# APPENDIX A

Biosolids Residuals Management Program

NPDES Permit Number or COC Number
MI0057679

# State of Michigan
# Biosolids Land Application Program

Facility Name
ALLENDALE CHARTER TOWNSHIP WWTP

## Residuals Management Program Development Document


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WATER BUREAU
MICHIGAN DEPARTMENT OF ENVIRONMENTAL QUALITY

## PURPOSE

The Michigan Biosolids Program establishes standards for the land application and beneficial recycling of biosolids in the state. Any treatment works treating domestic sewage proposing to land apply biosolids in the state shall prepare the enclosed Residuals Management Program (RMP) Guidance Document to obtain authorization. Authorization is required under the auspices of either an individual NPDES Permit or General Permit "Certificate of Coverage" (COC), dependent upon the type of permit held by the generating facility proposing to land apply.

For assistance on completing any section in this document you may contact the appropriate DEQ Water Bureau (WB) Office listed in Appendix A.

Industrial or commercial facilities with process wastewater entering the waste stream do not qualify for issuance of a biosolids land application permit. Contact the DEQ Waste Management Division in the appropriate district office for information on handling commercial or industrial wastes.

## AUTHORITY

The Part 24 Rules, Land Application of Biosolids, of Part 31, Water Resources Protection, of the Natural Resources and Environmental Protection Act, 1994 PA 451, as amended, (NREPA) provide authority to issue Biosolids Land Application Permits. Completion and subsequent approval of this document meets the RMP requirements contained in Rule 2403, Land Application Permit of the Part 24 Rules. Failure to prepare and submit an RMP prior to land applying biosolids is a violation of Part 24 Rules and may result in penalties for such violation.

**Rule 2403.**

(1) A generator or distributor shall have a valid permit before commencing any biosolids land application or distribution activity in the state of Michigan.

(2) A generator or distributor shall submit a permit application on a form provided by the DEQ not less than 180 days before expiration of an existing permit, commencement of biosolids land application, or distribution of a biosolids derivative, except at retail.

(3) All of the following provisions apply to a residuals management program:

(a) A generator shall submit a residuals management program for approval by the DEQ as required by its permit.

(b) A residuals management program submitted to the DEQ shall include all of the following information:

(i) Size and type of generating facility.
(ii) One year of records representing the volume and concentrations of pollutants in the biosolids.
(iii) Treatment process origin, for example, primary or secondary treatment and the volume of biosolids generated from each process.
(iv) A description of the treatment processes.
(v) Storage volume.
(vi) Transportation methods and spill prevention plan.
(vii) Land application method.
(viii) Land application site list.
(ix) Land application plan.
(x) Pathogen reduction method.
(xi) Vector attraction reduction method.
(xii) Monitoring program.

(c) Upon approval by the DEQ, the generating facility shall implement the approved residuals management program.

(d) A generating facility may modify the approved residuals management program by submitting a proposed modification to the DEQ for approval. The modification shall become effective upon approval by the DEQ.

(4) A person shall land apply biosolids or prepare biosolids for land application in accordance with the requirements established in these rules.

The Michigan Department of Environmental Quality (DEQ) will not discriminate against any individual or group on the basis of race, sex, religion, age, national origin, color, marital status, disability, or political beliefs. Questions or concerns should be directed to the Office of Personnel Services, PO Box 30473, Lansing MI 48909

Michigan Department of Environmental Quality - Water Bureau

# RESIDUALS MANAGEMENT PROGRAM

## SECTION I – GENERAL INFORMATION

**PLEASE TYPE OR PRINT**

1. NPDES or COC NUMBER
MI0057679

2. GENERATOR NAME AND MAILING ADDRESS
Name Allendale Charter Township
Superintendent, CEO, Principal Executive Officer Name
Mr. Steve Boss
Street Address or P.O. Box
6676 Lake Michigan Drive, PO Box 539

| City or Village | State | ZIP Code |
|---|---|---|
| Allendale | MI | 49401 |

Telephone (include area code)
616-895-6295

3. FACILITY NAME AND LOCATION (if different)
Name Allendale Charter Township WWTP
Street Address
11624 40th Ave.
Additional Street Address

| City or Village | State | ZIP Code |
|---|---|---|
| Allendale | MI | 49401 |

| Latitude (nearest 15 seconds) | Longitude |
|---|---|
| 40.50006 | -85.87274 |

Telephone (include area code)
616-895-5142

Fax Number (include area code)
616-892-7320

Email Address (if any)

4. FACILITY MAILING ADDRESS Street Address or P.O. Box
(or check box to use address corresponding to item number ☐2 ☒3)
Additional Street Address or P.O. Box Information

| City or Village | State | ZIP Code |
|---|---|---|
| | | |

5. BIOSOLIDS CONTACT PERSON Name (if different than Item 2)
Mr. Michael Barricklow
Title
Assistant Superintendent

ADDRESS Street Address or P.O. Box
( or check box to use address corresponding to item number ☐2 ☒3 ☐4)

| City or Village | State | ZIP Code |
|---|---|---|
| | | |

Telephone (include area code)
Fax Number (with area code)

6. Type of Treatment Facility

| | |
|---|---|
| Publicly owned treatment works ☒ | Privately owned treatment works ☐ |
| Federally owned treatment works ☐ | Blending or treatment operation ☐ |
| State owned treatment works ☐ | Tribal owned treatment works ☐ |

Other ☐ explain:

7. LAND APPLICATION REPORT FORMS
Check the box that corresponds to the address (above) to which forms should be mailed.

☐ 2 – Applicant Name & Mailing Address ☐ 3 - Facility Name & Location ☐ 4 - Facility Mailing Address ☒ 5 - Contact Person

**SEND FORMS TO THE ATTENTION OF:** Mr. Michael Barricklow

8. Provide the names, addresses and telephone numbers of the Land Application Contractors used by the facility, if applicable.

| | |
|---|---|
| Name of Contractor: | Synagro Central, LLC |
| Address: | 807 Lake Lansing Rd. |
| City, State, ZipCode: | Lansing, MI 48838 |
| Telephone: | 616-487-9280 Contact Person: Bill Goetsch 616-299-3368 |

| | |
|---|---|
| Name of Contractor: | |
| Address: | |
| City, State, ZipCode: | |
| Telephone: | |

Michigan Department of Environmental Quality - Water Bureau

# RESIDUALS MANAGEMENT PROGRAM

## SECTION I – GENERAL INFORMATION

**PLEASE TYPE OR PRINT**

| FACILITY NAME | NPDES or COC PERMIT NUMBER |
|---|---|
| Allendale Charter Township WWTP | MI0057679 |

### 9. RESIDUALS HANDLING

Provide total English dry tons per 365-day period of biosolids handled under the following practices:

Amount generated at the facility: 330

Amount received from off site: 0

Amount treated on site (including blending): 330

Amount sold or given away in a bag or other container for application to the land: 0

Amount of bulk biosolids shipped off site for treatment or for sale/give-away in a bag or other container for application to the land: 0

Amount applied to land in bulk form: 0

Amount fired in biosolids incinerator: 0

Amount sent to municipal solid waste landfill: 0

Amount used or disposed by another practice: 0

Describe: _____

### 10. RESIDUALS STORAGE

Enter the volume of residual storage capacity at this facility.

24 ☒ million gallons **or** ☐ cubic feet

### 11. WASTEWATER FLOW RATE

Provide design and actual flow rates in million gallons per day (MGD).

Design flow 1.6 MGD Average Actual Flow .9 MGD

### 12. SERVICE AREA

Enter the population serviced or NA if not applicable. 16,450

### 13. INDUSTRIAL PRETREATMENT PROGRAM

Does the generating facility have, or are they required to have, an Industrial Pretreatment Program? (See Appendix B)

☒ Yes – On attached sheet provide list of Significant Industrial Users and list of pollutants monitored.

☐ No – Continue with item 14.

### 14. SEPTAGE

Does your facility accept septage?

☐ Yes – Estimate amount received monthly gal.

☒ No – Continue with item 15.

### 15. BLENDING AND TREATMENT FACILITIES

Are (or will) biosolids from another acility (not including septage) be sent to your facility for treatment (including blending) or placement in a bag or other container for sale or give-away?

☐ Yes – Contact the Pretreatment and Biosolids Unit, Lansing

☒ No – Continue with item 16.

### 16. SOLIDS FLOW DIAGRAM, NARRATIVE DESCRIPTION, and PRODUCTION DATA

Provide a flow diagram (using 8 1/2" x 11" paper **if possible**) showing the solids handling process through the facility. Identify all treatment units and sampling points. Please attach this diagram.

Include a narrative description of all solids handling through the facility and provide solids production data of solids unit processes. Provide detailed information on residuals stabilization process including all solids handling unit processes (i.e. collection, dewatering, digestion, chemical feeds, storage). Include a narrative that briefly describes the history of the residuals handling practices at the treatment facility and any future plans for upgrade. **OPTIONAL-** To assist in calculating production data for your facility, Excel spreadsheets of various processes have been developed by the DEQ Operator Training Unit and are available from the appropriate DEQ WB Office listed in Appendix A or via the biosolids page at http://www.Michigan.gov/deq.

If you are an industrial or commercial facility treating domestic sewage sludge only, the line diagram shall include all operations contributing wastewater including process and production areas, sanitary flows, cooling water and storm water runoff. Include a narrative, which provides a brief description of the manufacturing processes. Note: Information for items 13 and 16 provided in Attachment A

Michigan Department of Environmental Quality - Water Bureau

# RESIDUALS MANAGEMENT PROGRAM

## SECTION II – BIOSOLIDS CHARACTERIZATION

**PLEASE TYPE OR PRINT**

| FACILITY NAME | NPDES or COC PERMIT NUMBER |
|---|---|
| Allendale Charter Township WWTP | MI0057679 |

1. BIOSOLIDS CHARACTERISTICS

Report one year biosolids monitoring data, and in no case less than three sampling events for the following Part 24 rules required parameters. Provide the actual analytical data sheets as an attachment. All sampling shall be representative of the biosolids being proposed to be applied to the land and in accordance with the minimum sample frequencies provided on the Page 10. Analytical methods shall be in accordance with R 323.2406 (2) Methods for Biosolids. Data that is available for parameters not specifically listed on this page shall be provided in the Pollutants of Concern table on page 4, Item 3 of this section.

| Parameter | Average Monthly Concentration | Maximum Monthly Concentration | Units | Number of Analyses | Method Detection Limit | Test Method | Sample Type |
|---|---|---|---|---|---|---|---|
| **Inorganics** | | | | | | | |
| Total Solids | 6.06 | 8.5 | % | 6 | .01 | 160.3 | ☐ Grab ☒ Composite |
| Total Arsenic | 5.47 | 7.61 | Mg/kg | 6 | .001 | 6020 | ☐ Grab ☒ Composite |
| Total Cadmium | 2.09 | 4.47 | Mg/kg | 6 | .006 | 6020 | ☐ Grab ☒ Composite |
| Total Copper | 332.17 | 468 | Mg/kg | 6 | .01 | 6010B | ☐ Grab ☒ Composite |
| Total Lead | .021 | 64.4 | Mg/kg | 6 | .001 | 6020 | ☐ Grab ☒ Composite |
| Total Mercury | .04 | .18 | Mg/kg | 6 | .001 | 6020 | ☐ Grab ☒ Composite |
| Total Molybdenum | 19.62 | 21.2 | Mg/kg | 6 | .001 | 6020 | ☐ Grab ☒ Composite |
| Total Nickel | 12.09 | 31.5 | Mg/kg | 6 | .001 | 6020 | ☐ Grab ☒ Composite |
| Total Selenium | .017 | .021 | Mg/kg | 6 | .001 | 6020 | ☐ Grab ☒ Composite |
| Total Zinc | 760.83 | 973 | Mg/kg | 6 | .04 | 6010B | ☐ Grab ☒ Composite |
| **Nutrients** | | | | | | | |
| Total Kjeldahl Nitrogen | 30286 | 39422 | Mg/kg | 6 | 1 | 351.3 | ☐ Grab ☒ Composite |
| Ammonium Nitrogen | 5916 | 7897 | Mg/kg | 6 | 1 | SM4500N | ☐ Grab ☒ Composite |
| Total Phosphorus | 32899 | 42468 | Mg/kg | 6 | 1 | 6010B | ☐ Grab ☒ Composite |
| Total Potassium | 1753 | 2439 | Mg/kg | 6 | 1 | 6010B | ☐ Grab ☒ Composite |

Note: Detection limits based on wet weight as received
Analytical Results, including fecal coliform and summaries provided in Attachment B

Michigan Department of Environmental Quality - Water Bureau

# RESIDUALS MANAGEMENT PROGRAM

## SECTION II – BIOSOLIDS CHARACTERIZATION

**PLEASE TYPE OR PRINT**

| FACILITY NAME | NPDES or COC PERMIT NUMBER |
|---|---|
| Allendale Charter Township WWTP | MI0057679 |

2. Pollutants of Concern

Do you believe or suspect that pollutants (other than parameters listed on the previous page) could be present in the biosolids to be land applied at concentrations that could possibly make them unsuitable for land application?

☐ Yes - Describe the circumstances below and provide representative analytical data for those pollutants of concern in Item 3.

☒ No

3. Report any biosolids monitoring data from the last permit cycle for parameters not specifically listed on the previous page. Include the actual analytical data sheets as an attachment. Upon submittal review, additional monitoring may be required if WB has reason(s) to suspect that the information provided (or not provided) does not adequately characterize the residuals proposed to be land applied. For assistance on completing this section or determining the necessity for completing this section, you may contact the appropriate DEQ WB office (see Appendix A).

| Parameter | Average Concentration | Maximum Concentration | Units | Number of Analyses | Method Detection Limit | Test Method | Sample Type |
|---|---|---|---|---|---|---|---|
| | | | | | | | |
| | | | | | | | ☐ Grab ☐ Composite |
| | | | | | | | ☐ Grab ☐ Composite |
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| | | | | | | | ☐ Grab ☐ Composite |

Michigan Department of Environmental Quality- Water Bureau

# RESIDUALS MANAGEMENT PROGRAM

## SECTION III – LAND APPLICATION PLAN

**Instructions for completing Section III.**

The information provided in this Land Application Plan section outlines the generating facility's RMP. In addition to requirements set forth in the Michigan Part 24 Biosolids Rules, the information provided (except items marked **Optional)** represent enforceable commitments to manage the land application program in the manner indicated. If changes in circumstances arise, opportunities do exist to request modification to approved RMPs during the biosolids permit cycle.

Although land application contractors are commonly utilized to handle many operational aspects of land application programs, each facility is required to take an active role in managing and overseeing certain administrative aspects of their land application program. Although the DEQ may hold contractors responsible for certain violations of Part 24 rules, the generating facility is responsible for ensuring compliance with state and federal statutes and the conditions found in the approved RMP.

A. **Biosolids Treatment** - Identify the exact alternatives used at the facility to meet Pathogen Reduction and Vector Attraction Reduction requirements and include the appropriate documentation to demonstrate compliance with those conditions. If your facility utilizes more than one alternative to meet the requirements, indicate all that apply. Provide additional information on attached sheets.

B. **Procedures** – General programmatic information outlining the facilities biosolids operating procedures.

C. **Site Information** – Information specific to your land application sites and overall site management.

Michigan Department of Environmental Quality - Water Bureau

# RESIDUALS MANAGEMENT PROGRAM

## SECTION III – LAND APPLICATION PLAN

### A. Biosolids Treatment

**PLEASE TYPE OR PRINT**

FACILITY NAME
Allendale Charter Township WWTP

NPDES or COC PERMIT NUMBER
MI0057679

1. PATHOGEN / VECTOR ATTRACTION REDUCTION
Describe, on this form or another sheet of paper, any treatment processes used at your facility to reduce pathogen and vector attraction properties in biosolids:

**Pathogen reduction is achieved through aerobic digestion. Solids are initially digested utilizing a series of rotating biological contactors. Solids are then pumped to two sludge holding tanks where further aeration is provided. Residual solids are pumped from sludge holding tanks to lagoons where further biological digestion and volatile solids destruction occurs between land application events. Time between land application events is estimated to be 20 years. A complete solids handling diagram is provided in Attachment A.**

☐ **Check this box if you need additional space for your answer.**

2. PATHOGEN REDUCTION
Which class of pathogen reduction does the biosolids meet at your facility?

☐ Class A - Continue with item 3.
☒ Class B - Continue with item 4.

3. CLASS A BIOSOLIDS
If Class A, check the alternative used and attach the appropriate certification statement(s) (Appendix C) and documentation demonstrating compliance.

☐ Class A – Alternative 1
☐ Class A – Alternative 2
☐ Class A – Alternative 3
☐ Class A – Alternative 4
☐ Class A – Alternative 5 (indicate which PFRP)
  ☐ (a) composting
  ☐ (b) heat drying
  ☐ (c) heat treatment
  ☐ (d) thermophilic aerobic digestion
  ☐ (e) beta ray irradiation
  ☐ (f) gamma ray irradiation
  ☐ (g) pasteurization
☐ Class A – Alternative 6 (attach PFRP equivalent documentation)

4. CLASS B BIOSOLIDS
If Class B, check the alternative used. Attach the appropriate certification statement(s) (Appendix C) and documentation to demonstrate compliance. Note Class B Site Restrictions on Page 7.

☒ Class B –Alternative 1
☐ Class B –Alternative 2 (indicate which PSRP)
  ☐ (a) aerobic digestion
  ☐ (b) air drying
  ☐ (c) anaerobic digestion
  ☐ (d) composting
  ☐ (e) lime stabilization (pH at 25° C or equivalent)
☐ Class B –Alternative 3 (attach PSRP equivalent documentation)

5. VECTOR ATTRACTION REDUCTION
Which vector attraction reduction option(s) is met for the biosolids at your facility? Attach the appropriate certification statement(s) (Appendix C) and documentation to demonstrate compliance.

☐ Option 1 (minimum 38 percent reduction in volatile solids)
☐ Option 2 (Anaerobic process, with bench-scale demonstration)
☐ Option 3 (Aerobic process, with bench-scale demonstration)
☐ Option 4 (Specific oxygen uptake rate, aerobically digested)
☐ Option 5 (Aerobic process plus raised temperature)
☐ Option 6 (Raise pH to 12 and retain at 11.5)
☐ Option 7 (75% solids with no unstabilized solids)
☐ Option 8 (90% solids with unstabilized solids)
☒ Option 9 (Injection below land surface)
☐ Option 10 (Covering active sewage sludge unit daily)

6. Describe, on this form or another sheet of paper, any secondary modes used at your facility to meet vector attraction reduction requirements:

☐ **Check this box if you need additional space for your answer.**

7. RE-USE/DISPOSAL ALTERNATIVES
Should the circumstances arise, describe alternative method(s) for the proper treatment, use or disposal of biosolids (include seeking authorization from the permitting authority).

If biosolids are determined, by the permitting authority under Part 24, not to meet quality criteria for land application, our present contractor could de-water and landfill the residual waste water treatment sludge.

☐ **Check this box if you need additional space for your answer.**

The following Site Restrictions contained in R323.2414 (f)(I) to (viii) apply to all land-applied biosolids meeting the class B pathogen reduction requirements.

(f) All of the following provisions apply to site restrictions:

(i) A land owner shall not harvest food crops that have harvested parts which touch the biosolids/soil mixture and which are totally above the land surface for 14 months after biosolids are applied.

(ii) A land owner shall not harvest food crops that have harvested parts below the surface of the land for 20 months after biosolids are applied if the biosolids remain on the land surface for 4 months or longer before incorporation into the soil.

(iii) A land owner shall not harvest food crops that have harvested parts below the surface of the land for 38 months after biosolids are applied if the biosolids remain on the land surface for less than 4 months before incorporation into the soil.

(iv) A land owner shall not harvest food crops, feed crops, and fiber crops for 30 days after biosolids are applied.

(v) A land owner shall not graze animals on the land for 30 days after biosolids are applied

(vi) A land owner shall not harvest turf grown on land where biosolids are applied for 1 year after biosolids are applied if the harvested turf is placed on either land that has a high potential for public exposure or a lawn, unless otherwise specified by the permitting authority.

(vii) A land owner shall restrict public access to land that has a high potential for public exposure for 1 year after biosolids are applied.

(viii) A land owner shall restrict public access to land with a low potential for public exposure for 30 days after biosolids are applied.

Michigan Department of Environmental Quality - Water Bureau

# RESIDUALS MANAGEMENT PROGRAM

## SECTION III – LAND APPLICATION PLAN

### B. Procedures

**PLEASE TYPE OR PRINT**

FACILITY NAME
Allendale Charter Township WWTP

NPDES or COC PERMIT NUMBER
MI0057679

1. ENVIRONMENTAL MANAGEMENT SYSTEM (EMS) **Optional**
Would your facility possibly be interested in implementing a voluntary EMS and "Code of Good Practices" as administered by the National Biosolids Partnership?

☐ Yes -Information will be sent to you on implementing an EMS
☒ No

2. TRANSPORTATION
Describe the method of handling and transporting residuals from the treatment facility to the site of land application.

Biosolids from lagoons will be removed using a floating dredge. Biosolids may be pumped directly into sealed tanker trailers. If a higher percent solids needs to be achieved biosolids would be pumped to a corner of the lagoon where solids will accumulate to enhance de-watering. Biosolids would be pumped from this location with a lagoon pump into sealed tanker-trailers positioned adjacent to the lagoon on property owned by the permitee. Approximately 7,500 to 8,700 gallons of biosolids will be hauled on each load. Transportation routes will be chosen to avoid densely populated areas if possible. Tankers will be unloaded in the field in which it will be applied if access to the site allows for safe and sensible ingress and egress for the type of equipment being utilized. If tanker trailer combinations can not reasonably enter the application site then they will be unloaded on the shoulder of the road and appropriate safety equipment such as orange cones or men working signs will be used to warn oncoming traffic of the work area.

☐ **Check this box if you need additional space for your answer.**

3. SPILL PREVENTION / RESPONSE PLAN
Describe your spill prevention measures and steps to be followed should a spill occur.

Biosolids will be pumped directly into sealed tankers on property owned by Allendale Charter Township WWTP. Loading of tankers will be in proximity to a manhole in the WWTP parking lot. This manhole discharges directly to surface water. A shut off valve will be installed on the outlet pipe to surface water. Additional sand bags and rubber mat to cover manhole will be present to minimize potential discharge to surface water of any spills. Persons on site responsible for the dredging and hauling of biosolids will be advised in the proper procedures to keep any spills from discharging from manhole to surface water. A log will be kept of those who have been advised of proper procedures. Any biosolids spilled at the loading site will be put back into the lagoon.

If a spill should occur on a public roadway then items such as sand, straw, brooms, shovels and a vacuum truck could all be utilized.

In addition our land application contractor has their own comprehensive spill response plan.

The MDEQ will be notified of any such spills.

☐ **Check this box if you need additional space for your answer.**

4. LAND APPLICATION METHOD
Describe the methods utilized for land application.

Biosolids will be sub-surface injected using modern calibrated equipment specifically designed for such work. A typical example of the machinery that may be utilized is an AG CHEM 2505

☐ **Check this box if you need additional space for your answer.**

5. APPLIER OVERSIGHT
Describe the method of applier oversight. Include performance specifications and any training/certification requirements. See Appendix C for applier certification requirements.

Prior to land application a representative Of Allendale Charter Township WWTP (Allendale WWTP) will affirm that the biosolids have been properly sampled and analyzed. The City will provide the land application contractor the Notice and Necessary Information (NANI) relative to pollutant concentrations, pathogen reduction and vector attraction as required by Part 24.

The City will send it's a representative(s) to the land application site(s) at random intervals in order to determine that the application is taking place in a safe environmentally sound manner.

Specific oversight shall be to proper injection of biosolids, agronomic applications, and site restrictions.

☐ **Check this box if you need additional space for your answer**

Michigan Department of Environmental Quality - Water Bureau

# RESIDUALS MANAGEMENT PROGRAM

## SECTION III – LAND APPLICATION PLAN

B. Procedures (continued)

**PLEASE TYPE OR PRINT**

| FACILITY NAME | NPDES or COC PERMIT NUMBER |
|---|---|
| Allendale Charter Township WWTP | MI0057679 |

6. REPORTING

Describe your facility's reporting procedure (provide example forms, letters, etc. as an attachment). Specific reporting requirements are summarized in Appendix C.

Allendale WWTP will follow Part 24 323.2313(2) (f) through (k) and 323.2416 when reporting all land application activity.

Annual reports will be submitted on the appropriate MDEQ provided forms.

An example land application report is provided in Attachment C.

☐ **Check this box if you need additional space for your answer**

7. RECORDKEEPING

Describe your facility's recordkeeping procedures and retention schedules. Specific recordkeeping and certification requirements are summarized in Appendix C.

Per 323.2413(1) and (2), all records shall be kept for a minimum of 5 years. These records include all land application activity reports, annual summaries, and documentation soils analytical.

Reports for fields subject to cumulative pollutant loading rates and biosolids analytical shall be kept indefinitely.

If future monitoring demonstrates that pollutants are above Table 3, the Allendale WWTP will provide notice to MDEQ requesting modification of the RMP.

☐ **Check this box if you need additional space for your answer**

8. COMPLAINT RESPONSE

Describe the procedure for responding to citizen complaints. Include details of any biosolids educational programs.

Complaints, concerns and questions of the land application activities will be handled by either the land application contractor or personnel from the Allendale WWTP, whomever it is determined would address the particular nature of the complaint most comprehensively.

Complaints will be immediately addressed.

General questions and concerns will be handled by providing educational information such as, biosolids brochures published by our land application contractor, MSU Extension bulletins and EPA/MDEQ publications.

MDEQ will be notified of any issues raised relative to compliance which are determined to be legitimate.

☐ **Check this box if you need additional space for your answer**

9. SAMPLING PLAN

a. Describe the proposed sample frequency and quality control methods utilized to assure representative samples are obtained. Minimum Sample Frequencies are provided on Page 10.

The minimum required samples have been taken and are included with this RMP. The lagoon to be hauled first is #2(1) and has had no additional biosolids pumped to it since the sampling.

Each of the two lagoons to be hauled was split into thirds. Several sub-samples were taken within each area and composited. A representative sample was taken from each composite and sent in for analysis.

Biological tests were taken at random intervals within lagoon 2(1). These samples were grab samples.

Six additional samples for inorganic nutrients and pollutants will be taken from lagoon 3(2) prior to initiating land application from it. One set of seven fecal coliform tests will also be taken at that time.

Trained personnel or contractor using appropriate equipment and technique will perform all sampling.

All analyses will be performed by an MDEQ certified laboratory using methodologies required by rule at the time of such sampling.

☐ **Check this box if you need additional space for your answer**

b. Describe the procedure for assuring that analytical results are below regulated limits and appropriate methods were used. Pollutant Limit Tables are provided on Page 11.

A chain of custody is maintained for all persons handling the samples prior to delivery to certified laboratory. Analytical and handling procedures will be reviewed for compliance with current MDEQ accepted methodologies prior to any sampling event.

Both Allendale WWTP and our land application contractor will review analytical results for pollutants and pathogens.

☐ **Check this box if you need additional space for your answer**

**Minimum Sample Frequencies**

**R 323.2412 Frequency of monitoring.**

Table 7

Amount of Biosolids Produced (per 365-day period)

| English Dry Tons | Metric Dry Tons | Frequency |
|---|---|---|
| Greater than zero, but less than 320 | Greater than zero, but less than 290 | Once per year |
| Equal to or greater than 320, but less than 1,650 | Equal to or greater than 290, but less than 1,500 | Once per quarter (4 times per year) |
| Equal to or greater than 1,650, but less than 16,500 | Equal to or greater than 1,500, but less than 15,000 | Once per 60 days (6 times per year) |
| Equal to or greater than 16,500 | Equal to or greater than 15,000 | Once per month (12 times per year) |

**Note:** Additional monitoring beyond that stated above may be required to obtain representative data of the material proposed to be land applied or to meet the following additional requirements of the Part 24 Rules. The following words in bold below are not part of the Part 24 Rules.

(4) If biosolids are accumulated before removal, the monitoring frequency, at a minimum, is that specified in this rule. If monitoring of biosolids or a derivative indicates a pollutant concentration in excess of that provided in table 3 of R 323.2409(5)(c) (**see page 11 of this document**), then the monitoring frequency shall be increased to not less than twice that provided for in table 7 (**sample frequency table above)** until pollutant concentrations are at or below the concentrations provided in table 3 of R 323.2409(5)(c). In the case of biosolids accumulating for periods of more than 1 year, biosolids must be monitored at the frequency determined in table 7 only in the year the biosolids are used. For a generator who removes biosolids monthly or more frequently, monitoring is required at least once per month each month that the biosolids are removed, unless more frequent monitoring is required in subrule(1) of this rule.

**R 323.2409 APPLICATION OF LIMITATIONS**

(a) TABLE 1 -- Ceiling Pollutant Concentrations

| Pollutant | Ceiling Concentration (milligrams per kilogram)[1] (dry weight basis) |
|---|---|
| Arsenic | 75 |
| Cadmium | 85 |
| Copper | 4300 |
| Lead | 840 |
| Mercury | 57 |
| Molybdenum | 75 |
| Nickel | 420 |
| Selenium | 100 |
| Zinc | 7500 |

(b) TABLE 2 -- Cumulative Pollutant Loading Rates

| Pollutant | Cumulative Pollutant Loading Rate | |
|---|---|---|
| | kilograms per hectare | pounds per acre |
| Arsenic | 41 | 37 |
| Cadmium | 39 | 35 |
| Copper | 1500 | 1335 |
| Lead | 300 | 267 |
| Mercury | 17 | 15 |
| Nickel | 420 | 374 |
| Selenium | 100 | 89 |
| Zinc | 2800 | 2492 |

(c) TABLE 3 -- Pollutant Concentrations

| Pollutant | Concentration (milligrams per kilogram) (on a dry weight basis) |
|---|---|
| Arsenic | 41 |
| Cadmium | 39 |
| Copper | 1500 |
| Lead | 300 |
| Mercury | 17 |
| Nickel | 420 |
| Selenium | 100 |
| Zinc | 2800 |

(d) TABLE 4 -- Annual Pollutant Loading Rates

| Pollutant | Annual Pollutant Loading Rate[1] | |
|---|---|---|
| | kilograms per hectare | pounds per acre |
| Arsenic | 2.0 | 1.8 |
| Cadmium | 1.9 | 1.7 |
| Copper | 75 | 67 |
| Lead | 15 | 13 |
| Mercury | 0.85 | 0.76 |
| Nickel | 21 | 19 |
| Selenium | 5.0 | 4.5 |
| Zinc | 140 | 125 |

[1] per 365-day period.

Michigan Department of Environmental Quality - Water Bureau

# RESIDUALS MANAGEMENT PROGRAM

## SECTION III – LAND APPLICATION PLAN

### C. Site Information

**PLEASE TYPE OR PRINT**

FACILITY NAME
Allendale Charter Township WWTP

NPDES or COC PERMIT NUMBER
MI0057679

1. CUMMULATIVE POLLUTANT LOADING AND REMAINING ALLOTMENTS (CPLR)

a. Has your facility land applied biosolids exceeding Table 3 - Pollutant Concentrations since July 20, 1993?

☐ Yes - You have sites subject to CPLRs. Attach the appropriate certification statement (See Appendix C) and continue with question b.

☒ No - Continue with Item 2.

b. Have you contacted the State where the bulk biosolids subject to CPLRs will be applied, to ascertain whether the bulk biosolids subject to CPLRs have been applied to your sites since July 20, 1993?

☐ Yes - Continue with question c.

☐ No - Bulk biosolids subject to CPLRs may not be applied to these sites.

c. Provide the following information for each site that has received bulk biosolids subject to CPLRs since July 20, 1993.

| Site ID # | CPLR Pollutant | Total English Dry Tons | Cumulative Loading (lb/ac) | Allotment Remaining (lb/ac) |
|---|---|---|---|---|
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2. LAND APPLICATION FREQUENCY

a. How often do you plan to land apply?

☐ Monthly during the land application season

☒ Once during permit cycle (i.e. lagoon cleaning)

☐ Seasonal, provide approximate timeframe

from to

3. WINTERTIME LAND APPLICATION

Do you intend to land apply between December 21 and March 21?

☐ Yes, provide the following:

- Description of what instances this activity would take place.
- Types of equipment utilized to achieve "substantial soil coverage" and the method of applier oversight.
- Listing of physical limitations of sites and a specification of "substantial soil coverage" that the applier must meet.
- Commitment for informal DEQ notification.

☒ No, continue with item 4.

Describe, (use additional sheets as necessary)

☐ **Check this box if you need additional space for your answer**

Michigan Department of Environmental Quality - Water Bureau

# RESIDUALS MANAGEMENT PROGRAM

## SECTION III – LAND APPLICATION PLAN

### C. Site Information (continued)

**PLEASE TYPE OR PRINT**

FACILITY NAME
Allendale Charter Township WWTP

NPDES or COC PERMIT NUMBER
MI0057679

4. NEW SITES

a. Indicate the geographical area covered by your Land Application Plan.

It is anticipated the area needed to find suitable new or transferred sites could require an area 30 miles in radius from the lagoons. The area will be predominately to the North due to the more rual setting.

Competition for land base is a large industrial permitee and several other municipal entitles. It is anticipated that there may be some ability to transfer existing approved sites from another municipality if they are not able to provide the grower the biosolids. There is additional competition for land base from animal producers including turkey, swine, cattle and dairy manures, many of which are under permit conditions also.

☐ **Check this box if you need additional space for your answer**

b. Describe your site selection criteria. Note the Management Practices summary on Page 14 and Class B site restrictions - Page 7. Applier/Preparer certification requirements are summarized in Appendix C.

Sites will be selected based upon many factors. These factors will include distance, access, cropping, soil suitability and slope along with other factors. Example of land owner / operator agreement form containing management practices and applier certification containing site restrictions in provided in Attachment D.

☐ **Check this box if you need additional space for your answer**

5. LAND OWNER AGREEMENTS

Do you have a signed landowner agreement for each existing site? See Appendix D for Landowner Agreement considerations.

☒ Yes - Continue with Item 6.

☐ No - Rule 323.2413(2)(b) and (c) requires written consent to apply biosolids and a written agreement not to apply biosolids from other sources or septage to a listed land application site.

6. OUT OF STATE SITES

Will the proposed land application activity occur on lands outside of the State of Michigan?

☐ Yes (describe procedure for permitting authority notification).

☒ No, Continue with Item 7.

☐ **Check this box if you need additional space for your answer**

7. AGRONOMIC RATE

a. Will biosolids be applied at the agronomic rate for the crop to be grown? See Appendix E for agronomic rate calculations.

☒ Yes - Continue with Item 8.

☐ No - Biosolids must be applied at the agronomic rate unless done in accordance with a DEQ approved Site Reclamation Plan.

*NOTE: Be advised that application rates may also need to be further restricted for operational reasons or based on loading rates for biosolids exceeding Table 3 limits or to avoid exceeding the 300 lb/ac P limit in site soils. Refer to WB guidance for calculations of agronomic rates based on Phosphorus.

8. SITE NOTIFICATION

Specific notification requirements and a sample public notification letter are provided in Appendix F. A DEQ site identification form is provided on page 15. **Optional:** Describe your facility's site notification procedure, including informal DEQ notification prior to seasonal or wintertime application. Provide any other sample forms and letters.

At least ten(10) days prior to initial land application of biosolids to a un-approved site, The Allendale WWTP or its authorized contractor will notify the Grand Rapids District MDEQ, proper county health department office and the township supervisor required site information.

Due to the inability to land apply in the near future The City of Grandville has provided several releases of fields to Allendale WWTP in order to provide biosolids application to growers who expected material this Fall and potentially in the Spring of 2007.

The grower participant will also be provided information necessary for them to adjust fertilizer rates in the fields that have had biosolids application.

An example of the information to be provided to the grower and required Notice and Necessary Information provided to land application contractor is provided in Attachment E.

Initial land application sites released from The City of Grandville are contained in Attachment F. Additional sites and transfers will submitted for approval.

☐ **Check this box if you need additional space for your answer**

## MANAGEMENT PRACTICES

**Slope Restrictions R 323.2410(4)**
A person shall not apply bulk biosolids on lands having a slope of more than 6% for surface application or more than 12% for subsurface injected biosolids, unless the person uses the bulk biosolids in accordance with a DEQ-approved site management plan.

**Isolation Distance Requirements R 323.2410(11)**

TABLE 6

| ISOLATION DISTANCE REQUIREMENTS | | |
|---|---|---|
| Isolation from existing: | Distance (feet) | |
| | Injection or Surface application with incorporation* | Surface application without incorporation |
| Municipal well (type I or type IIA)** | 2000 | 2000 |
| Non-community public water supply (type IIB or type III) | 800 | 800 |
| Domestic well | 100 | 150 |
| Homes | 100 | 150 |
| Commercial Buildings | 100 | 150 |
| Surface waters*** | 50 | 150 |

* Incorporation must be within 48 hours, unless a shorter time period is specified in these rules.

** As defined and specified in Act No. 399 of the Public Acts of 1976, as amended, being §325.1001 et seq. of the Michigan Compiled Laws and known as the safe drinking water act. As specified in Act No. 399 of Public Acts of 1976, as amended, the term includes water supplies such as schools, restaurants, industries, campgrounds, parks, and hotels.

*** Surface waters do not include grassed drainage ways or drainage ways that are tilled and planted.

**Refer to Rule R 323.2410 for the entire management practices section of Part 24 Rules.**

Michigan Department of Environmental Quality - Water Bureau

# RESIDUALS MANAGEMENT PROGRAM

## SECTION III – LAND APPLICATION PLAN

### Land Application Site List

Provide the following information for every new or existing site that you intend to use in the next five years (biosolids permit cycle). Each listed site should either have had a Site Identification Form with attachments submitted to the DEQ since January 1, 1998, or the completed forms should be included with this document. To add new sites to the Land Application Site List during the biosolids permit cycle, modify your RMP by submitting a completed DEQ Site Identification Form with attachments, a copy of your public notification letter and wait the required ten-day notification period. Use additional sheets as necessary.

**PLEASE TYPE OR PRINT**

| Facility Name: Allendale Charter Township WWTP | | | | NPDES or COC PERMIT NUMBER: MI0057679 | | |
|---|---|---|---|---|---|---|
| Site Identification Number | Latitude | Longitude | Acres | Owners Last Name | New Site? (check if yes) | CPLR Site? (check if yes) |
| 05N12W08-WD01 | 42:49:45 | 85:45:43 | 75 | De Boer | ☐ | ☐ |
| 05N12W07-AP01 | 42:49:35 | 85:46:15 | 28 | Pfieffer | ☐ | ☐ |
| 05N12W18-DP03 | 42:49:36 | 85:46:13 | 45 | Pfieffer | ☐ | ☐ |
| 05N12W18-DP02 | 42:48:57 | 85:46:14 | 40 | Pfeiffer | ☐ | ☐ |
| 05N12W08-DA01 | 42:49:52 | 85:45:10 | 60 | Allen | ☐ | ☐ |
| 06N13W08-WD02 | 42:55:11 | 85:52.87 | 45 | Dewnt | ☐ | ☐ |
| 06N13W08-WD03 | 42:55:57 | 85:52:37 | 37 | Hudsonville Schools | ☐ | ☐ |
| | | | | | ☐ | ☐ |
| | | | | | ☐ | ☐ |
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Michigan Department of Environmental Quality - Water Bureau

# RESIDUALS MANAGEMENT PROGRAM

## SECTION IV – SIGNATURE PAGE

**PLEASE TYPE OR PRINT**

| Facility Name | NPDES or COC PERMIT NUMBER |
|---|---|
| Allendale Charter Township WWTP | MI0057679 |

1. CERTIFICATION

*I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with the system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system or those persons directly responsible for gathering the information, the information is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there a significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.*

Name and official title: Mike Barricklow, Assistant Superintendent

Signature: _____

Telephone number: 616-895-5142

Date signed: September 22, 2006

Upon request from the State, you may be required to submit additional information necessary to access biosolids use or disposal practices at your facility or to identify appropriate permitting requirements.

SEND COMPLETED FORMS TO THE APPROPRIATE DISTRICT OFFICE LISTED IN APPENDIX A.

# ATTACHMENT A

# Process Narrative
# and
# Diagram

# IV. TREATMENT PLANT OPERATION
# SLUDGE HANDLING

## A. GENERAL

The proper treatment and disposal of sludge is just as important as the treatment of wastewater itself. The operator must be sure that the sludge is being processed at a known rate and quality to ensure proper operation of the entire treatment plant.

Proper sludge withdrawal and pumping procedures are critical to the operation of the primary and secondary clarifiers, as well as the sludge storage tanks. For example, if the sludge pumping rate is too slow, anaerobic conditions or short-circuiting will develop in the clarifiers. On the other hand, if the sludge pumping rate is too high, the sludge will be too thin, diluting the contents of the sludge storage tanks and causing further operational problems.

The sludge and scum from the primary clarifiers, scum from the secondary clarifiers, and sludge from the chlorine contact chamber is all pumped to the aerated sludge storage tanks for storage and aerobic digestion. The sludge from the secondary clarifiers is pumped to the Headworks effluent well, located just downstream of the Parshall flume. The sludge from the storage tanks is pumped directly to the sludge lagoons on a regular basis. Supernatant from the sludge lagoons is pumped by the supernatant pump station to the Headworks effluent well.

## B. SLUDGE PUMP OPERATION

1. Purpose - The sludge and scum pumps remove sludge and scum from the primary and secondary clarifiers, as well as the chlorine contact chamber. The sludge and scum is pumped to the sludge holding tanks, sludge lagoons, and/or the Headworks effluent well.

2. Description - "Sludge" and "scum" are the common names for wastewater treatment residue that settles and floats, respectively. Sludge is removed on a regular basis from the primary and secondary clarifiers. In addition, sludge is removed as required from the chlorine contact tank (former secondary clarifiers). Secondary sludge is normally transferred to the primary clarifier influent via the Headworks effluent well. Sludge from the primary clarifiers thus includes both primary and secondary solids, which are "co-wasted" to the aerated sludge holding tanks.

   Scum is removed from the primary clarifiers to respective sumps by lever-operated rotary scum troughs located near the effluent weirs. The scum is routed to the primary sludge sump and is pumped along with the sludge as described later in this section. Scum in the secondary clarifiers is removed by rotating scraper arms which direct the scum to a scum well adjacent to each tank. Primary sludge and scum is normally sent directly to the aerated sludge holding tanks. Sludge and scum are aerated for a period of time in the holding tanks prior to being pumped to the sludge management ponds.

   a. Primary Clarifier sludge and scum, and chlorine contact chamber sludge pumps:

There are three positive displacement progressing cavity type sludge pumps located in the sludge room of the Control Building. The pumps are belt driven by 7.5 hp, 460 volt, 3 phase motors. Each pump has the capacity to pump 100 gpm at 50-ft TDH, at 385 rpm. The pumps are constructed with packing glands. Non-potable water flushing connections are provided near each pump. The scum piping on the chlorine contact tanks (former secondary clarifiers) has been abandoned, but the sludge line remains in place and operational.

b. Secondary Clarifier sludge and scum pumps:
Secondary clarifier sludge and scum pumping equipment is located in the lower level of the Clarifier Building. This equipment consists of three sludge pumps on the north side and two scum pumps on the south side. One sludge pump is standby. These are all 5hp Moyno progressing cavity pumps (belt-driven) with a capacity of 100 gpm at 50 ft TDH and 302 rpm. Non-potable water flushing connections are provided in the suction and discharge piping.

The secondary clarifier sludge (activated slugde) is pumped back to the Headworks effluent well to aid in BOD reduction in the primary clarifiers. The secondary clarifier scum is pumped to the sludge holding tanks.

Additional sludge and scum draw-off pipes are capped under ground just south of the Clarifier Building to be used with future secondary clarifier tanks. Also, there are two places available for future sludge pumps inside the building (see Sheet P-10 of the 2000 Record Drawings).

3. Control – Primary sludge pump No.1 is controlled by an "Off-On" selector switch at MCC No.2 with an "On-Off-Auto" and a "Sludge Tank-Primary" low level cut-off selector switch located near the pump. There is a run indicator light on the ICP and a run indicator light with elapsed time meter on MCC No.2. In the "On" position, the pump operates continuously. The low level cut-off selector switch in the "sludge tank" position allows the pump to run continuously; while in the "Primary" position, the pump is shut off by electrodes in the primary sludge sump set at low level.

Sludge pumps No.2 and No.3 are controlled by an "Off-On" selector switch at MCC No.1 and a selector switch located near the pumps. There are also "Primary-Secondary" low level cut-off selector switches at each pump. Run indicator lights and elapsed time meters indicate operation at MCC No.1. Sludge pump No.3 can be operated on a 24-hour timer switch. By leaving the selector switch in the "On" position different pumping intervals can be selected 24hsr/day.

In the "On" position, pumps No.2 and No.3 run continuously. In the "Primary" or "Secondary" position, the pumps can draw from either the primary clarifier or chlorine contact sludge wells and will be automatically stopped by low level electrodes in the sludge wells.

Sludge from the primary clarifiers and chlorine contact chamber (former secondary clarifiers) is transferred to the respective sludge well by telescoping valves. There are separate valves for each of the two hoppers in each tank. To remove sludge from the clarifiers, lower the

telescoping valve until sludge begins spilling into the sludge sump. Lower the valve a little more and continue to draw sludge until water begins to spill into the sludge sump. Then raise the valve back to the original position. Do not draw the sludge too fast or excess water will get into the sludge sump.

Sludge should be drawn from the primary clarifiers frequently enough to prevent anaerobic conditions from developing. Sludge in the chlorine contact chamber (former secondary clarifiers) will have to be monitored and drawn off at intervals determined by the operator - this will not be required nearly as often as removing primary clarifier sludge.

4. Normal Operations - Never run the pump in a dry condition, even for a few revolutions, or the pump stator will be damaged immediately. The pumps must be filled with liquid before starting. Several modes of operation for sludge pumping follow. Refer to Figure IV-1 (Process Flow Schematic) for pipe information and valve numbering.

   a. **Removal of Primary Clarifier Sludge and Scum:**

      1) **Primary Sludge and Scum to Sludge Holding Tanks:**

         a) **Primary Clarifiers 1 and 2** - Sludge pump No. 2 is normally used. After transferring sludge and scum from the clarifiers to the adjacent sludge sump, the sludge passes through valves 2, 11, 13, 17, 18, 20 and 24 before leaving the control building. Valves 3, 4, 8, 9, 15, 19 and 22 must be closed. Make sure there is sludge in the primary sludge sump, then place the ON-OFF selector switch for Pump No.2 in the ON position and the " Primary- Secondary" selector switch in the "Primary" position. Refer to the section covering Sludge Tank Operation for more information.

         b) **Primary Clarifiers 3 and 4** – Sludge pump No. 3 is normally used. After transferring sludge and scum from the clarifiers to the adjacent sludge sump, the sludge passes through valves 5, 10, 14, 16, 17, 18, 20 and 24 before leaving the control building. Valves 6, 9, 15 and 22 must be closed. Make sure there is sludge in the primary sludge sump, then place the ON-OFF selector switch for Pump No.3 in the ON position and the " Primary- Secondary" selector switch in the "Primary" position. Refer to the section covering Sludge Tank Operation for more information.

         c) **Alternate Operation** – If necessary, any of the three sludge pumps can be used to remove sludge from the primary clarifiers. Refer to Figure IV-1 for the flow schematic to determine which valves need to be open and closed for the corresponding alternate pumping operations.

      2) **Primary Sludge and Scum to Sludge Lagoons:**

         a) **Primary Clarifiers 1 and 2** - Sludge pump No. 2 is normally used. After transferring sludge and scum from the clarifiers to the adjacent sludge sump, the sludge passes through valves 2, 11, 13, 17, 19, 28, 26 and 29 before leaving the control building. Valves 3, 4, 8, 9, 16, 18, and 25 must be closed. Make sure

there is sludge in the primary sludge sump, then place the ON-OFF selector switch for Pump No.2 in the ON position and the " Primary- Secondary" selector switch in the "Primary" position. This flow will be metered by the waste sludge flow meter. Refer to the section covering Sludge Lagoon Operation for more information.

b) **Primary Clarifiers 3 and 4** – Sludge pump No. 3 is normally used. After transferring sludge and scum from the clarifiers to the adjacent sludge sump, the sludge passes through valves 5, 10, 14, 16, 17, 19, 28, 26 and 29 before leaving the control building. Valves 6, 9, 15, 18 and 25 must be closed. Make sure there is sludge in the primary sludge sump, then place the ON-OFF selector switch for Pump No.3 in the ON position and the " Primary- Secondary" selector switch in the "Primary" position. This flow will be metered by the waste sludge flow meter. Refer to the section covering Sludge Lagoon Operation for more information.

c) **Alternate Operation** - If necessary, any of the three sludge pumps can be used to remove sludge from the primary clarifiers. Refer to Figure IV-1 for the flow schematic to determine which valves need to be open and closed for the corresponding alternate pumping operations.

b. **Removal of Chlorine Contact Chamber Sludge:**

1) **Chlorine Contact Sludge Sump to Sludge Holding Tanks** – This mode of operation transfers sludge from the chlorine contact chamber (former secondary clarifeir) sludge sump to the sludge holding tanks. Primary Sludge Pump No.3 is normally used for this operation. To use this pump, the sludge passes through valves 6, 10, 14, 16, 17, 18, 20 and 24 before leaving the control building. Valves 5, 9, 15, 19 and 22 must be closed.

2) **Chlorine Contact Sludge Sump to Sludge Lagoons** – Primary Sludge Pump No. 3 can be used for this operation. Using this pump, the sludge will pass through valves 6, 10, 14, 16, 17, 19, 28, 26 and 29 before leaving the control building. Valves 5, 9, 15, 18 and 25 should be closed.

3) **Chlorine Contact Sludge Sump to Headworks Effluent Well –**
   i. **Using Primary Sludge Pump No.3 (in Control Building)** – the sludge passes through valves 6, 10, 14, 15, 21 and 23. Valves 5, 9, 16 and 22 must be closed.
   ii. **Using Drain and Supernatant Pump Station** – open the valve between the chlorine contact chamber sludge sump and the supernatant pump station. The submersible pumps in the lift station will pump the sludge, along with lagoon supernatant, to the Headworks Effluent Well. These pumps operate automatically with pressure transducers, but should be monitored throughout the process of removing sludge from the chlorine contact chambers.

c. **Filling the Sludge Holding Tanks** – This operation describes the procedures to follow when filling, isolating, or switching operation between Sludge Holding Tanks 1 and 2.

These procedures deal with modifying the sludge piping valves located in the sludge blower building.

1) **To Fill Sludge Holding Tank 1 only** – Valves 16 and 17 must be open, and valve 18 must be closed.
2) **To Fill Sludge Holding Tank 2 only** – Valves 17 and 18 must be open, and valve 16 must be closed.
3) **To Fill both Sludge Holding Tanks simultaneously** – Valves 16, 17 and 18 must be open.

d. **Emptying the Sludge Holding Tanks** - This mode of operation transfers sludge from the sludge holding tanks directly to the sludge lagoons. Primary Sludge Pump No. 1 (located in the control building) is normally used.

1) **Sludge Holding Tank No.1 (North) to Sludge Lagoons** - To use Sludge Pump No. 1, the sludge passes through valves 37, 7, 12, 28, 26 and 29 before leaving the control building. Valves 1, 8, 19, 25, and 27 must be closed. Place the ON-OFF selector switch for Pump No.1 in the ON position. The pump will run until the water level in Sludge Holding Tank No.1 has reached the low water level float switch elevation, which will stop the pump.

2) **Sludge Holding Tank No.2 (South) to Sludge Lagoons** - To use Sludge Pump No. 1, the sludge passes through valves 1, 7, 12, 28, 26 and 29 before leaving the control building. Valves 37, 8, 19, 25, and 27 must be closed. Place the ON-OFF selector switch for Pump No.1 in the ON position. The pump will run until the water level in Sludge Holding Tank No.1 has reached the low water level float switch elevation, which will stop the pump.

e. **Secondary Scum to the Sludge Holding Tanks:**

1) **Secondary Clarifier No.1** - This mode of operation transfers secondary scum from the adjacent scum sump to the sludge holding tanks. Scum Pump No. 2 (east) is normally used. The secondary scum flows through valves 61, 65, and 67 before leaving the clarifier building. Valves 59 and 66 must be closed. During normal operation, the pump ON-OFF-AUTO switch is in the AUTO position, allowing the pump to operate automatically using the float system in the scum sump. To operate manually, make sure there is scum in the secondary scum sump, then place the HAND-OFF-AUTO selector switch for Scum Pump No.2 in the ON position. The operator must monitor the water level in the sump when operating the pump manually to avoid running the pumps dry. Refer to the section covering Sludge Tank Operation for more information.

2) **Secondary Clarifier No.2** - This mode of operation transfers secondary scum from the adjacent scum sump to the sludge holding tanks. Scum Pump No. 1 (west) is normally used. The secondary scum flows through valves 60, 63, and 67 before leaving the clarifier building. Valves 59 and 66 must be closed. During normal operation, the pump ON-OFF-AUTO switch is in the AUTO position, allowing the pump to operate automatically using the float system in the scum sump. To operate

manually, make sure there is scum in the secondary scum sump, then place the ON-OFF-AUTO selector switch for Scum Pump No.2 in the ON position. The operator must monitor the water level in the sump when operating the pump manually to avoid running the pumps dry. Refer to the section covering Sludge Tank Operation for more information.

3) **Alternate Operation** – With the piping arrangement, either of the two scum pumps can be used to transfer secondary scum from either secondary clarifier sump to the sludge holding tanks. It should be noted, however, that the AUTO mode should only be used for normal operation, as discussed above. Any operational changes would require manual operation of the pumps and close monitoring of the water level in the scum sumps.

   a) **Scum Pump No.1 out of service** – Valves 60 and 63 should be closed. Open valve 59 and operate Scum Pump No.2 manually, as required, until Scum Pump No.1 is back in service.

   b) **Scum Pump No.2 out of service** – Valves 61 and 65 should be closed. Open valve 59 and operate Scum Pump No.1 manually, as required, until Scum Pump No.2 is back in service.

   c) **To Pump Secondary Scum to Headworks Effluent Well** – Open Valve No.66 and close Valve No.67. The scum will then be added to the secondary sludge flow to the Headworks Effluent Well.

f. **Secondary Sludge to the Headworks Effluent Well:**

1) **Secondary Clarifier No.1** - This mode of operation transfers secondary (activated) sludge from Secondary Clarifier No.1 to the headworks effluent well. Sludge Pump No. 1 (east) is normally used. The secondary sludge flows through valves 73, 76, 86, and 87 before leaving the clarifier building. Valves 66 and 85 must be closed. During normal operation, the pump ON-OFF-AUTO switch is in the ON position, and the pumps run continuously.

2) **Secondary Clarifier No.2** - This mode of operation transfers secondary (activated) sludge from the Secondary Clarifier No.2 to the headworks effluent well. Sludge Pump No. 2 (west) is normally used. The secondary sludge flows through valves 69, 74, 77 and 87 before leaving the clarifier building. Valves 66 and 78 must be closed. During normal operation, the pump ON-OFF-AUTO switch is in the ON position, and the pumps run continuously.

3) **Alternate Operation** – With the piping and valve arrangement, either of the three sludge pumps can be used to transfer secondary sludge from either secondary clarifier to the headworks effluent well or to the sludge holding tanks.

   a) **Sludge Pump No.1 out of service** – Valves 73, 76, and 81 should be closed, and valves 86, 85, 84, 82, 75, 71, and 87 should be open. This will allow Sludge Pump No.5 to remove sludge from Secondary Clarifier No.1 (east).

b) **Sludge Pump No.2 out of service** – Valves 69, 74, and 82 should be closed, and valves 71, 75, 77, 78, 79, 81 and 87 should be open. This will allow Sludge Pump No.5 to remove sludge from Secondary Clarifier No.2 (west).

c) **To Pump Secondary Sludge to Sludge Holding Tanks** – Open Valve No.66 and close Valve No.87. The sludge will then be added to the secondary scum flow to the Sludge Holding Tanks.

Each of the previously described pumps have pressure gauges on both suction and discharge sides. These gauges should be observed closely to assure proper operation of the pump. These pumps must not run dry; therefore, positive reading on the suction gauge should be observed. Also, high discharge pressure readings above design maximum indicate a closed valve or plugged line. This could destroy the pump starters. Flow meters are provided for the primary and waste sludge lines.

5. Operational Problems - Plugged lines are the most common problem associated with sludge pumps. Each pump has a corporation cock on the suction and discharge lines to allow for flushing with non-potable water. It is suggested that both suction and discharge lines be flushed every time a sludge pump is taken out of service.

   Occasionally, a pump may lose its prime. This is probably caused by air getting into the suction lines. Once the leaks are fixed, the pump can be primed with non-potable water through the corporation cock on the pump suction.

6. Laboratory Controls - The sludge should be analyzed for percent solids and percent volatile solids for process control for:

   - Primary sludge to the sludge holding tanks
   - Secondary sludge to the Headworks effluent well
   - Waste sludge directly to sludge lagoons

   Samples can be drawn from the sample lines in the basement of the Control Building (primary sludge and scum) and the sample lines in the basement of the Clarifier Building (secondary sludge and scum).

## C. SLUDGE TANK OPERATION

This section explains the operation of the aerated sludge holding tanks and its related aerated system and valves.

1. Purpose - The primary purpose of the sludge tanks is to store and blend primary sludge, primary scum, and secondary scum. Since the sludge holding tanks are aerated, they also act as aerobic digesters.

2. Description - The sludge tanks are circular tanks with a cone bottom. Each tank has a volume of approximately 127,000 gallons. The detention time in each tank is approximately

18 days, based on the average design flow of 1.6 mgd. Two telescoping valves are used to draw off supernatant from each tank.

The tank is aerated by six submerged aerators. Air is supplied to the aerators by blowers No. 4 and No. 5, which are high pressure positive displacement blowers. Each blower has a capacity of 360 cfm at 10 psig with a maximum speed of 1,100 rpm. Each blower has a pressure gauge on the discharge and vacuum gauge on the suction. Ammeters for each blower are located on the ICP and MCC. Each blower has a vibration detector that will automatically stop the blower at excessive vibration. A timer locks out the sensor while starting and resetting the blower. The blowers are driven by 25 hp constant speed, 460 volt, 3-phase motors.

3. Start-up - Before starting the blower, check the following: base leveled, bolt tightness, belt alignment, piping, expansion joint in discharge, relief valve setting, air filter, oil and grease fittings, correct rotation, blower turns freely.

   Start the blower at no load by placing the selector switches on the ICP and MCC in the "on" position. Bring the load on gradually until operating conditions are reached. Check for unusual noises, excessive vibration, heat, and oil leakage. If any of these happen, shut down the blower immediately and determine the cause.

4. Control - Blowers No.4 and No.5 discharge into a common air header, each with its own check valve, shut-off valves, and pressure relief valves with shut-off valves on the inlet side of the blowers. Manual control switches for the blowers are located on the ICP and MCC.

   The control of sludge to and from the sludge tank is described in the Sludge Pumping section of this chapter. The flow of supernatant from the tank is controlled by raising or lowering the telescoping valves.

5. Normal Operation - Sludge and scum are pumped to the sludge tank daily from the primary clarifiers. Scum is pumped as needed from the secondary clarifiers to the sludge tanks. The sludge tank should operate with a side water depth fluctuating between 12 ft to 10 ft. The aeration must be sufficient to maintain a dissolved oxygen concentration of 2.0 mg/L and properly blend the primary and secondary sludges. It is anticipated that sludge will be removed from the sludge tanks one day each week.

   The night before the operator is going to withdraw sludge, he or she should shut off the air to the sludge tank. This will allow the sludge to settle and thicken to a concentration of approximately three to four percent solids overnight in the sludge tank. Following settling, the operator should decant the holding tanks. Once the sludge is processed, the blowers should be turned on and the regular pumping schedule followed.

   Before pumping sludge to the sludge lagoons, the operator may choose to decant supernatant off in an attempt to further concentrate the sludge. This is done by shutting off the air for about one hour and then decanting off the supernatant through the upper telescoping valve to the Headworks effluent well. The volume decanted should be at least the same volume of sludge to be pumped. One foot of depth in the digester is approximately 260 gallons. The air should be turned on after the decanting is complete.

At all times, the maximum discharge pressure ratings, 160 psi, on blowers 4 and 5 must not be exceeded. Lowering the water level in the sludge tanks should lower the discharge pressure 0.43 psi for each foot.

6. Alternate Operation: Aerobic Digestion - As an alternative to chemically stabilizing the sludge in the Purifax unit, the sludge tank may be aerobically digested prior to disposal in the sludge lagoons.

   Aerobic digestion biologically metabolizes the organic matter in the sludge to stabilize end products and reduces the total mass and volume of the sludge. The aerobically digested sludge is then disposed of in the sludge lagoons.

   Normal operation as an aerobic digester is to maintain a sludge age of 20 days and a dissolved oxygen concentration of 1.0 mg/L to 2.0 mg/L. Prior to pumping sludge to the digester, the operator should calculate the amount of sludge to be pumped, then decant off at least equal volume, and decant it as much as possible as described in the section covering Sludge Tank Operation. It is important that the amount of sludge fed to the digester is fairly consistent to minimize aeration requirements and process upsets. The organic loading rate of typical aerobic digesters vary from 0.024 to 0.14 lbs of volatile solids/day/$ft^3$ of digester. For the Allendale digester, this calculates out to 405 to 2,370 lbs of volatile solids/day/$ft^3$ of digester.

   Sludge should be digested until:
   a. Supernatant can no longer be decanted.
   b. The ammonia nitrogen/nitrate nitrogen level has stabilized.
   c. The reduction of volatile solids has stabilized (30 to 40%).
   d. The oxygen uptake level is less than 2 mg/L/hour/gram of volatile solids.

7. Laboratory Controls - The sludge in the tank should be analyzed daily for percent solids, volatile solids, dissolved oxygen, and pH. The supernatant should be analyzed for BOD, suspended solids, and nitrate nitrogen to determine loading on the east of the plant.

8. Operational Problems - Care must be taken to avoid hydraulically overloading the plant with excess supernatant. Experience will indicate how much can be decanted without causing problems to the rest of the plant. Care must also be exercised as to what depth the telescoping valves are lowered when decanting. If lowered too close to the sludge blanket or too low within the supernatant, sludge will rise up and be fed back to the plant, defeating the purpose of the operation and possibly overloading the basin.

   An increase in the blower discharge pressure may indicate clogging air diffusers in the sludge tank. Shutting down the aeration for decanting may allow fine particles to lodge in the diffusers, eventually clogging the diffusers.

   Low dissolved oxygen levels may be the result of problems in the aeration system - an increase in organic loading without an appropriate increase in aeration. Low dissolved oxygen levels will cause odors to develop if not corrected.

9. Emergency Operation - In the event of major equipment failure, the operator has two emergency alternatives. The first alternative is to pump primary and/or secondary sludge directly from the sludge sumps to the Purifax unit. In this case sludge pump No. 1 should be used. He could also store the sludge in the primary clarifiers for one to two days.

   The other alternative is to pump sludge directly from the sludge sumps to the sludge lagoons. Sludge pumps No. 2 or No. 3 should be used. This alternative should be used only in extreme cases when any of the previously described alternatives are not available.

## D. SLUDGE LAGOONS

1. Purpose - The sludge lagoons store the aerobically digested sludge.

2. Description - The sludge lagoons were the original treatment ponds for Allendale Township. During the construction of the original plant, the lagoons were modified to serve as sludge storage lagoons and to return supernatant back to the head end of the treatment plant.

   Lagoon 1 has a surface area of 0.65 acres and a depth of 10 feet, giving a total volume of 2.11 million gallons.

   Lagoon 2 has a surface area of 3.29 acres and a depth of 10 feet, giving a total volume of 10.7 million gallons.

   Lagoon 3 has a surface area of 3.48 acres and a depth of 10 feet, giving a total volume of 12.50 million gallons.

   It was anticipated that the storage lagoons would provide 10 years of storage capacity before needing to be cleaned out. Currently after 10 years there is a very small sludge blanket on the bottom of the storage lagoons.

3. Control - Flow to the various sludge lagoons is controlled by valves as indicated in Figure IV-2. To place sludge in lagoon 2, open valves A, B, and C, and close valve D. To place sludge in lagoon, open valves D, F, G, H, and close valves C and E.

   Sludge Lagoon No.1 has been converted to an aeration pond for the Leprino wastewater and is no longer a sludge storage lagoon.

4. Normal Operation - Aerobically digested sludge is pumped to the sludge lagoons for disposal. The sludge will settle to the bottom of the lagoons and the supernatant returned to the plant headworks for treatment. There should be no unpleasant odors from these lagoons if the sludge has been properly stabilized. It is recommended that the sludge be applied to all three lagoons to take advantage of the full surface areas.

## E. BIOSOLIDS (SLUDGE) MANAGEMENT

Appendix F contains information on developing and implementing a sludge management program as required by MDEQ. The operator should use this material and the information in this section to properly manage sludge processing and disposal at the Allendale plant.

1. Sludge Treatment Process - The normal sludge treatment process is to pump primary and sludge and scum, along with secondary scum, to the sludge holding tanks for storage. The alternative sludge treatment process is to operate the sludge holding tank as an aerobic digester and dispose of the digested sludge in the sludge lagoons.

   In emergency situations, the sludge tanks can be bypassed, pumping sludge directly to the sludge lagoons. This emergency operation should be used only in cases of extreme emergency, such as damage to the rest of the plant equipment or processes.

2. Sludge Production – Based on the 1997 Design Basis Report, it is estimated that 4,714 lbs/day (33,000 lbs/week) of sludge will be wasted to the sludge holding tanks at the design flow of 1.6 mgd. This includes primary sludge and recirculated secondary sludge, and is consisdered to be "cosettled" sludge. If the tanks were operated as aerobic digesters and decanted to 2% solids, this would correspond to approximately 18 days of storage for each tank. However, the current operation of the aerated holding tanks (no decanting) storage is limited to approximately 7 days of storage for each tank at an average flow rate of approximately 0.8 mgd.

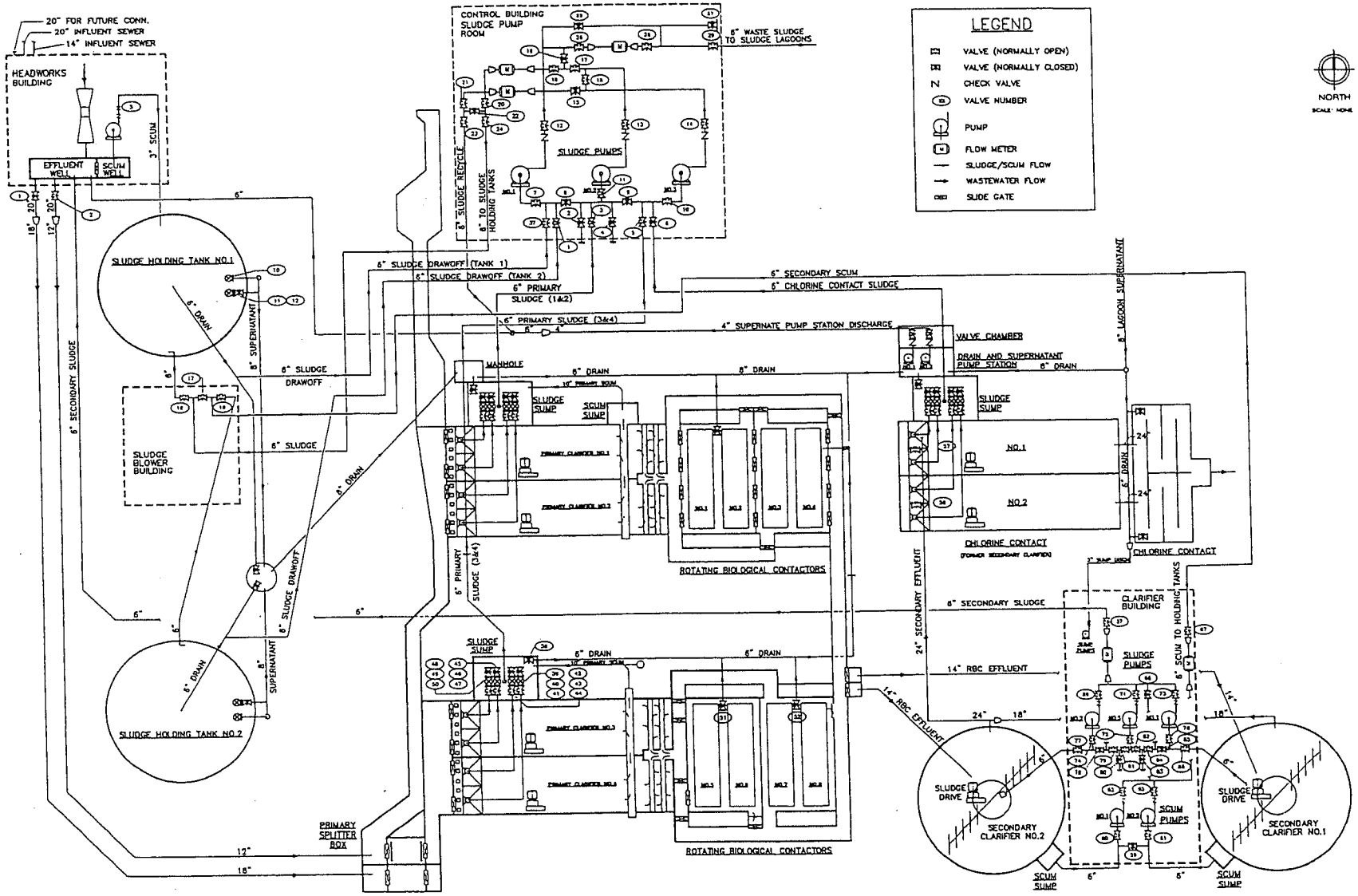
Quality of Sludge After Treatment:

The aerobically digested sludge should have the following characteristics:

| | |
|---|---|
| pH | 6.5 - 6.8 |
| Total Suspended Solids (Concentration) | 3.5% to 4.0% |
| Total Volatile Suspended Solids (%) | 38% to 48% |

3. Sludge Storage and Disposal - The sludge tanks have an estimated combined storage capacity of 250,000 gallons. Based on current operations (aerating and wasting, no decanting), this corresponds to approximately two weeks of sludge storage.

   The sludge lagoons have a total storage capacity of 12.50 million gallons. It is anticipated that the lagoons will provide approximately 10 years of storage capacity (after 10 years there is a small sludge blanket on the bottom of the storage lagoons).



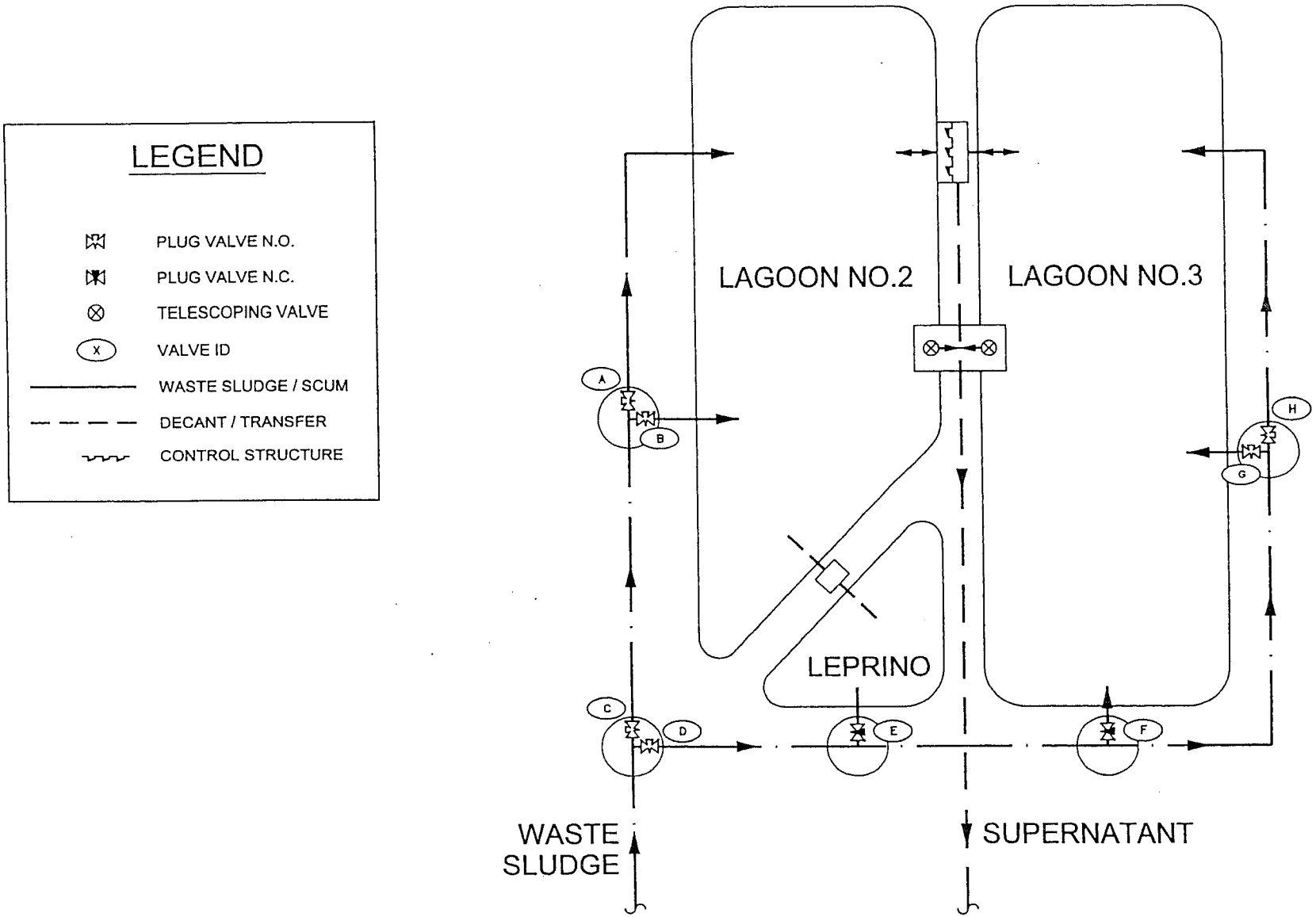

ALLENDALE WWTP

FIGURE IV-1 - PROCESS FLOW SCHEMATIC

2002

3106

LEIS & VANDENBRINK ENGINEERING, INC




# SLUDGE LAGOON SCHEMATIC

SCALE: NONE

ALLENDALE WWTP
OTTAWA COUNTY, MICHIGAN

FIGURE IV-2

2002

FLEIS & VANDENBRINK ENGINEERING, INC.

# Significant Industrial Users

# WASTEWATER CONTRIBUTION PERMIT

Leprino Foods

## PART 1 - EFFLUENT LIMITATIONS

A. During the period of 10/17/2002 to 10/16/2004 the permittee is authorized to discharge process wastewater to the Allendale Charter Township sewer system from the outfalls listed below.

Description of outfalls:

| Outfall | Descriptions |
|---|---|
| 001 | Outfall structure at Southeast end of Leprino Influent Pond. This Pond is immediately after the Leprino flow measuring structure. |

B. During the period of 10/17/2002 to 10/16/2004 the discharge from outfall 001 shall not exceed the following effluent limitations. Effluent from this outfall consists of treated process wastewater from the Leprino Foods Company wastewater treatment facility.

### EFFLUENT LIMITATIONS

| Parameter | 24 hour maximum (mg/l) | 30 day average (mg/l) |
|---|---|---|
| Flow * | 1,000,000 gpd | 850,000 gpd |
| CBOD-5 | 40 mg/l | 25 mg/l |
| Suspended Solids | 45 mg/l | 30 mg/l |
| Total Phosphorus | 1.5 mg/l | 1.0 mg/l |
| PH (acceptable range) | 6.5-9.0 | |
| Dissolved Oxygen (minimum required) | 4.0 | |

* measured at Leprino flow measuring structure before Leprino Influent Pond (West end of Leprino Influent Pond)

C. The permittee shall not discharge wastewater containing any of the substances listed in Section 5.5 (B) of the Allendale Charter Township Sewer Usage and Administration Ordinance.

D. All discharges shall comply with all other applicable laws, regulations, standards, and requirements contained in the Allendale Charter Township Sewer Usage and Administration Ordinance, and any applicable State and Federal pretreatment laws, regulations, standards, and requirements including any such laws, regulations, standards, or requirements that may become effective during the term of this permit.

# ATTACHMENT B

# Inorganic Nutrients and Pollutants

# Biosolids Annalytical Report for
# LAB ANALYSIS - April 28, 2006

## Allendale Charter Township WWTP

| Parameter | Minimum Annual Concentration | Average Annual Concentration | Maximum Annual Concentration | Units | # of Analyses | Method Detection Limit | Test Method | Sample Type |
|---|---|---|---|---|---|---|---|---|
| ***Inorganics*** | | | | | | | | |
| Solids | 4.660 | 6.062 | 8.500 | % | 6 | 0.010 | 160.3 | Composite |
| Arsenic | 0.021 | 5.469 | 7.610 | mg/kg | 6 | 0.001 | 6020 | Composite |
| Cadmium | 0.098 | 2.095 | 4.470 | mg/kg | 6 | 0.006 | 6020 | Composite |
| Copper | 238.000 | 332.167 | 468.000 | mg/kg | 6 | 0.010 | 6010B | Composite |
| Lead | 0.021 | 27.720 | 64.400 | mg/kg | 6 | 0.001 | 6020 | Composite |
| Mercury | 0.012 | 0.044 | 0.180 | mg/kg | 6 | 0.001 | 6020 | Composite |
| Molybdenum | 16.700 | 19.617 | 21.200 | mg/kg | 6 | 0.001 | 6020 | Composite |
| Nickel | 0.018 | 12.093 | 31.500 | mg/kg | 6 | 0.001 | 6020 | Composite |
| Selenium | 0.012 | 0.017 | 0.021 | mg/kg | 6 | 0.001 | 6020 | Composite |
| Zinc | 592.000 | 760.833 | 973.000 | mg/kg | 6 | 0.040 | 6010B | Composite |
| ***Nutrients*** | | | | | | | | |
| TKN | 20400.000 | 30286.000 | 39422.000 | mg/kg | 6 | 1.000 | 351.3 | Composite |
| Ammonium Nitrogen | 3984.000 | 5916.000 | 7897.000 | mg/kg | 6 | 1.000 | SM4500N | Composite |
| Phosphorus | 21012.000 | 32899.500 | 42468.000 | mg/kg | 6 | 1.000 | 6010B | Composite |
| Potassium | 1376.000 | 1753.833 | 2439.000 | mg/kg | 6 | 1.000 | 6010B | Composite |

## Allendale Charter Township WWTP
## LAB ANALYSIS - April 28, 2006

| | Lagoon 2A(1) Biosolids | Lagoon 2B(1) Biosolids | Lagoon 2C(1) Biosolids | Lagoon 3A(2) Biosolids | Lagoon 3B(2) Biosolids | Lagoon 3C(2) Biosolids | Minimum | Average | Maximum |
|---|---|---|---|---|---|---|---|---|---|
| DENSITY | 8.340 | 8.340 | 8.340 | 8.340 | 8.340 | 8.340 | 8.340 | 8.340 | 8.340 |
| MERCURY | 0.180 | 0.018 | 0.012 | 0.016 | 0.021 | 0.019 | 0.012 | 0.044 | 0.180 |
| AMMONIA, NITROGEN AS N | 5,876.000 | 6,445.000 | 4,118.000 | 3,984.000 | 7,897.000 | 7,176.000 | 3,984.000 | 5,916.000 | 7,897.000 |
| NITROGEN, TOTAL | 31,929.000 | 31,831.000 | 20,424.000 | 25,528.000 | 39,485.000 | 32,729.000 | 20,424.000 | 30,321.000 | 39,485.000 |
| NITROGEN, TOTAL AVAILABLE | | | | | | | 0.000 | #DIV/0! | 0.000 |
| NITROGEN, TOTAL KJELDAHL | 31,894.000 | 31,813.000 | 20,400.000 | 25,496.000 | 39,422.000 | 32,691.000 | 20,400.000 | 30,286.000 | 39,422.000 |
| pH | | | | | | | 0.000 | #DIV/0! | 0.000 |
| PHOSPHOROUS, TOTAL AS P | 33,080.000 | 35,871.000 | 21,012.000 | 28,000.000 | 42,468.000 | 36,966.000 | 21,012.000 | 32,899.500 | 42,468.000 |
| NITROGEN, NITRATE AS N | 35.400 | 55.200 | 23.500 | 32.500 | 42.900 | 38.200 | 23.500 | 37.950 | 55.200 |
| CADMIUM | 0.110 | 4.150 | 4.470 | 0.098 | 0.130 | 3.610 | 0.098 | 2.095 | 4.470 |
| CALCIUM | 44,743.000 | 51,508.000 | 56,200.000 | 48,488.000 | 40,644.000 | 41,851.000 | 40,644.000 | 47,239.000 | 56,200.000 |
| CHROMIUM | 30.200 | 26.500 | 28.700 | 27.000 | 31.200 | 25.300 | 25.300 | 28.150 | 31.200 |
| COPPER | 468.000 | 325.000 | 311.000 | 238.000 | 298.000 | 353.000 | 238.000 | 332.167 | 468.000 |
| LEAD | 35.900 | 21.000 | 64.400 | 27.400 | 0.021 | 17.600 | 0.021 | 27.720 | 64.400 |
| MAGNESIUM | 8,265.000 | 9,659.000 | 15,600.000 | 9,285.000 | 5,429.000 | 346.000 | 346.000 | 8,097.333 | 15,600.000 |
| MOLYBDENUM | 20.500 | 21.200 | 18.600 | 16.700 | 21.000 | 19.700 | 16.700 | 19.617 | 21.200 |
| NICKEL | 0.018 | 0.018 | 19.600 | 21.400 | 0.021 | 31.500 | 0.018 | 12.093 | 31.500 |
| POTASSIUM | 1,681.000 | 1,598.000 | 1,376.000 | 2,439.000 | 1,845.000 | 1,584.000 | 1,376.000 | 1,753.833 | 2,439.000 |
| ZINC | 973.000 | 761.000 | 647.000 | 592.000 | 859.000 | 733.000 | 592.000 | 760.833 | 973.000 |
| ARSENIC | 6.300 | 6.230 | 7.610 | 6.750 | 0.021 | 5.900 | 0.021 | 5.469 | 7.610 |
| SELENIUM | 0.018 | 0.018 | 0.012 | 0.016 | 0.021 | 0.019 | 0.012 | 0.017 | 0.021 |
| SOLIDS, TOTAL (TS) | 5.650 | 5.570 | 8.500 | 6.750 | 4.660 | 5.240 | 4.660 | 6.062 | 8.500 |
| SOLIDS, TOTAL VOLATILE (TVS) | | | | | | | | | |

| | Averages Lagoon 2(1) | Averages Lagoon 3(2) |
|---|---|---|
| DENSITY | 8.34 | 8.34 |
| MERCURY | 0.07 | 0.02 |
| AMMONIA, NITROGEN AS N | 5,479.67 | 6,352.33 |
| NITROGEN, TOTAL | 28,061.33 | 32,580.67 |
| NITROGEN, TOTAL AVAILABLE | #DIV/0! | #DIV/0! |
| NITROGEN, TOTAL KJELDAHL | 28,035.67 | 32,536.33 |
| pH | #DIV/0! | #DIV/0! |
| PHOSPHOROUS, TOTAL AS P | 29,987.67 | 35,811.33 |
| NITROGEN, NITRATE AS N | 38.03 | 37.87 |
| CADMIUM | 2.91 | 1.28 |
| CALCIUM | 50,817.00 | 43,661.00 |
| CHROMIUM | 28.47 | 27.83 |
| COPPER | 368.00 | 296.33 |
| LEAD | 40.43 | 15.01 |
| MAGNESIUM | 11,174.67 | 5,020.00 |
| MOLYBDENUM | 20.10 | 19.13 |
| NICKEL | 6.55 | 17.64 |
| POTASSIUM | 1,551.67 | 1,956.00 |
| ZINC | 793.67 | 728.00 |
| ARSENIC | 6.71 | 4.22 |
| SELENIUM | 0.02 | 0.02 |
| SOLIDS, TOTAL (TS) | 6.57 | 5.55 |

REPORT NUMBER: F06118-8003
ACCOUNT NUMBER: 08514


# A & L GREAT LAKES LABORATORIES, INC.

3505 Conestoga Drive • Fort Wayne, Indiana 46808-4413 • Phone 260-483-4759 • Fax 260-483-5274
www.algreatlakes.com • e-mail: lab@algreatlakes.com


# BIOSOLIDS ANALYSIS

| TO: | FOR: |
|---|---|
| BIOTECH AGRONOMICS, INC.<br>P.O. BOX 180<br>BENZONIA, MI 49616-0180 | ALLENDALE WWTP |

| | |
|---|---|
| REPORT NUMBER | F06118-8003 |
| LAB NUMBER | 4088 |
| SAMPLE ID | 2A (called # in contract) |

| | |
|---|---|
| DATE SAMPLED | 4/26/2006 1030 |
| DATE RECEIVED | 04/28/2006 |
| DATE REPORTED | 05/16/2006 |

| PARAMETER | WET BASIS | | DRY BASIS | | TABLE 1# | TABLE 3# | LOADING RATE | |
|---|---|---|---|---|---|---|---|---|
| | RESULT | UNIT | RESULT | UNIT | MG/KG | MG/KG | LBS/WET TON | LBS/ACRE/YEAR |
| Nitrogen, Total | 1804 | mg/kg | 31929 | mg/kg | --- | --- | 3.61 | 63.9 |
| Nitrogen, Total Kjeldahl | 1802 | mg/kg | 31894 | mg/kg | --- | --- | 3.60 | 63.8 |
| Nitrogen, Ammonia (as N) | 332 | mg/kg | 5876 | mg/kg | --- | --- | 0.66 | 11.8 |
| Nitrogen, Nitrate (as N) | 2 | mg/kg | 35.4 | mg/kg | --- | --- | 0.0040 | 0.071 |
| Phosphorus | 1869 | mg/kg | 33080 | mg/kg | --- | --- | 3.74 | 66.2 |
| Phosphorus (as P2O5) | 4280 | mg/kg | 75752 | mg/kg | --- | --- | 8.56 | 151.5 |
| Potassium | 95 | mg/kg | 1681 | mg/kg | --- | --- | 0.19 | 3.4 |
| Potassium (as K2O) | 114 | mg/kg | 2018 | mg/kg | --- | --- | 0.23 | 4.0 |
| Lead | 2.031 | mg/kg | 35.9 | mg/kg | 840 | 300 | 0.0041 | 0.072 |
| Zinc | 54.97 | mg/kg | 973 | mg/kg | 7500 | 2800 | 0.11 | 1.9 |
| Nickel | <0.001 | mg/kg | <0.018 | mg/kg | 420 | 420 | <0.0000 | <0.00004 |
| Copper | 26.42 | mg/kg | 468 | mg/kg | 4300 | 1500 | 0.053 | 0.94 |
| Cadmium | <0.006 | mg/kg | <0.11 | mg/kg | 85 | 39 | <0.0000 | <0.00021 |
| Solids, Total | 5.65 | % | 100.0 | % | --- | --- | 112.9 | 2000.0 |
| Arsenic | 0.356 | mg/kg | 6.30 | mg/kg | 75 | 41 | 0.00071 | 0.013 |
| Chromium | 1.708 | mg/kg | 30.2 | mg/kg | --- | --- | 0.0034 | 0.060 |
| Mercury | <0.001 | mg/kg | <0.018 | mg/kg | 57 | 17 | <0.0000 | <0.00004 |
| Molybdenum | 1.159 | mg/kg | 20.5 | mg/kg | 75 | --- | 0.0023 | 0.041 |
| Selenium | <0.001 | mg/kg | <0.018 | mg/kg | 100 | 100 | <0.0000 | <0.00004 |
| Calcium | 2528 | mg/kg | 44743 | mg/kg | --- | --- | 5.06 | 89.5 |

# Table 1 and Table 3 pollution concentrations for biosolids or industrial waste products, EPA-600/4-79-020, 327 IAC 6.1-5.

AM-BT3M

REPORT NUMBER: F06118-8003
ACCOUNT NUMBER: 08514


# A & L GREAT LAKES LABORATORIES, INC.

3505 Conestoga Drive • Fort Wayne, Indiana 46808-4413 • Phone 260-483-4759 • Fax 260-483-5274
www.algreatlakes.com • e-mail: lab@algreatlakes.com


# BIOSOLIDS ANALYSIS

| TO: | FOR: |
|---|---|
| BIOTECH AGRONOMICS, INC.<br>P.O. BOX 180<br>BENZONIA, MI 49616-0180 | ALLENDALE WWTP |

| | |
|---|---|
| REPORT NUMBER | F06118-8003 |
| LAB NUMBER | 4088 |
| SAMPLE ID | 2A |

| | |
|---|---|
| DATE SAMPLED | 4/26/2006 1030 |
| DATE RECEIVED | 04/28/2006 |
| DATE REPORTED | 05/16/2006 |

| PARAMETER | WET BASIS | | DRY BASIS | | TABLE 1# | TABLE 3# | LOADING RATE | |
|---|---|---|---|---|---|---|---|---|
| | RESULT | UNIT | RESULT | UNIT | MG/KG | MG/KG | LBS/WET TON | LBS/DRY TON |
| Magnesium | 467.0 | mg/kg | 8265 | mg/kg | --- | --- | 0.93 | 16.5 |
| Sodium | <1 | mg/kg | <17.7 | mg/kg | --- | --- | <0.002 | <0.035 |
| Silver | <0.001 | mg/kg | <0.018 | mg/kg | --- | --- | <0.0000 | <0.00004 |
| Chloride | 213 | mg/kg | 3770 | mg/kg | --- | --- | 0.43 | 7.5 |

# Table 1 and Table 3 pollution concentrations for biosolids or industrial waste products, EPA-600/4-79-020, 327 IAC 6.1-5.

AU-BT3M

REPORT NO.
F06118-8003
ACCOUNT NUMBER
08514

# A & L GREAT LAKES LABORATORIES, INC.

3505 Conestoga Drive • Fort Wayne, Indiana 46808-4413 • Phone 260-483-4759 • Fax 260-483-5274
www.algreatlakes.com • e-mail: lab@algreatlakes.com

TO: BIOTECH AGRONOMICS, INC.
P.O. BOX 180
BENZONIA, MI 49616-0180

FOR: ALLENDALE WWTP

ATTN: BROOKE BONNEY

## REPORT OF ANALYSIS

LAB NUMBER: 4088
SAMPLE ID: 2A

DATE SAMPLED: 4/26/06 1030
DATE RECEIVED: 04/28/2006
DATE REPORTED: 05/16/2006 PAGE: 1

| PARAMETER | RESULT | UNIT | DETECTION LIMIT | ANALYST | ANALYSIS DATE | METHOD REFERENCE |
|---|---|---|---|---|---|---|
| Nitrogen, Total | 1804 | mg/kg | 1 | MG | 5/1/06 | EPA-351.3/353.2 |
| Nitrogen, Total Kjeldahl | 1802 | mg/kg | 1 | MG | 5/1/06 | EPA-351.3 |
| Nitrogen, Ammonia (as N) | 332 | mg/kg | 1 | MG | 5/1/06 | SM(20th)-4500-NH3B,C |
| Nitrogen, Nitrate (as N) | 2 | mg/kg | 1 | DT | 5/2/06 | EPA-353.2 |
| Phosphorus | 1869 | mg/kg | 1 | CRT | */*/** | SW846-6010B |
| Potassium | 95 | mg/kg | 1 | CRT | 5/10/06 | SW846-6010B |
| Lead | 2.031 | mg/kg | 0.001 | CRT | 5/16/06 | SW846-6020 |
| Zinc | 54.97 | mg/kg | 0.04 | CRT | 5/10/06 | SW846-6010B |
| Nickel | BDL* | mg/kg | 0.001 | CRT | 5/16/06 | SW846-6020 |
| Copper | 26.42 | mg/kg | 0.01 | CRT | 5/10/06 | SW846-6010B |
| Cadmium | BDL* | mg/kg | 0.006 | CRT | 5/16/06 | SW846-6020 |
| Solids, Total | 5.65 | % | 0.01 | MG | 4/28/06 | EPA 160.3 |
| Arsenic | 0.356 | mg/kg | 0.001 | CRT | 5/16/06 | SW846-6020 |
| Chromium | 1.708 | mg/kg | 0.001 | CRT | 5/16/06 | SW846-6020 |
| Mercury | BDL* | mg/kg | 0.001 | CRT | 5/16/06 | SW846-6020 |
| Molybdenum | 1.159 | mg/kg | 0.001 | CRT | 5/16/06 | SW846-6020 |
| Selenium | BDL* | mg/kg | 0.001 | CRT | 5/16/06 | SW846-6020 |
| Calcium | 2528 | mg/kg | 1 | CRT | 5/10/06 | SW846-6010B |

ASI-bio

* BDL - Below detection level of method utilized.

REPORT NO.
F06118-8003
ACCOUNT NUMBER
08514

# A & L GREAT LAKES LABORATORIES, INC.

3505 Conestoga Drive • Fort Wayne, Indiana 46808-4413 • Phone 260-483-4759 • Fax 260-483-5274
www.algreatlakes.com • e-mail: lab@algreatlakes.com

TO: BIOTECH AGRONOMICS, INC.
P.O. BOX 180
BENZONIA, MI 49616-0180

FOR: ALLENDALE WWTP

ATTN: BROOKE BONNEY

## REPORT OF ANALYSIS

LAB NUMBER: 4088
SAMPLE ID: 2A

DATE SAMPLED: 4/26/06 1030
DATE RECEIVED: 04/28/2006
DATE REPORTED: 05/16/2006 PAGE: 2

| PARAMETER | RESULT | UNIT | DETECTION LIMIT | ANALYST | ANALYSIS DATE | METHOD REFERENCE |
|---|---|---|---|---|---|---|
| Magnesium | 467.0 | mg/kg | 0.3 | CRT | 5/10/06 | SW846-6010B |
| Sodium | BDL* | mg/kg | 1 | CRT | 5/10/06 | SW846-6010B |
| Silver | BDL* | mg/kg | 0.001 | CRT | 5/10/06 | SW846-6010B |
| Chloride | 213 | mg/kg | 10 | DT | 5/2/06 | LACH. 10-117-07 |

* BDL - Below detection level of method utilized.

ASI-bio

REPORT NUMBER: F06118-8003
ACCOUNT NUMBER: 08514


# A & L GREAT LAKES LABORATORIES, INC.

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# BIOSOLIDS ANALYSIS

| TO: | FOR: |
|---|---|
| BIOTECH AGRONOMICS, INC.<br>P.O. BOX 180<br>BENZONIA, MI 49616-0180 | ALLENDALE WWTP |

| | |
|---|---|
| REPORT NUMBER: | F06118-8003 |
| LAB NUMBER: | 4089 |
| SAMPLE ID: | 2B (#1 in contract) |

| | |
|---|---|
| DATE SAMPLED: | 4/26/2006 1130 |
| DATE RECEIVED: | 04/28/2006 |
| DATE REPORTED: | 05/16/2006 |

| PARAMETER | WET BASIS | | DRY BASIS | | TABLE 1# | TABLE 3# | LOADING RATES | |
|---|---|---|---|---|---|---|---|---|
| | RESULT | UNIT | RESULT | UNIT | MG/KG | MG/KG | LBS/WET TON | LBS/DRY TON |
| Nitrogen, Total | 1773 | mg/kg | 31831 | mg/kg | --- | --- | 3.55 | 63.7 |
| Nitrogen, Total Kjeldahl | 1772 | mg/kg | 31813 | mg/kg | --- | --- | 3.54 | 63.6 |
| Nitrogen, Ammonia (as N) | 359 | mg/kg | 6445 | mg/kg | --- | --- | 0.72 | 12.9 |
| Nitrogen, Nitrate (as N) | 1 | mg/kg | 18.0 | mg/kg | --- | --- | 0.0020 | 0.036 |
| Phosphorus | 1998 | mg/kg | 35871 | mg/kg | --- | --- | 4.00 | 71.7 |
| (4) Phosphorus (as P2O5) | 4575 | mg/kg | 82144 | mg/kg | --- | --- | 9.15 | 164.3 |
| Potassium | 89 | mg/kg | 1598 | mg/kg | --- | --- | 0.18 | 3.2 |
| (3) Potassium (as K2O) | 107 | mg/kg | 1917 | mg/kg | --- | --- | 0.21 | 3.8 |
| Lead | 1.167 | mg/kg | 21.0 | mg/kg | 840 | 300 | 0.0023 | 0.042 |
| Zinc | 42.41 | mg/kg | 761 | mg/kg | 7500 | 2800 | 0.085 | 1.5 |
| Nickel | <0.001 | mg/kg | <0.018 | mg/kg | 420 | 420 | <0.0000 | <0.00004 |
| Copper | 18.08 | mg/kg | 325 | mg/kg | 4300 | 1500 | 0.036 | 0.65 |
| Cadmium | 0.231 | mg/kg | 4.15 | mg/kg | 85 | 39 | 0.00046 | 0.0083 |
| Solids, Total | 5.57 | % | 100.0 | % | --- | --- | 111.3 | 2000.0 |
| Arsenic | 0.347 | mg/kg | 6.23 | mg/kg | 75 | 41 | 0.00069 | 0.012 |
| Chromium | 1.474 | mg/kg | 26.5 | mg/kg | --- | --- | 0.0029 | 0.053 |
| Mercury | <0.001 | mg/kg | <0.018 | mg/kg | 57 | 17 | <0.0000 | <0.00004 |
| Molybdenum | 1.179 | mg/kg | 21.2 | mg/kg | 75 | --- | 0.0024 | 0.042 |
| Selenium | <0.001 | mg/kg | <0.018 | mg/kg | 100 | 100 | <0.0000 | <0.00004 |
| Calcium | 2869 | mg/kg | 51508 | mg/kg | --- | --- | 5.74 | 103.0 |

# Table 1 and Table 3 pollution concentrations for biosolids or industrial waste products, EPA-600/4-79-020, 327 IAC 6.1-5.

ANI-BT3M

REPORT NUMBER: F06118-8003
ACCOUNT NUMBER: 08514


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# BIOSOLIDS ANALYSIS

| TO: | FOR: |
|---|---|
| BIOTECH AGRONOMICS, INC.<br>P.O. BOX 180<br>BENZONIA, MI 49616-0180 | ALLENDALE WWTP |

| | |
|---|---|
| REPORT NUMBER | F06118-8003 |
| LAB NUMBER | 4089 |
| SAMPLE ID | 2B |

| | |
|---|---|
| DATE SAMPLED | 4/26/2006 1130 |
| DATE RECEIVED | 04/28/2006 |
| DATE REPORTED | 05/16/2006 |

| PARAMETER | WET BASIS | | DRY BASIS | | TABLE 1 # | TABLE 3 # | LOADING RATE | |
|---|---|---|---|---|---|---|---|---|
| | RESULT | UNIT | RESULT | UNIT | MG/KG | MG/KG | LBS/WET TON | LBS/DRY TON |
| Magnesium | 538.0 | mg/kg | 9659 | mg/kg | --- | --- | 1.08 | 19.3 |
| Sodium | <1 | mg/kg | <18.0 | mg/kg | --- | --- | <0.002 | <0.036 |
| Silver | <0.001 | mg/kg | <0.018 | mg/kg | --- | --- | <0.0000 | <0.00004 |
| Chloride | 200 | mg/kg | 3591 | mg/kg | --- | --- | 0.40 | 7.2 |

# Table 1 and Table 3 pollution concentrations for biosolids or industrial waste products, EPA-600/4-79-020, 327 IAC 6.1-5.

AD-BT3M

REPORT NO.
F06118-8003
ACCOUNT NUMBER
08514

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TO: BIOTECH AGRONOMICS, INC.
P.O. BOX 180
BENZONIA, MI 49616-0180

FOR: ALLENDALE WWTP

ATTN: BROOKE BONNEY

## REPORT OF ANALYSIS

LAB NUMBER: 4089
SAMPLE ID: 2B

DATE SAMPLED: 4/26/06 1130
DATE RECEIVED: 04/28/2006
DATE REPORTED: 05/16/2006 PAGE: 3

| PARAMETER | RESULT | UNIT | DETECTION LIMIT | ANALYST | ANALYSIS DATE | METHOD REFERENCE |
|---|---|---|---|---|---|---|
| Nitrogen, Total | 1773 | mg/kg | 1 | MG | 5/1/06 | EPA-351.3/353.2 |
| Nitrogen, Total Kjeldahl | 1772 | mg/kg | 1 | MG | 5/1/06 | EPA-351.3 |
| Nitrogen, Ammonia (as N) | 359 | mg/kg | 1 | MG | 5/1/06 | SM(20th)-4500-NH3B,C |
| Nitrogen, Nitrate (as N) | 1 | mg/kg | 1 | DT | 5/2/06 | EPA-353.2 |
| Phosphorus | 1998 | mg/kg | 1 | CRT | 5/10/06 | SW846-6010B |
| Potassium | 89 | mg/kg | 1 | CRT | 5/10/06 | SW846-6010B |
| Lead | 1.167 | mg/kg | 0.001 | CRT | 5/16/06 | SW846-6020 |
| Zinc | 42.41 | mg/kg | 0.04 | CRT | 5/10/06 | SW846-6010B |
| Nickel | BDL* | mg/kg | 0.001 | CRT | 5/16/06 | SW846-6020 |
| Copper | 18.08 | mg/kg | 0.01 | CRT | 5/10/06 | SW846-6010B |
| Cadmium | 0.231 | mg/kg | 0.006 | CRT | 5/16/06 | SW846-6020 |
| Solids, Total | 5.57 | % | 0.01 | MG | 4/28/06 | EPA 160.3 |
| Arsenic | 0.347 | mg/kg | 0.001 | CRT | 5/16/06 | SW846-6020 |
| Chromium | 1.474 | mg/kg | 0.001 | CRT | 5/16/06 | SW846-6020 |
| Mercury | BDL* | mg/kg | 0.001 | CRT | 5/16/06 | SW846-6020 |
| Molybdenum | 1.179 | mg/kg | 0.001 | CRT | 5/16/06 | SW846-6020 |
| Selenium | BDL* | mg/kg | 0.001 | CRT | 5/16/06 | SW846-6020 |
| Calcium | 2869 | mg/kg | 1 | CRT | 5/10/06 | SW846-6010B |

ASI-bio

* BDL - Below detection level of method utilized.

REPORT NO.
F06118-8003
ACCOUNT NUMBER
08514

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TO: BIOTECH AGRONOMICS, INC.
P.O. BOX 180
BENZONIA, MI 49616-0180

FOR: ALLENDALE WWTP

ATTN: BROOKE BONNEY

## REPORT OF ANALYSIS

DATE SAMPLED: 4/26/06 1130
DATE RECEIVED: 04/28/2006
DATE REPORTED: 05/16/2006 PAGE: 4

LAB NUMBER: 4089
SAMPLE ID: 2B

| PARAMETER | RESULT | UNIT | DETECTION LIMIT | ANALYST | ANALYSIS DATE | METHOD REFERENCE |
|---|---|---|---|---|---|---|
| Magnesium | 538.0 | mg/kg | 0.3 | CRT | 5/10/06 | SW846-6010B |
| Sodium | BDL* | mg/kg | 1 | CRT | 5/10/06 | SW846-6010B |
| Silver | BDL* | mg/kg | 0.001 | CRT | 5/10/06 | SW846-6010B |
| Chloride | 200 | mg/kg | 10 | DT | 5/2/06 | LACH. 10-117-07 |

A&I-bio

* BDL - Below detection level of method utilized.

REPORT NUMBER: F06118-8003
ACCOUNT NUMBER: 08514


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# BIOSOLIDS ANALYSIS

| TO: | FOR: |
|---|---|
| BIOTECH AGRONOMICS, INC.<br>P.O. BOX 180<br>BENZONIA, MI 49616-0180 | ALLENDALE WWTP |

| | |
|---|---|
| REPORT NUMBER: | F06118-8003 |
| LAB NUMBER: | 4090 |
| SAMPLE ID: | 2C (#1 in Contract) |

| | |
|---|---|
| DATE SAMPLED: | 4/26/2006 1200 |
| DATE RECEIVED: | 04/28/2006 |
| DATE REPORTED: | 05/16/2006 |

| PARAMETER | WET BASIS | | DRY BASIS | | TABLE 1# | TABLE 3# | LOADING RATE | |
|---|---|---|---|---|---|---|---|---|
| | RESULT | UNIT | RESULT | UNIT | MG/KG | MG/KG | LBS/WET TON | LBS/DRY TON |
| Nitrogen, Total | 1736 | mg/kg | 20424 | mg/kg | --- | --- | 3.47 | 40.8 |
| Nitrogen, Total Kjeldahl | 1734 | mg/kg | 20400 | mg/kg | --- | --- | 3.47 | 40.8 |
| Nitrogen, Ammonia (as N) | 350 | mg/kg | 4118 | mg/kg | --- | --- | 0.70 | 8.2 |
| Nitrogen, Nitrate (as N) | 2 | mg/kg | 23.5 | mg/kg | --- | --- | 0.0040 | 0.047 |
| Phosphorus | 1786 | mg/kg | 21012 | mg/kg | --- | --- | 3.57 | 42.0 |
| Phosphorus (as P2O5) | 4090 | mg/kg | 48117 | mg/kg | --- | --- | 8.18 | 96.2 |
| Potassium | 117 | mg/kg | 1376 | mg/kg | --- | --- | 0.23 | 2.8 |
| Potassium (as K2O) | 140 | mg/kg | 1652 | mg/kg | --- | --- | 0.28 | 3.3 |
| Lead | 5.473 | mg/kg | 64.4 | mg/kg | 840 | 300 | 0.011 | 0.13 |
| Zinc | 54.97 | mg/kg | 647 | mg/kg | 7500 | 2800 | 0.11 | 1.3 |
| Nickel | 1.667 | mg/kg | 19.6 | mg/kg | 420 | 420 | 0.0033 | 0.039 |
| Copper | 26.42 | mg/kg | 311 | mg/kg | 4300 | 1500 | 0.053 | 0.62 |
| Cadmium | 0.380 | mg/kg | 4.47 | mg/kg | 85 | 39 | 0.00076 | 0.0089 |
| Solids, Total | 8.50 | % | 100.0 | % | --- | --- | 170.0 | 2000.0 |
| Arsenic | 0.647 | mg/kg | 7.61 | mg/kg | 75 | 41 | 0.0013 | 0.015 |
| Chromium | 2.436 | mg/kg | 28.7 | mg/kg | --- | --- | 0.0049 | 0.057 |
| Mercury | <0.001 | mg/kg | <0.012 | mg/kg | 57 | 17 | <0.0000 | <0.00002 |
| Molybdenum | 1.585 | mg/kg | 18.6 | mg/kg | 75 | --- | 0.0032 | 0.037 |
| Selenium | <0.001 | mg/kg | <0.012 | mg/kg | 100 | 100 | <0.0000 | <0.00002 |
| Calcium | 4777 | mg/kg | 56200 | mg/kg | --- | --- | 9.55 | 112.4 |

# Table 1 and Table 3 pollution concentrations for biosolids or industrial waste products, EPA-600/4-79-020, 327 IAC 6.1-5.

REPORT NO.
F06118-8003
ACCOUNT NUMBER
08514

# A & L GREAT LAKES LABORATORIES, INC.

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TO: BIOTECH AGRONOMICS, INC.
P.O. BOX 180
BENZONIA, MI 49616-0180

FOR: ALLENDALE WWTP

ATTN: BROOKE BONNEY

## REPORT OF ANALYSIS

LAB NUMBER: 4090
SAMPLE ID: 2C

DATE SAMPLED: 4/26/06 1200
DATE RECEIVED: 04/28/2006
DATE REPORTED: 05/16/2006 PAGE: 5

| PARAMETER | RESULT | UNIT | DETECTION LIMIT | ANALYST | ANALYSIS DATE | METHOD REFERENCE |
|---|---|---|---|---|---|---|
| Nitrogen, Total | 1736 | mg/kg | 1 | MG | 5/1/06 | EPA-351.3/353.2 |
| Nitrogen, Total Kjeldahl | 1734 | mg/kg | 1 | MG | 5/1/06 | EPA-351.3 |
| Nitrogen, Ammonia (as N) | 350 | mg/kg | 1 | MG | 5/1/06 | SM(20th)-4500-NH3B,C |
| Nitrogen, Nitrate (as N) | 2 | mg/kg | 1 | DT | 5/2/06 | EPA-353.2 |
| Phosphorus | 1786 | mg/kg | 1 | CRT | 5/10/06 | SW846-6010B |
| Potassium | 117 | mg/kg | 1 | CRT | 5/10/06 | SW846-6010B |
| Lead | 5.473 | mg/kg | 0.001 | CRT | 5/16/06 | SW846-6020 |
| Zinc | 54.97 | mg/kg | 0.04 | CRT | 5/10/06 | SW846-6010B |
| Nickel | 1.667 | mg/kg | 0.001 | CRT | 5/16/06 | SW846-6020 |
| Copper | 26.42 | mg/kg | 0.01 | CRT | 5/10/06 | SW846-6010B |
| Cadmium | 0.380 | mg/kg | 0.006 | CRT | 5/16/06 | SW846-6020 |
| Solids, Total | 8.50 | % | 0.01 | MG | 4/28/06 | EPA 160.3 |
| Arsenic | 0.647 | mg/kg | 0.001 | CRT | 5/16/06 | SW846-6020 |
| Chromium | 2.436 | mg/kg | 0.001 | CRT | 5/16/06 | SW846-6020 |
| Mercury | BDL* | mg/kg | 0.001 | CRT | 5/16/06 | SW846-6020 |
| Molybdenum | 1.585 | mg/kg | 0.001 | CRT | 5/16/06 | SW846-6020 |
| Selenium | BDL* | mg/kg | 0.001 | CRT | 5/16/06 | SW846-6020 |
| Calcium | 4777 | mg/kg | 1 | CRT | 5/10/06 | SW846-6010B |

A&L-bio

* BDL - Below detection level of method utilized.

REPORT NO.
F06118-8003
ACCOUNT NUMBER
08514

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TO: BIOTECH AGRONOMICS, INC.
P.O. BOX 180
BENZONIA, MI 49616-0180

FOR: ALLENDALE WWTP

ATTN: BROOKE BONNEY

## REPORT OF ANALYSIS

LAB NUMBER: 4090
SAMPLE ID: 2C

DATE SAMPLED: 4/26/06 1200
DATE RECEIVED: 04/28/2006
DATE REPORTED: 05/16/2006 PAGE: 6

| PARAMETER | RESULT | UNIT | DETECTION LIMIT | ANALYST | ANALYSIS DATE | METHOD REFERENCE |
|---|---|---|---|---|---|---|
| Magnesium | 1326.0 | mg/kg | 0.3 | CRT | 5/10/06 | SW846-6010B |
| Sodium | BDL* | mg/kg | 1 | CRT | 5/10/06 | SW846-6010B |
| Silver | BDL* | mg/kg | 0.001 | CRT | 5/10/06 | SW846-6010B |
| Chloride | 227 | mg/kg | 10 | DT | 5/2/06 | LACH. 10-117-07 |

A&l-bio

* BDL - Below detection level of method utilized.

REPORT NUMBER: F06118-8003
ACCOUNT NUMBER: 08514


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# BIOSOLIDS ANALYSIS

| TO: | FOR: |
|---|---|
| BIOTECH AGRONOMICS, INC.<br>P.O. BOX 180<br>BENZONIA, MI 49616-0180 | ALLENDALE WWTP |

| | |
|---|---|
| REPORT NUMBER | F06118-8003 |
| LAB NUMBER | 4090 |
| SAMPLE ID | 2C |

| | |
|---|---|
| DATE SAMPLED | 4/26/2006 1200 |
| DATE RECEIVED | 04/28/2006 |
| DATE REPORTED | 05/16/2006 |

| PARAMETER | WET BASIS | | DRY BASIS | | TABLE 1 # | TABLE 3 # | LOADING RATE | |
|---|---|---|---|---|---|---|---|---|
| | RESULT | UNIT | RESULT | UNIT | MG/KG | MG/KG | LBS/WET TON | LBS/DRY TON |
| Magnesium | 1326.0 | mg/kg | 15600 | mg/kg | --- | --- | 2.65 | 31.2 |
| Sodium | <1 | mg/kg | <11.8 | mg/kg | --- | --- | <0.002 | <0.024 |
| Silver | <0.001 | mg/kg | <0.012 | mg/kg | --- | --- | <0.0000 | <0.00002 |
| Chloride | 227 | mg/kg | 2671 | mg/kg | --- | --- | 0.45 | 5.3 |

# Table 1 and Table 3 pollution concentrations for biosolids or industrial waste products, EPA-600/4-79-020, 327 IAC 6.1-5.

AL-BT3M

REPORT NUMBER: F06118-8002
ACCOUNT NUMBER: 08514


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# BIOSOLIDS ANALYSIS

| TO: | FOR: |
|---|---|
| BIOTECH AGRONOMICS, INC.<br>P.O. BOX 180<br>BENZONIA, MI 49616-0180 | ALLENDALE WWTP |

| | |
|---|---|
| REPORT NUMBER | F06118-8002 |
| LAB NUMBER | 4085 |
| SAMPLE ID | 3A |

| | |
|---|---|
| DATE SAMPLED | 4/29/2060 245 |
| DATE RECEIVED | 04/28/2006 |
| DATE REPORTED | 05/16/2006 |

| PARAMETER | WET BASIS | | DRY BASIS | | TABLE 1# | TABLE 3# | LOADING RATE | |
|---|---|---|---|---|---|---|---|---|
| | RESULT | UNIT | RESULT | UNIT | MG/KG | MG/KG | LBS/WET TON | LBS/DRY TON |
| Nitrogen, Total | 1570 | mg/kg | 25528 | mg/kg | --- | --- | 3.14 | 51.1 |
| Nitrogen, Total Kjeldahl | 1568 | mg/kg | 25496 | mg/kg | --- | --- | 3.14 | 51.0 |
| Nitrogen, Ammonia (as N) | 245 | mg/kg | 3984 | mg/kg | --- | --- | 0.49 | 8.0 |
| Nitrogen, Nitrate (as N) | 2 | mg/kg | 32.5 | mg/kg | --- | --- | 0.0040 | 0.065 |
| Phosphorus | 1722 | mg/kg | 28000 | mg/kg | --- | --- | 3.44 | 56.0 |
| Phosphorus (as P2O5) | 3943 | mg/kg | 64120 | mg/kg | --- | --- | 7.89 | 128.2 |
| Potassium | 125 | mg/kg | 2033 | mg/kg | --- | --- | 0.25 | 4.1 |
| Potassium (as K2O) | 150 | mg/kg | 2439 | mg/kg | --- | --- | 0.30 | 4.9 |
| Lead | 1.687 | mg/kg | 27.4 | mg/kg | 840 | 300 | 0.0034 | 0.055 |
| Zinc | 36.39 | mg/kg | 592 | mg/kg | 7500 | 2800 | 0.073 | 1.2 |
| Nickel | 1.319 | mg/kg | 21.4 | mg/kg | 420 | 420 | 0.0026 | 0.043 |
| Copper | 14.61 | mg/kg | 238 | mg/kg | 4300 | 1500 | 0.029 | 0.48 |
| Cadmium | <0.006 | mg/kg | <0.098 | mg/kg | 85 | 39 | <0.0000 | <0.00020 |
| Solids, Total | 6.15 | % | 100.0 | % | --- | --- | 123.0 | 2000.0 |
| Arsenic | 0.415 | mg/kg | 6.75 | mg/kg | 75 | 41 | 0.00083 | 0.013 |
| Chromium | 1.662 | mg/kg | 27.0 | mg/kg | --- | --- | 0.0033 | 0.054 |
| Mercury | <0.001 | mg/kg | <0.016 | mg/kg | 57 | 17 | <0.0000 | <0.00003 |
| Molybdenum | 1.028 | mg/kg | 16.7 | mg/kg | 75 | --- | 0.0021 | 0.033 |
| Selenium | <0.001 | mg/kg | <0.016 | mg/kg | 100 | 100 | <0.0000 | <0.00003 |
| Calcium | 2982 | mg/kg | 48488 | mg/kg | --- | --- | 5.96 | 97.0 |

# Table 1 and Table 3 pollution concentrations for biosolids or industrial waste products, EPA-600/4-79-020, 327 IAC 6.1-5.

AN-BT.JM

REPORT NUMBER: F06118-8002
ACCOUNT NUMBER: 08514


# A & L GREAT LAKES LABORATORIES, INC.

3505 Conestoga Drive • Fort Wayne, Indiana 46808-4413 • Phone 260-483-4759 • Fax 260-483-5274
www.algreatlakes.com • e-mail: lab@algreatlakes.com


# BIOSOLIDS ANALYSIS

| | |
|---|---|
| TO: | BIOTECH AGRONOMICS, INC.<br>P.O. BOX 180<br>BENZONIA, MI 49616-0180 |
| FOR: | ALLENDALE WWTP |

| | |
|---|---|
| REPORT NUMBER: | F06118-8002 |
| LAB NUMBER: | 4085 |
| SAMPLE ID: | 3A |

| | |
|---|---|
| DATE SAMPLED: | 4/29/2060 245 |
| DATE RECEIVED: | 04/28/2006 |
| DATE REPORTED: | 05/16/2006 |

| PARAMETER | WET BASIS | | DRY BASIS | | TABLE 1 # | TABLE 3 # | LOADING RATE | |
|---|---|---|---|---|---|---|---|---|
| | RESULT | UNIT | RESULT | UNIT | MG/KG | MG/KG | LBS/WET TON | LBS/DRY TON |
| Magnesium | 571.0 | mg/kg | 9285 | mg/kg | --- | --- | 1.14 | 18.6 |
| Sodium | <1 | mg/kg | <16.3 | mg/kg | --- | --- | <0.002 | <0.033 |
| Silver | <0.001 | mg/kg | <0.016 | mg/kg | --- | --- | <0.0000 | <0.00003 |
| Chloride | 182 | mg/kg | 2959 | mg/kg | --- | --- | 0.36 | 5.9 |

# Table 1 and Table 3 pollution concentrations for biosolids or industrial waste products, EPA-600/4-79-020, 327 IAC 6.1-5.

A&L-BT3M

REPORT NO.
F06118-8002
ACCOUNT NUMBER
08514

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TO: BIOTECH AGRONOMICS, INC.
P.O. BOX 180
BENZONIA, MI 49616-0180

FOR: ALLENDALE WWTP

ATTN: BROOKE BONNEY

## REPORT OF ANALYSIS

LAB NUMBER: 4085
SAMPLE ID: 3A

DATE SAMPLED: 4/29/60 245
DATE RECEIVED: 04/28/2006
DATE REPORTED: 05/16/2006 PAGE: 1

| PARAMETER | RESULT | UNIT | DETECTION LIMIT | ANALYST | ANALYSIS DATE | METHOD REFERENCE |
|---|---|---|---|---|---|---|
| Nitrogen, Total | 1570 | mg/kg | 1 | MG | 5/1/06 | EPA-351.3/353.2 |
| Nitrogen, Total Kjeldahl | 1568 | mg/kg | 1 | MG | 5/1/06 | EPA-351.3 |
| Nitrogen, Ammonia (as N) | 245 | mg/kg | 1 | MG | 5/1/06 | SM(20th)-4500-NH3B,C |
| Nitrogen, Nitrate (as N) | 2 | mg/kg | 1 | DT | 5/2/06 | EPA-353.2 |
| Phosphorus | 1722 | mg/kg | 1 | CRT | 5/10/06 | SW846-6010B |
| Potassium | 125 | mg/kg | 1 | CRT | 5/10/06 | SW846-6010B |
| Lead | 1.687 | mg/kg | 0.001 | CRT | 5/15/06 | SW846-6020 |
| Zinc | 36.39 | mg/kg | 0.04 | CRT | 5/10/06 | SW846-6010B |
| Nickel | 1.319 | mg/kg | 0.001 | CRT | 5/15/06 | SW846-6020 |
| Copper | 14.61 | mg/kg | 0.01 | CRT | 5/10/06 | SW846-6010B |
| Cadmium | BDL* | mg/kg | 0.006 | CRT | 5/15/06 | SW846-6020 |
| Solids, Total | 6.15 | % | 0.01 | MG | 4/28/06 | EPA 160.3 |
| Arsenic | 0.415 | mg/kg | 0.001 | CRT | 5/15/06 | SW846-6020 |
| Chromium | 1.662 | mg/kg | 0.001 | CRT | 5/15/06 | SW846-6020 |
| Mercury | BDL* | mg/kg | 0.001 | CRT | 5/15/06 | SW846-6020 |
| Molybdenum | 1.028 | mg/kg | 0.001 | CRT | 5/15/06 | SW846-6020 |
| Selenium | BDL* | mg/kg | 0.001 | CRT | 5/15/06 | SW846-6020 |
| Calcium | 2982 | mg/kg | 1 | CRT | 5/10/06 | SW846-6010B |

AEI-bio

* BDL - Below detection level of method utilized.

REPORT NO.
F06118-8002
ACCOUNT NUMBER
08514

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TO: BIOTECH AGRONOMICS, INC.
P.O. BOX 180
BENZONIA, MI 49616-0180

FOR: ALLENDALE WWTP

ATTN: BROOKE BONNEY

## REPORT OF ANALYSIS

LAB NUMBER: 4085
SAMPLE ID: 3A

DATE SAMPLED: 4/29/60 245
DATE RECEIVED: 04/28/2006
DATE REPORTED: 05/16/2006 PAGE: 2

| PARAMETER | RESULT | UNIT | DETECTION LIMIT | ANALYST | ANALYSIS DATE | METHOD REFERENCE |
|---|---|---|---|---|---|---|
| Magnesium | 571.0 | mg/kg | 0.3 | CRT | 5/10/06 | SW846-6010B |
| Sodium | BDL* | mg/kg | 1 | CRT | 5/10/06 | SW846-6010B |
| Silver | BDL* | mg/kg | 0.001 | CRT | 5/10/06 | SW846-6010B |
| Chloride | 182 | mg/kg | 10 | DT | 5/2/06 | LACH. 10-117-07 |

* BDL - Below detection level of method utilized.

A&l-bio

REPORT NUMBER: F06118-8002
ACCOUNT NUMBER: 08514


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# BIOSOLIDS ANALYSIS

| TO | FOR |
|---|---|
| BIOTECH AGRONOMICS, INC.<br>P.O. BOX 180<br>BENZONIA, MI 49616-0180 | ALLENDALE WWTP |

| | |
|---|---|
| REPORT NUMBER | F06118-8002 |
| LAB NUMBER | 4086 |
| SAMPLE ID | 3B |

| | |
|---|---|
| DATE SAMPLED | 4/29/2060 345 |
| DATE RECEIVED | 04/28/2006 |
| DATE REPORTED | 05/16/2006 |

| PARAMETER | WET BASIS | | DRY BASIS | | TABLE 1# | TABLE 3# | LOADING RATE | |
|---|---|---|---|---|---|---|---|---|
| | RESULT | UNIT | RESULT | UNIT | MG/KG | MG/KG | LBS/WET TON | LBS/DRY TON |
| Nitrogen, Total | 1840 | mg/kg | 39485 | mg/kg | --- | --- | 3.68 | 79.0 |
| Nitrogen, Total Kjeldahl | 1838 | mg/kg | 39442 | mg/kg | --- | --- | 3.68 | 78.9 |
| Nitrogen, Ammonia (as N) | 368 | mg/kg | 7897 | mg/kg | --- | --- | 0.74 | 15.8 |
| Nitrogen, Nitrate (as N) | 2 | mg/kg | 42.9 | mg/kg | --- | --- | 0.0040 | 0.086 |
| Phosphorus | 1979 | mg/kg | 42468 | mg/kg | --- | --- | 3.96 | 84.9 |
| Phosphorus (as P2O5) | 4532 | mg/kg | 97251 | mg/kg | --- | --- | 9.06 | 194.5 |
| Potassium | 86 | mg/kg | 1845 | mg/kg | --- | --- | 0.17 | 3.7 |
| Potassium (as K2O) | 103 | mg/kg | 2215 | mg/kg | --- | --- | 0.21 | 4.4 |
| Lead | <0.001 | mg/kg | <0.021 | mg/kg | 840 | 300 | <0.0000 | <0.00004 |
| Zinc | 40.02 | mg/kg | 859 | mg/kg | 7500 | 2800 | 0.080 | 1.7 |
| Nickel | <0.001 | mg/kg | <0.021 | mg/kg | 420 | 420 | <0.0000 | <0.00004 |
| Copper | 13.87 | mg/kg | 298 | mg/kg | 4300 | 1500 | 0.028 | 0.60 |
| Cadmium | <0.006 | mg/kg | <0.13 | mg/kg | 85 | 39 | <0.0000 | <0.00026 |
| Solids, Total | 4.66 | % | 100.0 | % | --- | --- | 93.1 | 2000.0 |
| Arsenic | <0.001 | mg/kg | <0.021 | mg/kg | 75 | 41 | <0.0000 | <0.00004 |
| Chromium | 1.452 | mg/kg | 31.2 | mg/kg | --- | --- | 0.0029 | 0.062 |
| Mercury | <0.001 | mg/kg | <0.021 | mg/kg | 57 | 17 | <0.0000 | <0.00004 |
| Molybdenum | 0.978 | mg/kg | 21.0 | mg/kg | 75 | --- | 0.0020 | 0.042 |
| Selenium | <0.001 | mg/kg | <0.021 | mg/kg | 100 | 100 | <0.0000 | <0.00004 |
| Calcium | 1894 | mg/kg | 40644 | mg/kg | --- | --- | 3.79 | 81.3 |

# Table 1 and Table 3 pollution concentrations for biosolids or industrial waste products, EPA-600/4-79-020, 327 IAC 6.1-5.

AR-BT3M

REPORT NUMBER: F06118-8002
ACCOUNT NUMBER: 08514


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# BIOSOLIDS ANALYSIS

| | |
|---|---|
| TO: | BIOTECH AGRONOMICS, INC.<br>P.O. BOX 180<br>BENZONIA, MI 49616-0180 |
| FOR: | ALLENDALE WWTP |

| | |
|---|---|
| REPORT NUMBER | F06118-8002 |
| LAB NUMBER | 4086 |
| SAMPLE ID | 3B |

| | |
|---|---|
| DATE SAMPLED | 4/29/2060 345 |
| DATE RECEIVED | 04/28/2006 |
| DATE REPORTED | 05/16/2006 |

| PARAMETER | WET BASIS | | DRY BASIS | | TABLE 1# | TABLE 3# | LOADING RATE | |
|---|---|---|---|---|---|---|---|---|
| | RESULT | UNIT | RESULT | UNIT | MG/KG | MG/KG | LBS/ACRE/365 DAY PERIOD | LBS/ACRE/DAY |
| Magnesium | 253.0 | mg/kg | 5429 | mg/kg | --- | --- | 0.51 | 10.9 |
| Sodium | <1 | mg/kg | <21.5 | mg/kg | --- | --- | <0.002 | <0.043 |
| Silver | <0.001 | mg/kg | <0.021 | mg/kg | --- | --- | <0.0000 | <0.00004 |
| Chloride | 198 | mg/kg | 4249 | mg/kg | --- | --- | 0.40 | 8.5 |

# Table 1 and Table 3 pollution concentrations for biosolids or industrial waste products, EPA-600/4-79-020, 327 IAC 6.1-5.

ALI-BT.3M

REPORT NO.
F06118-8002
ACCOUNT NUMBER
08514

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TO: BIOTECH AGRONOMICS, INC.
P.O. BOX 180
BENZONIA, MI 49616-0180

FOR: ALLENDALE WWTP

ATTN: BROOKE BONNEY

## REPORT OF ANALYSIS

LAB NUMBER: 4086
SAMPLE ID: 3B

DATE SAMPLED: 4/29/60 345
DATE RECEIVED: 04/28/2006
DATE REPORTED: 05/16/2006 PAGE: 3

| PARAMETER | RESULT | UNIT | DETECTION LIMIT | ANALYST | ANALYSIS DATE | METHOD REFERENCE |
|---|---|---|---|---|---|---|
| Nitrogen, Total | 1840 | mg/kg | 1 | MG | 5/1/06 | EPA-351.3/353.2 |
| Nitrogen, Total Kjeldahl | 1838 | mg/kg | 1 | MG | 5/1/06 | EPA-351.3 |
| Nitrogen, Ammonia (as N) | 368 | mg/kg | 1 | MG | 5/1/06 | SM(20th)-4500-NH3B,C |
| Nitrogen, Nitrate (as N) | 2 | mg/kg | 1 | DT | 5/2/06 | EPA-353.2 |
| Phosphorus | 1979 | mg/kg | 1 | CRT | 5/10/06 | SW846-6010B |
| Potassium | 86 | mg/kg | 1 | CRT | 5/10/06 | SW846-6010B |
| Lead | BDL* | mg/kg | 0.001 | CRT | 5/15/06 | SW846-6020 |
| Zinc | 40.02 | mg/kg | 0.04 | CRT | 5/10/06 | SW846-6010B |
| Nickel | BDL* | mg/kg | 0.001 | CRT | 5/15/06 | SW846-6020 |
| Copper | 13.87 | mg/kg | 0.01 | CRT | 5/10/06 | SW846-6010B |
| Cadmium | BDL* | mg/kg | 0.006 | CRT | 5/15/06 | SW846-6020 |
| Solids, Total | 4.66 | % | 0.01 | MG | 4/28/06 | EPA 160.3 |
| Arsenic | BDL* | mg/kg | 0.001 | CRT | 5/15/06 | SW846-6020 |
| Chromium | 1.452 | mg/kg | 0.001 | CRT | 5/15/06 | SW846-6020 |
| Mercury | BDL* | mg/kg | 0.001 | CRT | 5/15/06 | SW846-6020 |
| Molybdenum | 0.978 | mg/kg | 0.001 | CRT | 5/15/06 | SW846-6020 |
| Selenium | BDL* | mg/kg | 0.001 | CRT | 5/15/06 | SW846-6020 |
| Calcium | 1894 | mg/kg | 1 | CRT | 5/10/06 | SW846-6010B |

* BDL - Below detection level of method utilized.

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REPORT NO.
F06118-8002
ACCOUNT NUMBER
08514

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P.O. BOX 180
BENZONIA, MI 49616-0180

FOR: ALLENDALE WWTP

ATTN: BROOKE BONNEY

## REPORT OF ANALYSIS

LAB NUMBER: 4086
SAMPLE ID: 3B

DATE SAMPLED: 4/29/60 345
DATE RECEIVED: 04/28/2006
DATE REPORTED: 05/16/2006 PAGE: 4

| PARAMETER | RESULT | UNIT | DETECTION LIMIT | ANALYST | ANALYSIS DATE | METHOD REFERENCE |
|---|---|---|---|---|---|---|
| Magnesium | 253.0 | mg/kg | 0.3 | CRT | 5/10/06 | SW846-6010B |
| Sodium | BDL* | mg/kg | 1 | CRT | 5/10/06 | SW846-6010B |
| Silver | BDL* | mg/kg | 0.001 | CRT | 5/10/06 | SW846-6010B |
| Chloride | 198 | mg/kg | 10 | DT | 5/2/06 | LACH. 10-117-07 |

A&I-bio

* BDL - Below detection level of method utilized.

REPORT NUMBER: F06118-8002
ACCOUNT NUMBER: 08514


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# BIOSOLIDS ANALYSIS

| TO: | FOR: |
|---|---|
| BIOTECH AGRONOMICS, INC.<br>P.O. BOX 180<br>BENZONIA, MI 49616-0180 | ALLENDALE WWTP |

| | |
|---|---|
| REPORT NUMBER: | F06118-8002 |
| LAB NUMBER: | 4087 |
| SAMPLE ID: | 3C |

| | |
|---|---|
| DATE SAMPLED: | 4/29/2060 315 |
| DATE RECEIVED: | 04/28/2006 |
| DATE REPORTED: | 05/16/2006 |

| PARAMETER | WET BASIS | | DRY BASIS | | TABLE 1# | TABLE 3# | LOADING RATE | |
|---|---|---|---|---|---|---|---|---|
| | RESULT | UNIT | RESULT | UNIT | MG/KG | MG/KG | LBS/WET TON | LBS/DRY TON |
| Nitrogen, Total | 1715 | mg/kg | 32729 | mg/kg | --- | --- | 3.43 | 65.5 |
| Nitrogen, Total Kjeldahl | 1713 | mg/kg | 32691 | mg/kg | --- | --- | 3.43 | 65.4 |
| Nitrogen, Ammonia (as N) | 376 | mg/kg | 7176 | mg/kg | --- | --- | 0.75 | 14.4 |
| Nitrogen, Nitrate (as N) | 2 | mg/kg | 38.2 | mg/kg | --- | --- | 0.0040 | 0.076 |
| Phosphorus | 1937 | mg/kg | 36966 | mg/kg | --- | --- | 3.87 | 73.9 |
| Phosphorus (as P2O5) | 4436 | mg/kg | 84651 | mg/kg | --- | --- | 8.87 | 169.3 |
| Potassium | 83 | mg/kg | 1584 | mg/kg | --- | --- | 0.17 | 3.2 |
| Potassium (as K2O) | 100 | mg/kg | 1901 | mg/kg | --- | --- | 0.20 | 3.8 |
| Lead | 0.920 | mg/kg | 17.6 | mg/kg | 840 | 300 | 0.0018 | 0.035 |
| Zinc | 38.39 | mg/kg | 733 | mg/kg | 7500 | 2800 | 0.077 | 1.5 |
| Nickel | 1.648 | mg/kg | 31.5 | mg/kg | 420 | 420 | 0.0033 | 0.063 |
| Copper | 18.48 | mg/kg | 353 | mg/kg | 4300 | 1500 | 0.037 | 0.71 |
| Cadmium | 0.189 | mg/kg | 3.61 | mg/kg | 85 | 39 | 0.00038 | 0.0072 |
| Solids, Total | 5.24 | % | 100.0 | % | --- | --- | 104.9 | 2000.0 |
| Arsenic | 0.309 | mg/kg | 5.90 | mg/kg | 75 | 41 | 0.00062 | 0.012 |
| Chromium | 1.324 | mg/kg | 25.3 | mg/kg | --- | --- | 0.0026 | 0.051 |
| Mercury | <0.001 | mg/kg | <0.019 | mg/kg | 57 | 17 | <0.0000 | <0.00004 |
| Molybdenum | 1.034 | mg/kg | 19.7 | mg/kg | 75 | --- | 0.0021 | 0.039 |
| Selenium | <0.001 | mg/kg | <0.019 | mg/kg | 100 | 100 | <0.0000 | <0.00004 |
| Calcium | 2193 | mg/kg | 41851 | mg/kg | --- | --- | 4.39 | 83.7 |

# Table 1 and Table 3 pollution concentrations for biosolids or industrial waste products, EPA-600/4-79-020, 327 IAC 6.1-5.

AU-BT3M

REPORT NUMBER: F06118-8002
ACCOUNT NUMBER: 08514


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# BIOSOLIDS ANALYSIS

| TO: | FOR: |
|---|---|
| BIOTECH AGRONOMICS, INC.<br>P.O. BOX 180<br>BENZONIA, MI 49616-0180 | ALLENDALE WWTP |

| | |
|---|---|
| REPORT NUMBER: | F06118-8002 |
| LAB NUMBER: | 4087 |
| SAMPLE ID: | 3C |

| | |
|---|---|
| DATE SAMPLED: | 4/29/2060 315 |
| DATE RECEIVED: | 04/28/2006 |
| DATE REPORTED: | 05/16/2006 |

| PARAMETER | WET BASIS | | DRY BASIS | | TABLE 1# | TABLE 3# | LOADING RATE | |
|---|---|---|---|---|---|---|---|---|
| | RESULT | UNIT | RESULT | UNIT | MG/KG | MG/KG | LBS/ACRE/365D | LBS/DRY TON |
| Magnesium | 346.0 | mg/kg | 6603 | mg/kg | --- | --- | 0.69 | 13.2 |
| Sodium | <1 | mg/kg | <19.1 | mg/kg | --- | --- | <0.002 | <0.038 |
| Silver | <0.001 | mg/kg | <0.019 | mg/kg | --- | --- | <0.0000 | <0.00004 |
| Chloride | 203 | mg/kg | 3874 | mg/kg | --- | --- | 0.41 | 7.7 |

# Table 1 and Table 3 pollution concentrations for biosolids or industrial waste products, EPA-600/4-79-020, 327 IAC 6.1-5.

AEI-BT3M

REPORT NO.
F06118-8002
ACCOUNT NUMBER
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BENZONIA, MI 49616-0180

FOR: ALLENDALE WWTP

ATTN: BROOKE BONNEY

## REPORT OF ANALYSIS

DATE SAMPLED: 4/29/60 315
DATE RECEIVED: 04/28/2006
DATE REPORTED: 05/16/2006 PAGE: 5

LAB NUMBER: 4087
SAMPLE ID: 3C

| PARAMETER | RESULT | UNIT | DETECTION LIMIT | ANALYST | ANALYSIS DATE | METHOD REFERENCE |
|---|---|---|---|---|---|---|
| Nitrogen, Total | 1715 | mg/kg | 1 | MG | 5/1/06 | EPA-351.3/353.2 |
| Nitrogen, Total Kjeldahl | 1713 | mg/kg | 1 | MG | 5/1/06 | EPA-351.3 |
| Nitrogen, Ammonia (as N) | 376 | mg/kg | 1 | MG | 5/1/06 | SM(20th)-4500-NH3B,C |
| Nitrogen, Nitrate (as N) | 2 | mg/kg | 1 | DT | 5/2/06 | EPA-353.2 |
| Phosphorus | 1937 | mg/kg | 1 | CRT | 5/10/06 | SW846-6010B |
| Potassium | 83 | mg/kg | 1 | CRT | 5/10/06 | SW846-6010B |
| Lead | 0.920 | mg/kg | 0.001 | CRT | 5/15/06 | SW846-6020 |
| Zinc | 38.39 | mg/kg | 0.04 | CRT | 5/10/06 | SW846-6010B |
| Nickel | 1.648 | mg/kg | 0.001 | CRT | 5/15/06 | SW846-6020 |
| Copper | 18.48 | mg/kg | 0.01 | CRT | 5/10/06 | SW846-6010B |
| Cadmium | 0.189 | mg/kg | 0.006 | CRT | 5/15/06 | SW846-6020 |
| Solids, Total | 5.24 | % | 0.01 | MG | 4/28/06 | EPA 160.3 |
| Arsenic | 0.309 | mg/kg | 0.001 | CRT | 5/15/06 | SW846-6020 |
| Chromium | 1.324 | mg/kg | 0.001 | CRT | 5/15/06 | SW846-6020 |
| Mercury | BDL* | mg/kg | 0.001 | CRT | 5/15/06 | SW846-6020 |
| Molybdenum | 1.034 | mg/kg | 0.001 | CRT | 5/15/06 | SW846-6020 |
| Selenium | BDL* | mg/kg | 0.001 | CRT | 5/15/06 | SW846-6020 |
| Calcium | 2193 | mg/kg | 1 | CRT | 5/10/06 | SW846-6010B |

ASI-bio

* BDL - Below detection level of method utilized.

REPORT NO.
F06118-8002
ACCOUNT NUMBER
08514

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P.O. BOX 180
BENZONIA, MI 49616-0180

FOR: ALLENDALE WWTP

ATTN: BROOKE BONNEY

## REPORT OF ANALYSIS

LAB NUMBER: 4087
SAMPLE ID: 3C

DATE SAMPLED: 4/29/60 315
DATE RECEIVED: 04/28/2006
DATE REPORTED: 05/16/2006 PAGE: 6

| PARAMETER | RESULT | UNIT | DETECTION LIMIT | ANALYST | ANALYSIS DATE | METHOD REFERENCE |
|---|---|---|---|---|---|---|
| Magnesium | 346.0 | mg/kg | 0.3 | CRT | 5/10/06 | SW846-6010B |
| Sodium | BDL* | mg/kg | 1 | CRT | 5/10/06 | SW846-6010B |
| Silver | BDL* | mg/kg | 0.001 | CRT | 5/10/06 | SW846-6010B |
| Chloride | 203 | mg/kg | 10 | DT | 5/2/06 | LACH. 10-117-07 |

A&I-bio

* BDL - Below detection level of method utilized.

# Fecal Coliform Analytical and Geometric Mean

Prein&Newhof
Engineers ▪ Surveyors ▪ Environmental ▪ Laboratory

**Date:** *07-Sep-06*

**Customer Name:** Synagro Central, LLC
1100 Arloa Drive
Greenville, MI 48838

**Contact Name:** Mr. Bill Goetsch
1100 Arloa Drive
Greenville, MI 48838

**Project:** Allendale WWTP Fecals

**Project No:** 990300L

**Lab Order:** 0609066

**Matrix:** SLUDGE

**Sampled By:** B. Goetsch

| Analyses | Result | Units | Analyst | Date Analyzed | Method # |
|---|---|---|---|---|---|
| **Lab ID:** 0609066-001A | | | | | **Collection Date:** 9/5/2006 |
| **Client Sample ID:** Allendale #1 | | | | | **Received Date:** 9/6/2006 |
| Fecal Coliform | 3834.9 | Colonies/g-dry | PS | 9/7/2006 | 9225D |
| Solids, Total(TS) | 4.22 | wt% | PS | 9/7/2006 | D2216 |
| **Lab ID:** 0609066-002A | | | | | **Collection Date:** 9/5/2006 |
| **Client Sample ID:** Allendale #2 | | | | | **Received Date:** 9/6/2006 |
| Fecal Coliform | 4138.1 | Colonies/g-dry | PS | 9/7/2006 | 9225D |
| Solids, Total(TS) | 3.70 | wt% | PS | 9/7/2006 | D2216 |
| **Lab ID:** 0609066-003A | | | | | **Collection Date:** 9/5/2006 |
| **Client Sample ID:** Allendale #3 | | | | | **Received Date:** 9/6/2006 |
| Fecal Coliform | 3848.7 | Colonies/g-dry | PS | 9/7/2006 | 9225D |
| Solids, Total(TS) | 4.15 | wt% | PS | 9/7/2006 | D2216 |
| **Lab ID:** 0609066-004A | | | | | **Collection Date:** 9/5/2006 |
| **Client Sample ID:** Allendale #4 | | | | | **Received Date:** 9/6/2006 |
| Fecal Coliform | 4951.5 | Colonies/g-dry | PS | 9/7/2006 | 9225D |
| Solids, Total(TS) | 4.60 | wt% | PS | 9/7/2006 | D2216 |
| **Lab ID:** 0609066-005A | | | | | **Collection Date:** 9/5/2006 |
| **Client Sample ID:** Allendale #5 | | | | | **Received Date:** 9/6/2006 |
| Fecal Coliform | 4184.1 | Colonies/g-dry | PS | 9/7/2006 | 9225D |
| Solids, Total(TS) | 4.79 | wt% | PS | 9/7/2006 | D2216 |
| **Lab ID:** 0609066-006A | | | | | **Collection Date:** 9/5/2006 |
| **Client Sample ID:** Allendale #6 | | | | | **Received Date:** 9/6/2006 |
| Fecal Coliform | 1350.5 | Colonies/g-dry | PS | 9/7/2006 | 9225D |
| Solids, Total(TS) | 7.58 | wt% | PS | 9/7/2006 | D2216 |
| **Lab ID:** 0609066-007A | | | | | **Collection Date:** 9/5/2006 |
| **Client Sample ID:** Allendale #7 | | | | | **Received Date:** 9/6/2006 |
| Fecal Coliform | 3249.5 | Colonies/g-dry | PS | 9/7/2006 | 9225D |
| Solids, Total(TS) | 4.70 | wt% | PS | 9/7/2006 | D2216 |
| **Lab ID:** 0609066-008A | | | | | **Collection Date:** 9/5/2006 |
| **Client Sample ID:** (1-7) | | | | | **Received Date:** 9/6/2006 |
| Geometric Mean | 3425.0 | Colonies/g -dry | PS | 9/7/2006 | CALCULATION |



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Grand Rapids, MI 49525
t. 616-364-7600
f. 616-364-4222

Client: Synagro
Project Name: Allendale WWTP
Project #:
Send Results to: William Goetsch
Sampling Personnel: William Goetsch

# CHAIN OF CUSTODY

| | |
|---|---|
| Air | A |
| Drinking Water | D |
| Groundwater | W |
| Soil | S |
| Sludge | L |
| Oil | O |
| Other | X |

| Lab Use | Sample Information | | | MATRIX | Preservative | | | | | | Analysis Requested |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Lab Sample ID # | Date | Time | Sample Description and Location (e.g. MW-1) | | None | H2SO4 | HNO3 | HCl | NaOH | Other | Fecal, Ferm Coli |
| 9066-1 | 9/5/06 | 2:00P | Allendale Lagoon # 1 grab 1 | L | ✓ | | | | | | X |
| 2 | 9/5/16 | 2:05 | " " " grab 2 | L | ✓ | | | | | | X |
| 3 | 9/5/06 | 2:10 | " " " grab 3 | L | ✓ | | | | | | X |
| 4 | 9/5/06 | 2:15 | " " " grab 4 | L | ✓ | | | | | | X |
| 5 | 9/5/06 | 2:20 | " " " grab 5 | L | ✓ | | | | | | X |
| 6 | 9/5/06 | 2:25 | " " " grab 6 | L | ✓ | | | | | | X |
| 7 | 9/5/06 | 2:30 | " " " grab 7 | L | ✓ | | | | | | X |
| | | | | | | | | | | | |
| | | | | | | | | | | | |
| | | | | | | | | | | | |

Comments:

| Relinquished By: (Signature) | Date | Time | Received By: (Signature) | Date | Time | Relinquished By: (Signature) | Date | Time | Received By: (Signature) | Date | Time |
|---|---|---|---|---|---|---|---|---|---|---|---|
| [signature] | 9/6/06 | 11:20 | | | | | | | | | |
| Relinquished By: (Signature) | Date | Time | Received By: (Signature) | Date | Time | Method of Shipment: | | | Bill of Lading: | | |
| | | | | | | | | | | | |
| Received for Laboratory By: | Date | Time | Data Package Relinquished By: | Date | Time | Data Received By: | Date | Time | № 10903 | | |
| [signature] | 9/6/06 | 11:20 | | | | | | | | | |

# ATTACHMENT C

## BIOSOLIDS APPLICATION REPORT
### Biosolids Analysis and Soil Loading Rates

Allendale Lagoon 2(1)
Sep-06
Digestion Method: 1
Anaerobic = 1, Aerobic = 2, Lime stabilized = 3
Synagro #: 0
Lat/Long: 0
Acres used this month: 10
Total acres in site: 17

**Crop and Soil Data**
Crop to be fertilized: Corn
CEC 3.5
pH 6.2 S.U.
Bray P1 194 lbs/a
K 198 lbs/a

Crop Yield: 180
N Allowed: 200
Org. N-1 yr. Ago (lbs/ac): 0 0 Residual N Credit
Org. N-2 yrs. Ago (lbs/ac): 0 0 Residual N Credit

**Acceptable Metal Accumulations**

| | |
|---|---|
| As | 37 |
| Cd | 4.5 |
| Cu | 97.5 |
| Pb | 268 |
| Hg | 15 |
| Ni | 39 |
| Se | 89 |
| Zn | 195 |

| DATE | Gallons | Den. | % Sol. | % VS | Analysis | DT/A | DT | Nitrogen TKN % | NH4 % | NO3 % | Phos. % | Potass. % | Arsenic mg/kg | Cad. mg/kg | Chrom. mg/kg | Copper mg/kg | Lead mg/kg | Mercury mg/kg | Molyb. mg/kg | Nickel mg/kg | Selen. mg/kg | Zinc mg/kg | Ca % | Mg % |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 9/30 | 200,000 | 1.00 | 6.0 | | Allendale Lagoon 2 | | 50.04 | 2.80 | 0.55 | 0.004 | 3.00 | 0.16 | 6.71 | 2.91 | 28.47 | 368.00 | 40.43 | 0.07 | 20.10 | 6.55 | 0.02 | 793.00 | 5.08 | 1.12 |
| 1/0 | 0 | 1.00 | 0.0 | | | | 0 | 2.80 | 0.55 | 0.004 | 3.00 | 0.16 | 6.71 | 2.91 | 28.47 | 368.00 | 40.43 | 0.07 | 20.10 | 6.55 | 0.02 | 793.00 | 5.08 | 1.12 |
| 1/0 | 0 | 1.00 | 0.0 | | | | 0 | 2.80 | 0.55 | 0.004 | 3.00 | 0.16 | 6.71 | 2.91 | 28.47 | 368.00 | 40.43 | 0.07 | 20.10 | 6.55 | 0.02 | 793.00 | 5.08 | 1.12 |
| 1/0 | 0 | 1.00 | 0.0 | | | | 0 | 2.80 | 0.55 | 0.004 | 3.00 | 0.16 | 6.71 | 2.91 | 28.47 | 368.00 | 40.43 | 0.07 | 20.10 | 6.55 | 0.02 | 793.00 | 5.08 | 1.12 |
| 1/0 | 0 | 1.00 | 0.0 | | | | 0 | 2.80 | 0.55 | 0.004 | 3.00 | 0.16 | 6.71 | 2.91 | 28.47 | 368.00 | 40.43 | 0.07 | 20.10 | 6.55 | 0.02 | 793.00 | 5.08 | 1.12 |
| 1/0 | 0 | 1.00 | 0.0 | | | | 0 | 2.80 | 0.55 | 0.004 | 3.00 | 0.16 | 6.71 | 2.91 | 28.47 | 368.00 | 40.43 | 0.07 | 20.10 | 6.55 | 0.02 | 793.00 | 5.08 | 1.12 |
| 1/0 | 0 | 1.00 | 0.0 | | | | 0 | 2.80 | 0.55 | 0.004 | 3.00 | 0.16 | 6.71 | 2.91 | 28.47 | 368.00 | 40.43 | 0.07 | 20.10 | 6.55 | 0.02 | 793.00 | 5.08 | 1.12 |
| 1/0 | 0 | 1.00 | 0.0 | | | | 0 | 2.80 | 0.55 | 0.004 | 3.00 | 0.16 | 6.71 | 2.91 | 28.47 | 368.00 | 40.43 | 0.07 | 20.10 | 6.55 | 0.02 | 793.00 | 5.08 | 1.12 |
| 1/0 | 0 | 1.00 | 0.0 | | | | 0 | 2.80 | 0.55 | 0.004 | 3.00 | 0.16 | 6.71 | 2.91 | 28.47 | 368.00 | 40.43 | 0.07 | 20.10 | 6.55 | 0.02 | 793.00 | 5.08 | 1.12 |
| 1/0 | 0 | 1.00 | 0.0 | | | | 0 | 2.80 | 0.55 | 0.004 | 3.00 | 0.16 | 6.71 | 2.91 | 28.47 | 368.00 | 40.43 | 0.07 | 20.10 | 6.55 | 0.02 | 793.00 | 5.08 | 1.12 |
| 1/0 | 0 | 1.00 | 0.0 | | | | 0 | 2.80 | 0.55 | 0.004 | 3.00 | 0.16 | 6.71 | 2.91 | 28.47 | 368.00 | 40.43 | 0.07 | 20.10 | 6.55 | 0.02 | 793.00 | 5.08 | 1.12 |
| 1/0 | 0 | 1.00 | 0.0 | | | | 0 | 2.80 | 0.55 | 0.004 | 3.00 | 0.16 | 6.71 | 2.91 | 28.47 | 368.00 | 40.43 | 0.07 | 20.10 | 6.55 | 0.02 | 793.00 | 5.08 | 1.12 |
| 1/0 | 0 | 1.00 | 0.0 | | | | 0 | 2.80 | 0.55 | 0.004 | 3.00 | 0.16 | 6.71 | 2.91 | 28.47 | 368.00 | 40.43 | 0.07 | 20.10 | 6.55 | 0.02 | 793.00 | 5.08 | 1.12 |
| 1/0 | 0 | 1.00 | 0.0 | | | | 0 | 2.80 | 0.55 | 0.004 | 3.00 | 0.16 | 6.71 | 2.91 | 28.47 | 368.00 | 40.43 | 0.07 | 20.10 | 6.55 | 0.02 | 793.00 | 5.08 | 1.12 |
| 1/0 | 0 | 1.00 | 0.0 | | | | 0 | 2.80 | 0.55 | 0.004 | 3.00 | 0.16 | 6.71 | 2.91 | 28.47 | 368.00 | 40.43 | 0.07 | 20.10 | 6.55 | 0.02 | 793.00 | 5.08 | 1.12 |
| 1/0 | 0 | 1.00 | 0.0 | | | | 0 | 2.80 | 0.55 | 0.004 | 3.00 | 0.16 | 6.71 | 2.91 | 28.47 | 368.00 | 40.43 | 0.07 | 20.10 | 6.55 | 0.02 | 793.00 | 5.08 | 1.12 |
| 1/0 | 0 | 1.00 | 0.0 | | | | 0 | 2.80 | 0.55 | 0.004 | 3.00 | 0.16 | 6.71 | 2.91 | 28.47 | 368.00 | 40.43 | 0.07 | 20.10 | 6.55 | 0.02 | 793.00 | 5.08 | 1.12 |
| 1/0 | 0 | 1.00 | 0.0 | | | | 0 | 2.80 | 0.55 | 0.004 | 3.00 | 0.16 | 6.71 | 2.91 | 28.47 | 368.00 | 40.43 | 0.07 | 20.10 | 6.55 | 0.02 | 793.00 | 5.08 | 1.12 |
| 1/0 | 0 | 1.00 | 0.0 | | | | 0 | 2.80 | 0.55 | 0.004 | 3.00 | 0.16 | 6.71 | 2.91 | 28.47 | 368.00 | 40.43 | 0.07 | 20.10 | 6.55 | 0.02 | 793.00 | 5.08 | 1.12 |
| 1/0 | 0 | 1.00 | 0.0 | | | | 0 | 2.80 | 0.55 | 0.004 | 3.00 | 0.16 | 6.71 | 2.91 | 28.47 | 368.00 | 40.43 | 0.07 | 20.10 | 6.55 | 0.02 | 793.00 | 5.08 | 1.12 |
| 1/0 | 0 | 1.00 | 0.0 | | | | 0 | 2.80 | 0.55 | 0.004 | 3.00 | 0.16 | 6.71 | 2.91 | 28.47 | 368.00 | 40.43 | 0.07 | 20.10 | 6.55 | 0.02 | 793.00 | 5.08 | 1.12 |
| 1/0 | 0 | 1.00 | 0.0 | | | | 0 | 2.80 | 0.55 | 0.004 | 3.00 | 0.16 | 6.71 | 2.91 | 28.47 | 368.00 | 40.43 | 0.07 | 20.10 | 6.55 | 0.02 | 793.00 | 5.08 | 1.12 |
| 1/0 | 0 | 1.00 | 0.0 | | | | 0 | 2.80 | 0.55 | 0.004 | 3.00 | 0.16 | 6.71 | 2.91 | 28.47 | 368.00 | 40.43 | 0.07 | 20.10 | 6.55 | 0.02 | 793.00 | 5.08 | 1.12 |
| 1/0 | 0 | 1.00 | 0.0 | | | | 0 | 2.80 | 0.55 | 0.004 | 3.00 | 0.16 | 6.71 | 2.91 | 28.47 | 368.00 | 40.43 | 0.07 | 20.10 | 6.55 | 0.02 | 793.00 | 5.08 | 1.12 |
| 1/0 | 0 | 1.00 | 0.0 | | | | 0 | 2.80 | 0.55 | 0.004 | 3.00 | 0.16 | 6.71 | 2.91 | 28.47 | 368.00 | 40.43 | 0.07 | 20.10 | 6.55 | 0.02 | 793.00 | 5.08 | 1.12 |
| 1/0 | 0 | 1.00 | 0.0 | | | | 0 | 2.80 | 0.55 | 0.004 | 3.00 | 0.16 | 6.71 | 2.91 | 28.47 | 368.00 | 40.43 | 0.07 | 20.10 | 6.55 | 0.02 | 793.00 | 5.08 | 1.12 |
| 1/0 | 0 | 1.00 | 0.0 | | | | 0 | 2.80 | 0.55 | 0.004 | 3.00 | 0.16 | 6.71 | 2.91 | 28.47 | 368.00 | 40.43 | 0.07 | 20.10 | 6.55 | 0.02 | 793.00 | 5.08 | 1.12 |
| 1/0 | 0 | 1.00 | 0.0 | | | | 0 | 2.80 | 0.55 | 0.004 | 3.00 | 0.16 | 6.71 | 2.91 | 28.47 | 368.00 | 40.43 | 0.07 | 20.10 | 6.55 | 0.02 | 793.00 | 5.08 | 1.12 |
| 1/0 | 0 | 1.00 | 0.0 | | | | 0 | 2.80 | 0.55 | 0.004 | 3.00 | 0.16 | 6.71 | 2.91 | 28.47 | 368.00 | 40.43 | 0.07 | 20.10 | 6.55 | 0.02 | 793.00 | 5.08 | 1.12 |
| 1/0 | 0 | 1.00 | 0.0 | | | | 0 | 2.80 | 0.55 | 0.004 | 3.00 | 0.16 | 6.71 | 2.91 | 28.47 | 368.00 | 40.43 | 0.07 | 20.10 | 6.55 | 0.02 | 793.00 | 5.08 | 1.12 |
| 1/0 | 0 | 1.00 | 0.0 | | | | 0 | 2.80 | 0.55 | 0.004 | 3.00 | 0.16 | 6.71 | 2.91 | 28.47 | 368.00 | 40.43 | 0.07 | 20.10 | 6.55 | 0.02 | 793.00 | 5.08 | 1.12 |
| 1/0 | 0 | 1.00 | 0.0 | | | | 0 | 2.80 | 0.55 | 0.004 | 3.00 | 0.16 | 6.71 | 2.91 | 28.47 | 368.00 | 40.43 | 0.07 | 20.10 | 6.55 | 0.02 | 793.00 | 5.08 | 1.12 |
| 1/0 | 0 | 1.00 | 0.0 | | | | 0 | 2.80 | 0.55 | 0.004 | 3.00 | 0.16 | 6.71 | 2.91 | 28.47 | 368.00 | 40.43 | 0.07 | 20.10 | 6.55 | 0.02 | 793.00 | 5.08 | 1.12 |
| 1/0 | 0 | 1.00 | 0.0 | | | | 0 | 2.80 | 0.55 | 0.004 | 3.00 | 0.16 | 6.71 | 2.91 | 28.47 | 368.00 | 40.43 | 0.07 | 20.10 | 6.55 | 0.02 | 793.00 | 5.08 | 1.12 |
| 1/0 | 0 | 1.00 | 0.0 | | | | 0 | 2.80 | 0.55 | 0.004 | 3.00 | 0.16 | 6.71 | 2.91 | 28.47 | 368.00 | 40.43 | 0.07 | 20.10 | 6.55 | 0.02 | 793.00 | 5.08 | 1.12 |
| 1/0 | 0 | 1.00 | 0.0 | | | | 0 | 2.80 | 0.55 | 0.004 | 3.00 | 0.16 | 6.71 | 2.91 | 28.47 | 368.00 | 40.43 | 0.07 | 20.10 | 6.55 | 0.02 | 793.00 | 5.08 | 1.12 |
| 1/0 | 0 | 1.00 | 0.0 | | | | 0 | 2.80 | 0.55 | 0.004 | 3.00 | 0.16 | 6.71 | 2.91 | 28.47 | 368.00 | 40.43 | 0.07 | 20.10 | 6.55 | 0.02 | 793.00 | 5.08 | 1.12 |
| 1/0 | 0 | 1.00 | 0.0 | | | | 0 | 2.80 | 0.55 | 0.004 | 3.00 | 0.16 | 6.71 | 2.91 | 28.47 | 368.00 | 40.43 | 0.07 | 20.10 | 6.55 | 0.02 | 793.00 | 5.08 | 1.12 |
| 1/0 | 0 | 1.00 | 0.0 | | | | 0 | 2.80 | 0.55 | 0.004 | 3.00 | 0.16 | 6.71 | 2.91 | 28.47 | 368.00 | 40.43 | 0.07 | 20.10 | 6.55 | 0.02 | 793.00 | 5.08 | 1.12 |
| 1/0 | 0 | 1.00 | 0.0 | | | | 0 | 2.80 | 0.55 | 0.004 | 3.00 | 0.16 | 6.71 | 2.91 | 28.47 | 368.00 | 40.43 | 0.07 | 20.10 | 6.55 | 0.02 | 793.00 | 5.08 | 1.12 |
| 1/0 | 0 | 1.00 | 0.0 | | | | 0 | 2.80 | 0.55 | 0.004 | 3.00 | 0.16 | 6.71 | 2.91 | 28.47 | 368.00 | 40.43 | 0.07 | 20.10 | 6.55 | 0.02 | 793.00 | 5.08 | 1.12 |
| 1/0 | 0 | 1.00 | 0.0 | | | | 0 | 2.80 | 0.55 | 0.004 | 3.00 | 0.16 | 6.71 | 2.91 | 28.47 | 368.00 | 40.43 | 0.07 | 20.10 | 6.55 | 0.02 | 793.00 | 5.08 | 1.12 |
| 1/0 | 0 | 1.00 | 0.0 | | | | 0 | 2.80 | 0.55 | 0.004 | 3.00 | 0.16 | 6.71 | 2.91 | 28.47 | 368.00 | 40.43 | 0.07 | 20.10 | 6.55 | 0.02 | 793.00 | 5.08 | 1.12 |
| 1/0 | 0 | 1.00 | 0.0 | | | | 0 | 2.80 | 0.55 | 0.004 | 3.00 | 0.16 | 6.71 | 2.91 | 28.47 | 368.00 | 40.43 | 0.07 | 20.10 | 6.55 | 0.02 | 793.00 | 5.08 | 1.12 |
| 1/0 | 0 | 1.00 | 0.0 | | | | 0 | 2.80 | 0.55 | 0.004 | 3.00 | 0.16 | 6.71 | 2.91 | 28.47 | 368.00 | 40.43 | 0.07 | 20.10 | 6.55 | 0.02 | 793.00 | 5.08 | 1.12 |
| 1/0 | 0 | 1.00 | 0.0 | | | | 0 | 2.80 | 0.55 | 0.004 | 3.00 | 0.16 | 6.71 | 2.91 | 28.47 | 368.00 | 40.43 | 0.07 | 20.10 | 6.55 | 0.02 | 793.00 | 5.08 | 1.12 |
| 1/0 | 0 | 1.00 | 0.0 | | | | 0 | 2.80 | 0.55 | 0.004 | 3.00 | 0.16 | 6.71 | 2.91 | 28.47 | 368.00 | 40.43 | 0.07 | 20.10 | 6.55 | 0.02 | 793.00 | 5.08 | 1.12 |
| 1/0 | 0 | 1.00 | 0.0 | | | | 0 | 2.80 | 0.55 | 0.004 | 3.00 | 0.16 | 6.71 | 2.91 | 28.47 | 368.00 | 40.43 | 0.07 | 20.10 | 6.55 | 0.02 | 793.00 | 5.08 | 1.12 |
| 1/0 | 0 | 1.00 | 0.0 | | | | 0 | 2.80 | 0.55 | 0.004 | 3.00 | 0.16 | 6.71 | 2.91 | 28.47 | 368.00 | 40.43 | 0.07 | 20.10 | 6.55 | 0.02 | 793.00 | 5.08 | 1.12 |
| | | 1 g/cc | | | | | | 2.8035 | 0.55 | 0.004 | | | | | | | | | | | | | | |
| Ave. | 20,000 Gal. | | 6.00 % | | | | | | | Weighted Averages ---> | 3.00 | 0.16 | 6.71 | 2.91 | 28.47 | 368.00 | 40.43 | 0.07 | 20.10 | 6.55 | 0.02 | 793.00 | 5.08 | 1.12 |

| | | | | | | Phos. | Potass. | Arsenic | Cad. | Chrom. | Copper | Lead | Mercury | Molyb. | Nickel | Selen. | Zinc | Ca | Mg |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Month | 200,000 Gal. | Dt/Ac | 5.00 | Lb/Ac | ----> 100 (avan) | 300 | 15.52 | 0.067 | 0.029 | 0.285 | 3.683 | 0.405 | 0.001 | 0.201 | 0.066 | 0.000 | 7.936 | 508.577 | 111.829 |
| Year | 200,000 Gal. | Dt/Ac | 5.00 | Lb/Ac | ----> 100 (avan) | 300 | 15.52 | 0.067 | 0.029 | 0.285 | 3.683 | 0.405 | 0.001 | 0.201 | 0.066 | 0.000 | 7.936 | 508.577 | 111.829 |
| | | DMt/Ha | 11.21 | Kg/Ha | ----> 112 (avan) | 336 | 17.39 | 0.075 | 0.033 | 0.319 | 4.125 | 0.453 | 0.001 | 0.225 | 0.073 | 0.000 | 8.889 | 569.606 | 125.249 |
| Cumulative | | | | Lb/Ac | | | | 0.067 | 0.029 | 0.285 | 3.683 | 0.405 | 0.001 | 0.201 | 0.066 | 0.000 | 7.936 | 508.577 | 111.829 |
| Cumulative | | | | Kg/Ha | | | | 0.075 | 0.033 | 0.319 | 4.125 | 0.453 | 0.001 | 0.225 | 0.073 | 0.000 | 8.889 | 569.606 | 125.249 |

# ATTACHMENT D

# Synagro Central, LLC

807 Lake Lansing Road - Lansing, MI 48906 - Phone: (517) 487-9280 - Fax: (517) 487-2508

We, as Owner and Operator, hereby agree to voluntarily participate in a biosolids recycling program administered by Synagro Midwest, under contract by the _____ Wastewater Treatment Facility.

We understand that biosolids will be applied to the site(s) listed below in accordance with regulations administered by the Michigan Department of Environmental Quality (MDEQ) and the United States Environmental Protection Agency (EPA).

We understand and agree that all land proposed for application under this agreement is to be used for agricultural production only. We further understand that following biosolids application certain site limitations apply, and have been explained as listed below:

1. **Feed crops, fiber crops, and food crops with harvested parts above the soil surface shall not be harvested for 30 days;**
2. **Food crops with harvested parts that touch the biosolids/soil mixture (i.e. Tomato, pepper) shall not be harvested for 14 months;**
3. **Food crops with harvested parts below the soil surface (i.e. Potato, carrot) shall not be harvested for 38 months;**
4. **Animals shall not intentionally be allowed to graze on the land for 30 days;**
5. **Public access to land with a low potential for public exposure (private property) shall be restricted for 30 days and public access to land with a high potential for public exposure shall be restricted for one year;**
6. **Turf shall not be harvested for one year when the harvested turf is placed on either land with a high potential for public exposure or lawn, unless other wise specified by the permitting authority.**

We agree to allow representatives of the MDEQ, USEPA, Wastewater Treatment Facility and Synagro access to my land for the purposes of conducting site inspections, obtaining soil samples, applying biosolids and related testing. We reserve the right to ask the above parties for proper identification. We authorize a representative of Synagro to obtain maps of my land from the local FSA office on my behalf.

We certify this land has not been permitted for use by another facility, and that no prior application of residuals (including septage) from another municipal, industrial or private treatment facility has been made to this land except as specifically stated below. Further, we agree not to accept biosolids (including septage) from any other source during the term of this agreement. ¥

We understand that this transaction is not contemplated to be a sale of goods, and that the Generator, and Synagro are willing to provide the service of land applying biosolids without charge. We understand that Synagro, or the Generator, does not guarantee specific quantities, delivery dates or crop yields. It is understood that application and field data provided to me is intended for informational purposes. The Wastewater Treatment Plant and Synagro Midwest do not assume any responsibility for the interpretation and/or use of this data.

We understand that successful crop production depends on many variables, such as weather, soil conditions and specific farming practices and that while the Generator and Synagro have experience with land application of biosolids, the responsibility for properly adapting agricultural practices to biosolids utilization are solely ours.

Biosolids shall only be applied consistent with good agronomic principles. As such, we understand and agree that it is my responsibility to inform a Synagro representative of my cropping intentions prior to land application so they may apply biosolids at an agronomic rate best suited to our cropping choices.

We understand that should land ownership change, it is our responsibility to advise Synagro of these changes prior to the next biosolids application. Land use restrictions from biosolids application overlap all ownership changes until the restrictions expire. 3

**RENTER ACKNOWLEDGMENT**

SIGNATURE:_____ DATE:_____

NAME:_____ PHONE:_____

ADDRESS:_____

(¥) **OWNER ACKNOWLEDGMENT**

SIGNATURE:_____ DATE:_____

NAME:_____ PHONE:_____

ADDRESS:_____ PREVIOUS OWNER:_____

_____ PROPERTY PURCHASE DATE:_____

**FIELD INFORMATION**

COUNTY:_____ TOWNSHIP:_____ SECTION:_____ ACRES:_____

CURRENT CROP:_____ NEXT CROP:_____

# STATE OF MICHIGAN CERTIFICATION

"I certify, under penalty of law, that the information that will be used to determine compliance with the management practices in R 323.2410, the site restrictions in R 323.2414(3)(f) and the vector attraction reduction requirements in R 323.2415(4)(i) has been prepared for each site on which bulk biosolids are applied under my direction and supervision in accordance with the system designed to ensure that qualified personnel properly gather and evaluate this information. I am aware that there are significant penalties for false certification including the possibility of fine and imprisonment."

Project(s): Allendale, MI Liquid

Reporting Year: October 1, 2005 – September 30, 2006

Name: Mark Miller Synagro

Signature: _____ Date:_____

The management practices were met as follows:

(1) Sites currently in agricultural production or drastically disturbed lands are not potential habitat for endangered species. Sites which are in a natural state and are converted to agricultural use are evaluated case by case.

(2) Biosolids are not applied to land that is flooded, saturated with water, frozen or snow covered such that bulk biosolids enter a wetland or other waters of the state.

(3) Bulk biosolids were only injected on frozen or snow covered ground if there was substantial soil coverage of the applied biosolids. Surface application of bulk non-exceptional quality biosolids, on frozen or snow covered ground only occurred if approval from the department was obtained.

(4) Bulk biosolids were not applied on land having a slope of >6% for surface application or >12% for subsurface injected biosolids unless the biosolids were used in accordance with a department-approved site management plan.

(5) Bulk biosolids were applied at a rate that is less than or equal to the agronomic rate unless the biosolids were applied in accordance with a department-approved site management plan.

(6) Not applicable as biosolids were applied in bulk form.

(7) Each application site was soil sampled before the initial biosolids application and soil fertility testing was performed. Resampling and testing occurs on a regular basis so that the last soil fertility test is not >2 years old at the time of the next biosolids application.

(8) For agricultural land biosolids were not applied if the Bray P1 or the Mehlich 3 soil test levels exceed 300 lbs. P/acre (150 ppm) or 340 lbs P/acre (170 ppm) respectively based on soil samples taken prior to application.

(9)&(10)For silvicultural land the nitrogen and phosphorus application rates outlined in R 323.2410 (9) and (10) were complied with.

(11) Sites were flagged prior to application to meet all the isolation distance requirements in Table 6 of R 323.2410 (11) and biosolids were not applied within the buffer zones.

(12) Biosolids were applied in a manner to maintain a minimum 30-inch separation distance between the soil surface and groundwater at the time of biosolids application. Soil borings were conducted where appropriate to confirm the separation distance was met.

The site restrictions were met through written agreements with the landowner and/or farm operator (leaseholder) specifying their obligation to comply with site restrictions.

The vector attraction reduction requirement was met through R 323.2415(4)(i) injection of biosolids below the land surface with no significant amount of biosolids being present on the land surface within one hour after the biosolids were injected.

NTYPE 7MI: CB T3 LA MP SR INJ

# ATTACHMENT E

# NOTICE AND NECESSARY INFORMATION (NANI) / CERTIFICATIONS

*This form is to assist compliance with the bulk sewage sludge (biosolids) notification requirements [§503.12(f)], and pathogen reduction certification requirements [§503.32]. Please note, however, that if the biosolids meet the exceptional quality criteria, then the notification requirements do not apply. This form can be used by preparers of biosolids to transmit information to land appliers and also by land appliers to transmit information to land owners or lease holders.*

**Facility and Biosolids Type:** Allendale Charter Township WWTP

**Monitoring Period: From** 9/1/06 **To** 12/31/06 lagoon #2(1)

**To be Completed by PREPARERS of Biosolids**

A. Please provide pollutant concentrations

| Name | Concentration (mg/kg) Dry Weight | Pollutant Concentrations (Table 3, 40 CFR 503.13) (monthly average) | Ceiling Concentrations* (Table 1, 40 CFR 503.13) (daily maximum) |
|---|---|---|---|
| Arsenic | 5.469 | 41 mg/kg | 75 mg/kg |
| Cadmium | 2.095 | 39 mg/kg | 85 mg/kg |
| Copper | 332.167 | 1500 mg/kg | 4300 mg/kg |
| Lead | 27.720 | 300 mg/kg | 840 mg/kg |
| Mercury | .044 | 17 mg/kg | 57 mg/kg |
| Molybdenum | 19.617 | N/A** | 75 mg/kg |
| Nickel | 12.093 | 420 mg/kg | 420 mg/kg |
| Selenium | .017 | 100 mg/kg | 100 mg/kg |
| Zinc | 760.833 | 2800 mg/kg | 7500 mg/kg |
| Nitrogen Concentration | | N/A | N/A |

* Biosolids may not be land applied if any pollutant exceeds these values.

** EPA has temporarily removed molybdenum limits from Table 2, Table 3, and Table 4, and dropped chromium.

B. Pathogen Reduction (40 CFR 503.32) -- Please indicate the level achieved ☐ Class A ☒ Class B

Alternative: 1 Fecal Coliform Geometric Mean

I certify under penalty of law, that the information that will be used to determine compliance with the Class B pathogen requirements in §503.32(b) and R 323.2414(3) has been prepared under my direction and supervision in accordance with the system designed to ensure that qualified personnel properly gather and evaluate the information. I am aware that there are significant penalties for false certification including the possibility of fine and imprisonment.

C. Vector Attraction Reduction (40 CFR 503.33) -- Please indicate the option performed (1-8), if any _____

☐ I certify under penalty of law, that the information that will be used to determine compliance with the vector attraction reduction requirements in §503.33(b)(1) and R323.2415(4)(a) has been prepared under my direction and supervision in accordance with the system designed to ensure that qualified personnel properly gather and evaluate the information. I am aware that there are significant penalties for false certification including the possibility of fine and imprisonment.

☒ No vector attraction reduction options were performed

D. I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system or these persons directly responsible for gathering information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

| A. Name and Official Title *(type or print)* | B. Area Code and Telephone Number |
|---|---|
| STEVEN E. BOSS, SUPERINTENDENT PUBLIC WORKS | 616 - 895 - 6295 |
| C. Signature Steven E. Boss | D. Date Signed 9/14/06 |

SYNAGRO

**Farm Operator Report**

September 14, 2006

Dear Grower:

Thank you for your participation in Synagro Midwest, Inc.'s land application program. Biosolids are a valuable soil amendment, which greatly reduces your need to apply commercial fertilizer and provides the added benefit of organic matter additions to your fields.

The enclosed Farm Report sheet(s) detail the amount of biosolids applied to each of your fields and the resulting plant nutrients, lime (when lime conditioned or lime stabilized biosolids are applied), and trace elements supplied through biosolids application.

Because biosolids are an organic material, plant nutrients are slowly released as the biosolids are decomposed (mineralized) by soil microorganisms. The following is a brief description of primary nutrients available for crop growth during the first year in which biosolids are applied.

Nitrogen:

The available nitrogen (commonly referred to as Plant Available Nitrogen or PAN) you see for each field is that amount which will become available throughout the entire growing season. Although the biosolids contain inorganic nitrogen (ammonia and nitrate), which are readily available for plant uptake, typically the majority of the nitrogen in biosolids is in an organic form, which is released as organic matter is mineralized. Organic nitrogen release from biosolids depends largely on soil temperatures; as the soil warms up, microorganisms convert organic nitrogen into the ammonium and nitrate forms, which the plant can take up.

The greatest release of organic nitrogen from the biosolids application occurs during the growing season when it is applied; however, measurable amounts of nitrogen are also released in the second and third years following application. By accounting for this residual nitrogen you can maximize the benefits (i.e., reduced fertilizer costs) you receive from the biosolids application.

Field methods are the best way to monitor residual nitrogen available for crops planted after the first growing season. This can be done by determining nitrogen needs through the use of soil nitrate test kits or plant tissue and soil testing and then sidedressing the additional nitrogen.

Phosphorus:

While you will note large amounts of phosphorus applied, this represents the total phosphorus contained in the biosolids application. We estimate that approximately 30 percent of this phosphorus will be available for plant uptake. The Farm Report shows both total phosphorus (P) applied and the first year estimated available phosphate ($P_2O_5$) applied.

Potassium:

As you can see from the farm report, biosolids provide very little potassium (K). Therefore, you may need to apply potash depending on your current soil test levels. The Farm Report shows both total potassium (K) and total potash ($K_2O$) applied.

# ATTACHMENT 1
## USING BIOSOLIDS AS A FERTILIZER

Biosolids Generation

Biosolids are the accumulated, treated solids that are separated from water during the wastewater treatment process. Biosolids are produced by public and private wastewater treatment plants (Generators). The Generator is responsible for supplying biosolids that are suitable for land application according to state and federal specifications.

Benefits of Biosolids

Biosolids provide nitrogen in a form that can be taken up by plants during their growth cycle. Biosolids also add phosphorus to the soil. If lime is added to biosolids, the biosolids will have the added benefit of a liming agent. Biosolids contain many primary, secondary and micronutrients that can be used by plants. Biosolids are primarily an organic material; when added to soil, they improve water and nutrient retention, reduce erosion potential and improve soil structure.

Agronomic Considerations

Tractor-trailer units are used to deliver biosolids to the fields approved for biosolids applications. Soil compaction may occur on the travel areas used by the trucks and in areas where biosolids is unloaded for transfer to the applicator vehicle.

Since some biosolids contain lime, it is important to recognize any increase in soil pH where biosolids have been applied and exercise care in using certain herbicides. If considering the use of a sulfonylurea herbicide, particular attention should be paid to any label restrictions. High soil pH and dry weather may slow decomposition of these chemicals, resulting in carry-over.

In planning a herbicide program, it should be noted that seeds may sometimes survive the biosolids treatment process-- for example, tomato seeds. Also, the organic matter additions from biosolids application (organic matter tends to tie up certain herbicides) may require increased herbicide application rates. Consult your extension agent or chemical representative for a specific recommendation.

Biosolids contain salts. Biosolids applications alone rarely cause salt problems. However, if combined with other significant salt-increasing factors, such as drought, excessive soil compaction, saline irrigation water and salt-containing fertilizers, salts may reach levels that could negatively affect germination and growth of some crops.

Since biosolids provide nitrogen that will be released slowly throughout the growing season with diminishing carry-over in subsequent years, it is important to reduce the use of nitrogen and other fertilizers to appropriate levels.

Federal and State Management Requirements

The site restrictions you are responsible for are listed below. These are federal regulatory requirements; if state requirements conflict with these requirements, the most restrictive of the state and federal requirements must be followed. Your Technical Specialist can provide you with information on the most restrictive requirements, including information on biosolids products (e.g., pellets, BIO*FIX and compost) where these requirements may not apply.

1. Animals shall not be allowed to graze on the land for 30 days after the application of biosolids.
2. Food crops (crops consumed by humans including but not limited to fruits, vegetables, tobacco) with harvested parts that touch the biosolids/soil mixture and are totally above the land surface shall not be harvested for 14 months after the application of biosolids.
3. Food crops with harvested parts below the surface of the land shall not be harvested for 20 months after the application of biosolids when the biosolids remain on the land surface $\geq$4 months prior to incorporation into the soil, or 38 months when the biosolids remain on the land surface <4 months prior to incorporation.
4. Food crops, feed crops, and fiber crops shall not be harvested for 30 days after application of biosolids.
5. Public access to land with a low potential for public exposure (private property, remote or restricted public lands) shall be restricted for 30 days. Public access to land with a high potential for public exposure (parks, playgrounds, golf courses, etc.) shall be restricted for 1 year.
6. Turf grown on land where biosolids are applied shall not be harvested for one year after application of biosolids when the harvested turf is placed on either land with a high potential for public exposure or a lawn, unless otherwise specified by the permitting authority.

In planning your fertilizer program after biosolids are applied, please note that the biosolids in most cases provide all the nitrogen and phosphorus your crop should need as well as secondary and micronutrients. The attached Farm Report sheet(s) show the amounts of these nutrients supplied by the biosolids application. Please note that for projects where the biosolids generator is responsible for biosolids testing Synagro Midwest may only be able to supply you with the nitrogen, phosphorus, potassium and 10 federally regulated metals on the Farm Report sheet(s). In these situations, the symbol NR, which means data Not Reported to Synagro Midwest, will be displayed on the Farm Report sheet(s).

As a participant in the Synagro Midwest land application program you signed a Request and Consent for Biosolids form. This form contained state and federal management requirements and important information about using biosolids as a fertilizer. For your convenience, excerpts from this form are given in Attachment 1.

Synagro Midwest looks forward to your continued participation in our biosolids program. If you would like any further information about this report or your supplemental commercial fertilizer needs, please contact me at, (616) 299-3386

Sincerely,

William Goetsch
Technical Services Manager

# APPENDIX B

Asset Management Plan

*Protecting our Infrastructure Investment*

# ASSET MANAGEMENT PLAN

for Wastewater Collection System



Prepared for:

## Allendale Charter Township

SAW Project No. 1622-01

Allendale Charter Township est. 1849

November 2018

FLEIS&VANDENBRINK

DESIGN. BUILD. OPERATE.

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Appendix B: Collection System Asset Inventory
Appendix C: Manhole Assessment Inventory Summary
Appendix D: Pipeline Televising Individual Reports
Appendix E: Mass Flow Monitoring Report
Appendix F: Smoke Testing Report
Appendix G: Collection System Hydraulic Modeling/Analysis
Appendix H: Critical Assets Evaluation Approach
Appendix I: Critical Assets Evaluation Structure
Appendix J: CIP Recommendations for Addressing Assets Over Time
Appendix K: O&M Recommendations for Addressing Assets Over Time

# 1.0 INTRODUCTION

In 2015, the Allendale Charter Township received a Stormwater, Asset Management, and Wastewater (SAW) Grant from the Michigan Department of Environmental Quality (MDEQ) to provide financial assistance with the development of a wastewater system (collection and treatment) Asset Management Plan (AMP), and entered into an agreement with the MDEQ in November 2015 (MDEQ Project No. 1622-01). The grant provided 90% funding (10% local match) based on the SAW grant application submitted in December of 2013.

This report, prepared by Fleis & VandenBrink (F&V), addresses the wastewater collection system AMP component of the MDEQ agreement.

The goal of collection system asset management is to meet a desired level of service in the most cost-effective way through the proper operation, maintenance, and replacement/rehabilitation of assets to provide consistent collection of wastewater flows for wastewater treatment and environmental compliance for the Township's current and future customers. The major components of the AMP for the wastewater collection system contained in this report are:

- Asset Inventory
- Critical Assets
- Capital Improvement Plan

Figure 0 below shows the report structure for the Township's Wastewater Asset Management plan.

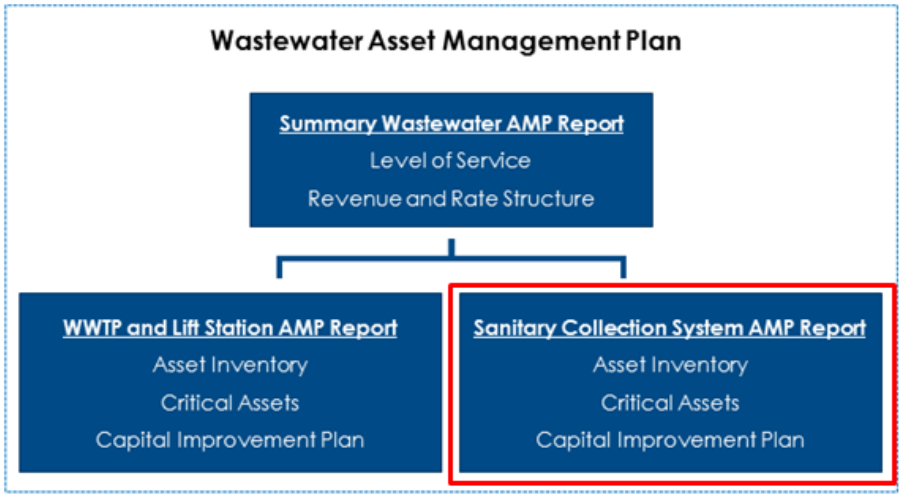



*Figure 0. Wastewater System AMP Report Format*

Working with community staff, F&V provided technical assistance for asset identification, condition assessment, and capital improvement planning in the collection system and WWTF. The following is a brief summary of the collection system assets for the Township.

The wastewater collection system assets consists of three "asset classes" which include:

- Wastewater Gravity Pipes
- Wastewater Pressure Pipes (Forcemains)
- Wastewater Manholes

There is 281,155 feet (53.3 miles) of sanitary sewer (gravity pipe and forcemains), 7 lift stations in the collection system, and 1079 wastewater manholes connecting the gravity pipelines. These assets are in existing street rights-of-way or in easements dedicated for the assets use and maintenance. The wastewater collection system is shown graphically in Appendix A.

# 2.0 COLLECTION SYSTEM ASSET INVENTORY

## 2.1 APPROACH TO ASSET INVENTORY

The development of a collection system asset inventory can be challenging. In many cases, visual inspection of the assets may not be possible or economically feasible. Therefore, development of the asset inventory must sometimes rely on existing information and indirect assessments. The process typically includes several steps and evaluates information provided through several sources. These sources include local knowledge, community records including record drawings, field surveys and condition assessments and can include hydraulic modeling and analysis to determine existing and future capacity. Several of these sources are further described in the following sections.

### 2.1.1 ASSET IDENTIFICATION AND LOCATION

The development of a comprehensive collection system asset inventory included a review of existing historical records (drawings, field notes, staff knowledge, etc.), supplemented with field survey work.

Asset material, size and age were identified through the review of available historical record documents. Spatial orientation (pipe location), pipe depth and invert elevations were determined through GPS field survey and a comprehensive evaluation of the gravity system. This information was organized into a new (GIS) database and piping network for archiving, mapping and further evaluation purposes.

After preparing the initial GIS database and base map, a quality review process of the data was completed, which included a review for missing or erroneous information and the building of a pipe network to properly connect the system operationally. Secondary field work was then performed to collect or correct information to make sure that the most accurate database was provided.

### 2.1.2 CONDITION ASSESSMENT

Existing local knowledge and historical information is an important resource. Interviews of DPW staff were held to gather this information. There is, however, a great amount of variability of accuracy with this information. For these reasons, additional evaluations were necessary to supplement historical data to develop a more accurate understanding of collection system asset conditions. For the Township, a comprehensive evaluation of the gravity pipelines in the collection system was performed, including:

- NASSCO-MACP manhole field based assessments
- NASSCO-PACP pipeline CCTV field based inspections
- Mass Flow Monitoring
- Smoke Testing

To provide comprehensive and consistent field-based inspections, the National Association of Sewer Service Companies (NASSCO) has developed industry standards for the assessment and rehabilitation of underground infrastructure. F&V utilized NASSCO's "Assessment and Certification Programs" to perform field inspections of collection system assets for manholes (MACP), pipelines (PACP) and lateral pipes (LACP).

The field inspections on pipes and manholes were completed by staff trained and certified to perform NASSCO-based assessments. NASSCO defect rating methods were used to generate structural condition scores, O&M condition scores, and combined condition scores for every asset that was assessed.

**Manhole Assessments**

Manholes are an important component of the wastewater collection system since they are the primary means of access to pipelines for maintenance, inspection and renovation. As the main access point to the collection system, a manhole must be accessible from the ground surface, and must extend to the wastewater pipe connections.

A manhole must be structurally capable of resisting damage caused machinery, withstand constant traffic in street installations, and must be resistant to a variety of weather conditions including frost heave in colder climates.

A comprehensive assessment is completed to determine the overall condition of each manhole by identifying what defects, if any, need to be corrected.

The Manhole Grade Score was provided, which is the severity level multiplied by the total number of occurrences. This grading system separates structural defects and O&M defects. A combination of the various scoring methodologies were used in the development of the rehabilitation plan detailed in Section 5.0 of this report.

**Pipeline Closed Circuit Televising (CCTV) Inspection**
Using the pipe network, a plan is developed to perform cleaning and CCTV for gravity pipeline more than 20 years old. CCTV is provided by a crew consisting of NASSCO PACP trained technicians operating camera and vacuum trucks. In a typical operation, the CCTV truck is set up at the upstream manhole, while the vacuum truck is stationed two to three manholes downstream. A basket is placed in the flow line to catch any debris, and lines are cleaned well enough to allow the camera to pass through the pipes and see all of the defects.

A camera records video and audio as it travels downstream in the pipe. As the camera travels down the sewer, a certified technician makes notes and takes pictures of everything within the pipe. This information includes any sort of defect such as joint offsets, areas of inflow and infiltration (I&I), root intrusion, cracked or broken pipes, as well as construction information including sewer taps, pipe material changes, and pipe size changes.

**Mass Flow Monitoring (MFM)**
The MFM approach utilizes near-instantaneous water depth and temperature data at several key manholes throughout a collection system. Lift station flow is used for data analysis. Site specific rain data is collected as part of the monitoring approach. The data is then used to determine real-time flow rates for the collection system's baseline dry weather flows and its response to rainfall, snow melt, surface water impacts and high groundwater conditions. Results from the flow monitoring are then used to prioritize additional field investigation (e.g. smoke testing, CCTV, inspection), hydraulic modeling and locations for improvements.

**Smoke Testing**
Smoke testing is a fast and economical way to identify areas of inflow within a sanitary sewer system. White smoke is pumped through the collection system that expels through openings to help detect point sources of inflow that could cause capacity concerns. It is another step taken to help evaluate capacity concern areas within the collection system. CCTV data, MFM results and local knowledge are used to narrow down specific areas where heavy inflow was suspected. A smoke test plan is then developed and smoke testing inspections performed.

## 2.2 Asset Identification

The wastewater collection system is comprised of gravity sewer main, pressure sewer main (force main), and connected manholes that are owned, maintained and operated by the Township. For valve manholes, which are part of the force main system, only the manhole structures are included in the collection system asset evaluation.

The wastewater collection system is located within street rights-of-way or in easements dedicated to the Township. Individual sewer laterals and connections to the public collection sewers serving residential, commercial and industrial users are privately owned by the user and are not included in this asset evaluation.

**Collection System Statistics**
There is a total of 240,029 feet of gravity main and 41,127 feet of force main in the collection system for a total collection system pipeline length of 281,155 feet. The predominant pipe size for the gravity collection system piping is 8 inch, which makes up approximately 75 percent of the system piping. The pipe sizes for the force main lines are 2, 3, 6, 8, 10 & 12 inch. The entire system is connected through 1079 manhole structures.

Figure 1 and 2 provides a graphical summary of pipe diameters for gravity sewer and force main by footage of the collection system.

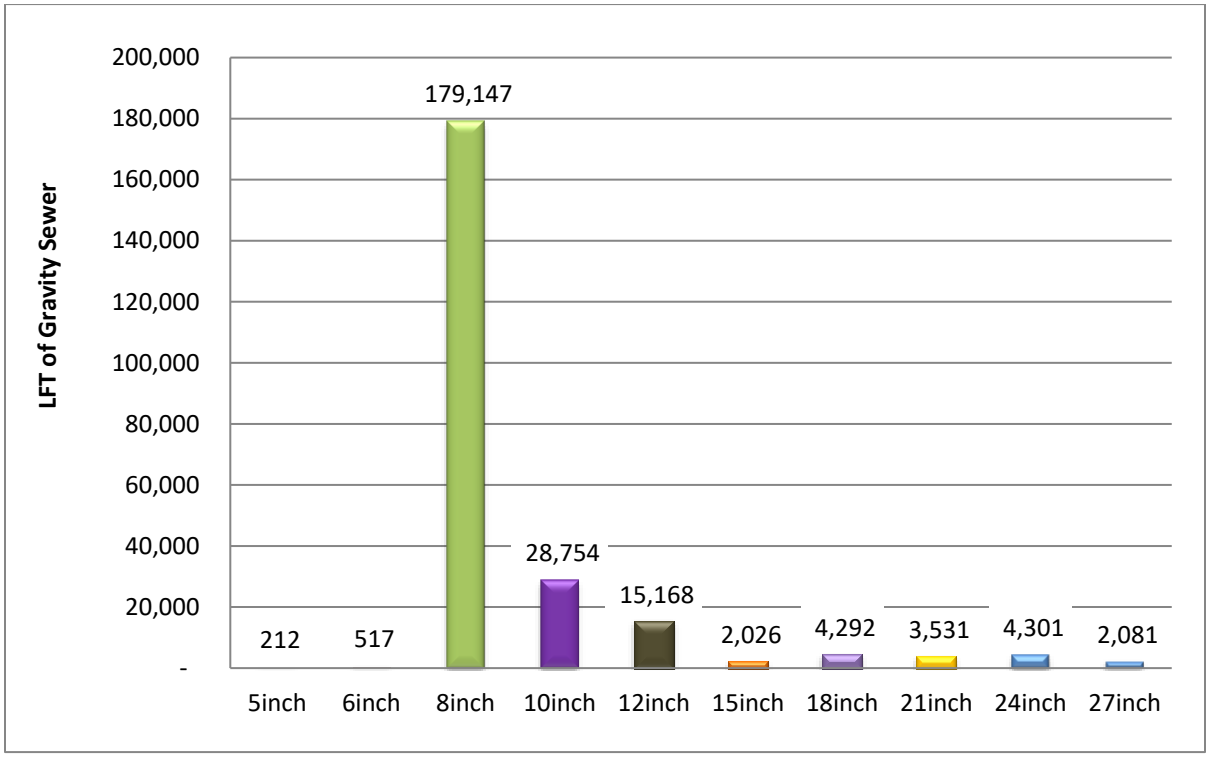



*Figure 1. Sanitary Sewer Length of Gravity by Pipe Size*

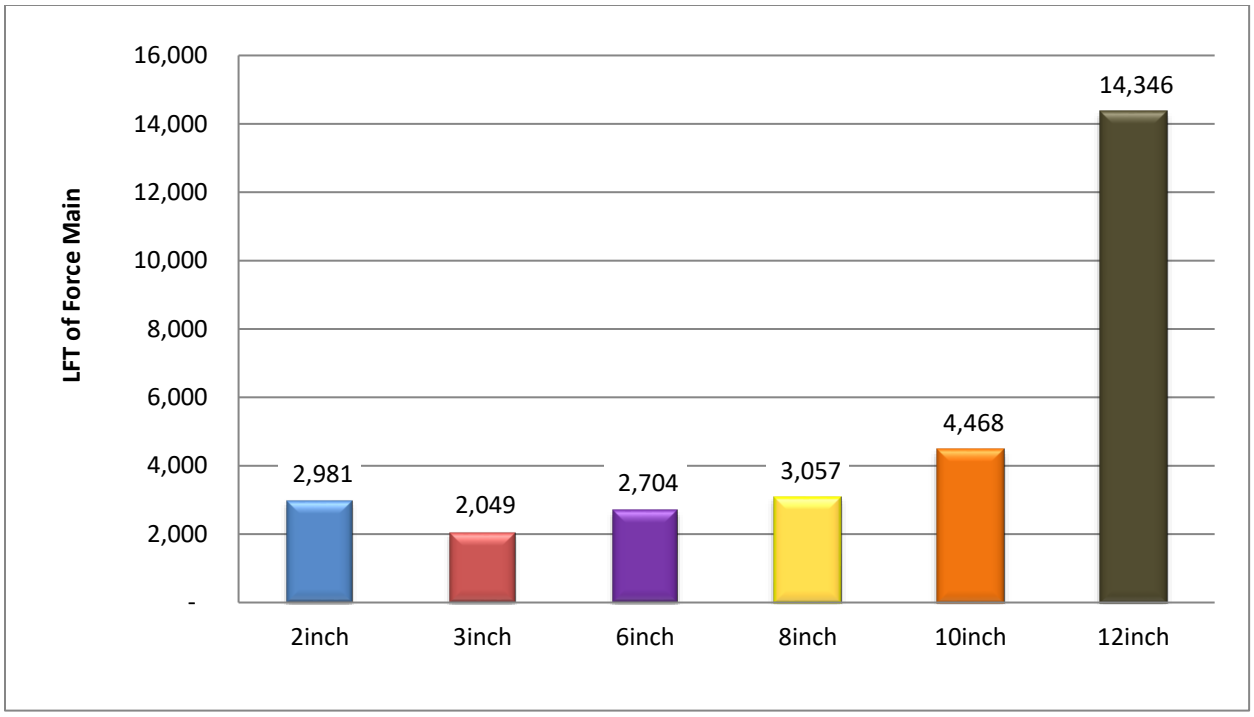



*Figure 2. Sanitary Sewer Length of Force main by Pipe Size*

The predominant pipe material in the system is Polyvinyl Chloride (PVC) which comprises approximately 78 percent of the system. Collection system pipes by material are shown in Figure 3.

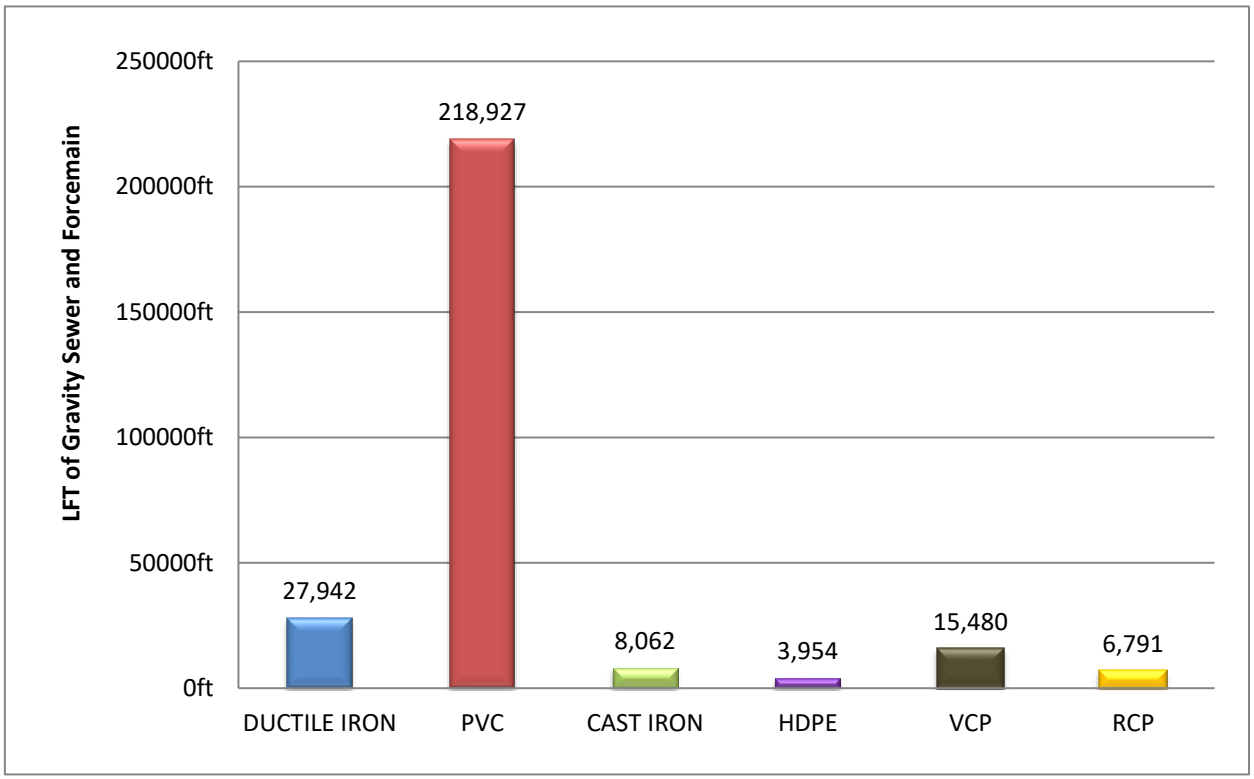



*Figure 3. Sanitary Sewer Length by Material Type*

The oldest part of the collection system was installed in the 1960's, along with the original wastewater treatment plant. The majority of the system was installed in the 1990's and 2000's, which makes up approximately 84% of the system. Figure 4 identifies collection system pipe age by year and by length.

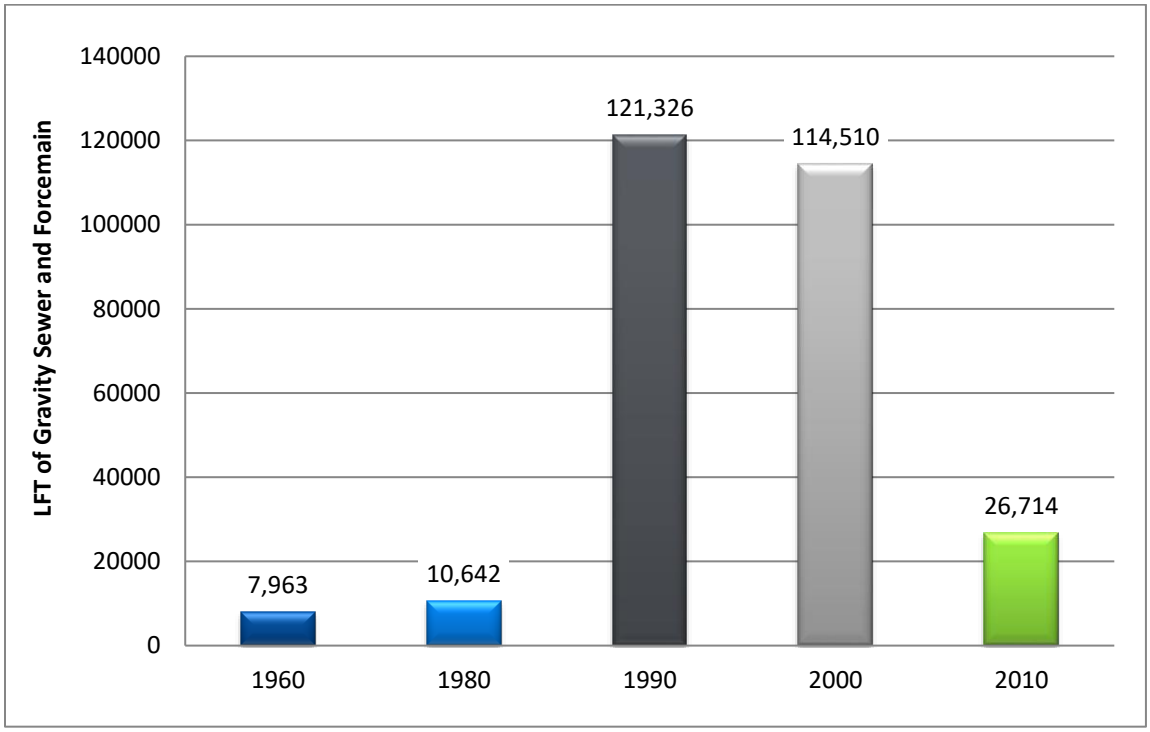



*Figure 4. Sanitary Sewer Length by Age*

A graphical representation of the system showing pipe size, material, and age are included in Appendix B; Figures B-1, B-2 and B-3 respectively.

The asset information contained within this evaluation was obtained from records attained from the Township, along with contribution of historical knowledge from DPW staff.

A field survey was performed to accurately locate and determine the top elevation of each structure. Rim to invert measurements were taken to establish an invert elevation for each pipe. Pipe diameter, material and condition were noted as well.

This information was then compared to the historical data and discrepancies were verified in the field. From this collection of data, the pipe network was constructed creating a model of the wastewater collection system. F&V imported the spatial data from this model to ArcGIS to form a GIS base map.

## 2.3 CONDITION ASSESSMENT

### 2.3.1 MANHOLE ASSESSMENT

Manhole assessments for the Township's wastewater collection system were completed during 2017. A few buried structures were located and added to the system map . All structures were coded, graded and assessed for risk. Assessment data was uploaded and linked to the GIS database and is available to review through the GIS mapping product. A manhole assessment report including individual manhole IDs, location and ratings is provided in Appendix C.

Manhole assessments resulted in the following field observations:

- Inflow and infiltration (I&I)
- Damage/deterioration
- Root intrusion
- Chemical deterioration

### 2.3.2 PIPELINE CCTV INSPECTION

Pipeline Cleaning and Closed-Circuit Televising (CCTV) was performed on a approximately 66% of the Township's wastewater collection system. CCTV inspection videos and data were uploaded and linked to the GIS database and are available to review through the GIS mapping product. A pipeline CCTV inspection report includes individual CCTV assessments, segment IDs (manhole to manhole). Location and ratings are provided in Appendix D.

CCTV assessments resulted in the following field observations:

- Structural Conditions: Breaks, Cracks, Fracture, Defective Joints
- O&M Conditions: Defective Taps, Root Intrusion, Grease, Encrustations & Scale, Settled Deposits, Infiltration, Obstruction, Line Deviations, Water Level +20%

### 2.3.3 MASS FLOW MONITORING

Mass flow monitoring (MFM) can generate data from the measurement of:

- Wastewater flow at a few essential locations in the collection system, and;
- Depths and temperatures at numerous other important locations. Monitoring during dry weather and wet weather (i.e. rainfall) helps determine how the collection system is performing (i.e. how much groundwater/rain water infiltration and inflow (I&I) is entering it) and to pinpoint problem locations. Additionally, peak flow estimates help determine where the system may lack capacity to handle the flows from more intense rainfall events.

I&I reductions in the wastewater collection system could provide capacity/conveyance improvements and prevent potential overflows during extreme wet weather events. I&I source correction should be carried out in conjunction with cleaning and physical improvements to ensure that the lower resultant flow rates (and thus flushing capacities) do not lead to increased debris retention in the sewer and possible obstructions.

Details of the MFM report are contained in Appendix E.

### 2.3.4 SMOKE TESTING

After determining areas of high concern from the mass flow monitoring, smoke testing was conducted on portions of the wastewater collection system over a three-day period by F&V on May 27th, May 28th and 29th, 2015. The field crew identified 25 areas of concern that are summarized in the Smoke Testing Report, Appendix F.

# 3.0 CAPACITY ANALYSIS

## 3.1 APPROACH TO CAPACITY ANALYSIS

In areas where collection system pipeline capacity concerns have been identified by historical information or mass flow monitoring, hydraulic modeling and analysis (HM&A) is used to identify the scope and extent of the system capacity issues. HM&A can be used to verify future pipeline sizing, and to guide existing pipeline replacement or rehabilitation, to restore capacity necessary to eliminate the potential for surcharges and overflows.

F&V uses Autodesk Storm and Sanitary Analysis (SSA) software for collection system capacity analysis. SSA includes an easy to use and graphical user interface to provide an advanced graphical output. Results can be imported and exported to an Excel spreadsheet which allows preparation of custom capacity reports. The following steps are included in HM&A:

- Creating a network that represents the collection system assets from the GIS database
- Verifying and editing the data
- Calibrating and validating the model.
- Defining the analysis options and running the analysis
- Reviewing the analysis output results

## 3.2 HYDRAULIC MODELING RESULTS AND RECOMMENDATIONS

Results from SSA for gravity mains, manholes, lift stations, and forcemains were evaluated for both the average day and peak flow conditions. As a result of the average day analysis, eight potential gravity sewer concerns were identified. These pipes are flowing near full pipe capacity at the average daily flow. For the peak hour conditions, there were twenty gravity main and four manhole concerns identified. Two forcemains were also identified to have the potential for low flow velocity. There were no concerns regarding lift station capacity. In general, the lift stations appear to have adequate capacity to meet peak hour demands. The concerns identified in the analysis may need to be further evaluated to determine if adequate capacity exists to accommodate potential additional flows.

The HM&A summary report available in Appendix G provides additional details.

# 4.0 CRITICAL ASSETS (BUSINESS RISK EVALUATION)

## 4.1 APPROACH TO CRITICAL ASSETS

Business Risk is the determination of criticality of each asset in the collection system. Criticality is determined based on two factors:

- Likelihood of Failure (LoF), also known as Probability of Failure
- Consequence of Failure (CoF)

Defining an asset's Business Risk allows for management of risk and aids in decision making on where to allocate O&M and capital improvement funds. Consequence of Failure and Likelihood of Failure are described in greater detail below, along with the approach to define the Business Risk of an asset.

InfoMaster is an ArcGIS-based sewer asset management and capital planning software from Innovyze. It is being utilized in this AMP to compile, analyze and assess Business Risk for each asset and to develop a CIP for the wastewater collection system assets.

**Likelihood of Failure**

Likelihood of Failure (LoF) is a measure of how likely an asset is to fail. Several categories have been developed to quantify how likely an asset is to fail, including:

- Condition of the asset based on historical data as well as NASSCO based field assessments of pipelines and manholes
- Remaining useful life with respect to its expected useful life, based on pipe material and age
- Service History - preventative maintenance repairs performed on the asset
- Operational status of the asset

For each asset, a LoF score is assigned for each category based on a scale of 1 (low) to 10 (high). Conditions leading to a high LoF are scored high while conditions leading to a low LoF are scored low.

Each LoF category is also given a weighting factor. A larger weighting factor is assigned to the categories which are more likely to lead to failure. The overall LoF score for an asset is determined by multiplying the score of each category by the weighting factor and summing the weighted scores.

The LoF categories and weighting factors used for the wastewater collection system components are shown in Table 1.

**Table 1. Likelihood of Failure Risk Weighting**

| Category | Criteria | Pipes | Manholes |
|---|---|---|---|
| Condition | CCTV Assessments – PACP<br>Manhole Assessments – MACP<br>▪ Structural Condition<br>▪ O&M Condition | 35% | 50% |
| Remaining Useful Life | Age<br>Material Type | 15% | 15% |
| Service History | CCTV History<br>Maintenance Repair History | 40% | N/A |
| Operational Status | Mass Flow Monitoring – Pipes<br>Evidence of Surcharge | 10% | 5% |
| User Input | Based on Community | N/A | 30% |

**Consequence of Failure**
Consequence of Failure (CoF) is a measure of the social, economic or environmental impact of failure of an asset within the collection system. Several categories have been developed to quantify the impact of failure for each asset, including:

- Proximity to critical environmental features, (including lakes, rivers, streams and wetlands)
- Location of asset (i.e., location with respect to commercial/downtown or residential/rural areas)
- Facilities served by asset (i.e., schools/hospitals, other critical facilities)
- Size and location of asset within the utility network (i.e., trunk line/interceptor, intermediate main, or branch)
- Type of asset (i.e.; gravity sewer, force main or manhole structure)

For each asset, a CoF score is assigned based on a scale of 1 (low) to 10 (high). Conditions leading to a significant impact are scored high while conditions leading to a minimal impact are scored low.

Each category within the CoF is also assigned a weighting factor. The weighting factor is based on the relative impact for each category. Larger weighting factors are assigned to categories with higher impact if failure were to occur. The CoF score is determined by multiplying the score of each category by the weighting factor and summing the weighted scores.

The CoF categories and weighting factors used for the wastewater collection system components are shown in Table 2.

**Table 2. Consequence of Failure Risk Weighting**

| Category | Descriptions | Pipes | Manholes |
|---|---|---|---|
| Proximity to Environmental Features | Lakes, Rivers, Wetlands, Streams | 10% | 35% |
| Location of Asset | Commercial/Downtown<br>Location to Roadway, Railroad | 40% | 35% |
| Facilities Served by Asset | School, Hospitals or other Critical Facilities | 10% | N/A |
| Size, Location within Utility Network | Trunk line/Interceptor<br>River/Stream Crossing | 10% | 10% |
| User Input | Based on Community | 30% | 20% |

**Business Risk**
The Business Risk of each asset is calculated using the following equation:

*Business Risk = Likelihood of Failure Score x Consequence of Failure Score*

A Business Risk score, also known as Criticality score, is assigned to each individual collection system asset on a scale of 1 to 100. The score is used as an informative indicator for rehabilitation prioritization.

Assets with high consequence and high likelihood of failure are vital to the collection system operation and require some form of near term renewal. Assets with high consequence, but low likelihood of failure are vital to the collection system operation and should be regularly monitored to mitigate potential failure. Assets with low consequence of failure and high likelihood of failure are likely to fail sooner, but are less vital to the collection system operation. These assets should be preemptively replaced as the budget allows or repaired as failure occurs. Assets with low consequence and low likelihood of failure should continue to be monitored but are not likely to fail soon.

Business Risk is depicted visually in the risk matrix shown in Figure 6, and the Business Risk of each asset determines the appropriate strategy for risk management as shown in Table 3.

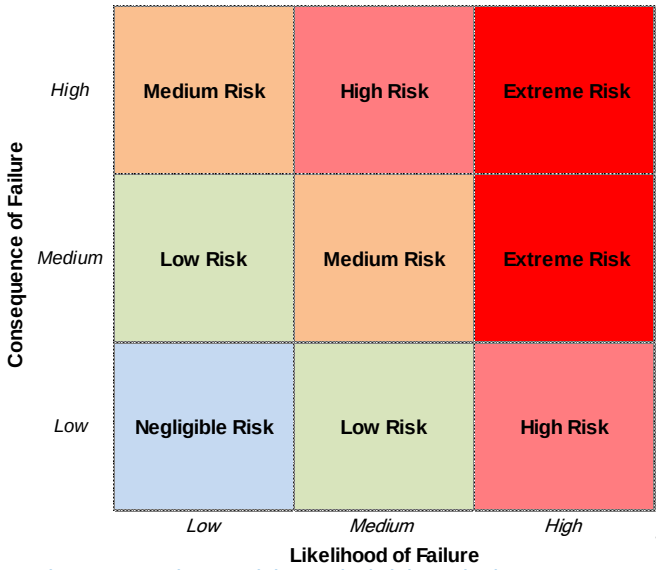



*Figure 6. Business Risk Matrix (Risk Rating)*

**Table 3. Strategies for Asset Rehabilitation and Replacement**

| Risk Rating | Strategies for Asset Rehabilitation or Replacement |
|---|---|
| Extreme | Inspect immediately and develop 1-2 year rehabilitation plan |
| High | Inspect immediately and develop short to medium term rehabilitation plan |
| Medium | Inspect immediately and develop long term rehabilitation plan |
| Low | Develop short term inspection strategy and develop long term rehabilitation plan |
| Negligible | Develop long term inspection strategy |

A 3x3 Business Risk Matrix identifies the relative "Criticality" of each asset based on their CoF and LoF scores to establish a "Risk Rating" for each asset. Asset rating categories range from *Negligible* to *Extreme* criticality based on position within the matrix and are color coded to better identify significance. Upper and lower CoF and LoF score "boundaries" are set for each matrix box to establish the Risk Rating for each asset and place each asset in the proper rating category.

## 4.2 Business Risk Evaluation of Collection System

Using the strategy outlined above, a Business Risk Evaluation (BRE) was performed on each asset for the Township's collection system using Innovyze-InfoMaster software.

A comprehensive list in table format of the Business Risk based on Risk Rating for each asset (pipelines and manholes) is included in Table H-1 of Appendix H.

Risk Ratings for the collection system assets are further broken down in the following figures for gravity pipeline, force main and manholes.

Figure 7 provides the risk rating for gravity and force main pipe by number of pipe segments. 30 pipe segments in the collection system have an extreme risk rating and are recommended to be inspected with full lining, point repairs, replacement recommended in the next 1-2 years.

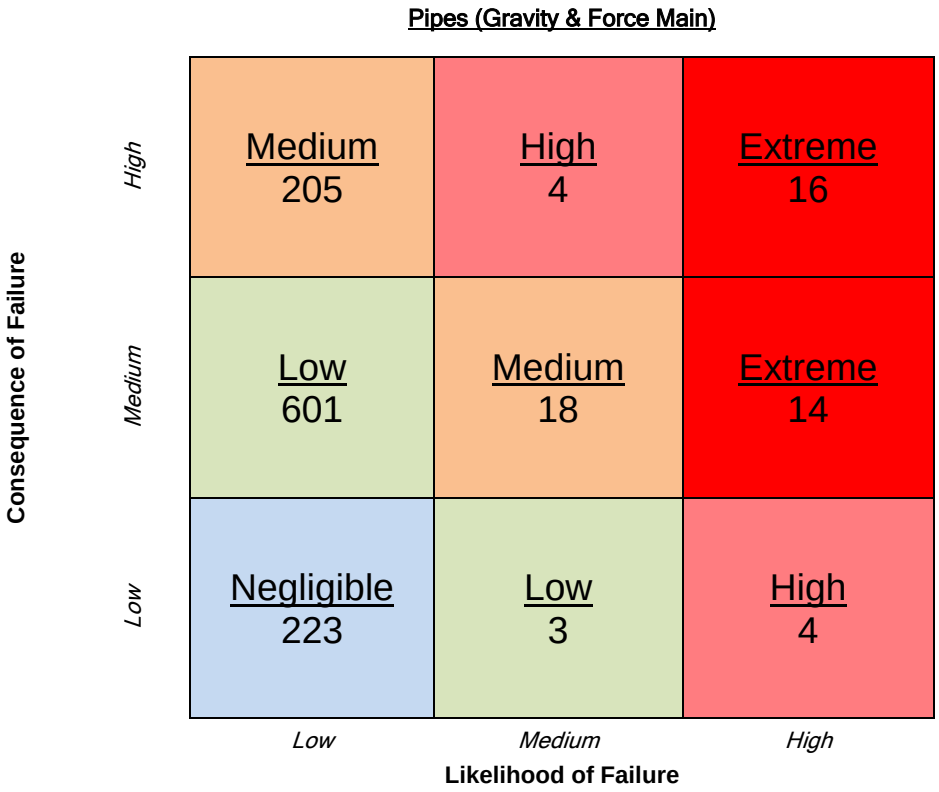



*Figure 7. Business Risk Matric (Risk Rating) by Number of Gravity and Force Main Pipes*

Much of the collection system's gravity pipes, 74 percent as shown in Figure 8, have a low to negligible risk rating and are indicative of pipes or manholes in relatively good condition.

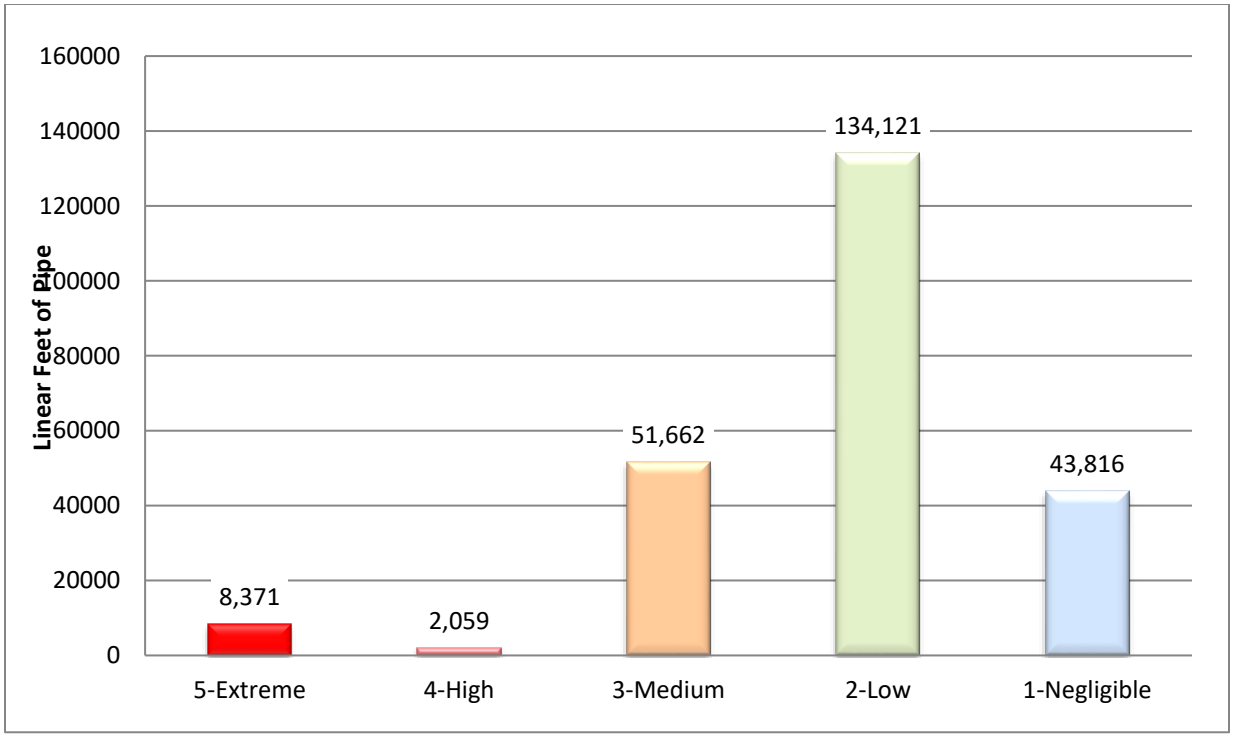



*Figure 8. Risk Distribution by Length (Gravity and Force main)*

Figure 9 provides the risk rating for the collection system manholes. 17 manholes are identified as extreme risk, 16 are recommended for repair and lining in the next 1-2 years, and the other 1 manhole is recommended to be inspected. Many manholes are at negligible to medium risk and are recommended to be included in a long-term rehabilitation strategy (97 percent).

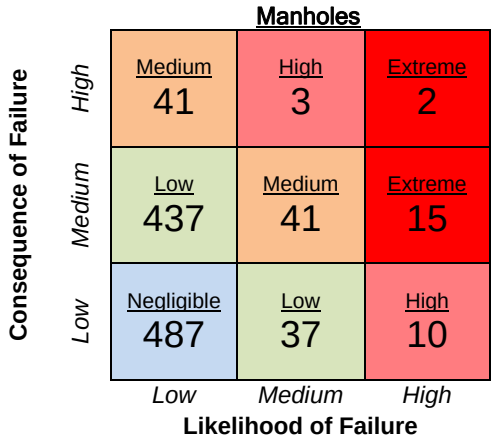



*Figure 9. Business Risk Matrix (Risk Rating) by Number of Manholes*

Figures 10.1 and 10.2 presents the Risk Rating for pipes and manholes by location within the collection system in a graphical format.

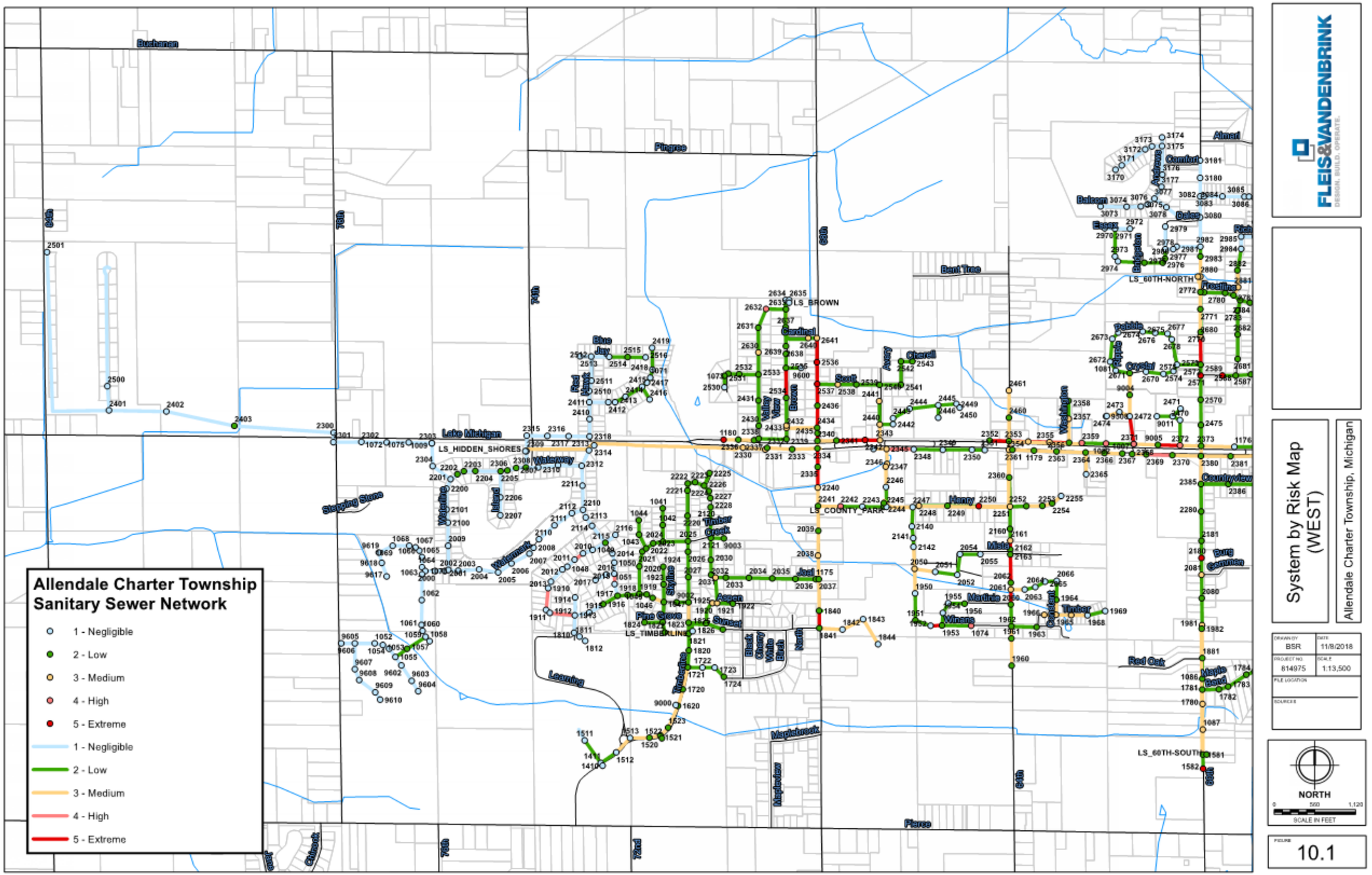



Figure 10.1 Risk Rating by Pipe/Manhole Location

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System by Risk Map (WEST)

Allendale Charter Township, Michigan

| DRAWN BY | DATE |
|---|---|
| BSR | 11/8/2018 |
| PROJECT NO. | SCALE |
| 814975 | 1:13,500 |
| FILE LOCATION | |
| SOURCES | |

NORTH
0 560 1,120
SCALE IN FEET

FIGURE
10.1

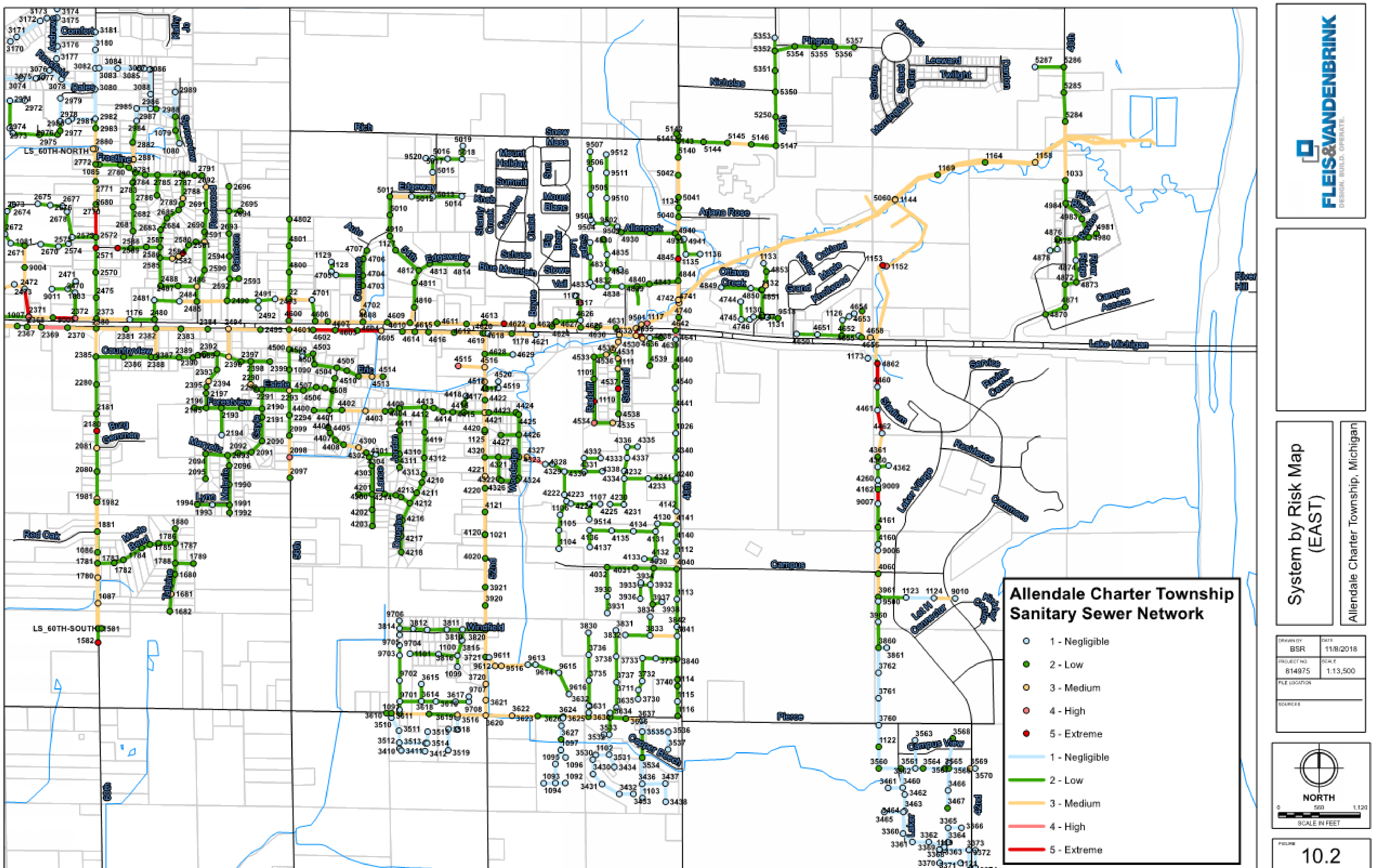



*Figure 10.1 Risk Rating by Pipe/Manhole Location*

# 5.0 CAPITAL IMPROVEMENT PLANNING

## 5.1 APPROACH TO CAPITAL IMPROVEMENT PLANNING

Based on the Business Risk evaluation, a Short-Term 1-5 year and Long-Term 6-20 year Capital Improvement Plan (CIP) was prepared to address the projected needs for each asset in the collection system. The development of the 1-5 year CIP and the resulting user rate structure must incorporate the Level of Service (LOS) goals and objectives of the Township.

LOS defines the way in which the stakeholders want the wastewater utility to perform over the long term. LOS might include technical, managerial, or financial determinants, and needs to address all regulatory requirements. The LOS is an important component of the development of the Asset Management Plan and will become a fundamental part of how the utility is operated. The LOS statement for the wastewater system is in the “Report of Wastewater System – LOS, CIP Summary, and Rate Structure” report.

To create the CIP, each asset was assigned a strategy based on the type and severity of defects identified in the condition assessment. Rehabilitation strategies include:

- No Action
- Pipe replacement; either through direct bury or trenchless construction
- Pipe rehabilitation; options include cleaning and CIPP lining or pipe bursting
- Manhole replacement
- Manhole rehabilitation; options include cleaning, rim adjustment, point repair and lining

InfoMaster software utilizes a “decision tree” rehabilitation model process to assign a rehabilitation strategy for each asset.

Assets were grouped by strategy and assigned costs from a unit database. This database includes unit construction values in 2018 construction dollars based on a survey of recent projects in Michigan and includes engineering and administrative rates where applicable. The database is specific to pipe and manhole, size and material. Costs assume basic construction practices, including imported sand bedding and backfill, compaction, pavement removal, hauling, shoring, trench excavation and testing. Tables I-1 and I-2 of Appendix I outline this pricing.

## 5.2 CIP RECOMMENDATIONS FOR ADDRESSING ASSETS OVER TIME

The development of CIP recommendations includes identifying and prioritizing asset rehabilitation strategies and grouping those assets into recommended rehabilitation projects. The comprehensive table of Business Risk based on Risk Rating, previously identified in Table H-1 of Appendix H includes a proposed strategy and cost for each asset.

**Assets Recommended in the Short-Term 1-2 year CIP**
Assets in this category are those that are at extreme risk. These assets should be considered for immediate attention in the 1-2 year CIP and include replacement, lining or point repairs for pipes and rehabilitation for aging manholes. The short term 1-2 year CIP including the asset strategy and cost are identified in Table J-1 and graphically in Figure J-1 of Appendix J.

**Assets Recommended in the Short-Term 3-5 year CIP**
Assets in this category are those that are at extreme or high risk. These assets should be considered in the 3-5 year CIP and include replacement, lining or point repairs for pipes and rehabilitation for aging manholes. The short term 3-5 year CIP, including the asset strategy and cost are identified in Table J-2 and graphically in Figure J-2 of Appendix J.

**Assets Recommended in the Long-Term 6-20 year CIP**
Assets in this category are at lower risk and are of a condition or age that will require attention in the future, but specific timelines cannot be accurately determined based on available information. A list of these assets ranked by grading and risk score including recommended action strategy and costs based on 2018 unit prices are included in Table J-4 of Appendix J.

## 5.3 Collection System Capital Improvement Plan

The CIP is an important component of the development of user rates and implementation of a new or revised rate structure to raise the capital needed for identified capital projects. The MDEQ requires that a rate structure be developed to secure the funding necessary to implement projects identified in a 5-Year CIP. A 5-Year CIP to address short term needs has been developed for this purpose. The evaluation of collection system assets also allows for identification of projects that will likely be needed in the Long-Term 6-20 year. While these projects are not included in a CIP format, they are nonetheless important for future planning by the Township.

**5-Year Collection System Capital Improvement Plan**

The CIP was developed by assigning each project to a CIP year (1-5) based on several factors. In addition to Risk Rating, other factors used to assign CIP year include:

- Asset rehabilitation grouping (i.e. the type of repair/construction recommended)
- Logical construction project groupings based on geographic proximity
- Coordination with other planned projects to achieve economies of scale or limiting disruption (an example is a street reconstruction project where identified utility recommendations can be included)

The 5-Year CIP also considers project cost to CIP year to balance capital requirements with generated utility revenues. The recommended 5-Year Capital Improvement Plan for the wastewater collection system is included in Table 4 below and in Table J-3 of Appendix J. The CIP reflects estimated costs for sanitary sewer construction only. It is recommended to add 20% to the budget if the municipality plans to use an engineering firm to design and administer the project.

**Table 4. Capital Improvement Plan Summary by Year**

| Rehabilitation Action | Total Cost (Current Year Dollars) | 2019 | 2020 | 2021 | 2022 | 2023 |
|---|---|---|---|---|---|---|
| Pipe Replacement | $ 199,900 | $ - | $ 205,897 | $ - | $ - | $ - |
| Pipe Lining | $ 415,448 | $ - | $ 350,851 | $ - | $ 81,753 | $ - |
| Pipe Point Repair | $ 28,838 | $ 19,466 | $ - | $ 9,942 | $ - | $ - |
| Manhole Clean, Line, Repair and Adjust | $ 8,055 | $ - | $ - | $ - | $ 8,802 | $ - |
| Manhole Clean, Line and Repair | $ 64,529 | $ - | $ 38,771 | $ - | $ 29,380 | $ - |
| Manhole Repair and Line | $ 54,888 | $ - | $ 37,690 | $ - | $ 19,993 | $ - |
| Manhole Clean and Line | $ 16,154 | $ - | $ 4,160 | $ - | $ 13,239 | $ - |
| Total | $ 787,812 | $ 19,466 | $ 637,369 | $ 9,942 | $ 153,167 | $ - |

# 6.0 OPERATIONS AND MAINTENANCE

## 6.1 APPROACH TO OPERATIONS AND MAINTENANCE

Regular operation and maintenance is essential in the management of a wastewater collection system. The collection system is subject to a variety of operational problems and can suffer from clogging, scour, corrosion, and collapse. These adverse effects to the system can lead to early deterioration, reducing the intended useful life and eventually cause Sanitary Sewer Overflows (SSOs). Operation and maintenance of collection systems are not new and presently exist within the NPDES regulations. Inadequate system O&M practices can lead to SSOs, violating permit conditions. Under existing federal regulations, all NPDES permits must contain two standard conditions addressing operations and maintenance:

Code of Federal Regulations, Title 40, Protection of Environment: 40 CFR 122.41

(d) ***Duty to Mitigate.*** The permittee shall take all reasonable steps to minimize or prevent any discharge or sludge use or disposal in violation of this permit which has a reasonable likelihood of adversely affecting human health or the environment.

(e) ***Proper operation and maintenance.*** The permittee shall at all times properly operate and maintain all facilities and systems of treatment and control (and related appurtenances) which are installed or used by the permittee to achieve compliance with the conditions of this permit. Proper operation and maintenance also includes adequate laboratory controls and appropriate quality assurance procedures. This provision requires the operation of backup or auxiliary facilities or similar systems which are installed by a permittee only when the operation is necessary to achieve compliance with the conditions of the permit.

**Physical Inspection**

A physical inspection is vital to an O&M program. Without it, a maintenance program cannot be implemented in a systematic way since problems cannot be quantified. Elements of a physical inspection program include visual and equipment-based techniques that use established industry methods of system evaluation. Physical inspections should be performed on a regularly scheduled basis as a part of the preventative maintenance program.

**Cleaning**

Stoppages in gravity sewers are usually caused by either structural defects or an accumulation of material in the pipe. Accumulated material includes fats, oil, grease, sediment, or other materials. Certain structural defects, such as protruding taps, may catch debris, which then causes a further buildup of solids that will eventually block the sewer. Root intrusion through structural defects is a major contributor to blockages. Repair or elimination of any defects that contribute to a buildup of material in the pipe should be evaluated as part of a rehabilitation program since the defects will always be a maintenance problem.

Good records and planned analysis of the recorded data will aide in the development of a cost-effective preventative maintenance program.

An Operation and Maintenance (O&M) Plan with recommendations was prepared for the Township's assets based on the Business Risk evaluation. As previously described, the InfoMaster software utilizes a "decision tree" rehabilitation model where assets were further evaluated and prioritized for possible preventative maintenance, including cleaning and inspection. If no preventative maintenance was needed they were categorized as "No Action" needed. The Comprehensive table of Business Risk based on Risk Rating, previously identified in Table H-1 of Appendix H includes a proposed rehabilitation strategy and cost for O&M for each asset.

Assets were grouped by strategy and assigned costs from a unit database. This database includes unit construction values in 2018 construction dollars based on a survey of recent projects in Michigan and includes engineering and administrative rates where applicable. The database is specific to pipe and manhole, size and material. Table's I-1 and I-2 Appendix I of outlines this pricing.

Assets were categorized and prioritized by year based on risk rating and criticality score to develop the O&M Plan.

## 6.2 O&M Recommendations for Addressing Assets Over Time

**Pipeline CCTV Recommended in the Short-Term 1-5 year O&M Plan**

A preventative maintenance program to systematically clean and CCTV inspect pipelines to NASSCO-certified standards is critical for a sound collection system. The process of cleaning and CCTV inspection of pipelines, either with equipment owned by the community or contracted, is a relatively inexpensive maintenance effort when compared to rehabilitation efforts. For this reason, it is recommended that at a minimum, all pipelines be cleaned and televised every five years, or that 20% of the system be cleaned and televised annually. Available budget will dictate the frequency or size of yearly projects.

By performing cleaning and CCTV inspection on all remaining pipeline assets not inspected during the AMP, 100% of the collection system will have been inspected in the next 5 years, thereby providing full "baseline" assessment data for the entire collection system.

Beyond the initial 5 year period, the Township is encouraged to develop an ongoing preventative maintenance program for cleaning and CCTV inspection, meeting NASSCO-certified standards. Pipelines should be cleaned and CCTV inspected on a periodic basis to better ensure that proper operating conditions exist, and to plan proactive maintenance where needed.

186,235 feet, or 66% percent, of the Township's collection system was cleaned and CCTV inspected in the preparation of this Asset Management Plan. It is recommended that the Township clean and CCTV inspect the remaining 93,558 feet over the next five years at an estimated cost of $353,633.

A detailed summary table listing remaining pipelines that are recommended to be cleaned and CCTV inspected, in the short term is included in Table's K-1 and K-2, and is shown graphically in Figure K-1 of Appendix K. The summary table identifies each asset by risk rating to assist in determining a year-by-year preventative maintenance pipeline cleaning and CCTV inspection program with estimated inspection costs.

**Manhole Cleaning and Assessment Recommended in the Short-Term 1-5 year O&M Plan**

Based on the risk rating analysis, some manholes were identified for further cleaning and assessment. They are listed in Table's K-1 and K-2 and shown graphically in Figure K-1 of Appendix K.

## 6.3 Collection System Operations and Maintenance Plan

The collection system is designed to serve for a specific useful life. Operation and Maintenance is an important component of the development of user rates and implementation of a new or revised rate structure to raise the capital needed to maximize the benefit throughout its designed useful life.

**5-Year Collection System Operation and Maintenance Plan**

Operation and maintenance recommendations (pipeline cleaning/CCTV inspection and manhole cleaning/inspection) have a relatively low cost and not included in the 5-year CIP. They are important elements for continued operation of the collection system. A comprehensive list of each asset identified for O&M action is provided in Table K-3 of Appendix K.

Table 5 summarizes the recommended preventative maintenance inspections to be considered in the short term (1-5 years) with recommended costs over the 5-year period.

**Table 5. Collection System Maintenance Summary Table: Year by Year**

| Maintenance Action | Total Cost (Current Year Dollars) | 2019 | 2020 | 2021 | 2022 | 2023 |
|---|---|---|---|---|---|---|
| Manhole Assessment | $ 369,564 | $ 536 | $ - | $ - | $ 403,247 | $ - |
| Manhole Cleaning | $ 3,214 | $ - | $ - | $ - | $ - | $ 3,617 |
| CCTV | $ 353,633 | $ - | $ - | $ 375,169 | $ - | $ - |
| CCTV - Heavy Cleaning | $ 2,760 | $ - | $ - | $ 2,928 | $ - | $ - |
| ***Total Project Cost*** | ***$ 729,170*** | ***$ 536*** | ***$ -*** | ***$ 378,097*** | ***$ 403,247*** | ***$ 3,617*** |

**APPENDIX A – Background Figures and Other Historical Documentation**

Figure A-1a: Allendale Charter Township Sanitary Collection System – West
Figure A-1b: Allendale Charter Township Sanitary Collection System – East

# Allendale Charter Township Sanitary Sewer Network

- Lift Station
- Manhole
- Force Main
- Gravity Main

Buchanan
Pingree
Bent Tree
Almari
Comfort
Baicom
Dales
Essex
Bridgeton
Rich
Frostline
Pebble
Village
Crystal
Timber
Constant
Marthnie
Mista
Henry
Washington
Cherell
Avery Sheridan
Scott
Cardinal
Blue Jay
Red Hawk
Valley View
Brown
Lake Michigan
Waterway
Island
Waterline
Watermark
Timber Creek
Pinevalley
Pine Grove
Aspen
Joal
Sunset
Black Cherry White Birch
North
Timberline
Learning
Stepping Stone
Countryview
Burg Gemmen
Red Oak
Maple Bend
Maplebrook
Mapleview
Pierce
Chinook
LS_HIDDEN_SHORES
LS_BROWN
LS_60TH-NORTH
LS_COUNTY_PARK
LS_TIMBERLINE
LS_60TH-SOUTH
84th
78th
74th
68th
64th
60th
76th
72nd

NORTH
0 560 1,120
SCALE IN FEET

FIGURE A-1A

DRAWN BY BSR | DATE 9/5/2018
PROJECT NO. 814975 | SCALE 1:13,500
FILE LOCATION
SOURCES

Sanitary Collection System (WEST)

Allendale Charter Township, Michigan

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# Allendale Charter Township Sanitary Sewer Network

- Lift Station
- Manhole
- Force Main
- Gravity Main

Comfort
Kathy Jo
Rosefield
Spencerview
LS_60TH-NORTH
Frostline
Cameron
Hunters Meadow
Prairie
Vow
Village
Crystal
Rich
Edgeway
Auto Commerce
54th
Edgewater
Blue Mountain
Snow
Mount Holiday
Sun
Summit
Mount Moritz
Shanty Creek
Cobblestone
Chalet
Big Aspen
Bear
Schuss
Stowe
Vail
Boyne
Nicholas
Arjana Rose
Allenpark
Becker
Oakland
Maple
Knollwood
Grand
Pingree
Chateau
Sundrop
Ludlow
Glen
Sunset
Morningstar
Leeward
Twilight
Beulah
40th
46th
48th
52nd
56th
Ottawa Creek
Grand River Outfall
Wastewater Treatment Plant
Grand River
Cadence
River Bluff
Ravine
River Ridge
Campus Access
River Hill
Lake Michigan
Service
Ravine Center
Stadium
Residence
Lakes Village
Commons
Campus
Pierce
Calder
Kinloch
Campus View
Lakes
Windfield
Woodedge
Copper Beech
Jordan
Douglas
Erie
Eastern
Gayle
Forestview
Lynn
Maryellen
Burg
Gemmen
Red Oak
Maple Bend
Tallpine
LS_60TH-SOUTH

NORTH
0 560 1,120
SCALE IN FEET

FIGURE
A-1B

DRAWN BY: BSR
DATE: 5/22/2019
PROJECT NO.: 814975
SCALE: 1:13,500
FILE LOCATION:
SOURCES:

Sanitary Collection System (EAST)

Allendale Charter Township, Michigan

FLEIS&VANDENBRINK
DESIGN. BUILD. OPERATE.

**APPENDIX B – Collection System Asset Inventory**

Figure B-1: Sanitary Sewer Network Pipe Diameter
Figure B-2: Sanitary Sewer Network Pipe Material
Figure B-3: Sanitary Sewer Network Installation Date

## Allendale Charter Township Sanitary Sewer Network

- Lift Station
- Manhole
- FM - 2"
- FM - 3"
- FM - 4"
- FM - 6"
- FM - 8"
- FM - 10"
- FM - 12"
- FM - 20"
- 5"
- 6"
- 8"
- 10"
- 12"
- 15"
- 18"
- 21"
- 24"
- 27"

FLEIS&VANDENBRINK
DESIGN. BUILD. OPERATE.

# Sanitary Sewer Network Pipe Diameter

Allendale Charter Township, Michigan

| DRAWN BY | DATE |
|---|---|
| KCS | 1/9/2019 |
| PROJECT NO. | SCALE |
| 814975 | 1:25,000 |
| FILE LOCATION | |
| SOURCES | |

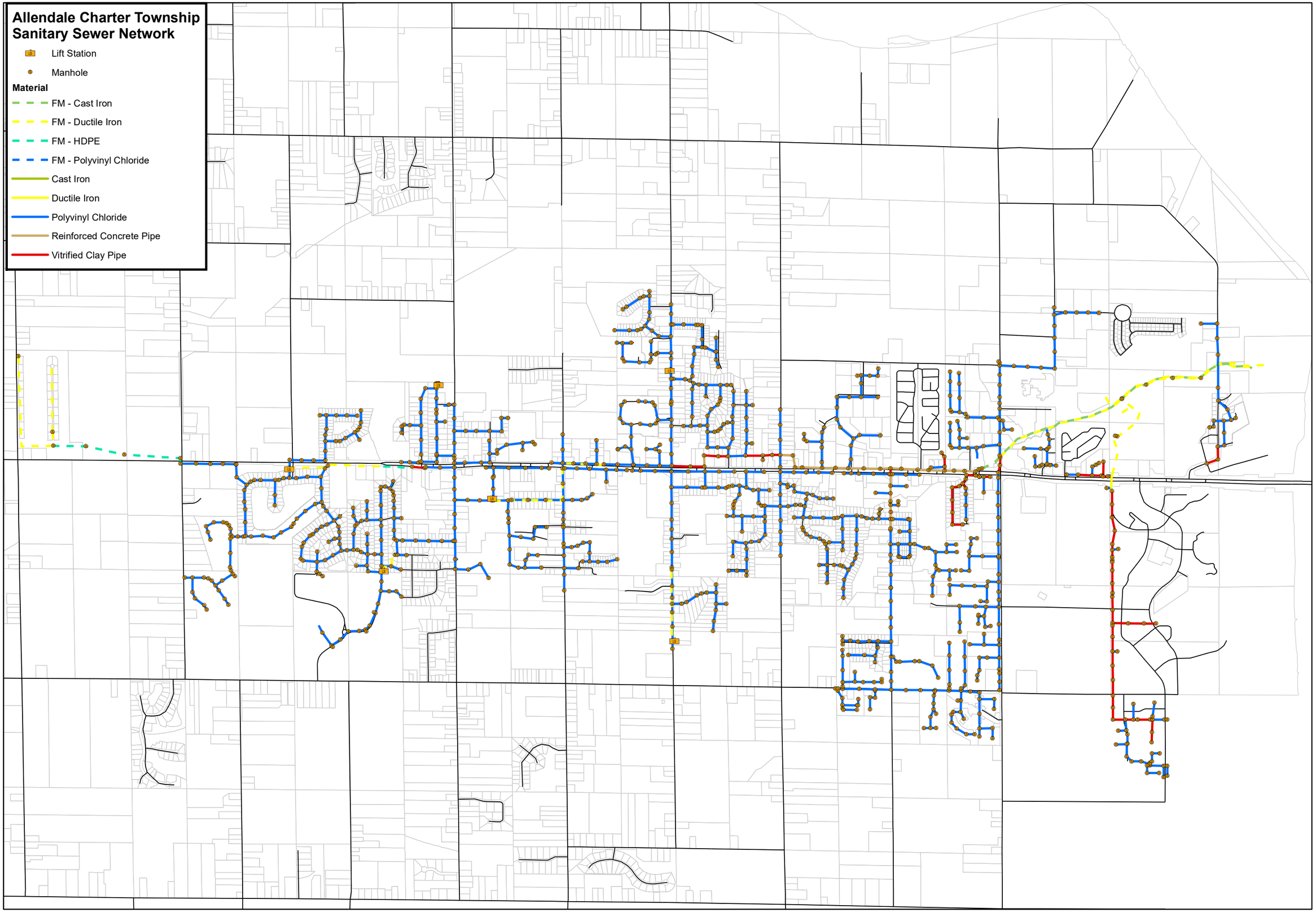
NORTH

0 1,000 2,000

SCALE IN FEET

FIGURE

B-1




FLEIS&VANDENBRINK
DESIGN. BUILD. OPERATE.

# Sanitary Sewer Network Pipe Material

Allendale Charter Township, Michigan

| DRAWN BY | DATE |
|---|---|
| BSR | 9/5/2018 |
| PROJECT NO. | SCALE |
| 814975 | 1:25,000 |
| FILE LOCATION | |
| SOURCES | |

NORTH

0 1,000 2,000

SCALE IN FEET

FIGURE

B-2

## Allendale Charter Township Sanitary Sewer Network

- Lift Station
- Manhole

**Installation Date**

- FM - 1980-1989
- FM - 1990-1999
- FM - 2000-2009
- 1960-1969
- 1980-1989
- 1990-1999
- 2000-2009
- 2010-Present

FLEIS&VANDENBRINK
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# Sanitary Sewer Network Pipe Installation Date

Allendale Charter Township, Michigan

| DRAWN BY | DATE |
|---|---|
| BSR | 9/5/2018 |
| PROJECT NO. | SCALE |
| 814975 | 1:25,000 |
| FILE LOCATION | |
| SOURCES | |

NORTH

0 1,000 2,000

SCALE IN FEET

FIGURE

B-3

**APPENDIX C – Manhole Assessment Inventory Summary Report**

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Background ..... 1
Method ..... 2
Results ..... 2

**Supplemental Attachments**

C-1: Sanitary Manhole Structural Level Map
C-2: Sanitary Manhole O/M Level Map
C-3: Manhole Assessment Grades

## BACKGROUND

Manholes consist of multiple components, each serving a different purpose combined into one complete structure. Each component of a manhole will deteriorate independently from each other, creating different defects with multiple repair options. Unlike sanitary pipes, which are one component replicated for each section, manholes require that each component be coded individually. While manholes may be constructed using different materials such as brick, concrete block or poured concrete, the basic components are the same and are depicted in Figure 1.

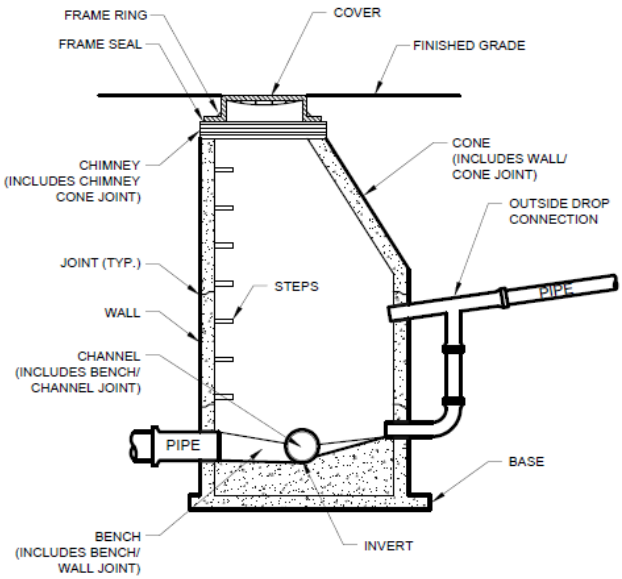



*Figure 1: Typical Manhole Components*

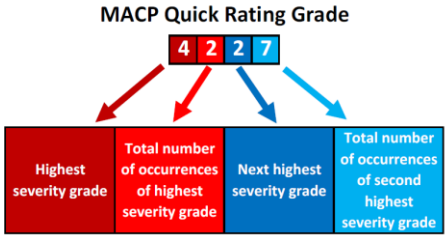
To provide comprehensive and consistent field-based inspections, the National Association of Sewer Service Companies (NASSCO) has developed industry standards for the assessment and rehabilitation of underground infrastructure. NASSCO's "Assessment and Certification Programs" (ACP) are used to perform field inspections of collection system assets for manholes (MACP). Even though there are several naming conventions for manholes such as catch basin, junction box, catchment, or structure, NASSCO MACP provides a standard for each one.

Manhole inspections are divided into Level 1 and Level 2. A Level 1 manhole assessment provides information about components gathered from a visual inspection at the top of the manhole without entry. Level 1 inspections are designed to identify the physical attributes of manholes and gather enough information to determine if a level 2 inspection is needed.

A Level 2 inspection includes comprehensive information of each component and requires entry into the manhole or a 360-degree camera capable of observing components and defects for the entire structure. A Level 2 inspection is more detailed to fully document each component and recommend a specific rehabilitation.

NASSCO has developed two MACP condition assessment inspection protocols with 103 or more recordable field observations depending on the number of pipes extending into or out of the structure. NASSCO coding is used to record all structural and operations/maintenance (O&M) defects along with general observations. Each individual defect is assigned a score ranging from 1 to 5, with 5 being the most severe.

All of the defects are combined into a quick rating grade for the manhole. Quick rating grades provide an overall summary of the manhole grade.




## METHOD

Fleis & VandenBrink (F&V) completed visual manholes inspections from the surface with no entry into the manholes. F&V collected more information than required for a Level 1 inspection but not to the detail required for Level 2 inspections. This approach maximized the number of manholes inspected and collected enough information to recommend rehabilitation while minimizing expenses.

F&V utilized one or two person crews equipped with a GPS unit capable of recording pictures. At each inspected manhole, the crew recorded the MACP data, pictures of casting and structure, and a sketch of existing pipes. Each inspected manhole was uploaded to GIS and entered into a collection system GIS map. The GIS map reflects the grades of the manhole components and assigns a level based on the most extreme grade rating encountered.

The completed GIS map is analyzed by Innovyze Infomaster; a complete ArcGIS based asset integrity management and capital planning software. Infomaster uses a tree matrix of the available manhole information, and then reviews the likelihood of failure and consequence of failure to calculate the total risk.

Once Infomaster calculates the total risk, each manhole is analyzed for the best rehabilitation or repair option and several budget scenarios are calculated. Each budget scenario is reviewed and a prioritized Capital Improvement Plan (CIP) report is generated.

## RESULTS

### Sanitary Manholes

Three hundred eighty-nine (389) manholes were inspected. A summary of the information is shown in Table 1.

| Score | Number of O/M defects | Number of Structural Defects |
|---|---|---|
| 5 | 17 | 18 |
| 4 | 22 | 34 |
| 3 | 64 | 38 |
| 2 | 1249 | 66 |
| 1 | 397 | 74 |

*Table 1: Summary of Sanitary Sewer Defects*

1) Manhole 1153 shows clear signs of mechanical damage to the wall in which surface aggregate is visible throughout much of the wall. This manhole should seek immediate attention.
2) Manhole 4845 has a large area of separation between the casting and the chimney, where it appears the chimney has fractured in several areas. This manhole should seek immediate attention.
3) Manholes 4622,2357,2589. These manholes have voids in the chimney, ranging from approximately 50-200 square inches in size. It is recommended that these manholes be repaired and lined.
4) Manholes 2359,2372,2032,1920. These manholes have chemical damage to the wall, cone and chimney.

### Infiltration & Inflow (I&I)

I&I is separated into five categories. “Stains” are where there is no visible water, but mineral and iron deposits appears on the manhole indicating water infiltration. “Weeper” is where the structure looks damp. Visible water entering the structure is categorized as “Dripper”, “Runner” or “Gusher”, depending upon the amount of water flowing into the structure. Each component of the manhole structure is reviewed for I&I. Table 2 summarizes the I&I information for the inspected manholes.

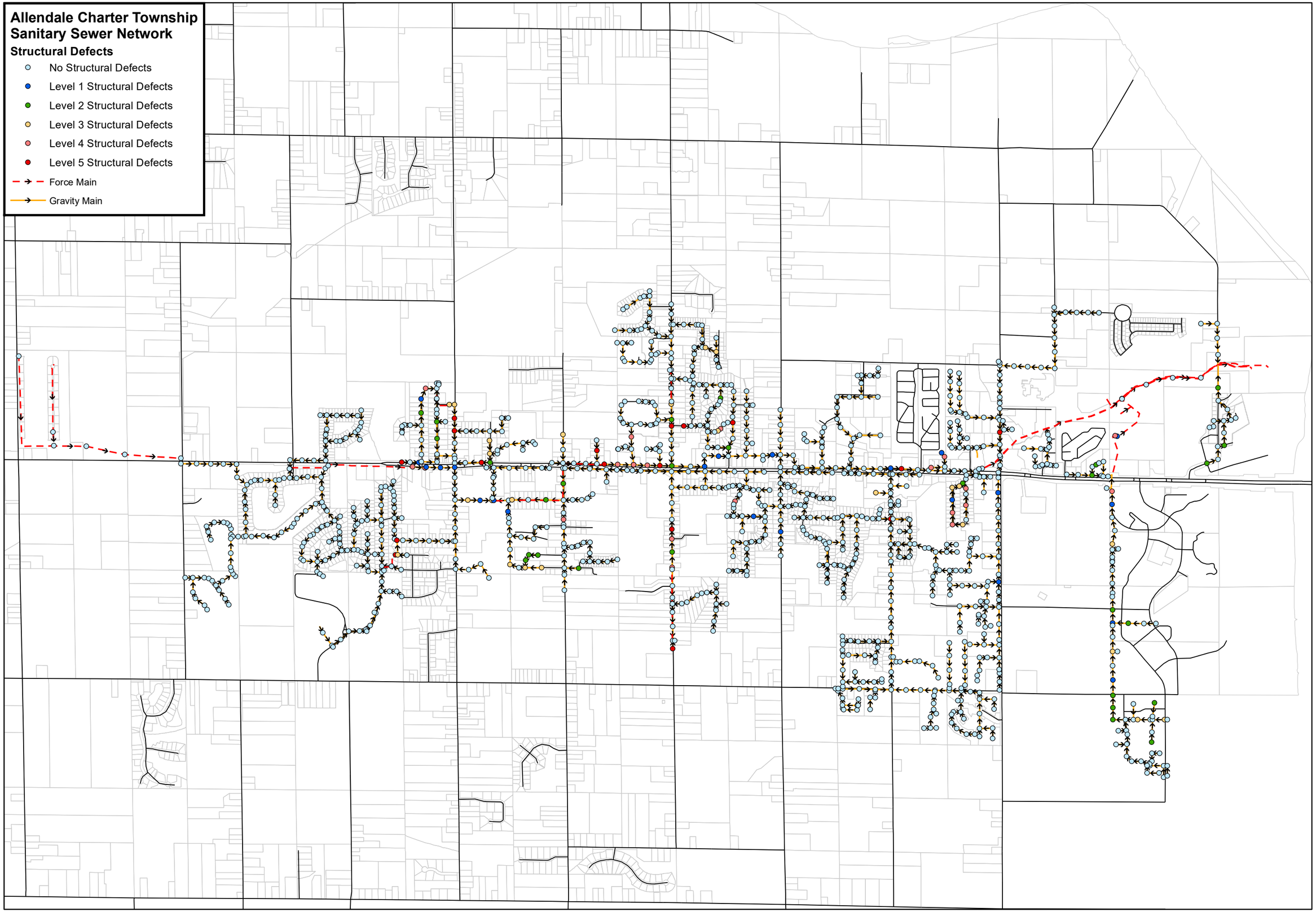
| Score | Frame | Chimney | Cone | Wall |
|---|---|---|---|---|
| Stain | 290 | 279 | 262 | 253 |
| Weeper | 1 | 2 | 4 | 23 |
| Dripper | 0 | 0 | 0 | 0 |
| Runner | 0 | 0 | 1 | 2 |
| Gusher | 0 | 0 | 0 | 0 |

*Table 2: Summary of Manhole Inflow and Infiltration*

**Allendale Charter Township**
**Sanitary Sewer Network**

**Structural Defects**

- No Structural Defects
- Level 1 Structural Defects
- Level 2 Structural Defects
- Level 3 Structural Defects
- Level 4 Structural Defects
- Level 5 Structural Defects
- Force Main
- Gravity Main



FLEIS&VANDENBRINK
DESIGN. BUILD. OPERATE.

# Sanitary Sewer AMP Structural MACP Scores

Allendale Charter Township, Michigan

| DRAWN BY | DATE |
|---|---|
| BSR | 9/5/2018 |
| PROJECT NO. | SCALE |
| 814975 | 1:25,000 |
| FILE LOCATION | |
| SOURCES | |

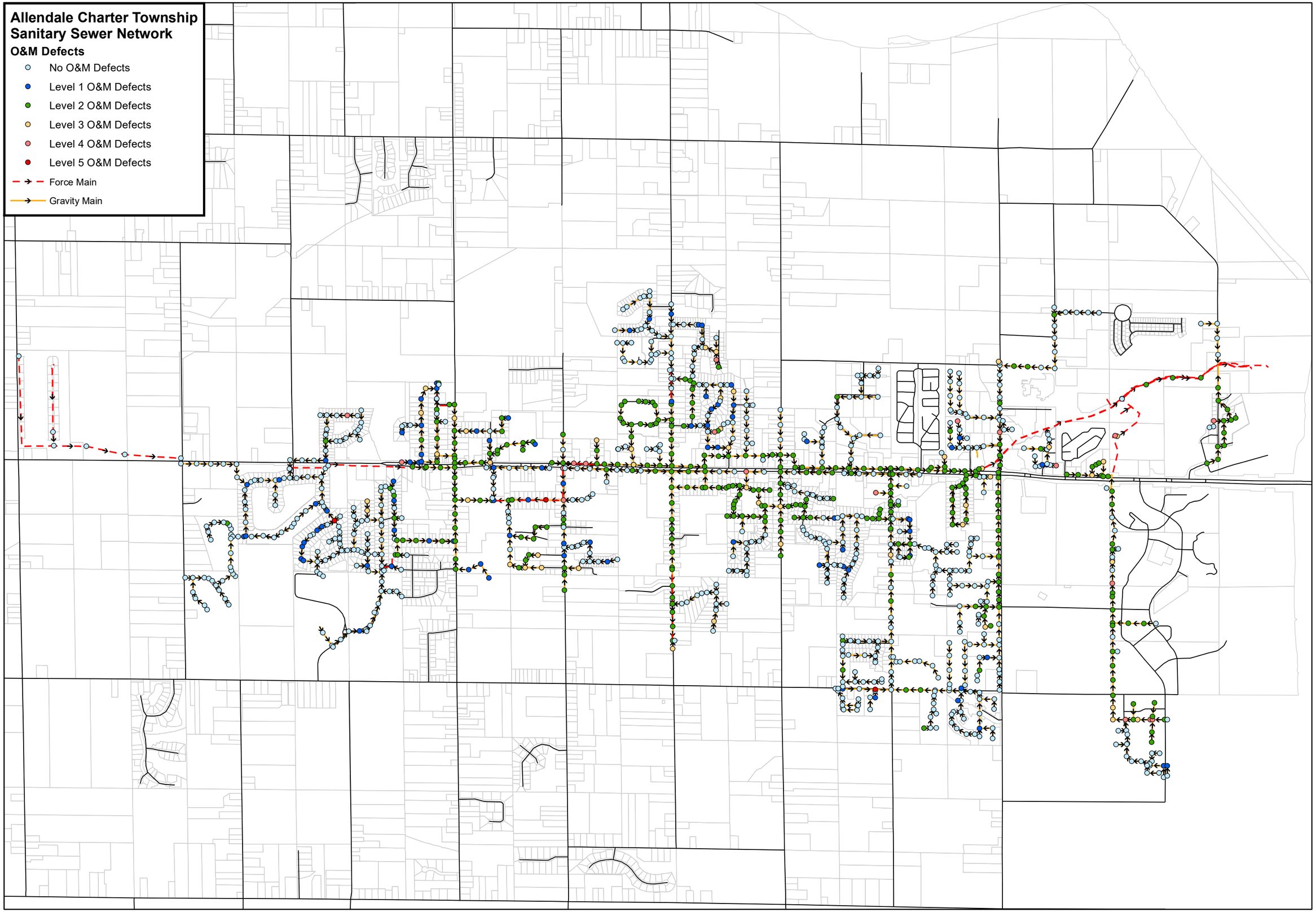
NORTH

0 1,000 2,000

SCALE IN FEET

FIGURE

C-1




FLEIS&VANDENBRINK
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# Sanitary Sewer AMP O&M MACP Scores

Allendale Charter Township, Michigan

| DRAWN BY | DATE |
|---|---|
| BSR | 9/5/2018 |
| PROJECT NO. | SCALE |
| 814975 | 1:25,000 |
| FILE LOCATION | |
| SOURCES | |

NORTH

0 1,000 2,000

SCALE IN FEET

FIGURE

C-2

| Table C-3: Manhole Assessment Grades | | | |
|---|---|---|---|
| **Manhole ID** | **Address** | **Quick Rating - Operations & Maintenance** | **Quick Rating - Structural** |
| 4622 | 5187 Lake Michigan Dr | 2411 | 5200 |
| 2359 | 6261 Lake Michigan Dr | 2900 | 5143 |
| 2372 | 6039 Lake Michigan Dr | 2711 | 5142 |
| 4845 | 11359 48th Ave | 4132 | 5141 |
| 2536 | 11397 68th Ave | 3121 | 5141 |
| 2180 | 10969 60th Ave | 2711 | 5141 |
| 2357 | 11245 Washington Ave | 2100 | 5141 |
| 2342 | 6679 Lake Michigan Dr | 2411 | 5132 |
| 1180 | 7003 Lake Michigan Dr | 4131 | 5123 |
| 2032 | 7008 Joal St | 2514 | 5122 |
| 1920 | 7024 Aspen St | 2311 | 5122 |
| 2571 | 11361 60th Ave | 2412 | 5121 |
| 1582 | 10537 60th Ave | 3125 | 5100 |
| 4421 | 5202 Jordan St | 2511 | 5100 |
| 2537 | 11303 68th Ave | 2400 | 5100 |
| 2589 | 5957 Dewpointe Dr | 2211 | 5100 |
| 2591 | 5701 Ivory Rd | 0000 | 5100 |
| 2371 | 6161 Lake Michigan Dr | 3127 | 4232 |
| 1153 | 4400 Knollwood Dr | 4131 | 4222 |
| 9005 | 6065 Lake Michigan Dr | 2500 | 4221 |
| 2330 | 6946 Lake Michigan Dr | 2611 | 4211 |
| 4627 | 5065 Lake Michigan Dr | 2313 | 4211 |
| 1981 | 10843 60th Ave | 2700 | 4131 |
| 2394 | 11091 Pleasant Point Dr | 2411 | 4131 |
| 1082 | 6195 Lake Michigan Dr | 2612 | 4122 |
| 4862 | 4422 Lake Michigan Dr | 2411 | 4122 |
| 2632 | 11497 Brown St | 3113 | 4121 |
| 1110 | 11041 Radcliff Dr | 2412 | 4121 |
| 1172 | Becker Dr | 3128 | 4112 |
| 2331 | 6940 Lake Michigan Dr | 2711 | 4112 |
| 4536 | 11085 Stanford Ave | 2412 | 4111 |

| Table C-3: Manhole Assessment Grades | | | |
|---|---|---|---|
| **Manhole ID** | **Address** | **Quick Rating - Operations & Maintenance** | **Quick Rating - Structural** |
| 9004 | 6175 Library Ln | 2211 | 4111 |
| 4537 | 11055 Stanford Ave | 3125 | 4100 |
| 2582 | 5804 Ivory Rd | 3100 | 4100 |
| 2081 | 10933 60th Ave | 2515 | 4100 |
| 4534 | 11011 Radcliff Dr | 2413 | 4100 |
| 2161 | 11003 64th Ave | 2411 | 4100 |
| 1074 | 6495 Winans St | 3124 | 3221 |
| 2641 | 6802 Cardinal St | 2411 | 3221 |
| 4515 | 11127 52nd Ave | 4131 | 3200 |
| 2461 | 11315 64th Ave | 2111 | 3200 |
| 1953 | 6562 Winans St | 3124 | 3122 |
| 1951 | 6599 Winans St | 3223 | 3121 |
| 2987 | 5870 Rich St | 3126 | 3121 |
| 2242 | 11048 68th Ave | 3122 | 3121 |
| 1921 | 7072 Aspen St | 2413 | 3121 |
| 2640 | 6830 Cardinal St | 2400 | 3121 |
| 2680 | 11435 60th Ave | 2400 | 3121 |
| 2248 | 6698 Henry St | 2312 | 3121 |
| 3569 | 10281 42nd Ave | 2400 | 3114 |
| 4533 | 11101 Radcliff Dr | 2412 | 3111 |
| 4361 | 1 Campus Dr | 2411 | 3111 |
| 4532 | 11137 Radcliff Dr | 2411 | 3111 |
| 2244 | 6676 Lake Michigan Dr | 2200 | 3111 |
| 2988 | 5825 Rich St | 3226 | 3100 |
| 3564 | 4332 Campus View Dr | 3123 | 3100 |
| 4535 | 11003 Radcliff Dr | 3123 | 3100 |
| 2432 | 11235 Brown St | 3113 | 3100 |
| 3860 | 1 Campus Dr | 2500 | 3100 |
| 2440 | 11243 Avery Ave | 2112 | 3100 |
| 2583 | 5827 Ivory Rd | 2100 | 3100 |
| 2441 | 11305 Avery Ave | 1100 | 3100 |

| Table C-3: Manhole Assessment Grades | | | |
|---|---|---|---|
| **Manhole ID** | **Address** | **Quick Rating - Operations & Maintenance** | **Quick Rating - Structural** |
| 2373 | 11208 60th Ave | 2412 | 2200 |
| 1954 | 6550 Winans St | 2314 | 2200 |
| 2343 | 6667 Lake Michigan Dr | 3125 | 2111 |
| 1122 | 10332 Campus View Dr | 3123 | 2111 |
| 2080 | 10891 60th Ave | 2513 | 2111 |
| 3760 | 4400 Pierce St | 2411 | 2111 |
| 4060 | 4546 W Campus Dr | 2311 | 2111 |
| 4636 | 4866 Lake Michigan Dr | 5131 | 2100 |
| 2250 | 6504 Henry St | 5122 | 2100 |
| 3560 | 10155 Laker Ln | 3222 | 2100 |
| 1963 | 6290 Winans St | 3221 | 2100 |
| 4652 | 4473 Lake Michigan Dr | 3125 | 2100 |
| 1956 | 6618 Martinie Dr | 3123 | 2100 |
| 2486 | 5802 Larkspur Ave | 3100 | 2100 |
| 2630 | 11391 Valley View Ave | 3100 | 2100 |
| 2788 | 11463 Prairie Ave | 3100 | 2100 |
| 3467 | Campus View Housing | 2412 | 2100 |
| 4531 | 11151 Radcliff Dr | 2412 | 2100 |
| 4653 | 4477 Lake Michigan Dr | 2412 | 2100 |
| 4870 | 11253 40th Ave | 2412 | 2100 |
| 2572 | 11397 60th Ave | 2412 | 2100 |
| 1123 | 10556 Laker Village Dr | 2411 | 2100 |
| 3568 | 10383 42nd Ave | 2411 | 2100 |
| 1033 | 11529 40th Ave | 2311 | 2100 |
| 4873 | 3967 River Ridge Ct | 2300 | 2100 |
| 1955 | 6694 Martinie Dr | 2112 | 2100 |
| 2535 | 11351 Brown St | 2111 | 2100 |
| 2534 | 11301 Brown St | 2100 | 2100 |
| 2360 | 11151 64th Ave | 1100 | 2100 |
| 1152 | 4400 Knollwood Dr | 3125 | 1300 |
| 2332 | 6936 Lake Michigan Dr | 2612 | 1300 |
| 2334 | 68th Ave | 2612 | 1300 |

| Table C-3: Manhole Assessment Grades | | | |
|---|---|---|---|
| **Manhole ID** | **Address** | **Quick Rating - Operations & Maintenance** | **Quick Rating - Structural** |
| 2333 | Lake Michigan Dr | 2611 | 1300 |
| 2480 | 5881 Lake Michigan Dr | 2411 | 1300 |
| 3961 | 10555 Laker Village Dr | 2400 | 1300 |
| 2484 | 5836 Larkspur Ave | 2400 | 1200 |
| 2243 | 6676 Lake Michigan Dr | 2211 | 1200 |
| 2099 | 10975 56th Ave | 2412 | 1100 |
| 2192 | 5578 Forest View Dr | 2412 | 1100 |
| 4613 | 5187 Lake Michigan Dr | 2412 | 1100 |
| 1109 | 11071 Radcliff Dr | 2411 | 1100 |
| 3761 | 1 Campus Dr | 2411 | 1100 |
| 4460 | 4498 Stadium Dr | 2411 | 1100 |
| 4640 | 11127 48th Ave | 2411 | 1100 |
| 4141 | Meadows Xing | 2400 | 1100 |
| 2493 | 11255 56th Ave | 2300 | 1100 |
| 2245 | 6676 Lake Michigan Dr | 1200 | 1100 |
| 2337 | 11215 Valley View Ave | 1200 | 1100 |
| 2631 | 11438 Valley View Ave | 1100 | 1100 |
| 2140 | 6698 Henry St | 0000 | 1100 |
| 9517 | Becker Dr | 0000 | 1100 |
| 2115 | 10997 Waterway Dr | 5100 | 0000 |
| 3619 | 5256 Pierce St | 5100 | 0000 |
| 3565 | 4270 Campus View Dr | 4222 | 0000 |
| 3566 | 4260 Campus View Dr | 4222 | 0000 |
| 4161 | Laker Village Dr | 4222 | 0000 |
| 2354 | 6387 Lake Michigan Dr | 4131 | 0000 |
| 2355 | 6341 Lake Michigan Dr | 4131 | 0000 |
| 2494 | 11195 Northgate Ave | 4131 | 0000 |
| 3561 | 10152 Laker Ln | 4131 | 0000 |
| 2361 | 11195 64th Ave | 4131 | 0000 |
| 1079 | 11547 Spruce View Dr | 4125 | 0000 |
| 4876 | 11405 40th Ave | 4123 | 0000 |
| 9518 | 4617 Lake Michigan Dr | 4113 | 0000 |
| 2251 | 6402 Henry St | 4111 | 0000 |

| Table C-3: Manhole Assessment Grades | | | |
|---|---|---|---|
| **Manhole ID** | **Address** | **Quick Rating - Operations & Maintenance** | **Quick Rating - Structural** |
| 2515 | 7170 Blue Jay Dr | 4111 | 0000 |
| 2584 | 5852 Ivory Rd | 4100 | 0000 |
| 4834 | 4998 Allenpark Dr | 4100 | 0000 |
| 1117 | 4861 Lake Michigan Dr | 3225 | 0000 |
| 4162 | 1 Campus Dr | 3222 | 0000 |
| 1041 | 11057 Skyway Ln | 3200 | 0000 |
| 4657 | 4415 Lake Michigan Dr | 3128 | 0000 |
| 2290 | 11057 Gayle Ln | 3127 | 0000 |
| 2293 | 5654 Estate Rd | 3126 | 0000 |
| 2472 | 6161 Library Ln | 3126 | 0000 |
| 2098 | 10929 56th Ave | 3125 | 0000 |
| 2396 | 5743 Country View Dr | 3125 | 0000 |
| 3937 | Campus West Apartments | 3125 | 0000 |
| 2433 | 11235 Brown St | 3111 | 0000 |
| 2538 | 6761 Scott St | 3111 | 0000 |
| 2692 | 11553 Rosewood Ave | 3111 | 0000 |
| 2358 | 11283 Washington Ave | 3100 | 0000 |
| 5143 | 11619 48th Ave | 3100 | 0000 |
| 1042 | 10953 Skyway Ln | 3100 | 0000 |
| 1681 | 10635 Tallpine Ln | 3100 | 0000 |
| 4639 | 4830 Lake Michigan Dr | 3100 | 0000 |
| 4221 | 10855 52nd Ave | 3100 | 0000 |
| 4852 | 11317 Whispering Creek Dr | 3100 | 0000 |
| 4626 | 5053 Lake Michigan Dr | 2711 | 0000 |
| 4656 | 4419 Lake Michigan Dr | 2611 | 0000 |
| 3938 | Campus West Apartments | 2600 | 0000 |
| 1112 | 10745 48th Ave | 2512 | 0000 |
| 2033 | 7060 Joal St | 2511 | 0000 |
| 2097 | 10887 56th Ave | 2511 | 0000 |
| 3932 | Campus West Apartments | 2511 | 0000 |
| 4608 | 11205 Commerce Rd | 2511 | 0000 |
| 1080 | 11562 Spruce View Dr | 2511 | 0000 |
| 2677 | 11498 Pebble Dr | 2500 | 0000 |

| Table C-3: Manhole Assessment Grades | | | |
|---|---|---|---|
| **Manhole ID** | **Address** | **Quick Rating - Operations & Maintenance** | **Quick Rating - Structural** |
| 2335 | 11177 68th Ave | 2414 | 0000 |
| 2341 | 6791 Lake Michigan Dr | 2413 | 0000 |
| 2190 | 11027 Gayle Ln | 2412 | 0000 |
| 2193 | 5752 Forest View Dr | 2412 | 0000 |
| 2291 | Estate Rd | 2412 | 0000 |
| 2294 | 11017 56th Ave | 2412 | 0000 |
| 2390 | 5813 Country View Dr | 2412 | 0000 |
| 2442 | 6633 Lake Michigan Dr | 2412 | 0000 |
| 2570 | 11307 60th Ave | 2412 | 0000 |
| 2670 | 6085 Crystal Dr | 2412 | 0000 |
| 3567 | 4260 Campus View Dr | 2412 | 0000 |
| 4415 | 5278 Jordan St | 2412 | 0000 |
| 4417 | 11055 Summer Brook Ct | 2412 | 0000 |
| 4517 | 11075 52nd Ave | 2412 | 0000 |
| 4618 | 5206 Lake Michigan Dr | 2412 | 0000 |
| 4620 | 5190 Lake Michigan Dr | 2412 | 0000 |
| 4634 | 11195 Radcliff Dr | 2412 | 0000 |
| 4650 | 11230 Kistler Dr | 2412 | 0000 |
| 4651 | 4535 Lake Michigan Dr | 2412 | 0000 |
| 4654 | 4477 Lake Michigan Dr | 2412 | 0000 |
| 4655 | 4427 Lake Michigan Dr | 2412 | 0000 |
| 4658 | 4395 Lake Michigan Dr | 2412 | 0000 |
| 4981 | 3951 River Ridge Ct | 2412 | 0000 |
| 22 | 11253 56th Ave | 2411 | 0000 |
| 1090 | 11113 56th Ave | 2411 | 0000 |
| 1111 | 11085 Stanford Ave | 2411 | 0000 |
| 1124 | 10769 S Campus Dr | 2411 | 0000 |
| 1126 | 4477 Lake Michigan Dr | 2411 | 0000 |
| 1176 | 5947 Lake Michigan Dr | 2411 | 0000 |
| 1781 | 10709 60th Ave | 2411 | 0000 |
| 1841 | 6801 Sunset Dr | 2411 | 0000 |
| 1960 | 10729 64th Ave | 2411 | 0000 |
| 1961 | 10835 64th Ave | 2411 | 0000 |

| Table C-3: Manhole Assessment Grades | | | |
|---|---|---|---|
| **Manhole ID** | **Address** | **Quick Rating - Operations & Maintenance** | **Quick Rating - Structural** |
| 1962 | 6402 Winans St | 2411 | 0000 |
| 1982 | 10835 60th Ave | 2411 | 0000 |
| 2034 | 6996 Joal St | 2411 | 0000 |
| 2181 | 11003 60th Ave | 2411 | 0000 |
| 2191 | 10997 Gayle Ln | 2411 | 0000 |
| 2195 | 5780 Forest View Dr | 2411 | 0000 |
| 2196 | 5798 Forest View Dr | 2411 | 0000 |
| 2241 | 11048 68th Ave | 2411 | 0000 |
| 2280 | 11063 60th Ave | 2411 | 0000 |
| 2292 | Estate Rd | 2411 | 0000 |
| 2352 | 6433 Lake Michigan Dr | 2411 | 0000 |
| 2356 | 11207 Washington Ave | 2411 | 0000 |
| 2385 | 11147 60th Ave | 2411 | 0000 |
| 2386 | 5954 Country View Dr | 2411 | 0000 |
| 2387 | 5908 Country View Dr | 2411 | 0000 |
| 2389 | 5850 Country View Dr | 2411 | 0000 |
| 2391 | 5796 Country View Dr | 2411 | 0000 |
| 2392 | 5773 Country View Dr | 2411 | 0000 |
| 2393 | 11143 Pleasant Point Dr | 2411 | 0000 |
| 2397 | 5696 Country View Dr | 2411 | 0000 |
| 2434 | 11227 68th Ave | 2411 | 0000 |
| 2436 | 11263 68th Ave | 2411 | 0000 |
| 2475 | 11253 60th Ave | 2411 | 0000 |
| 2481 | 5864 Larkspur Ave | 2411 | 0000 |
| 2491 | 5673 Lake Michigan Dr | 2411 | 0000 |
| 2574 | 6028 Crystal Dr | 2411 | 0000 |
| 2671 | 6180 Crystal Dr | 2411 | 0000 |
| 2676 | 6047 Pebble Dr | 2411 | 0000 |
| 2780 | 5965 Frostline Dr | 2411 | 0000 |
| 2781 | 5953 Frostline Dr | 2411 | 0000 |
| 3466 | 10239 42nd Ave | 2411 | 0000 |
| 3762 | 1 Campus Dr | 2411 | 0000 |
| 4030 | 4930 W Campus Dr | 2411 | 0000 |

| Table C-3: Manhole Assessment Grades | | | |
|---|---|---|---|
| **Manhole ID** | **Address** | **Quick Rating - Operations & Maintenance** | **Quick Rating - Structural** |
| 4340 | 10929 48th Ave | 2411 | 0000 |
| 4402 | 5456 Jordan St | 2411 | 0000 |
| 4422 | 11031 52nd Ave | 2411 | 0000 |
| 4441 | 11027 48th Ave | 2411 | 0000 |
| 4506 | 5568 Estate Rd | 2411 | 0000 |
| 4601 | 11197 56th Ave | 2411 | 0000 |
| 4606 | 5543 Lake Michigan Dr | 2411 | 0000 |
| 4607 | 5525 Lake Michigan Dr | 2411 | 0000 |
| 4609 | 5421 Lake Michigan Dr | 2411 | 0000 |
| 4610 | 5377 Lake Michigan Dr | 2411 | 0000 |
| 4619 | 11193 52nd Ave | 2411 | 0000 |
| 4624 | Lake Michigan Dr | 2411 | 0000 |
| 4628 | 11143 52nd Ave | 2411 | 0000 |
| 4641 | 11125 48th Ave | 2411 | 0000 |
| 4642 | Lake Michigan Dr | 2411 | 0000 |
| 4742 | 11269 48th Ave | 2411 | 0000 |
| 4844 | 11313 48th Ave | 2411 | 0000 |
| 4871 | 11276 40th Ave | 2411 | 0000 |
| 4875 | 3962 Ravine Dr | 2411 | 0000 |
| 4980 | 3934 Ravine Dr | 2411 | 0000 |
| 4984 | 11478 40th Ave | 2411 | 0000 |
| 9006 | Laker Village Dr | 2411 | 0000 |
| 2380 | 11193 60th Ave | 2411 | 0000 |
| 4600 | 11207 56th Ave | 2411 | 0000 |
| 4635 | 4876 Lake Michigan Dr | 2411 | 0000 |
| 4440 | 10975 48th Ave | 2400 | 0000 |
| 1081 | 11303 Ripple Dr | 2400 | 0000 |
| 1086 | 10723 60th Ave | 2400 | 0000 |
| 1087 | 10617 60th Ave | 2400 | 0000 |
| 1089 | 5812 Country View Dr | 2400 | 0000 |
| 1780 | 10681 60th Ave | 2400 | 0000 |
| 1840 | 10841 68th Ave | 2400 | 0000 |
| 1881 | 6175 Red Oak Ln | 2400 | 0000 |

| Table C-3: Manhole Assessment Grades | | | |
|---|---|---|---|
| **Manhole ID** | **Address** | **Quick Rating - Operations & Maintenance** | **Quick Rating - Structural** |
| 2037 | 6802 Joal St | 2400 | 0000 |
| 2038 | 10975 68th Ave | 2400 | 0000 |
| 2039 | 11025 68th Ave | 2400 | 0000 |
| 2162 | 11003 64th Ave | 2400 | 0000 |
| 2240 | 11115 68th Ave | 2400 | 0000 |
| 2340 | 11233 68th Ave | 2400 | 0000 |
| 2353 | 11205 64th Ave | 2400 | 0000 |
| 2382 | 5916 Lake Michigan Dr | 2400 | 0000 |
| 2388 | 5900 Country View Dr | 2400 | 0000 |
| 2435 | 11217 68th Ave | 2400 | 0000 |
| 2485 | 11271 Rosewood Ave | 2400 | 0000 |
| 2490 | 5737 Lake Michigan Dr | 2400 | 0000 |
| 2575 | 6064 Crystal Dr | 2400 | 0000 |
| 2672 | 11359 Ripple Dr | 2400 | 0000 |
| 2673 | 11433 Ripple Dr | 2400 | 0000 |
| 2678 | 11456 Pebble Dr | 2400 | 0000 |
| 2681 | 11369 Hunters Meadow Dr | 2400 | 0000 |
| 2682 | 11465 Hunters Meadow Dr | 2400 | 0000 |
| 2782 | 5931 Frostline Dr | 2400 | 0000 |
| 2783 | 5934 Frostline Dr | 2400 | 0000 |
| 3563 | 4355 Campus View Dr | 2400 | 0000 |
| 4040 | 4902 W Campus Dr | 2400 | 0000 |
| 4140 | 10745 48th Ave | 2400 | 0000 |
| 4142 | 10861 48th Ave | 2400 | 0000 |
| 4160 | Laker Village Dr | 2400 | 0000 |
| 4241 | 10865 48th Ave | 2400 | 0000 |
| 4360 | 1 Campus Dr | 2400 | 0000 |
| 4416 | 5270 Jordan St | 2400 | 0000 |
| 4500 | 11155 56th Ave | 2400 | 0000 |
| 4507 | 5538 Estate Rd | 2400 | 0000 |
| 4508 | 5520 Estate Rd | 2400 | 0000 |
| 4509 | 5502 Estate Rd | 2400 | 0000 |
| 4516 | 11111 52nd Ave | 2400 | 0000 |

| Table C-3: Manhole Assessment Grades | | | |
|---|---|---|---|
| **Manhole ID** | **Address** | **Quick Rating - Operations & Maintenance** | **Quick Rating - Structural** |
| 4518 | 11059 52nd Ave | 2400 | 0000 |
| 4530 | 11181 Radcliff Dr | 2400 | 0000 |
| 4540 | 11077 48th Ave | 2400 | 0000 |
| 4611 | 5315 Lake Michigan Dr | 2400 | 0000 |
| 4612 | 5255 Lake Michigan Dr | 2400 | 0000 |
| 4623 | Lake Michigan Dr | 2400 | 0000 |
| 4625 | Lake Michigan Dr | 2400 | 0000 |
| 4630 | Lake Michigan Dr | 2400 | 0000 |
| 4631 | Lake Michigan Dr | 2400 | 0000 |
| 4632 | Lake Michigan Dr | 2400 | 0000 |
| 4701 | 11258 56th Ave | 2400 | 0000 |
| 4740 | 11227 48th Ave | 2400 | 0000 |
| 4741 | 11261 48th Ave | 2400 | 0000 |
| 4983 | 11434 Cadence Ct | 2400 | 0000 |
| 9500 | 10545 Laker Village Dr | 2400 | 0000 |
| 9501 | 4873 Lake Michigan Dr | 2400 | 0000 |
| 1158 | 11563 40th Ave | 2400 | 0000 |
| 1164 | 11563 40th Ave | 2400 | 0000 |
| 1169 | 4310 Rich St | 2400 | 0000 |
| 1581 | 10565 60th Ave | 2400 | 0000 |
| 2197 | 11059 Pleasant Point Dr | 2311 | 0000 |
| 2395 | 11071 Pleasant Point Dr | 2311 | 0000 |
| 2399 | 5620 Country View Dr | 2311 | 0000 |
| 4401 | 5532 Jordan St | 2311 | 0000 |
| 4538 | 11004 Radcliff Dr | 2311 | 0000 |
| 1134 | 11463 48th Ave | 2300 | 0000 |
| 2444 | 6635 Lake Michigan Dr | 2300 | 0000 |
| 2573 | 6003 Crystal Dr | 2300 | 0000 |
| 2675 | 6095 Pebble Dr | 2300 | 0000 |
| 4418 | 11063 Summer Brook Ct | 2300 | 0000 |
| 4872 | 11299 40th Ave | 2300 | 0000 |
| 2370 | 6052 Lake Michigan Dr | 2300 | 0000 |
| 2247 | 6605 Henry St | 2213 | 0000 |

| Table C-3: Manhole Assessment Grades | | | |
|---|---|---|---|
| **Manhole ID** | **Address** | **Quick Rating - Operations & Maintenance** | **Quick Rating - Structural** |
| 2443 | 11272 Avery Ave | 2212 | 0000 |
| 4400 | 5557 Jordan St | 2212 | 0000 |
| 4874 | 11351 River Ridge Dr | 2212 | 0000 |
| 2381 | 5948 Lake Michigan Dr | 2212 | 0000 |
| 4510 | 5520 Eric St | 2211 | 0000 |
| 4325 | 10890 Woodedge Dr | 2211 | 0000 |
| 2364 | WJ Presley Pkwy | 2211 | 0000 |
| 2398 | 5663 Country View Dr | 2200 | 0000 |
| 2431 | 11293 Valley View Ave | 2200 | 0000 |
| 2674 | 6189 Pebble Dr | 2200 | 0000 |
| 3562 | 4352 Campus View Dr | 2200 | 0000 |
| 1094 | 5122 Pierce St | 2200 | 0000 |
| 3622 | 5160 Pierce St | 2200 | 0000 |
| 4605 | 5382 Lake Michigan Dr | 2200 | 0000 |
| 2446 | 6545 Lake Michigan Dr | 2113 | 0000 |
| 2449 | 6561 Lake Michigan Dr | 2113 | 0000 |
| 2051 | 6754 Mista Dr | 2112 | 0000 |
| 2052 | 6654 Mista Ct | 2112 | 0000 |
| 2054 | 6606 Mista Dr | 2112 | 0000 |
| 2445 | 6561 Lake Michigan Dr | 2112 | 0000 |
| 2542 | 6615 Cherell St | 2112 | 0000 |
| 1952 | 6588 Winans St | 2111 | 0000 |
| 2036 | 6868 Joal St | 2111 | 0000 |
| 2055 | 6524 Mista Dr | 2111 | 0000 |
| 2121 | 7040 Timbercreek Dr | 2111 | 0000 |
| 2339 | 11209 Brown St | 2111 | 0000 |
| 2541 | 11306 Sheridan Ave | 2111 | 0000 |
| 3623 | 5122 Pierce St | 2111 | 0000 |
| 4323 | 5103 Circleview Dr | 2111 | 0000 |
| 4603 | 5504 Lake Michigan Dr | 2111 | 0000 |
| 2635 | 11495 Brown St | 2100 | 0000 |
| 2638 | 11397 Brown St | 2100 | 0000 |
| 5144 | 4774 Rich St | 2100 | 0000 |

| Table C-3: Manhole Assessment Grades | | | |
|---|---|---|---|
| **Manhole ID** | **Address** | **Quick Rating - Operations & Maintenance** | **Quick Rating - Structural** |
| 5145 | 4750 Rich St | 2100 | 0000 |
| 5352 | 11821 46th Ave | 2100 | 0000 |
| 2224 | 11127 Creekside Ct | 2100 | 0000 |
| 2227 | 11057 Creekside Dr | 2100 | 0000 |
| 2411 | 11287 Red Hawk Ln | 2100 | 0000 |
| 3732 | 10485 48th Ave | 2100 | 0000 |
| 3814 | 5396 Windfield Dr | 2100 | 0000 |
| 4031 | 4950 W Campus Dr | 2100 | 0000 |
| 4414 | 5286 Jordan St | 2100 | 0000 |
| 4514 | 5402 Eric St | 2100 | 0000 |
| 4519 | 11060 52nd Ave | 2100 | 0000 |
| 9702 | 5401 Pierce St | 2100 | 0000 |
| 4020 | 10723 52nd Ave | 2100 | 0000 |
| 1067 | Marsh Ave | 2100 | 0000 |
| 4121 | 10829 52nd Ave | 2100 | 0000 |
| 4321 | 5163 Circleview Dr | 2100 | 0000 |
| 4420 | 10967 52nd Ave | 2100 | 0000 |
| 4604 | 5426 Lake Michigan Dr | 2100 | 0000 |
| 4850 | 4657 Ottawa Creek Dr | 2100 | 0000 |
| 2368 | 6144 Lake Michigan Dr | 2100 | 0000 |
| 4615 | 5328 Lake Michigan Dr | 2100 | 0000 |
| 4831 | 4926 Becker Dr | 2100 | 0000 |
| 5011 | 5499 Edgeway Dr | 2100 | 0000 |
| 2062 | 10939 64th Ave | 1200 | 0000 |
| 2336 | 6981 Lake Michigan Dr | 1200 | 0000 |
| 2338 | 11215 Valley View Ave | 1200 | 0000 |
| 2533 | 6910 Valley View Ct | 1200 | 0000 |
| 1175 | 6812 Joal St | 1100 | 0000 |
| 2030 | 10943 Creekside Dr | 1100 | 0000 |
| 2035 | 6930 Joal St | 1100 | 0000 |
| 2050 | 6798 Mista Dr | 1100 | 0000 |
| 2060 | 6406 Martinie Dr | 1100 | 0000 |
| 2228 | 11043 Creekside Dr | 1100 | 0000 |

| Table C-3: Manhole Assessment Grades | | | |
|---|---|---|---|
| **Manhole ID** | **Address** | **Quick Rating - Operations & Maintenance** | **Quick Rating - Structural** |
| 2249 | 6606 Henry St | 1100 | 0000 |
| 2430 | 11241 Valley View Ave | 1100 | 0000 |
| 2450 | 6561 Lake Michigan Dr | 1100 | 0000 |
| 2487 | 5855 Larkspur Ave | 1100 | 0000 |
| 2488 | 11281 Prairie Ave | 1100 | 0000 |
| 2539 | 6725 Scott St | 1100 | 0000 |
| 2543 | 6603 Cherell St | 1100 | 0000 |
| 2586 | 5016 Dewpointe Dr | 1100 | 0000 |
| 2588 | 5930 Dewpointe Dr | 1100 | 0000 |
| 2633 | 11495 Brown St | 1100 | 0000 |
| 2634 | 11495 Brown St | 1100 | 0000 |
| 2684 | 11425 Prairie Ave | 1100 | 0000 |
| 2685 | 11441 Prairie Ave | 1100 | 0000 |
| 2690 | 11403 Rosewood Ave | 1100 | 0000 |
| 2691 | 11439 Rosewood Ave | 1100 | 0000 |
| 2786 | 11475 Eagle Nest Ct | 1100 | 0000 |
| 2791 | 5711 Frostline Dr | 1100 | 0000 |
| 3372 | 10133 42nd Ave | 1100 | 0000 |
| 3373 | 10130 42nd Ave | 1100 | 0000 |
| 1091 | 5366 Pierce St | 1100 | 0000 |
| 1823 | 7151 Pine Grove St | 1100 | 0000 |
| 1826 | 7055 Sunset Dr | 1100 | 0000 |
| 1910 | 7517 Water View Ln | 1100 | 0000 |
| 1911 | 7593 Water View Ln | 1100 | 0000 |
| 1912 | 7389 Pinevalley Dr | 1100 | 0000 |
| 1968 | 6246 Timber Dr | 1100 | 0000 |
| 2010 | 7338 Water View Ln | 1100 | 0000 |
| 2011 | 7376 Water View Ln | 1100 | 0000 |
| 2013 | 7491 Water View Ln | 1100 | 0000 |
| 2066 | 10920 64th Ave | 1100 | 0000 |
| 2094 | 10931 Mary Eliz Ct | 1100 | 0000 |
| 2112 | 7320 Watermark Dr | 1100 | 0000 |
| 2114 | 11015 Waterway Dr | 1100 | 0000 |

| Table C-3: Manhole Assessment Grades | | | |
|---|---|---|---|
| **Manhole ID** | **Address** | **Quick Rating - Operations & Maintenance** | **Quick Rating - Structural** |
| 2201 | 11149 Waterpoint Dr | 1100 | 0000 |
| 2225 | 11145 Creekside Ct | 1100 | 0000 |
| 2306 | 7478 Waterline Dr | 1100 | 0000 |
| 2318 | 11211 Red Hawk Ln | 1100 | 0000 |
| 2530 | 7598 Valley View Ct | 1100 | 0000 |
| 3074 | 6104 Balcom Ln | 1100 | 0000 |
| 3086 | 11799 Brookridge Dr | 1100 | 0000 |
| 3087 | 11795 Brookridge Dr | 1100 | 0000 |
| 3177 | 11738 Andrews Ave | 1100 | 0000 |
| 3436 | Copper Beech Townhomes | 1100 | 0000 |
| 3517 | 5256 Pierce St | 1100 | 0000 |
| 3533 | Copper Beech Townhomes | 1100 | 0000 |
| 3634 | 5013 Pierce St | 1100 | 0000 |
| 3734 | 4886 Country Pl S | 1100 | 0000 |
| 4201 | 10835 Lance Ave | 1100 | 0000 |
| 4212 | 5305 Sunshine St | 1100 | 0000 |
| 4213 | 5351 Sunshine St | 1100 | 0000 |
| 4311 | 10807 Jordan Ct | 1100 | 0000 |
| 4404 | 5194 Jordan St | 1100 | 0000 |
| 1130 | 11239 Whispering Creek Dr | 1100 | 0000 |
| 1520 | Pleasant View Ct | 1100 | 0000 |
| 2001 | 7584 Watermark Dr | 1100 | 0000 |
| 2002 | 10803 Waterpoint Dr | 1100 | 0000 |
| 2345 | 6660 Lake Michigan Dr | 1100 | 0000 |
| 2350 | 6474 Lake Michigan Dr | 1100 | 0000 |
| 2770 | 11441 60th Ave | 1100 | 0000 |
| 3180 | 11755 60th Ave | 1100 | 0000 |
| 4324 | 10811 Woodedge Dr | 1100 | 0000 |
| 4424 | 5110 Jordan St | 1100 | 0000 |
| 4425 | 10999 Woodedge Dr | 1100 | 0000 |
| 4426 | 10975 Woodedge Dr | 1100 | 0000 |
| 4747 | 11253 Whispering Creek Dr | 1100 | 0000 |
| 1842 | 10798 68th Ave | 1100 | 0000 |

| Table C-3: Manhole Assessment Grades | | | |
|---|---|---|---|
| **Manhole ID** | **Address** | **Quick Rating - Operations & Maintenance** | **Quick Rating - Structural** |
| 1843 | New Options High School | 1100 | 0000 |
| 1844 | New Options High School | 1100 | 0000 |
| 4705 | 11301 Commerce Rd | 1100 | 0000 |
| 4833 | Becker Dr | 1100 | 0000 |
| 4836 | 4926 Allenpark Dr | 1100 | 0000 |
| LS_60TH-NORTH | 11555 60th Ave | 0000 | 0000 |
| LS_60TH-SOUTH | 10550 60th Ave | 0000 | 0000 |
| LS_BROWN | 11495 Brown St | 0000 | 0000 |
| LS_COUNTY_PARK | 6676 Lake Michigan Dr | 0000 | 0000 |
| LS_HIDDEN_SHORES | 7423 Waterline Dr | 0000 | 0000 |
| LS_TIMBERLINE | 7060 Sunset Dr | 0000 | 0000 |
| 2300 | 11213 78th Ave | 0000 | 0000 |
| 2301 | 11191 78th Ave | 0000 | 0000 |
| 2401 | Placid Waters Dr | 0000 | 0000 |
| 2402 | 8100 Placid Waters Dr | 0000 | 0000 |
| 2403 | 8011 Lake Michigan Dr | 0000 | 0000 |
| 2500 | 11315 Wake Dr | 0000 | 0000 |
| 2501 | 11578 84th Ave | 0000 | 0000 |
| 9007 | 1 Campus Dr | 0000 | 0000 |
| 9009 | 1 Campus Dr | 0000 | 0000 |
| 3960 | 10517 Laker Village Dr | 0000 | 0000 |
| 4260 | 1 Campus Dr | 0000 | 0000 |
| 9010 | 10744 S Campus Dr | 0000 | 0000 |
| 1007 | 6161 Lake Michigan Dr | 0000 | 0000 |
| 1119 | S University Dr | 0000 | 0000 |
| 1121 | 10095 42nd Ave | 0000 | 0000 |
| 1135 | 11368 48th Ave | 0000 | 0000 |
| 1136 | 11378 48th Ave | 0000 | 0000 |
| 1173 | 4442 Lake Michigan Dr | 0000 | 0000 |
| 1950 | 6587 Winans St | 0000 | 0000 |
| 2031 | 10905 Creekside Dr | 0000 | 0000 |
| 2061 | 6431 Martinie Dr | 0000 | 0000 |
| 2120 | 11025 Creekside Dr | 0000 | 0000 |

| Table C-3: Manhole Assessment Grades | | | |
|---|---|---|---|
| **Manhole ID** | **Address** | **Quick Rating - Operations & Maintenance** | **Quick Rating - Structural** |
| 2141 | Allendale Community Park | 0000 | 0000 |
| 2142 | 6799 Mista Dr | 0000 | 0000 |
| 2160 | 11015 64th Ave | 0000 | 0000 |
| 2163 | 10991 64th Ave | 0000 | 0000 |
| 2460 | 11261 64th Ave | 0000 | 0000 |
| 2540 | 6683 Scott St | 0000 | 0000 |
| 2580 | 5735 Ivory Rd | 0000 | 0000 |
| 2581 | 5764 Ivory Rd | 0000 | 0000 |
| 2585 | 11351 Prairie Ave | 0000 | 0000 |
| 2587 | 5443 Dewpointe Dr | 0000 | 0000 |
| 2590 | 11319 Rosewood Ave | 0000 | 0000 |
| 2637 | 11431 Brown St | 0000 | 0000 |
| 2639 | 11377 Brown St | 0000 | 0000 |
| 2683 | 11399 Prairie Ave | 0000 | 0000 |
| 2784 | 5899 Frostline Dr | 0000 | 0000 |
| 2785 | 5859 Frostline Dr | 0000 | 0000 |
| 2787 | 5821 Frostline Dr | 0000 | 0000 |
| 2789 | 11453 Prairie Ave | 0000 | 0000 |
| 2790 | 5755 Frostline Dr | 0000 | 0000 |
| 3360 | 10033 Laker Ln | 0000 | 0000 |
| 3361 | S University Dr | 0000 | 0000 |
| 3362 | S University Dr | 0000 | 0000 |
| 3363 | S University Dr | 0000 | 0000 |
| 3364 | 10149 42nd Ave | 0000 | 0000 |
| 3366 | 10173 42nd Ave | 0000 | 0000 |
| 3368 | S University Dr | 0000 | 0000 |
| 3369 | S University Dr | 0000 | 0000 |
| 3370 | S University Dr | 0000 | 0000 |
| 3371 | 10111 42nd Ave | 0000 | 0000 |
| 3374 | 10100 42nd Ave | 0000 | 0000 |
| 3460 | 10000 Laker Ln | 0000 | 0000 |
| 3461 | 10001 Laker Ln | 0000 | 0000 |
| 3462 | 10000 Laker Ln | 0000 | 0000 |

| Table C-3: Manhole Assessment Grades | | | |
|---|---|---|---|
| **Manhole ID** | **Address** | **Quick Rating - Operations & Maintenance** | **Quick Rating - Structural** |
| 3463 | 10119 Laker Ln | 0000 | 0000 |
| 3464 | 10073 Laker Ln | 0000 | 0000 |
| 3465 | Laker Ln | 0000 | 0000 |
| 3570 | 10246 42nd Ave | 0000 | 0000 |
| 3861 | 1 Campus Dr | 0000 | 0000 |
| 4240 | 10865 48th Ave | 0000 | 0000 |
| 4362 | 1 Campus Dr | 0000 | 0000 |
| 4461 | 4443 Stadium Dr | 0000 | 0000 |
| 4462 | 4307 Stadium Dr | 0000 | 0000 |
| 4877 | 11377 40th Ave | 0000 | 0000 |
| 4878 | 11375 40th Ave | 0000 | 0000 |
| 4932 | 4812 Allenpark Dr | 0000 | 0000 |
| 4940 | 11403 48th Ave | 0000 | 0000 |
| 4941 | 11410 48th Ave | 0000 | 0000 |
| 5040 | 11443 48th Ave | 0000 | 0000 |
| 5041 | 11483 48th Ave | 0000 | 0000 |
| 5042 | 11529 48th Ave | 0000 | 0000 |
| 5140 | 11565 48th Ave | 0000 | 0000 |
| 5141 | 4802 Rich St | 0000 | 0000 |
| 5142 | 11613 48th Ave | 0000 | 0000 |
| 5146 | 4726 Rich St | 0000 | 0000 |
| 5147 | 4702 Rich St | 0000 | 0000 |
| 5250 | 11605 46th Ave | 0000 | 0000 |
| 5350 | Nicholas Dr | 0000 | 0000 |
| 5351 | 11761 46th Ave | 0000 | 0000 |
| 5353 | 11859 46th Ave | 0000 | 0000 |
| 5354 | 4544 Pingree St | 0000 | 0000 |
| 5355 | 4488 Pingree St | 0000 | 0000 |
| 5356 | 4431 Pingree St | 0000 | 0000 |
| 5357 | 4375 Pingree St | 0000 | 0000 |
| 9600 | 11358 Brown St | 0000 | 0000 |
| 1043 | 11051 Pinecreek Ct | 0000 | 0000 |
| 1044 | 11099 Pinecreek Ct | 0000 | 0000 |

| Table C-3: Manhole Assessment Grades | | | |
|---|---|---|---|
| **Manhole ID** | **Address** | **Quick Rating - Operations & Maintenance** | **Quick Rating - Structural** |
| 1045 | 7145 Pinevalley Dr | 0000 | 0000 |
| 1046 | 7128 Pinevalley Dr | 0000 | 0000 |
| 1047 | 7102 Pinevalley Dr | 0000 | 0000 |
| 1048 | 7340 Water View Ln | 0000 | 0000 |
| 1049 | 7272 Water View Ln | 0000 | 0000 |
| 1050 | 7239 Bittersweet Ct | 0000 | 0000 |
| 1051 | 10911 Waterway Dr | 0000 | 0000 |
| 1071 | 7145 Barn Owl Ln | 0000 | 0000 |
| 1073 | 7360 Valley View Ct | 0000 | 0000 |
| 1083 | 6101 Lake Michigan Dr | 0000 | 0000 |
| 1085 | 5995 Frostline Dr | 0000 | 0000 |
| 1092 | 5122 Pierce St | 0000 | 0000 |
| 1093 | 5122 Pierce St | 0000 | 0000 |
| 1095 | 5122 Pierce St | 0000 | 0000 |
| 1096 | 5050 Pierce St | 0000 | 0000 |
| 1097 | 5050 Pierce St | 0000 | 0000 |
| 1099 | 10500 Rockfield Rd | 0000 | 0000 |
| 1100 | 5270 Crestfield Ln | 0000 | 0000 |
| 1101 | 5378 Crestfield Ln | 0000 | 0000 |
| 1102 | Copper Beech Townhomes | 0000 | 0000 |
| 1103 | Copper Beech Townhomes | 0000 | 0000 |
| 1104 | 5057 W Campus Dr | 0000 | 0000 |
| 1105 | 5057 W Campus Dr | 0000 | 0000 |
| 1106 | Southtown Dr | 0000 | 0000 |
| 1107 | Southtown Dr | 0000 | 0000 |
| 1113 | 10581 48th Ave | 0000 | 0000 |
| 1114 | 10445 48th Ave | 0000 | 0000 |
| 1115 | 10445 48th Ave | 0000 | 0000 |
| 1116 | 10411 48th Ave | 0000 | 0000 |
| 1680 | 10675 Tallpine Ln | 0000 | 0000 |
| 1682 | 10601 Tallpine Ln | 0000 | 0000 |
| 1782 | 5961 Maple Bend Trl | 0000 | 0000 |
| 1783 | 5936 Maple Bend Trl | 0000 | 0000 |

| Table C-3: Manhole Assessment Grades | | | |
|---|---|---|---|
| **Manhole ID** | **Address** | **Quick Rating - Operations & Maintenance** | **Quick Rating - Structural** |
| 1784 | 5884 Maple Bend Trl | 0000 | 0000 |
| 1785 | 5863 Maple Bend Trl | 0000 | 0000 |
| 1786 | 5841 Maple Bend Trl | 0000 | 0000 |
| 1787 | 5800 Maple Bend Trl | 0000 | 0000 |
| 1788 | 10701 Tallpine Ln | 0000 | 0000 |
| 1789 | 5807 Horizon Ln | 0000 | 0000 |
| 1810 | 10800 Pinevalley Ct | 0000 | 0000 |
| 1811 | 10801 Pinevalley Ct | 0000 | 0000 |
| 1812 | 10798 Learning Ln | 0000 | 0000 |
| 1824 | 7192 Pine Grove St | 0000 | 0000 |
| 1825 | 10821 Timberline Dr | 0000 | 0000 |
| 1827 | 7005 Sunset Dr | 0000 | 0000 |
| 1880 | 10789 Tallpine Ln | 0000 | 0000 |
| 1913 | 7303 Pinevalley Dr | 0000 | 0000 |
| 1914 | 10877 Pinevalley Ct | 0000 | 0000 |
| 1915 | 7273 Pinevalley Dr | 0000 | 0000 |
| 1916 | 7243 Pinevalley Dr | 0000 | 0000 |
| 1917 | 7208 Pinevalley Dr | 0000 | 0000 |
| 1918 | 7187 Pinevalley Dr | 0000 | 0000 |
| 1919 | 7163 Pinevalley Dr | 0000 | 0000 |
| 1922 | 6994 Aspen St | 0000 | 0000 |
| 1923 | 10911 Skylane Ct | 0000 | 0000 |
| 1924 | 10989 Skylane Ct | 0000 | 0000 |
| 1925 | 7002 Pinevalley Dr | 0000 | 0000 |
| 1964 | 10873 Constant Dr | 0000 | 0000 |
| 1965 | 6324 Timber Dr | 0000 | 0000 |
| 1966 | 6356 Timber Dr | 0000 | 0000 |
| 1967 | 6286 Timber Dr | 0000 | 0000 |
| 1990 | 10901 Melanie Dr | 0000 | 0000 |
| 1991 | 5702 Lynn Dr | 0000 | 0000 |
| 1992 | 10803 Melanie Dr | 0000 | 0000 |
| 1993 | 5769 Lynn Dr | 0000 | 0000 |
| 1994 | 5796 Lynn Dr | 0000 | 0000 |

| Table C-3: Manhole Assessment Grades | | | |
|---|---|---|---|
| **Manhole ID** | **Address** | **Quick Rating - Operations & Maintenance** | **Quick Rating - Structural** |
| 2003 | 7560 Watermark Dr | 0000 | 0000 |
| 2004 | 7523 Watermark Dr | 0000 | 0000 |
| 2005 | 7488 Watermark Dr | 0000 | 0000 |
| 2006 | 7461 Watermark Dr | 0000 | 0000 |
| 2007 | 7424 Watermark Dr | 0000 | 0000 |
| 2008 | 7412 Watermark Dr | 0000 | 0000 |
| 2009 | 10975 Waterpoint Dr | 0000 | 0000 |
| 2012 | 7431 Water View Ln | 0000 | 0000 |
| 2014 | 10969 Waterway Dr | 0000 | 0000 |
| 2015 | 7204 Bittersweet Ct | 0000 | 0000 |
| 2016 | 7240 Bittersweet Ct | 0000 | 0000 |
| 2017 | 7294 Bittersweet Ct | 0000 | 0000 |
| 2020 | 7219 Timbercreek Dr | 0000 | 0000 |
| 2021 | 7173 Timbercreek Dr | 0000 | 0000 |
| 2022 | 7158 Timbercreek Dr | 0000 | 0000 |
| 2023 | 7144 Timbercreek Dr | 0000 | 0000 |
| 2024 | 7130 Timbercreek Dr | 0000 | 0000 |
| 2025 | 7100 Timbercreek Dr | 0000 | 0000 |
| 2026 | 10979 Timberline Dr | 0000 | 0000 |
| 2027 | 10929 Timberline Dr | 0000 | 0000 |
| 2090 | 10962 Gayle Ln | 0000 | 0000 |
| 2091 | 5634 Mary Eliz Dr | 0000 | 0000 |
| 2092 | 5670 Mary Eliz Dr | 0000 | 0000 |
| 2093 | 5727 Mary Eliz Dr | 0000 | 0000 |
| 2095 | 10801 Mary Eliz Ct | 0000 | 0000 |
| 2096 | 10965 Melanie Dr | 0000 | 0000 |
| 2100 | 11017 Waterpoint Dr | 0000 | 0000 |
| 2101 | 11057 Waterpoint Dr | 0000 | 0000 |
| 2110 | 7395 Watermark Dr | 0000 | 0000 |
| 2111 | 7359 Watermark Dr | 0000 | 0000 |
| 2113 | 11031 Waterway Dr | 0000 | 0000 |
| 2116 | 7218 Water View Ln | 0000 | 0000 |
| 2194 | 5753 Mary Eliz Dr | 0000 | 0000 |

| Table C-3: Manhole Assessment Grades | | | |
|---|---|---|---|
| **Manhole ID** | **Address** | **Quick Rating - Operations & Maintenance** | **Quick Rating - Structural** |
| 2200 | 11103 Waterpoint Dr | 0000 | 0000 |
| 2202 | 7546 Waterline Dr | 0000 | 0000 |
| 2203 | 7508 Waterline Dr | 0000 | 0000 |
| 2204 | 7534 Waterline Dr | 0000 | 0000 |
| 2205 | 7596 Waterline Dr | 0000 | 0000 |
| 2206 | 11087 Island Ct | 0000 | 0000 |
| 2207 | 11005 Island Ct | 0000 | 0000 |
| 2210 | 11048 Waterway Dr | 0000 | 0000 |
| 2211 | 11103 Waterway Dr | 0000 | 0000 |
| 2220 | 11093 Timberline Dr | 0000 | 0000 |
| 2221 | 11185 Timberline Dr | 0000 | 0000 |
| 2222 | 11178 Creekside Dr | 0000 | 0000 |
| 2223 | 11127 Creekside Ct | 0000 | 0000 |
| 2226 | 11122 Creekside Ct | 0000 | 0000 |
| 2307 | 7444 Waterline Dr | 0000 | 0000 |
| 2308 | 7408 Waterline Dr | 0000 | 0000 |
| 2309 | 7423 Waterline Dr | 0000 | 0000 |
| 2310 | 7388 Waterline Dr | 0000 | 0000 |
| 2311 | 7349 Waterline Dr | 0000 | 0000 |
| 2312 | 7301 Waterline Dr | 0000 | 0000 |
| 2410 | 11247 Red Hawk Ln | 0000 | 0000 |
| 2412 | 7232 Barn Owl Ln | 0000 | 0000 |
| 2413 | 7222 Barn Owl Ln | 0000 | 0000 |
| 2414 | 7193 Barn Owl Ln | 0000 | 0000 |
| 2415 | 7157 Barn Owl Ln | 0000 | 0000 |
| 2417 | 7157 Barn Owl Ln | 0000 | 0000 |
| 2418 | 7099 Barn Owl Ln | 0000 | 0000 |
| 2419 | 7210 Blue Jay Dr | 0000 | 0000 |
| 2470 | 11263 60th Ave | 0000 | 0000 |
| 2471 | 11289 60th Ave | 0000 | 0000 |
| 2473 | 6182 Library Ln | 0000 | 0000 |
| 2474 | 6223 Lake Michigan Dr | 0000 | 0000 |
| 2510 | 11309 Red Hawk Ln | 0000 | 0000 |

| Table C-3: Manhole Assessment Grades | | | |
|---|---|---|---|
| **Manhole ID** | **Address** | **Quick Rating - Operations & Maintenance** | **Quick Rating - Structural** |
| 2511 | 11347 Red Hawk Ln | 0000 | 0000 |
| 2512 | 7270 Blue Jay Dr | 0000 | 0000 |
| 2513 | 7296 Blue Jay Dr | 0000 | 0000 |
| 2514 | 7220 Blue Jay Dr | 0000 | 0000 |
| 2516 | 7120 Blue Jay Dr | 0000 | 0000 |
| 2531 | 7437 Valley View Ct | 0000 | 0000 |
| 2532 | 7198 Valley View Ct | 0000 | 0000 |
| 2592 | 5720 Victoria St | 0000 | 0000 |
| 2593 | 5710 Victoria St | 0000 | 0000 |
| 2594 | 11275 Cameron Ave | 0000 | 0000 |
| 2693 | 11385 Cameron Ave | 0000 | 0000 |
| 2694 | 5732 Crabtree St | 0000 | 0000 |
| 2695 | 5702 Crabtree St | 0000 | 0000 |
| 2696 | 11599 Cameron Ave | 0000 | 0000 |
| 2881 | 11530 Brookland Ct | 0000 | 0000 |
| 2882 | 11587 Brookland Ct | 0000 | 0000 |
| 2970 | 6178 Balcom Ln | 0000 | 0000 |
| 2971 | 6142 Balcom Ln | 0000 | 0000 |
| 2972 | 6090 Balcom Ln | 0000 | 0000 |
| 2973 | Norfolk Dr | 0000 | 0000 |
| 2974 | Norfolk Dr | 0000 | 0000 |
| 2975 | 11698 Wilmington Dr | 0000 | 0000 |
| 2976 | 11691 Wilmington Dr | 0000 | 0000 |
| 2977 | 11682 Wilmington Dr | 0000 | 0000 |
| 2978 | 11666 Wilmington Dr | 0000 | 0000 |
| 2979 | 11627 Wilmington Dr | 0000 | 0000 |
| 2981 | 11531 Wilmington Dr | 0000 | 0000 |
| 2984 | 11659 Brookland Ct | 0000 | 0000 |
| 2985 | 11697 Brookland Ct | 0000 | 0000 |
| 2986 | 5882 Rich St | 0000 | 0000 |
| 2989 | 11677 Spruce View Dr | 0000 | 0000 |
| 3073 | 6196 Balcom Ln | 0000 | 0000 |
| 3075 | 6054 Balcom Ln | 0000 | 0000 |

| Table C-3: Manhole Assessment Grades | | | |
|---|---|---|---|
| **Manhole ID** | **Address** | **Quick Rating - Operations & Maintenance** | **Quick Rating - Structural** |
| 3076 | 6112 Balcom Ln | 0000 | 0000 |
| 3077 | 6095 Rossfield Ct | 0000 | 0000 |
| 3078 | 6082 Rossfield Ct | 0000 | 0000 |
| 3079 | 6063 Rossfield Ct | 0000 | 0000 |
| 3084 | 11716 60th Ave | 0000 | 0000 |
| 3085 | 11799 Brookridge Dr | 0000 | 0000 |
| 3088 | 11667 Brookridge Dr | 0000 | 0000 |
| 3170 | 6185 Kingsbury Ct | 0000 | 0000 |
| 3171 | 6162 Kingsbury Ct | 0000 | 0000 |
| 3172 | 6068 Kingsbury Ct | 0000 | 0000 |
| 3173 | 6042 Kingsbury Ct | 0000 | 0000 |
| 3174 | 6093 Kingsbury Ct | 0000 | 0000 |
| 3175 | 6002 Kingsbury Ct | 0000 | 0000 |
| 3176 | 11775 Andrews Ave | 0000 | 0000 |
| 3365 | 10173 42nd Ave | 0000 | 0000 |
| 3410 | Mystic Wds | 0000 | 0000 |
| 3411 | Mystic Wds | 0000 | 0000 |
| 3412 | Mystic Wds | 0000 | 0000 |
| 3430 | Copper Beech Townhomes | 0000 | 0000 |
| 3431 | Copper Beech Townhomes | 0000 | 0000 |
| 3432 | Copper Beech Townhomes | 0000 | 0000 |
| 3433 | Copper Beech Townhomes | 0000 | 0000 |
| 3434 | Copper Beech Townhomes | 0000 | 0000 |
| 3437 | Copper Beech Townhomes | 0000 | 0000 |
| 3438 | Copper Beech Townhomes | 0000 | 0000 |
| 3510 | Mystic Wds | 0000 | 0000 |
| 3511 | Mystic Wds | 0000 | 0000 |
| 3512 | Mystic Wds | 0000 | 0000 |
| 3513 | Mystic Wds | 0000 | 0000 |
| 3514 | Mystic Wds | 0000 | 0000 |
| 3515 | Mystic Wds | 0000 | 0000 |
| 3516 | 5256 Pierce St | 0000 | 0000 |
| 3518 | 5298 Pierce St | 0000 | 0000 |

| Table C-3: Manhole Assessment Grades | | | |
|---|---|---|---|
| **Manhole ID** | **Address** | **Quick Rating - Operations & Maintenance** | **Quick Rating - Structural** |
| 3519 | Mystic Wds | 0000 | 0000 |
| 3530 | Copper Beech Townhomes | 0000 | 0000 |
| 3531 | Copper Beech Townhomes | 0000 | 0000 |
| 3532 | Copper Beech Townhomes | 0000 | 0000 |
| 3534 | Copper Beech Townhomes | 0000 | 0000 |
| 3535 | Copper Beech Townhomes | 0000 | 0000 |
| 3610 | 5392 Pierce St | 0000 | 0000 |
| 3611 | Mystic Wds | 0000 | 0000 |
| 3614 | 5343 Pierce St | 0000 | 0000 |
| 3615 | 5313 Pierce St | 0000 | 0000 |
| 3616 | 5313 Pierce St | 0000 | 0000 |
| 3617 | 5269 Pierce St | 0000 | 0000 |
| 3618 | 5310 Pierce St | 0000 | 0000 |
| 3620 | 5202 Pierce St | 0000 | 0000 |
| 3624 | 5083 Pierce St | 0000 | 0000 |
| 3625 | 5050 Pierce St | 0000 | 0000 |
| 3626 | 5050 Pierce St | 0000 | 0000 |
| 3627 | 5084 Pierce St | 0000 | 0000 |
| 3630 | 5045 Pierce St | 0000 | 0000 |
| 3631 | 5045 Pierce St | 0000 | 0000 |
| 3632 | 5045 Pierce St | 0000 | 0000 |
| 3633 | 5013 Pierce St | 0000 | 0000 |
| 3635 | 4997 Pierce St | 0000 | 0000 |
| 3636 | 4986 Pierce St | 0000 | 0000 |
| 3637 | 4962 Pierce St | 0000 | 0000 |
| 3730 | Hillcrest Town Houses | 0000 | 0000 |
| 3733 | 4924 Country Pl S | 0000 | 0000 |
| 3735 | 4967 Pierce St | 0000 | 0000 |
| 3736 | 4967 Pierce St | 0000 | 0000 |
| 3737 | Hillcrest Town Houses | 0000 | 0000 |
| 3738 | 4954 Country Pl S | 0000 | 0000 |
| 3740 | 10471 48th Ave | 0000 | 0000 |
| 3810 | 5252 Windfield Dr | 0000 | 0000 |

| Table C-3: Manhole Assessment Grades | | | |
|---|---|---|---|
| **Manhole ID** | **Address** | **Quick Rating - Operations & Maintenance** | **Quick Rating - Structural** |
| 3811 | 5288 Windfield Dr | 0000 | 0000 |
| 3812 | 5324 Windfield Dr | 0000 | 0000 |
| 3813 | 5364 Windfield Dr | 0000 | 0000 |
| 3815 | 10564 Rockfield Rd | 0000 | 0000 |
| 3816 | 10518 Rockfield Rd | 0000 | 0000 |
| 3830 | Campus West Apartments | 0000 | 0000 |
| 3831 | Campus West Apartments | 0000 | 0000 |
| 3832 | 4968 Country Pl S | 0000 | 0000 |
| 3833 | 10506 Country Pl W | 0000 | 0000 |
| 3834 | 4915 Country Pl N | 0000 | 0000 |
| 3840 | 10489 48th Ave | 0000 | 0000 |
| 3841 | 10561 48th Ave | 0000 | 0000 |
| 3842 | 10539 48th Ave | 0000 | 0000 |
| 3930 | Campus West Apartments | 0000 | 0000 |
| 3931 | Campus West Apartments | 0000 | 0000 |
| 3933 | Campus West Apartments | 0000 | 0000 |
| 3934 | Campus West Apartments | 0000 | 0000 |
| 3936 | Campus West Apartments | 0000 | 0000 |
| 4032 | Campus West Apartments | 0000 | 0000 |
| 4130 | Meadows Xing | 0000 | 0000 |
| 4131 | Meadows Xing | 0000 | 0000 |
| 4132 | Meadows Xing | 0000 | 0000 |
| 4133 | Meadows Xing | 0000 | 0000 |
| 4134 | Meadows Xing | 0000 | 0000 |
| 4135 | Meadows Xing | 0000 | 0000 |
| 4136 | Meadows Xing | 0000 | 0000 |
| 4137 | Meadows Xing | 0000 | 0000 |
| 4200 | 5475 Sunshine St | 0000 | 0000 |
| 4202 | 10783 Lance Ave | 0000 | 0000 |
| 4203 | 10701 Lance Ave | 0000 | 0000 |
| 4210 | 10887 Douglas Dr | 0000 | 0000 |
| 4211 | 10861 Douglas Dr | 0000 | 0000 |
| 4214 | 5373 Sunshine St | 0000 | 0000 |

| Table C-3: Manhole Assessment Grades | | | |
|---|---|---|---|
| **Manhole ID** | **Address** | **Quick Rating - Operations & Maintenance** | **Quick Rating - Structural** |
| 4215 | 5421 Sunshine St | 0000 | 0000 |
| 4216 | 10801 Douglas Dr | 0000 | 0000 |
| 4217 | 10745 Douglas Dr | 0000 | 0000 |
| 4218 | 10705 Douglas Dr | 0000 | 0000 |
| 4223 | Southtown Dr | 0000 | 0000 |
| 4224 | Southtown Dr | 0000 | 0000 |
| 4225 | Southtown Dr | 0000 | 0000 |
| 4230 | Southtown Dr | 0000 | 0000 |
| 4231 | Southtown Dr | 0000 | 0000 |
| 4232 | 10897 48th Ave | 0000 | 0000 |
| 4233 | Village Center Dr | 0000 | 0000 |
| 4300 | 10938 Lance Ave | 0000 | 0000 |
| 4301 | 10925 Lance Ave | 0000 | 0000 |
| 4302 | 10917 Lance Ave | 0000 | 0000 |
| 4303 | 10905 Lance Ave | 0000 | 0000 |
| 4304 | 10934 Lance Ave | 0000 | 0000 |
| 4310 | 10943 Jordan Ct | 0000 | 0000 |
| 4312 | 10963 Douglas Dr | 0000 | 0000 |
| 4313 | 10921 Douglas Dr | 0000 | 0000 |
| 4335 | Northside Dr | 0000 | 0000 |
| 4336 | Northside Dr | 0000 | 0000 |
| 4337 | Northside Dr | 0000 | 0000 |
| 4338 | Northside Dr | 0000 | 0000 |
| 4403 | 5312 Jordan St | 0000 | 0000 |
| 4405 | 10993 Lance Ave | 0000 | 0000 |
| 4406 | 10987 Lance Ave | 0000 | 0000 |
| 4407 | 10973 Lance Ave | 0000 | 0000 |
| 4408 | 10959 Lance Ave | 0000 | 0000 |
| 4409 | 5158 Jordan St | 0000 | 0000 |
| 4410 | 5102 Jordan St | 0000 | 0000 |
| 4411 | 10991 Jordan Ct | 0000 | 0000 |
| 4412 | 5304 Jordan St | 0000 | 0000 |
| 4413 | 5292 Jordan St | 0000 | 0000 |

| Table C-3: Manhole Assessment Grades | | | |
|---|---|---|---|
| **Manhole ID** | **Address** | **Quick Rating - Operations & Maintenance** | **Quick Rating - Structural** |
| 4419 | 10985 Douglas Dr | 0000 | 0000 |
| 4503 | 5596 Eric St | 0000 | 0000 |
| 4504 | 5566 Eric St | 0000 | 0000 |
| 4505 | 5502 Eric St | 0000 | 0000 |
| 4511 | 5478 Eric St | 0000 | 0000 |
| 4512 | 5452 Eric St | 0000 | 0000 |
| 4513 | 5424 Eric St | 0000 | 0000 |
| 4520 | 11088 52nd Ave | 0000 | 0000 |
| 4539 | 4868 Lake Michigan Dr | 0000 | 0000 |
| 4637 | 4864 Lake Michigan Dr | 0000 | 0000 |
| 4638 | 4850 Lake Michigan Dr | 0000 | 0000 |
| 4930 | 4991 Allenpark Dr | 0000 | 0000 |
| 4931 | 4896 Allenpark Dr | 0000 | 0000 |
| 9708 | 5241 Pierce St | 0000 | 0000 |
| 9011 | 6101 Lake Michigan Dr | 0000 | 0000 |
| 9502 | 4999 Allenpark Dr | 0000 | 0000 |
| 9503 | Allenpark Dr | 0000 | 0000 |
| 9504 | Allenpark Dr | 0000 | 0000 |
| 9505 | Allenpark Dr | 0000 | 0000 |
| 9506 | 11540 Boyne Blvd | 0000 | 0000 |
| 9507 | 4920 Rich St | 0000 | 0000 |
| 9508 | 6223 Lake Michigan Dr | 0000 | 0000 |
| 9700 | 5399 Pierce St | 0000 | 0000 |
| 9701 | 5399 Pierce St | 0000 | 0000 |
| 9703 | 5398 Crestfield Ln | 0000 | 0000 |
| 9704 | 5360 Windfield Dr | 0000 | 0000 |
| 9705 | 5360 Windfield Dr | 0000 | 0000 |
| 9706 | 5363 Windfield Dr | 0000 | 0000 |
| 9707 | 10439 52nd Ave | 0000 | 0000 |
| 1822 | 7112 Pine Grove St | 0000 | 0000 |
| 2880 | 11555 60th Ave | 0000 | 0000 |
| 3720 | 10463 52nd Ave | 0000 | 0000 |
| 1021 | 10781 52nd Ave | 0000 | 0000 |

| Table C-3: Manhole Assessment Grades | | | |
|---|---|---|---|
| **Manhole ID** | **Address** | **Quick Rating - Operations & Maintenance** | **Quick Rating - Structural** |
| 1064 | Marsh Ave | 0000 | 0000 |
| 1065 | Marsh Ave | 0000 | 0000 |
| 1066 | Marsh Ave | 0000 | 0000 |
| 1068 | Marsh Ave | 0000 | 0000 |
| 1069 | Marsh Ave | 0000 | 0000 |
| 1070 | Marsh Ave | 0000 | 0000 |
| 1125 | 10963 52nd Ave | 0000 | 0000 |
| 1131 | 11266 Whispering Creek Dr | 0000 | 0000 |
| 1132 | 4616 Ottawa Creek Dr | 0000 | 0000 |
| 1133 | 11367 Whispering Creek Dr | 0000 | 0000 |
| 1144 | 4310 Rich St | 0000 | 0000 |
| 1178 | 5150 Lake Michigan Dr | 0000 | 0000 |
| 1179 | 6370 Lake Michigan Dr | 0000 | 0000 |
| 1411 | 10581 Learning Ln | 0000 | 0000 |
| 1512 | 10603 Learning Ln | 0000 | 0000 |
| 1513 | Timberline Dr | 0000 | 0000 |
| 1521 | 10805 Timberline Dr | 0000 | 0000 |
| 1522 | 10808 Timberline Dr | 0000 | 0000 |
| 1523 | 10809 Timberline Dr | 0000 | 0000 |
| 1620 | 10815 Timberline Dr | 0000 | 0000 |
| 1720 | 10819 Timberline Dr | 0000 | 0000 |
| 1721 | 10825 Timberline Dr | 0000 | 0000 |
| 1722 | 10828 Timberline Dr | 0000 | 0000 |
| 1723 | 10601 White Birch Dr | 0000 | 0000 |
| 1724 | 10633 White Birch Dr | 0000 | 0000 |
| 1820 | 10829 Timberline Dr | 0000 | 0000 |
| 1821 | 10807 Timberline Dr | 0000 | 0000 |
| 2000 | 10931 Waterpoint Dr | 0000 | 0000 |
| 2063 | 10926 64th Ave | 0000 | 0000 |
| 2064 | 10928 64th Ave | 0000 | 0000 |
| 2065 | 10899 Constant Dr | 0000 | 0000 |
| 2313 | 7280 Lake Michigan Dr | 0000 | 0000 |
| 2314 | 7280 Lake Michigan Dr | 0000 | 0000 |

| Table C-3: Manhole Assessment Grades | | | |
|---|---|---|---|
| **Manhole ID** | **Address** | **Quick Rating - Operations & Maintenance** | **Quick Rating - Structural** |
| 2315 | 7409 Lake Michigan Dr | 0000 | 0000 |
| 2316 | 7347 Lake Michigan Dr | 0000 | 0000 |
| 2317 | 7273 Lake Michigan Dr | 0000 | 0000 |
| 2344 | 6660 Lake Michigan Dr | 0000 | 0000 |
| 2348 | 6600 Lake Michigan Dr | 0000 | 0000 |
| 2349 | 6550 Lake Michigan Dr | 0000 | 0000 |
| 2351 | 6448 Lake Michigan Dr | 0000 | 0000 |
| 2362 | 6394 Lake Michigan Dr | 0000 | 0000 |
| 2363 | 6306 Lake Michigan Dr | 0000 | 0000 |
| 2365 | 6218 Lake Michigan Dr | 0000 | 0000 |
| 2369 | 6098 Lake Michigan Dr | 0000 | 0000 |
| 2416 | 7168 Barn Owl Ln | 0000 | 0000 |
| 2492 | 5677 Lake Michigan Dr | 0000 | 0000 |
| 2495 | 5680 Lake Michigan Dr | 0000 | 0000 |
| 2771 | 11475 60th Ave | 0000 | 0000 |
| 2772 | 11525 60th Ave | 0000 | 0000 |
| 2980 | 11531 Wilmington Dr | 0000 | 0000 |
| 2982 | 11637 60th Ave | 0000 | 0000 |
| 2983 | 11571 60th Ave | 0000 | 0000 |
| 3080 | 11705 60th Ave | 0000 | 0000 |
| 3082 | 11727 60th Ave | 0000 | 0000 |
| 3083 | 11714 60th Ave | 0000 | 0000 |
| 3181 | 11777 60th Ave | 0000 | 0000 |
| 3536 | Copper Beech Townhomes | 0000 | 0000 |
| 3537 | Copper Beech Townhomes | 0000 | 0000 |
| 3621 | 10431 52nd Ave | 0000 | 0000 |
| 3721 | 10517 52nd Ave | 0000 | 0000 |
| 3820 | 5202 Windfield Dr | 0000 | 0000 |
| 3920 | 10621 52nd Ave | 0000 | 0000 |
| 3921 | 10657 52nd Ave | 0000 | 0000 |
| 4120 | 10781 52nd Ave | 0000 | 0000 |
| 4220 | 10855 52nd Ave | 0000 | 0000 |
| 4222 | Southtown Dr | 0000 | 0000 |

| Table C-3: Manhole Assessment Grades | | | |
|---|---|---|---|
| **Manhole ID** | **Address** | **Quick Rating - Operations & Maintenance** | **Quick Rating - Structural** |
| 4320 | 10913 52nd Ave | 0000 | 0000 |
| 4322 | 5176 Circlewood Ln | 0000 | 0000 |
| 4326 | 5176 Circlewood Ln | 0000 | 0000 |
| 4327 | 10924 Woodedge Dr | 0000 | 0000 |
| 4328 | Northside Dr | 0000 | 0000 |
| 4329 | Northside Dr | 0000 | 0000 |
| 4330 | Northside Dr | 0000 | 0000 |
| 4331 | Northside Dr | 0000 | 0000 |
| 4332 | Northside Dr | 0000 | 0000 |
| 4333 | Northside Dr | 0000 | 0000 |
| 4334 | Northside Dr | 0000 | 0000 |
| 4423 | 5188 Jordan St | 0000 | 0000 |
| 4427 | 5193 Woodedge Ct | 0000 | 0000 |
| 4602 | 5500 Lake Michigan Dr | 0000 | 0000 |
| 4744 | Boltwood Apartments | 0000 | 0000 |
| 4745 | Boltwood Apartments | 0000 | 0000 |
| 4746 | 11253 Whispering Creek Dr | 0000 | 0000 |
| 4748 | 11277 Whispering Creek Dr | 0000 | 0000 |
| 4800 | 11307 56th Ave | 0000 | 0000 |
| 4801 | 11363 56th Ave | 0000 | 0000 |
| 4802 | 11417 56th Ave | 0000 | 0000 |
| 4849 | 4689 Lake Michigan Dr | 0000 | 0000 |
| 4851 | 4614 Ottawa Creek Dr | 0000 | 0000 |
| 4853 | 4687 Ottawa Creek Dr | 0000 | 0000 |
| 5060 | 4310 Rich St | 0000 | 0000 |
| 5284 | 11654 40th Ave | 0000 | 0000 |
| 5285 | 11717 40th Ave | 0000 | 0000 |
| 5286 | 11773 40th Ave | 0000 | 0000 |
| 5287 | 11773 40th Ave | 0000 | 0000 |
| 9000 | 10815 Timberline Dr | 0000 | 0000 |
| 9509 | 4999 Allenpark Dr | 0000 | 0000 |
| 9510 | 4923 Allenpark Dr | 0000 | 0000 |
| 9511 | 4923 Allenpark Dr | 0000 | 0000 |

| Table C-3: Manhole Assessment Grades | | | |
|---|---|---|---|
| **Manhole ID** | **Address** | **Quick Rating - Operations & Maintenance** | **Quick Rating - Structural** |
| 9512 | 4898 Rich St | 0000 | 0000 |
| 1009 | 7588 Lake Michigan Dr | 0000 | 0000 |
| 1052 | Hawkin St | 0000 | 0000 |
| 1053 | Hawkin St | 0000 | 0000 |
| 1054 | Hawkin St | 0000 | 0000 |
| 1055 | Hawkin St | 0000 | 0000 |
| 1057 | Hawkin St | 0000 | 0000 |
| 1058 | Marsh Ave | 0000 | 0000 |
| 1059 | Marsh Ave | 0000 | 0000 |
| 1060 | Marsh Ave | 0000 | 0000 |
| 1061 | Marsh Ave | 0000 | 0000 |
| 1062 | Marsh Ave | 0000 | 0000 |
| 1063 | Marsh Ave | 0000 | 0000 |
| 1072 | 7680 Lake Michigan Dr | 0000 | 0000 |
| 1075 | 7634 Lake Michigan Dr | 0000 | 0000 |
| 1127 | 11149 54th Ave | 0000 | 0000 |
| 1128 | 11301 Commerce Rd | 0000 | 0000 |
| 1129 | 11301 Commerce Rd | 0000 | 0000 |
| 1410 | 10582 Learning Ln | 0000 | 0000 |
| 1511 | 10581 Learning Ln | 0000 | 0000 |
| 1969 | 6202 Timber Dr | 0000 | 0000 |
| 2246 | 6676 Lake Michigan Dr | 0000 | 0000 |
| 2252 | 6342 Henry St | 0000 | 0000 |
| 2253 | 6322 Henry St | 0000 | 0000 |
| 2254 | 6308 Henry St | 0000 | 0000 |
| 2255 | 6301 Henry St | 0000 | 0000 |
| 2302 | 7738 Lake Michigan Dr | 0000 | 0000 |
| 2303 | 7588 Lake Michigan Dr | 0000 | 0000 |
| 2304 | 11127 Waterpoint Dr | 0000 | 0000 |
| 2346 | 6652 Lake Michigan Dr | 0000 | 0000 |
| 2347 | 6656 Lake Michigan Dr | 0000 | 0000 |
| 2366 | 6154 Lake Michigan Dr | 0000 | 0000 |
| 2367 | 6164 Lake Michigan Dr | 0000 | 0000 |

| Table C-3: Manhole Assessment Grades | | | |
|---|---|---|---|
| **Manhole ID** | **Address** | **Quick Rating - Operations & Maintenance** | **Quick Rating - Structural** |
| 2383 | 5824 Lake Michigan Dr | 0000 | 0000 |
| 2384 | 5768 Lake Michigan Dr | 0000 | 0000 |
| 4501 | 5564 Eric St | 0000 | 0000 |
| 4502 | 5560 Eric St | 0000 | 0000 |
| 4614 | 5350 Lake Michigan Dr | 0000 | 0000 |
| 4616 | 5316 Lake Michigan Dr | 0000 | 0000 |
| 4617 | 5270 Lake Michigan Dr | 0000 | 0000 |
| 4621 | 5088 Lake Michigan Dr | 0000 | 0000 |
| 4629 | 5128 Lake Michigan Dr | 0000 | 0000 |
| 4702 | 11225 Commerce Rd | 0000 | 0000 |
| 4703 | 11277 Commerce Rd | 0000 | 0000 |
| 4704 | 11297 Commerce Rd | 0000 | 0000 |
| 4706 | 11329 Commerce Rd | 0000 | 0000 |
| 4707 | 5405 Auto Ct | 0000 | 0000 |
| 4810 | Edgewater Dr | 0000 | 0000 |
| 4811 | 11327 Edgewater Dr | 0000 | 0000 |
| 4812 | 11008 54th Ave | 0000 | 0000 |
| 4813 | 5349 Edgewater Dr | 0000 | 0000 |
| 4814 | 5200 Edgewater Dr | 0000 | 0000 |
| 4830 | 4926 Becker Dr | 0000 | 0000 |
| 4832 | Becker Dr | 0000 | 0000 |
| 4835 | Becker Dr | 0000 | 0000 |
| 4837 | 11299 University Pkwy | 0000 | 0000 |
| 4838 | 11287 University Pkwy | 0000 | 0000 |
| 4839 | 11295 University Pkwy | 0000 | 0000 |
| 4840 | 4878 Becker Dr | 0000 | 0000 |
| 4843 | 4857 Becker Dr | 0000 | 0000 |
| 4910 | 11291 54th Ave | 0000 | 0000 |
| 5010 | 11671 54th Ave | 0000 | 0000 |
| 5012 | 5405 Edgeway Dr | 0000 | 0000 |
| 5013 | 5307 Edgeway Dr | 0000 | 0000 |
| 5014 | 5201 Edgeway Dr | 0000 | 0000 |
| 5015 | 11547 53rd Ave | 0000 | 0000 |

| Table C-3: Manhole Assessment Grades | | | |
|---|---|---|---|
| **Manhole ID** | **Address** | **Quick Rating - Operations & Maintenance** | **Quick Rating - Structural** |
| 5016 | 11523 53rd Ave | 0000 | 0000 |
| 5017 | 11550 53rd Ave | 0000 | 0000 |
| 5018 | 11550 53rd Ave | 0000 | 0000 |
| 5019 | 5224 Rich St | 0000 | 0000 |
| 9002 | 7050 Pinevalley Dr | 0000 | 0000 |
| 9003 | 11018 Creekside Dr | 0000 | 0000 |
| 3731 | Hillcrest Town Houses | 0000 | 0000 |
| 9602 | 10691 Poppy Ln | 0000 | 0000 |
| 9603 | 10687 Poppy Ln | 0000 | 0000 |
| 9514 | Meadows Xing | 0000 | 0000 |
| 9604 | Poppy Ln | 0000 | 0000 |
| 9605 | 10776 78th Ave | 0000 | 0000 |
| 9606 | 10774 78th Ave | 0000 | 0000 |
| 9607 | Winnie Ln | 0000 | 0000 |
| 9608 | Winnie Ln | 0000 | 0000 |
| 9609 | Winnie Ln | 0000 | 0000 |
| 9610 | Winnie Ln | 0000 | 0000 |
| 9611 | 10520 52nd Ave | 0000 | 0000 |
| 9612 | 10498 52nd Ave | 0000 | 0000 |
| 9613 | 10520 52nd Ave | 0000 | 0000 |
| 9614 | 10520 52nd Ave | 0000 | 0000 |
| 9615 | 10520 52nd Ave | 0000 | 0000 |
| 9616 | 5075 Pierce St | 0000 | 0000 |
| 9617 | Marsh Ave | 0000 | 0000 |
| 9618 | Marsh Ave | 0000 | 0000 |
| 9619 | Marsh Ave | 0000 | 0000 |
| 9516 | 10498 52nd Ave | 0000 | 0000 |
| 9520 | 11547 53rd Ave | 0000 | 0000 |

**APPENDIX D – Pipeline Televising Report**

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Figure D-3a: Sanitary Sewer Structural Defects – West
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Figure D-4a: Sanitary Sewer Sags (Structural) Defects – West
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Figure D-5a: Sanitary Sewer Infiltration & Inflow Defects – West
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CCTV Photo Log
CCTV Summary Table

## BACKGROUND

Closed circuit television inspection (CCTV) is a process used to inspect storm and sanitary sewer pipe. CCTV inspections allow for visual inspection of pipes where the diameters are not large enough to allow for safe access. CCTV inspection is used to locate structural and operational (O&M) defects, evidence of Inflow & Infiltration (I&I), service laterals, obstructions such as roots, grease, debris, cross-bores, and identify pipe size and material.

The CCTV process involves placing a pan and tilt video camera into a sewer pipe at the manhole connection. The camera sits on a robotic vehicle referred to as a crawler. An operator is able to control the camera and crawler from a control center typically located inside the CCTV truck. As the camera moves through the pipe it records the distance traveled and sends back a video feed to the operator. The operator is able to record the video feed and produce a televising inspection for review.

As the operator controls the camera, they will also record each defect encountered in the pipe. Each defect is coded using the National Association of Sewer Service Companies (NASSCO) pipe assessment certification program. The NASSCO PACP identification and assessment is the industry standard used to provide consistent identification and assessment data.

## METHOD

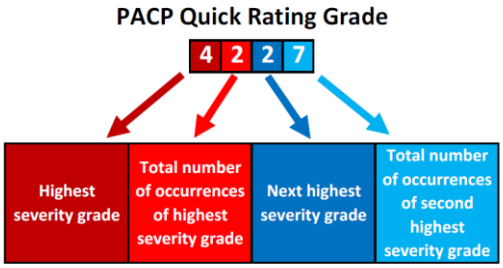
Fleis & VandenBrink (F&V) subcontracted with Plummer's Environmental Services to perform the CCTV inspection field work. Once the video field work was completed, the information was forwarded to F&V. F&V performed a quick review of the information looking for major issues, areas of grease concentration and location of possible I&I.

F&V used the NASSCO PACP identification system to assess the condition of each pipe and identify possible I&I locations. Each defect is categorized as structural or O&M. Structural defects are where the pipe has been physically damaged or otherwise defective. O&M defects describe various types of foreign objects located in the pipe interfering with the operation of the system, thus reducing reliable service to customers. I&I and grease defects are categorized under O&M as they are more of an operational concern than structural.

Structural defects were categorized into one of eleven categories and assigned a score of 5 to 1 as determined by PACP assessment guidelines. A structural defect of 5 is the most severe. A level of 5 indicates the pipe has failed or will fail soon and immediate attention is required. A score of 4 indicates the pipe is in poor shape and will become a 5 in the future. A score of 3 is fair and 2 is good. A score of 1 or 0 indicates the pipe is in excellent condition.

O&M defects were categorized into one of 9 obstruction concerns and evidence of I&I and assigned a level of 5 to 1. An O&M score of 5 indicates a severe obstruction which has or will completely stop the flow and cause a backup. A score of 4 indicates a significant obstruction which will soon become a 5. A score of 3 indicates a cause for concern but has yet to create an issue. A score of 2 or 1 is worth noting but is not of any great concern.

All of the defects are combined into a quick rating grade for the pipe. Quick rating grades provide an overall summary of the pipe grade.



I&I defects are coded as infiltration or encrustations and rated 5 to 1 as determined by PACP. Infiltration is coded when ground water is seen entering the pipe. Encrustations are coded when mineral deposits are seen on the videos.

Grease defects are coded and assigned a score of 5 to 1 based on the percent of pipe area the grease occupies.

The CCTV pipe inspection data is analyzed by Innovyze Infomaster; a complete ArcGIS based asset integrity management and capital planning software. Infomaster uses a tree matrix of the available information reviewing the likelihood of failure and consequence of failure to calculate the total risk.

Infomaster is able to use the CCTV quick rating grades to create a GIS based map and assign a level to each pipe based on the most extreme grade rating encountered.

Once Infomaster calculates the total risk, each pipe is analyzed for the best rehabilitation or repair option and several budget scenarios are calculated. Each budget scenario is reviewed and a prioritized Capital Improvement Plan report is generated.

## RESULTS

### Sanitary Sewer System

620 sections of pipe were inspected totaling 187,006 feet. A summary of the information is shown in Table 1.

| Score | Number of O/M defects | Number of Structural Defects |
|---|---|---|
| 5 | 2 | 10 |
| 4 | 13 | 43 |
| 3 | 53 | 68 |
| 2 | 889 | 1194 |
| 1 | 12 | 304 |

*Table 1: Summary of Sanitary Sewer Defects*

1. Pipe 3960 – 3961A located on Pierce Dr. This pipe has nine (9) locations of various degrees of encrustation.
2. Pipe 4060 – 4061 located on Campus Dr. This pipe has 34 locations of infiltration and will need attention in the short term.
3. Pipe 2342 – 2341 located on Lake Michigan Dr. This pipe has three (3) locations (11.7 ft, 54.9 ft, and 63.1 ft) downstream of MH2342 with structural deformations that will need attention in the short term.
4. Pipe 172 – 176 located on Copper Beach. This pipe has 15 locations of sag which cannot be rehabilitated and do not require immediate attention.
5. Pipe 2 – 1 located on Lubbers Stadium Dr. This pipe has seven (7) locations of root intrusion which can be cut yearly to prevent back-ups.
6. Pipe 4461 – 4460 located on Campus Dr. This pipe has a fracture 125 feet downstream of MH4461 and can be rehabilitated with a point repair or replacement.
7. Pipe 2038 – 2039 located on 68$^{th}$ Ave. This pipe has various grease deposits at 252 feet, 259 feet, and 341 feet downstream of MH2038 which can be removed with heavy sewer cleaning.

Attachments D-1 to D-8 highlight locations of various structural and O/M defects throughout the sanitary collection system.

### Infiltration & Inflow

247 noted cases of direct infiltration were noted in the CCTV videos. 1 was assigned a level of 5, 11 were assigned a level of 4, 165 were assigned a level of 3, 17 were assigned a score of 2, and 53 were assigned a level of 1. I&I locations are highlighted in Attachment D-5a and D-5b.

### Grease

There are 2 noted cases of grease in the pipes. In each case the defect was observed to be less than 10% of the pipe capacity and was assigned a score of 2. Grease locations are highlighted in Attachment D-7.

**Allendale Charter Township**
**Sanitary Sewer Network**
**Structural Defects**

- No Structural Defects
- Level 1 Structural Defects
- Level 2 Structural Defects
- Level 3 Structural Defects
- Level 4 Structural Defects
- Level 5 Structural Defects
- Force Main
- No CCTV

FLEIS&VANDENBRINK
DESIGN. BUILD. OPERATE.

# Sanitary Sewer AMP
# Structural PACP Scores

Allendale Charter Township, Michigan

| DRAWN BY | DATE |
|---|---|
| BSR | 9/5/2018 |
| PROJECT NO. | SCALE |
| 814975 | 1:25,000 |
| FILE LOCATION | |
| SOURCES | |

NORTH
0 1,000 2,000
SCALE IN FEET

FIGURE
D-1

**Allendale Charter Township**
**Sanitary Sewer Network**
**O&M Defects**

- No O&M Defects
- Level 1 O&M Defects
- Level 2 O&M Defects
- Level 3 O&M Defects
- Level 4 O&M Defects
- Level 5 O&M Defects
- Force Main
- No CCTV

FLEIS&VANDENBRINK
DESIGN. BUILD. OPERATE.

# Sanitary Sewer AMP O&M PACP Scores

Allendale Charter Township, Michigan

| DRAWN BY | DATE |
|---|---|
| BSR | 9/5/2018 |
| PROJECT NO. | SCALE |
| 814975 | 1:25,000 |
| FILE LOCATION | |
| SOURCES | |

NORTH

0 1,000 2,000

SCALE IN FEET

FIGURE

D-2

# Allendale Charter Township Sanitary Sewer Network

- Deformed - 5
- Deformed - 4
- Broken - 5
- Broken - 3
- Hole - 5
- Fracture - 3
- Fracture - 2
- Crack - 3
- Crack - 3 (Continuous)
- Crack - 2
- Crack - 1
- Defective Joint - 2
- Defective Joint - 1
- Defective Joint - 1 (Continuous)

Buchanan
Pingree
Almari
Bent Tree
Lake Michigan
Waterway
Island
Stepping Stone
Waterline
Watermark
Waterview
Bittersweet
Timber Creek
Pinevalley
Pine Creek
Skyway
Skyline
Creekside
Joal
Aspen
Pine Grove
Sunset
Learning
Timberline
Maplebrook
Mapleview
Black Cherry
White Birch
North
Cardinal
Blue Jay
Red Hawk
Barn Owl
Valley View
Brown
Scott
Sheridan
Avery
Washington
Kingsbury
Andrews
Comfort
Balcom
Dales
Essex
Nottoli
Bridgeton
Wilmington
Brookland
Frostline
Hunters Meadow
Pebble
Ripple
Crystal
Village
Dewpointe
Countryview
Henry
Mista
Burg
Gemmen
Martinie
Winans
Constant
Timber
Red Oak
Maple Bend
Pierce
Jane
Chinook
76th
72nd
64th
60th
74th
78th
84th
68th

CC - 1
CM - 3
USL - 2
D - 5
FL - 2
FL - 3
FC - 2
CL - 2
JSM - 1
JDM - 1
B - 5
BSV - 5
LS

Sanitary Sewer Structural Defects (WEST)

Allendale Charter Township, Michigan

| DRAWN BY | DATE |
|---|---|
| BSR | 10/16/2018 |
| PROJECT NO. | SCALE |
| 814975 | 1:13,500 |
| FILE LOCATION | |
| SOURCES | |

NORTH
0 560 1,120
SCALE IN FEET

FIGURE
D-3A

FLEIS&VANDENBRINK
DESIGN. BUILD. OPERATE.

# Allendale Charter Township Sanitary Sewer Network

- Deformed - 5
- Deformed - 4
- Broken - 5
- Broken - 3
- Hole - 5
- Fracture - 3
- Fracture - 2
- Crack - 3
- Crack - 3 (Continuous)
- Crack - 2
- Crack - 1
- Defective Joint - 2
- Defective Joint - 1
- Defective Joint - 1 (Continuous)

FLEIS&VANDENBRINK
DESIGN. BUILD. OPERATE.

Sanitary Sewer Structural Defects (EAST)

Allendale Charter Township, Michigan

| DRAWN BY | DATE |
|---|---|
| BSR | 10/16/2018 |
| PROJECT NO. | SCALE |
| 814975 | 1:13,500 |
| FILE LOCATION | |
| SOURCES | |

NORTH
0 560 1,120
SCALE IN FEET

FIGURE
D-3B

Buchanan
Pingree
Almari
Bent Tree
Lake Michigan
Learning
Pierce
Maplebrook
Mapleview
Stepping Stone
Red Oak
Countryview
Henry
Mista
Martinie
Winans
Timber
Burg
Cemmen
Maple Bend
Crawford Ave
Kingsbury
Andrews
Comfort
Balcom
Dales
Essex
Norfolk
Bridgeton
Wilmington
Brookland
Frostline
Hunters Meadow
Pebble
Ripple
Crystal
Village
Dewpointe
Washington
Cardinal
Brown
Sheridan
Scott
Avery
Valley View
Blue Jay
Red Hawk
Barn Owl
Waterway
Island
Waterline
Watermark
Waterview
Bittersweet
Timber Creek
Pinevalley
Pine Grove
Sunset
Aspen
Skyline
Joal
Creekside
Pine
Creek
Skyway
Black Cherry
White Birch
North
Timberline
84th
78th
74th
68th
72nd
76th
64th
60th
Jenner
Quinnock

## Allendale Charter Township Sanitary Sewer Network

- Water Level Sag - 4
- Water Level Sag - 3
- Water Level Sag - 3 (Continuous)
- Water level Sag - 2
- Water Level Sag - 2 (Continuous)

FLEIS&VANDENBRINK
DESIGN. BUILD. OPERATE.

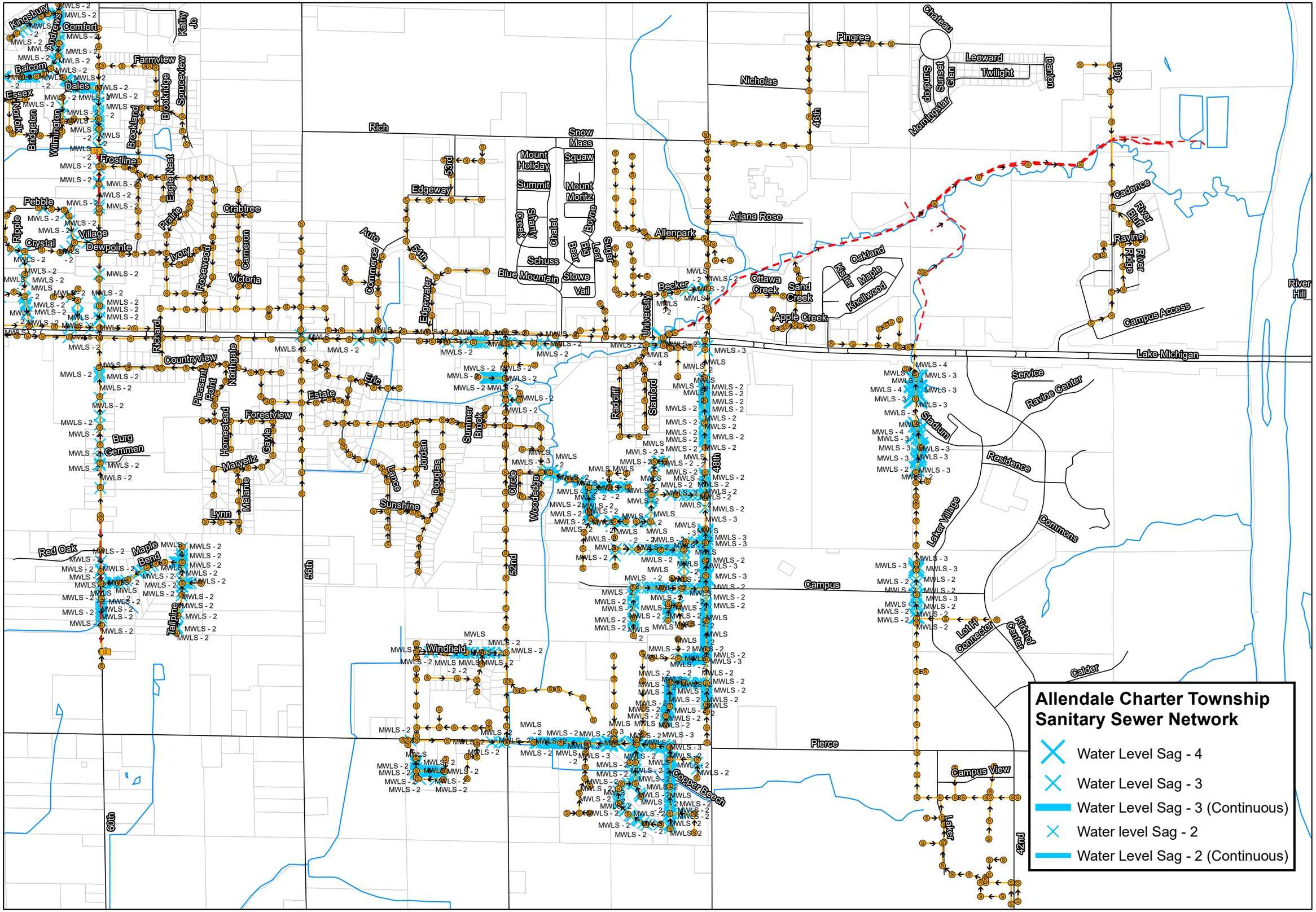
# Sanitary Sewer Sags (Structural) Defects (WEST)

Allendale Charter Township, Michigan

| DRAWN BY | DATE |
|---|---|
| BSR | 10/16/2018 |
| PROJECT NO. | SCALE |
| 814975 | 1:13,500 |
| FILE LOCATION | |
| SOURCES | |

NORTH
0 560 1,120
SCALE IN FEET

FIGURE
D-4A




# Allendale Charter Township Sanitary Sewer Network

- Water Level Sag - 4
- Water Level Sag - 3
- Water Level Sag - 3 (Continuous)
- Water level Sag - 2
- Water Level Sag - 2 (Continuous)

FLEIS&VANDENBRINK
DESIGN. BUILD. OPERATE.

Sanitary Sewer Sags (Structural) Defects (EAST)

Allendale Charter Township, Michigan

| DRAWN BY | DATE |
|---|---|
| BSR | 10/16/2018 |
| PROJECT NO. | SCALE |
| 814975 | 1:13,500 |
| FILE LOCATION | |
| SOURCES | |

NORTH
0 560 1,120
SCALE IN FEET

FIGURE
D-4B

Buchanan
Pingree
Almari
Bent Tree
84th
78th
74th
68th
64th
60th
Lake Michigan
Pierce
Learning
Stepping Stone
Red Oak
Kingsbury
Andrews
Comfort
Balcom
Dales
Essex
Wilmington
Bridgeton
Norfolk
Brookland
Frostline
Hunters Meadow
Pebble
Ripple
Crystal
Village
Dewpointe
Cardinal
Blue Jay
Red Hawk
Barn Owl
Valley View
Brown
Scott
Sheridan
Avery
Washington
Waterway
Island
Waterline
Watermark
Waterview
Bittersweet
Timber Creek
Pine Creek
Skyway
Skyline
Creekside
Joal
Aspen
Sunset
Pine Grove
Pinevalley
Timberline
Black Cherry
White Birch
North
Henry
Mista
Martinie
Winans
Constant
Timber
Burg
Gemmen
Countryview
Maple Bend
Maplebrook
Mapleview
Jane
Ohio
76th
72nd
DAE - 2
IS - 0
IR - 4
IG - 5
ID - 3
IW - 2

## Allendale Charter Township Sanitary Sewer Network

- Infiltration Gusher - 5
- Infiltration Runner - 4
- Infiltration Dripper - 3
- Infiltration Weeper - 2
- Infiltration Stains - 0
- Infiltration Stains - 0 (Continuous)
- Encrustation Deposits - 3
- Encrustation Deposits - 2
- Encrustation Deposits - 2 (Continuous)

FLEIS&VANDENBRINK
DESIGN. BUILD. OPERATE.

# Sanitary Sewer Infiltration & Inflow Defects (WEST)

Allendale Charter Township, Michigan

| DRAWN BY | DATE |
|---|---|
| BSR | 10/16/2018 |
| PROJECT NO. | SCALE |
| 814975 | 1:13,500 |
| FILE LOCATION | |
| SOURCES | |

NORTH
0 560 1,120
SCALE IN FEET

FIGURE
D-5A

FLEIS&VANDENBRINK
DESIGN. BUILD. OPERATE.

# Sanitary Sewer Infiltration & Inflow Defects (EAST)

Allendale Charter Township, Michigan

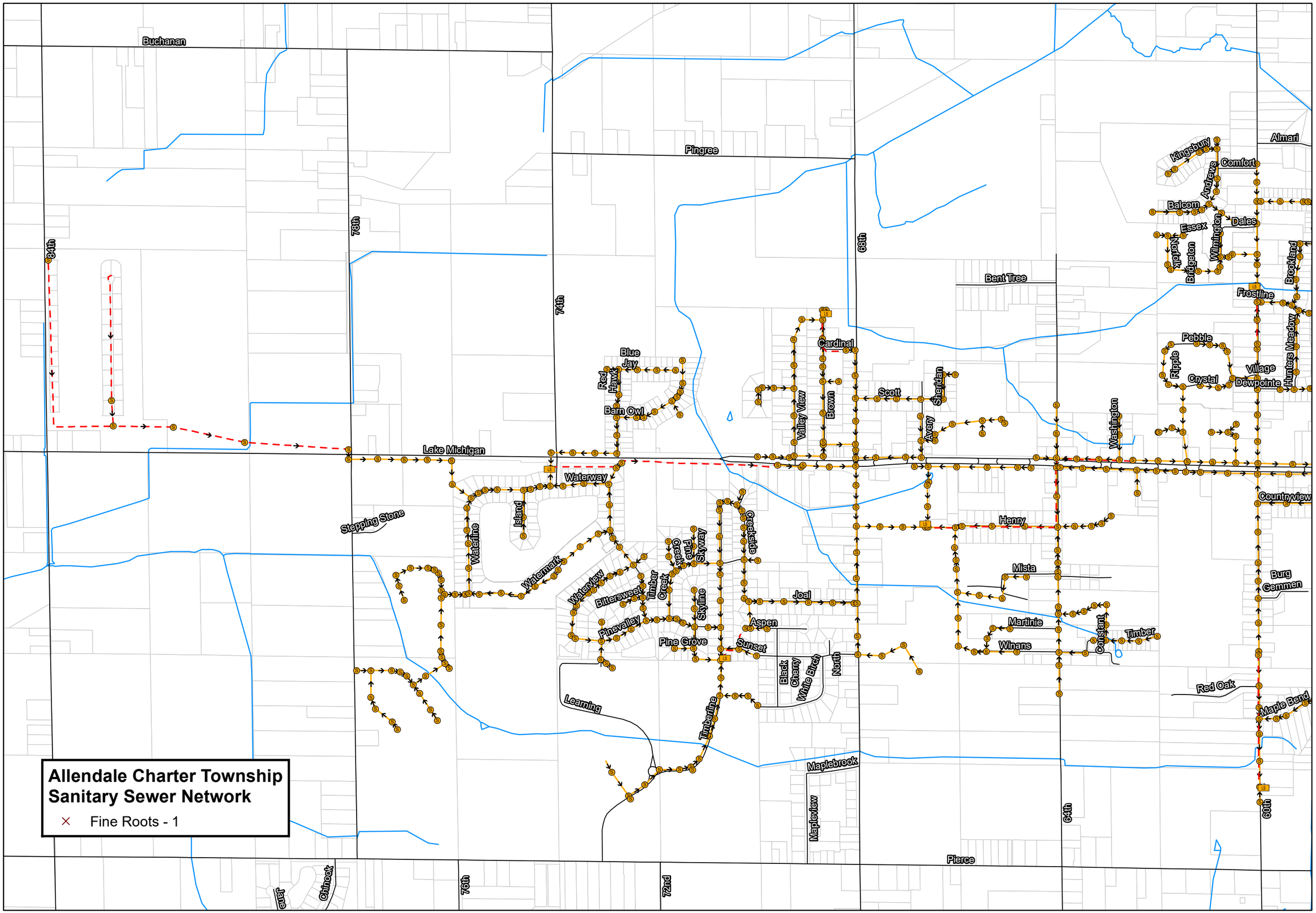
## Allendale Charter Township Sanitary Sewer Network

- Infiltration Gusher - 5
- Infiltration Runner - 4
- Infiltration Dripper - 3
- Infiltration Weeper - 2
- Infiltration Stains - 0
- Infiltration Stains - 0 (Continuous)
- Encrustation Deposits - 3
- Encrustation Deposits - 2
- Encrustation Deposits - 2 (Continuous)

| DRAWN BY | DATE |
|---|---|
| BSR | 10/16/2018 |
| PROJECT NO. | SCALE |
| 814975 | 1:13,500 |
| FILE LOCATION | |
| SOURCES | |

NORTH
0 560 1,120
SCALE IN FEET

FIGURE
D-5B




FLEIS&VANDENBRINK
DESIGN. BUILD. OPERATE.

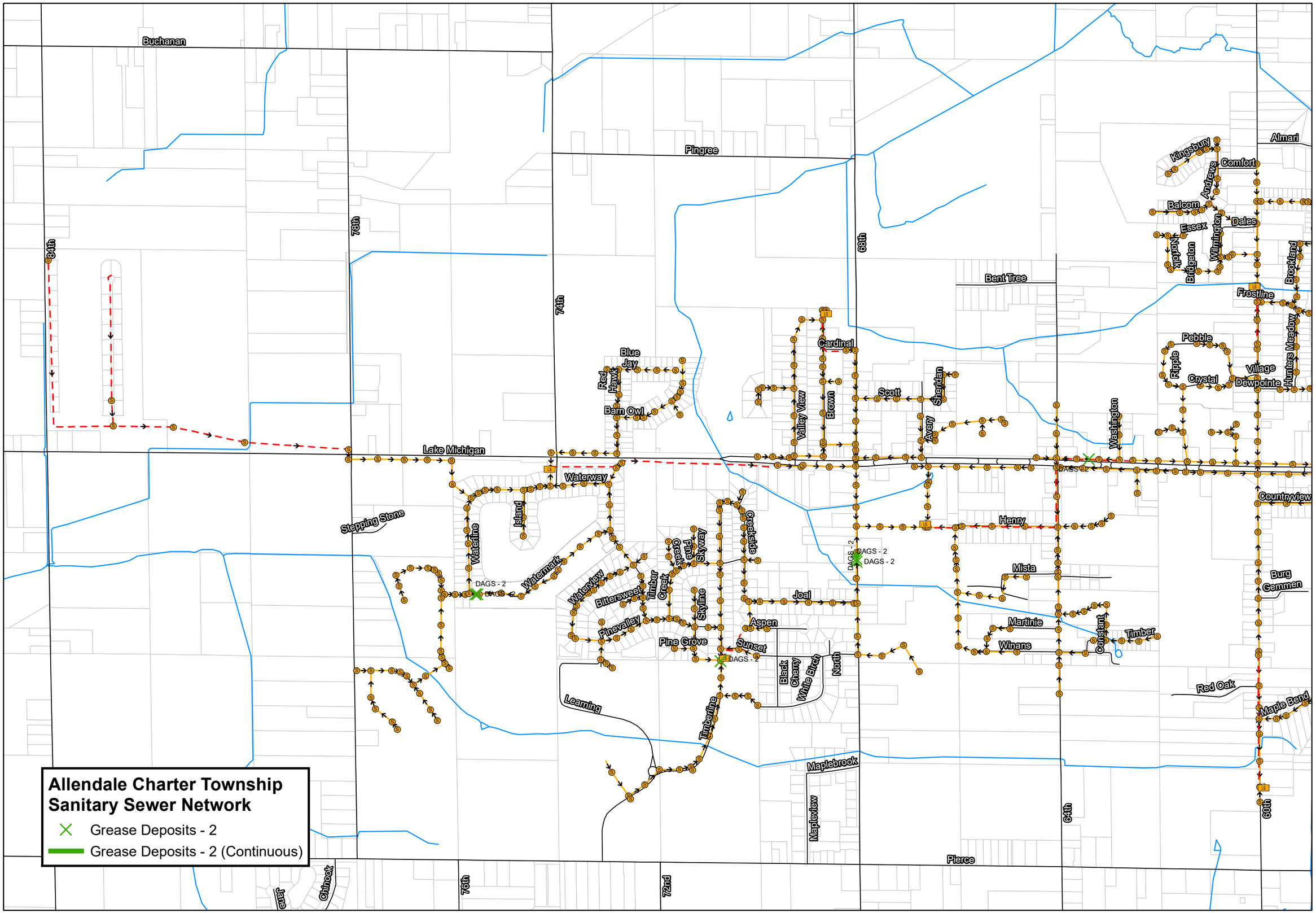
# Sanitary Sewer Roots Defects (WEST)

Allendale Charter Township, Michigan

| DRAWN BY | DATE |
|---|---|
| BSR | 10/16/2018 |
| PROJECT NO. | SCALE |
| 814975 | 1:13,500 |
| FILE LOCATION | |
| SOURCES | |

NORTH
0 560 1,120
SCALE IN FEET

FIGURE
D-6A




FLEIS&VANDENBRINK
DESIGN. BUILD. OPERATE.

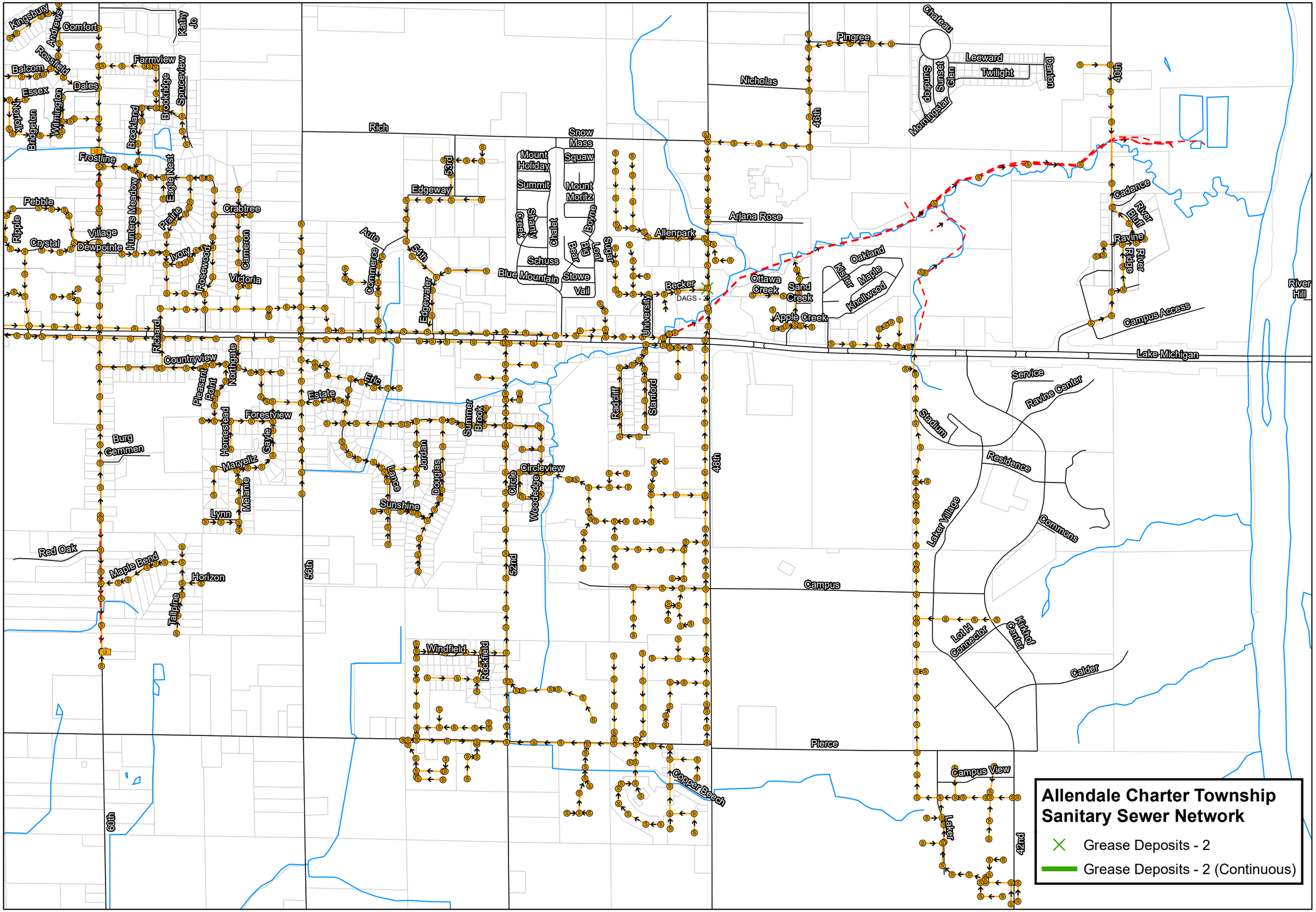
# Sanitary Sewer Grease Defects (WEST)

Allendale Charter Township, Michigan

| DRAWN BY | DATE |
|---|---|
| BSR | 10/16/2018 |
| PROJECT NO. | SCALE |
| 814975 | 1:13,500 |
| FILE LOCATION | |
| SOURCES | |

NORTH
0 560 1,120
SCALE IN FEET

FIGURE
D-7A




# Allendale Charter Township Sanitary Sewer Network

- Grease Deposits - 2
- Grease Deposits - 2 (Continuous)

NORTH

0 560 1,120

SCALE IN FEET

FLEIS&VANDENBRINK
DESIGN. BUILD. OPERATE.

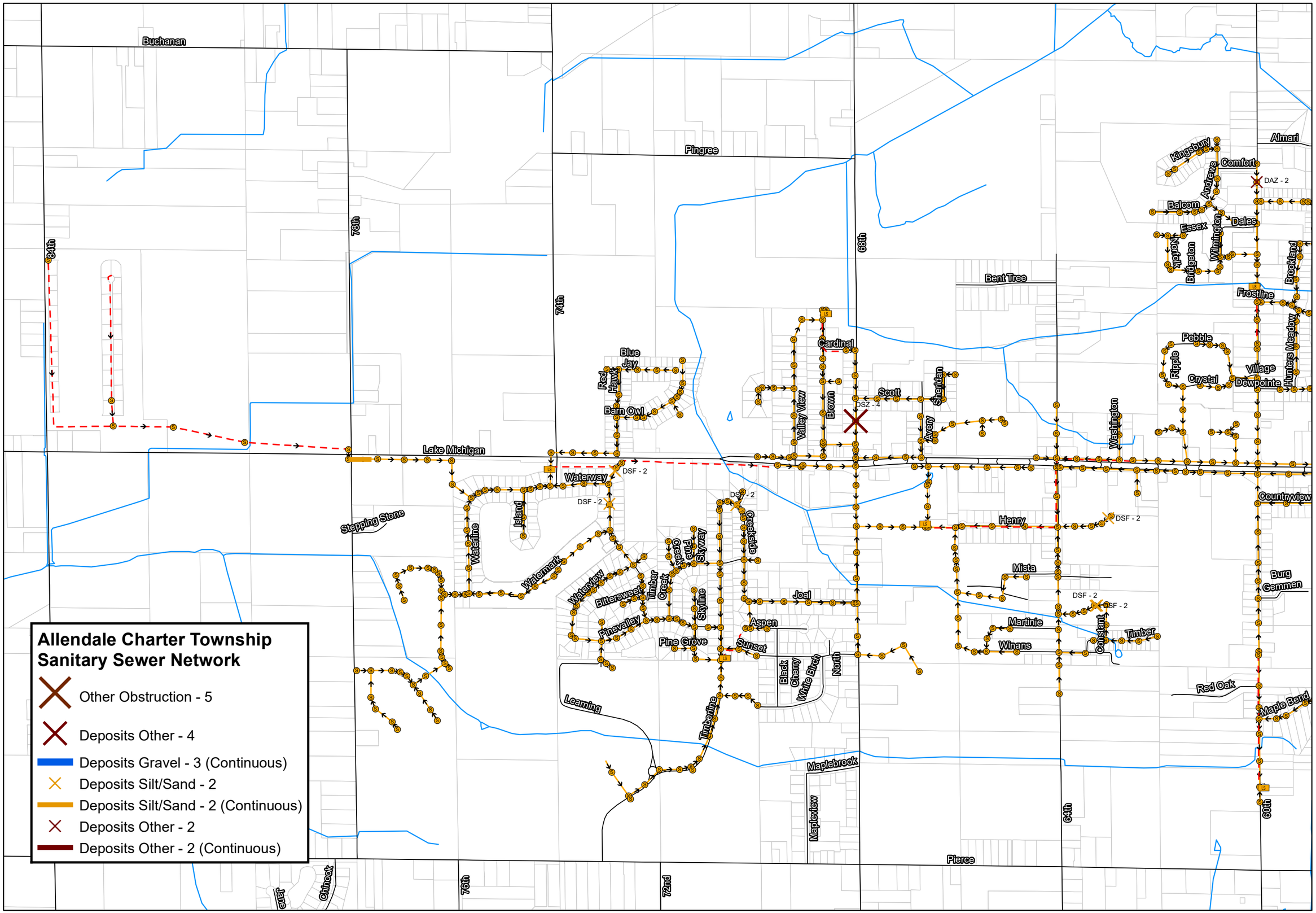
# Sanitary Sewer Grease Defects (EAST)

Allendale Charter Township, Michigan

| DRAWN BY | DATE |
|---|---|
| BSR | 10/16/2018 |
| PROJECT NO. | SCALE |
| 814975 | 1:13,500 |
| FILE LOCATION | |
| SOURCES | |

FIGURE

D-7B




## Allendale Charter Township Sanitary Sewer Network

- Other Obstruction - 5
- Deposits Other - 4
- Deposits Gravel - 3 (Continuous)
- Deposits Silt/Sand - 2
- Deposits Silt/Sand - 2 (Continuous)
- Deposits Other - 2
- Deposits Other - 2 (Continuous)

FLEIS&VANDENBRINK
DESIGN. BUILD. OPERATE.

# Sanitary Sewer Obstacles/Obstructions & Deposits Defects (WEST)

Allendale Charter Township, Michigan

| DRAWN BY | DATE |
|---|---|
| BSR | 10/16/2018 |
| PROJECT NO. | SCALE |
| 814975 | 1:13,500 |
| FILE LOCATION | |
| SOURCES | |

NORTH
0 560 1,120
SCALE IN FEET

FIGURE
D-8A

FLEIS&VANDENBRINK
DESIGN. BUILD. OPERATE.

# Sanitary Sewer Obstacles/Obstructions & Deposits Defects (EAST)

Allendale Charter Township, Michigan

| DRAWN BY | DATE |
|---|---|
| BSR | 10/16/2018 |
| PROJECT NO. | SCALE |
| 814975 | 1:13,500 |
| FILE LOCATION | |
| SOURCES | |

## Allendale Charter Township Sanitary Sewer Network

- Other Obstruction - 5
- Deposits Other - 4
- Deposits Gravel - 3 (Continuous)
- Deposits Silt/Sand - 2
- Deposits Silt/Sand - 2 (Continuous)
- Deposits Other - 2
- Deposits Other - 2 (Continuous)

NORTH

0 560 1,120

SCALE IN FEET

FIGURE D-8B

**Allendale Charter Township**

Photo Log of Typical Major Defects

Project #: 814970

**Photo Log**

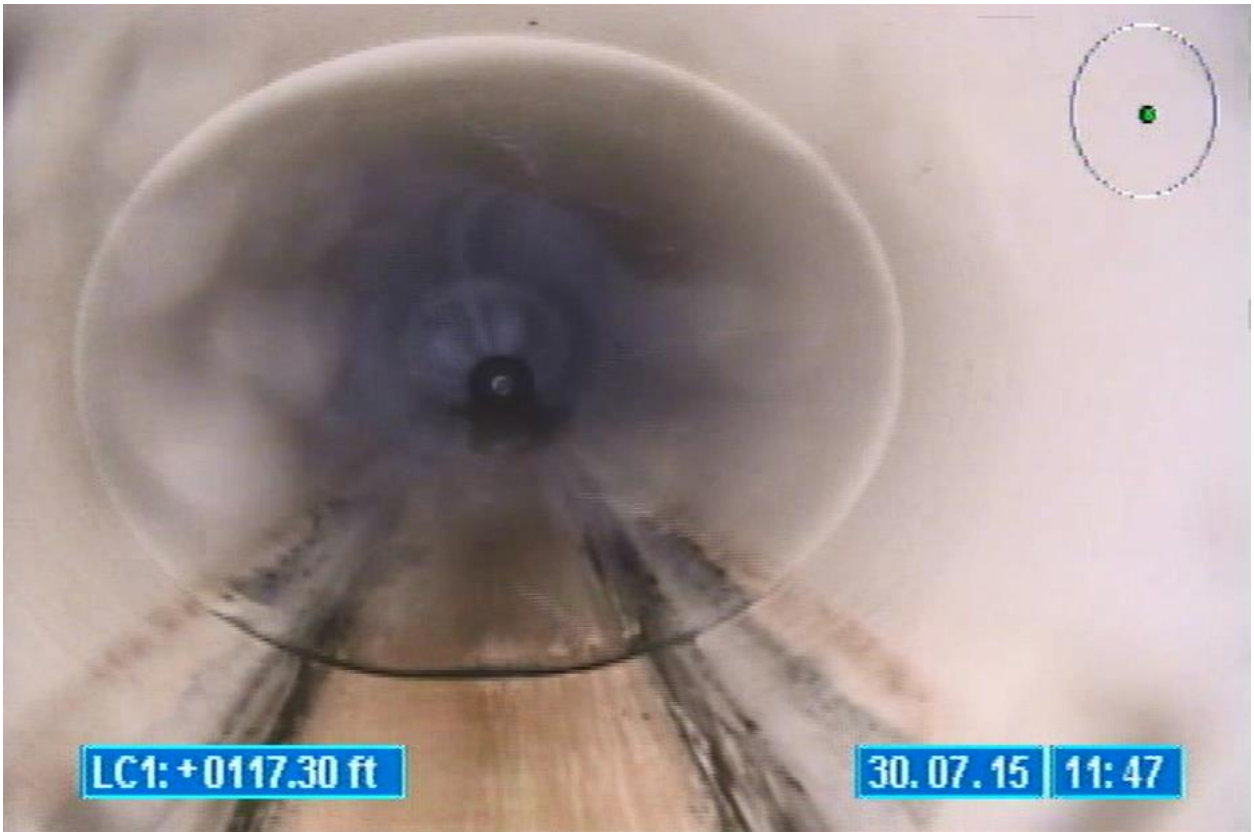



**Photo 1**: Shows a typical deformed pipe. Deformed pipes are created when multiple fractures have been created reducing the integrity of the pipe. If the deformation is not severe, it is possible to rehabilitate the pipe using a cured in place pipe liner. Otherwise, the pipe will need to be excavated and replaced. This picture is pipe 124 – 125, 117.5 feet downstream of MH124 on 64$^{th}$ Ave.




**Photo 2:** Shows a typical fracture in the pipe. Fractures reduce the integrity of the pipe and lead to deformations and collapses. When discovered early, fractures can be rehabilitated using point repair patches. This picture is pipe 4461 – 4460, 125 feet downstream of MH4461 on Campus Dr.

**Allendale Charter Township**

Photo Log of Typical Major Defects

Project #: 814970




**Photo 3:** Shows a typical break in the pipe. Breaks can reduce the integrity of the pipe and lead to holes. Breaks can be repaired with a point repair patch. This picture is pipe 398 – 388, 253.6 feet downstream of MH398 on 60th Ave.

**Allendale Charter Township**

Photo Log of Typical Major Defects

Project #: 814970




**Photo 4:** Shows a typical sag. Loss of soil support under the pipe causes sags. Sags will slow down the velocity of the flow cause solids to settle to the bottom. As solid accumulate the potential for clogs increases. Sags cannot be rehabilitated and must be excavated and the pipe replaced. Sags do not require immediate attention and should be replaced at the same time as the street. This picture is pipe 2 – 1, 30.4 feet downstream of MH2 on Lubbers Stadium Drive.




**Photo 5:** Shows a typical root intrusion at a joint. Roots will catch debris and eventually cause a back up. Roots can be cut from the main but they will need to be treated every year or they will grow back. A cured in place pipe will prevent roots from intruding in the pipe. This picture is pipe 2 – 1, 63.6 feet downstream of MH2 on Lubbers Stadium Drive.




**Photo 6:** Shows a typical encrustation at a pipe joint. Encrustations are typically mineral deposits left behind from ground water flowing into pipe. Ground water is clean water that enters the system and is treated by the plant. Ground water will reduce the capacity of the system and treatment plant and generates no revenue requiring system uses to pay the cost of treatment. Ground water infiltration can quickly be reduced by injecting the joints with ground to seal off the leaks. The picture is pipe 3960 – 3961A, 52.1 feet downstream of MH3960 on Pierce Drive.




**Photo 7:** Shows grease deposits on the pipe. Grease comes from homes or business and is typically dumped down the drain while still hot and in liquid form. As grease cools it turns into a solid and will stick to the outside of pipes. Grease can build up and catch debris leading to backups. Grease can removed using heavy sewer cleaning methods but preventing grease from entering the system is the best prevention. The picture is pipe 332 - T32, 223.2 feet downstream of MH332 of Learning Lane.




**Photo 8:** Shows a typical offset joint. Offset joints can catch debris leading to blockages. The best repair of offset joints is to excavate and replace the pipe sections. This picture is pipe 01A – 01, 102 feet downstream of MH01A on 68th Ave.




**Photo 9:** Shows hydrogen sulfide damage in the pipe. Hydrogen Sulfide is created when the oxygen in the wastewater is low or absent. When the hydrogen sulfide gas is released it into the air it is converted to sulfuric acid by bacteria. The sulfuric acid will begin to dissolve the concrete reducing the structural integrity of the pipe. Depending on the damages, the sewer pipe can be lined with a cured in place pipe of will need to be replaced. This picture is pipe 10 – 9, feet downstream of MH2 on Campus Drive.

Allendale Charter Township
Sanitary Sewer: Preliminary CCTV Data Results

| | | | | | | | | | | | Structural Score 5 | | | | | | | | O&M Score 5 | | | | | | | | | | Structural Score 4 | | | | | | | | O&M Score 4 | | | | | | | | | | | Structural 3 | | | | | | | | | | | O&M Score 3 | | | | | | | | | | Structural 2 | | | | | | | | | O&M Score 2 | | | | | | | | | | | Structural 1 | | | O&M Score 1 | | | | Structural 0 | | | | O&M 0 | Other Features | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Inspection ID | Pipe ID | Upstream MH | Downstream MH | Address | Diameter | Material | Surveyed Length | Video Link | PDF Link | Survey Abandoned | Collapse | Broken | Deformed >5% | Hole | Fracture | Crack | H2S Damage | Sag: >75% | Roots | Infiltration | Encrustation >30% | Grease >30% | Deposits >30% | Debris >30% | Intruding Object >30% | Intruding Tap >30% | Obstacle >30% | Dye Test | Broken | Deformed <5% | Hole | Fracture | Crack | H2S Damage | Defective Repair | Sag: >50%<=75% | Camera Underwater | Roots | Infiltration | Encrustation 20% < 30% | Grease 20% < 30% | Deposits 20% < 30% | Debris 20% < 30% | Intruding Object 20% < 30% | Intruding Tap 20% < 30% | Obstacle 20% < 30% | Alighment Shift >20% | Broken | Hole | Fracture | Crack | H2S Damage | Defective Repair | Defectective Tap | Brick Missing Mortar | Displaced Brick | Sag >30%<=50% | Weld Failure | Roots | Infiltration | Encrustation 10% < 20% | Grease 10% < 20% | Dye Test | Deposits 10% < 20% | Debris 10% < 20% | Intruding Object 10% < 20% | Intruding Tap 10% < 20% | Obstacle 10% < 20% | Fracture | Crack | H2S Damage | Sag >30% | Brick Missing Mortar | Defective Joint | Defective Tap | Lining Failure | Weld Failure | Roots | Infiltration | Encrustation < 10% | Grease < 10% | Deposits <10% | Debris < 10% | Intruding Object <10% | Intruding Tap <10% | Alignment Shift 10% < 20% | Obstacle <10% | Vermin | Crack | H2S Damage | Defective Joint | Roots | Infiltration | Vermin | Alignment Shift <10% | Buckling | H2S Damage | Defective Joint | Lining Failure | Roots | Manhole | Wet Well | Wet Well - Access Device | Catch Basin | Special Chamber | Junction Box | Discharge Point | End of Pipe | Repair | Sewer Change | Material Change | Size Change | Connection | Tap | Tap Abandoned | Tap Capped | Cleanout - Mainline | Cleanout - Property Line | Cleanout - House | Cleanout - Saddle | Wye | Double Wye | Connection | Tee Connection | Mainline | Fitting | Grout | Meter | Photo | Water level | Water Mark |
| 1 | P1982.1 D 1 | MH 9 | MH 10 | 60 th Ave | 8 | Polyvinyl Chloride | 405.5 | V | P | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 1 | | | | | | | | | | 6 | | | | | | | | | | | | | | | 1 | | | | | | | | | | | | | | | 6 |
| 2 | P1881.1 D 2 | MH 10 | MH 11 | 60 th Ave | 8 | Polyvinyl Chloride | 281.9 | V | P | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 6 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 5 |
| 3 | P1086 D 3 | MH 11 | MH 12 | 60 th Ave | 8 | Polyvinyl Chloride | 151.9 | V | P | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 1 | | | | | | | | | | 6 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 8 |
| 4 | P1781.1 D 4 | MH 12 | MH 12A | 60 th Ave | 8 | Polyvinyl Chloride | 200.2 | V | P | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 1 | | | | | | | | | | 6 | | | | | | | | | | | 1 | | | | 3 | | | | | | | | | | | | | | | 9 |
| 5 | P1780.1 D 5 | MH 12A | MH 13 | 60 th Ave | 8 | Polyvinyl Chloride | 351.4 | V | P | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 6 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 3 |
| 6 | P1087 D 6 | MH 13 | MH 14 | 60 th Ave | 8 | Polyvinyl Chloride | 341.4 | V | P | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 1 | | | | | | | | | | | | | | | | | | | | | | 6 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 7 |
| 7 | P1582 D 7 | MH 15 | MH 14 | 60 th Ave | 8 | Polyvinyl Chloride | 192 | V | P | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 6 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 5 |
| 8 | P1981.1 D 8 | MH 1 | MH 2 | 60 th Ave | 10 | Polyvinyl Chloride | 370.1 | V | P | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 6 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 4 |
| 9 | P2080.1 D 9 | MH 2 | MH 3 | 60 th Ave | 10 | Polyvinyl Chloride | 323.8 | V | P | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 5 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 7 |
| 10 | P9012 U 10 | MH 3A | MH 3 | 60 th Ave | 10 | Polyvinyl Chloride | 40.1 | V | P | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 5 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 7 |
| 11 | P2081.1 D 11 | MH 3 | MH 4 | 60 th Ave | 10 | Polyvinyl Chloride | 230.9 | V | P | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 1 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 6 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 7 |
| 12 | P2333.1 U 12 | MH 01A | MH 01 | 68 th Ave | 8 | Polyvinyl Chloride | 348.2 | V | P | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 1 | | | | | | | | | | | | | | | | | | | 2 | | | | | | | | | | 5 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 11 |
| 13 | P9016 U 13 | MH 01B | MH 01 | 68 th Ave | 8 | Polyvinyl Chloride | 38.1 | V | P | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 6 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 3 |
| 14 | P2340.1 U 14 | MH 01C | MH 01 | 68 th Ave | 8 | Polyvinyl Chloride | 210.9 | V | P | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 1 | | | | | | | | | | 6 | | | | | | | | | | 1 | | | | | | | | | | | | | | | | | | | | 9 |
| 15 | P2334.1 D 15 | MH 01 | MH 02 | 68 th Ave | 12 | Polyvinyl Chloride | 250.6 | V | P | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 6 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 3 |
| 16 | P2335.1 D 16 | MH 02 | MH 03 | 68 th Ave | 12 | Polyvinyl Chloride | 286.2 | V | P | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 6 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 8 |
| 17 | P2240.1 D 17 | MH 03 | MH 04 | 68 th Ave | 12 | Polyvinyl Chloride | 254.7 | V | P | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 1 | | | | | | | | | | 6 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 5 |
| 18 | P9014 U 18 | MH 09A | MH 09 | 68 th Ave | 8 | Polyvinyl Chloride | 29.8 | V | P | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 6 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 3 |
| 19 | P1842.1 U 19 | MH 09B | MH 09 | 68 th Ave | 8 | Polyvinyl Chloride | 316.2 | V | P | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 1 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 6 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 13 |
| 20 | P1841.1 D 20 | MH 09 | MH 08 | 68 th Ave | 10 | Polyvinyl Chloride | 239.8 | V | P | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 6 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 6 |
| 21 | P9015 U 21 | MH 08B | MH 08 | 68 th Ave | 8 | Polyvinyl Chloride | 38.5 | V | P | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 6 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 7 |
| 22 | P1840.1 D 22 | MH 08 | MH 07 | 68 th Ave | 10 | Polyvinyl Chloride | 437 | V | P | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 6 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 3 |
| 23 | P1175.1 U 23 | MH 07A | MH 07 | 68 th Ave | 8 | Polyvinyl Chloride | 39.6 | V | P | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 1 | | | | | | | | | | 6 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 6 |
| 24 | P2037.1 D 24 | MH 07 | MH 06 | 68 th Ave | 10 | Polyvinyl Chloride | 324.3 | V | P | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 1 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 6 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 7 |
| 25 | P2038.1 D 25 | MH 06 | MH 05 | 68 th Ave | 10 | Polyvinyl Chloride | 340.7 | V | P | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 6 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 6 |
| 26 | P2039.1 D 26 | MH 05 | MH 04 | 68 th Ave | 10 | Polyvinyl Chloride | 339 | V | P | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 6 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 9 |
| 27 | P2241.1 D 27 | MH 04 | MH 04A | 68 th Ave | 12 | Polyvinyl Chloride | 307.9 | V | P | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 6 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 8 |
| 28 | P2180.1 D 28 | MH 4 | MH 5 | 60 th Ave | 8 | Polyvinyl Chloride | 233.8 | V | P | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 1 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 6 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 4 |
| 29 | P2181.1 D 29 | MH 5 | MH 6 | 60 th Ave | 8 | Polyvinyl Chloride | 406.1 | V | P | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 6 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 6 |
| 30 | P9013 U 30 | MH 6A | MH 6 | 60 th Ave | 8 | Polyvinyl Chloride | 40 | V | P | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 5 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 11 |
| 31 | P2280.1 D 31 | MH 6 | MH 7 | 60 th Ave | 10 | Polyvinyl Chloride | 381 | V | P | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 6 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 3 |
| 32 | P2385 D 32 | MH 7 | MH 8 | 60 th Ave | 10 | Polyvinyl Chloride | 383.6 | V | P | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 6 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 6 |
| 33 | P2097 D 33 | MH 001 | MH 002 | 56 th Ave | 8 | Polyvinyl Chloride | 281.4 | V | P | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 6 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 6 |
| 34 | P2098 D 34 | MH 002 | MH 003 | 56 th Ave | 8 | Polyvinyl Chloride | 298.6 | V | P | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 6 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 10 |
| 35 | P2099 D 35 | MH 003 | MH 004 | 56 th Ave | 8 | Polyvinyl Chloride | 280.2 | V | P | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 6 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 3 |
| 36 | P2294 D 36 | MH 004 | MH 005 | 56 th Ave | 8 | Polyvinyl Chloride | 341.3 | V | P | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 1 | | | | | | | | | | 6 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 3 |
| 37 | P2292 U 37 | MH 005A | MH 005 | 56 th Ave | 8 | Polyvinyl Chloride | 375.3 | V | P | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 6 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 7 |
| 38 | P2293 D 38 | MH 005 | MH 006 | 56 th Ave | 8 | Polyvinyl Chloride | 283.2 | V | P | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 6 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 6 |
| 39 | P1090 D 39 | MH 006 | MH 007 | 56 th Ave | 8 | Polyvinyl Chloride | 281 | V | P | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 6 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 5 |
| 40 | P4500 D 40 | MH 007 | MH 008 | 56 th Ave | 8 | Polyvinyl Chloride | 271.7 | V | P | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 1 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 6 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 5 |
| 41 | P2360.1 U 41 | 64TH 2 | 64TH 1 | 64 Th Ave | 8 | Polyvinyl Chloride | 406.5 | V | P | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 6 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 5 |
| 42 | P2361 U 42 | 64TH 3 | 64TH 2 | 64 Th Ave | 8 | Polyvinyl Chloride | 385.2 | V | P | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 6 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 5 |
| 43 | 0 U 43 | 68TH 2 | 68TH 1 | 68 Th Ave | 12 | Polyvinyl Chloride | 256.5 | V | P | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 6 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 11 |
| 44 | 0 U 44 | 68TH 3 | 68TH 2 | 68 Th Ave | 12 | Polyvinyl Chloride | 121.9 | V | P | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 6 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 9 |
| 45 | 0 U 45 | 68TH 2 | 68TH 1 | 68 Th Ave | 12 | Polyvinyl Chloride | 359 | V | P | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 6 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 8 |
| 46 | P4851 U 46 | WHI 2 | WHI 3 | Whispering Creek | 8 | Polyvinyl Chloride | 81.5 | V | P | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 6 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 7 |
| 47 | P4748 D 47 | WHI 3 | WHI 4 | Whispering Creek | 8 | Polyvinyl Chloride | 376.5 | V | P | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 6 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 12 |
| 48 | 0 D 48 | WHI 4 | WHI 5 | Whispering Creek | 8 | Polyvinyl Chloride | 84.4 | V | P | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 6 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 10 |
| 49 | 0 D 49 | WHI 5 | WHI 6 | Whispering Creek | 8 | Polyvinyl Chloride | 187.8 | V | P | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 6 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 6 |
| 50 | 0 D 50 | WHI 6 | WHI 7 | Whispering Creek | 8 | Polyvinyl Chloride | 111.4 | V | P | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 6 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 3 |
| 51 | P4851.1 U 51 | WHI 2 | WHI 3 | Whispering Creek | 8 | Polyvinyl Chloride | 81.4 | V | P | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 1 | | | | | | | | | | 6 | | | | | | | | | | | 1 | | | | | | | | | | | | | | | | | | | 9 |
| 52 | P4748.1 D 52 | WHI 3 | WHI 4 | Whispering Creek | 8 | Polyvinyl Chloride | 377 | V | P | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 6 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 7 |
| 53 | 0 D 53 | WHI 4 | WHI 5 | Whispering Creek | 8 | Polyvinyl Chloride | 80.1 | V | P | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 1 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 6 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 9 |
| 54 | 0 U 54 | WHI 5 | WHI 6 | Whispering Creek | 8 | Polyvinyl Chloride | 187.1 | V | P | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 6 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 3 |
| 55 | 0 D 55 | WHI 6 | WHI 7 | Whispering Creek | 8 | Polyvinyl Chloride | 114.3 | V | P | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 6 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 9 |
| 1 | P1682 D 1 | SAN MH 86 | SAN MH 87 | Tall Pine | 8 | Polyvinyl Chloride | 237.4 | V | P | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 4 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 2 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 1 |
| 2 | P1681 D 2 | SAN MH 87 | SAN MH 88 | Tall Pine | 8 | Polyvinyl Chloride | 273.1 | V | P | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 2 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 2 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 1 |
| 3 | P1680 D 3 | SAN MH 88 | SAN MH 89 | Tall Pine | 8 | Polyvinyl Chloride | 155.7 | V | P | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 4 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 2 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 2 |
| 4 | P1789 U 4 | SAN MH 90 | SAN MH 89 | Tall Pine | 8 | Polyvinyl Chloride | 251.6 | V | P | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 5 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 2 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 2 |
| 5 | P1788 D 5 | SAN MH 89 | SAN MH 91 | Tall Pine | 8 | Polyvinyl Chloride | 268.2 | V | P | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 4 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 2 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 1 |
| 6 | P1880 U 6 | SAN MH 92 | SAN MH 91 | Tall Pine | 8 | Polyvinyl Chloride | 200.3 | V | P | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 6 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 2 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 1 |
| 7 | P1787 D 7 | SAN MH 91 | SAN MH 93 | Maple Bend | 8 | Polyvinyl Chloride | 231.1 | V | P | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 4 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 2 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 2 |
| 8 | P1786 D 8 | SAN MH 93 | SAN MH 94 | Maple Bend | 8 | Polyvinyl Chloride | 123.3 | V | P | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 2 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 1 |
| 9 | P1785 U 9 | SAN MH 94 | SAN MH 95 | Maple Bend | 8 | Polyvinyl Chloride | 119.7 | V | P | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 2 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 2 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 1 |
| 10 | P1784 D 10 | SAN MH 95 | SAN MH 96 | Maple Bend | 8 | Polyvinyl Chloride | 296.6 | V | P | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 5 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 2 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 2 |
| 11 | P1783 D 11 | SAN MH 96 | SAN MH 97 | Maple Bend | 8 | Polyvinyl Chloride | 132.4 | V | P | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 3 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 2 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 1 |
| 12 | P1782 D 12 | SAN MH 97 | SAN MH 98 | Maple Bend | 8 | Polyvinyl Chloride | 225.1 | V | P | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 5 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 2 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 2 |
| 13 | P1982 D 13 | SAN MH 104 | SAN MH 103 | 60th Ave | 8 | Polyvinyl Chloride | 409.7 | V | P | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 1 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 2 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 2 |
| 14 | P1881 D 14 | SAN MH 103 | SAN MH 98 | 60th Ave | 8 | Polyvinyl Chloride | 282.3 | V | P | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 3 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 2 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 1 |
| 15 | P1781 D 15 | SAN MH 98 | SAN MH 102 | 60th Ave | 8 | Polyvinyl Chloride | 197.7 | V | P | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 3 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 2 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 1 |
| 16 | P1780 D 16 | SAN MH 102 | SAN MH 101 | 60th Ave | 8 | Polyvinyl Chloride | 350.2 | V | P | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 1 | | | | | | | | | | | | | | 9 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 2 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 4 |
| 17 | P1969.1 D 17 | SAN MH 113 | SAN MH 114 | Timber Dr | 8 | Polyvinyl Chloride | 249.3 | V | P | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 1 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 2 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 1 |
| 18 | P1968.1 D 18 | SAN MH 114 | SAN MH 115 | Timber Dr | 8 | Polyvinyl Chloride | 223.9 | V | P | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 1 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 2 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 3 |
| 19 | P1967.1 D 19 | SAN MH 115 | SAN MH 116 | Timber Dr | 8 | Polyvinyl Chloride | 207 | V | P | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 2 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 2 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 3 |
| 20 | P1966.1 U 20 | SAN MH 117 | SAN MH 116 | Timber Dr | 8 | Polyvinyl Chloride | 165.1 | V | P | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 1 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 2 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 1 |
| 21 | P1965 D 21 | SAN MH 116 | SAN MH 116A | Timber Dr | 8 | Polyvinyl Chloride | 210.3 | V | P | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 2 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 2 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 2 |
| 22 | P2063.1 U 22 | SAN MH 121 | SAN MH 125 | 64th St | 8 | Polyvinyl Chloride | 196.8 | V | P | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 5 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 2 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 1 |
| 23 | P2064.1 U 23 | SAN MH 120 | SAN MH 121 | 64th St | 8 | Polyvinyl Chloride | 148.9 | V | P | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 1 | | | | | | | | | | 2 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 1 |
| 24 | P2065.1 U 24 | SAN MH 119 | SAN MH 120 | 64th St | 8 | Polyvinyl Chloride | 154.9 | V | P | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 2 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 1 |
| 25 | P2066.1 U 25 | SAN MH 118 | SAN MH 119 | 64th St | 8 | Polyvinyl Chloride | 158 | V | P | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 1 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 2 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 1 |
| 26 | P1960.1 D 26 | SAN MH 123B | SAN MH 123A | 64th St | 8 | Polyvinyl Chloride | 374.2 | V | P | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 13 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 2 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 2 |
| 27 | P1961.1 U 27 | SAN MH 123A | SAN MH 123 | 64th St | 8 | Polyvinyl Chloride | 164.2 | V | P | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 2 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 2 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 2 |
| 28 | P1963.1 U 28 | SAN MH 122 | SAN MH 123 | 64th St | 8 | Polyvinyl Chloride | 352.4 | V | P | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 1 | | | | | | | | | | | | | | | | 1 | | 2 | | 1 | | | | | | | | | 2 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 2 |
| 29 | P1962.1 D 29 | SAN MH 123 | SAN MH 124 | 64th St | 8 | Polyvinyl Chloride | 303.1 | V | P | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 4 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 2 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 2 |
| 30 | P2060.1 D 30 | SAN MH 124 | SAN MH 125 | 64th St | 8 | Polyvinyl Chloride | 208.4 | V | P | | | | | | | | | | | | 1 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 4 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 2 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 2 |
| 31 | P2061.1 U 31 | SAN MH 125 | SAN MH 126 | 64th St | 8 | Polyvinyl Chloride | 88 | V | P | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 3 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 2 | | | | | | | | | | | 1 | | | | | | | | | | | | | | | | | | | 1 |
| 32 | P2062.1 D 32 | SAN MH 126 | SAN MH 127 | 64th St | 8 | Polyvinyl Chloride | 388.4 | V | P | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 9 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 2 | | | | | | | | | | | 1 | | | | | | | | | | | | | | | | | | | 7 |
| 33 | P2163.1 D 33 | SAN MH 127 | SAN MH 128 | 64th St | 10 | Polyvinyl Chloride | 66.7 | V | P | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 2 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 3 |
| 34 | P2162.1 D 34 | SAN MH 128 | SAN MH 129 | 64th St | 10 | Polyvinyl Chloride | 122.5 | V | P | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 2 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 2 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 2 |
| 35 | P2161.1 D 35 | SAN MH 129 | SAN MH 129A | 64th St | 10 | Polyvinyl Chloride | 162 | V | P | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 1 | | | | | | | | | | | | | | 2 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 2 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 1 |
| 36 | P2160.1 D 36 | SAN MH 129A | SAN MH 130 | 64th St | 10 | Polyvinyl Chloride | 307.6 | V | P | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 5 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 2 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 4 |
| 37 | P1981 D 37 | SAN MH 105 | SAN MH 106 | 60th St | 10 | Polyvinyl Chloride | 373.7 | V | P | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 1 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 2 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 1 |
| 38 | P2080 D 38 | SAN MH 106 | SAN MH 107 | 60th St | 10 | Polyvinyl Chloride | 325.7 | V | P | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 2 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 2 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 1 |
| 39 | P2081 D 39 | SAN MH 107 | SAN MH 108 | 60th St | 10 | Polyvinyl Chloride | 231.2 | V | P | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 1 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 2 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 1 |
| 40 | P2180 D 40 | SAN MH 108 | SAN MH 109 | 60th St | 10 | Polyvinyl Chloride | 233.6 | V | P | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 1 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 2 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 2 |
| 41 | P2181 D 41 | SAN MH 109 | SAN MH 110 | 60th St | 10 | Polyvinyl Chloride | 406.2 | V | P | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 3 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 2 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 2 |
| 42 | P2280 D 42 | SAN MH 110 | SAN MH 111 | 60th St | 10 | Polyvinyl Chloride | 345.9 | V | P | 1 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 3 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 1 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 5 |
| 43 | P2116.1 D 43 | SAN MH 131 | SAN MH 132 | Waterway Ct | 8 | Polyvinyl Chloride | 167.7 | V | P | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 4 | | | 1 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 2 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 1 |
| 44 | P2115.1 D 44 | SAN MH 132 | SAN MH 133 | Waterway Dr | 8 | Polyvinyl Chloride | 296.6 | V | P | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 2 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 1 |
| 45 | P2114.1 D 45 | SAN MH 133 | SAN MH 134 | Waterway Dr | 8 | Polyvinyl Chloride | 145.9 | V | P | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 2 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 1 |
| 46 | P2114.1 D 46 | SAN MH 134 | SAN MH 135 | Waterway Dr | 8 | Polyvinyl Chloride | 104.5 | V | P | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 2 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 1 |
| 47 | P2008.1 U 47 | SAN MH 139 | SAN MH 140 | Watermark Dr | 8 | Polyvinyl Chloride | 100.1 | V | P | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 1 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 2 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 48 | P2007.1 D 48 | SAN MH 140 | SAN MH 141 | Watermark Dr | 8 | Polyvinyl Chloride | 279 | V | P | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 1 | | | 1 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 2 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 1 |
| 49 | P2006.1 U 49 | SAN MH 141 | SAN MH 142 | Watermark Dr | 8 | Polyvinyl Chloride | 238 | V | P | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 3 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 2 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 1 |
| 50 | P2005.1 D 50 | SAN MH 142 | SAN MH 143 | Watermark Dr | 8 | Polyvinyl Chloride | 269 | V | P | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 5 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 1 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 2 |
| 51 | P2004.1 D 51 | SAN MH 143 | SAN MH 144 | Watermark Dr | 8 | Polyvinyl Chloride | 290.2 | V | P | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 2 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 2 | | | | | | | | | | | | | 3 | | | | | | | | | | | | | | | | | 1 |
| 52 | P2003.1 D 52 | SAN MH 144 | SAN MH 145 | Watermark Dr | 8 | Polyvinyl Chloride | 141.3 | V | P | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 1 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 2 | | | | | | | | | | | | | 2 | | | | | | | | | | | | | | | | | 8 |

Allendale Charter Township
Sanitary Sewer: Preliminary CCTV Data Results

| Inspection ID | Pipe ID | Upstream MH | Downstream MH | Address | Diameter | Material | Surveyed Length | Video Link | PDF Link | Survey Abandoned | Structural Score 4: Sag: >50%<=75% | O&M Score 4: Infiltration | O&M Score 4: Alighment Shift >20% | Structural 3: Sag >30%<=50% | O&M Score 3: Roots | O&M Score 3: Infiltration | Structural 2: Crack | Structural 2: Sag >30% | Structural 2: Defective Tap | O&M Score 2: Encrustation < 10% | Structural 1: Defective Joint | O&M Score 1: Roots | O&M Score 1: Infiltration | Other Features: Manhole | Other Features: Repair | Other Features: Size Change | Other Features: Tap | Other Features: Tap Capped | Other Features: Water Mark |
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| 53 | P2001.1 D 53 | SAN MH 145 | SAN MH 146 | Watermark Dr | 8 | Polyvinyl Chloride | 51.6 | V | P | | | | | | | | | 1 | | | | | | 2 | | 1 | | | 2 |
| 54 | P2000.1 U 54 | SAN MH 147 | SAN MH 146 | Watermark Dr | 10 | Polyvinyl Chloride | 135.9 | V | P | | | | | | | | | 1 | | | | | | 2 | | | 1 | | 3 |
| 55 | P2110.1 U 55 | SAN MH 138 | SAN MH 137 | Watermark Dr | 8 | Polyvinyl Chloride | 287.6 | V | P | | | | | | | | | 1 | | | | | | 2 | | | | | 2 |
| 56 | P2111.1 D 56 | SAN MH 137 | SAN MH 136 | Watermark Dr | 8 | Polyvinyl Chloride | 296.7 | V | P | | | | | | | | | 3 | | | | | | 2 | | | | | 3 |
| 57 | P2112.1 D 57 | SAN MH 136 | SAN MH 135 | Watermark Dr | 8 | Polyvinyl Chloride | 159.7 | V | P | | | | | | | | | 1 | | | | | | 2 | | | | | 1 |
| 58 | P2210 U 58 | SAN MH 135 | SAN MH 165 | Waterway Dr | 8 | Polyvinyl Chloride | 334.3 | V | P | | | | | | | | | | | | | | | 2 | | | | | 7 |
| 59 | P2211.1 D 59 | SAN MH 165 | SAN MH 166 | Waterway Dr | 8 | Polyvinyl Chloride | 276 | V | P | | | | | | | | | 2 | | | | | | 2 | | | | | 7 |
| 60 | P2314.1 U 60 | SAN MH 167 | SAN MH 166 | Waterway Dr | 8 | Polyvinyl Chloride | 46.3 | V | P | | | | | | | | | | | | | | | 2 | | | | | 1 |
| 61 | P2312.1 D 61 | SAN MH 164 | SAN MH 163 | Waterline Dr | 8 | Polyvinyl Chloride | 329.4 | V | P | | | | | | | | | 5 | | | | | | 1 | | | 2 | | 3 |
| 1 | P3438 U 1 | MH 168 | MH 169 | Copper Beach | 8 | Polyvinyl Chloride | 256 | V | P | | | | | | | | | | | | | | | 2 | | | 4 | | 1 |
| 2 | P3437 D 2 | MH 169 | MH 171 | Copper Beach | 8 | Polyvinyl Chloride | 323.5 | V | P | | | | | | | | | 4 | | | | | | 2 | | | 3 | | 6 |
| 3 | P1103 U 3 | MH 170 | MH 171 | Copper Beach | 8 | Polyvinyl Chloride | 195.7 | V | P | | | | | | | | | 4 | | | | | | 2 | | | | | 1 |
| 4 | P3436 D 4 | MH 171 | MH 172 | Copper Beach | 8 | Polyvinyl Chloride | 361.9 | V | P | | | | | | | | | 10 | | | | | | 2 | | | 3 | | 3 |
| 5 | P3536.1 D 5 | MH 172 | MH 176 | Copper Beach | 8 | Polyvinyl Chloride | 364.5 | V | P | | | | | 2 | | | | 15 | | | | | | 2 | | | 3 | | 3 |
| 6 | P3534 D 6 | MH 172 | MH 176 | Copper Beach | 8 | Polyvinyl Chloride | 364.5 | V | P | | | | | 2 | | | | 15 | | | | | | 2 | | | 3 | | 3 |
| 7 | P3537 U 7 | MH 174 | MH 175 | Copper Beach | 8 | Polyvinyl Chloride | 246.5 | V | P | | | | | | | | | 2 | | | | | | 2 | | | 3 | | 3 |
| 8 | P3536 D 8 | MH 175 | MH 176 | Copper Beach | 8 | Polyvinyl Chloride | 366.7 | V | P | | | | | | | | | 2 | | | | | | 2 | | | | | 3 |
| 9 | P3535 U 9 | MH 176 | MH 181 | Pierce St | 8 | Polyvinyl Chloride | 162.4 | V | P | | | | | | | | | | | | | | | 2 | | | 2 | | 6 |
| 10 | P3637 D 10 | MH 181 | MH 182 | Pierce St | 8 | Polyvinyl Chloride | 235.2 | V | P | | | | | 2 | | | | 7 | 1 | | | | | 2 | | | | | 3 |
| 11 | P3636 D 11 | MH 182 | MH 183 | Pierce St | 8 | Polyvinyl Chloride | 216.8 | V | P | | | | | | | | | 6 | | | | | | 2 | | | | | 2 |
| 12 | P3433 D 12 | MH 190 | MH 189 | Copper Beach | 8 | Polyvinyl Chloride | 197.3 | V | P | | | | | | | | | 2 | | | | | | 2 | | | 2 | | 1 |
| 13 | P3432 U 13 | MH 189 | MH 173 | Copper Beach | 8 | Polyvinyl Chloride | 274.3 | V | P | | | | | | | | | 6 | | | | | 1 | 2 | | | 2 | | 2 |
| 14 | P3431 D 14 | MH 173 | MH 178 | Copper Beach | 8 | Polyvinyl Chloride | 190.1 | V | P | | | | | | | | | 4 | | | | | | 2 | | | 1 | | 1 |
| 15 | P3430 U 15 | MH 178 | MH 178A | Copper Beach | 8 | Polyvinyl Chloride | 200 | V | P | | | | | | | | | 5 | | | | | | 2 | | | 2 | | 1 |
| 16 | P3530 D 16 | MH 178A | MH 178B | Copper Beach | 8 | Polyvinyl Chloride | 76.9 | V | P | | | | | | | | | 1 | | | | | | 2 | | | | | 1 |
| 17 | P3434 U 17 | MH 177 | MH 179 | Copper Beach | 8 | Polyvinyl Chloride | 188.4 | V | P | | | | | | | | | 3 | | | | | | 2 | | | 2 | | 1 |
| 18 | P1102 U 18 | MH 178B | MH 179 | Copper Beach | 8 | Polyvinyl Chloride | 183.9 | V | P | | | | | | | | | 3 | | | | | | 2 | | | | | 1 |
| 19 | P3531 D 19 | MH 179 | MH 180 | Copper Beach | 8 | Polyvinyl Chloride | 283 | V | P | | | | | | | | | 5 | | | | | | 2 | | | 1 | | 2 |
| 20 | P3532 D 20 | MH 180 | MH 183 | Copper Beach | 8 | Polyvinyl Chloride | 242.2 | V | P | | | | | | | | | 6 | | | | | | 2 | | | 1 | | 3 |
| 21 | P3533 U 21 | MH 191 | MH 180 | Copper Beach | 8 | Polyvinyl Chloride | 76.6 | V | P | | | | | | | | | 3 | | | | | | 2 | | | | | 1 |
| 22 | P3633 U 22 | MH 183 | MH 184 | Pierce St | 8 | Polyvinyl Chloride | 301.4 | V | P | | | | | 4 | | | | 1 | | | | | | 2 | | | | | 4 |
| 23 | P3630 D 23 | MH 184 | MH 185 | Pierce St | 8 | Polyvinyl Chloride | 355.7 | V | P | | | | | 2 | | | | 9 | | | | | | 2 | | | | | 5 |
| 24 | P3624.1 U 24 | MH 185 | MH 186 | Pierce St | 8 | Polyvinyl Chloride | 359.1 | V | P | | | | | 3 | | | | 1 | | | | | | 1 | | | | | 4 |
| 25 | P3624 D 25 | MH 186 | MH 187 | Pierce St | 8 | Polyvinyl Chloride | 360.1 | V | P | | | | | 1 | | | | 14 | | | | | | 2 | | | | | 5 |
| 26 | P3623 D 26 | MH 187 | MH 188 | Pierce St | 8 | Polyvinyl Chloride | 363.4 | V | P | | | | | | | | | 13 | | | | | | 2 | | | | | 1 |
| 27 | P3931 D 27 | MH 192 | MH 193 | Campus West Apartments | 8 | Polyvinyl Chloride | 231.7 | V | P | | | | | | | | | 4 | | | | | | 2 | | | 2 | | 1 |
| 28 | P3930 D 28 | MH 193 | MH 194 | Campus West Apartments | 8 | Polyvinyl Chloride | 404.1 | V | P | | | | | | | | | 7 | | | | | | 2 | | | 5 | | 1 |
| 29 | P4032 D 29 | MH 194 | MH 195 | Campus West Apartments | 8 | Polyvinyl Chloride | 390.5 | V | P | | | | | | | | | 7 | | | | | | 2 | | | 1 | | 3 |
| 30 | P4031 D 30 | MH 195 | MH 196 | Campus West Apartments | 8 | Polyvinyl Chloride | 260.9 | V | P | | | | | | | | | 5 | | | | | | 1 | | | | | 2 |
| 31 | P3731 U 31 | MH 204 | MH 205 | Hillcrest Apartments | 8 | Polyvinyl Chloride | 139.7 | V | P | | | | | | | | | 8 | | | | | | 2 | | | 1 | | 2 |
| 32 | P3730 U 32 | MH 203 | MH 204 | Hillcrest Apartments | 8 | Polyvinyl Chloride | 123.7 | V | P | | | | | | | | | 2 | | | | | | 2 | 1 | | 1 | | 1 |
| 33 | P3732 D 33 | MH 205 | MH 206 | Hillcrest Apartments | 8 | Polyvinyl Chloride | 312.7 | V | P | | | 1 | | 1 | | | | 18 | | 1 | | | | 1 | | | 2 | | 1 |
| 34 | P3734 U 34 | MH 207 | MH 209 | Hillcrest Apartments | 8 | Polyvinyl Chloride | 300.5 | V | P | | | 1 | | | | | | 8 | 1 | | 2 | | | 2 | | | | 1 | 2 |
| 35 | P3733 U 35 | MH 206 | MH 207 | Hillcrest Apartments | 8 | Polyvinyl Chloride | 186.1 | V | P | | | | | | | | | 8 | | | | | | 2 | | | | | 1 |
| 36 | P3933 D 36 | MH 201 | MH 202 | West Campus Apartments | 8 | Polyvinyl Chloride | 136.2 | V | P | | | | | | | | | 1 | | | | | | 2 | | | | | 1 |
| 37 | P3936 D 37 | MH 199 | MH 200 | West Campus Apartments | 8 | Polyvinyl Chloride | 193.1 | V | P | | | | | | | | | 6 | | | | | | 2 | | | 2 | | 1 |
| 38 | P3934 U 38 | MH 201 | MH 200 | West Campus Apartments | 8 | Polyvinyl Chloride | 24.5 | V | P | | | | | | | | | 1 | | | | | | 2 | | | 1 | | 1 |
| 39 | P3938 D 39 | MH 197 | MH 198 | West Campus Apartments | 8 | Polyvinyl Chloride | 137.3 | V | P | | | | | | | | | | | | | | | 2 | | | 1 | | 1 |
| 40 | P3937 D 40 | MH 198 | MH 202 | West Campus Apartments | 8 | Polyvinyl Chloride | 278.1 | V | P | | | | | | | | | 1 | | | | | | 2 | | | 5 | | 1 |
| 41 | P3932 U 41 | MH 202 | MH 196 | West Campus Apartments | 8 | Polyvinyl Chloride | 235.5 | V | P | | | | | | | | | | | | | | | 2 | | | 2 | | 1 |
| 42 | P3740 U 42 | MH 208 | MH 209 | 48th Ave | 10 | Polyvinyl Chloride | 287.4 | V | P | | | | | | | | | 9 | | | | | | 2 | | | 1 | | 2 |
| 43 | P3833 D 43 | MH 209 | MH 210 | 48th Ave | 10 | Polyvinyl Chloride | 318.7 | V | P | | | | | 2 | | | | 13 | | 1 | | | | 2 | | | | | 2 |
| 44 | P3841 D 44 | MH 210 | MH 211 | 48th Ave | 10 | Polyvinyl Chloride | 126.4 | V | P | | | | | | | | | 7 | | | | | | 2 | | | | | 1 |
| 45 | P3842 D 45 | MH 211 | MH 212 | 48th Ave | 10 | Polyvinyl Chloride | 387.6 | V | P | | | | | | | | | 20 | | | | | | 2 | | | | | 1 |
| 46 | P1113 U 46 | MH 212 | MH 213 | 48th Ave | 10 | Polyvinyl Chloride | 419.3 | V | P | | | | | 1 | | | | 10 | | | | | 1 | 2 | | | | | 3 |
| 47 | P4030 U 47 | MH 196 | MH 213 | 48th Ave | 8 | Polyvinyl Chloride | 322.3 | V | P | | | | | 1 | | | | 4 | | | | | | 2 | | | | | 5 |
| 48 | P4040 D 48 | MH 213 | MH 214 | 48th Ave | 10 | Polyvinyl Chloride | 177.5 | V | P | | | | | 2 | | | | 5 | | | | | | 2 | | | | | 3 |
| 49 | P1112 D 49 | MH 214 | MH 215 | 48th Ave | 10 | Polyvinyl Chloride | 200.7 | V | P | | | | | 2 | | | | 4 | | | | | | 2 | | | | | 2 |
| 50 | P4140 D 50 | MH 215 | MH 216 | 48th Ave | 10 | Polyvinyl Chloride | 244.5 | V | P | | | | | | | | | 9 | | | | | | 2 | | | | | 3 |
| 51 | P4240 U 51 | MH 217 | MH 218 | 48th Ave | 12 | Polyvinyl Chloride | 25.4 | V | P | | | | | | | | | | | | | | | 2 | | | | | 1 |
| 52 | P4142 U 52 | MH 219 | MH 217 | 48th Ave | 12 | Polyvinyl Chloride | 424.3 | V | P | | | | | 1 | | | | | | | | | | 2 | | | | | 1 |
| 53 | P4141 U 53 | MH 216 | MH 219 | 48th Ave | 10 | Polyvinyl Chloride | 181.5 | V | P | | 1 | | | 3 | | | | | | | | | | 2 | | | | | 1 |
| 54 | P4241 D 54 | MH 218 | MH 220 | 48th Ave | 12 | Polyvinyl Chloride | 301 | V | P | | | | | | | | | 8 | | | | | | 2 | | | | | 1 |
| 55 | P4440 D 55 | MH 220 | MH 221 | 48th Ave | 12 | Polyvinyl Chloride | 337.5 | V | P | | | | | | | | | 10 | | | | | | 2 | | | | | 1 |
| 56 | P4441 D 56 | MH 221 | MH 222 | 48th Ave | 12 | Polyvinyl Chloride | 323 | V | P | | | | | | | | | 8 | | | | | | 2 | | | | | 2 |
| 57 | P4540 D 57 | MH 222 | MH 223 | 48th Ave | 12 | Polyvinyl Chloride | 303.4 | V | P | | | | | | | | | 11 | | | | | | 1 | | | | | 3 |
| 58 | P4641 U 58 | MH 224 | MH 225 | 48th Ave & LMD | 12 | Polyvinyl Chloride | 124.4 | V | P | | | | | 1 | | | | 1 | | | | | | 2 | | | | | 3 |
| 59 | P4640 D 59 | MH 224 | MH 223 | 48th Ave & LMD | 12 | Polyvinyl Chloride | 377.9 | V | P | | | | | | | | | | | | | | 1 | 2 | | | | | 2 |
| 60 | P4642 D 60 | MH 225 | VALVES | 48th Ave & LMD | 12 | Ductile Iron Pipe | 57 | V | P | 1 | | | | | | | | | | | | | | 1 | | | | | 1 |
| 1 | P4230 U 1 | SAN MH 243 | SAN MH 244 | Southtown Dr | 8 | Polyvinyl Chloride | 189.6 | V | P | | | | | | | | | 3 | | | | | | 2 | | | 1 | | 1 |
| 2 | P4231 D 2 | SAN MH 244 | SAN MH 245 | Centertown Place | 8 | Polyvinyl Chloride | 355.4 | V | P | | | | | | | | | 6 | | | | | | 2 | | | 5 | | 1 |
| 3 | P4335 U 3 | SAN MH 249 | SAN MH 248 | Centertown Place | 8 | Polyvinyl Chloride | 143.5 | V | P | | | | | | | | | 2 | | | | | | 2 | | | 3 | | 1 |
| 4 | P4336 D 4 | SAN MH 248 | SAN MH 247 | Centertown Place | 8 | Polyvinyl Chloride | 149.1 | V | P | | | | | | | | | 1 | | | | | | 2 | | | | | 1 |
| 5 | P4337 D 5 | SAN MH 247 | SAN MH 246 | Centertown Place | 8 | Polyvinyl Chloride | 186.3 | V | P | | | | | | | | | 1 | | | | | | 2 | | | 3 | | 1 |
| 6 | P4338 D 6 | SAN MH 246 | SAN MH 245 | Centertown Place | 8 | Polyvinyl Chloride | 101 | V | P | | | | | | | | | 1 | | | | | | 2 | | | 1 | | 1 |
| 7 | P4232 D 7 | SAN MH 245 | SAN MH 250 | Centertown Place | 8 | Polyvinyl Chloride | 327.1 | V | P | | | | | | | | | 1 | | | | | | 2 | | | | | 1 |
| 8 | P4137 U 8 | SAN MH 251 | SAN MH 252 | Meadows Crossing | 8 | Polyvinyl Chloride | 231.7 | V | P | | | | | | | | | 1 | | | | | | 2 | | | | | 2 |
| 9 | P4136 D 9 | SAN MH 252 | SAN MH 252A | Meadows Crossing | 8 | Polyvinyl Chloride | 305.2 | V | P | | | | | | | | | 3 | | | | | | 2 | | | 3 | | 2 |
| 10 | P4135 D 10 | SAN MH 252A | SAN MH 252B | Meadows Crossing | 8 | Polyvinyl Chloride | 302.1 | V | P | | | | | | | | | 5 | | | | | | 2 | | | 3 | | 3 |
| 11 | P4134 D 11 | SAN MH 252B | SAN MH 255 | Meadows Crossing | 8 | Polyvinyl Chloride | 299.1 | V | P | | | | | | | | | 8 | | | | | | 2 | | | 3 | | 4 |
| 13 | P4132 D 13 | SAN MH 254 | SAN MH 255 | Meadows Crossing | 8 | Polyvinyl Chloride | 376.9 | V | P | | | | | | | | | 6 | | | | | | 2 | | | 1 | | 2 |
| 16 | P4233 D 16 | SAN MH 250 | SAN MH 218 | 48th West | 8 | Polyvinyl Chloride | 380.5 | V | P | | | | | | | | | 7 | | | | | | 2 | | | | | 4 |
| 17 | P3814 D 17 | SAN MH 270 | SAN MH 271 | Windfield Dr | 8 | Polyvinyl Chloride | 226.2 | V | P | | | | | | | | | 1 | | | | | | 2 | | | 5 | | 1 |
| 20 | P3811 D 20 | SAN MH 273 | SAN MH 274 | Windfield Dr | 8 | Polyvinyl Chloride | 219.1 | V | P | | | | | | | | | 4 | | | | | | 2 | | | 4 | | 1 |
| 28 | P2510 U 28 | SAN MH 235 | SAN MH 236 | Red Hawk Lane | 8 | Polyvinyl Chloride | 153.3 | V | P | | | | | | | | | | | | | | | 2 | | | 3 | | 1 |
| 38 | P4332 D 38 | MH 258 | MH 260 | Buildings S T U V | 8 | Polyvinyl Chloride | 179.5 | V | P | | | | | | | | | | | | | | | 2 | | | | | 1 |
| 44 | P4223 D 44 | MH 262A | MH 262 | 48 west | 8 | Polyvinyl Chloride | 92.9 | V | P | | | | | | | | | 6 | | | | | | 1 | | | | | 1 |
| 45 | P4222 D 45 | MH 262 | MH 261 | 48 west | 8 | Polyvinyl Chloride | 323.2 | V | P | | | | | | | | | 17 | | | | | | 2 | | | 3 | | 1 |
| 48 | P3512 D 48 | MH 281 | MH 282 | Mystic Woods | 8 | Polyvinyl Chloride | 169.3 | V | P | | | | | 1 | | | | 5 | | | | | | 2 | | | 2 | | |
| 49 | P3513 U 49 | MH 280 | MH 281 | Mystic Woods | 8 | Polyvinyl Chloride | 366 | V | P | | | | | | | | | 11 | | | | | | 2 | | | 4 | | 1 |
| 58 | P4515 D 58 | MH 289 | MH 290 | Ottawa Creek | 8 | Polyvinyl Chloride | 365.2 | V | P | | | | 1 | | | | | 14 | | | | | | 1 | | | 2 | | 1 |
| 60 | P4519 D 60 | MH 292 | MH 291 | Sutter Mill | 8 | Polyvinyl Chloride | 184.2 | V | P | | | | 1 | | | | | 2 | | | | | | 2 | | | 1 | | 1 |
| 65 | P3171 D 65 | MH 301 | MH 302 | Dewpoint West | 8 | Polyvinyl Chloride | 400.8 | V | P | | | | | | | | | 9 | | | | | | 2 | | | 10 | | 1 |
| 66 | P3172 U 66 | MH 302 | MH 303 | Dewpoint West | 8 | Polyvinyl Chloride | 98.5 | V | P | | | | | | | | | 1 | | | | | | 2 | | | 2 | | 1 |
| 69 | P3175 D 69 | MH 304 | MH 306 | Dewpoint West | 8 | Polyvinyl Chloride | 401 | V | P | | | | | | | | | 9 | | | | | | 2 | | | 7 | | 1 |
| 71 | P3177 D 71 | MH 307 | MH 308 | Dewpoint West | 8 | Polyvinyl Chloride | 190.6 | V | P | | | | | | | | | 3 | | | | | 1 | 2 | | | 4 | | 1 |
| 75 | P3076 D 75 | MH 309 | MH 308 | Dewpoint West | 10 | Polyvinyl Chloride | 122.7 | V | P | | | | | | | | | 3 | | | | | | 2 | | | 3 | | 1 |
| 81 | P1411.1 D 81 | MH 316 | MH 319 | Learning Lane | 8 | Polyvinyl Chloride | 262.8 | V | P | | | | | | | | | 3 | | | | | | 2 | | | | | 1 |
| 83 | P1513.1 U 83 | MH 320 | MH 321 | Learning Lane | 8 | Polyvinyl Chloride | 270.4 | V | P | | | | | | | | | 1 | | | | | | 2 | | | | | 1 |
| 84 | P1520.1 D 84 | MH 321 | MH 322 | Learning Lane | 8 | Polyvinyl Chloride | 150.9 | V | P | | | | | | | | | 1 | | | | | | 2 | | | | | 1 |
| 86 | P1521.1 D 86 | MH 322 | MH 324 | Learning Lane | 8 | Polyvinyl Chloride | 150.8 | V | P | | | | | | | | | | | | | | | 2 | | | | | 1 |
| 4 | P9006.1 U 4 | MH 9 | MH 9A | Campus Dr | 12 | Vitrified Clay Pipe | 82.5 | V | P | | | | | | | 4 | | | | 2 | | | 1 | 2 | | | | | 1 |
| 11 | P9007.1 U 11 | MH 7 | MH 7C | Campus Dr | 12 | Vitrified Clay Pipe | 101.3 | V | P | 1 | | | | | | 1 | | | | 1 | | | 2 | 1 | | | | | 1 |
| 16 | P4460.1 D 16 | MH 2 | MH 1 | Campus Dr | 12 | Vitrified Clay Pipe | 322.4 | V | P | | | | | | 2 | | 3 | | | 2 | | 5 | 2 | 2 | | | | | 1 |
| 17 | P3960 D 17 | MH 12 | MH 11 | Campus Dr | 12 | Vitrified Clay Pipe | 342 | V | P | | | | 1 | | | 5 | | | | 1 | | | 2 | 2 | | | | | 1 |
| 19 | P4361 D 19 | MH 5 | MH 4 | Lubbers Stadium | 12 | Vitrified Clay Pipe | 331.1 | V | P | | | | | 8 | | | | | | 3 | 5 | | | 2 | | | | | 4 |
| 20 | P4462 D 20 | MH 4 | MH 3 | Lubbers Stadium | 12 | Vitrified Clay Pipe | 325.4 | V | P | | 2 | | | 3 | | | | 5 | | | 2 | | 1 | 2 | | | | | 3 |

Allendale Charter Township
Sanitary Sewer: Preliminary CCTV Data Results

| Inspection ID | Pipe ID | Upstream MH | Downstream MH | Address | Diameter | Material | Surveyed Length | Video Link | PDF Link |
|---|---|---|---|---|---|---|---|---|---|
| 21 | P4460 D 21 | MH 2 | MH 1 | Lubbers Stadium | 12 | Vitrified Clay Pipe | 323.1 | V | P |
| 22 | P3961 D 22 | MH 11 | MH 10 | Campus Drive | 12 | Vitrified Clay Pipe | 322.7 | V | P |
| 23 | P4060 D 23 | MH 10 | MH 9 | Campus Drive | 12 | Vitrified Clay Pipe | 324.6 | V | P |
| 24 | P9006 D 24 | MH 9 | MH 9A | Campus Drive | 12 | Vitrified Clay Pipe | 86.6 | V | P |
| 25 | P9010 U 25 | MH 22A | MH 22B | Campus Drive | 12 | Vitrified Clay Pipe | 292.3 | V | P |
| 26 | P4260 U 26 | MH 7A | MH 6 | Campus Drive | 12 | Vitrified Clay Pipe | 183.7 | V | P |
| 27 | P9009 U 27 | MH 7B | MH 7A | Campus Drive | 12 | Vitrified Clay Pipe | 76.7 | V | P |
| 28 | P4162 U 28 | MH 7C | MH 7B | Campus Drive | 12 | Vitrified Clay Pipe | 42.2 | V | P |
| 29 | P9007.1 U 29 | MH 7 | MH 7C | Campus Drive | 12 | Vitrified Clay Pipe | 102.9 | V | P |
| 30 | P4160 D 30 | MH 9A | MH 8 | Campus Drive | 12 | Vitrified Clay Pipe | 236.1 | V | P |
| 31 | P4161 D 31 | MH 8 | MH 7 | Campus Drive | 12 | Vitrified Clay Pipe | 328.5 | V | P |
| 1 | P2430 D 1 | MH 333 | MH 334 | Valley View Ave | 8 | Polyvinyl Chloride | 350.3 | V | P |
| 2 | P2431 D 2 | MH 334 | MH 335 | Valley View Ave | 8 | Polyvinyl Chloride | 359.7 | V | P |
| 3 | P2533 D 3 | MH 335 | MH 340 | Valley View Ave | 8 | Polyvinyl Chloride | 302 | V | P |
| 4 | P2530 U 4 | MH 336 | MH 337 | Valley View Ct | 8 | Polyvinyl Chloride | 152.8 | V | P |
| 5 | P2531 D 5 | MH 337 | MH 338 | Valley View Ct | 8 | Polyvinyl Chloride | 56 | V | P |
| 8 | P2638 D 8 | MH 342 | MH 343 | Brown St | 8 | Reinforced Plastic | 257.8 | V | P |
| 14 | P2543 U 14 | MH 352 | MH 353 | Cherell St | 8 | Reinforced Plastic | 154.8 | V | P |
| 15 | P2542 D 15 | MH 353 | MH 354 | Sheridan St | 8 | Reinforced Plastic | 324.1 | V | P |
| 18 | P2539 D 18 | MH 356 | MH 357 | Scott St | 8 | Reinforced Plastic | 257 | V | P |
| 19 | P2538 D 19 | MH 357 | MH 361 | Scott St | 8 | Reinforced Plastic | 284 | V | P |
| 21 | P2445 D 21 | MH 365 | MH 366 | Life Stream Easement | 8 | Polyvinyl Chloride | 397.8 | V | P |
| 27 | P2676 D 27 | MH 376 | MH 377 | Pebble Dr | 8 | Polyvinyl Chloride | 168.7 | V | P |
| 37 | P2573 D 37 | MH 379 | MH 388 | Crystal Dr | 8 | Polyvinyl Chloride | 322.5 | V | P |
| 42 | P3080 D 42 | MH 314 | MH 392 | 60th Ave | 8 | Polyvinyl Chloride | 404.3 | V | P |
| 44 | P2983 D 44 | MH 393 | MH 394 | 60th Ave | 8 | Polyvinyl Chloride | 277 | V | P |
| 49 | P2680 D 49 | MH 398 | MH 388 | 60th Ave | 10 | Polyvinyl Chloride | 385.1 | V | P |
| 50 | P2572 D 50 | MH 388 | MH 399 | 60th Ave | 10 | Polyvinyl Chloride | 147.7 | V | P |
| 51 | P2571 D 51 | MH 399 | MH 400 | 60th Ave | 10 | Polyvinyl Chloride | 334.9 | V | P |
| 52 | P2570 D 52 | MH 400 | MH 401 | 60th Ave | 10 | Polyvinyl Chloride | 345.4 | V | P |
| 54 | P2671 D 54 | MH 384 | MH 403 | Crystal Dr Easement | 10 | Reinforced Plastic | 299.1 | V | P |
| 60 | P2356 D 60 | MH 409 | MH 410 | Lake Michigan Dr | 8 | Reinforced Plastic | 269.5 | V | P |
| 62 | P2354 D 62 | MH 411 | MH 412 | Lake Michigan Dr | 8 | Polyvinyl Chloride | 261.9 | V | P |
| 64 | P2472 D 64 | MH 404 | MH 415 | Library Lane | 10 | Polyvinyl Chloride | 385.3 | V | P |
| 65 | P1082 D 65 | MH 416 | MH 415 | Lake Michigan Dr | 15 | Polyvinyl Chloride | 384.1 | V | P |
| 66 | P2359 U 66 | MH 417 | MH 416 | Lake Michigan Dr | 15 | Polyvinyl Chloride | 328.3 | V | P |
| 72 | P2536 D 72 | MH 360 | MH 361 | 68th Ave | 8 | Reinforced Plastic | 301.8 | V | P |
| 73 | P2537 D 73 | MH 361 | MH 362 | 68th Ave | 8 | Reinforced Plastic | 296.6 | V | P |
| 74 | P2436 D 74 | MH 362 | MH 363 | 68th Ave | 8 | Reinforced Plastic | 300.8 | V | P |
| 75 | P2432 D 75 | MH 351 | MH 363 | Brown St to 68th Ave | 8 | Polyvinyl Chloride | 422.9 | V | P |
| 76 | P2471 U 76 | MH 418 | MH 419 | 60th St Shopping Center | 8 | Polyvinyl Chloride | 147.3 | V | P |
| 77 | P1083 D 77 | MH 419 | MH 420 | 60th St Shopping Center | 8 | Polyvinyl Chloride | 112.5 | V | P |
| 78 | P2470 D 78 | MH 420 | MH 421 | 60th St Shopping Center | 8 | Polyvinyl Chloride | 343 | V | P |
| 79 | P2440 U 79 | MH 370 | MH 371 | Avery Ave | 8 | Polyvinyl Chloride | 216 | V | P |
| 80 | P2343 D 80 | MH 371 | MH 372 | Lake Michigan Dr | 8 | Polyvinyl Chloride | 204 | V | P |
| 84 | P2435 D 84 | MH 422 | MH 374 | 68th St | 10 | Polyvinyl Chloride | 105.3 | V | P |
| 91 | P2632 D 91 | MH 345 | MH 344 | Valley View Ave-Brown St Ea | 8 | Reinforced Plastic | 264.2 | V | P |
| 95 | P4329 U 95 | MH 266 | MH 267 | 48 West-Woodedge Dr Ease | 8 | Polyvinyl Chloride | 98.1 | V | P |
| 1 | P2975 U 1 | D7 | D6 | Charleston drive | 8 | Polyvinyl Chloride | 253.4 | V | P |
| 11 | P2008 D 11 | 139 | 140 | Watermark dr | 8 | Polyvinyl Chloride | 98.5 | V | P |
| 14 | P2005 D 14 | 142 | 143 | Watermark dr | 8 | Polyvinyl Chloride | 268.4 | V | P |
| 17 | P2001 U 17 | 146 | 145 | Watermark dr | 10 | Polyvinyl Chloride | 50.1 | V | P |
| 25 | P2202 D 25 | 153 | 154 | Waterline dr | 10 | Polyvinyl Chloride | 104 | V | P |
| 27 | P2204 D 27 | 155 | 156 | Waterline dr | 10 | Polyvinyl Chloride | 356.3 | V | P |
| 28 | P2207 D 28 | 158 | 157 | Island ct | 8 | Polyvinyl Chloride | 248.9 | V | P |
| 29 | P2206 D 29 | 157 | 156 | Island ct | 8 | Polyvinyl Chloride | 364.6 | V | P |
| 30 | P2306 U 30 | 156A | 159 | Waterline dr | 10 | Polyvinyl Chloride | 123.6 | V | P |
| 32 | P2307 D 32 | 159 | 160 | Waterline dr | 10 | Polyvinyl Chloride | 137.5 | V | P |
| 40 | P2114 D 40 | 133 | 134 | Waterway dr | 8 | Polyvinyl Chloride | 148.1 | V | P |
| 42 | P2110 U 42 | 138 | 137 | Watermark dr | 8 | Polyvinyl Chloride | 291.5 | V | P |
| 45 | P2113 D 45 | 135 | 165 | Waterway dr | 8 | Polyvinyl Chloride | 337.4 | V | P |
| 50 | P2311 D 50 | 163 | 162 | Waterline dr | 8 | Polyvinyl Chloride | 280 | V | P |
| 51 | P2310 D 51 | 162 | 160 | Waterline dr | 8 | Polyvinyl Chloride | 168.9 | V | P |
| 54 | P1910 D 54 | WV7 | WV8 | Waterview dr | 8 | Polyvinyl Chloride | 305.1 | V | P |
| 62 | P1916 D 62 | PVD13 | PVD14 | Pinevalley drive | 8 | Polyvinyl Chloride | 235 | V | P |
| 65 | P2014 D 65 | WW16 | WW15A | Waterway dr | 8 | Polyvinyl Chloride | 128.1 | V | P |
| 67 | P2015 D 67 | WW15 | WW19 | Waterway dr | 8 | Polyvinyl Chloride | 141.8 | V | P |
| 68 | P1051 D 68 | WW19 | PVD14 | Waterway dr | 8 | Polyvinyl Chloride | 167.3 | V | P |
| 73 | P1919 D 73 | PVD21 | PVD24 | Pine Valley Drive | 10 | Polyvinyl Chloride | 100.1 | V | P |
| 75 | P1920 D 75 | PVD24 | PVD25 | Pine Valley drive | 10 | Polyvinyl Chloride | 96.7 | V | P |
| 78 | P1923 D 78 | SKY27 | PVD26 | Skyline ct | 8 | Polyvinyl Chloride | 245.5 | V | P |
| 82 | P1822 U 82 | TD32 | SKY31 | Timberline dr | 10 | Polyvinyl Chloride | 336.2 | V | P |
| 83 | P1044.1 D 83 | PCD33 | PCD34 | Pinecreek ct | 10 | Polyvinyl Chloride | 197.9 | V | P |
| 87 | P1042 U 87 | SKY38 | TCD37 | Skyway lane | 8 | Polyvinyl Chloride | 230.1 | V | P |
| 92 | P2222 D 92 | TCD46 | TCD47 | Timberline dr | 8 | Polyvinyl Chloride | 97.9 | V | P |
| 94 | P2220 D 94 | TCD48 | TCD40 | Timberline dr | 8 | Polyvinyl Chloride | 357.5 | V | P |
| 96 | P2226 D 96 | CSD42 | CSD43 | Creekside dr | 8 | Polyvinyl Chloride | 102.7 | V | P |
| 98 | P2026 D 98 | TCD49 | TCD50 | Timberline dr | 8 | Polyvinyl Chloride | 356.2 | V | P |
| 99 | P2027 D 99 | TCD50 | TCD51 | Timberline dr | 8 | Polyvinyl Chloride | 350.8 | V | P |
| 100 | P1925 D 100 | TCD51 | TCD53 | Timberline dr | 8 | Polyvinyl Chloride | 282.2 | V | P |
| 101 | P9002 U 101 | PVD52 | TCD51 | Timberline dr | 8 | Polyvinyl Chloride | 165.1 | V | P |
| 102 | P1827 U 102 | SD55 | SD54 | Sunset dr | 8 | Polyvinyl Chloride | 249.9 | V | P |
| 103 | P1826 D 103 | SD54 | TCP53 | Sunset dr | 8 | Polyvinyl Chloride | 239.4 | V | P |
| 105 | P1510 U 105 | 318 | 317 | Learning lane | 8 | Polyvinyl Chloride | 163.5 | V | P |
| 107 | P1512 D 107 | 319 | 320 | Learning lane | 8 | Polyvinyl Chloride | 280 | V | P |
| 115 | P1820 D 115 | 332 | T32 | Learning lane | 8 | Polyvinyl Chloride | 233.6 | V | P |
| 120 | P1723 D 120 | 330 | 329 | Learning lane | 8 | Polyvinyl Chloride | 173.6 | V | P |
| 122 | P4419 U 122 | 66 | 67 | Aspen drive | 8 | Polyvinyl Chloride | 222.1 | V | P |
| 128 | P9003 U 128 | TCD59 | CD58 | Creekside dr | 8 | Polyvinyl Chloride | 179.5 | V | P |
| 129 | P2030 U 129 | CD59 | CD60 | Creekside dr | 8 | Polyvinyl Chloride | 209.8 | V | P |
| 130 | P2031 D 130 | CD60 | CD61 | Creekside dr | 8 | Polyvinyl Chloride | 69.9 | V | P |
| 132 | P2033 D 132 | CD62 | CD63 | Joal st | 8 | Reinforced Plastic | 325.7 | V | P |
| 133 | P2034 D 133 | CD63 | CD64 | Joal st | 8 | Reinforced Plastic | 327.4 | V | P |
| 134 | P2035 D 134 | CD64 | CD65 | Joal st | 8 | Reinforced Plastic | 322.6 | V | P |
| 141 | P2060 D 141 | 124 | 125 | 64th ave | 8 | Polyvinyl Chloride | 211.7 | V | P |
| 150 | P2066 D 150 | 119 | 118 | 64th ave | 8 | Polyvinyl Chloride | 162 | V | P |
| 157 | P2255 U 157 | H201 | H202 | Henry st | 8 | Polyvinyl Chloride | 160.6 | V | P |
| 159 | P2253 D 159 | H203 | H204 | Henry st | 8 | Polyvinyl Chloride | 227.4 | V | P |
| 163 | P2249 D 163 | H206 | H207 | Henry st | 12 | Polyvinyl Chloride | 399 | V | P |
| 164 | P1844 D 164 | HS1 | HS2 | High School | 8 | Polyvinyl Chloride | 406 | V | P |
| 165 | P1843 D 165 | HS2 | HS3 | High School | 8 | Polyvinyl Chloride | 325.1 | V | P |
| 167 | P1956 D 167 | H208 | H209 | Martinie drive | 8 | Polyvinyl Chloride | 227.9 | V | P |
| 168 | P1955 D 168 | H209 | H210 | Martinie drive | 8 | Polyvinyl Chloride | 155.4 | V | P |
| 169 | P1954 D 169 | H210 | H211 | Martinie drive | 8 | Polyvinyl Chloride | 176.5 | V | P |
| 172 | P1952 D 172 | H213 | H214 | Winans street | 8 | Polyvinyl Chloride | 228.2 | V | P |
| 173 | P1951 D 173 | H214 | H215 | Winans street | 8 | Polyvinyl Chloride | 374 | V | P |
| 174 | P2243 D 174 | MH H223 | MH H222 | County Park | 12 | Polyvinyl Chloride | 295.5 | V | P |

| Inspection ID | Pipe ID | Upstream MH | Downstream MH | Address | Diameter | Material | Surveyed Length | Video Link | PDF Link | Survey Abandoned | Structural Score 5: Deformed >5% | Structural Score 4: Deformed <5% | Structural Score 4: Sag: >50%<=75% | O&M Score 4: Infiltration | O&M Score 4: Encrustation 20% < 30% | Structural 3: Fracture | Structural 3: Sag >30%<=50% | O&M Score 3: Roots | O&M Score 3: Infiltration | O&M Score 3: Encrustation 10% < 20% | O&M Score 3: Deposits 10% < 20% | Structural 2: Crack | Structural 2: Sag >30% | Structural 2: Defective Joint | O&M Score 2: Infiltration | O&M Score 2: Encrustation < 10% | O&M Score 2: Grease < 10% | O&M Score 2: Deposits <10% | Structural 1: Crack | Structural 1: H2S Damage | Structural 1: Defective Joint | O&M Score 1: Roots | O&M Score 1: Infiltration | Other Features: Manhole | Other Features: End of Pipe | Other Features: Repair | Other Features: Material Change | Other Features: Tap | Other Features: Tap Capped | Other Features: Water Mark |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 176 | P2050 D 176 | MH H216 | MH H217 | High School Easement | 8 | Polyvinyl Chloride | 303.6 | V | P | | | | | | | | | | | | | | | | | | | | | | | | | 2 | | | | | | 1 |
| 178 | P2141 D 178 | MH H218 | MH H219 | High School Easement | 8 | Polyvinyl Chloride | 165 | V | P | | | | | | | | | | | | | | | | | | | | | | | | | 2 | | | | | | 1 |
| 180 | P2241 U 180 | MH H225 | MH H224 | County Park | 12 | Polyvinyl Chloride | 310.6 | V | P | | | | | | | | | | | | | | | | | | | | | | | | | 2 | | | | | | 1 |
| 182 | P2244 D 182 | H 222 | LS COUNTY PAR | County Park | 15 | Ductile Iron Pipe | 49.5 | V | P | | | | | | | | | | | | | | | | | | | | | 2 | | | | 2 | | | | | | 1 |
| 183 | P2055 D 183 | MIS 226 | MIS 227 | Mista Drive | 8 | Polyvinyl Chloride | 282.6 | V | P | | | | | | | | | | | | | | 1 | | | | | | | | | | | 2 | | | | 1 | | 1 |
| 184 | P2054 D 184 | MIS 227 | MIS 228 | Mista Drive | 8 | Polyvinyl Chloride | 286.7 | V | P | | | | | | | | | | | | | | 1 | | | | | | | | | | | 2 | | | | 1 | | 1 |
| 185 | P2052 D 185 | MIS 228 | MIS 229 | Mista Drive | 8 | Polyvinyl Chloride | 307.7 | V | P | | | | | | | | | | | | | | 4 | | | | | | | | | | | 2 | | | | 1 | | 1 |
| 4 | STUB X U | STUB | AB | Winnie lane | 8 | Polyvinyl Chloride | 15.4 | V | P | | | | | | | | | | | | | | | | | | | | | | | | | 1 | 1 | | | | | 1 |
| 8 | Y X U 8 | Y | X | Hawkin St | 8 | Polyvinyl Chloride | 101.7 | V | P | | | | | | | | | | | | | | 1 | | | | | 2 | | | | | | 2 | | | | 2 | | 1 |
| 12 | G Z D 1 | G | F | Wetland lane | 10 | Polyvinyl Chloride | 305.6 | V | P | | | | | | | | | | | | | | 1 | | | | | | | | | | | 2 | | | | | | 1 |
| 18 | D Y D 1 | D | C | Marsh Ave | 10 | Polyvinyl Chloride | 344.3 | V | P | | | | | | | | | | | | | | 8 | | | | | | 1 | | | | | 2 | | | | 7 | | 1 |
| 19 | BM X U | BM | BL | View Pond Ct | 8 | Polyvinyl Chloride | 210.6 | V | P | | | | | | | | | | | | | | | | | | | | | | | | | 2 | | | | 4 | | 1 |
| 20 | BL X D | BL | BK | View Pond Ct | 8 | Polyvinyl Chloride | 226.7 | V | P | | | | | | | | | | | | | | 1 | | | | | 1 | | | | | | 2 | | | | 5 | | 1 |
| 23 | BG X U | BG | A | View Pond Ct | 8 | Polyvinyl Chloride | 65 | V | P | | | | | | | | | | | | | | 1 | | | | | 2 | | | | | | 2 | | | | | | 1 |
| 27 | A X D 2 | A | EXISTING | Marsh Ave | 10 | Polyvinyl Chloride | 129.8 | V | P | | | | | | | | | | | | | | 2 | | | | | | | | | | | 2 | | | | 1 | | 1 |
| 28 | C X U 2 | C | B | Marsh Ave | 10 | Polyvinyl Chloride | 353.2 | V | P | | | | | | | | | | | | | | | | | | | | | | | | | 2 | | | | 6 | | 1 |
| 1 | P2359.1 U 1 | 2359.1 | 2359 | Lake Michigan Dr. | 15 | Polyvinyl Chloride | 325.4 | V | P | | | | | | | | | | | | | | 2 | | | | | | | | | | | 2 | | | | 1 | | 1 |
| 7 | P2356.1 D 7 | 2356.1 | 2355 | Lake Michigan Dr. | 8 | Polyvinyl Chloride | 269.3 | V | P | | | 1 | | | | | | | | | | | 1 | | | | | | | | | | | 2 | | | | 1 | | 1 |
| 9 | P2354.1 D 9 | 2354.1 | 2353 | Lake Michigan Dr. | 8 | Polyvinyl Chloride | 262.9 | V | P | | | 1 | | 1 | | | | | | | | 1 | 1 | | | 1 | | | | | | | | 2 | | | | | | 1 |
| 12 | P2350.1 D 12 | 2350.1 | 2349 | Lake Michigan Dr. | 8 | Reinforced Plastic | 399.3 | V | P | | | | | | | | | | | | | | | | | | | | | | | | | 2 | | | | 5 | | 1 |
| 16 | P2367.1 D 16 | 2367.1 | 2366 | Lake Michigan Dr. | 8 | Reinforced Plastic | 247.8 | V | P | | | | | | | | | | | | | | | | | | | | | | | | | 2 | | | | 2 | | 1 |
| 25 | P2370.1 D 25 | 2370.1 | 2380 | Lake Michigan Dr. | 8 | Polyvinyl Chloride | 390.6 | V | P | | | | | | | | | | | | | | | | | | | | | | | | | 2 | | | | | | 1 |
| 28 | P2382.1 D 28 | 2382.1 | 2381 | Lake Michigan Dr. | 8 | Polyvinyl Chloride | 411.4 | V | P | | | | | | | | | | | | | | | | | | | | | | | | | 2 | | | | 3 | | 1 |
| 43 | P4620.1 D 43 | 4620.1 | 4619 | Lake Michigan Dr. | 8 | Polyvinyl Chloride | 44.2 | V | P | | | | | | | | | | | | | | 1 | | | | | | | | | | | 2 | | | | | | 1 |
| 47 | P4608.1 D 47 | 4608.1 | 4609 | Lake Michigan Dr. | 21 | Reinforced Concre | 328.7 | V | P | | | | | | | | | | | | | | | | | | | | | | | | | 2 | | | | 3 | | 1 |
| 56 | P4624.1 D 56 | 4624.1 | 4625 | Lake Michigan Dr. | 27 | Reinforced Concre | 390.7 | V | P | | | | | | | | | | 3 | | | | | | | 2 | | | | | | | 5 | 2 | | | | 2 | | 1 |
| 57 | P4625.1 D 57 | 4625.1 | 4630 | Lake Michigan Dr. | 27 | Reinforced Concre | 228.4 | V | P | | | | | | | | | | | | | | | | | | | | | 2 | | | | 2 | | | | | | 1 |
| 59 | P4631.1 D 59 | 4631.1 | 4632 | Lake Michigan Dr. | 27 | Reinforced Concre | 270.1 | V | P | | | | | | | | | | | | | | | | | | | | | | | | | 2 | | | | 1 | | 1 |
| 61 | P4639.1 D 61 | 4639.1 | 4636 | Lake Michigan Dr. | 8 | Reinforced Plastic | 272 | V | P | | | | | | | | | | | | | | | | | | | | | | | | | 2 | | | | 1 | 2 | 1 |
| 62 | P4635.1 D 62 | 4635.1 | 4632 | Lake Michigan Dr. | 12 | Reinforced Concre | 93.6 | V | P | | | | 1 | | | | | | | | | | | 1 | | | | | | | | | | 2 | | | | | | 1 |
| 68 | P2641.1 D 68 | 2641.1 | 2536 | 68th Ave. | 8 | Reinforced Plastic | 329.2 | V | P | | | 1 | | | | | | | | | | | | | | | | | | | | | | 2 | | | | 6 | | 1 |
| 75 | P2340.1 D 75 | 2340.1 | 2334 | 68th Ave. | 12 | Reinforced Plastic | 105.9 | V | P | | | | | | | | | | | | | | | | | | | | | | | | | 2 | | | | | | 1 |
| 85 | P2343.1 U 85 | 2343.1 | 2342 | Lake Michigan Dr. | 10 | Reinforced Plastic | 201.7 | V | P | | 1 | | | | | | | | | | | | | | | | | | | | | | | 2 | | | | 2 | | 1 |
| 93 | P2335.1 D 93 | 2335.1 | 2240 | 68th Ave. | 12 | Polyvinyl Chloride | 283.5 | V | P | | | | | | | | | | | | | | 2 | | | | | | | | | | | 2 | | | | 1 | | 1 |
| 100 | P1082 D 100 | 416 | 2371 | Lake Michigan Dr. | 15 | Polyvinyl Chloride | 384 | V | P | | | | | | | | | | | | | 1 | | | | | | | | | | | | 2 | | | | | | 1 |
| 103 | P2373 U 103 | 2373 | 1176 | Lake Michigan Dr. | 18 | Reinforced Concre | 456.9 | V | P | | | | | | | | | | | | | | | | | | | | | | | | 2 | 2 | | | | 2 | | 1 |
| 106 | P2355 D 106 | 2355 | 2354 | Lake Michigan Dr. | 8 | Polyvinyl Chloride | 292 | V | P | | 1 | | | | | | | | | | | | 1 | | | | 1 | | | | | | | 2 | | | | 3 | | 1 |
| 108 | P2352 D 108 | 2352 | 2353 | Lake Michigan Dr. | 8 | Polyvinyl Chloride | 263.4 | V | P | | | 2 | | | | | | | | | | | 1 | | | | | | | | | | | 2 | | | | 2 | | 1 |
| 112 | P2344 D 112 | 2344 | 2345 | Lake Michigan Dr. | 8 | Reinforced Plastic | 177.1 | V | P | | | | | | | | | | | | | | 1 | | | | | | | | | | | 2 | | | | 1 | | 1 |
| 124 | P2384 D 124 | 2384 | 2383 | Lake Michigan Dr. | 8 | Polyvinyl Chloride | 364.5 | V | P | | | | | | | | | | | | | | | | | | | | | | | | | 2 | | | | 4 | | 1 |
| 127 | P2381 D 127 | 2381 | 2380 | Lake Michigan Dr. | 8 | Polyvinyl Chloride | 408.7 | V | P | | | | | | | | | | | | | | | | | | | | | | | | | 2 | | | | | | 1 |
| 138 | P4621 D 138 | 4621 | 1178 | Lake Michigan Dr. | 8 | Polyvinyl Chloride | 325.9 | V | P | | | | | | | | | | | | | | 3 | | | | | | | | | | 1 | 2 | | | | 3 | | 1 |
| 143 | P4607 U 143 | 4607 | 4608 | Lake Michigan Dr. | 21 | Reinforced Concre | 319.9 | V | P | | | | | | | | | | | | | | | | | | | | | | | | | 2 | | 1 | | 1 | | 1 |
| 145 | P4608 D 145 | 4608 | 4609 | Lake Michigan Dr. | 21 | Reinforced Concre | 328.7 | V | P | | | | | | | | | | | | | | | | | | | | | | | | | 2 | | | | 3 | | 1 |
| 147 | P4610 D 147 | 4610 | 4611 | Lake Michigan Dr. | 21 | Reinforced Concre | 371.6 | V | P | | | | | | | | | | | | | | | | | | | | | | | | | 2 | | | | 2 | | 1 |
| 154 | P4624 D 154 | 4624 | 4625 | Lake Michigan Dr. | 27 | Reinforced Concre | 390.7 | V | P | | | | | | | | | | 2 | | | | | | | 2 | | | | | | | 5 | 2 | | | | 2 | | 1 |
| 155 | P4625 D 155 | 4625 | 4630 | Lake Michigan Dr. | 27 | Reinforced Concre | 228.4 | V | P | | | | | | | | | | | | | | | | | | | | | 2 | | | | 2 | | | | | | 1 |
| 157 | P4631 D 157 | 4631 | 4632 | Lake Michigan Dr. | 27 | Reinforced Concre | 270.1 | V | P | | | | | | | | | | | | | | | | | | | | | | | | | 2 | | | | 1 | | 1 |
| 165 | P2640 D 165 | 2640 | 2641 | Cardinal St. | 8 | Reinforced Plastic | 116.9 | V | P | | | | | | | | | | | | | | 2 | | | | | | | | | | | 2 | | | | 1 | | 1 |
| 170 | P2436 D 170 | 2436 | 2434 | 68th Ave. | 8 | Reinforced Plastic | 303.6 | V | P | | | 1 | | | | | | | | | | | 8 | | | | | | | | | | | 2 | | | | 4 | | 2 |
| 175 | P1841 U 175 | 1841 | 1840 | 68th Ave. | 8 | Reinforced Plastic | 237.4 | V | P | | 1 | | | | | | | | | | | | 1 | | | | | | | | | | | 2 | | | | 2 | | 1 |
| 177 | P2037 D 177 | 2037 | 2038 | 68th Ave. | 10 | Reinforced Plastic | 321.7 | V | P | | | | | | | | | | | | | | | | | | | | | | | | | 1 | | | | 2 | | 1 |
| 179 | P2335.1 U 179 | 2335 | 2240 | 68th Ave. | 12 | Reinforced Plastic | 284.1 | V | P | | | 1 | | | | | | | | | | | | | | | | | | | | | | 2 | | | | 1 | | 1 |
| 184 | P2342 D 184 | 2342 | 2341 | Lake Michigan Dr. | 8 | Reinforced Plastic | 64.3 | V | P | 1 | 3 | | | | | | | | | | | | 1 | | | | | | | | | | | 1 | | | | 1 | | 1 |
| 188 | P2331 D 188 | 2331 | 2332 | Lake Michigan Dr. | 10 | Reinforced Plastic | 33.3 | V | P | | | | | | | | | | | | | | | | | | | | | | | | | 2 | | | | | | 1 |
| 192 | P4632 D 192 | 4632 | 1117 | Lake Michigan Dr. | 27 | Reinforced Concre | 87.4 | V | P | | | | | | | | | | | | | | | | | 1 | | | | 2 | | | 1 | 2 | | | | | | 1 |
| 3 | P3567 D 3 | 3567 | 3566 | 42nd Ave. GVSU Art Gallery | 8 | Polyvinyl Chloride | 68.3 | V | P | | | | | | | | | | | | | | | | | | | | | | 1 | | 1 | 2 | | | 1 | 1 | | 1 |
| 5 | P3569 D 5 | 3569 | 3566 | 42nd Ave | 12 | Polyvinyl Chloride | 287.2 | V | P | | | | | | | | | | 5 | 1 | | 1 | 1 | | | 9 | | | | | | | | 2 | | | | | | 1 |
| 6 | P1029 D 6 | 3566 | 3565 | 42nd Ave | 12 | Polyvinyl Chloride | 57.1 | V | P | | | | | | 1 | | | | 1 | 1 | | | | | | 2 | | | | | | | | 2 | | | | | | 1 |
| 7 | P3565 D 7 | 3565 | 3564 | 42nd Ave | 12 | Polyvinyl Chloride | 204.2 | V | P | 1 | | | | | | | | 1 | 5 | 11 | 2 | | 1 | | | 5 | | | | | | | | 1 | | | | 1 | | 1 |
| 9 | P3564 U 9 | 3562 | 3564 | 42nd Ave | 12 | Polyvinyl Chloride | 102.6 | V | P | | | | | | 1 | | | | 6 | 1 | | | | | 1 | 5 | | | | | | | | 1 | | | | | | 1 |
| 10 | P3562 D 10 | 3562 | 3561 | 42nd Ave | 12 | Polyvinyl Chloride | 193.6 | V | P | | | | | | | | | | 4 | 1 | | 1 | 1 | | | 4 | | | | | | | | 2 | | | | | | 1 |
| 12 | P3560 D 12 | 3560 | 3660 | 42nd Ave | 12 | Polyvinyl Chloride | 291.7 | V | P | | | | | | | 1 | | | 4 | 2 | 1 | | 2 | | | 12 | | 1 | | | | | 1 | 2 | | | | | | 1 |
| 13 | SAN MH 11 | 3660 | 3760 | Pierce Dr. | 12 | Polyvinyl Chloride | 154.2 | V | P | 1 | | | | | | | | | 3 | 10 | | | | | | 7 | | | | | | | | 1 | | | | | | 1 |
| 14 | SAN MH 11 | 3660 | 3760 | Pierce Dr. | 12 | Polyvinyl Chloride | 132.3 | V | P | 1 | | | | | 2 | | | | 1 | 10 | 2 | | | | | 2 | | 2 | | | | | | 1 | | | | | | 1 |
| 15 | P3761 D 15 | 3760 | 3761 | Pierce Dr. | 12 | Vitrified Clay Pipe | 120.4 | V | P | 1 | | | | | 2 | | 1 | | 7 | 6 | | | | | 2 | 3 | | | | | | | | 1 | | | | | | 1 |
| 16 | P3761 U 16 | 3760 | 3761 | Pierce Dr. | 12 | Vitrified Clay Pipe | 162.3 | V | P | 1 | | | | 1 | 3 | | | | 4 | 6 | | | | | | 3 | | | | | | | | 1 | | | | | | 1 |
| 17 | SAN MH 3761-376 | 3761 | 3762 | Pierce Dr. | 12 | Vitrified Clay Pipe | 345.8 | V | P | | | | | | 1 | | | | 21 | 3 | | | | | | 5 | | | | | | | 1 | 2 | | | | | | 1 |
| 18 | P3762 D 18 | 3762 | 3860 | Pierce Dr. | 12 | Vitrified Clay Pipe | 59.5 | V | P | 1 | | | | | 1 | | | | 1 | | 1 | | | | | 2 | | | | | | | | 1 | | | | | | 1 |
| 19 | P3762 U 19 | 3762 | 3860 | Pierce Dr. | 12 | Vitrified Clay Pipe | 267 | V | P | 1 | | | | | | | | | 3 | 5 | | | | | 1 | 2 | | | | | | | | 1 | | | | | | 1 |
| 20 | SAN MH 3860 | 3860 | 3960 | Pierce Dr. | 12 | Vitrified Clay Pipe | 346.5 | V | P | | | | | 1 | | | | | 6 | 15 | 2 | | 1 | | 2 | 7 | | 4 | | | | | | 2 | | | | | | 1 |
| 21 | SAN MH 3960 | 3960 | 3961A | Pierce Dr. | 12 | Vitrified Clay Pipe | 287 | V | P | | | | | | 4 | | 1 | | 9 | 3 | | | 1 | | 2 | 2 | | | | | | | | 2 | | | | | | 1 |
| 23 | P3961 U 23 | 3961 | 4060 | Pierce Dr. | 12 | Vitrified Clay Pipe | 314.8 | V | P | | | | | | | | | | 1 | 2 | | | | | | 7 | | | | | | | | 2 | | | | 1 | | 1 |
| 24 | P4060 D 24 | 4060 | 4061 | Campus Dr. | 12 | Vitrified Clay Pipe | 318.1 | V | P | | | | | 2 | | | | | 29 | 4 | | | 1 | | | 3 | | | | | | | | 2 | | | | | | 1 |
| 26 | P4160 D 26 | 4160 | 4161 | Campus Dr. | 12 | Vitrified Clay Pipe | 236.3 | V | P | | | | | | 2 | | 1 | | 8 | | | | | | | 2 | | | | | | 2 | | 2 | | | | | | 1 |
| 31 | SAN MH 4360 | 4260 | 4360 | Campus Dr. | 12 | Vitrified Clay Pipe | 185.1 | V | P | | | | | | | | 1 | | 3 | 1 | | | | | | 2 | | 3 | | | | | | 2 | | | | | | 1 |
| 33 | SAN MH 4361 | 4360 | 4361 | Campus Dr. | 12 | Vitrified Clay Pipe | 122.4 | V | P | 1 | | | | 1 | | | | | 1 | | | | | 1 | | 4 | | 1 | | | | | | 1 | | | | | | 1 |
| 35 | P4461 D 35 | 4461 | 4460 | Campus Dr. | 12 | Vitrified Clay Pipe | 317.6 | V | P | | | | | 1 | | 1 | 1 | | | | | | | | | 3 | | 2 | | | 1 | | | 2 | | 1 | 2 | 1 | | 1 |
| 36 | P4460 D 36 | 4460 | 4862 | Campus Dr. | 12 | Vitrified Clay Pipe | 322.7 | V | P | | | | | | | | 2 | | 2 | 1 | 5 | 1 | | | 1 | 3 | | 1 | | | | 4 | | 2 | | | | | | 1 |

*Protecting our Infrastructure Investment*

# ASSET MANAGEMENT PLAN

## Mass Flow Monitoring

Prepared for:

## Allendale Charter Township

FINAL

June 2017

FLEIS&VANDENBRINK

DESIGN. BUILD. OPERATE.

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# APPENDICES

Appendix A – Maps and Schematics

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# EXECUTIVE SUMMARY

Allendale Charter Township (ACT) retained Fleis & VandenBrink Engineering, Inc. (F&V) to evaluate its wastewater collection and treatment system as part of a stormwater, asset management and wastewater (SAW) grant-funded project. In general, SAW work involves an inventory and assessment of the condition of the assets in a stormwater and/or wastewater collection and wastewater treatment system and the development of a long-term asset management plan (AMP).

**Study Details**. This report, ultimately an appendix to the full AMP, presents a hydraulic analysis of the underground sewers and manholes whose condition can be difficult to determine. The analysis relies on a new methodology called mass flow monitoring (MFM) that generates millions of data points from the measurement of 1) wastewater flow at a few essential locations in the collection system and 2) depths and temperatures at numerous other important locations. The MFM approach allows for a comprehensive evaluation of wastewater systems that was not previously affordable for small and medium sized utility systems.

Monitoring during dry weather, precipitation events, and elevated ground and surface water level periods helps determine how much clean water (called inflow and infiltration, or I/I) is entering the system and pinpoint problem locations. Additionally, peak flow estimates help determine where the system may lack capacity to handle the flows from more intense rainfall events. The results from the MFM analysis help guide further field investigations of wastewater collection system conditions and help limit and prioritize capital expenditures to most effectively use the available funds.

Flow monitoring data was collected from December 2015 to July 2016. Sewage depths and temperatures were measured with Solinst® Leveloggers® (LLs) at 37 manholes throughout the collection system. Pump-on and pump-off times and wet well levels were obtained from ACT's Supervisory Control and Data Acquisition (SCADA) system for all 6 lift stations. In addition, Wastewater Treatment Facility (WWTF) influent flows from monthly operating reports (MORs) were used to verify flow estimates. Precipitation data was collected with a tipping-bucket style rain gage located at the ACT Booster Pump Station and was verified with precipitation data obtained from the weather stations at West Michigan Regional Airport (KBIV), located in Holland, MI, Muskegon County Airport (KMKG), located in Muskegon, MI, and the Gerald R. Ford International Airport (GRR), located in Grand Rapids, MI.

**Collection System**. The ACT wastewater collection system in the area around the Grand Valley State University (GVSU) was largely constructed in the late 1970s. Expansion of the system began in the 1980s and has continued through the present day. The materials of construction vary, with older portions of the system being mostly concrete and clay pipe, while the majority of the newer sewers are constructed of PVC pipe. The system can best be split into two areas – the area where sewage flows by gravity before being pumped up to a downstream sewer and the area consisting entirely of gravity and pressure sewer.

The portion of the ACT system that relies on pumping of the sewage collects from areas generally west of and along 60$^{th}$ Avenue. All of the wastewater collected from these areas are conveyed through a system of gravity sewers and force mains to either the Park Street Lift Station, the 60$^{th}$ Street North Lift Station, or the 60$^{th}$ Street South Lift Station, where it is pumped into the trunk sewer along Lake Michigan Drive that flows east to the gravity and pressure sewer area.

The portion of the ACT system that relies solely on gravity and pressure sewer collects from areas generally east of 60$^{th}$ Avenue. Most of the wastewater collected from these areas, along with the wastewater pumped from the Park Street Lift Station, the 60$^{th}$ Street North Lift Station, and the 60$^{th}$ Street South Lift Station is conveyed through a system of gravity sewers to the gravity trunk sewer along Lake

Michigan Drive. At the east end of Lake Michigan Drive, near the Grand Valley State University (GVSU) campus, the gravity trunk sewer becomes a pressure sewer. Sewage from the gravity trunk sewer and from gravity sewers around the GVSU campus then flows under pressure to the ACT WWTF.

**Conclusions**. Key conclusions generated from analysis of the collected data are summarized below:

*Wastewater generation in Allendale Charter Township is lower than expected based on population served.*

- Wastewater in ACT is generated at a much lower rate than the standard planning rate of 70 gallons per capita (person) per day (gpcd) due to vast areas of new construction utilizing modern construction standards and materials, high efficiency appliances, and low water usage fixtures.

*Infiltration and inflow is relatively low throughout the system, however localized areas of infiltration and/or inflow were identified.*

- Groundwater infiltration is indicated throughout most of the ACT system but is not considered excessive compared to the Michigan Department of Environmental Quality (MDEQ) threshold of 120 gpcd.
- Precipitation events yielded volumes of inflow and storm induced I/I that are not excessive by MDEQ standards and did not cause SSOs, significant sewer backups, poor treatment, or other problems.
- Though not considered excessive by MDEQ standards, the volume of I/I experienced throughout the ACT sanitary sewer system consumes valuable WWTF capacity, which may become important as GVSU continues to expand and the Township grows.
- Anecdotal evidence shows that during extreme rain events (100-year storm), inflow experienced in ACT has been disruptive to operations at the WWTF, suggesting the need to isolate and remove such flows.
- The largest volume of Inflow and storm-induced I/I was observed in the sewers serving the GVSU campus.
- Localized, but small volumes, of inflow was identified at the following monitoring locations: LL-38, LL-31, 60$^{th}$ Street South Lift Station, LL-23, LL-20, LL-17, LL-15, LL-12, and LL-07.

*Maintenance issues including vulnerability to temporary (but recurring) clogs or long-term problems with elevated depths compared to flowrate.*

- Due at least in part to a lower than typical dry weather wastewater flow, sewer segments throughout the ACT system are vulnerable to partial clogging resulting in sewage depth greater than expected and lowered system capacities until the clogs are cleared (either naturally by increased wastewater flows or by ACT staff).
- Several sanitary sewers in the ACT system exhibited symptoms of long-term elevated hydraulic grade line and backwater conditions (resulting from issues like offset joints, pipe bellies, tree roots, partially collapsed pipes), recording higher than theoretical wastewater levels for the velocity/flow rate throughout the study period.
- While the issues noted throughout the ACT sanitary sewer system represent maintenance issues, they currently do not result in significant sanitary sewer backups, sanitary sewer overflows (SSOs), or other conveyance problems.

**Recommendations**. Based on the results of the MFM study, F&V recommends follow-up field investigations, such as smoke testing, closed-circuit televising, and manhole inspections, at locations where localized I/I was observed to pinpoint, and ultimately remove, specific I/I sources. A map showing the locations for further investigation are recommended is included as Figure A4.

# INTRODUCTION

A Michigan stormwater, asset management, and wastewater (SAW) grant was awarded to Allendale Charter Township (ACT) to fund the development of an asset management plan (AMP) for the Township's wastewater collection and treatment system. One of the tasks involved in developing the AMP was to characterize the performance of the collection system through flow monitoring and subsequent data analysis. Specifically, the monitoring (completed from December 2015 through July 2016) involved 1) near-continuous flow depth and temperature monitoring at 37 locations throughout the system's sewers, 2) pump station run time monitoring at all six of the Township's wastewater pump stations, and 3) rainfall monitoring at the Allendale Booster Pump Station, verified by comparison to weather observations at the West Michigan Regional Airport (KBIV), located approximately 18 miles south-southwest of the study area in Holland, MI, Muskegon County Airport (KMKG), located 20 miles northwest of the study area in Muskegon, MI, and the Gerald R. Ford International Airport (GRR), located 22 miles east-southeast in Grand Rapids, MI.

The subsequent data analysis involved 1) calculation or estimation of dry weather flows (DWF) throughout the system, 2) calculation or estimation of the quantity, distribution, type, and sources of infiltration and inflow (I/I) from groundwater and rainfall / snowmelt surface runoff, and 3) identification of trends and cause-and-effect relationships related to the collection system's normal DWF operating conditions and its response to wet weather in the form of I/I. Where possible, the quantitative and statistical analyses have been supplemented by qualitative observations, including historical observations and anecdotal evidence provided by ACT staff, as well as documented conditions and events witnessed by the individuals installing and maintaining the monitoring equipment.

This report summarizes 1) the data collection and analysis efforts, 2) the technical reasoning involved in the development of conclusions regarding the flow characterization, 3) conclusions concerning the potential impacts of I/I on the collection system and wastewater treatment facility (WWTF), and 4) recommendations for future actions in the context of the AMP development[1].

# METHODOLOGY

## APPROACH

The approach to documenting system flows utilized for this study is derived from an approach known as mass[2] flow monitoring (MFM). The approach was pioneered by David Saylor and originally involved utilizing patented equipment and software. The MFM approach relies primarily on flow depth and temperature monitoring with compact and easily installed equipment. It contrasts with traditional efforts involving significant manpower in the field making spot measurements during dry and wet weather. These traditional efforts typically generate only a small amount of useful data. MFM is also significantly more nimble than comprehensive flow monitoring efforts that rely on expensive flow metering and other

[1] Ultimately, this report will be an appendix to the ACT wastewater AMP that is to be completed as part of the SAW program. The information presented herein forms the basis upon which projections of long-term system performance will be made (as part of a subsequent AMP development task). Additional analyses may be performed that refine aspects of this report. In such a case, the information presented in the final AMP will take precedence.

[2] In this case, the definition of 'mass' is 'widespread' or 'extensive' as opposed to the more common meaning referring to 'a characteristic of matter'.

equipment deployed throughout the sewer system, requiring specially trained and certified personnel for installation.

The MFM approach employed for this study strikes a balance between traditional and comprehensive flow monitoring efforts by obtaining numerous sets of near-continuous, high-resolution data while utilizing targeted and efficient deployment of a variety of cost-conscious monitoring devices. Once these large amounts of data have been gathered, the MFM approach utilizes a systematic analysis of the data to develop dry and wet weather flow estimates that can be used in identifying I/I and evaluating its impact on wastewater facilities. Thus, the MFM approach allows for a comprehensive evaluation of wastewater systems that was not previously affordable for small and medium sized utility systems.

## Data Collection and Analysis

The equipment monitored wastewater depth and temperature at 5-minute intervals at 37 locations in the sewer system, as shown in Figures A2-1 through A2-6. Pump run-times were recorded at all of the ACT pump stations, as shown in Figures A1-1 through A1-6, in order to generate flow data using recorded wet well fill times and calculated wet well volumes. This allowed for the documentation of the overall system flow rates. Local rainfall data was also collected to characterize the system's wet weather response.

The collected data was evaluated for trends and potential cause and effect relationships were developed. As appropriate, the analyses made use of anecdotal evidence and collection system staff observations, documented conditions and events witnessed by the individuals installing and maintaining the monitoring equipment, topography, groundwater contours, surface water locations, and other supplemental information to further support quantitative conclusions.

## Final Product

The end result of the MFM process is a comprehensive estimate of I/I flows and the locations of clean water sources. This information provides the basis for conclusions about wastewater flows throughout the system as well as for defining future study and investigative opportunities (e.g. additional monitoring, sewer televising, smoke testing) to further enhance discovery and characterization of I/I problems. In addition, corrective actions are proposed to provide guidance on future steps to address I/I. The precision of the I/I locations, estimates, and efficacy of corrective actions is dependent on the deployment scheme, the time period monitored, the amount of rainfall during that period, and many other factors.

The output from the MFM process can be utilized as a stand-alone investigation or in concert with sewer televising and smoke testing to validate perceived I/I or pinpoint known I/I. It can facilitate the development of reliable cost estimates and a sanitary sewer evaluation survey (SSES), and, in this case, it is being used as part of the development of a comprehensive AMP to help identify I/I issues to be addressed in the context of a long term planning effort.

## Equipment Used

For this study, three major types of data collection equipment were used: water pressure and temperature monitors, the wet well levels as recorded by the ACT pump station Supervisory Control and Data Acquisition (SCADA) system, and a rain gauge.

### Measuring Wastewater Depth and Temperature

Solinst®[3] Leveloggers® (LLs) were utilized to measure and record wastewater depths and temperatures at 5-minute intervals at specific locations in the sanitary sewer system as shown in Figures A2-1 through A2-6. The device measures the absolute pressure at the tip of the LL and therefore requires the use of a Solinst® Barologger® (BL) to measure the atmospheric pressure. Solinst® software is used to process

[3] Headquarters and manufacturing in Georgetown, Ontario, Canada.

the data stored in the LLs and the BL and generates data consisting of depth and temperature in 5-minute increments. The wastewater depth is derived from the difference in pressures measured by the LL and the BL. The software also accounts for elevation-based atmospheric pressure differences between the devices, in addition to many other factors, by automatically incorporating any provided correction factors into the final depth calculation. See Figure 1 for stock photos of the loggers.

The LLs are typically installed in a manhole with the sensor located at the center of the flow channel near the downstream pipe invert. The LLs are installed inside a 1-inch diameter PVC casing pipe (with a flexible section inserted near the bottom) that helps to protect the LL and hold it in a stationary position at the bottom of the flow channel, while allowing for debris accumulated behind the apparatus to eventually pass through the flow channel. The PVC pipe is mounted to a spreader bar apparatus near the top of the manhole. This setup allows for both the installation and data gathering to be done without the need for a full-body confined space entry into the manhole, thereby saving time and money and increasing safety. A typical LL installation is shown in Figure 2. The BL is generally installed in a LL manhole near the center of the study area.




*Figure 1. Solinst® Levelogger® and Barologger® (stock photos).*



*Figure 2. Typical Levelogger® mounting apparatus – upper bracket, example (left), and drop pipe assembly (right).*

## MONITORING PUMP STATION OPERATION

ACT utilizes a SCADA system to control and monitor their lift stations, meaning that the lift station can be controlled both locally (at the lift station) and from the WWTF. In addition, the status of the pumps

(running or not) and the level of the sewage in the lift station wet well is recorded at the WWTF several times per minute. Communication with the lift stations and access to the stored data from the lift stations is accomplished through the SCADA software running on a computer at the WWTF (see Figure 3).

Data from all 6 ACT pump stations was downloaded during each Levelogger data download to document the pump run times since the previous data download. After the SCADA data was downloaded, the pump on/off and wet well level data was imported to an Excel spreadsheet, along with the known geometry and cross sectional area of the wet well. This data was used to calculate flow rates into the lift station wet well. In addition, WWTF influent flows, as reported on the WWTF's monthly operating reports (MORs), anticipated flows based on service populations, and flow balancing between the various lift stations that function in series were used to validate flows calculated from the pump station run time data.




*Figure 3. ACT lift station status as displayed from the WWTF SCADA software.*

## MEASURING PRECIPITATION

A Texas Electronics tipping-bucket-type rain gauge was installed at the ACT Booster Pump Station and was used to record time-stamped precipitation data in 0.01-inch increments. The gauge included an integrated heating element to prevent freezing and convert snowfall into its rain equivalent. When necessary, precipitation data recorded at the West Michigan Regional Airport (KBIV), located approximately 18 miles south-southwest of the study area in Holland, MI, Muskegon County Airport (KMKG), located 20 miles northwest of the study area in Muskegon, MI, and the Gerald R. Ford International Airport (GRR), located 22 miles east-southeast in Grand Rapids, MI., was used to provide supplemental rainfall data or to validate recorded rainfall data. Figure 4 shows the rain gauge installation (with cord attached to power the heating element).



*Figure 4. Rain gauge installation at the ACT Booster Pump Station.*

# BACKGROUND AND OBSERVATIONS

The ACT wastewater collection system in the area around the Grand Valley State University (GVSU) was largely constructed in the 1970s. In the 1980s, the system began to expand with expansion continuing through the present day. The system currently consists of over 44 miles of gravity sewers and approximately 8 miles of force mains and pressure sewers. The material of construction varies, with the older portions of the system being mostly concrete and clay pipe, while the majority of the newer sewers are constructed of PVC pipe. At the time of this study, Michigan Department of Environmental Quality (MDEQ) permit no. MI0057679[4] authorizes the Township's WWTF to discharge treated effluent to the Grand River through a submerged outfall on the east side of the WWTF. For the purposes of this study, the ACT wastewater collection system was divided into two separate areas – the areas where the sewage is pumped and areas of gravity and pressure sewer.

The portion of the ACT system that relies on pumping of the sewage collects wastewater from areas generally west of and along 60th Avenue. It covers an area that is predominantly residential, with some light commercial and industrial areas, which are primarily located along Lake Michigan Drive. All of the wastewater collected from these areas is conveyed through a system of gravity sewers and force mains to either the Park Street Lift Station, the 60th Street North Lift Station, or the 60th Street South Lift Station. From these lift stations, the sewage is pumped into the trunk sewer along Lake Michigan Drive that flows east to the gravity and pressure sewer area.

The portion of the ACT system that relies solely on gravity and pressure sewer collects from areas generally east of 60th Avenue. Most of the wastewater collected from these areas, along with the wastewater pumped from the Park Street Lift Station, the 60th Street North Lift Station, and the 60th Street South Lift Station is conveyed through a system of gravity sewers to the gravity trunk sewer along Lake Michigan Drive. At the east end of Lake Michigan Drive, near the GVSU campus, the gravity trunk sewer becomes a pressure sewer. Sewage from the gravity trunk sewer and from gravity sewers around the GVSU campus then flows under pressure to the ACT WWTF.

[4] Though the current permit expired on 10/1/2015, ACT has been working with the MDEQ to obtain a new discharge permit and continues to discharge under the old one.

Within the study areas monitored by the MFM project, there are approximately 5,800 connections to the system, equivalent to 7,702 residential equivalent units (REUs). Of these, approximately 1,136 connections (1,364 REUs) are within the areas served by the pump stations. The remaining connections (6,338 REUs) are within the gravity and pressure sewer area. The pumped areas utilize a total of 6 major pump stations to route the wastewater to the gravity and pressure sewer area on its way to the WWTF.

For this study, the collection system was divided into the two major areas previously described. The pumped and pressure/gravity sewer areas were then further divided into *branches* and *sub-districts*, as defined below. The sewer areas included in each branch are shown in Figures A1-1 through A1-6 and sewer sub-districts are shown in Figures A2-1 through A2-6. A schematic diagram of the way the various branches and sub-districts are interconnected is shown in Figure A3.

- A *sub-district* is all sanitary sewer upstream of a particular LL and, if applicable, downstream of one or more upstream LLs. The name of a sub-district takes the name of the downstream-end LL.
- A *branch* is a large area of sewer, usually comprised of multiple sub-districts, that characterizes a significant portion of the study area sewer flow. For this project, the collection system was divided into 7 branches based on the 6 lift stations throughout the pumped areas and the wastewater treatment facility branch, consisting of the pressure and gravity sewer area.

Three types of I/I were investigated as a part of this study as defined below:

- **Groundwater infiltration** – groundwater entering the sewers through structural defects (e.g. cracks or separated joints) on a constant basis, regardless of precipitation or surface water elevations.
- **Inflow** – surface runoff entering the sanitary sewer through a direct connection (e.g. storm sewer connection, roof drain, manhole cover). It is characterized by a flow spike immediately following precipitation, especially during intense periods of precipitation.
- **Storm-induced I/I** – increase in sewer flow caused by precipitation-based clean water intrusion, starting a few hours after precipitation and lasting at least a day. Sources of storm-induced I/I tend to be temporary storages of precipitation, such as the soil (elevated groundwater levels) or foundation drains. Elevated surface water levels can also lead to storm-induced I/I. As surface water levels rise, water can flow into the sewers through structural defects or manhole lids, it can lead to elevated groundwater levels, and/or it can create flooding and drainage issues.

Data was collected for this study from December 2015 to July 2016. Total influent flow to the WWTF was measured using the existing WWTF influent flow meter. These WWTF flows, along with historical WWTF influent plant flows and the corresponding measured precipitation, are shown in Figure 5 to present a longer-term analysis of the flows observed in the ACT wastewater collection system.

The expected DWF was calculated and compared to the observed flows at the WWTF. While the measured DWF is generally close to the expected DWF, the collection system responds to large precipitation events or chains of precipitation events with elevated flows lasting anywhere from a few hours to as long as a month. This phenomenon is seen in Figure 5 as the spikes in the WWTF influent flow that correspond to the precipitation events shown in blue on the top axis of the graph.

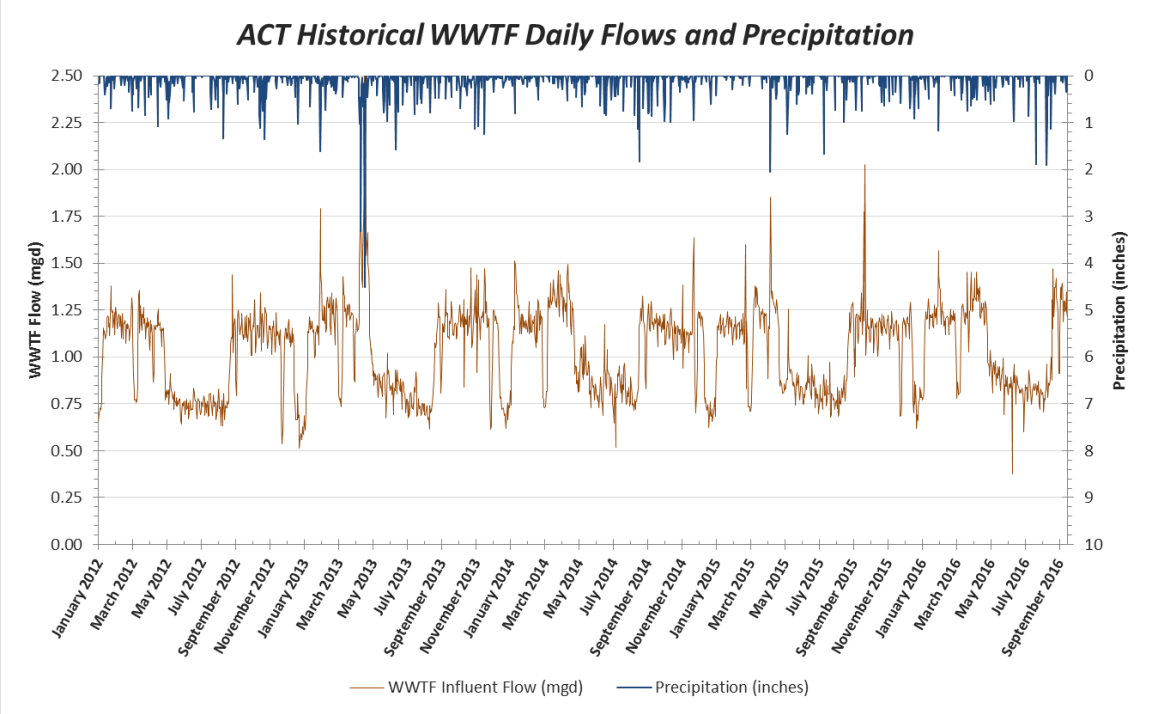



*Figure 5. ACT WWTF daily flows and precipitation, January 1, 2012 through September 18, 2016*

Figure 6 shows the historical rainfall intensity-duration-frequency curves for southwest Michigan along with the precipitation events observed during the study period to compare the study period rainfall events with historical averages. The flow monitoring study period was relatively dry, without even a 1-year, 24-hour total precipitation event, though a couple of events had precipitation intensities that exceeded 1-year averages. The average annual precipitation recorded from 2011 through 2014 is within 1.2 inches of the long-term annual average for this region. However, from August 2015 through July 2016 ACT received approximately 7.6 inches less precipitation than average (20.5% less precipitation than average).

Due to the relatively dry weather during the study period, if there are significant I/I issues, the sewer flow data collected for this study could potentially be lower than normal long-term flow conditions. However, overall system flows for the study period (as seen in Figure 5) appear to be similar to previous years. A summary of monthly precipitation amounts monitored during the study period compared to the generally accepted average rainfall for each month is shown in Appendix C.

The eastern edge of the ACT sanitary sewer system as well as the WWTF are located adjacent to the Grand River. In general, collection systems located close to surface water can experience elevated flows when the surface water stage is elevated. These phenomena may be attributed to direct inflow caused by flood waters entering a system through manholes or to increased infiltration due to an elevated groundwater surface and a corresponding increase in hydraulic pressure.

Grand River stages, as measured about 15.7 miles upstream of the ACT WWTF at Grand Rapids, are recorded by the United States Geological Survey (USGS). Data obtained from this station (USGS station 04119000) were used to analyze any correlation between Grand River stage and WWTF influent flow that would indicate direct inflow from the Grand River to the ACT sanitary sewer system. As the figures in Appendix D show, there is no correlation between Grand River stage and WWTF influent flow.

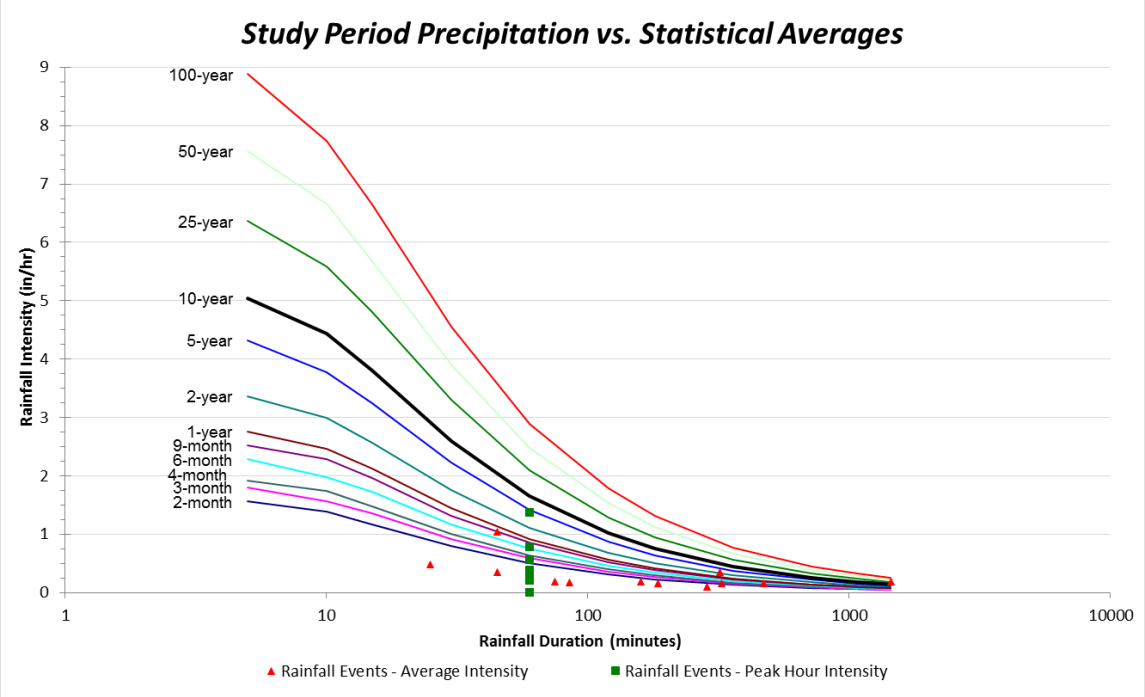



*Figure 6. Study period observed peak and average precipitation intensities vs. statistical average precipitation intensity.*

In addition to monitoring the sanitary sewers for signs of I/I, the techniques and equipment used for MFM can help to identify areas of the sanitary sewer system that are vulnerable to clogging or may potentially have structural defects. Some of the LLs deployed in the ACT sanitary sewer system consistently recorded wastewater depths that were greater than expected, followed by rapid drops back to expected levels. These excessive depths, resulting in calculated (approximate) flow rates that are greater than known downstream flow rates are an indication that further investigation is warranted in that area in order to determine the cause(s) of the elevated wastewater depth.

# RESULTS AND CONCLUSIONS

Key results and conclusions based on analyses of collected data are summarized as follows.

**Wastewater in ACT is generated at a rate much lower than the standard planning rate of 70 gallons per capita per day (gpcd).**

Based on the number of houses counted in the ACT service area and the average household size from the United States Census Bureau's 2010 Census, the population served by the ACT sanitary sewer system was calculated as 14,906. This compares to a 2010 Census Bureau population of 17,579 for ACT. Adding in the residential equivalent units (REUs) counted[5] for commercial, government, and industrial buildings throughout the ACT service area and using the standard wastewater generation rate of 70 gpcd[6], the anticipated WWTF flow would be 1.634 mgd (with GVSU in session). As Table 1 shows, based on the WWTF flows observed during the study period, the per capita sewage generation rate is calculated

[5] See Appendix B for further details about how the REUs were counted and the DWF was calculated.
[6] MDEQ standard for estimating sewer flow – their estimated average water usage per person per day.

as 52.6 gpcd. Table 1 shows that this same trend is also seen in the upstream lift station branches, which all serve areas that are predominantly residential.

*Table 1. Average dry weather flow rates vs. expected wastewater flow rates at 70 gpcd with GVSU in session.*

| | Average DWF (gpd) | Expected Flow (gpd) | Percentage of Expected Flow | Per Capita Flow (gpcd) |
|---|---|---|---|---|
| Brown Street Lift Station | 5,896 | 8,700 | 67.8 % | 47.5 |
| Hidden Shores Lift Station | 28,182 | 48,790 | 57.7 % | 40.4 |
| Timber Creek Lift Station | 39,160 | 65,530 | 59.8 % | 41.8 |
| Park Street Lift Station | 165,399 | 233,100 | 71.0 % | 49.7 |
| 60th Street North Lift Station | 32,646 | 43,900 | 74.4 % | 52.1 |
| 60th Street South Lift Station | 8,810 | 12,300 | 71.6 % | 50.1 |
| **WWTF** | **1,228,278** | **1,633,580** | **75.2 %** | **52.6** |

Brown Street, Park Street, and both 60th Street lift stations all averaged around 30% less flow than expected. The Hidden Shores and Timber Creek lift stations, which both serve areas of newer construction west of town averaged 41% less flow than expected. This trend is likely due to much of the new construction in both the west side of the township and at and around the GVSU campus. Most of this construction is likely using low flow fixtures and appliances, decreasing the per capita amount of sewage generated per person. It is anticipated that this trend will continue in the future as more low flow fixtures are used.

**Sewer segments throughout the ACT system are vulnerable to partial clogging resulting in sewage depths greater than expected.**

Elevated depths recorded by LLs throughout the ACT sanitary sewer system not attributed to elevated flows are a result of downstream flow conditions, such as partial pipe clogs or sewer defects. In addition to the elevated depths recorded by the LLs, clogs were noted throughout the sanitary sewer system by the crews installing and maintaining the LLs and from anecdotal evidence from ACT maintenance personnel. Specific areas found to be vulnerable to clogging or increased depths include:

- The area around LL 6 (Campus View Apartments)
- The area around LL 8 and LL 10 (48th Avenue south of Lake Michigan Drive and the south side of Lake Michigan Drive west of 48th Avenue)
- The area from LL 12 through LL 17 (52nd Avenue between Lake Michigan Drive and Pierce Street and along Pierce Street between 48th Avenue and 56th Avenue)
- The area around LL 19 and LL 20 (the intersection of Lake Michigan Drive and 56th Avenue)
- The area around LL 25, LL 26, and LL 27 (60th Avenue north of Lake Michigan Drive and into the Frostline Drive subdivision)
- The areas around LL 35 and LL 36 (68th Avenue south of Henry Street and along the Joal Street subdivision)
- The area upstream of LL 37 (the portion of the Hidden Shores subdivision that flows south and eventually into the Timber Creek Lift Station)

These clogs are likely a result of the lower per capita flow rates seen in ACT. Even though there is less wastewater, the amount of solids (e.g. plastics, “flushable” wipes, paper, etc.) in the wastewater does not decrease. Without the additional wastewater to assist in moving the solids through the sewer, clog formation is more likely. This will likely result in ongoing maintenance issues for ACT staff.

In addition to the temporary (but recurring) clogging issues noted above, several locations experienced increased levels throughout the entire study period. These locations required the use of an alternate method of flow estimation than Manning's Equation (the Stevens-Schutzbach Method) that takes into account a continual partial pipe blockage for reasons ranging from joint issues (offset joints, pipe bellies, etc.) to permanent clogs (like tree roots, etc.). These locations can be even more problematic than temporary clogs, which eventually clear and restore the full pipe capacity. Instead, these locations may represent a permanent decrease in pipe capacity until they are repaired. The locations identified and their approximate blockage depths are:

- Downstream of LL 12 (elevated approximately 1-inch deep)
- Downstream of LL 21 (elevated approximately 3/8-inch deep)
- Downstream of LL 27 (elevated approximately 5/8-inch deep)
- Downstream of LL 30 (elevated approximately 1 1/8-inch deep)
- Downstream of LL 31 (elevated approximately 3-inch deep)
- Downstream of LL 36 (elevated approximately 1 3/8-inch deep)

While these clogs and/or joint/pipe issues are a maintenance issue, the elevated wastewater depths caused by them currently result in no significant sanitary sewer backups, sanitary sewer overflows (SSOs), or other conveyance problems in the ACT sanitary sewer system. The only instance of a significant sewer surcharge during the course of the study occurred at LL 6 (Pierce Street just north of the Campus View Apartments) or between LL 6 and LL 5 (south of the GVSU football stadium) from March 13 through March 17, 2016 causing a minor sewer surcharge upstream of that location until the clog cleared itself.

**Seasonal groundwater infiltration is indicated throughout most of the ACT sanitary sewer system, but is not significantly affecting WWTF costs or utility capacity.**

Infiltration amounts are typically calculated using MDEQ methodology based on averaging the WWTF per capita influent flow on non-precipitation days during the months of March through May and September through November (months when the groundwater in Michigan is typically elevated). Figure 7 is a graphical representation of the MDEQ infiltration analysis, showing the WWTF influent flow for days in March through May and September through November when there was no recorded precipitation. Also shown are the MDEQ "dry sewage"[7] calculated flow (based on a flow of 70 gpcd) and the MDEQ excessive infiltration threshold of 120 gpcd.

[7] "Dry sewage" refers to the amount of sewage a typical person generates in a day. This value is referred to as "dry sewage" because it is the expected sewage flow excluding the effects of additional water from I/I.

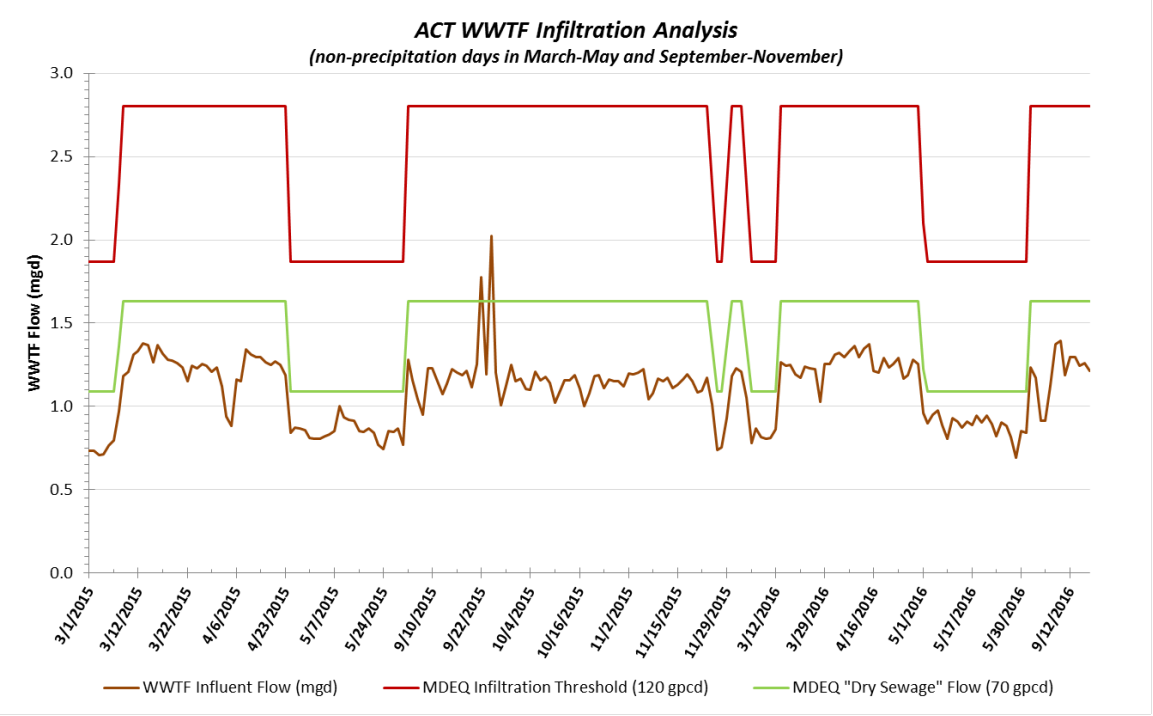



*Figure 7. Infiltration and storm-induced I/I flow analysis, based on the WWTF flow and precipitation from 2015-2016.*

As previously noted, the average DWF to the ACT WWTF during the study period was below the MDEQ standard of 70 gpcd. Figure 7 shows that there were only 2 occasions in 2015-2016 when the average flow to the WWTF surpassed 70 gpcd. In neither of those instances did the daily flow exceed the average excessive infiltration threshold value of 120 gpcd.

While the MDEQ analysis does not indicate excessive infiltration, data from the WWTF indicates infiltration is likely taking place. Data from 2010 through 2016 shows that influent flows to the WWTF drop drastically when GVSU's school year ends as expected, and then continue to drop even more, but at a slower rate, through late May. In comparing flows from 2010 through 2016 for the time GVSU's school year ends until May 20 with flows from May 21 until students begin to return to GVSU in the fall, there is an average of 73,800 gpd more flow in early May.

This trend is also noted in data from the upstream lift stations and corresponds to the time frame when groundwater tables are beginning to drop off towards summer lows. Table 2 summarizes the average daily infiltration flows observed during the study period.

*Table 2. Average infiltration rates during the study period for locations where flows were measured.*

| | Average Spring Flow (gpd)[1] | Average Summer Flow (gpd)[2] | Infiltration Flow (gpd) |
|---|---|---|---|
| Brown Street Lift Station | 5,448 | 2,726 | 2,721 |
| Hidden Shores Lift Station | 28,577 | 27,336 | 1,242 |
| Timber Creek Lift Station | 44,615 | 32,132 | 12,484 |
| Park Street Lift Station | 175,107 | 140,976 | 34,131 |
| 60th Street North Lift Station | 33,983 | 28,843 | 5,141 |
| 60th Street South Lift Station | 10,849 | 6,495 | 4,354 |
| **WWTF** | **913,429** | **803,652** | **109,777** |

[1] Average spring flow refers to the average flow during the period of time from when GVSU's school year ends until May 20.
[2] Average summer flow refers to the average flow during the period of time from May 21 until students begin to return to GVSU in the fall.

This same trend was noted in multiple Leveloggers scattered throughout the ACT sanitary sewer system. The widespread nature of the infiltration, along with the relatively minor amount of excess flow involved means that attempting to remove the infiltration is not cost effective. It is also noted that there were no instances of significant sanitary sewer backups, SSOs, poor treatment performance, or other problems caused during the study period by the amounts of infiltration experienced in the ACT sanitary sewer system. In addition, this infiltration helps keep solids moving through the sanitary sewer system when the actual sewage flows are lower, providing a degree of sewer flushing.

**Precipitation events yielded volumes of inflow and storm-induced I/I that are not excessive by the MDEQ's standards and did not cause sanitary sewer overflows (SSOs), significant sewer backups, poor treatment, or other problems.**

During the study period, there were only two precipitation events with total daily precipitation amounts in excess of 1-inch. July 24, 2016 saw 1.89 inches of precipitation in the ACT service area. This resulted in a daily flow to the WWTF of 0.859 mgd, an increase of 2.8% over the previous two-week average of 0.835 mgd. However, taking into account that July 24 was a Sunday and looking at the average WWTF flows for the 3 Sundays before July 24, the precipitation event resulted in an increase of 18.1% (131,833 gallons) over the Sunday average of 0.727 mgd.

February 2, 2016 saw 1.18 inches of precipitation, resulting in WWTF flow increase of 28.0% over the previous 14-day average flow (1.569 mgd vs. 1.226 mgd). This precipitation event likely caused even more of an inflow response due to the time of year it happened. Typically, precipitation events from November through March are excluded from the MDEQ inflow calculations due to the potential for frozen ground and ice/snow melt to cause more runoff than the same sized storm during April through October.

These responses to relatively minor rainfall indicates that there is potential for large volumes of excess wastewater due to I/I responses to larger storms. The 1.89 inches of precipitation that fell on July 24 is not even equivalent to a 1-year, 24-hour storm for ACT (the 24-hour precipitation amount that has a statistical probability of occurring once a year, 1.95 inches for ACT). In comparison, the design storm for the MDEQ inflow analysis (the 25-year, 24-hour storm) for ACT would be 4.45 inches.

However, despite the increases in WWTF flow for both of these events, the flows were still within the design rated peaking factor for the WWTF and below the design average day flow capacity for the WWTF as well. There were no significant sewer backups or SSOs, and the treatment performance of the WWTF was not affected.

MDEQ methodology for the calculation of excessive inflow amounts involves projecting observed flows and precipitation amounts for at least the top 6 precipitation events from April through October out to the 25-year, 24-hour storm event. Since no large storm events occurred during the study period, historical data from 2010-2016 was also considered. The analysis was conducted using adjusted flow data to account for GVSU's seasonal flows as discussed in Appendix B. Figure 8 is a graphical representation of the inflow analysis.

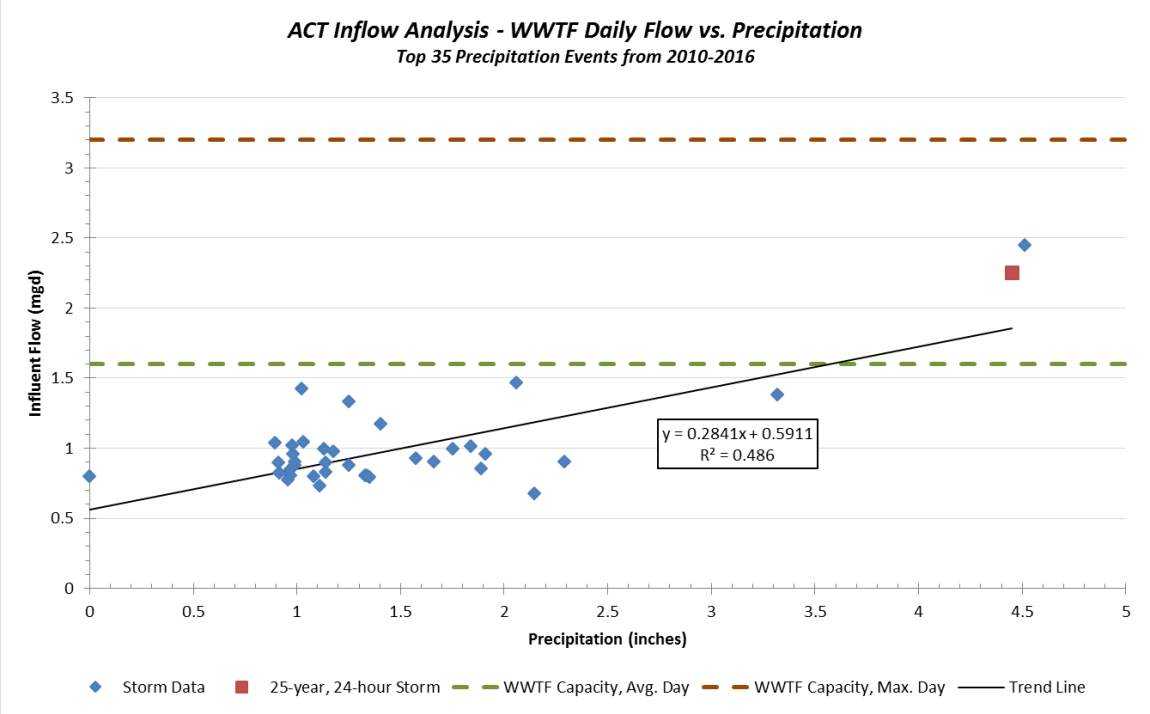



*Figure 8. Correlation between ACT WWTF daily flow and precipitation, based on the flow and precipitation from the top 35 precipitation events from 2010-2016.*

As shown in Figure 8, there is a slight correlation between measured ACT influent flows and precipitation during the period examined. Projecting to the 25-year, 24-hour precipitation amount of 4.45 inches shows that the anticipated flow to the WWTF during this event would be 1.86 mgd based on the summer population without GVSU's school year flows. Accounting for GVSU's school in session flow, the 25-year, 24-hour storm event shown in Figure 8 would be 2.25 mgd, or 151 gpcd – well below the MDEQ's threshold value for excessive inflow and within the rated maximum day treatment capacity of the WWTF. Specifically, even at the design storm event (25-year, 24-hour storm), the total flows expected at the WWTF are anticipated to readily managed and treated.

**Anecdotal evidence shows that I/I flows in ACT can be disruptive to the WWTF, suggesting the need to isolate and remove such flows; Inflow and storm-induced I/I flows were noted in every branch of the collection system and most of the LL sub-districts during the study period.**

While the projected 25-year, 24-hour inflow amounts are not deemed excessive by MDEQ standards and none of the precipitation events occurring during the study period resulted in conveyance issues in the collection system or treatment issues at the WWTF, anecdotal evidence provided by ACT staff indicates that historical storms have resulted in disruptive wastewater flows to the WWTF. There has been one SSO at the WWTF corresponding to a large precipitation event, occurring in 2011. Historical incidents of SSOs serve as an indicator that they could be repeated in the future – especially as baseline flows rise with an increasing service population. In addition, flows need not reach the point to where a SSO will occur in order to be disruptive to the treatment process. With this history of disruptive flows, it may be beneficial to isolate where they are entering the sanitary sewer system and repair the problems to remove those excess volumes from the system and add that capacity back to the WWTF.

In looking at the two precipitation events from the study period that exceeded 1-inch, flow data from the lift stations and the WWTF indicate that all 7 branches were affected by inflow and/or storm-induced I/I.

Table 3 summarizes the responses seen in the branches of the sewer system. Note that the volumes shown in Table 3 are the excess volume for that branch alone, not necessarily the lift station (i.e. the volume shown for the Park Street Lift Station Branch is the excess volume calculated at the Park Street Lift Station minus the excess volumes from the Hidden Shores, Brown Street, and Timber Creek Lift Stations). Table 3 lists both the initial inflow (the excess volume of wastewater seen on the day of the precipitation) and the total approximate excess volume, which includes both the initial inflow and storm-induced I/I causing elevated flows for the number of days indicated by the response duration.

*Table 3. Branch responses to February 2, 2016 and July 24, 2016 precipitation events.*

| | February 2, 2016 | | | July 24, 2016[1] | |
|---|---|---|---|---|---|
| | Initial Inflow (gpd) | Response Duration (days) | Approx. RDII Volume (gal) | Initial Inflow (gal) | Response Duration (days) |
| Hidden Shores Branch | 350 | 1 | 350 | 1,800 | 2 |
| Timber Creek Branch | 2,400 | 3 | 5,300 | 5,200 | >4[2] |
| 60th Street South Branch | 1,200 | 14 | 22,000 | 300 | >4 |
| Brown Street Branch | 3,000 | 14 | 39,000 | 1,000 | 2 |
| 60th Street North Branch | 9,300 | 7 | 66,000 | 4,700 | 2 |
| Park Street Branch | 2,500[3] | 10 | 104,000 | No Inflow[3] | >4[2] |
| WWTF Branch | 332,500 | 5 | 694,000 | 132,000 | 1 |

[1] No approximate excess volume was calculated for the July 24 storm as it occurred at the end of the study period and many of the lift station branches had not yet returned to pre-storm flows.
[2] >4 days was entered for the response duration of all branches that had not returned to pre-storm flows by the end of the study period.
[3] The Park Street Lift Station experienced a larger excess flow of 27,000 gpd the day after the 2/2/2016 rain event, indicating rainfall-derived infiltration is more significant than inflow for this location. Similarly, 30,000 gpd of extra flow was observed at the Park Street lift station the day after the 7/24/2016 rain event.

As Table 3 shows, in looking at the February 2 event, the branches discharging the most excess volume for the area served are the Brown Street and 60th Street North Branches. Combined, the amount of excess volume from these branches is over 100,000 gallons. The Park Street Branch also generated over 100,000 gallons of excess wastewater due to this event. However, the majority of the excess volume seen at the WWTF from both events is from the WWTF Branch, the oldest area of the ACT sanitary sewer system.

While the data from the lift stations or the WWTF at the end of the branches provide actual flows (as opposed to calculated approximate flows for the LL sub-districts), they cover large areas of the sanitary sewer system and don't provide much resolution for pin-pointing the sources of the observed I/I. The data from the LLs provide more resolution and indicates that the LL 4 sub-district (and its upstream sub-districts) is the largest source of storm-induced I/I in the ACT system, accounting for 30% to 40% of the excess flows. Table 4 presents the projected 25-year, 24-hour storm flows for the major LL sub-districts compared to the 275 gpcd MDEQ threshold for excessive inflow rates.

*Table 4. Monitored Dry Weather and Wet Weather Flows; and Projected WWF with GVSU in Session*

| | Monitored Dry Weather Flows | | Average Wet Weather Flows | | Projected Wet Weather Flows (25-yr, 24-hr) | |
|---|---|---|---|---|---|---|
| Monitoring Location | Monitored DWF (gpd) | Monitored DWF per capita (gpcd) | Avg. WWF (gpd) | Avg. WWF per capita (gpcd) | Projected WWF (gpd) | Projected WWF per capita (gpcd) |
| Brown Street LS | 5,900 | 47 | 7,700 | 62 | 10,500 | 85 |
| LL-34 | 14,000 | 60 | 14,000 | 60 | 18,000 | 76 |
| LL-33 | 66,200 | 38 | 77,000 | 45 | 128,300 | 74 |
| LL-38 | 6,500 | 117 | 7,600 | 138 | 15,500 | 282 |
| Hidden Shores LS | 28,200 | 40 | 30,200 | 43 | 40,300 | 58 |
| LL-37 | 19,600 | 39 | 19,900 | 40 | 40,000 | 80 |
| Timber Creek LS | 39,200 | 42 | 46,300 | 49 | 60,500 | 65 |
| LL-36 | 62,400 | 57 | 72.200 | 66 | 93,000 | 86 |
| LL-35 | 71,200 | 55 | 76,900 | 59 | 93,100 | 72 |
| LL-32 | 157,000 | 52 | 166,800 | 55 | 217,200 | 71 |
| LL-31 | 25,800 | 42 | 31,600 | 51 | 60,400 | 98 |
| Park Street LS | 165,100 | 42 | 182,200 | 46 | 227,000 | 58 |
| LL-29 | 181,500 | 43 | 200,000 | 48 | 263,300 | 63 |
| 60th Street South LS | 8,800 | 50 | 13,000 | 74 | 18,500 | 105 |
| LL-28 | 15,800 | 55 | 24,200 | 84 | 40,700 | 141 |
| LL-27 | 14,200 | 51 | 16,700 | 60 | 24,300 | 87 |
| LL-26 | 13,100 | 41 | 17,100 | 53 | 24,500 | 76 |
| 60th Street North LS | 32,700 | 52 | 38,200 | 61 | 51,000 | 81 |
| LL-23 | 10,000 | 41 | 18,000 | 74 | 39,200 | 162 |
| LL-24 | 273,000 | 52 | 282,300 | 54 | 374,000 | 71 |
| LL-20 | 28,700 | 48 | 41,800 | 70 | 67,300 | 113 |
| LL-22 | 246,300 | 41 | 315,500 | 54 | 410,200 | 68 |
| LL-18 | 305,700 | 50 | 331,000 | 54 | 439,300 | 72 |
| LL-17 | 46,000 | 51 | 58,300 | 65 | 194,200 | 217 |
| LL-15 | 87,600 | 66 | 104,400 | 79 | 260,000 | 196 |
| LL-13 | 89,500 | 46 | 108,700 | 56 | 328,000 | 169 |
| LL-12 | 133,000 | 56 | 140,500 | 59 | 421,700 | 178 |
| LL-11 | 507,000 | 50 | 507,000 | 50 | 691,000 | 68 |
| LL-10 | 8,700 | 38 | 11,000 | 48 | 15,500 | 68 |
| LL-07 | 94,700 | 40 | 96,000 | 41 | 269,400 | 115 |
| LL-01 | 55,800 | 31 | 47,500 | 26 | 82,200 | 45 |
| LL-06 | 65,000 | 20 | 65,000 | 20 | 88,700 | 28 |
| LL-05 | 324,600 | 44 | 330,300 | 45 | 402,500 | 55 |
| LL-04 | 399,000 | 44 | 457,000 | 51 | 642,000 | 71 |
| LL-02 | 6,000 | 50 | 6,000 | 50 | 10,000 | 83 |

Sub-district LL-38, upstream of the Hidden Shores lift station, is the only sub-district with projected inflow at an excessive per capita rate.

Important, but not excessive, amounts of inflow at the 25-year, 24-hour storm event, were also identified for several other locations. Sub-districts with important inflow amounts are depicted in orange text in Table 4.

A few residential areas are experiencing some inflow. Data from LL-12 indicates that the neighborhood south of Lake Michigan Drive and East of 56th Avenue (specifically Lance Ave, Jordan Drive, and Douglas) receives inflow during rain events. Data from the 60th Street South lift station shows substantially more water coming from that neighborhood during rain events. The many student townhouse and apartment housing complexes located along 48th Avenue south of Lake Michigan Drive also experiences inflow, as indicated by LL-07.

Data from LL-04, which collects most of the GVSU campus indicate inflow occurring from the campus; although it is not an excessive amount. The projected wet weather flow for the GVSU campus is about double the average dry weather flow. This is important to note as GVSU continues to grow to meet students' needs.

# RECOMMENDATIONS

## CURRENT RECOMMENDATIONS

Based on the results of the MFM project, F&V recommends performing further field investigations to narrow the general areas prone to I/I down to specific areas that can be cost-effectively addressed. These further field investigations include smoke testing, manhole inspections and assessments, and sanitary sewer cleaning and closed-circuit televising (CCTV).

Smoke testing will help to identify locations where there are physical storm connections to the sanitary sewers (downspouts, storm drains, etc.) Manhole inspections will help to identify portions of the sanitary sewer system that are in poor condition and/or contributing to I/I. Cleaning and CCTV will help to pinpoint not only those sanitary sewer defects contributing to infiltration, but also defects affecting the structural integrity of the pipe.

Smoke Testing

The priority locations for smoke testing and manhole inspection are listed below. A map depicting these locations is presented in Appendix A.

**High Priority:**

- **Sewers upstream of LL-38 –** This area is the only location in the entire ACT Service Area with a per capita flow exceeding the 275 gpcd threshold for inflow. There are few active service connections in this area, however, this sewer appears to serve a residential development that is only partially constructed at this time. Smoke testing should locate any taps that have been made but are not active and possibly draining stormwater from undeveloped properties.
- **Sewers upstream of LL-17 and LL-07 –** These area include several off-campus student housing developments. Smoke testing may discern if any roof drains, foundation drains, or parking lot catch basins have been inadvertently connected to the sanitary sewer.
- **Sewers upstream of LL-15 and LL-12–** This includes a few small residential subdivisions. Smoke testing is recommended to look for roof drains, foundation drains, or other inflow sources.
- **Sewers from the GVSU Campus** – This area represents the oldest portion of the ACT sanitary sewer system. Flow estimates indicate that it is responsible for the largest volume of I/I flow. Additionally, anecdotal evidence from ACT staff indicate that this is a major area of concern.

**Medium Priority:**

- **Sewers near the 60th Street South –** The 60$^{th}$ Street South lift station serves a small residential neighborhood. Smoke testing is recommended to look for roof drains, foundation drains, or other inflow sources. Data from LL-28 indicates additional I/I is entering along the sewer between the 60$^{th}$ Street South LS forcemain discharge location and the intersection of 60$^{th}$ Avenue and Countryview.
- **Sewers upstream of LL-31 –** This service area includes residential neighborhoods, a small grade school, and a grocery/shopping center.

CCTV

The priority locations for CCTV and manhole inspection are listed below. A map depicting these locations is presented in Appendix A.

**High Priority:**

- **Sewer upstream and downstream of LL 25** – The LL 25 manhole, the first manhole north of Lake Michigan Drive on 60th Ave. and the inlet and outlet sewers were consistently experiencing an elevated depth throughout the data collection period. This is indicative of a possible structural defect in the sanitary sewer causing clogs to form and propagate upstream.
- **Sewers upstream of LL-38 –** In addition to inflow, this area also receives groundwater infiltration, particularly during the Spring. CCTV should be used in conjunction with the smoke testing prescribed above to locate any taps that have been made but are not active and possibly draining stormwater from undeveloped properties.
- **Sewers from the GVSU Campus** – This area represents the oldest portion of the ACT sanitary sewer system. Estimates of summer flow, when most students are not in class, did not drop off as much as expected, possibly indicating year-round infiltration.

**Medium Priority:**

- **Sewers upstream of LL-31 –** This service area includes residential neighborhoods, a small private grade school, and a grocery/shopping center.
- **The rest of the collection system** – The majority of the ACT collection system receives some amount of I/I, and much of it was found to be vulnerable to debris backups. Though not quite as reactive to precipitation events or as vulnerable to clogging as those areas listed as high-priority areas, the remainder of the collection system should be cleaned and televised in the near future to catalog current defects and serve as a benchmark for future investigations.

## Long Term Recommendations

F&V recommends the following as follow-up to the field investigations specified above:

- Address areas with known inflow impacts with remediation projects.
    - The study pinpointed some general areas where I/I is impacting the sanitary sewer system. The additional field work recommended above should help to narrow these general areas down to some specific areas where remediation projects could significantly reduce I/I in a cost effective manner.
    - ACT personnel may know of some other specific sources that can be addressed cost effectively, including:
        - Removal of known downspout or roof drain connections to the sanitary sewers.
        - Verification and separation of suspected or known sump pumps and foundation drains from the sanitary sewers.
        - Correction of known issues causing I/I

# APPENDIX A: MAPS AND SCHEMATICS

# ALLENDALE CHARTER TOWNSHIP
OTTAWA COUNTY, MICHIGAN

## LIFT STATION BRANCHES

FIGURE A1-1

NORTH

SCALE IN FEET

F&V PROJECT NO. 616373

F&V

MATCH LINE A1-2

MATCH LINE A1-4

MATCH LINE SEE BELOW LEFT

MATCH LINE SEE ABOVE RIGHT

94TH AVENUE

WAKE DRIVE

PLACID WATERS DRIVE

LAKE MICHIGAN DRIVE / M-45

78TH AVENUE

74th AVENUE

68TH AVENUE

BENT TREE DRIVE

BROWN ST. LIFT STATION

PARK STREET BRANCH

BROWN STREET BRANCH

CARDINAL STREET

CHERELL STREET

SCOTT STREET

VALLEY VIEW AVENUE

BROWN AVENUE

AVERY AVENUE

SHERIDAN AVENUE

HENRY STREET

JOAL STREET

LL34

LL33

LL32

LL31

LL35

LL38

HIDDEN SHORES LIFT STATION

HIDDEN SHORES BRANCH

TIMBER CREEK BRANCH

BLUE JAY DRIVE

RED HAWK LANE

BARN OWL LN.

BARN OWL CT.

SKYWAY LANE

WATERWAY DRIVE

ISLAND COURT

WATERLINE DRIVE

WATERMARK DRIVE

WATERVIEW DRIVE

CREEK DRIVE

LINE DRIVE

# ALLENDALE CHARTER TOWNSHIP
OTTAWA COUNTY, MICHIGAN

## LIFT STATION BRANCHES

FIGURE A1-2

F&V PROJECT NO. 616373

NORTH

0 200 400
SCALE IN FEET

MATCH LINE A1-1

MATCH LINE A1-3

MATCH LINE A1-5

60th STREET
NORTH BRANCH
LIFT STATION

WASTEWATER TREATMENT
PLANT BRANCH

60th STREET
NORTH BRANCH

PARK STREET
BRANCH

LL12
LL13
LL18
LL19
& BL
LL20
LL21
LL22
LL23
LL24
LL25
LL26
LL27
LL28
LL29
LL30

60TH AVENUE
64TH AVENUE
56TH AVENUE
54TH AVENUE
53RD AVENUE

ALMARI DRIVE
KINGSBURY COURT
COMFORT ST.
BALCOM LANE
FARMVIEW DRIVE
BROOKRIDGE DRIVE
WILLMINGTON
NORFOLK DRIVE
CHARLESTON DRIVE
BROOKLAND DRIVE
SPRUCEVIEW CT.
RICH STREET
FROSTLINE DRIVE
EAGLE NEST COURT
HUNTERS MEADOW DRIVE
PEBBLE DRIVE
PRAIRIE AVENUE
IVORY ROAD
ROSEWOOD AVENUE
CAMERON AVENUE
CRABTREE ST.
EDGEWAY
RIPPLE DRIVE
CRYSTAL DRIVE
DEWPOINTE DRIVE
LARKSPUR LANE
WASHINGTON AVENUE
COMMERCE DRIVE
EDGEWATER
LAKE MICHIGAN DRIVE / M-45
COUNTRYVIEW DRIVE
NORTH GATE
ERIC STREET
RICHARD AVENUE
ESTATE DRIVE
FOREST VIEW
HOMESTEAD LN
JORDAN STREET
SUMMER BROOK COURT
MISTA DRIVE
BURG GEMMEN STREET
WOODED

# ALLENDALE CHARTER TOWNSHIP
OTTAWA COUNTY, MICHIGAN

## LIFT STATION BRANCHES

FIGURE A1-3

F&V PROJECT NO. 616373

NORTH
0 200 400
SCALE IN FEET

MATCH LINE A1-2

WASTEWATER TREATMENT PLANT BRANCH

46TH AVENUE
PINGREE STREET
CHATEAU CIRCLE
LEEWARD LANE
TWILIGHT WAY
SUNDROP CRICLE
SUNSET GLEN
MORNINGSTAR DRIVE
DANTON DRIVE
NICHOLAS DRIVE
40TH AVENUE
ALLENDALE WWTP
LEPRINO WWTP
CADET
LL2
RAVINES DR
RIVER RIDGE DR
RIVER RIDGE CT
CAMPUS ACCESS DRIVE
ALLEN PARK DR
BECKER
UNIVERSITY PKWY
LL7
LL11
LL9
LL10
RADCLIFF DRIVE
STANFORD AVE
LL4
N CAMPUS DRIVE
STADIUM DRIVE
LL5
ODEDGE
ODEDGE DRIVE
COURT

MATCH LINE A1-6

MATCH LINE A1-1

HIDDEN SHORES BRANCH

TIMBER CREEK BRANCH

WATERMARK

WATERVIEW

PINEVALLEY COURT

TIMBER CREEK

TIMBERLINE DRIVE

PINE GROVE STREET

LL37

TIMBER CREEK LIFT STATION

LEARNING LANE

JOAL STREET

LL36

ASPEN DRIVE

SUNSET

DRIVE

BLACK CHERRY

WHITE BIRCH DRIVE

MAPLEBROOK DRIVE

MAPLEVIEW AVENUE

MARTINIE

WINANS STRE

PARK STREET BRANCH

CHINOOK DRIVE

COURT

68TH AVENUE

ELWOOD COURT

ANT

MATCH LINE A1-5

NORTH

0 200 400

SCALE IN FEET

ALLENDALE CHARTER TOWNSHIP

OTTAWA COUNTY, MICHIGAN

LIFT STATION BRANCHES

FIGURE A1-4

F&V PROJECT NO. 51073

F&V

MATCH LINE A1-2

MARTINIE DRIVE

TIMBER DRIVE

INANS STREET

RED OAK LANE

MAPLE BEND TRAIL

TALLPINE LANE

HORIZON LANE

MARYELIZ COURT

MELANIE DRIVE

LYNN DRIVE

SUNSHINE STREET

JORDAN COURT

DOUGLAS AVENUE

CIRCLEVIEW

LL14

PARK STREET BRANCH

60th STREET SOUTH BRANCH LIFT STATION

WINDFIELD DRIVE

ROCKFIELD DRIVE

CRESTFIELD LANE

60th STREET SOUTH BRANCH

PIERCE STREET

LL15

LL16

MALTA DR

N MALTA DR

S MALTA DR

WASTEWATER TREATMENT PLANT BRANCH

64TH AVENUE

ANNABELLE DRIVE

COURT

60TH AVENUE

56TH AVENUE

52ND AVENUE

MATCH LINE A1-4

MATCH LINE A1-6

NORTH

0 200 400

SCALE IN FEET

# ALLENDALE CHARTER TOWNSHIP

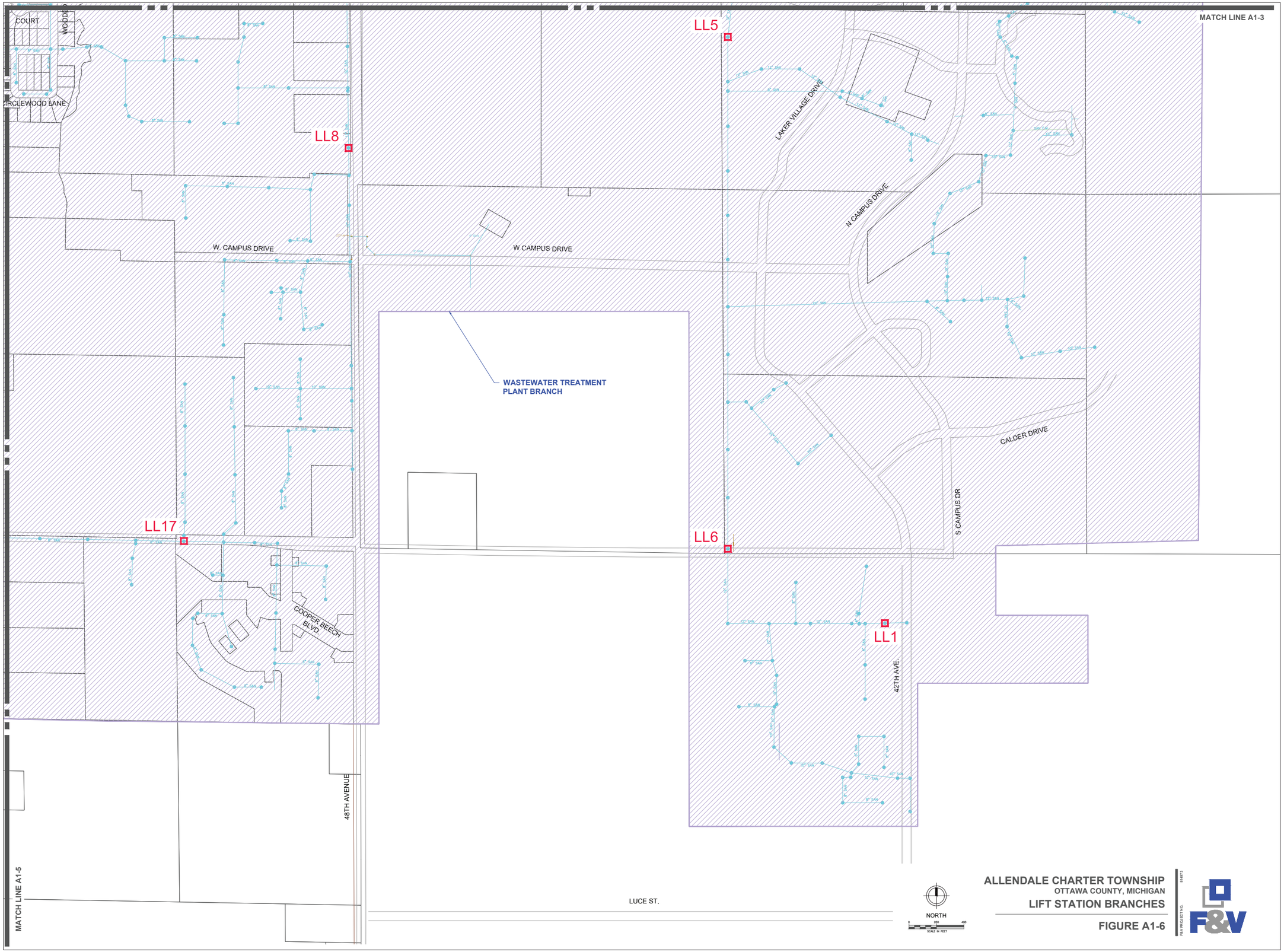
OTTAWA COUNTY, MICHIGAN

## LIFT STATION BRANCHES

## FIGURE A1-5

F&V PROJECT NO. 914073

F&V




**ALLENDALE CHARTER TOWNSHIP**
OTTAWA COUNTY, MICHIGAN
**LIFT STATION BRANCHES**

**FIGURE A1-6**

F&V PROJECT NO. 210877.2

# ALLENDALE CHARTER TOWNSHIP
OTTAWA COUNTY, MICHIGAN

## LEVEL LOGGER SUB-DISTRICTS

FIGURE A2-1

NORTH
0 200 400
SCALE IN FEET

F&V PROJECT NO. 616373

F&V

MATCH LINE A2-2

MATCH LINE A2-4

MATCH LINE SEE ABOVE RIGHT

MATCH LINE SEE BELOW LEFT

LL38 SUB-DISTRICT

LL34 SUB-DISTRICT

LL33 SUB-DISTRICT

LL32 SUB-DISTRICT

LL31 SUB-DISTRICT

LL36 SUB-DISTRICT

LL35 SUB-DISTRICT

BROWN ST. LIFT STATION

HIDDEN SHORES LIFT STATION

84TH AVENUE

WAKE DRIVE

PLACID WATERS DRIVE

LAKE MICHIGAN DRIVE / M-45

74th AVENUE

78TH AVENUE

68TH AVENUE

BLUE JAY DRIVE

RED HAWK LANE

BARN OWL LN

BARN OWL CT

VALLEY VIEW AVENUE

BROWN AVENUE

AVERY AVENUE

SHERIDAN AVENUE

BENT TREE DRIVE

CARDINAL STREET

CHERELL STREET

SCOTT STREET

WATERWAY DRIVE

WATERLINE DRIVE

WATERMARK DRIVE

WATERVIEW DRIVE

ISLAND COURT

SKYWAY LANE

CREEK DRIVE

LINE DRIVE

PUMP STATION

LL38

LL34

LL33

LL32

LL31

LL35

# ALLENDALE CHARTER TOWNSHIP
OTTAWA COUNTY, MICHIGAN

## LEVEL LOGGER SUB-DISTRICTS

FIGURE A2-2

F&V PROJECT NO. 616373

NORTH

0 200 400
SCALE IN FEET

MATCH LINE A2-1

MATCH LINE A2-3

MATCH LINE A2-5

60TH AVENUE

56TH AVENUE

64TH AVENUE

53RD AVENUE

RICH STREET

ALMARI DRIVE

KINGSBURY COURT

COMFORT ST.

FARMVIEW DRIVE

BALCOM LANE

WILLMINGTON

NORFOLK DRIVE

CHARLESTON DRIVE

BROOKRIDGE DRIVE

BROOKLAND DRIVE

VIEW CT.

FROSTLINE DRIVE

EAGLE NEST COURT

HUNTERS MEADOW DRIVE

PRAIRIE AVENUE

IVORY ROAD

ROSEWOOD AVENUE

CAMERON AVENUE

CRABTREE ST.

EDGEWAY

PEBBLE DRIVE

RIPPLE DRIVE

CRYSTAL DRIVE

DEW POINTE DRIVE

LARKSPUR LANE

WASHINGTON AVENUE

COMMERCE DRIVE

EDGEWATER

LAKE MICHIGAN DRIVE / M-45

NORTH GATE

ERIC STREET

SUMMER BROOK COURT

JORDAN STREET

COUNTRYVIEW DRIVE

RICHARD AVENUE

ESTATE DRIVE

FOREST VIEW

HOMESTEAD LN.

MISTA DRIVE

BURG GEMMEN STREET

WOODED COURT

LL11 SUB-DISTRICT

LL27 SUB-DISTRICT

LL26 SUB-DISTRICT

LL25 SUB-DISTRICT

LL29 SUB-DISTRICT

LL30 SUB-DISTRICT

LL33 SUB-DISTRICT

LL24 SUB-DISTRICT

LL23 SUB-DISTRICT

LL22 SUB-DISTRICT

LL18 SUB-DISTRICT

LL19 SUB-DISTRICT

LL20 SUB-DISTRICT

LL31 SUB-DISTRICT

LL28 SUB-DISTRICT

LL21 SUB-DISTRICT

LL12 SUB-DISTRICT

LL27

LL26

LL25

LL29

LL30

LL23

LL22

LL18

LL19 & BL

LL20

LL21

LL12

LL13

60th STREET NORTH BRANCH LIFT STATION

# ALLENDALE CHARTER TOWNSHIP
OTTAWA COUNTY, MICHIGAN

## LEVEL LOGGER SUB-DISTRICTS

FIGURE A2-3

F&V PROJECT NO. 516373

NORTH
0 200 400
SCALE IN FEET

MATCH LINE A2-2

46TH AVENUE
PINGREE STREET
NICHOLAS DRIVE
CHATEAU CIRCLE
LEEWARD LANE
SUNDROP CRICLE
SUNSET GLEN
TWILIGHT WAY
MORNINGSTAR DRIVE
DANTON DRIVE
40TH AVENUE
10" SAN. P.S.
14" & 20" SAN. P.S.
ALLENDALE WWTP
LEPRINO WWTP
12" SAN P.S.
20" SAN P.S.
GARFIELD
RAVINES DR
RIVER RIDGE DR
RIVER RIDGE CT
CAMPUS ACCESS DRIVE
ALLEN PARK DR.
BECKER
UNIVERSITY PKWY
RADCLIFF DRIVE
STANFORD AVE
N CAMPUS DRIVE
STADIUM DRIVE
ODEDGE DRIVE
COURT

LL11 SUB-DISTRICT
LL9 SUB-DISTRICT
LL10 SUB-DISTRICT
LL7 SUB-DISTRICT
LL4 SUB-DISTRICT
LL2 SUB-DISTRICT

LL11
LL9
LL10
LL7
LL4
LL5
LL2
12

MATCH LINE A2-6

MATCH LINE A2-1

LL36
SUB-DISTRICT

LL36

LL37

LL37
SUB-DISTRICT

TIMBER CREEK
LIFT STATION

LL35
SUB-DISTRICT

WATERVIEW DRIVE

TIMBER CREEK DRIVE

TIMBERLINE DRIVE

PINEVALLEY COURT

PINE GROVE STREET

ASPEN DRIVE

SUNSET DRIVE

BLACK CHERRY

WHITE BIRCH DRIVE

LEARNING LANE

MAPLEBROOK DRIVE

MAPLEVIEW AVENUE

68TH AVENUE

CHINOOK DRIVE

ELWOOD COURT

MARTINIE

WINANS STRE

MATCH LINE A2-5

NORTH

0 200 400
SCALE IN FEET

ALLENDALE CHARTER TOWNSHIP
OTTAWA COUNTY, MICHIGAN
LEVEL LOGGER SUB-DISTRICTS

FIGURE A2-4

F&V PROJECT NO. 81973

MATCH LINE A2-2

LL28 SUB-DISTRICT

LL20 SUB-DISTRICT

LL21 SUB-DISTRICT

LL12 SUB-DISTRICT

LL13 SUB-DISTRICT

LL14 SUB-DISTRICT

LL30 SUB-DISTRICT

LL16 SUB-DISTRICT

LL15 SUB-DISTRICT

LL14

LL15

LL16

MARTINIE DRIVE

TIMBER DRIVE

MANANS STREET

RED OAK LANE

MAPLE BEND TRAIL

HORIZON LANE

TALLPINE LANE

LYNN DRIVE

MELANIE DRIVE

MARKETZ COURT

SUNSHINE STREET

JORDAN COURT

DOUGLAS DRIVE

CIRCLEVIEW

ROCKFIELD DRIVE

WINDFIELD DRIVE

CRESTFIELD LANE

60th STREET
SOUTH BRANCH
LIFT STATION

PUMP STATION

PIERCE STREET

64TH AVENUE

60TH AVENUE

56TH AVENUE

52ND AVENUE

ANNABELLE DRIVE

MALTA DR

N MALTA DR

S MALTA DR

MATCH LINE A2-4

MATCH LINE A2-6

NORTH

0 200 400

SCALE IN FEET

# ALLENDALE CHARTER TOWNSHIP
OTTAWA COUNTY, MICHIGAN

## LEVEL LOGGER SUB-DISTRICTS

## FIGURE A2-5

F&V PROJECT NO. 210073

F&V

COURT

WOODED

CIRCLEWOOD LANE

LL7
SUB-DISTRICT

LL13
SUB-DISTRICT

LL8

LL5

MATCH LINE A2-3

LAKER VILLAGE DRIVE

N CAMPUS DRIVE

W. CAMPUS DRIVE

W CAMPUS DRIVE

LL8
SUB-DISTRICT

LL5
SUB-DISTRICT

LL14
SUB-DISTRICT

CALDER DRIVE

S CAMPUS DR

LL17

LL6

LL1

LL1
SUB-DISTRICT

COOPER BEECH BLVD

LL15
SUB-DISTRICT

LL17
SUB-DISTRICT

42TH AVE.

LL6
SUB-DISTRICT

48TH AVENUE

MATCH LINE A2-5

LUCE ST.

NORTH

0 200 400
SCALE IN FEET

# ALLENDALE CHARTER TOWNSHIP
OTTAWA COUNTY, MICHIGAN

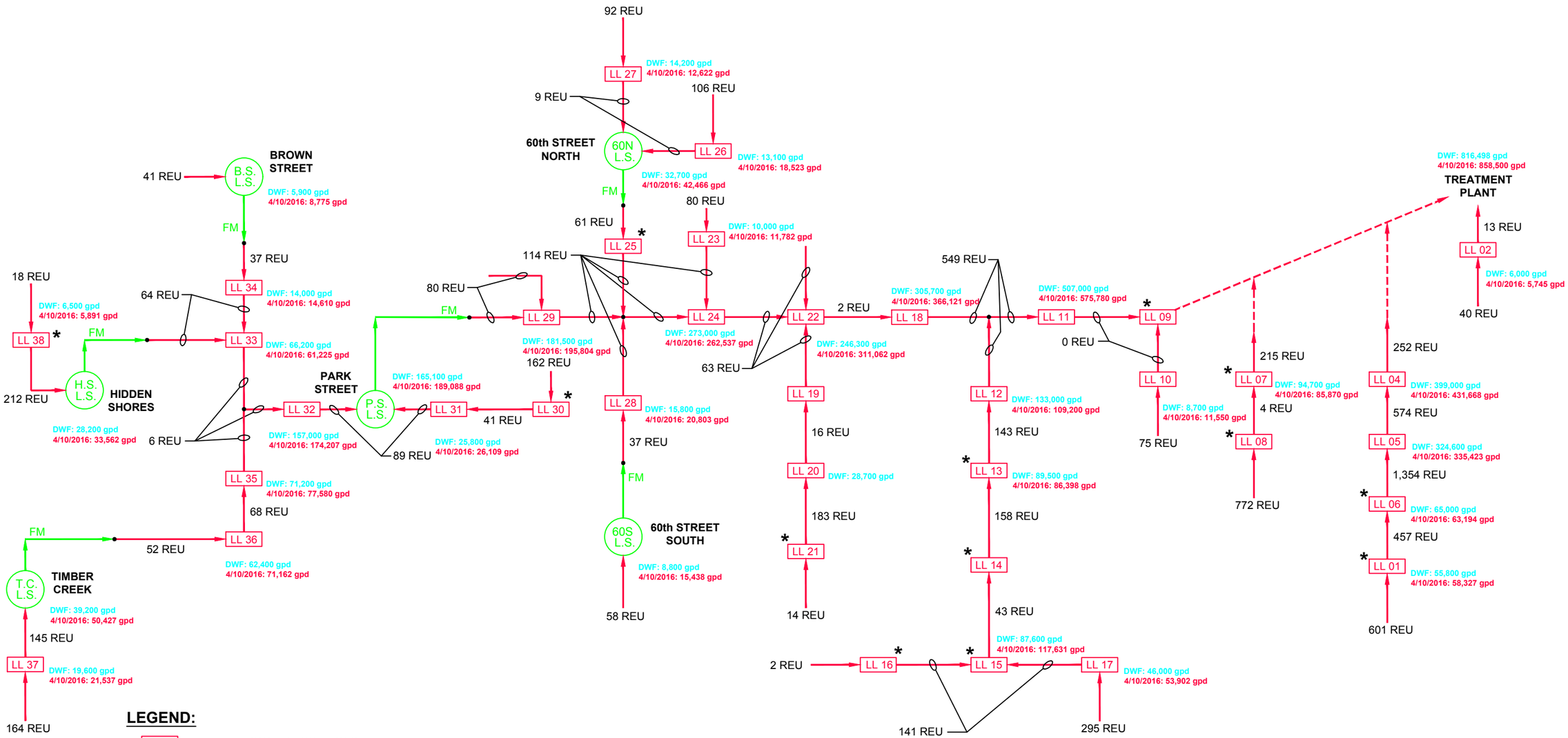
## LEVEL LOGGER SUB-DISTRICTS

FIGURE A2-6

F&V PROJECT NO. 31973

F&V

DWF: 30,567 gpd




## LEGEND:

| | |
|---|---|
| LL## | LEVEL LOGGER LOCATIONS |
| - - - - - | PRESSURE SEWER |
| ——→ | GRAVITY SEWER |
| FM ——→ | FORCEMAIN |
| ## L.S. | LIFT STATION LOCATIONS |
| DWF: # gpd | ESTIMATED DRY WEATHER FLOW DURING GVSU SCHOOL YEAR |
| 4/10/2016: # gpd | ESTIMATED BASED ON DEPTH MEASURED DURING 4/10/2016 RAIN EVENT |
| * | LOCATIONS WHERE CLOGGING OR OTHER ISSUES SEVERLY AFFECTED FLOW ESTIMATES |

# ALLENDALE CHARTER TOWNSHIP

OTTAWA COUNTY, MICHIGAN

## SEWER SCHEMATIC

## FIGURE A3

F&V PROJECT NO. 814973

F&V

BROWN ST.
LIFT STATION

60th STREET
NORTH BRANCH
LIFT STATION

HIDDEN SHORES
LIFT STATION

PARK STREET
LIFT STATION

TIMBER CREEK
LIFT STATION

60th STREET
SOUTH BRANCH
LIFT STATION

GEORGETOWN
TOWNSHIP

LL1 LL2 LL3 LL4 LL5 LL6 LL7 LL8 LL9 LL10 LL11 LL12 LL13 LL14 LL15 LL16 LL17 LL18 LL19 & BL LL20 LL21 LL22 LL23 LL24 LL25 LL26 LL27 LL28 LL29 LL30 LL31 LL32 LL33 LL34 LL35 LL36 LL37 LL38

LEGEND:

LL# LEVELOGGER LOCATION

HIGH PRIORITY.

MEDIUM PRIORITY

NORTH

**ALLENDALE CHARTER TOWNSHIP**

**OTTAWA COUNTY, MICHIGAN**

**SANITARY SEWER SYSTEM SMOKE TESTING**

**PRIORITY AREAS**

**FIGURE A4**

F&V PROJECT NO. 814973

F&V

M:\Proj\812001-815000\814973 ACT SAW - MFM\Mass Flow Monitoring\Mapping\814973_S□□ o□e.dwg, 8/3/2017 2:20:35 PM, davet, 1:1

BROWN ST.
LIFT STATION

HIDDEN SHORES
LIFT STATION

PARK STREET
LIFT STATION

TIMBER CREEK
LIFT STATION

60th STREET
NORTH BRANCH
LIFT STATION

60th STREET
SOUTH BRANCH
LIFT STATION

LL1
LL2
LL4
LL5
LL6
LL7
LL8
LL9
LL10
LL11
LL12
LL13
LL14
LL15
LL16
LL17
LL18
LL19
& BL
LL20
LL21
LL22
LL23
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LL33
LL34
LL35
LL36
LL37
LL38

GEORGETOWN
TOWNSHIP

LEGEND:

LL# ▫ LEVELOGGER LOCATION

HIGH PRIORITY

MEDIUM PRIORITY

NORTH

# ALLENDALE CHARTER TOWNSHIP
OTTAWA COUNTY, MICHIGAN

## SANITARY SEWER SYSTEM TELEVISING PRIORITY AREAS

## FIGURE A5

F&V PROJECT NO. 814973

F&V

M:\Proj\812001-815000\814973 ACT SAW - MFM\Mass Flow Monitoring\Mapping\814973_TV.dwg, 8/3/2017 2:15:58 PM, davet, 1:1

# APPENDIX B: DETAILED ANALYSES, OBSERVATIONS AND DISCUSSION

Appendix B documents detailed analysis and illustrates the reactions within the various study area branches and sub-districts to specific, namely the February 2, 2016 and July 24, 2016, precipitation events. The figures show the recorded influent flows at the branch lift stations (calculated based on the wet well fill time of each lift station pump cycle) and the sewage levels and temperatures recorded by the Leveloggers in the sub-districts. As noted in the report, the volumes of I/I experienced throughout the ACT system are not excessive, but they can cause disruptive flows at the WWTF during periods of high intensity precipitation or periods of prolonged precipitation resulting in high total storm precipitation amounts. These figures suggest where field investigations should be carried out to locate sources of direct or storm induced I/I.

## WASTEWATER TREATMENT FACILITY BRANCH

As Figure A3 in Appendix A shows, there are 8 main Levelogger sub-districts (including 12 upstream Levelogger sub-districts and 2 upstream Lift Station branches) and 1 upstream Lift Station branch that discharge into the trunk sewer running through the WWTF branch. In addition, there are 6 Leveloggers along the trunk sewer that can be used to trace I/I reactions along the trunk sewer.

**Levelogger 4 Sub-District (GVSU Campus)**

Figures B1 and D2 present data from the Levelogger 4 sub-district. LL-4 is located at the downstream end of the main GVSU campus service area, just south of M-45 / Lake Michigan Drive.

As illustrated in Figure B1, LL-4 shows a marked response in both wastewater level and wastewater temperature to the July 24, 2016 precipitation event. While the lower intensity precipitation earlier in the day caused some minor reactions in both level and temperature, the very intense precipitation at around 8:30 a.m. (1.36 inches/hour) caused the wastewater level to rise by over 1.5 inches corresponding to a nearly 6 degree temperature increase at LL-4. The quick response in water depth (and therefore, flow) during the most intense period of rainfall is indicative of inflow. Inflow coming from roof drains and parking lots tends to be warmer than sewage during the summer months.




*Figure B1. Levelogger 4 wastewater depth (green), temperatures (red), and precipitation (blue) for the July 24, 2016 precipitation event.*

Conversely, inflow during the winter tends to be colder than sewage. This temperature correlation was observed during the February 2, 2016 precipitation event. Figure B2 below illustrates the LL-4 data on 2/2/16, with the wastewater temperature dropping in response to the first batch of precipitation, recovering when the precipitation stops and then dropping almost 5 degrees when the precipitation starts again.




*Figure B2. Levelogger 4 wastewater depth (green), temperatures (red), and precipitation (blue) for the February 2, 2016 precipitation event.*

LL-5 is upstream of LL-4 just south of Stadium Drive. Figure B3 shows that LL-5 was being affected by a clog immediately prior to the July 24 precipitation event, beginning to lift the Levelogger sensor out of the flow channel on July 22, likely causing the pressure sensor to record lower than actual levels. The data indicate that the clog cleared as a result of the extra flow iduring the most intense portion of the July 24 precipitation. The temperature responded as well.




*Figure B3. Levelogger 5 wastewater depth (green), temperatures (red), and precipitation (blue) for the July 24, 2016 precipitation event.*

Figure B4 shows a reaction in both temperature and wastewater levels to the February 2 precipitation event with wastewater depths remaining elevated for a couple of days after the event before beginning to fall back to pre-precipitation average levels.




*Figure B4. Levelogger 5 wastewater depth (green), temperatures (red), and precipitation (blue) for the February 2, 2016 precipitation event.*

LL-6 is upstream of LL-5, at Pierce Street. While there is a reaction in wastewater level to the July 24 precipitation event, the temperature reaction is not as intense as that observed at LL-5.




*Figure B5. Levelogger 6 wastewater depth (green), temperatures (red), and precipitation (blue) for the July 24, 2016 precipitation event.*

Figure B6 shows a slight reaction in both wastewater levels and temperature to the February 2 event. This indicates that there is I/I occurring in the LL-5 sub-district as well as upstream of LL-6.




*Figure B6. Levelogger 6 wastewater depth (green), temperatures (red), and precipitation (blue) for the February 2, 2016 precipitation event.*

LL-1 is upstream of LL-6, near 42nd Ave south of Campus View Drive. Figures B7 and B8 show only very slight reactions in wastewater levels and temperatures to the precipitation events. This reaction indicates that there is some amount of I/I coming from the LL-11 sub-district, but that much of the I/I from the GVSU campus is entering the sanitary sewer system north of Pierce Street.

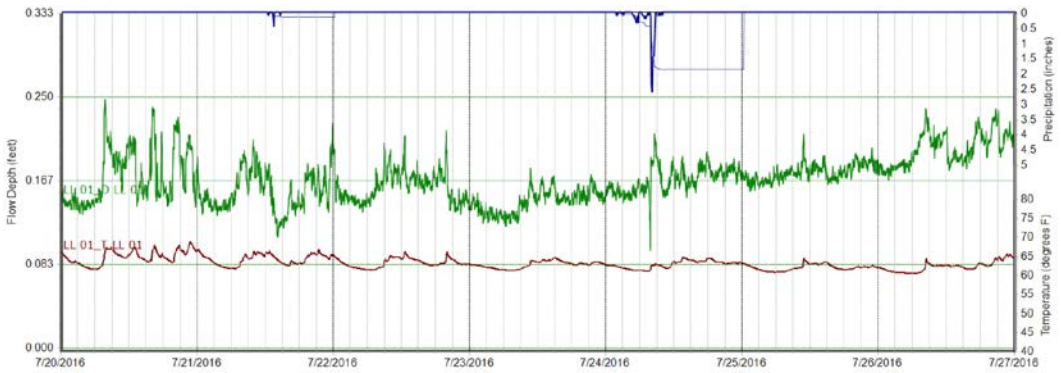



*Figure B7. Levelogger 1 wastewater depth (green), temperatures (red), and precipitation (blue) for the July 24, 2016 precipitation event.*




*Figure B8. Levelogger 1 wastewater depth (green), temperatures (red), and precipitation (blue) for the February 2, 2016 precipitation event.*

**Levelogger 7 sub-district (and upstream Levelogger sub-district)**

LL-7 is located at Lake Michigan Drive and 48th Avenue. Figures B9 and B10 present data from the LL-7 sub-district. The wastewater levels are somewhat elevated during the July 24 precipitation event and there is a minor response in temperature as well. Figure B10 also shows slight responses in both wastewater level and wastewater temperature to the February 2 precipitation event, though there was more of a reaction than in the July 24 event. However, wastewater levels remain elevated in the days following the July 23 precipitation event.




*Figure B9. Levelogger 7 wastewater depth (green), temperatures (red), and precipitation (blue) for the July 24, 2016 precipitation event.*

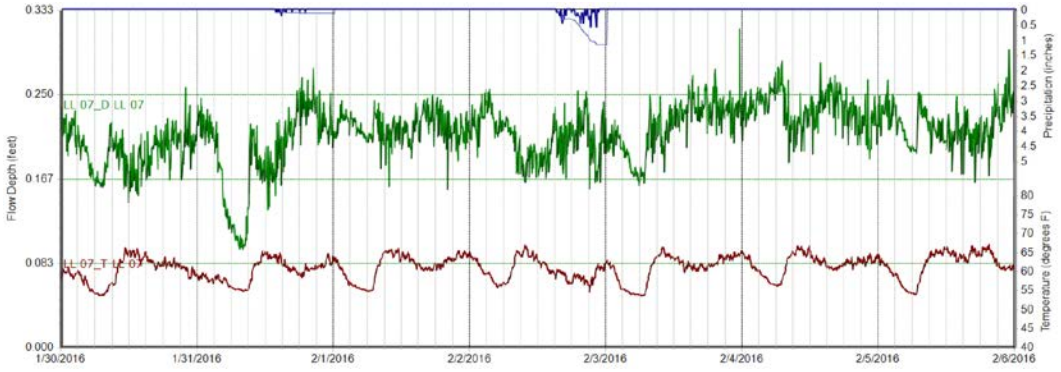



*Figure B10. Levelogger 7 wastewater depth (green), temperatures (red), and precipitation (blue) for the February 2, 2016 precipitation event.*

The reactions seen at LL-7 are similar to the reactions seen at LL-8, which is upstream of LL-7. Data from LL-8 is shown in Figures B11 and B12. As with the reactions in LL-7, there are slight initial reactions with a larger reaction to the February 2 event than the July 24 event. Also, similar to LL-7, while there is some initial I/I reaction during the precipitation events, wastewater levels remain elevated following the precipitation. This indicates that the majority of the excess flows are as a result of storm induced I/I elevating the flows in the days after the initial precipitation event.




*Figure B11. Levelogger 8 wastewater depth (green), temperatures (red), and precipitation (blue) for the July 24, 2016 precipitation event.*




*Figure B12. Levelogger 8 wastewater depth (green), temperatures (red), and precipitation (blue) for the February 2, 2016 precipitation event.*

**Levelogger 12 sub-district (and upstream Levelogger sub-districts)**

LL-12 is located south of Lake Michigan Drive on 52nd Ave. It monitors wastewater from residential subdivisions and an apartment complex adjacent to 52nd Ave. Figures B13 through B24 show the reactions throughout the LL-12 sub-district and the upstream Levelogger sub-districts, which includes LL-13, LL-14, LL-15, LL-16, and LL-17.

Figures B13 and B14 show the reactions from LL-12 for the July 24 and February 2 precipitation events. Both show initial reactions in both wastewater levels and temperatures, with elevated wastewater depths following the February 2 event. This indicates minor initial I/I reactions followed by several days of storm induced I/I.

There is also a secondary response to the July 24 event in both wastewater levels and temperatures about 6 hours after the most intense period of precipitation. This reaction is seen in each of the upstream Leveloggers (LL-13 through LL-17), with the secondary response getting closer to the end of the precipitation event (about 5 hours after the end of the precipitation).




*Figure B13. Levelogger 12 wastewater depth (green), temperatures (red), and precipitation (blue) for the July 24, 2016 precipitation event.*




*Figure B14. Levelogger 12 wastewater depth (green), temperatures (red), and precipitation (blue) for the February 2, 2016 precipitation event.*

Figures B15 and B16 show the reactions from LL- 13, upstream of LL-12. Similar to the reactions seen in LL12, Figure B15 shows an initial reaction to the July 24 precipitation event in both wastewater level and temperature, followed by the secondary reaction after the precipitation had ended.




*Figure B15. Levelogger 13 wastewater depth (green), temperatures (red), and precipitation (blue) for the July 24, 2016 precipitation event.*




*Figure B16. Levelogger 13 wastewater depth (green), temperatures (red), and precipitation (blue) for the February 2, 2016 precipitation event.*

Figures B17 and B18 show the reactions from the next upstream Levelogger, LL-14. As seen in LL-12 and LL-13, Figure B17 shows a slight initial response to the precipitation in both wastewater level and temperature. Figure B17 also shows the delayed reaction to the July 24 event. Figure B18 shows that LL-14 was affected by a clog before the February 2 precipitation event that cleared itself during the precipitation. It also shows a slight response in temperature to the precipitation.

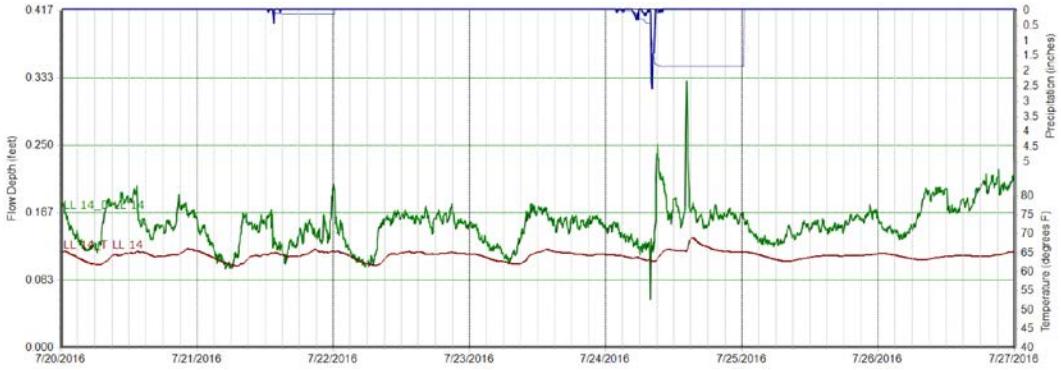



*Figure B17. Levelogger 14 wastewater depth (green), temperatures (red), and precipitation (blue) for the July 24, 2016 precipitation event.*

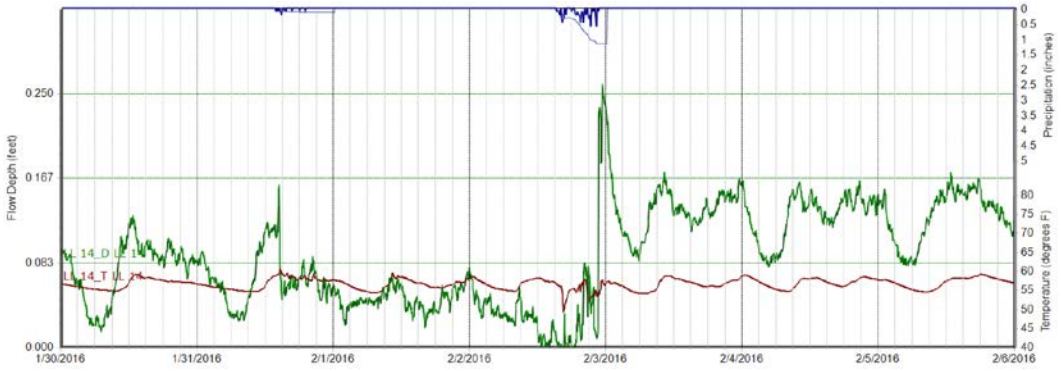



*Figure B18. Levelogger 14 wastewater depth (green), temperatures (red), and precipitation (blue) for the February 2, 2016 precipitation event.*

Figure B19 shows that the same wastewater level and temperature reactions observed in downstream Leveloggers are observed in LL-15 during the July 24 precipitation event. Figure B20 also shows similar reactions to those seen upstream and also shows that a clog was present before the February 2 precipitation event. The clog cleared itself late in the day on February 3.

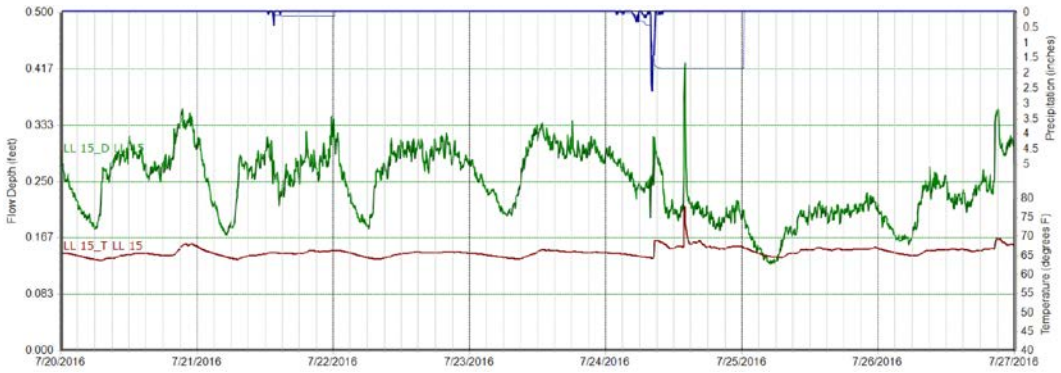



*Figure B19. Levelogger 15 wastewater depth (green), temperatures (red), and precipitation (blue) for the July 24, 2016 precipitation event.*




*Figure B20. Levelogger 15 wastewater depth (green), temperatures (red), and precipitation (blue) for the February 2, 2016 precipitation event.*

LL-16 is located on Pierce Street and is monitoring wastewater from the housing development on Malta Drive. Figures B21 and B22 show that there is little reaction observed to either precipitation event at LL-16. The majority of the depth observed at LL-16 is static depth due to an unknown downstream condition with spikes resulting from a lift station upstream of LL-16. There is little change in the static depth, nor is there any appreciable change in temperature due to the precipitation over that seen in normal upstream lift station runs.

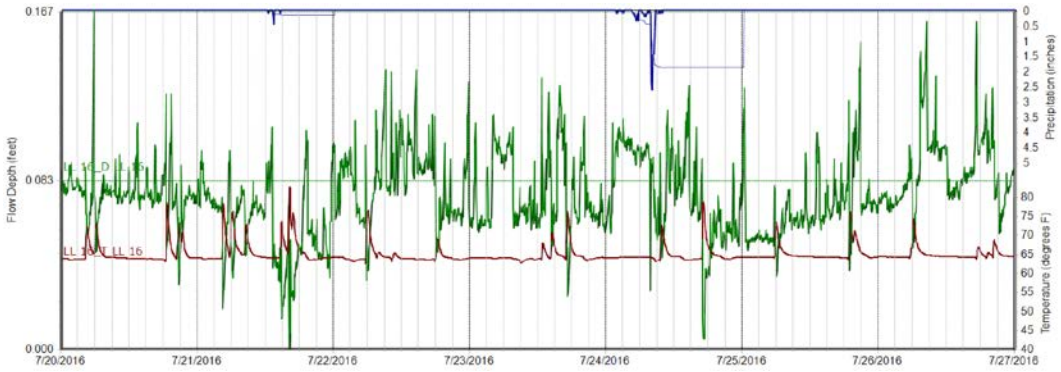



*Figure B21. Levelogger 16 wastewater depth (green), temperatures (red), and precipitation (blue) for the July 24, 2016 precipitation event.*

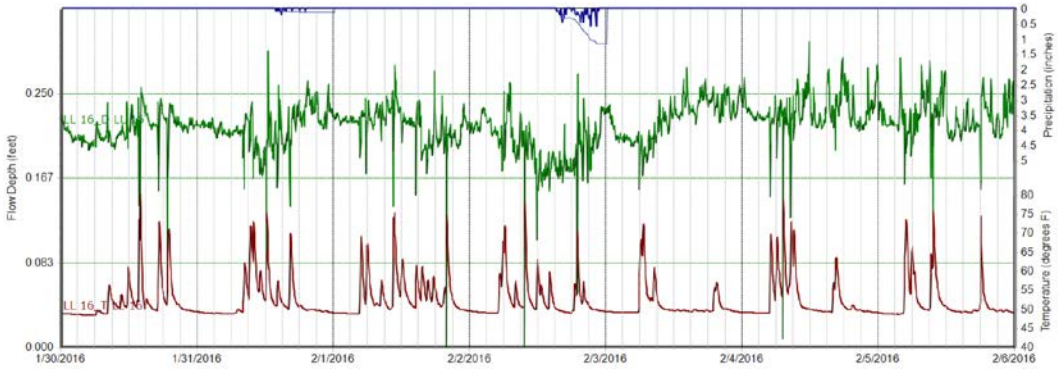



*Figure B22. Levelogger 16 wastewater depth (green), temperatures (red), and precipitation (blue) for the February 2, 2016 precipitation event.*

LL-17 monitors the wastewater depth and temperature for the Copper Beach apartment complex. Figure B23 shows that the same reaction in wastewater levels observed in downstream Leveloggers are observed in LL-17 during the July 24 precipitation event. Figure B23 also shows the same delayed reaction seen through the downstream sewers with a clog possibly starting to lift the Levelogger after the initial precipitation event and then clearing itself just prior to the delayed reaction

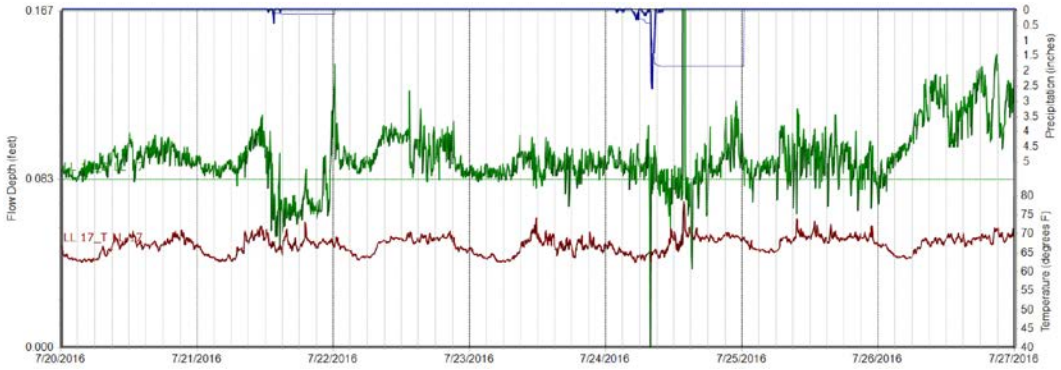



*Figure B23. Levelogger 17 wastewater depth (green), temperatures (red), and precipitation (blue) for the July 24, 2016 precipitation event.*

Figure B24 also shows similar reactions to those seen upstream. A clog was present before the February 2 precipitation event that cleared itself slowly during the day on January 31.

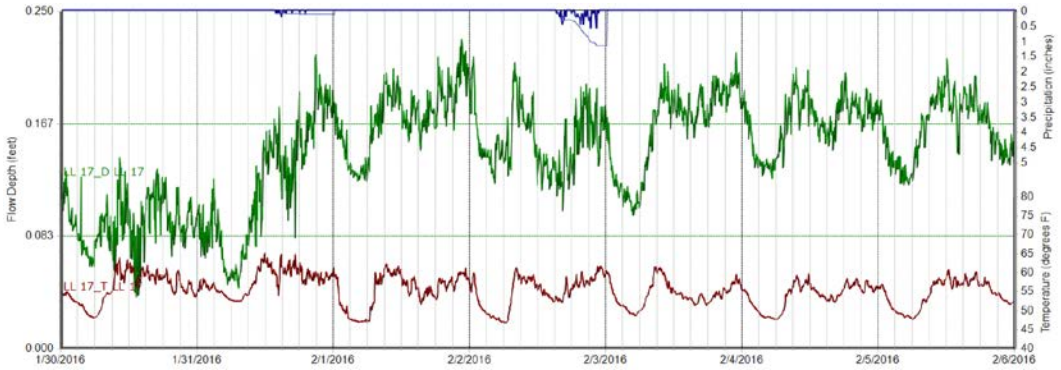



*Figure B24. Levelogger 17 wastewater depth (green), temperatures (red), and precipitation (blue) for the February 2, 2016 precipitation event.*

**Levelogger 19 sub-district (and upstream Levelogger sub-districts)**

LL-19 is located at the intersection of Lake Michigan Drive and 56th Avenue. Figure B25 shows that there was a short-duraction reaction in both wastewater levels and temperatures during the July 24 precipitation even.

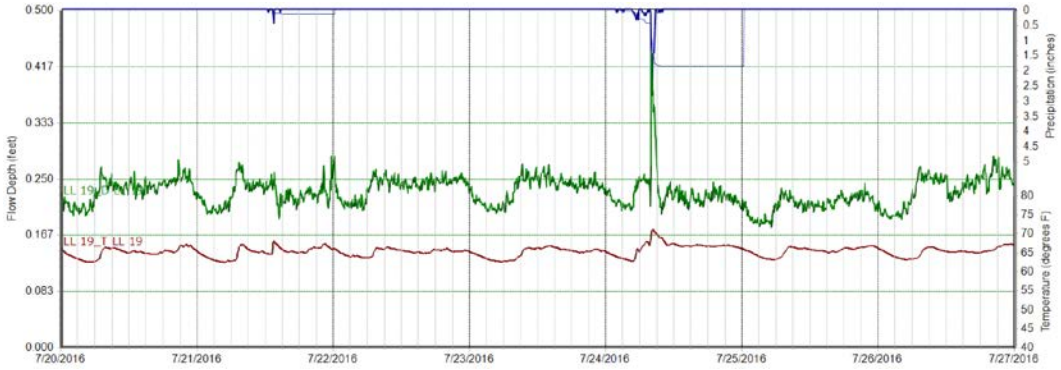



*Figure B25. Levelogger 19 wastewater depth (green), temperatures (red), and precipitation (blue) for the July 24, 2016 precipitation event.*

Figure B26 also shows reactions to the February 2 precipitation event in both wastewater levels and temperatures, but the wastewater levels remain elevated for several days after the event. This is indicative of an initial I/I response during precipitation events and continued storm induced I/I after the rain event, especially as groundwater levels are elevated, as happens during late winter/early spring as accumulated snow begins to melt.




*Figure B26. Levelogger 19 wastewater depth (green), temperatures (red), and precipitation (blue) for the February 2, 2016 precipitation event.*

LL-20 and LL-21, upstream of LL-19, are located south of Lake Michigan Drive on 56th Ave and on the sewer that collects wastewater from the residential areas adjacent to 56th Ave. Figures B27 through B30 show the reactions recorded at LL-20 and LL-21 to the July 24 and February 2 precipitation events. LL-20 showed similar reactions to those observed at LL-19. However, LL-21 showed little to no reaction to the precipitation events. This is indicative that there is both I/I and storm induced I/I occurring in the LL-20 sub-district that is mostly responsible for the response seen in LL-19, though another, smaller source of I/I and/or storm induced I/I in the Levelogger 19 sub-district cannot be completely ruled out from this data.

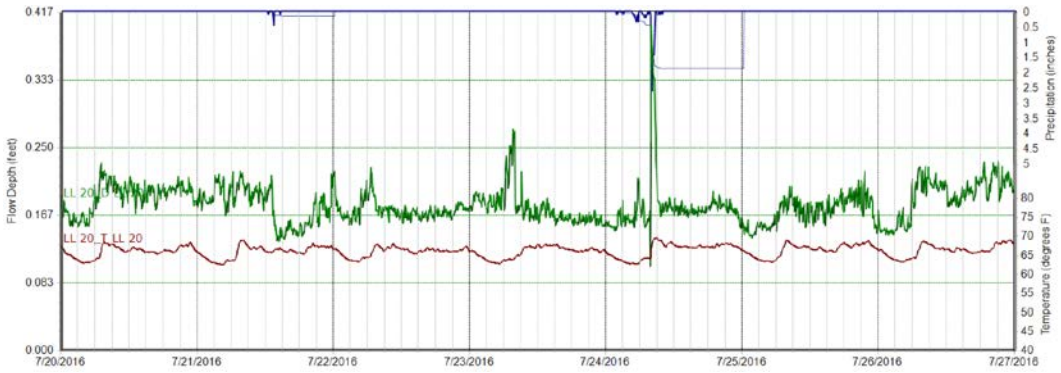



*Figure B27. Levelogger 20 wastewater depth (green), temperatures (red), and precipitation (blue) for the July 24, 2016 precipitation event.*




*Figure B28. Levelogger 20 wastewater depth (green), temperatures (red), and precipitation (blue) for the February 2, 2016 precipitation event.*

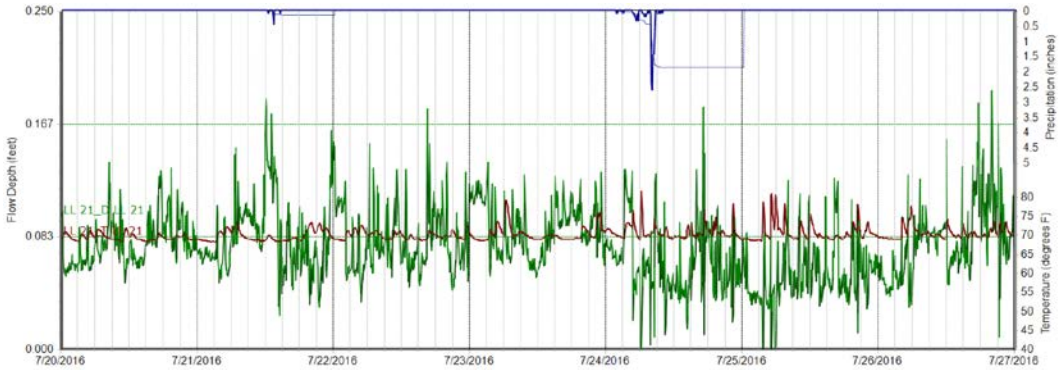



*Figure B29. Levelogger 21 wastewater depth (green), temperatures (red), and precipitation (blue) for the July 24, 2016 precipitation event.*

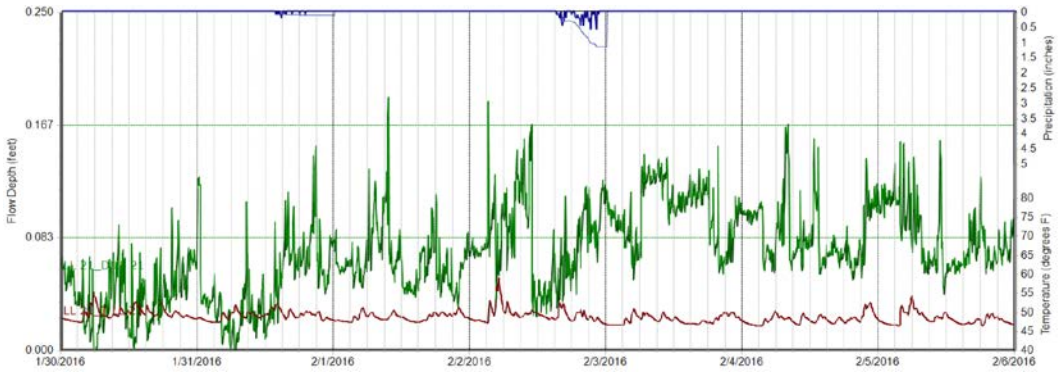



*Figure B30. Levelogger 21 wastewater depth (green), temperatures (red), and precipitation (blue) for the February 2, 2016 precipitation event.*

**Levelogger 25 sub-district (and upstream Lift Station branches/Levelogger sub-districts)**

LL-25 is located on 60th Avenue, just north of Lake Michigan Drive. Figures B31 and B32 show the reactions LL-25 had to the precipitation events on July 24 and February 2. The LL-25 data is influenced by the operations of the 60th Avenue North Lift Station. It appears that for both precipitation events the pump station runs more with fewer pump off cycles. This phenomenon is more pronounced for the February rain event.




*Figure B31. Levelogger 25 wastewater depth (green), temperatures (red), and precipitation (blue) for the July 24, 2016 precipitation event.*

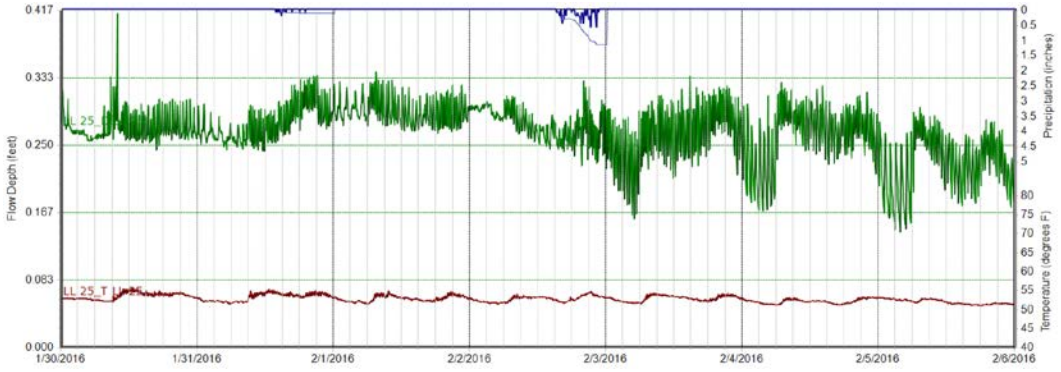



*Figure B32. Levelogger 25 wastewater depth (green), temperatures (red), and precipitation (blue) for the February 2, 2016 precipitation event.*

The 60th Avenue North Lift Station is upstream of the LL-25 monitoring location. Figures B33 and B34 illustrate the flow rate into the lift station wet well.




*Figure B33. 60th Street North Lift Station influent flow rate (purple) and precipitation (blue) for the July 24, 2016 precipitation event.*

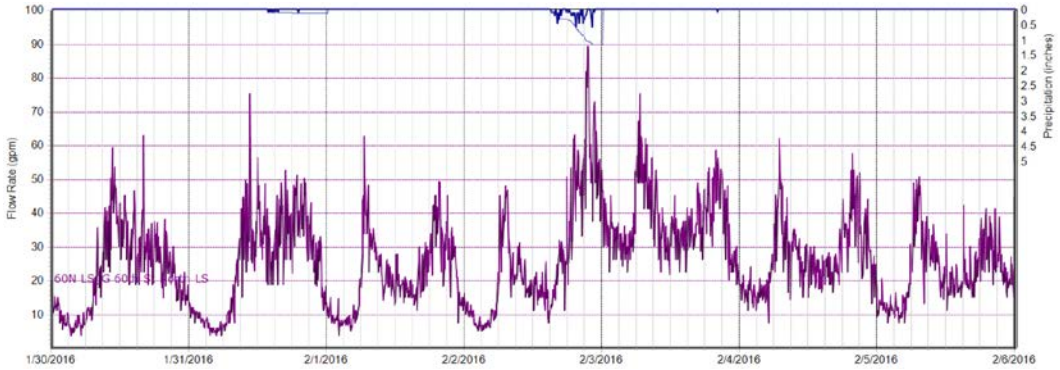



*Figure B34. 60th Street North Lift Station influent flow rate (purple) and precipitation (blue) for the February 2, 2016 precipitation event.*

Figure B35 and B36 illustrated the wastewater depth and temperature reactions recorded at LL-26. LL-26 is located on Frostline Drive, east of 60th Avenue on the sewer branch collecting wastewater from the Hunters Meadow/Eagle Nest residential neighborhood.

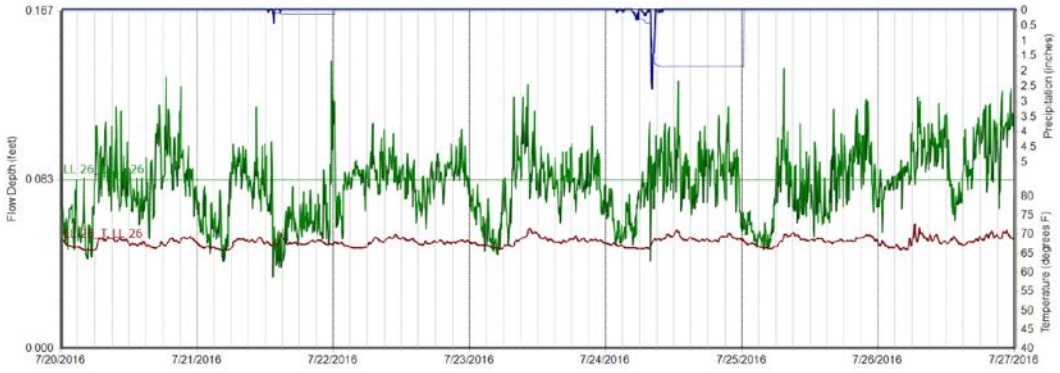



*Figure B35. Levelogger 26 wastewater depth (green), temperatures (red), and precipitation (blue) for the July 24, 2016 precipitation event.*

A much more pronounced reaction was observed during and for several days after the February event, indicating that the I/I source may be mostly infiltration of groundwater.

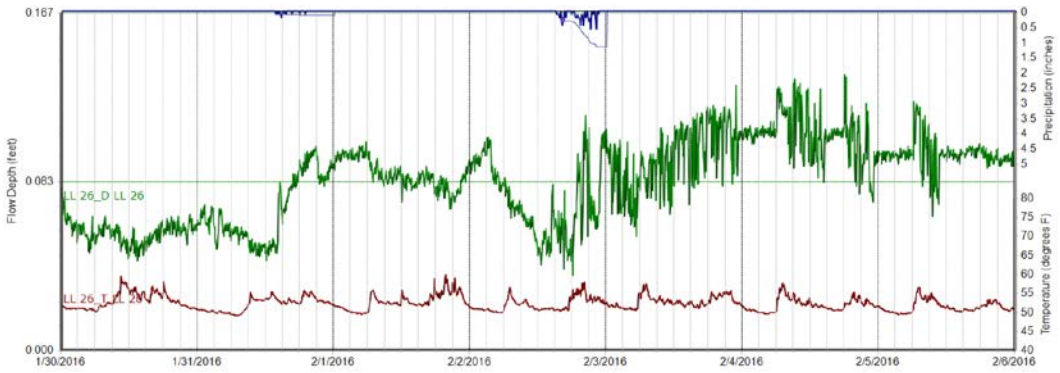



*Figure B36. Levelogger 26 wastewater depth (green), temperatures (red), and precipitation (blue) for the February 2, 2016 precipitation event.*

LL-27 was installed upstream of the 60th Avenue North Lift Station on 60th Avenue to record the wastewater depth patterns from the small residential neighborhoods north of the lift station. Figure Figures B37 and B38 illustrate the July and February precipitation events.

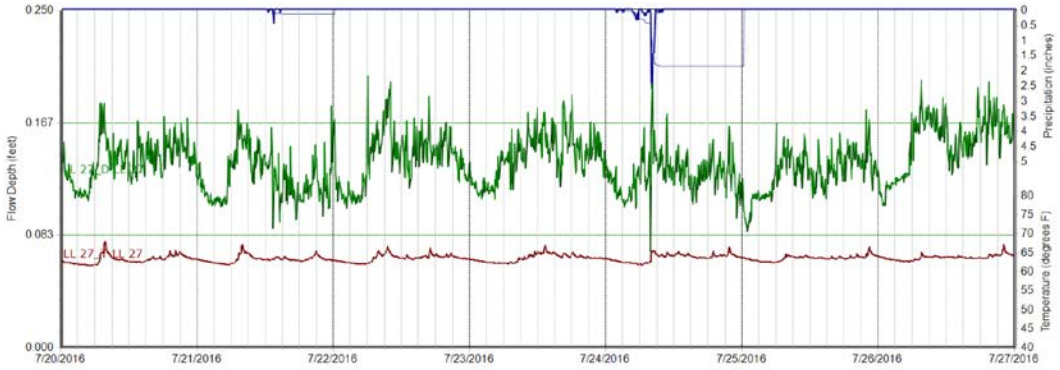



*Figure B37. Levelogger 27 wastewater depth (green), temperatures (red), and precipitation (blue) for the July 24, 2016 precipitation event.*

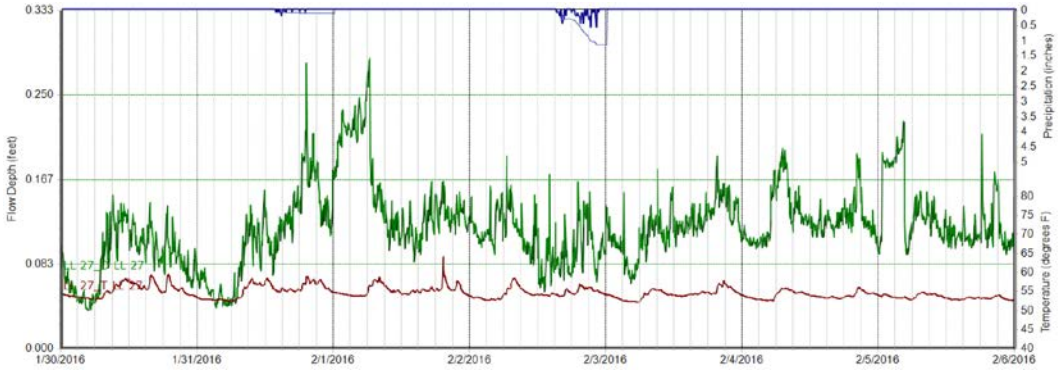



*Figure B38. Levelogger 27 wastewater depth (green), temperatures (red), and precipitation (blue) for the February 2, 2016 precipitation event.*

The reactions at LL-27 were not as pronounced as those at LL-26, therefore the data indicate much of the I/I observed at the 60th Ave. North Lift Station originates in the subdivisions east of 60th Avenue.

**Levelogger 28 sub-district (and upstream Lift station branches/Levelogger sub-districts)**

LL-28 is located south of Lake Michigan Drive on 60th Avenue to monitor the 60th Avenue South Lift Station service Area. Figures B39 and B40 illustrate the reactions observed at LL-28. Because the Levelogger is downstream of the pump station, the pump station cycles are clearly seen.

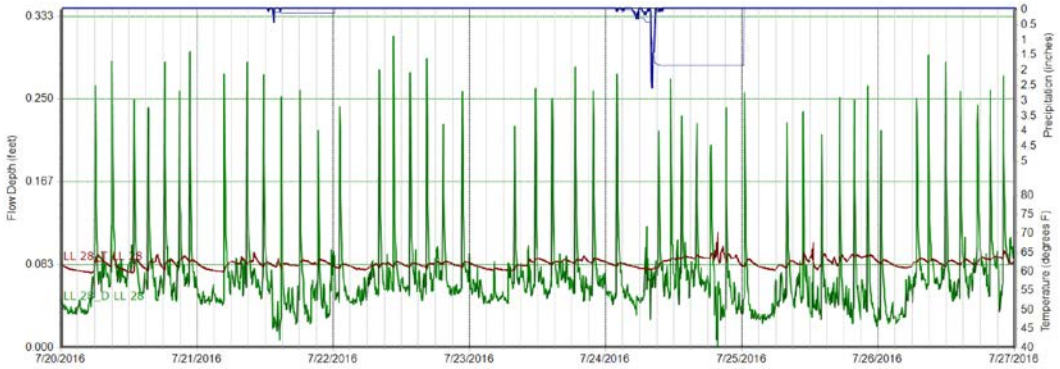



*Figure B39. Levelogger 28 wastewater depth (green), temperatures (red), and precipitation (blue) for the July 24, 2016 precipitation event.*

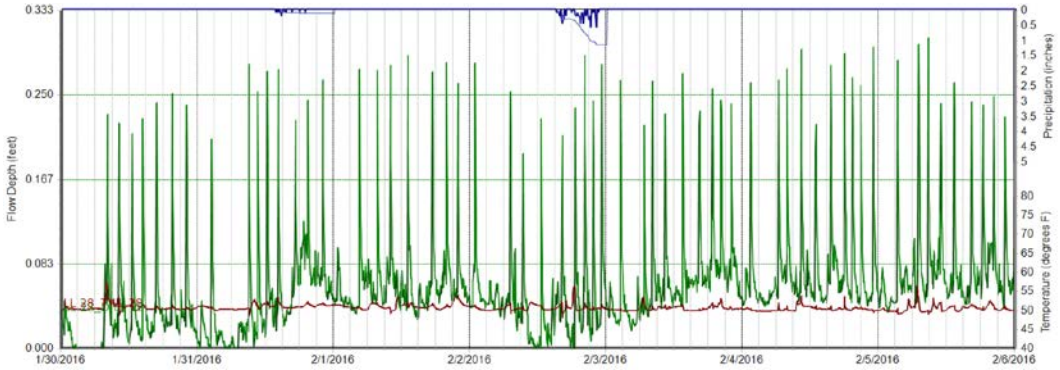



*Figure B40. Levelogger 28 wastewater depth (green), temperatures (red), and precipitation (blue) for the February 2, 2016 precipitation event.*

Figures B41 and B42 show in the flow into the wet well for the 60th Avenue South pump station for the July 24 and February 3 rain events. A quick, short-duration response is observed for both events, indicating a small amount of inflow is entering the sewer system upstream of the pump station.




*Figure B41. 60th Street South Lift Station influent flow rate (purple) and precipitation (blue) for the July 24, 2016 precipitation event.*

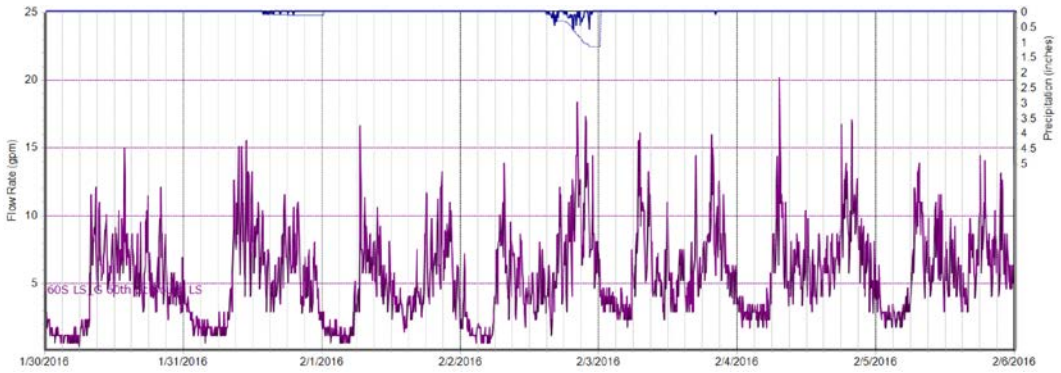



*Figure B42. 60th Street South Lift Station influent flow rate (purple) and precipitation (blue) for the February 2, 2016 precipitation event.*

**Trunk sewer Leveloggers**

Several leveloggers were installed to monitor the main trunk sewer that mostly follows Lake Michigan Drive through the township before turning into a pressure gravity sewer and routing flow northeast to the WWTP. LL-11 was installed on Lake Michigan Drive just before the gravity sewer becomes a pressure gravity sewer. LL-11 captures wastewater from most of the ACT service area, with the exception of the GVSU campus and areas east of 48th Avenue.

Figures B43 and B44 present the data collected at LL-11 for the July and February rain events. The July 24 event resulted in a short duration peak in flow, with a corresponding increase in temperature.

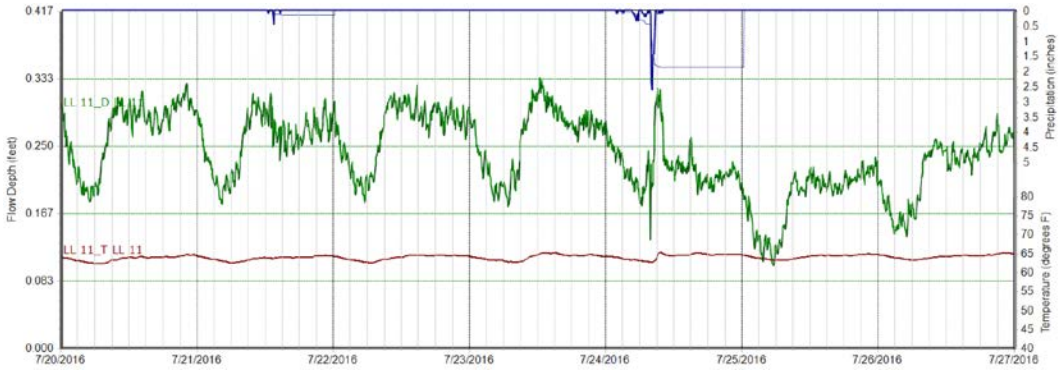



*Figure B43. Levelogger 11 wastewater depth (green), temperatures (red), and precipitation (blue) for the July 24, 2016 precipitation event.*




*Figure B44. Levelogger 11 wastewater depth (green), temperatures (red), and precipitation (blue) for the February 2, 2016 precipitation event.*

Results displayed in Figure B44 indicate slight increase in depth (and corresponding flow) for a period of several days following the February 2 rain event, indicating groundwater infiltration.

LL-18 was also installed on the trunk sewer, upstream of LL-11 just east of 56th Avenue.

Figures B45 and B46 illustrate the results at LL-18 during the July and February rain events.




*Figure B45. Levelogger 18 wastewater depth (green), temperatures (red), and precipitation (blue) for the July 24, 2016 precipitation event.*




*Figure B46. Levelogger 18 wastewater depth (green), temperatures (red), and precipitation (blue) for the February 2, 2016 precipitation event.*

LL-22 and LL-24 are located upstream of LL-18 on the trunk sewer. Results are similar to LL-18 and are displayed in Figures B47 through B50 below. Short duration inflow is observed during the July event and longer duration infiltration is observed during the February event at both locations.




*Figure B47. Levelogger 22 wastewater depth (green), temperatures (red), and precipitation (blue) for the July 24, 2016 precipitation event.*




*Figure B48. Levelogger 22 wastewater depth (green), temperatures (red), and precipitation (blue) for the February 2, 2016 precipitation event.*




*Figure B49. Levelogger 24 wastewater depth (green), temperatures (red), and precipitation (blue) for the July 24, 2016 precipitation event.*

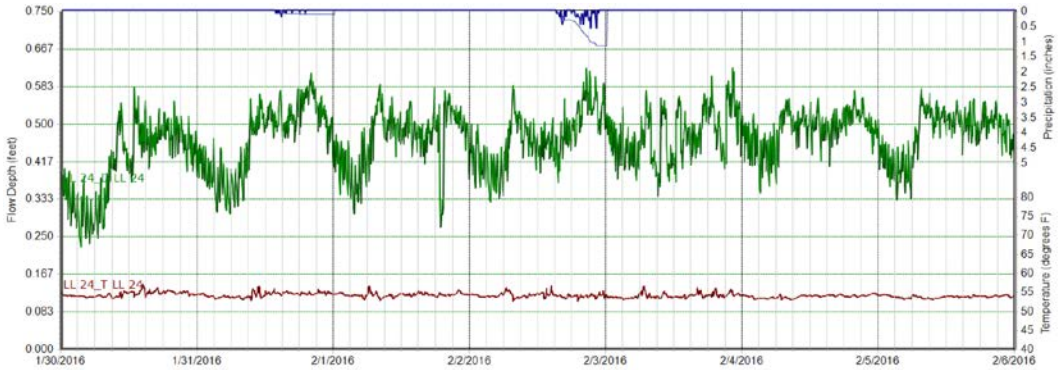



*Figure B50. Levelogger 24 wastewater depth (green), temperatures (red), and precipitation (blue) for the February 2, 2016 precipitation event.*

LL-29 was installed on Lake Michigan Drive west of 60th Avenue. Figures B51 and B52 illustrate the reactions at LL-29 during the July and February rain events. LL-29 is just downstream of the Park Lift Station discharge location, therefore the pump cycles show up quite clearly.

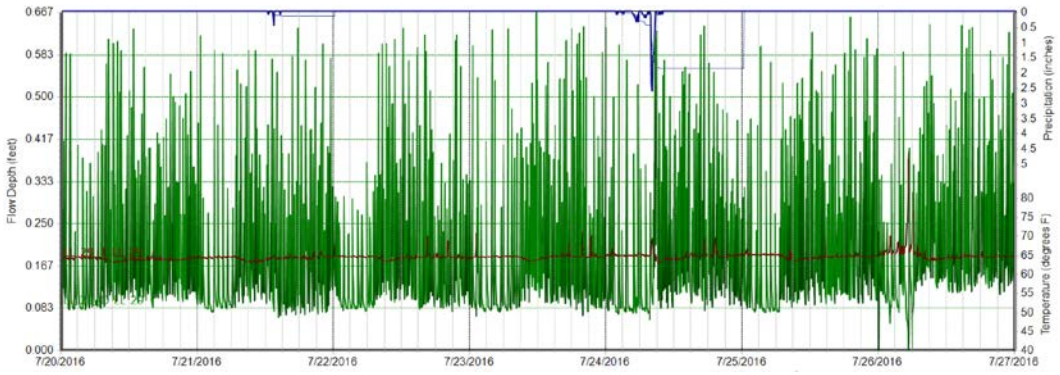



*Figure B51. Levelogger 29 wastewater depth (green), temperatures (red), and precipitation (blue) for the July 24, 2016 precipitation event.*

I/I is indicated during the February 2-3 events, as indicated by more frequent pump station cycling and an elevated diurnal flow pattern.

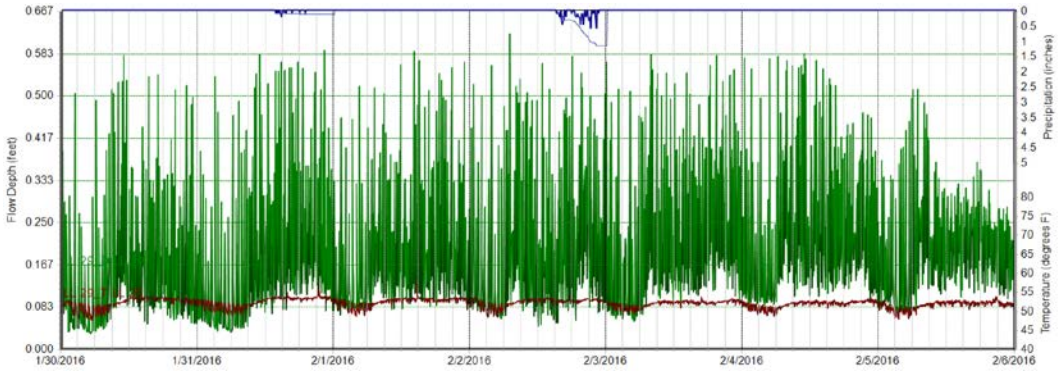



*Figure B52. Levelogger 29 wastewater depth (green), temperatures (red), and precipitation (blue) for the February 2, 2016 precipitation event.*

## Park Street Lift Station Branch

I/I was indicated at the levelogger (LL-29) just downstream of the Park Street Lift Station. The Township's SCADA data for Park St LS during the July and February rain events is shown in Figures B53 and B54.

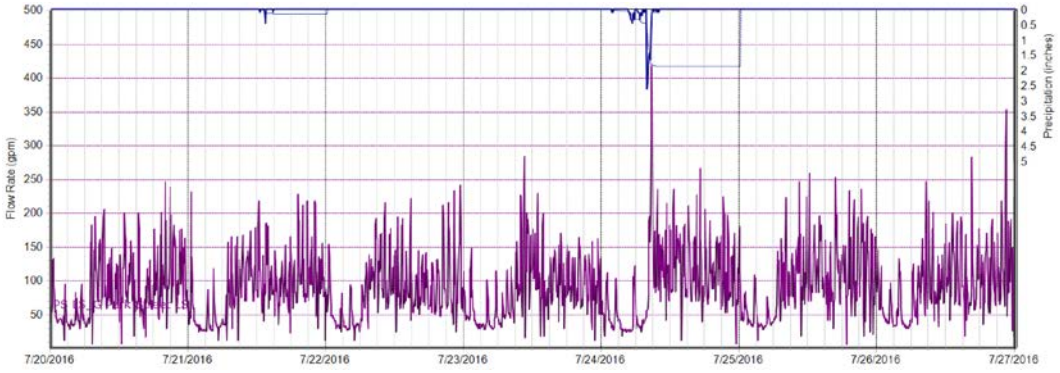



*Figure B53. Park Street Lift Station inflow into the wet well prior to, during, and just after the July 24 precipitation event.*

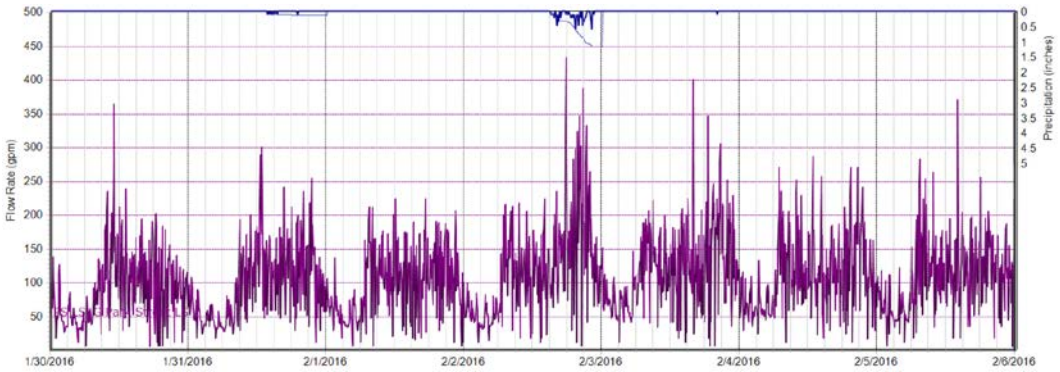



*Figure B54. Park Street Lift Station inflow into the wet well prior to, during, and just after the February 2 precipitation event.*

Several loggers were deployed upstream of the Park Street Lift Station to determine if the source(s) of the I/I could be identified.

**Levelogger 31 sub-district (and upstream Levelogger sub-district)**

LL-31 was installed upstream of the Park Street Lift Station, in the branch entering the wet well from the east. The subdistrict for LL-31 includes a school, supermarket, and a few residential apartment buildings.

Figures B55 and B56 display the data collected at LL-31 during the July 24 and February 2 rain events. A slight, but longer term response was observed for both rain events.




*Figure B55. Levelogger 31 wastewater depth (green), temperatures (red), and precipitation (blue) for the July 24, 2016 precipitation event.*

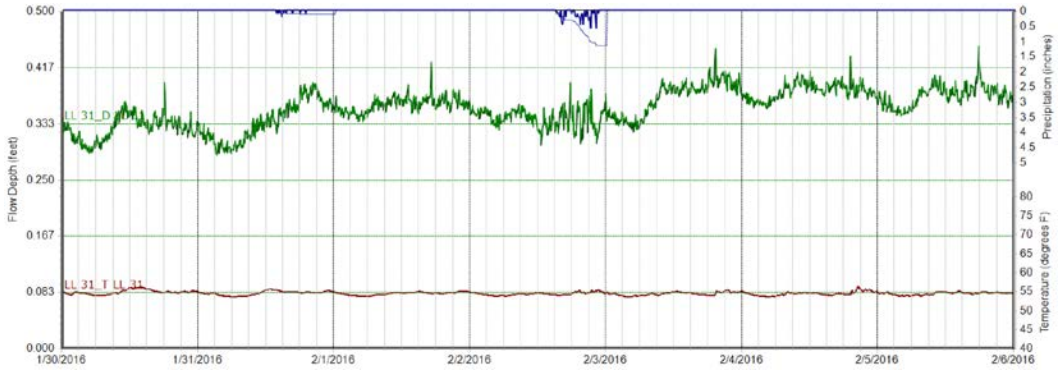


*Figure B56. Levelogger 31 wastewater depth (green), temperatures (red), and precipitation (blue) for the February 2, 2016 precipitation event.*

**Levelogger 32 sub-district (and upstream Lift station branches and Levelogger sub-districts)**

LL-32 was installed upstream of the Park Street Lift Station, in the branch entering the wet well from the west.

Figures B57 and B58 display the data collected at LL-32 during the July 24 and February 2 rain events. Short duration inflow was observed during the July 24 rain event.

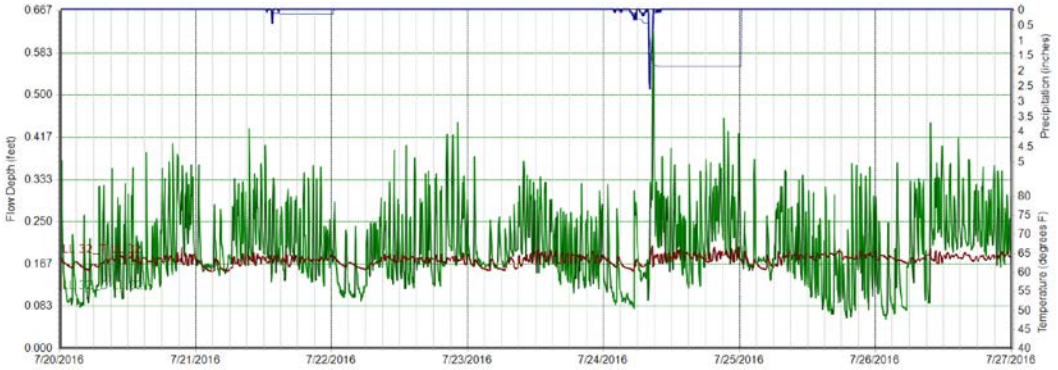



*Figure B57. Levelogger 32 wastewater depth (green), temperatures (red), and precipitation (blue) for the July 24, 2016 precipitation event.*

A very small increase was noted during the February event, however the duration was for several days, indicating a possible groundwater impact during spring thaw.

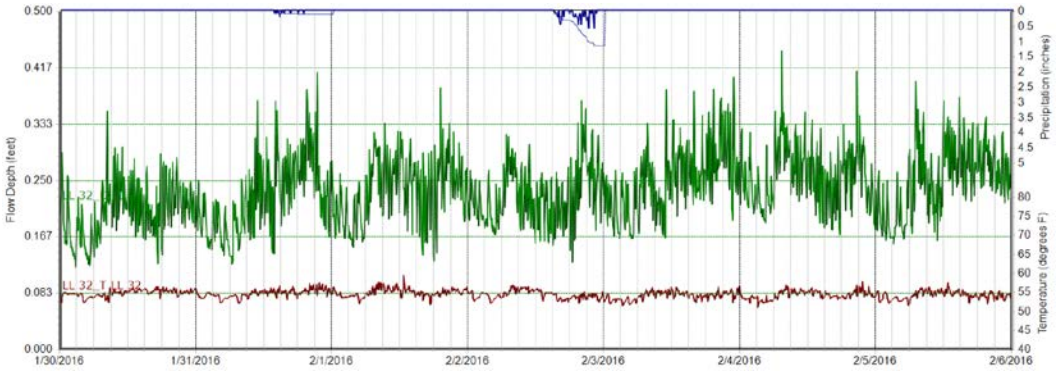



*Figure B58. Levelogger 32 wastewater depth (green), temperatures (red), and precipitation (blue) for the February 2, 2016 precipitation event.*

LL-33 was installed upstream of the LL-32, north of Henry Street.

Figures B59 and B60 display the data collected at LL-33 during the July 24 and February 2 rain events. Short duration inflow was observed during the July 24 rain event.

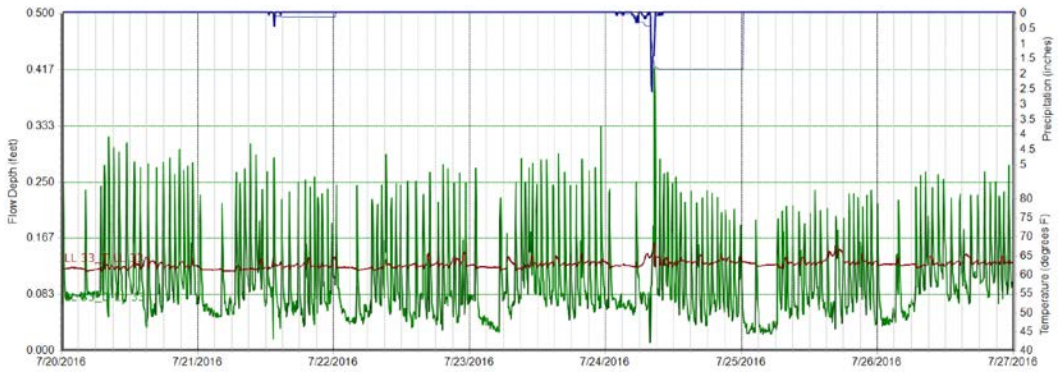



*Figure B59. Levelogger 33 wastewater depth (green), temperatures (red), and precipitation (blue) for the July 24, 2016 precipitation event.*

A very small increase was noted during the February event, however the duration was for several days, indicating a possible groundwater impact during spring thaw.

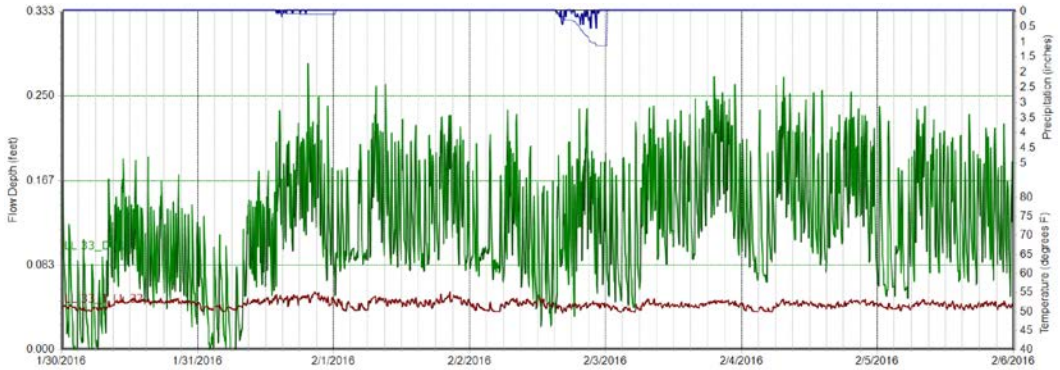



*Figure B60. Levelogger 33 wastewater depth (green), temperatures (red), and precipitation (blue) for the February 2, 2016 precipitation event.*

The Hidden Shores Lift Station discharges just upstream of the LL-33 monitoring location. The Hidden Shores flow into the wet well is graphed in Figures B61 and B62 below. Interestingly, only the July 24 rain event affected the Hidden Shores Lift Station.

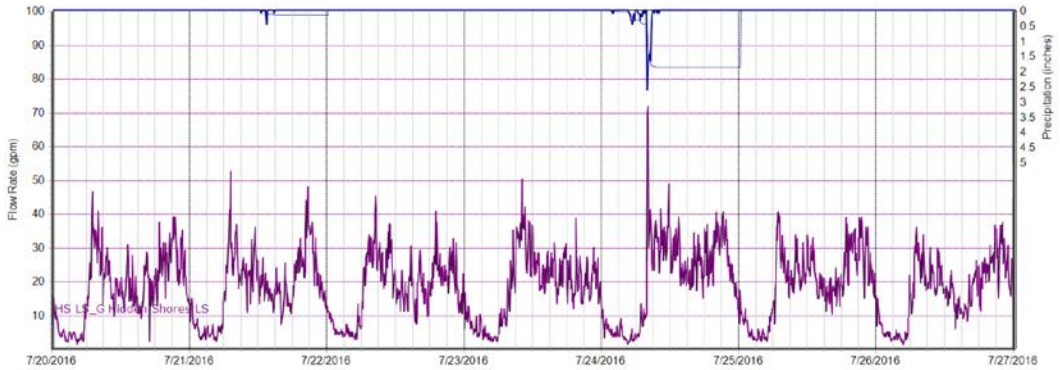



*Figure B61. Hidden Shores Lift Station inflow into the wet well prior to, during, and just after the July 24 precipitation event.*

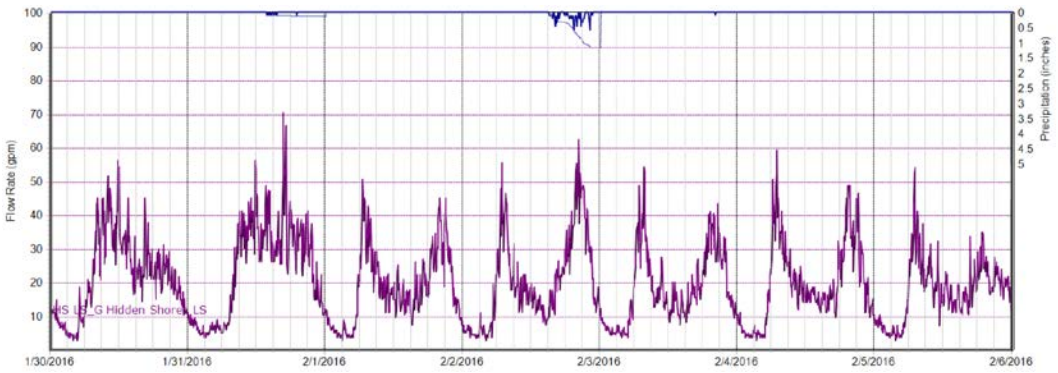



*Figure B62. Hidden Shores Lift Station inflow into the wet well prior to, during, and just after the February 2 precipitation event.*

Similar to the results at LL-32, LL-33 also indicates a longer duration infiltration response following the February 2 rain event, possibly due to high groundwater during late winter / early spring thaw.

As we move upstream to monitoring location LL-34, the results are a little easier to see graphically. Figures B62 and B63 show the July and February data for LL-34, which was installed upstream of LL-33 north of Lake Michigan Drive. A short duration peak was observed during and immediately after the precipitation event on July 24, 2016. Temperature also increased slightly during this timeframe, indicating an inflow response.

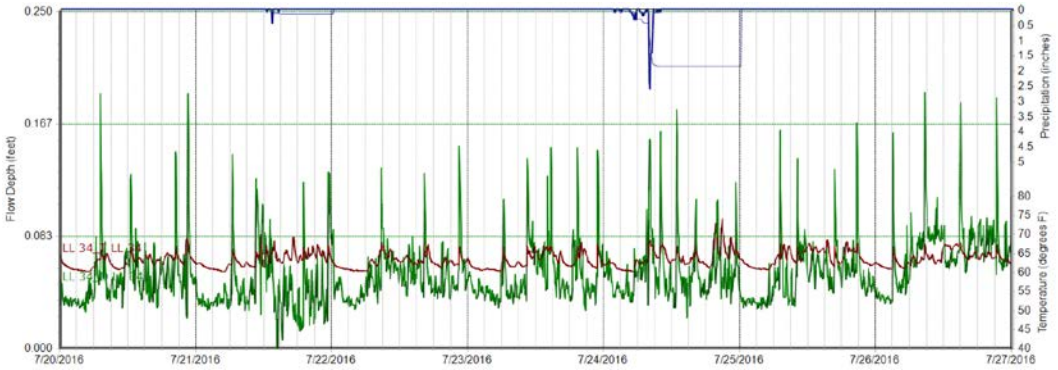



*Figure B63. Levelogger 34 wastewater depth (green), temperatures (red), and precipitation (blue) for the July 24, 2016 precipitation event.*

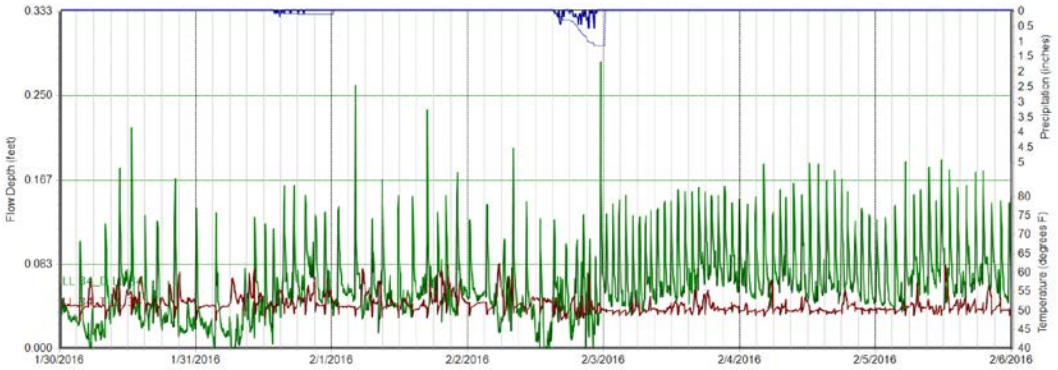



*Figure B64. Levelogger 34 wastewater depth (green), temperatures (red), and precipitation (blue) for the February 2, 2016 precipitation event.*

During and immediately after the rain on February 2 an inflow response is observed followed by a longer duration rain induced or groundwater infiltration response as seen by more frequent pump cycling from the Brown Street Lift station and an elevated diurnal flow pattern.

The Brown Street Lift Station flow into the wet well is graphed in Figures B65 and B66 below. Both the July and February event show a response to the rain event; however the duration is substantially longer during the February event.

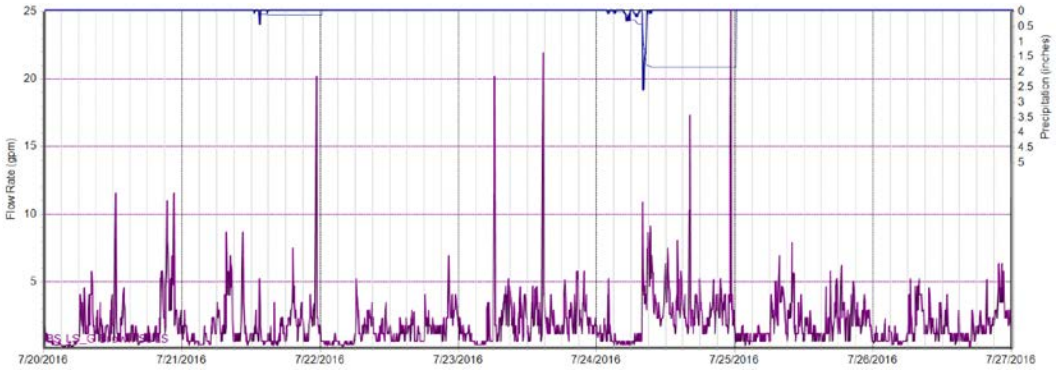



*Figure B65. Brown Street Lift Station inflow into the wet well prior to, during, and just after the July 24 precipitation event.*




*Figure B66. Brown Street Lift Station inflow into the wet well prior to, during, and just after the February 2 precipitation event.*

LL-35 and LL-36 were installed upstream of LL-32, south of Henry Street. Figures B67 through B70 display the data collected at LL-35 and LL-36 during the July 24 and February 2 rain events. Short duration inflow was observed during the July 24 rain event. Data indicate that this location was not impacted by I/I for either rain event.

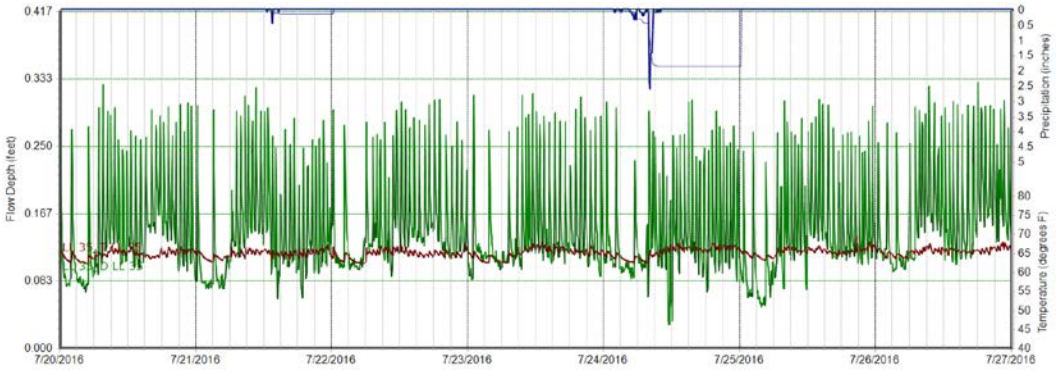


*Figure B67. Levelogger 35 wastewater depth (green), temperatures (red), and precipitation (blue) for the July 24, 2016 precipitation event.*

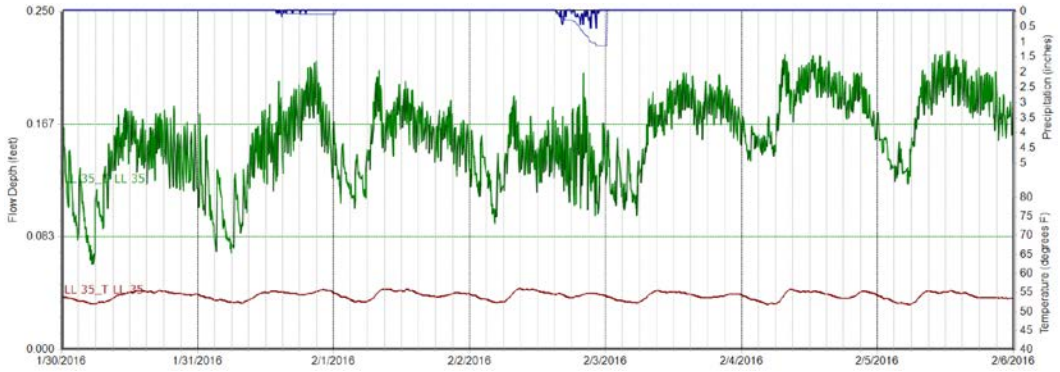



*Figure B68. Levelogger 35 wastewater depth (green), temperatures (red), and precipitation (blue) for the February 2, 2016 precipitation event.*

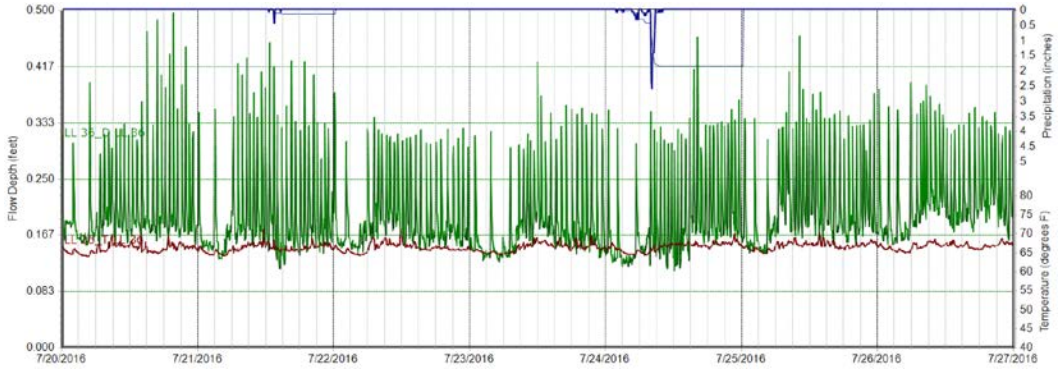



*Figure B69. Levelogger 36 wastewater depth (green), temperatures (red), and precipitation (blue) for the July 24, 2016 precipitation event.*

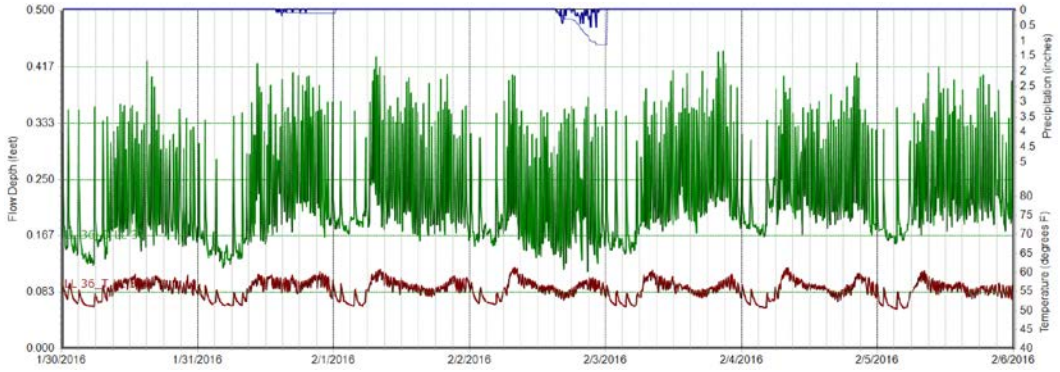



*Figure B70. Levelogger 36 wastewater depth (green), temperatures (red), and precipitation (blue) for the February 2, 2016 precipitation event.*

The Timber Creek Lift Station is upstream of LL-36. SCADA data provided by the Township for this lift station also showed very little response to the precipitation events.

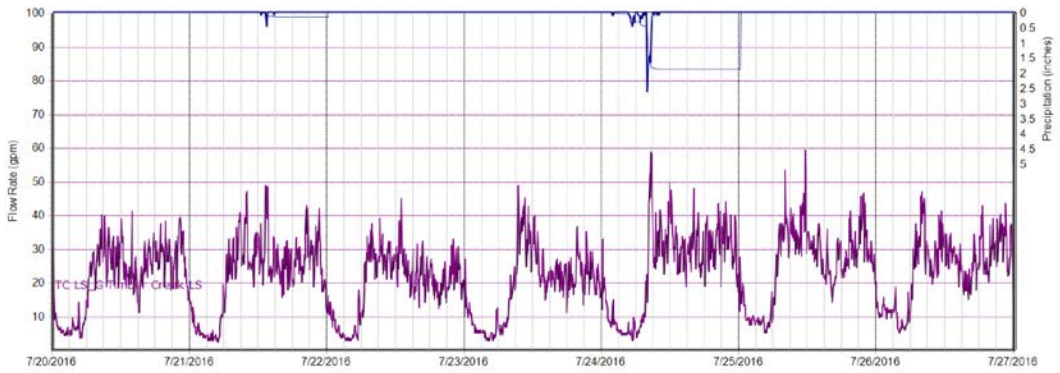



*Figure B71. Timber Creek Lift Station inflow into the wet well prior to, during, and just after the July 24 precipitation event.*

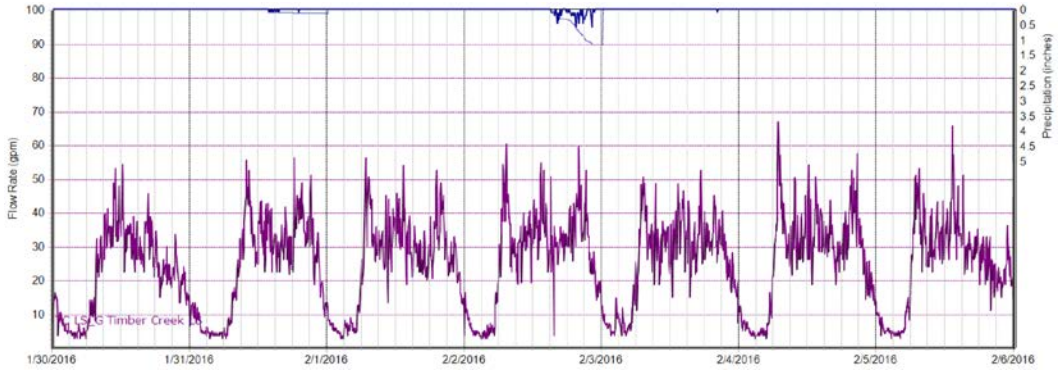



*Figure B72. Timber Creek Lift Station inflow into the wet well prior to, during, and just after the February 2, 2016 precipitation event.*

## LEVELOGGER SUB-DISTRICTS THAT TIE INTO THE PRESSURE GRAVITY SEWER

Three separate branches of gravity sewer located south of Lake Michigan Drive tie into the trunk sewer that routes flow to the WWTP either right before or after the sewer has transitioned from gravity sewer into pressure sewer.

LL-10 was installed at Lake Michigan Drive immediately upstream of the transition from gravity sewer to pressure sewer. LL-10 monitored the flow patterns and temperature for a residential subdivision and fast food joint.

Figures B73 and B74 show the inflow reactions to the July 24 and February 2 rain events.

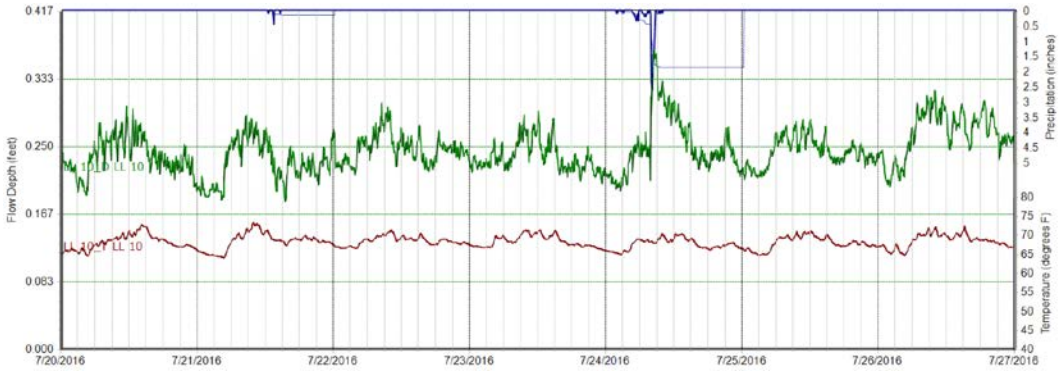



*Figure B73. Levelogger 10 wastewater depth (green), temperatures (red), and precipitation (blue) for the July 24, 2016 precipitation event.*




*Figure B74. Levelogger 10 wastewater depth (green), temperatures (red), and precipitation (blue) for the February 2, 2016 precipitation event.*

The two other branches that discharge into the pressure sewer serve the GVSU campus and off-campus housing located near the campus. These were monitored with LL-7 and LL-8 and LL-1, LL-4, LL-5, and LL-6. Those detailed results were discussed at the beginning of this appendix.

A small area of sewer along 40th Avenue discharges directly to the WWTP. LL-2 was installed to monitor the residential subdivision south of the WWTP. Figures B75 and B76 present the results for the July and February rain events. Not much impact was noted for either of these rainfall events at this location.

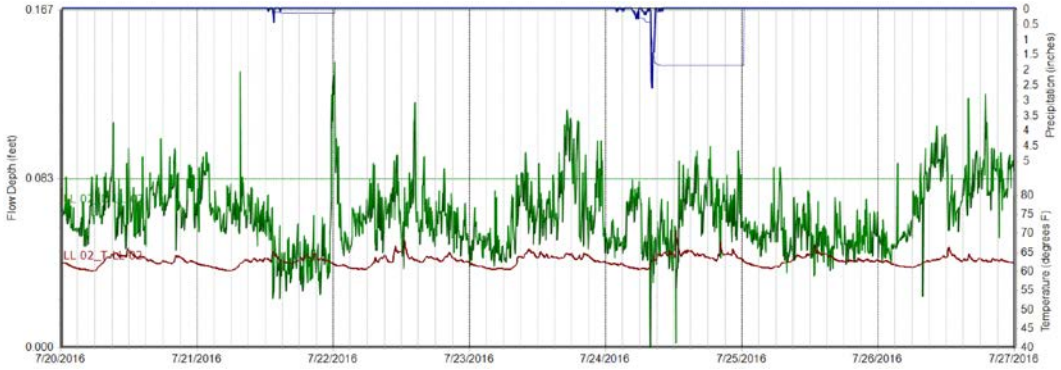



*Figure B75. Levelogger 2 wastewater depth (green), temperatures (red), and precipitation (blue) for the July 24, 2016 precipitation event.*

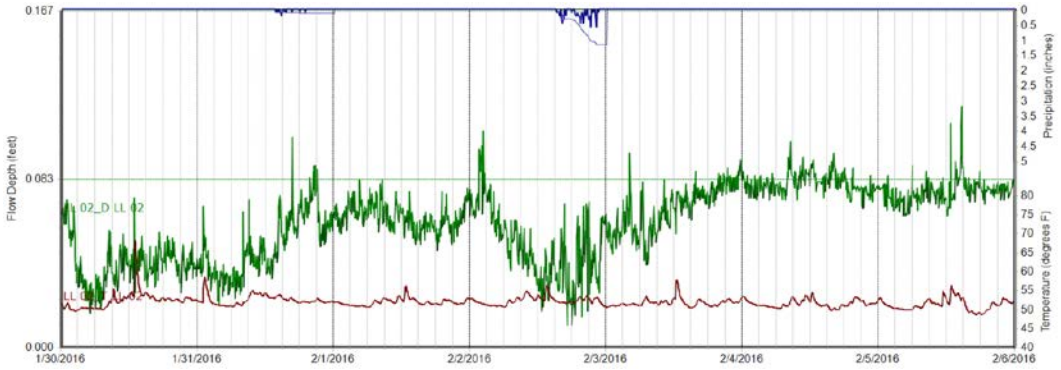



*Figure B76. Levelogger 2 wastewater depth (green), temperatures (red), and precipitation (blue) for the February 2, 2016 precipitation event.*

# APPENDIX C: MONTHLY PRECIPITATION SUMMARY FOR 2015-2016

The amount of precipitation received during the study period has an effect on the ability to project the observed results out to larger "design" storm events, such as the 25-year, 24-hour storm event used as the benchmark for comparison to MDEQ excessive I/I values. More uncertainty exists in projecting observed values to design values when lower amounts of precipitation are received during the study period (as well as a lack of large individual storms, approaching the design storm values). In order to show how well the precipitation observed during the study period aligned with long-term averages, 30 year normal precipitation data from the National Oceanic & Atmospheric Administration (NOAA) data is used.

Allendale Charter Township is located almost equidistant from four NOAA weather stations that keep track of 30 year normal precipitation trends – Holland, MI (NOAA station USC00203858), Muskegon, MI (NOAA station USW00014840), Kent City, MI (NOAA station USC00204320), and Grand Rapids, MI (NOAA station USW00094860). Tables C1 through C4 show the 30-year average precipitation at each of these locations as well as the 25$^{th}$, 50$^{th}$, and 75$^{th}$ percentile precipitations. The percentile values represent the precipitation amount with that statistical percentage chance that the monthly precipitation will be less than, or equal to that amount. For example, looking at Table C1, there is a 25% chance that total precipitation in January will be less than 1.35 inches, a 50% chance that total precipitation will be less than 1.93 inches, and a 75% chance that total precipitation will be less than 3.61 inches. Average precipitation in January at the Holland station is 2.47 inches.

*Table C1. Holland Regional Monthly Precipitation Summary (units are inches).*

| Month | 25th Percentile[1] | 50th Percentile[1] | 75th Percentile[1] | Mean Precipitation[1] |
|---|---|---|---|---|
| January | 1.35 | 1.93 | 3.61 | 2.47 |
| February | 0.98 | 1.55 | 2.43 | 1.74 |
| March | 1.24 | 1.78 | 2.44 | 1.92 |
| April | 2.13 | 2.98 | 3.70 | 2.96 |
| May | 2.37 | 3.85 | 5.10 | 4.01 |
| June | 1.40 | 3.03 | 4.09 | 3.27 |
| July | 2.32 | 3.13 | 4.40 | 3.40 |
| August | 2.20 | 3.70 | 5.04 | 3.83 |
| September | 2.14 | 3.28 | 4.87 | 3.99 |
| October | 2.58 | 3.19 | 4.38 | 3.75 |
| November | 1.98 | 2.65 | 4.74 | 3.32 |
| December | 1.44 | 1.87 | 2.69 | 2.13 |
| **Annual** | **22.13** | **32.94** | **47.49** | **36.79** |

[1]Holland, MI 1981-2010 precipitation normals for listed month. Source: National Oceanic & Atmospheric Administration (NOAA) station USC00203858 (https://www.ncdc.noaa.gov/data-access/land-based-station-data/land-based-datasets/climate-normals/1981-2010-normals-data). Located approximately 17 miles southeast of Allendale Charter Township.

*Table C2. Muskegon Regional Monthly Precipitation Summary (units are inches).*

| Month | 25th Percentile[1] | 50th Percentile[1] | 75th Percentile[1] | Mean Precipitation[1] |
|---|---|---|---|---|
| January | 1.20 | 1.78 | 2.67 | 2.03 |
| February | 1.08 | 1.63 | 2.66 | 1.83 |
| March | 1.48 | 1.94 | 3.02 | 2.25 |
| April | 2.00 | 2.72 | 3.83 | 2.91 |
| May | 1.89 | 2.86 | 4.28 | 3.25 |
| June | 1.19 | 2.60 | 3.84 | 2.55 |
| July | 1.66 | 2.29 | 3.15 | 2.37 |
| August | 2.02 | 3.09 | 4.67 | 3.39 |
| September | 2.57 | 3.34 | 4.59 | 3.89 |
| October | 2.00 | 2.50 | 4.09 | 3.11 |
| November | 2.00 | 3.05 | 4.82 | 3.36 |
| December | 1.42 | 2.27 | 3.11 | 2.55 |
| **Annual** | **20.51** | **30.07** | **44.73** | **33.49** |

[1]Muskegon, MI 1981-2010 precipitation normals for listed month. Source: National Oceanic & Atmospheric Administration (NOAA) station USC00203858 (https://www.ncdc.noaa.gov/data-access/land-based-station-data/land-based-datasets/climate-normals/1981-2010-normals-data). Located approximately 20 miles northeast of Allendale Charter Township.

*Table C3. Kent City Regional Monthly Precipitation Summary (units are inches).*

| Month | 25th Percentile[1] | 50th Percentile[1] | 75th Percentile[1] | Mean Precipitation[1] |
|---|---|---|---|---|
| January | 1.30 | 2.14 | 3.48 | 2.36 |
| February | 1.28 | 1.74 | 2.20 | 1.80 |
| March | 1.57 | 2.21 | 3.92 | 2.62 |
| April | 2.14 | 3.06 | 4.20 | 3.18 |
| May | 2.62 | 3.44 | 5.19 | 4.03 |
| June | 2.04 | 2.86 | 4.43 | 3.37 |
| July | 2.06 | 3.00 | 4.48 | 3.35 |
| August | 2.14 | 2.98 | 5.26 | 3.74 |
| September | 1.92 | 3.14 | 4.60 | 3.79 |
| October | 1.92 | 3.14 | 4.43 | 3.51 |
| November | 2.04 | 3.23 | 5.41 | 3.67 |
| December | 1.65 | 2.53 | 3.01 | 2.49 |
| **Annual** | **22.68** | **33.47** | **50.67** | **37.91** |

[1]Kent City, MI 1981-2010 precipitation normals for listed month. Source: National Oceanic & Atmospheric Administration (NOAA) station USC00204320 (https://www.ncdc.noaa.gov/data-access/land-based-station-data/land-based-datasets/climate-normals/1981-2010-normals-data). Located approximately 18 miles north-northeast of Allendale Charter Township.

*Table C4. Grand Rapids Regional Monthly Precipitation Summary (units are inches).*

| Month | 25th Percentile[1] | 50th Percentile[1] | 75th Percentile[1] | Mean Precipitation[1] |
|---|---|---|---|---|
| January | 0.99 | 1.85 | 2.74 | 2.09 |
| February | 1.03 | 1.50 | 2.39 | 1.79 |
| March | 1.40 | 2.33 | 3.31 | 2.37 |
| April | 2.22 | 3.04 | 4.27 | 3.35 |
| May | 2.14 | 3.72 | 4.77 | 3.98 |
| June | 2.06 | 3.37 | 5.67 | 3.77 |
| July | 2.12 | 3.63 | 4.76 | 3.78 |
| August | 1.74 | 3.31 | 4.74 | 3.59 |
| September | 2.39 | 3.80 | 5.38 | 4.28 |
| October | 2.05 | 2.76 | 4.33 | 3.26 |
| November | 2.12 | 2.83 | 5.28 | 3.51 |
| December | 1.48 | 2.38 | 3.04 | 2.50 |
| ***Annual*** | ***21.74*** | ***34.52*** | ***50.68*** | ***38.27*** |

[1]Grand Rapids, MI 1981-2010 precipitation normals for listed month. Source: National Oceanic & Atmospheric Administration (NOAA) station USW00094860 (https://www.ncdc.noaa.gov/data-access/land-based-station-data/land-based-datasets/climate-normals/1981-2010-normals-data). Located approximately 22.5 miles east-southeast of Allendale Charter Township.

Using these four NOAA stations as data points, a Thiessen Polygon Analysis was conducted to determine how to weight the data from the four NOAA stations based on the distance of the station from Allendale Charter Township. Table C5, on the following page, presents the result of this analysis and represents the approximate average and percentile amounts of precipitation that should occur in Allendale Charter Township on a given month. Table C5 also presents the amount of precipitation that was recorded by the rain gauge mounted at the Allendale Charter Township Booster Pump Station (9722 68th Avenue).

As can be seen in Table C5, May is typically the wettest month, followed closely by September.

*Table C5. Distance Weighted Monthly Precipitation Summary for Allendale Charter Township (units are inches).*

| Month | 25th Percentile[1] | 50th Percentile[1] | 75th Percentile[1] | Mean Precipitation[1] | 2015-16 Measured Precipitation[2] |
|---|---|---|---|---|---|
| January | 1.32 | 2.00 | 3.50 | 2.40 | (2016) |
| February | 1.10 | 1.63 | 2.35 | 1.77 | (2016) |
| March | 1.38 | 1.96 | 3.06 | 2.22 | (2016) |
| April | 2.13 | 3.00 | 3.91 | 3.04 | (2016) |
| May | 2.44 | 3.63 | 5.09 | 3.97 | (2016) |
| June | 1.64 | 2.94 | 4.21 | 3.27 | (2016) |
| July | 2.18 | 3.03 | 4.36 | 3.32 | (2016) |
| August | 2.17 | 3.38 | 5.10 | 3.77 | (2015) |
| September | 2.08 | 3.23 | 4.75 | 3.91 | (2015) |
| October | 2.29 | 3.13 | 4.38 | 3.62 | (2015) |
| November | 2.00 | 2.90 | 5.01 | 3.46 | (2015) |
| December | 1.52 | 2.15 | 2.84 | 2.30 | (2015) |
| ***Annual*** | ***22.25*** | ***32.98*** | ***48.58*** | ***37.04*** | |

[1]Based on distance weighted average of values from NOAA weather stations in Grand Rapids, MI, Kent City, MI, Holland, MI, and Muskegon, MI.

[2]Based on precipitation recordings from the F&V rain gauge at the Allendale Charter Township Booster Pump Station (9722 68th Avenue), supplemented by weighted average precipitation amounts from surrounding airports (Grand Rapids, West Michigan Regional Airport in Holland, and Muskegon).

The highlighted months illustrate months for which the MFM project was conducted.

Table C6 compares the long term mean precipitation for each month to the actual precipitation observed during the MFM project.

*Table C6. Mean Monthly Precipitation Compared to Actual for 2015-2016 MFM Project*

| Month | Mean Precipitation[1] | 2015-16 Measured Precipitation[2] |
|---|---|---|
| January | 2.40 | 1.92 |
| February | 1.77 | 1.73 |
| March | 2.22 | 3.45 |
| April | 3.04 | 2.91 |
| May | 3.97 | 2.35 |
| June | 3.27 | 2.08 |
| July | 3.32 | 3.29* |
| August | 3.77 | N/A |
| September | 3.91 | N/A |
| October | 3.62 | N/A |
| November | 3.46 | N/A |
| December | 2.30 | 0.57* |
| ***Annual*** | ***37.04*** | ***N/A*** |

*Data collection began on 12/17/2015 and ended on 7/26/2016, therefore only a portion of the precipitation in July and December are included in the monthly total

# APPENDIX D: HISTORICAL GRAND RIVER STAGE

The Grand River is the major surface water in the Allendale area. It is generally located to the east and north of the sewer district, and is adjacent to the WWTP.

The daily Grand River stage was analyzed to determine if a correlation exists between river stage and the influent flow received at the ACT WWTP. The stage data for the Grand River was obtained from United States Geological Survey (USGS) site 04119000, which is located downtown Grand Rapids, approximately 15 miles upstream of the ACT WWTP.

Figure D1 presents the Grand River stages for the years 2008 through 2013 plotted on the same graph as precipitation and flow received at the WWTP. The influent flow recorded at the WWTP was adjusted so that impacts from GVSU did not skew the impacts from the river stage for this analysis.

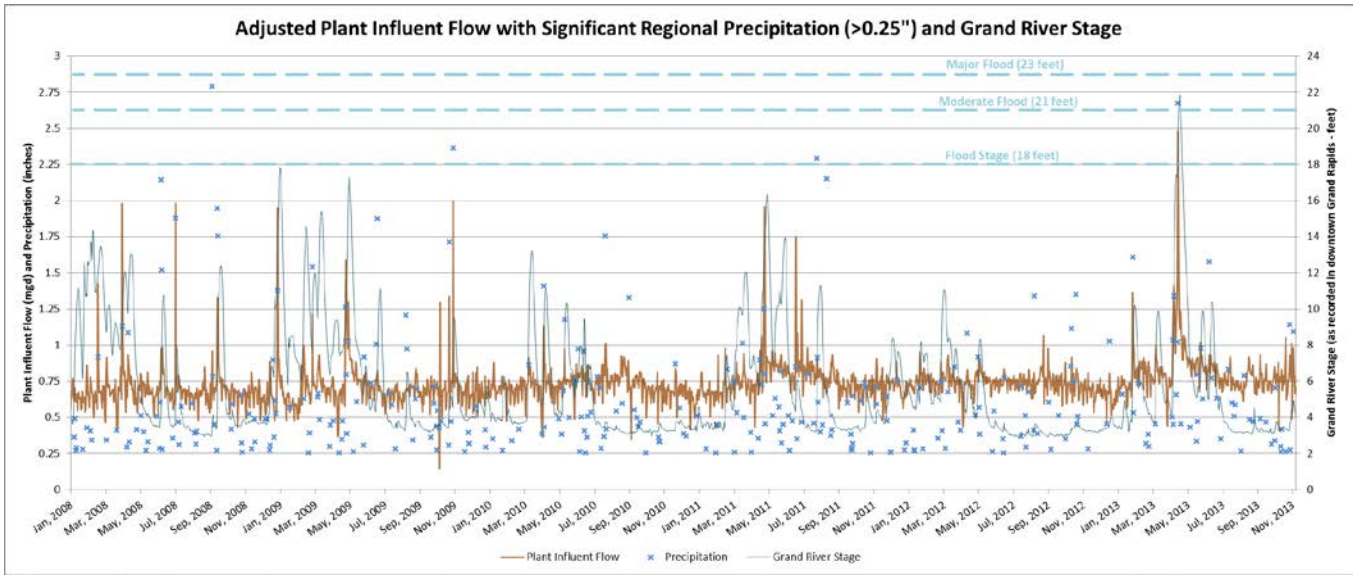



*Figure D1. Grand River daily mean stage and adjusted influent flow, January 1, 2008 through November 10, 2013.*

Graphing the river stage corresponding to influent flow, shows almost no correlation, indicated by a low $R^2$ value when developing a statistical trendline. This analysis is shown graphically in Figure D2.

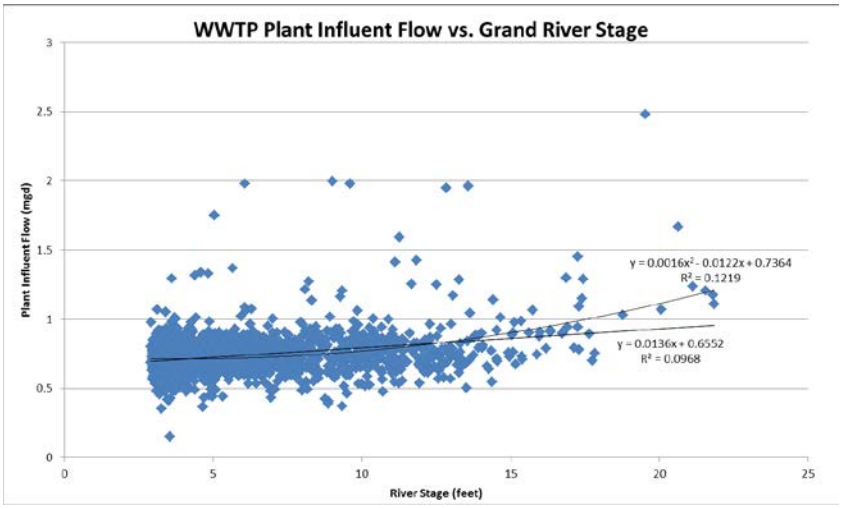



*Figure D2. Grand River daily mean stage vs adjusted influent flow*

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# ASSET MANAGEMENT PLAN

## Smoke Testing

Prepared for:

## Allendale Charter Township

FINAL

November, 2018

FLEIS&VANDENBRINK

DESIGN. BUILD. OPERATE.

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Introduction ..... 2
Project Background ..... 2
Terminology ..... 2
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Results & Recommendations ..... 4

**List of Appendices for Smoke Testing Report**

Attachment A: Smoke Testing Maps
Attachment B: Observation Photo Log

# EXECUTIVE SUMMARY

Allendale Charter Township retained Fleis & VandenBrink (F&V) to evaluate their wastewater collection system as part of a Stormwater, Asset Management and Wastewater (SAW) grant-funded project. In general, SAW work involves an inventory and assessment of the condition of the assets in a wastewater collection system and the development of a long-term asset management plan (AMP). This Smoke Testing report was commissioned as part of the SAW grant.

**Study Details**

This report, ultimately an appendix to the full AMP, presents the results of the smoke testing that occurred on November 28th through the 29th of 2017. Smoke testing is a relatively fast, economical, and effective method of locating potential sources of inflow and infiltration (I&I) into the sanitary sewer collection system. The goal for this study was to complete smoke testing of high priority areas in town based on anecdotal evidence provided by the Township and results from mass flow monitoring indicating areas of higher I&I. A map of the area tested and the locations of smoke observations can be found in Appendix A.

**Conclusions**

Twenty-three instances of smoke exiting the wastewater collection system at inappropriate locations were found during smoke testing. The list below identifies each of these locations, their priority in fixing them and the recommended remediation.

<u>Open Sanitary Cleanout- Property owner to install new cleanout cap (Low Priority):</u>

- Campus View #4298
- Campus View #10065
- Campus View #10095
- Campus View #10125
- Campus View #10105
- Campus View 10126-10184
- Campus View #10126
- Campus View #10276
- Campus View #10337
- Copper Beach S-106
- Copper Beach O-208
- Copper Beach Unit H
- Copper Beach N-203
- Copper Beach O-201
- Copper Beach U-106
- Mystic Woods Main Office
- 48 West Phase 1
- 48 West Phase 1 #10897
- 11015 Jordan Ct.

<u>Miscellaneous- (Low Priority):</u>

- 48th Ave. – Large breach into storm sewer manhole. This was not discovered to be connected to the sanitary sewer system.
- 48th Ave. – Infilitration into sanitary manhole that is locased in the sidewalk along 48th Ave. (See attached photos).
- 48th Ave. Jimmy Johns Complex – grease traps are not sealed properly.

# INTRODUCTION

## PROJECT BACKGROUND

In 2013, the Township, with assistance from F&V, submitted an application to the Michigan Department of Environmental Quality's (MDEQ's) Stormwater, Asset Management, and Wastewater (SAW) grant program. A grant to fund the development of an asset management plan (AMP) for the Township's wastewater collection and treatment system was awarded in 2015.

This smoke testing report is one of the tasks associated with Allendale's SAW project and will be included in an appendix of the AMP.

## TERMINOLOGY

Infiltration and Inflow (I&I) is a broad term that is often defined differently by different people and organizations. For the purposes of this report, the below list of types of I&I with their accompanying definitions is used.

- **Groundwater Infiltration** – groundwater entering the sanitary sewer through structural defects (e.g. cracks or separated joints) on a constant basis, regardless of precipitation or surface water elevations.
- **Inflow** – surface runoff from precipitation entering the sanitary sewer through direct connections (e.g. storm sewer connections, roof drains, open sewer cleanouts). It is characterized by a flow spike immediately following precipitation, especially intense periods of precipitation.
- **Storm-Induced I&I** – an increase in sewer flow starting 1-2 days after a precipitation event and lasting 1-2 days. Sources of storm-induced tend to be temporary storages of precipitation, such as the soil (e.g. elevated groundwater levels) or basements.
- **River-Induced I&I** – elevated flows in response to elevated Flat River water surface levels. During the study, periods of elevated river stage lasted 4-7 days. This form of I&I can be attributed to a number of causes, the major ones being, in order of likelihood:
    - Elevated groundwater levels causing increased infiltration through structural defects.
    - Exfiltration from storm sewers or overland drains travelling through the ground and infiltrating the sanitary sewers.
    - Direct connections between storm sewers or overland drains and the sanitary sewers.
    - Surface flooding entering manholes not adequately watertight.

Due to the nature of smoke testing, it has a tendency to identify inflow sources, but usually does not identify any of the other sources of I&I listed above. For instance, smoke testing is more likely to identify a catch basin connected to the sanitary sewer or a broken sewer lateral clean-out cap than structural defects in the buried piping system.

## OBJECTIVES

The objective of this study is to determine as many I&I sources as can be found by smoke testing as well as to present the findings in a manner in which each inflow point can be tracked for future confirmation of correction. The report also categorizes each inflow point into its relative priority based on the estimated volume of clean water inflow that might occur at that point. For instance, a catch basin connected to the sanitary sewer system will have a higher priority because it will discharge significantly more clean water into the sanitary sewer system than a broken cap on a sanitary lateral clean-out will.

# TESTING METHODOLOGY

Smoke Testing involves blowing a non-toxic synthetic smoke like gas into the sanitary sewer system at strategically located manholes and recording observations of where the smoke emerges from the sewer system at inappropriate locations such as catch basins, uncapped sewer lateral clean-outs, roof drains, etc. Smoke from these inappropriate locations indicates potential pathways of I&I entering the sanitary sewer system.

Prior to testing, affected businesses and homeowners were notified by the Township and Fleis & VandenBrink employees via printed notices on doors. The local police and fire department were informed of the testing, prior to testing, in the event that the artificial smoke might be interpreted as real smoke and reported to the authorities.

A portable blower specifically designed and built for use in smoke testing was utilized for the work. The smoke fluid used for the testing produces artificial smoke when pumped from a container onto the heating element of the blower manifold. The artificial smoke generated is white in color and leaves no residue. The smoke is non-toxic, non-explosive, and dissipates quickly once the blower is deactivated.

To perform the testing, the blower was positioned on a sanitary manhole and a visual inspection was conducted of the surrounding area as smoke was continuously introduced into the system. The effective area of coverage for each manhole set-up was defined by the observation of the smoke exiting home roof vents, sanitary manhole covers, and suspect locations of the sanitary sewer system noted in the field as potential sources of I&I.

Blower setup locations were selected to provide overlap within the coverage areas in order to facilitate testing of the entire target area of the sanitary collection system without gap. The operation of the collection system was not interrupted, nor was it necessary to plug the sewer pipes.

# RESULTS & RECOMMENDATIONS

A total of 23 instances were noted where smoke exited the sanitary sewer system at an inappropriate location. Each of these instances were logged with a sketch of the area along with a written description of what was visually observed. Additionally, many instances were documented with pictures identifying the location where smoke was observed. The field logs and pictures are attached to this report in Attachment A.

Each instance where smoke was observed has been categorized into one of three categories based on how much clean water inflow it is felt likely to occur at that location. The priority classifications are identified by a visual inspection and are intended to help the Springfield economically and efficiently prioritize correcting the problems. The three categories are:

- *Low Priority* – Small chance for inflow to occur due to natural runoff and infiltration of the area around the specified object.
- *Medium Priority* – Good chance for inflow to occur due to natural runoff and infiltration of the area around the specified object.
- *High Priority* – High chance for inflow to occur due to natural runoff and infiltration of the area around the specified object.

Recommended actions accompany each location where smoke was observed. Many of the locations are outside of the right-of-way and therefore privately owned by the property owner. The Township is not responsible for either making repairs or the associated cost for problems found on private property as ownership and maintenance responsibilities of the sewer system end at the right-of-way. However, the Township can enforce its sewer use ordinance and its rules and regulations of the sewer system. Therefore, it is recommended that the Township notify each of the private property owners in writing of the I&I issues discovered and require that repairs be made by the property owner within a timely manner.

The table below identifies each of the instances where smoke exited the sanitary sewer system at an inappropriate location and identifies the priority and recommended action.

**Table 1: Smoke Testing Observations**

| Event | Location | Number | Observation | Priority | Remedy Recommendation | Pictures |
|---|---|---|---|---|---|---|
| 1 | Campus View | Catholic Church | Smoke around manhole | Low | Grout the manhole | |
| 2 | Campus View | #4298 | Open Cleanout | Low | Property owner to install new cap | 1 |
| 3 | Campus View | #10065 | Open Cleanout | Low | Property owner to install new cap | 2 |
| 4 | Campus View | #10095 | Open Cleanout | Low | Property owner to install new cap | 3 |
| 5 | Campus View | #10125 | Broken Cleanout | Low | Property owner to install new cap | 4 |
| 6 | Campus View | #10105 | Open Cleanout | Low | Property owner to install new cap | 5 |
| 7 | Campus View | 10126-10184 | Open Cleanout | Low | Property owner to install new cap | 6 & 7 |
| 8 | Campus View | #10126 | Open Cleanout | Low | Property owner to install new cap | 8 & 9 |
| 9 | Campus View | #10276 | Open Cleanout | Low | Property owner to install new cap | 10 & 11 |
| 10 | Campus View | #10337 | Open Cleanout | Low | Property owner to install new cap | 12 |
| 11 | Copper Beach | S-106 | Open Cleanout | Low | Property owner to install new cap | 13 & 14 |
| 12 | Copper Beach | O-208 | Open Cleanout | Low | Property owner to install new cap | 15 |
| 13 | Copper Beach | Unit H | Open Cleanout | Low | Property owner to install new cap | 16 |
| 14 | Copper Beach | N-203 | Open Cleanout | Low | Property owner to install new cap | 17 |
| 15 | Copper Beach | O-201 | Broken Cleanout | Low | Property owner to install new cap | 18 |
| 16 | Copper Beach | U-106 | Open Cleanout | Low | Property owner to install new cap | 19 |
| 17 | Mystic Woods | | Broken Cleanout | Low | Property owner to install new cap | 20 |
| 18 | 48 West Phase 1 | | Broken Cleanout | Low | Property owner to install new cap | 21 |
| 19 | 48 West Phase 1 | #10897 | Broken Cleanout | Low | Property owner to install new cap | 22 |
| 20 | 48th Ave | | Infiltration into manhole | Low | Seal manhole (sanitary) | 23 |
| 21 | 48th Ave | | Storm manhole with infilitration | Low | Replace manole | 24 |
| 22 | 48th Ave | | Lid of manholes not sealed | Low | Property owner to eal manhole lids | 25 |
| 23 | 11015 Jordan Ct | | Open Cleanout | Low | Property owner to install new cap | 26 |

BROWN ST.
LIFT STATION

HIDDEN SHORES
LIFT STATION

PARK STREET
LIFT STATION

TIMBER CREEK
LIFT STATION

60th STREET
NORTH BRANCH
LIFT STATION

60th STREET
SOUTH BRANCH
LIFT STATION

LL38 LL34 LL33 LL32 LL31 LL30 LL35 LL36 LL37 LL29 LL25 LL27 LL26 LL28 LL23 LL24 LL22 LL19 & BL LL18 LL20 LL21 LL12 LL13 LL14 LL11 LL9 LL10 LL7 LL8 LL4 LL5 LL2 LL16 LL15 LL17 LL6 LL1

LINED IN 2017

GVSU OWNED

GEORGETOWN
TOWNSHIP

LEGEND:

LL# ▫ LEVELOGGER LOCATION

HIGH PRIORITY.

MEDIUM PRIORITY

NORTH

# ALLENDALE CHARTER TOWNSHIP
OTTAWA COUNTY, MICHIGAN

## SANITARY SEWER SYSTEM SMOKE TESTING
## PRIORITY AREAS

FIGURE A4

F&V PROJECT NO. 814973

F&V

M:\Proj\812001-815000\814973 ACT SAW - MFM\Mass Flow Monitoring\Mapping\814973_S□□e.dwg, 10/26/2017 11:12:12 AM, davet, 1:1

**Allendale Charter Township**

Sanitary Sewer Collection System Smoke Testing

Project #: 814970

**Attachment B**

**Photograph Log**

Smoke Testing Dates: November 28, 2017, and November 29, 2017.



**Photo 1:** Clean out at Campus View #4289



**Photo 2**: Cleanout at Campus View #10065



**Photo 3:** Cleanout at Campus View #10095



**Photo 4:** Cleanout cap is there but there is leakage at the ground level at Campus View #10125



**Photo 5:** Back side of the apartment has broken 6" cleanout at Campus View #10105



**Photo 6:** Campus View 10126-10184 (Laker Lane) – Broken cleanout @ north entrance in green area.



**Photo 7:** Campus View 10126-10184 (Laker Lane) – Broken cleanout @ north entrance in green area.



**Photo 8**: Cleanout with broken cap at Campus View #10126




**Photo 9**: Cleanout with broken cap at Campus View #10126



**Photo 10**: Cleanout with broken cap at Campus View #10276



**Photo 11**: Cleanout with broken cap at Campus View #10276




**Photo 12**: Cleanout with broken cap at Campus View #10337



**Photo 13**: Broken cleanout lid approximately 50 feet west of Copper Beach #S-106 on the west side of the sidewalk.



**Photo 14:** Broken cleanout lid approximately 50 feet west of Copper Beach #S-106 on the west side of the sidewalk.



**Photo 15**: Cleanout with broken lid at Copper Beach #O-288




**Photo 16:** Perspective photo of clean out at Copper Beach Unit H.



**Photo 17**: Broken cleanout lid at Copper Beach #N-203.



**Photo 18**: Broken/plugged cleanouts and a manhole that need grouting at Copper Beach #O-201.



**Photo 19:** Cleanout without a cap at Copper Beach U-106.



**Photo 20:** Cleanout broken in front of office.



**Photo 21**: Building AA Apartment 1 in 48 West Ph I – broken cleanout lid.




**Photo 22:** Building E at south end of 48 West Ph I – broken cleanout lid.



**Photo 23**: First manhole north of Le Petit Chateau in 10 ft sidewalk – Smoke present along edge of sidewalk and small sinkhole present.



**Photo 24**: Storm MH just north of sanitary manhole near 48th Ave.



**Photo 25**: Three grease trap lids not properly sealed at the Jimmy John's complex (NE corner building).



**Photo 26:** Dewpointe East – 11015 Jordan Ct. – Cleanout with no cap.

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# ASSET MANAGEMENT PLAN

## Hydraulic Modeling and Analysis

Prepared for:

## Allendale Charter Township

FINAL

November 2018

FLEIS&VANDENBRINK

DESIGN. BUILD. OPERATE.

# HYDRAULIC MODELING AND CAPACITY ANALYSIS

## EXECUTIVE SUMMARY

This portion of the AMP discusses the results of hydraulic modeling and analysis (HM&A) conducted on the Allendale Charter Township (ACT) wastewater collection system as a part of the SAW Grant. The purpose of the HM&A is to provide a cursory overview of the hydraulic capacity of the system and evaluate gravity sewer pipe, manholes, pump stations, and forcemains for capacity concerns based on average day and peak hour flows and provide recommendations resulting from the hydraulic modeling analysis.

## MODEL DEVELOPMENT AND VERIFICATION

### Methodology and Software

F&V utilized Autodesk Storm and Sanitary Analysis (SSA) software for collection system capacity analysis. SSA is a comprehensive hydraulic modeling system that uses accepted calculation methods to model sewer systems. Calculations within SSA are made using the following equations:

- Manning's equation for open channel (free flowing) conditions:

$$Q = \frac{1.49}{n} A R^{\frac{2}{3}} \sqrt{S}$$

where Q = flow rate,
n = Manning roughness coefficient
A = cross-sectional area
R = hydraulic radius
S = energy slope

- Hazen-Williams equation for pressure sewer:

$$Q = 1.318 C A R^{2/3} S^{1/2}$$

where:
Q = flow rate
C = Hazen-Williams C-factor, which varies inversely with surface roughness
A = cross-sectional area
R = hydraulic radius
S = energy slope

- The hydrodynamic calculation method for surcharged pipe and manhole conditions. The hydrodynamic routing method solves the complete one-dimensional Saint Venant equations consisting of continuity and momentum equation for each conduit and volume continuity equation for each node. Hydrodynamic routing method allows for pressurized flow, such as an adverse slope within the gravity collection system, and it can account for channel storage, backwater, entrance/exit losses, flow reversal, and surcharging. SSA can calculate the maximum hydraulic grade line (HGL), energy grade line (EGL), critical depth, peak flow in a sewer pipe for a given event, and maximum flow depth and velocity.

SSA directly imports pipe and manhole information gathered from field survey from AutoCAD or GIS applications. Pump stations and forcemains are also modeled based on drawings and information provided by the Township. The ACT model consists of:

- Approximately 245,060 LFt of 6 inch to 24-inch sanitary sewer

- Approximately 8,280 LFt of 2 inch to 12 inch sanitary forcemain
- Six (6) pumping stations are in the model, including:

**Table 1. Lift Station Capacities**

| Lift Station | Design Firm Capacity (gpm) |
|---|---|
| Hidden Shores Lift Station | 360 |
| Timber Creek Lift Station | 185 |
| Brown Street Lift Station | 125 |
| Park Street Lift Station | 850 |
| 60th Avenue North Lift Station | 130 |
| 60th Avenue South Lift Station | 215 |

After the model was created, F&V verified that the physical features of the network are correct including pipe size, location, slope, elevations, and materials. After the model network is verified, initial flow demands are placed on the system and the model is run. A continuity check is then made to determine if the model output matches the expected flow inputted into the model. Once the model results match what is expected, flow analysis of the system can begin.

### Basis of System Evaluation

Flows monitored during the City's Mass Flow Monitoring (MFM) project provided the basis for flows simulated in the model. In the MFM project, 35 depth and temperature measuring devices called Leveloggers® (LLs) were installed at various manholes in the collection system. Data from the LLs, lift stations, and WWTP influent was analyzed to estimate the dry-weather flow and volumes and durations of inflow at each monitoring location.

After the average day analysis was run, a peak hour analysis was performed based on the population and the peaking factor calculation from the 10 State Recommended Standards for Wastewater Facilities. The equation to determine the peaking factor for peak hour flow is:

$$P.F. = \frac{18 + \sqrt{P}}{4 + \sqrt{P}}$$

where P.F. = peaking factor,
P = population in thousands

With a population of 20,708 the peaking factor for Allendale Charter Township is 2.64.

For both the average day and peak hour flow conditions, it was assumed that all pump stations were in operation and discharging wastewater into the collection system.

## RESULTS AND RECOMMENDATIONS

### SUMMARY

Results from SSA for gravity mains, manholes, lift stations, and forcemains were evaluated for both the average day and peak flow conditions. As a result of the average day analysis, eight potential gravity sewer concerns were identified. These pipes are flowing near full pipe capacity at the average daily flow. For the peak hour conditions, there were twenty gravity main and four manhole concerns identified. Two forcemains were also identified to have the potential for low flow velocity. There were no concerns regarding lift station capacity. In general, the lift stations appear to have adequate capacity to meet peak hour demands. The concerns identified in the analysis may need to be further evaluated to determine if adequate capacity exists to accommodate potential additional flows.

## ANALYSIS AND DISCUSSION

The results from the hydraulic analysis of the ACT system as well as associated recommendations are summarized in this section. These results were exported and prioritized into 4 categories including gravity sewer mains, manholes (junctions), pump stations, and force mains.

### Gravity Mains

The gravity sewer system was analyzed based on full flowing percentage of average day and peak hour flows and grouped into the following categories for illustration and discussion:

- <25%
- 25-50%
- 50-75%
- 75-100%
- >100%

Figures 1 and 2 illustrate the number of and length of pipe, respectively, falling into each maximum percent flow capacity category. Results for both simulation scenarios are illustrated in these figures. As shown in the figures, the simulated peak flow rate was less than 25% pipe capacity in most of the system in both scenarios. In the dry-weather scenario, no pipes had a simulated peak flow greater than 75% capacity. In the peak flow scenario, 8 pipes had simulated peak flows greater than 75%, with 2 of these being over capacity. These results indicate that most of the system is able to adequately convey wastewater during both dry-weather and inflow periods, but several pipes are predicted to experience capacity issues during periods of significant flow.

For the dry-weather scenario, pipes falling into each maximum percent flow capacity category are shown in Attachment G1. Pipes falling into the maximum percent depth categories for the peak flow scenario are shown in Attachment G2.

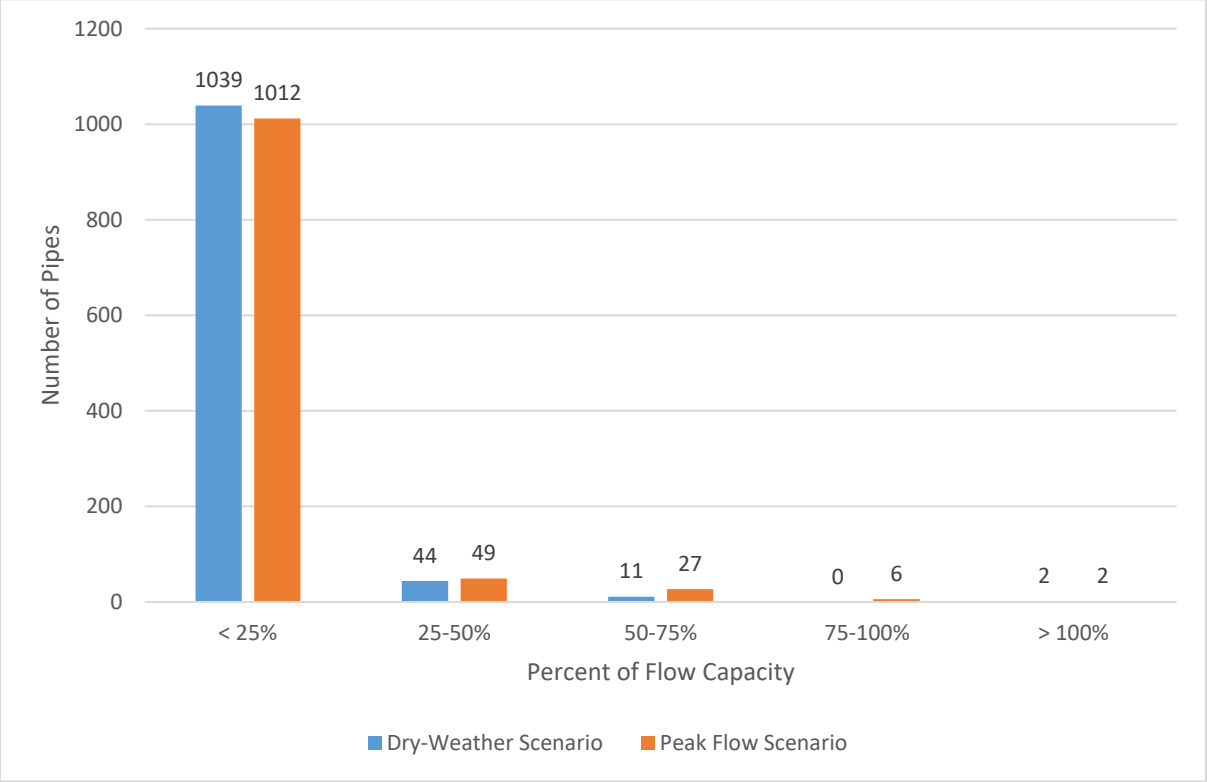



*Figure 1. Number of pipes in each maximum percent flow capacity category in the dry-weather and peak flow scenarios.*

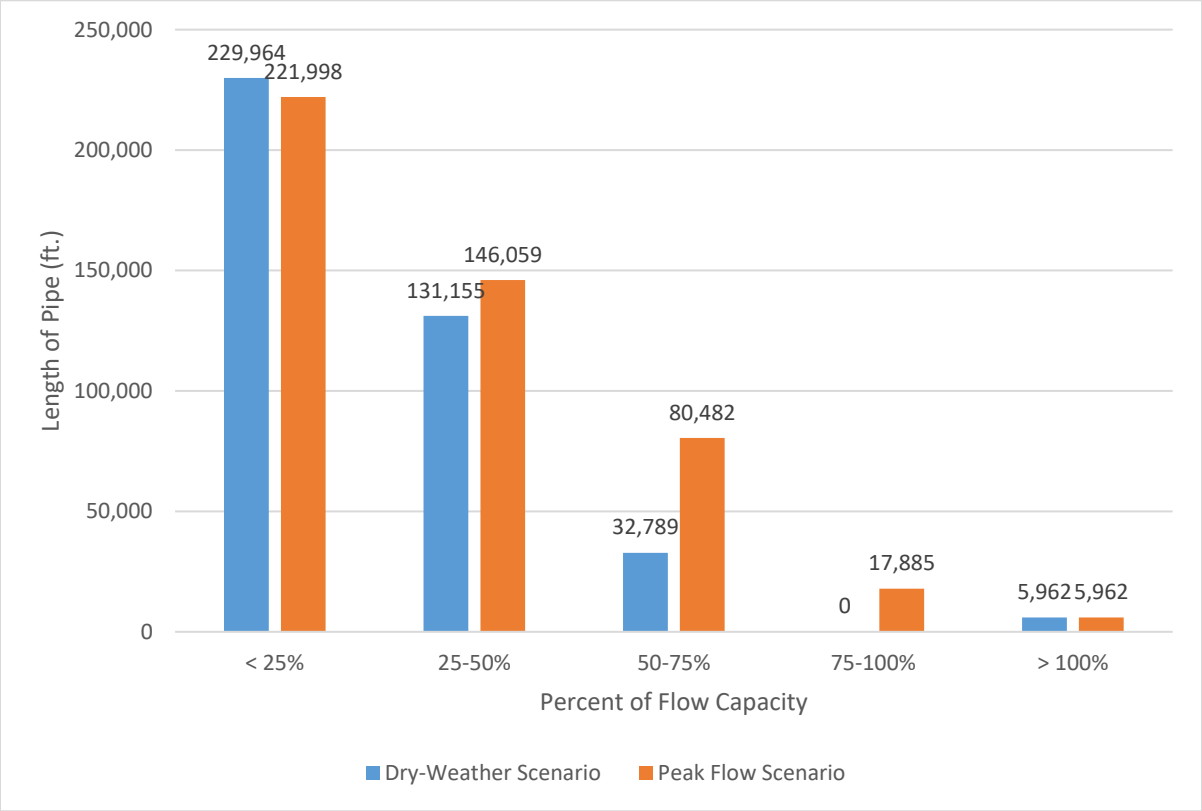



*Figure 2. Length of pipes in each maximum percent flow capacity category in the dry-weather and peak flow scenarios.*

**Manholes**

For the purposes of the model, surcharged manholes are defined as having a water depth above the top of the manhole flow channel. When wastewater levels exceed the top of the flow channels, there tend to be increased operations and maintenance costs associated with cleaning and maintaining the manholes due to solids buildup and greater potential for manhole corrosion due to hydrogen sulfide gas.

Under the peak hour analysis, the model resulted in 4 potentially surcharged manholes.

**Table 4. Potentially Surcharge Manholes under Peak Hour Conditions**

| MH # | Location |
|---|---|
| 1036 | 40th and Cadence Ct. |

Surcharged manholes can be a result of a multitude of items, however items related to the following can result in larger collection system issues:

- Design capacity concerns – system not adequately designed to handle peak hour flows for the collection system
- Construction Issues – Adverse slopes on pipes and/or outflowing pipe inverts are higher than incoming pipe inverts causing surcharged manholes or pressurized flow.

**Lift Stations**

For all six lift stations, the simulated peak hour influent scenario was compared to the lift station's design capacity. As shown in Table 3, all of the lift stations have adequate capacity to handle the peak hour flow during the maximum monitored inflow. Except for these lift stations, no modifications are deemed necessary, but the pump stations should be further evaluated if additional development or new connections are made to the system.

**Table 6. Peak Flow Scenario Evaluation: Lift Stations**

| Lift Station | Station Design Capacity (gpm) | Model Peak Inflow (GPM) | % Capacity |
|---|---|---|---|
| Hidden Shores | 360 | 54 | 15% |
| Timber Creek | 185 | 72 | 39% |
| Brown Street | 125 | 11 | 8.8% |
| Park Street | 850 | 409 | 48% |
| 60th Avenue North | 130 | 73 | 56% |
| 60th Avenue South | 215 | 16 | 7.4% |

For more comprehensive results or analysis or if there are concerns at one of the stations, further evaluation involving installation of 24-hour pump station monitors would be recommended.

Further discussions pertaining to lift stations including condition assessments and recommendations for asset management and capital improvements are included in the Wastewater Treatment Plant Asset Management Plan

**Force Mains**

Force mains were modeled within SSA using the pump station design conditions and were analyzed per the 10 State Recommendations for Wastewater Facilities. Per the standards, the velocity of force mains to be at least 2 feet per second for flushing velocity and not greater than 8 feet per second to avoid excessive friction losses, increased energy consumption, and protection of valves. There are currently 6 force mains for the Township collection system with the following velocities:

**Table 8. Force Main Velocities**

| Force Main | Size (in) | Velocity (ft/sec) |
|---|---|---|
| Hidden Shores Force Main | 8 | 2.30 |
| Timber Creek Force Main | 4 | 4.72 |
| Brown Street Force Main | 4 | 3.19 |
| Park Street Force Main | 12 | 2.41 |
| 60th Avenue North Force Main | 6 | 1.48 |
| 60th Avenue South Force Main | 8 | 1.37 |

Hidden Shores, Timber Creek, Brown Street and Park Street Lift Stations all have velocities that adequately meet the 10 State Standards for recommended wastewater facilities. The 60th Avenue North and 60th Avenue South Lift Stations fall below the 2 feet per second velocity recommendation. The low velocity in these force mains may result in the buildup of grit in the line. If the Township experiences operational issues with these force mains, the Township should consider increasing the pump capacity at the lift stations or replacement of the force main while decreasing pipe diameter.

**Attachment G1. Dry Weather Flow Scenario: Maximum Percent Flow Capacities**

| Element ID | Length (ft) | Inlet Invert Elevation (ft) | Outlet Invert Elevation (ft) | Average Slope (%) | Pipe Diameter (inches) | Peak Flow (gpm) | Max Flow Depth / Total Depth Ratio |
|---|---|---|---|---|---|---|---|

**Attachment G2. Peak Flow Scenario: Maximum Percent Flow Capacities**

| Element ID | Length (ft) | Inlet Invert Elevation (ft) | Outlet Invert Elevation (ft) | Average Slope (%) | Pipe Diameter (inches) | Peak Flow (gpm) | Max Flow Depth / Total Depth Ratio |
|---|---|---|---|---|---|---|---|
| FM10 | 515.77 | 604.09 | 604.09 | 0.0000 | 18 | 1112.9 | 1.00 |
| FM11 | 692.84 | 604.09 | 604.09 | 0.0000 | 20 | 1582.9 | 1.00 |
| FM13 | 7.92 | 604.09 | 604.09 | 0.0000 | 18 | 809.6 | 1.00 |
| FM6 | 1371.92 | 614.58 | 613.49 | 0.0800 | 4 | 6.5 | 1.00 |
| FM9 | 1376.86 | 604.09 | 604.09 | 0.0000 | 20 | 1582.9 | 1.00 |
| P1032 | 28.27 | 603.69 | 602.99 | 2.4800 | 12 | 62.6 | 1.00 |
| P1048 | 139.11 | 640.84 | 640.17 | 0.4800 | 8 | 0.6 | 1.00 |
| P4658 | 97.36 | 649.19 | 648.70 | 0.5000 | 8 | 25.8 | 1.00 |
| P5284 | 248.56 | 605.38 | 602.99 | 0.9600 | 10 | 158.2 | 0.88 |
| P1106 | 205.59 | 650.29 | 649.18 | 0.5400 | 8 | 4.5 | 0.87 |
| P4659 | 15.41 | 648.70 | 648.62 | 0.5200 | 8 | 735.5 | 0.83 |
| P4635 | 102.26 | 623.98 | 623.32 | 0.6500 | 12 | 17.2 | 0.81 |
| FM8 | 916.44 | 604.09 | 604.67 | -0.0600 | 20 | 932.9 | 0.80 |

## APPENDIX H – Rehabilitation Summary

Table H-1: Rehabilitation Summary Table and Asset Risk Ratings

**Table H-1: Rehabilitation Summary Table and Asset Risk Ratings**

| Asset | ID | Address | Rehab Actions | Total Cost | Normalized Risk | Size (in) | Year Constructed | Length (ft) | Material | Risk(By Grading) |
|---|---|---|---|---|---|---|---|---|---|---|
| Manhole | 1153 | 4400 Knollwood Dr | MH Clean + Line + Repair | $ 5,377 | 100 | 0 | 1987 | 0 | Concrete (Reinforced) [CR | 5-Extreme |
| Gravity Main | P2342 | 6679-6791 Lake Michigan Dr | Full Lining | $ 16,873 | 100 | 8 | 1990 | 394 | PVC | 5-Extreme |
| Manhole | 2582 | 5804 Ivory Rd | MH Clean + Line + Repair | $ 5,377 | 97 | 0 | 1992 | 0 | Concrete (Reinforced) [CR | 5-Extreme |
| Gravity Main | P2472 | 6132 Library Ln | Point Repair | $ 19,466 | 95 | 10 | 1999 | 389 | PVC | 5-Extreme |
| Gravity Main | P2680 | 11435-11397 60th Ave | Full Lining | $ 20,746 | 94 | 10 | 1990 | 387 | PVC | 5-Extreme |
| Gravity Main | P2536 | 11397-11303 68th Ave | Full Lining | $ 12,927 | 94 | 8 | 1992 | 302 | PVC | 5-Extreme |
| Manhole | 4845 | 11359 48th Ave | MH Clean + Line + Repair | $ 5,377 | 93 | 0 | 1987 | 0 | Concrete (Reinforced) [CR | 5-Extreme |
| Manhole | 2180 | 10969 60th Ave | MH Repair+Lining | $ 4,574 | 88 | 0 | 1992 | 0 | Concrete (Reinforced) [CR | 5-Extreme |
| Gravity Main | P9007 | 1 Campus Dr | Full Lining | $ 12,889 | 87 | 12 | 1963 | 201 | VCP | 5-Extreme |
| Manhole | 1180 | 7003 Lake Michigan Dr | MH Clean + Line + Repair | $ 5,377 | 86 | 0 | 2007 | 0 | Concrete (Reinforced) [CR | 5-Extreme |
| Gravity Main | P2335 | 11177-11115 68th Ave | Full Lining | $ 18,402 | 81 | 12 | 1990 | 286 | PVC | 5-Extreme |
| Gravity Main | P4635 | Lake Michigan Dr | Full Lining | $ 6,572 | 80 | 12 | 2000 | 102 | PVC | 5-Extreme |
| Manhole | 2342 | 6679 Lake Michigan Dr | MH Repair+Lining | $ 4,574 | 80 | 0 | 1990 | 0 | Concrete (Reinforced) [CR | 5-Extreme |
| Gravity Main | P2343 | 6667-6679 Lake Michigan Dr | Full Lining | $ 8,797 | 79 | 8 | 1990 | 205 | PVC | 5-Extreme |
| Gravity Main | P4605 | 5382-5426 Lake Michigan Dr | Full Lining | $ 14,104 | 79 | 8 | 2001 | 329 | PVC | 5-Extreme |
| Gravity Main | P2060 | 6406-6431 Martinie Dr | Full Lining | $ 8,914 | 77 | 8 | 1990 | 208 | PVC | 5-Extreme |
| Gravity Main | P2435 | 11217-11233 68th Ave | Replacement | $ 35,778 | 77 | 18 | 1990 | 108 | PVC | 5-Extreme |
| Gravity Main | P2334 | 11189 68th Ave | Full Lining | $ 16,185 | 76 | 12 | 1999 | 252 | PVC | 5-Extreme |
| Gravity Main | P9005 | 6065-6039 Lake Michigan Dr | Upsize | $ 100,656 | 76 | 15 | 1990 | 303 | PVC | 5-Extreme |
| Manhole | 4862 | 4422 Lake Michigan Dr | MH Repair+Lining | $ 4,574 | 76 | 0 | 1963 | 0 | Other - Block [ZZZ] | 5-Extreme |
| Manhole | 1582 | 10537 60th Ave | MH Clean + Line + Repair | $ 5,377 | 75 | 0 | 1992 | 0 | Concrete (Reinforced) [CR | 5-Extreme |
| Manhole | 4622 | 5187 Lake Michigan Dr | MH Repair+Lining | $ 4,574 | 75 | 0 | 1990 | 0 | Concrete (Reinforced) [CR | 5-Extreme |
| Gravity Main | P2641 | 11404 68th Ave | Full Lining | $ 14,274 | 74 | 8 | 1992 | 333 | PVC | 5-Extreme |
| Gravity Main | P2352 | 6401 Lake Michigan Dr | Replacement | $ 77,584 | 74 | 8 | 1987 | 268 | PVC | 5-Extreme |
| Gravity Main | P2356 | 6299 Lake Michigan Dr | Full Lining | $ 11,633 | 74 | 8 | 1987 | 271 | PVC | 5-Extreme |
| Gravity Main | P2354 | 6387 Lake Michigan Dr | Full Lining | $ 11,346 | 74 | 8 | 1987 | 265 | PVC | 5-Extreme |
| Gravity Main | P2355 | 6341-6387 Lake Michigan Dr | Full Lining | $ 12,539 | 74 | 8 | 1987 | 293 | PVC | 5-Extreme |
| Gravity Main | P4603 | 5504-5500 Lake Michigan Dr | Full Lining | $ 12,899 | 74 | 8 | 2001 | 301 | PVC | 5-Extreme |
| Gravity Main | P4604 | 5426-5504 Lake Michigan Dr | Full Lining | $ 13,034 | 74 | 8 | 2001 | 304 | PVC | 5-Extreme |
| Gravity Main | P2537 | 11303-11263 68th Ave | Replacement | $ 86,538 | 73 | 8 | 1992 | 299 | PVC | 5-Extreme |
| Gravity Main | P2436 | 11263-11227 68th Ave | Full Lining | $ 13,065 | 73 | 8 | 1992 | 305 | PVC | 5-Extreme |
| Gravity Main | P1841 | 10823 68th Ave | Full Lining | $ 10,311 | 72 | 8 | 1990 | 241 | PVC | 5-Extreme |
| Gravity Main | P4600 | 11229 56th Ave | Full Lining | $ 16,016 | 72 | 10 | 1990 | 299 | PVC | 5-Extreme |
| Gravity Main | P2162 | 11007 64th Ave | Full Lining | $ 6,644 | 72 | 10 | 1990 | 124 | PVC | 5-Extreme |
| Gravity Main | P2535 | 11351-11301 Brown St | Full Lining | $ 17,590 | 72 | 8 | 1992 | 411 | PVC | 5-Extreme |
| Manhole | 4537 | 11055 Stanford Ave | MH Clean + Line + Repair | $ 5,377 | 71 | 0 | 1966 | 0 | Concrete (Reinforced) [CR | 5-Extreme |
| Gravity Main | P2062 | 10939-10991 64th Ave | Full Lining | $ 16,787 | 71 | 8 | 1990 | 392 | PVC | 5-Extreme |
| Manhole | 1110 | 11041 Radcliff Dr | MH Repair+Lining | $ 4,574 | 71 | 0 | 1966 | 0 | Concrete (Reinforced) [CR | 5-Extreme |
| Manhole | 2571 | 11361 60th Ave | MH Repair+Lining | $ 4,574 | 71 | 0 | 1990 | 0 | Concrete (Reinforced) [CR | 5-Extreme |
| Manhole | 2536 | 11397 68th Ave | MH Clean + Line + Repair | $ 5,377 | 69 | 0 | 1992 | 0 | Concrete (Reinforced) [CR | 5-Extreme |
| Gravity Main | P4460 | 4645 W Campus Dr | Full Lining | $ 20,674 | 69 | 12 | 1963 | 322 | VCP | 5-Extreme |
| Gravity Main | P4462 | 4307-4443 Stadium Dr | Full Lining | $ 20,744 | 68 | 12 | 1963 | 323 | VCP | 5-Extreme |
| Gravity Main | P1953 | 6562-6588 Winans St | Full Lining | $ 6,664 | 68 | 8 | 1992 | 156 | PVC | 5-Extreme |

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Manhole | 4636 | 4866 Lake Michigan Dr | MH Inspection | $ | 536 | 68 | 0 | 2001 | 0 | Concrete (Reinforced) [CR | 5-Extreme |
| Manhole | 2537 | 11303 68th Ave | MH Repair+Lining | $ | 4,574 | 68 | 0 | 1992 | 0 | Concrete (Reinforced) [CR | 5-Extreme |
| Manhole | 2250 | 6504 Henry St | MH Clean + Line | $ | 4,038 | 65 | 0 | 1990 | 0 | Concrete (Reinforced) [CR | 5-Extreme |
| Manhole | 2589 | 5957 Dewpointe Dr | MH Repair+Lining | $ | 4,574 | 63 | 0 | 1993 | 0 | Concrete (Reinforced) [CR | 5-Extreme |
| Manhole | 2632 | 11497 Brown St | MH Clean + Line + Repair | $ | 5,377 | 68 | 0 | 1992 | 0 | Concrete (Reinforced) [CR | 4-High |
| Manhole | 2371 | 6161 Lake Michigan Dr | MH Clean + Line + Repair | $ | 5,377 | 67 | 0 | 1990 | 0 | Concrete (Reinforced) [CR | 4-High |
| Manhole | 1082 | 6195 Lake Michigan Dr | MH Repair+Lining | $ | 4,574 | 67 | 0 | 1990 | 0 | Concrete (Reinforced) [CR | 4-High |
| Manhole | 1117 | 4861 Lake Michigan Dr | MH Clean + Line | $ | 4,038 | 65 | 0 | 1990 | 0 | Concrete (Reinforced) [CR | 4-High |
| Manhole | 2242 | 11048 68th Ave | MH Clean + Line + Repair +Adjust | $ | 8,055 | 64 | 0 | 1990 | 0 | Concrete (Reinforced) [CR | 4-High |
| Manhole | 2372 | 6039 Lake Michigan Dr | MH Repair+Lining | $ | 4,574 | 63 | 0 | 1990 | 0 | Concrete (Reinforced) [CR | 4-High |
| Manhole | 4515 | 11127 52nd Ave | MH Clean + Line + Repair | $ | 5,377 | 63 | 0 | 1997 | 0 | Concrete (Reinforced) [CR | 4-High |
| Manhole | 2359 | 6261 Lake Michigan Dr | MH Repair+Lining | $ | 4,574 | 61 | 0 | 1990 | 0 | Concrete (Reinforced) [CR | 4-High |
| Manhole | 1152 | 4400 Knollwood Dr | MH Clean + Line | $ | 4,038 | 60 | 0 | 1987 | 0 | Concrete (Reinforced) [CR | 4-High |
| Manhole | 1074 | 6495 Winans St | MH Clean + Line + Repair | $ | 5,377 | 60 | 0 | 1992 | 0 | Concrete (Reinforced) [CR | 4-High |
| Manhole | 1172 | Becker Dr | MH Clean + Line + Repair | $ | 5,377 | 60 | 0 | 2000 | 0 | Concrete (Reinforced) [CR | 4-High |
| Gravity Main | P1910 | 7517-7593 Water View Ln | Full Lining | $ | 12,913 | 58 | 8 | 2004 | 301 | PVC | 4-High |
| Gravity Main | P2011 | 7376-7338 Water View Ln | Full Lining | $ | 6,286 | 58 | 8 | 2004 | 147 | PVC | 4-High |
| Gravity Main | P1912 | 7389-7303 Pinevalley Dr | Full Lining | $ | 14,766 | 58 | 8 | 2004 | 345 | PVC | 4-High |
| Gravity Main | P2015 | 7244 Bittersweet Ct | Full Lining | $ | 6,072 | 58 | 8 | 2004 | 142 | PVC | 4-High |
| Manhole | 4534 | 11011 Radcliff Dr | MH Repair+Lining | $ | 4,574 | 57 | 0 | 1966 | 0 | Concrete (Reinforced) [CR | 4-High |
| Gravity Main | P2369 | 6098-6052 Lake Michigan Dr | Full Lining | $ | 15,416 | 50 | 8 | 2000 | 360 | PVC | 4-High |
| Gravity Main | P4641 | 4806 Lake Michigan Dr | Full Lining | $ | 7,916 | 50 | 12 | 1987 | 123 | PVC | 4-High |
| Manhole | 2098 | 10929 56th Ave | MH Clean + Line | $ | 4,038 | 49 | 0 | 1990 | 0 | Concrete (Reinforced) [CR | 4-High |
| Gravity Main | P2348 | 6600-6660 Lake Michigan Dr | Point Repair | $ | 9,372 | 47 | 8 | 1993 | 374 | PVC | 4-High |
| Gravity Main | P4328 | 10924 Woodedge Dr | Full Lining | $ | 11,447 | 44 | 8 | 2007 | 267 | PVC | 4-High |
| Manhole | 2788 | 11463 Prairie Ave | MH Clean + Line | $ | 4,038 | 65 | 0 | 1990 | 0 | Concrete (Reinforced) [CR | 3-Medium |
| Manhole | 4517 | 11075 52nd Ave | No Action | $ | - | 63 | 0 | 1990 | 0 | Concrete (Reinforced) [CR | 3-Medium |
| Manhole | 2248 | 6698 Henry St | MH Repair+Lining | $ | 4,574 | 63 | 0 | 1990 | 0 | Concrete (Reinforced) [CR | 3-Medium |
| Manhole | 3621 | 10431 52nd Ave | MH Inspection | $ | 536 | 63 | 0 | 2006 | 0 | Not Known [XXX] | 3-Medium |
| Manhole | 2630 | 11391 Valley View Ave | MH Clean + Line | $ | 4,038 | 62 | 0 | 1992 | 0 | Concrete (Reinforced) [CR | 3-Medium |
| Manhole | 4421 | 5202 Jordan St | MH Repair+Lining | $ | 4,574 | 60 | 0 | 2005 | 0 | Concrete (Reinforced) [CR | 3-Medium |
| Manhole | 2361 | 11195 64th Ave | MH Clean + Line | $ | 4,038 | 60 | 0 | 1990 | 0 | Concrete (Reinforced) [CR | 3-Medium |
| Manhole | 2081 | 10933 60th Ave | MH Repair+Lining | $ | 4,574 | 60 | 0 | 1992 | 0 | Concrete (Reinforced) [CR | 3-Medium |
| Manhole | 2357 | 11245 Washington Ave | MH Repair+Lining | $ | 4,574 | 60 | 0 | 2004 | 0 | Concrete (Reinforced) [CR | 3-Medium |
| Manhole | 2354 | 6387 Lake Michigan Dr | MH Clean + Line | $ | 4,038 | 60 | 0 | 1987 | 0 | Concrete (Reinforced) [CR | 3-Medium |
| Manhole | 3619 | 5256 Pierce St | MH Clean | $ | 803 | 60 | 0 | 2015 | 0 | Concrete (Non-reinforced) | 3-Medium |
| Manhole | 9501 | 4873 Lake Michigan Dr | No Action | $ | - | 60 | 0 | 1990 | 0 | Concrete (Reinforced) [CR | 3-Medium |
| Manhole | 4221 | 10855 52nd Ave | MH Inspection | $ | 536 | 60 | 0 | 2005 | 0 | Not Known [XXX] | 3-Medium |
| Manhole | 2396 | 5743 Country View Dr | MH Clean + Line | $ | 4,038 | 60 | 0 | 1992 | 0 | Concrete (Reinforced) [CR | 3-Medium |
| Manhole | 2461 | 11315 64th Ave | MH Repair+Lining | $ | 4,574 | 60 | 0 | 1987 | 0 | Concrete (Reinforced) [CR | 3-Medium |
| Manhole | 2331 | 6940 Lake Michigan Dr | MH Inspection | $ | 536 | 59 | 0 | 1998 | 0 | Concrete (Reinforced) [CR | 3-Medium |
| Manhole | 2330 | 6946 Lake Michigan Dr | MH Repair+Lining | $ | 4,574 | 57 | 0 | 2013 | 0 | Concrete (Reinforced) [CR | 3-Medium |
| Manhole | 4516 | 11111 52nd Ave | No Action | $ | - | 57 | 0 | 1990 | 0 | Concrete (Reinforced) [CR | 3-Medium |
| Manhole | 4741 | 11261 48th Ave | No Action | $ | - | 56 | 0 | 1987 | 0 | Concrete (Reinforced) [CR | 3-Medium |
| Manhole | 2394 | 11091 Pleasant Point Dr | MH Repair+Lining | $ | 4,574 | 56 | 0 | 1992 | 0 | Concrete (Reinforced) [CR | 3-Medium |

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Manhole | 2343 | 6667 Lake Michigan Dr | MH Clean + Line | $ | 4,038 | 56 | 0 | 1990 | 0 | Concrete (Reinforced) [CR | 3-Medium |
| Manhole | 1681 | 10635 Tallpine Ln | MH Inspection | $ | 536 | 54 | 0 | 1998 | 0 | Not Known [XXX] | 3-Medium |
| Manhole | 2680 | 11435 60th Ave | MH Repair+Lining | $ | 4,574 | 54 | 0 | 1990 | 0 | Concrete (Reinforced) [CR | 3-Medium |
| Manhole | 2433 | 11235 Brown St | MH Clean + Line | $ | 4,038 | 54 | 0 | 1990 | 0 | Concrete (Reinforced) [CR | 3-Medium |
| Manhole | 2038 | 10975 68th Ave | No Action | $ | - | 53 | 0 | 1990 | 0 | Concrete (Reinforced) [CR | 3-Medium |
| Manhole | 1158 | 11563 40th Ave | No Action | $ | - | 53 | 0 | 1990 | 0 | Concrete (Reinforced) [CR | 3-Medium |
| Manhole | 2641 | 6802 Cardinal St | MH Repair+Lining | $ | 4,574 | 52 | 0 | 1992 | 0 | Concrete (Reinforced) [CR | 3-Medium |
| Manhole | 2880 | 11555 60th Ave | MH Inspection | $ | 536 | 52 | 0 | 2006 | 0 | Not Known [XXX] | 3-Medium |
| Manhole | 2251 | 6402 Henry St | MH Clean | $ | 803 | 51 | 0 | 2008 | 0 | Concrete (Reinforced) [CR | 3-Medium |
| Manhole | 1965 | 6324 Timber Dr | MH Inspection | $ | 536 | 51 | 0 | 2004 | 0 | Not Known [XXX] | 3-Medium |
| Manhole | 4535 | 11003 Radcliff Dr | MH Clean + Line + Repair | $ | 5,377 | 51 | 0 | 1966 | 0 | Concrete (Reinforced) [CR | 3-Medium |
| Manhole | 2161 | 11003 64th Ave | MH Repair+Lining | $ | 4,574 | 51 | 0 | 1990 | 0 | Concrete (Reinforced) [CR | 3-Medium |
| Manhole | 2486 | 5802 Larkspur Ave | MH Clean + Line | $ | 4,038 | 51 | 0 | 1992 | 0 | Concrete (Reinforced) [CR | 3-Medium |
| Manhole | 2355 | 6341 Lake Michigan Dr | MH Clean + Line | $ | 4,038 | 49 | 0 | 1987 | 0 | Concrete (Reinforced) [CR | 3-Medium |
| Manhole | 2432 | 11235 Brown St | MH Clean + Line + Repair | $ | 5,377 | 49 | 0 | 1990 | 0 | Concrete (Reinforced) [CR | 3-Medium |
| Manhole | 2640 | 6830 Cardinal St | MH Repair+Lining | $ | 4,574 | 49 | 0 | 1992 | 0 | Concrete (Reinforced) [CR | 3-Medium |
| Manhole | 4658 | 4395 Lake Michigan Dr | No Action | $ | - | 49 | 0 | 1990 | 0 | Concrete (Reinforced) [CR | 3-Medium |
| Manhole | 4635 | 4876 Lake Michigan Dr | No Action | $ | - | 49 | 0 | 2000 | 0 | Concrete (Reinforced) [CR | 3-Medium |
| Manhole | 2240 | 11115 68th Ave | No Action | $ | - | 49 | 0 | 1990 | 0 | Concrete (Reinforced) [CR | 3-Medium |
| Manhole | 1087 | 10617 60th Ave | No Action | $ | - | 49 | 0 | 1992 | 0 | Concrete (Reinforced) [CR | 3-Medium |
| Manhole | 2583 | 5827 Ivory Rd | MH Repair+Lining | $ | 4,574 | 49 | 0 | 1992 | 0 | Concrete (Reinforced) [CR | 3-Medium |
| Manhole | 1921 | 7072 Aspen St | MH Repair+Lining | $ | 4,574 | 49 | 0 | 2001 | 0 | Concrete (Reinforced) [CR | 3-Medium |
| Manhole | 4634 | 11195 Radcliff Dr | No Action | $ | - | 49 | 0 | 1966 | 0 | Concrete (Reinforced) [CR | 3-Medium |
| Manhole | 2441 | 11305 Avery Ave | MH Repair+Lining | $ | 4,574 | 49 | 0 | 1990 | 0 | Concrete (Reinforced) [CR | 3-Medium |
| Manhole | 2538 | 6761 Scott St | MH Clean + Line | $ | 4,038 | 48 | 0 | 1992 | 0 | Concrete (Reinforced) [CR | 3-Medium |
| Gravity Main | P4040 | 10745 48th Ave | Full Lining | $ | 9,476 | 47 | 10 | 1990 | 177 | PVC | 3-Medium |
| Manhole | 4742 | 11269 48th Ave | No Action | $ | - | 46 | 0 | 1987 | 0 | Concrete (Reinforced) [CR | 3-Medium |
| Manhole | 4403 | 5312 Jordan St | MH Inspection | $ | 536 | 46 | 0 | 2000 | 0 | Not Known [XXX] | 3-Medium |
| Gravity Main | P2251 | 6402-6504 Henry St | Point Repair | $ | 9,526 | 46 | 12 | 1990 | 430 | PVC | 3-Medium |
| Gravity Main | P1982 | 10809 60th Ave | Full Lining | $ | 17,351 | 46 | 8 | 1992 | 405 | PVC | 3-Medium |
| Manhole | 2584 | 5852 Ivory Rd | MH Clean | $ | 803 | 46 | 0 | 1992 | 0 | Concrete (Reinforced) [CR | 3-Medium |
| Gravity Main | P2637 | 11431-11495 Brown St | Full Lining | $ | 10,588 | 45 | 8 | 1992 | 247 | PVC | 3-Medium |
| Gravity Main | P1925 | 10853 Timberline Dr | Full Lining | $ | 12,002 | 45 | 8 | 1996 | 280 | PVC | 3-Medium |
| Gravity Main | P4141 | 10857 48th Ave | Full Lining | $ | 9,571 | 45 | 10 | 1987 | 179 | PVC | 3-Medium |
| Manhole | LS_60TH-NORTH | 11555 60th Ave | No Action | $ | - | 44 | 0 | 2006 | 0 | Concrete (Reinforced) [CR | 3-Medium |
| Manhole | 2347 | 6656 Lake Michigan Dr | MH Inspection | $ | 536 | 44 | 0 | 1992 | 0 | Not Known [XXX] | 3-Medium |
| Manhole | 1144 | 4310 Rich St | No Action | $ | - | 44 | 0 | 1990 | 0 | Concrete (Reinforced) [CR | 3-Medium |
| Gravity Main | P3833 | 4801 Country Pl S | Point Repair | $ | 14,775 | 43 | 10 | 1997 | 370 | PVC | 3-Medium |
| Gravity Main | P2247 | 6698 Henry St | Point Repair | $ | 9,526 | 43 | 12 | 1990 | 359 | PVC | 3-Medium |
| Gravity Main | P3630 | 5045-5083 Pierce St | Full Lining | $ | 14,837 | 43 | 8 | 2008 | 346 | PVC | 3-Medium |
| Gravity Main | P3633 | 5013-5045 Pierce St | Full Lining | $ | 12,644 | 43 | 8 | 2008 | 295 | PVC | 3-Medium |
| Manhole | 4536 | 11085 Stanford Ave | MH Repair+Lining | $ | 4,574 | 43 | 0 | 1966 | 0 | Concrete (Reinforced) [CR | 3-Medium |
| Gravity Main | P4060 | 4547 W Campus Dr | Point Repair | $ | 9,526 | 42 | 12 | 1963 | 321 | VCP | 3-Medium |
| Gravity Main | P3961 | 4546 W Campus Dr | Point Repair | $ | 9,526 | 42 | 12 | 1963 | 320 | VCP | 3-Medium |
| Gravity Main | P3637 | 4962-4986 Pierce St | Full Lining | $ | 9,683 | 42 | 8 | 2008 | 226 | PVC | 3-Medium |

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|---|---|---|---|---|---|---|---|---|---|---|---|
| Gravity Main | P4361 | 1 Campus Dr | Full Lining | $ | 21,262 | 42 | 12 | 1963 | 331 | VCP | 3-Medium |
| Gravity Main | P2635 | 11495 Brown St | Replacement | $ | 10,152 | 42 | 8 | 1992 | 35 | PVC | 3-Medium |
| Manhole | 1920 | 7024 Aspen St | MH Repair+Lining | $ | 4,574 | 42 | 0 | 2001 | 0 | Concrete (Reinforced) [CR | 3-Medium |
| Manhole | 2591 | 5701 Ivory Rd | MH Repair+Lining | $ | 4,574 | 42 | 0 | 1992 | 0 | Concrete (Reinforced) [CR | 3-Medium |
| Manhole | 2494 | 11195 Northgate Ave | MH Clean + Line | $ | 4,038 | 42 | 0 | 1992 | 0 | Concrete (Reinforced) [CR | 3-Medium |
| Manhole | 4530 | 11181 Radcliff Dr | No Action | $ | - | 42 | 0 | 1966 | 0 | Concrete (Reinforced) [CR | 3-Medium |
| Manhole | 4632 | Lake Michigan Dr | No Action | $ | - | 42 | 0 | 2000 | 0 | Concrete (Reinforced) [CR | 3-Medium |
| Manhole | 4605 | 5382 Lake Michigan Dr | MH Inspection | $ | 536 | 42 | 0 | 2001 | 0 | Not Known [XXX] | 3-Medium |
| Manhole | 1780 | 10681 60th Ave | No Action | $ | - | 41 | 0 | 1992 | 0 | Concrete (Reinforced) [CR | 3-Medium |
| Manhole | 3622 | 5160 Pierce St | MH Inspection | $ | 536 | 41 | 0 | 2006 | 0 | Not Known [XXX] | 3-Medium |
| Manhole | 2881 | 11530 Brookland Ct | MH Inspection | $ | 536 | 41 | 0 | 1990 | 0 | Not Known [XXX] | 3-Medium |
| Gravity Main | P1822 | 10807 Timberline Dr | Point Repair | $ | 9,526 | 41 | 10 | 2004 | 330 | PVC | 3-Medium |
| Gravity Main | P1046 | 7128-7102 Pinevalley Dr | Full Lining | $ | 8,698 | 41 | 10 | 2004 | 162 | PVC | 3-Medium |
| Manhole | 3720 | 10463 52nd Ave | MH Inspection | $ | 536 | 40 | 0 | 2006 | 0 | Not Known [XXX] | 3-Medium |
| Manhole | 5060 | 4310 Rich St | No Action | $ | - | 40 | 0 | 1990 | 0 | Concrete (Reinforced) [CR | 3-Medium |
| Manhole | 4327 | 10924 Woodedge Dr | MH Inspection | $ | 536 | 40 | 0 | 2007 | 0 | Not Known [XXX] | 3-Medium |
| Gravity Main | P4861 | 4426-4379 Lake Michigan Dr | Upsize | $ | 95,985 | 40 | 12 | 1963 | 320 | DUCTILE IRON | 3-Medium |
| Manhole | 2440 | 11243 Avery Ave | MH Repair+Lining | $ | 4,574 | 40 | 0 | 1990 | 0 | Concrete (Reinforced) [CR | 3-Medium |
| Manhole | 4532 | 11137 Radcliff Dr | MH Repair+Lining | $ | 4,574 | 39 | 0 | 1966 | 0 | Concrete (Reinforced) [CR | 3-Medium |
| Manhole | 1981 | 10843 60th Ave | MH Repair+Lining | $ | 4,574 | 38 | 0 | 1992 | 0 | Concrete (Reinforced) [CR | 3-Medium |
| Manhole | 2032 | 7008 Joal St | MH Repair+Lining | $ | 4,574 | 38 | 0 | 1995 | 0 | Concrete (Reinforced) [CR | 3-Medium |
| Manhole | 3569 | 10281 42nd Ave | MH Repair+Lining | $ | 4,574 | 37 | 0 | 2004 | 0 | Concrete (Reinforced) [CR | 3-Medium |
| Manhole | 2050 | 6798 Mista Dr | No Action | $ | - | 37 | 0 | 1992 | 0 | Concrete (Reinforced) [CR | 3-Medium |
| Manhole | 2061 | 6431 Martinie Dr | No Action | $ | - | 37 | 0 | 2004 | 0 | Concrete (Reinforced) [CR | 3-Medium |
| Manhole | 2346 | 6652 Lake Michigan Dr | MH Inspection | $ | 536 | 37 | 0 | 1992 | 0 | Not Known [XXX] | 3-Medium |
| Manhole | 4513 | 5424 Eric St | MH Inspection | $ | 536 | 37 | 0 | 2000 | 0 | Not Known [XXX] | 3-Medium |
| Manhole | 1966 | 6356 Timber Dr | MH Inspection | $ | 536 | 37 | 0 | 2004 | 0 | Not Known [XXX] | 3-Medium |
| Manhole | 1967 | 6286 Timber Dr | MH Inspection | $ | 536 | 37 | 0 | 2004 | 0 | Not Known [XXX] | 3-Medium |
| Gravity Main | P9010 | 10744-10769 S Campus Dr | Point Repair | $ | 9,526 | 36 | 12 | 1990 | 292 | VCP | 3-Medium |
| Manhole | 3620 | 5202 Pierce St | MH Inspection | $ | 536 | 35 | 0 | 2006 | 0 | Not Known [XXX] | 3-Medium |
| Manhole | 4300 | 10938 Lance Ave | MH Inspection | $ | 536 | 35 | 0 | 2005 | 0 | Not Known [XXX] | 3-Medium |
| Gravity Main | P4530 | 11181-11195 Radcliff Dr | CCTV | $ | 372 | 34 | 10 | 1966 | 99 | PVC | 3-Medium |
| Force Main | FM19 | 11616 40th Ave | No Action | $ | - | 34 | 20 | 1990 | 1363 | DUCTILE IRON | 3-Medium |
| Gravity Main | P2344 | 6660 Lake Michigan Dr | No Action | $ | - | 34 | 8 | 1993 | 181 | PVC | 3-Medium |
| Manhole | 2345 | 6660 Lake Michigan Dr | MH Inspection | $ | 536 | 34 | 0 | 1993 | 0 | Not Known [XXX] | 3-Medium |
| Manhole | 4852 | 11317 Whispering Creek Dr | MH Inspection | $ | 536 | 34 | 0 | 2012 | 0 | Not Known [XXX] | 3-Medium |
| Manhole | 4531 | 11151 Radcliff Dr | No Action | $ | - | 34 | 0 | 1966 | 0 | Concrete (Reinforced) [CR | 3-Medium |
| Gravity Main | P4632 | 4873 Lake Michigan Dr | Full Lining | $ | 10,604 | 33 | 24 | 1990 | 94 | RCP | 3-Medium |
| Manhole | 1111 | 11085 Stanford Ave | No Action | $ | - | 33 | 0 | 1966 | 0 | Concrete (Reinforced) [CR | 3-Medium |
| Manhole | 2293 | 5654 Estate Rd | MH Clean + Line | $ | 4,038 | 33 | 0 | 1990 | 0 | Concrete (Reinforced) [CR | 3-Medium |
| Manhole | 2290 | 11057 Gayle Ln | MH Clean + Line + Adjust Rim | $ | 6,716 | 33 | 0 | 1990 | 0 | Concrete (Reinforced) [CR | 3-Medium |
| Gravity Main | P1780 | 10681-10617 60th Ave | No Action | $ | - | 33 | 8 | 1992 | 351 | PVC | 3-Medium |
| Gravity Main | P1781 | 10709-10681 60th Ave | No Action | $ | - | 33 | 8 | 1992 | 199 | PVC | 3-Medium |
| Force Main | FM20 | 4310 Rich St | No Action | $ | - | 32 | 12 | 1990 | 7350 | CAST IRON | 3-Medium |
| Gravity Main | P4622 | 5135 Lake Michigan Dr | No Action | $ | - | 32 | 27 | 1990 | 396 | RCP | 3-Medium |

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|---|---|---|---|---|---|---|---|---|---|---|---|
| Manhole | 2692 | 11553 Rosewood Ave | MH Inspection | $ | 536 | 32 | 0 | 1990 | 0 | Concrete (Reinforced) [CR | 3-Medium |
| Manhole | 4702 | 11225 Commerce Rd | MH Inspection | $ | 536 | 32 | 0 | 2001 | 0 | Not Known [XXX] | 3-Medium |
| Manhole | 4637 | 4864 Lake Michigan Dr | MH Inspection | $ | 536 | 32 | 0 | 2001 | 0 | Not Known [XXX] | 3-Medium |
| Manhole | 9516 | 10498 52nd Ave | MH Inspection | $ | 536 | 32 | 0 | 2006 | 0 | Not Known [XXX] | 3-Medium |
| Force Main | FM15 | 11261-11272 48th Ave | No Action | $ | - | 32 | 20 | 1990 | 3372 | DUCTILE IRON | 3-Medium |
| Gravity Main | P4515 | 11127-11111 52nd Ave | Point Repair | $ | 9,372 | 32 | 8 | 1997 | 364 | PVC | 3-Medium |
| Gravity Main | P2357 | 11245-11207 Washington Ave | No Action | $ | - | 32 | 8 | 1987 | 330 | PVC | 3-Medium |
| Force Main | FM21 | 4476 Rich St | No Action | $ | - | 32 | 10 | 1990 | 4468 | DUCTILE IRON | 3-Medium |
| Gravity Main | P4608 | 5447 Lake Michigan Dr | No Action | $ | - | 32 | 21 | 1987 | 331 | RCP | 3-Medium |
| Gravity Main | P2061 | 10933 64th Ave | No Action | $ | - | 32 | 8 | 1990 | 92 | PVC | 3-Medium |
| Gravity Main | P4631 | Lake Michigan Dr | No Action | $ | - | 32 | 27 | 2000 | 274 | RCP | 3-Medium |
| Gravity Main | P4517 | 11075-11111 52nd Ave | CCTV | $ | 848 | 32 | 21 | 1990 | 198 | RCP | 3-Medium |
| Gravity Main | P4516 | 11111-11143 52nd Ave | CCTV | $ | 792 | 32 | 21 | 1990 | 185 | RCP | 3-Medium |
| Gravity Main | P4518 | 11059-11075 52nd Ave | CCTV | $ | 369 | 32 | 21 | 1990 | 86 | RCP | 3-Medium |
| Gravity Main | P4658 | 4395-4379 Lake Michigan Dr | CCTV | $ | 365 | 31 | 8 | 1990 | 97 | PVC | 3-Medium |
| Force Main | FM11 | 10709 60th Ave | Upsize | $ | 540,100 | 31 | 6 | 1992 | 1867 | DUCTILE IRON | 3-Medium |
| Gravity Main | P4634 | 4886 Lake Michigan Dr | No Action | $ | - | 31 | 12 | 2000 | 227 | VCP | 3-Medium |
| Force Main | FM14 | 4817 Lake Michigan Dr | No Action | $ | - | 30 | 12 | 1990 | 533 | CAST IRON | 3-Medium |
| Gravity Main | P4702 | 11225-11205 Commerce Rd | CCTV | $ | 510 | 30 | 8 | 2001 | 136 | PVC | 3-Medium |
| Force Main | FM8.1 | 11152 Creekside Ct | No Action | $ | - | 30 | 8 | 2003 | 703 | HDPE | 3-Medium |
| Force Main | FM8 | 7174 Lake Michigan Dr | No Action | $ | - | 30 | 8 | 2003 | 2354 | DUCTILE IRON | 3-Medium |
| Gravity Main | P1523 | 10809-10815 Timberline Dr | No Action | $ | - | 30 | 8 | 2008 | 331 | PVC | 3-Medium |
| Gravity Main | P5284 | 11654-11615 40th Ave | CCTV | $ | 932 | 30 | 10 | 2000 | 249 | PVC | 3-Medium |
| Gravity Main | P1032 | 11611-11615 40th Ave | CCTV | $ | 106 | 30 | 12 | 1990 | 28 | PVC | 3-Medium |
| Gravity Main | P2671 | 6152 Crystal Dr | No Action | $ | - | 30 | 10 | 1990 | 301 | PVC | 3-Medium |
| Force Main | FM16 | 4310 Rich St | No Action | $ | - | 30 | 20 | 1990 | 698 | DUCTILE IRON | 3-Medium |
| Gravity Main | P1034 | 11601-11611 40th Ave | CCTV | $ | 262 | 30 | 12 | 1990 | 70 | PVC | 3-Medium |
| Gravity Main | P3623 | 5122-5160 Pierce St | No Action | $ | - | 30 | 8 | 2006 | 351 | PVC | 3-Medium |
| Gravity Main | P9004 | 6175-6161 Library Ln | No Action | $ | - | 29 | 10 | 1990 | 295 | PVC | 3-Medium |
| Gravity Main | P2240 | 11115-11048 68th Ave | No Action | $ | - | 29 | 12 | 1990 | 256 | PVC | 3-Medium |
| Gravity Main | P4601 | 11197-11207 56th Ave | No Action | $ | - | 29 | 10 | 1990 | 122 | PVC | 3-Medium |
| Gravity Main | P5040 | 11443-11403 48th Ave | CCTV | $ | 1,054 | 29 | 8 | 1987 | 281 | PVC | 3-Medium |
| Gravity Main | P4844 | 11313-11269 48th Ave | CCTV | $ | 976 | 29 | 8 | 1987 | 260 | PVC | 3-Medium |
| Gravity Main | P1033 | 11529-11601 40th Ave | CCTV | $ | 1,733 | 29 | 8 | 1990 | 462 | PVC | 3-Medium |
| Gravity Main | P2341 | 6781 Lake Michigan Dr | No Action | $ | - | 29 | 8 | 2001 | 264 | PVC | 3-Medium |
| Gravity Main | P2474 | 6223 Lake Michigan Dr | No Action | $ | - | 29 | 8 | 1998 | 12 | PVC | 3-Medium |
| Gravity Main | P2473 | 6182-6161 Library Ln | No Action | $ | - | 29 | 8 | 1999 | 154 | PVC | 3-Medium |
| Gravity Main | P2038 | 10975-11025 68th Ave | No Action | $ | - | 28 | 10 | 1990 | 340 | PVC | 3-Medium |
| Gravity Main | P2037 | 10937 68th Ave | No Action | $ | - | 28 | 10 | 1990 | 324 | PVC | 3-Medium |
| Gravity Main | P2039 | 11025-11048 68th Ave | No Action | $ | - | 28 | 10 | 1990 | 343 | PVC | 3-Medium |
| Gravity Main | P4616 | 5316-5270 Lake Michigan Dr | No Action | $ | - | 28 | 8 | 2001 | 352 | PVC | 3-Medium |
| Gravity Main | P4602 | 5596 Lake Michigan Dr | No Action | $ | - | 28 | 8 | 2001 | 333 | PVC | 3-Medium |
| Gravity Main | P4617 | 5270-5206 Lake Michigan Dr | No Action | $ | - | 28 | 8 | 2001 | 390 | PVC | 3-Medium |
| Gravity Main | P4621 | 5088-5150 Lake Michigan Dr | No Action | $ | - | 28 | 8 | 1992 | 328 | PVC | 3-Medium |
| Gravity Main | P2051 | 6754-6798 Mista Dr | No Action | $ | - | 28 | 8 | 1995 | 286 | PVC | 3-Medium |

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|---|---|---|---|---|---|---|---|---|---|---|---|
| Gravity Main | P1844 | New Options High School | No Action | $ | - | 28 | 8 | 1990 | 401 | PVC | 3-Medium |
| Gravity Main | P1178 | 5150-5190 Lake Michigan Dr | No Action | $ | - | 28 | 8 | 1992 | 326 | PVC | 3-Medium |
| Gravity Main | P4620 | 11192 52nd Ave | No Action | $ | - | 28 | 8 | 1990 | 47 | PVC | 3-Medium |
| Gravity Main | P2364 | 6274 Lake Michigan Dr | No Action | $ | - | 28 | 8 | 2000 | 402 | PVC | 3-Medium |
| Gravity Main | P4618 | 11193 52nd Ave | No Action | $ | - | 28 | 8 | 2001 | 31 | PVC | 3-Medium |
| Gravity Main | P4625 | Lake Michigan Dr | Full Lining | $ | 9,541 | 28 | 27 | 1990 | 223 | RCP | 3-Medium |
| Gravity Main | P2461 | 11315-11261 64th Ave | CCTV | $ | 1,403 | 28 | 8 | 1987 | 374 | PVC | 3-Medium |
| Gravity Main | P2882 | 11587-11530 Brookland Ct | CCTV | $ | 871 | 28 | 8 | 1990 | 232 | PVC | 3-Medium |
| Gravity Main | P4531 | 11151-11181 Radcliff Dr | CCTV | $ | 475 | 28 | 8 | 1966 | 127 | VCP | 3-Medium |
| Gravity Main | P2881 | 11541 Brookland Ct | CCTV | $ | 485 | 28 | 8 | 1990 | 129 | PVC | 3-Medium |
| Gravity Main | P2772 | 11525-11555 60th Ave | CCTV | $ | 807 | 28 | 8 | 1990 | 215 | PVC | 3-Medium |
| Gravity Main | P3619 | 5256-5202 Pierce St | No Action | $ | - | 28 | 8 | 2006 | 391 | PVC | 3-Medium |
| Gravity Main | P2983 | 11571-11555 60th Ave | No Action | $ | - | 28 | 8 | 2006 | 279 | PVC | 3-Medium |
| Gravity Main | P4327 | 10924 Woodedge Dr | No Action | $ | - | 28 | 8 | 2007 | 114 | PVC | 3-Medium |
| Gravity Main | P2432 | 11231 68th Ave | No Action | $ | - | 28 | 10 | 1990 | 426 | PVC | 3-Medium |
| Gravity Main | P4659 | 4379-4375 Lake Michigan Dr | Upsize | $ | 4,622 | 28 | 8 | 1987 | 15 | DUCTILE IRON | 3-Medium |
| Force Main | FM18 | 11563 40th Ave | No Action | $ | - | 28 | 20 | 1990 | 690 | DUCTILE IRON | 3-Medium |
| Force Main | FM22 | 4375 Lake Michigan Dr | No Action | $ | - | 28 | 12 | 1987 | 2460 | DUCTILE IRON | 3-Medium |
| Force Main | FM17 | 4310 Rich St | No Action | $ | - | 28 | 20 | 1990 | 683 | DUCTILE IRON | 3-Medium |
| Gravity Main | P4742 | 11269-11261 48th Ave | CCTV | $ | 167 | 28 | 8 | 1987 | 45 | CAST IRON | 3-Medium |
| Gravity Main | P4636 | 4866-4876 Lake Michigan Dr | No Action | $ | - | 28 | 8 | 2001 | 75 | PVC | 3-Medium |
| Gravity Main | P4630 | Lake Michigan Dr | Full Lining | $ | 11,071 | 28 | 27 | 1990 | 258 | RCP | 3-Medium |
| Gravity Main | P4656 | 4419-4395 Lake Michigan Dr | CCTV | $ | 451 | 28 | 12 | 1990 | 120 | VCP | 3-Medium |
| Gravity Main | P4403 | 5312-5456 Jordan St | No Action | $ | - | 27 | 8 | 2000 | 323 | PVC | 3-Medium |
| Gravity Main | P4404 | 5194-5312 Jordan St | No Action | $ | - | 27 | 8 | 2000 | 268 | PVC | 3-Medium |
| Gravity Main | P4514 | 5402-5424 Eric St | No Action | $ | - | 27 | 8 | 2000 | 150 | PVC | 3-Medium |
| Gravity Main | P1087 | 10617-10565 60th Ave | No Action | $ | - | 27 | 8 | 1992 | 346 | PVC | 3-Medium |
| Gravity Main | P4513 | 5424-5452 Eric St | No Action | $ | - | 27 | 8 | 2000 | 185 | PVC | 3-Medium |
| Force Main | FM12 | 11151 64th Ave | No Action | $ | - | 27 | 12 | 1990 | 3690 | DUCTILE IRON | 3-Medium |
| Gravity Main | P2063 | 10926 64th Ave | No Action | $ | - | 27 | 8 | 2004 | 192 | PVC | 3-Medium |
| Gravity Main | P3620 | 10415 52nd Ave | CCTV | $ | 902 | 27 | 24 | 2006 | 211 | PVC | 3-Medium |
| Gravity Main | P3621 | 10431-10463 52nd Ave | CCTV | $ | 945 | 27 | 24 | 2006 | 221 | PVC | 3-Medium |
| Gravity Main | P3720 | 10463-10517 52nd Ave | CCTV | $ | 1,583 | 27 | 24 | 2006 | 370 | PVC | 3-Medium |
| Gravity Main | P2098 | 10929-10975 56th Ave | No Action | $ | - | 27 | 8 | 1990 | 299 | PVC | 3-Medium |
| Gravity Main | P2097 | 10887-10929 56th Ave | No Action | $ | - | 27 | 8 | 1990 | 281 | PVC | 3-Medium |
| Gravity Main | P4703 | 11277-11225 Commerce Rd | No Action | $ | - | 27 | 8 | 2001 | 361 | PVC | 3-Medium |
| Gravity Main | P4610 | 5377-5315 Lake Michigan Dr | No Action | $ | - | 27 | 21 | 1987 | 372 | RCP | 3-Medium |
| Gravity Main | P2485 | 5751 Lake Michigan Dr | CCTV | $ | 1,569 | 27 | 18 | 1990 | 418 | PVC | 3-Medium |
| Gravity Main | P4700 | 11258 56th Ave | CCTV | $ | 1,198 | 27 | 18 | 1990 | 319 | RCP | 3-Medium |
| Gravity Main | P1842 | 10798 68th Ave | No Action | $ | - | 26 | 8 | 1990 | 318 | PVC | 3-Medium |
| Gravity Main | P5042 | 11529-11483 48th Ave | CCTV | $ | 1,138 | 26 | 8 | 1991 | 304 | PVC | 3-Medium |
| Gravity Main | P5140 | 11565-11529 48th Ave | CCTV | $ | 912 | 26 | 8 | 1991 | 243 | PVC | 3-Medium |
| Gravity Main | P4740 | 11227-11261 48th Ave | CCTV | $ | 749 | 26 | 15 | 1987 | 200 | VCP | 3-Medium |
| Gravity Main | P5146 | 4726-4750 Rich St | CCTV | $ | 1,232 | 26 | 8 | 1991 | 329 | PVC | 3-Medium |
| Gravity Main | P4609 | 5421-5377 Lake Michigan Dr | No Action | $ | - | 26 | 18 | 1987 | 314 | RCP | 3-Medium |

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| Gravity Main | P4607 | 5497 Lake Michigan Dr | No Action | $ | - | 26 | 18 | 1992 | 485 | RCP | 3-Medium |
| Force Main | FM23 | 4310 Rich St | No Action | $ | - | 26 | 12 | 1990 | 313 | DUCTILE IRON | 3-Medium |
| Gravity Main | P4628 | 11143-11193 52nd Ave | No Action | $ | - | 26 | 21 | 1990 | 283 | RCP | 3-Medium |
| Gravity Main | P4611 | 5315-5255 Lake Michigan Dr | No Action | $ | - | 26 | 21 | 1987 | 403 | RCP | 3-Medium |
| Gravity Main | P4624 | Lake Michigan Dr | Point Repair | $ | 9,372 | 26 | 27 | 1990 | 394 | RCP | 3-Medium |
| Gravity Main | P4613 | 5187 Lake Michigan Dr | No Action | $ | - | 26 | 27 | 1990 | 268 | RCP | 3-Medium |
| Gravity Main | P4623 | Lake Michigan Dr | No Action | $ | - | 26 | 27 | 1990 | 267 | RCP | 3-Medium |
| Gravity Main | P2372 | 6021 Lake Michigan Dr | No Action | $ | - | 26 | 15 | 1990 | 291 | PVC | 3-Medium |
| Gravity Main | P4422 | 11031-11059 52nd Ave | CCTV | $ | 712 | 26 | 21 | 1990 | 166 | RCP | 3-Medium |
| Force Main | FM13 | 11495 60th Ave | Upsize | $ | 241,872 | 26 | 6 | 2006 | 836 | PVC | 3-Medium |
| Gravity Main | P3622 | 5160-5202 Pierce St | CCTV | $ | 1,354 | 26 | 8 | 2006 | 361 | PVC | 3-Medium |
| Gravity Main | P1961 | 10835 64th Ave | No Action | $ | - | 25 | 8 | 1990 | 167 | PVC | 3-Medium |
| Gravity Main | P4606 | 5543 Lake Michigan Dr | No Action | $ | - | 25 | 21 | 1992 | 173 | RCP | 3-Medium |
| Gravity Main | P4612 | 5255-5187 Lake Michigan Dr | No Action | $ | - | 25 | 21 | 1987 | 250 | RCP | 3-Medium |
| Gravity Main | P1960 | 10729-10835 64th Ave | No Action | $ | - | 25 | 8 | 1990 | 375 | PVC | 3-Medium |
| Gravity Main | P1118 | 4867 Lake Michigan Dr | Full Lining | $ | 8,699 | 25 | 24 | 1990 | 77 | RCP | 3-Medium |
| Gravity Main | P2380 | 11193-11208 60th Ave | CCTV | $ | 519 | 25 | 10 | 1989 | 138 | PVC | 3-Medium |
| Gravity Main | P2495 | 5680 Lake Michigan Dr | CCTV | $ | 1,643 | 25 | 8 | 1992 | 438 | PVC | 3-Medium |
| Gravity Main | P2494 | 11149 Northgate Ave | CCTV | $ | 1,448 | 25 | 8 | 1992 | 386 | PVC | 3-Medium |
| Gravity Main | P3611 | 5366 Pierce St | No Action | $ | - | 25 | 24 | 2015 | 112 | PVC | 3-Medium |
| Gravity Main | P5012 | 5405-5499 Edgeway Dr | No Action | $ | - | 25 | 10 | 2000 | 299 | PVC | 3-Medium |
| Gravity Main | P2368 | 6144-6098 Lake Michigan Dr | No Action | $ | - | 25 | 8 | 2001 | 197 | PVC | 3-Medium |
| Gravity Main | P2365 | WJ Presley Pkwy | CCTV | $ | 1,125 | 25 | 8 | 2000 | 300 | PVC | 3-Medium |
| Gravity Main | P2473A | 6194 Library Ln | CCTV | $ | 690 | 25 | 8 | 1998 | 184 | PVC | 3-Medium |
| Gravity Main | P2347 | 6656-6676 Lake Michigan Dr | CCTV | $ | 1,063 | 25 | 8 | 1992 | 284 | PVC | 3-Medium |
| Gravity Main | P4637 | 4864-4866 Lake Michigan Dr | CCTV | $ | 113 | 25 | 8 | 2001 | 30 | PVC | 3-Medium |
| Gravity Main | P4638 | 4850-4864 Lake Michigan Dr | CCTV | $ | 374 | 25 | 8 | 2001 | 100 | PVC | 3-Medium |
| Gravity Main | P2346 | 6652-6656 Lake Michigan Dr | CCTV | $ | 141 | 25 | 8 | 1992 | 38 | PVC | 3-Medium |
| Gravity Main | P2388 | 11147 Richard Ave | CCTV | $ | 1,481 | 25 | 8 | 1992 | 395 | PVC | 3-Medium |
| Gravity Main | P2460 | 11261-11205 64th Ave | CCTV | $ | 1,217 | 25 | 8 | 1987 | 325 | PVC | 3-Medium |
| Gravity Main | P2345 | 6660-6652 Lake Michigan Dr | CCTV | $ | 779 | 25 | 8 | 1993 | 208 | PVC | 3-Medium |
| Gravity Main | P2362 | 11194 64th Ave | CCTV | $ | 180 | 25 | 8 | 2000 | 48 | PVC | 3-Medium |
| Gravity Main | P1965 | 10855 Constant Dr | No Action | $ | - | 25 | 8 | 2004 | 207 | PVC | 3-Medium |
| Gravity Main | P5015 | 11489 53rd Ave | No Action | $ | - | 25 | 8 | 2000 | 332 | PVC | 3-Medium |
| Gravity Main | P2385 | 11147-11193 60th Ave | No Action | $ | - | 25 | 10 | 1992 | 386 | PVC | 3-Medium |
| Gravity Main | P1513 | 10801 Timberline Dr | No Action | $ | - | 24 | 8 | 2008 | 268 | PVC | 3-Medium |
| Gravity Main | P1520 | 10805 Timberline Dr | No Action | $ | - | 24 | 8 | 2008 | 152 | PVC | 3-Medium |
| Gravity Main | P1620 | 10815-10819 Timberline Dr | No Action | $ | - | 24 | 8 | 2008 | 237 | PVC | 3-Medium |
| Gravity Main | P1967 | 6286-6324 Timber Dr | No Action | $ | - | 24 | 8 | 2004 | 210 | PVC | 3-Medium |
| Gravity Main | P1512 | Learning Ln | No Action | $ | - | 24 | 8 | 2008 | 276 | PVC | 3-Medium |
| Gravity Main | P1521 | 10805-10809 Timberline Dr | No Action | $ | - | 24 | 8 | 2008 | 151 | PVC | 3-Medium |
| Gravity Main | P2383 | 5824-5916 Lake Michigan Dr | No Action | $ | - | 24 | 8 | 1992 | 348 | PVC | 3-Medium |
| Gravity Main | P4810 | Edgewater Dr | No Action | $ | - | 24 | 10 | 2000 | 222 | PVC | 3-Medium |
| Gravity Main | P2333 | Lake Michigan Dr | No Action | $ | - | 24 | 8 | 1999 | 348 | PVC | 3-Medium |
| Gravity Main | P2332 | Lake Michigan Dr | No Action | $ | - | 24 | 8 | 1999 | 345 | PVC | 3-Medium |

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|---|---|---|---|---|---|---|---|---|---|---|---|
| Gravity Main | P4500 | 11177 56th Ave | No Action | $ | - | 24 | 8 | 1990 | 272 | PVC | 3-Medium |
| Gravity Main | P2241 | 11048 68th Ave | No Action | $ | - | 24 | 12 | 1990 | 313 | PVC | 3-Medium |
| Gravity Main | P2340 | 68th Ave | No Action | $ | - | 24 | 12 | 1999 | 105 | PVC | 3-Medium |
| Gravity Main | P2331 | 6940-6936 Lake Michigan Dr | No Action | $ | - | 24 | 10 | 1999 | 35 | PVC | 3-Medium |
| Gravity Main | P9016 | Lake Michigan Dr | No Action | $ | - | 23 | 8 | 1998 | 38 | PVC | 3-Medium |
| Gravity Main | P2361 | 11195-11151 64th Ave | No Action | $ | - | 23 | 8 | 1990 | 381 | PVC | 3-Medium |
| Gravity Main | P4421 | 11015 52nd Ave | CCTV | $ | 738 | 23 | 21 | 2005 | 172 | RCP | 3-Medium |
| Gravity Main | P2371 | 6161-6065 Lake Michigan Dr | No Action | $ | - | 23 | 15 | 1990 | 335 | PVC | 3-Medium |
| Gravity Main | P4408 | 10959-10938 Lance Ave | No Action | $ | - | 23 | 8 | 2005 | 210 | PVC | 3-Medium |
| Gravity Main | P4300 | 10938-10925 Lance Ave | No Action | $ | - | 23 | 8 | 2005 | 125 | PVC | 3-Medium |
| Gravity Main | P3721 | 10547 52nd Ave | CCTV | $ | 1,606 | 23 | 24 | 2006 | 375 | PVC | 3-Medium |
| Gravity Main | P2440 | 6677 Lake Michigan Dr | No Action | $ | - | 22 | 8 | 1990 | 217 | PVC | 3-Medium |
| Gravity Main | P1005 | 11555 60th Ave | No Action | $ | - | 22 | 10 | 2006 | 33 | PVC | 3-Medium |
| Gravity Main | P2434 | 11227-11217 68th Ave | No Action | $ | - | 22 | 12 | 1990 | 73 | PVC | 3-Medium |
| Gravity Main | P2493 | 11255-11253 56th Ave | CCTV | $ | 709 | 22 | 18 | 1990 | 189 | VCP | 3-Medium |
| Gravity Main | P2484 | 11271 Rosewood Ave | CCTV | $ | 905 | 22 | 18 | 1990 | 241 | VCP | 3-Medium |
| Manhole | 9612 | 10498 52nd Ave | MH Inspection | $ | 536 | 22 | 0 | 2006 | 0 | Not Known [XXX] | 3-Medium |
| Gravity Main | P4614 | 5350-5328 Lake Michigan Dr | No Action | $ | - | 22 | 8 | 2001 | 175 | PVC | 3-Medium |
| Gravity Main | P1843 | New Options High School | No Action | $ | - | 22 | 8 | 1990 | 321 | PVC | 3-Medium |
| Gravity Main | P2381 | 5964 Lake Michigan Dr | No Action | $ | - | 22 | 8 | 1992 | 407 | PVC | 3-Medium |
| Gravity Main | P1950 | 6798 Mista Dr | No Action | $ | - | 22 | 8 | 1992 | 338 | PVC | 3-Medium |
| Gravity Main | P4615 | 5328-5316 Lake Michigan Dr | No Action | $ | - | 22 | 8 | 2001 | 185 | PVC | 3-Medium |
| Gravity Main | P2353 | 11205-11195 64th Ave | No Action | $ | - | 22 | 8 | 1990 | 120 | PVC | 3-Medium |
| Gravity Main | P2384 | 5768-5824 Lake Michigan Dr | No Action | $ | - | 22 | 8 | 1992 | 366 | PVC | 3-Medium |
| Gravity Main | P2382 | 5916-5948 Lake Michigan Dr | No Action | $ | - | 22 | 8 | 1992 | 414 | PVC | 3-Medium |
| Gravity Main | P2366 | 11150 WJ Presley Pkwy | No Action | $ | - | 22 | 8 | 2000 | 258 | PVC | 3-Medium |
| Gravity Main | P1179 | 6370-6387 Lake Michigan Dr | No Action | $ | - | 22 | 8 | 2000 | 298 | PVC | 3-Medium |
| Gravity Main | P2370 | 6026 Lake Michigan Dr | No Action | $ | - | 22 | 8 | 1992 | 394 | PVC | 3-Medium |
| Gravity Main | P2367 | 6164-6154 Lake Michigan Dr | No Action | $ | - | 22 | 8 | 2000 | 250 | PVC | 3-Medium |
| Gravity Main | P2363 | 6306-6370 Lake Michigan Dr | No Action | $ | - | 22 | 8 | 2000 | 310 | PVC | 3-Medium |
| Gravity Main | P2050 | 6798-6799 Mista Dr | No Action | $ | - | 22 | 8 | 1992 | 303 | PVC | 3-Medium |
| Gravity Main | P4320 | 10913-10963 52nd Ave | CCTV | $ | 1,494 | 22 | 21 | 2005 | 349 | PVC | 3-Medium |
| Gravity Main | P1840 | 10887 68th Ave | No Action | $ | - | 21 | 10 | 1990 | 438 | PVC | 3-Medium |
| Gravity Main | P3921 | 10657-10723 52nd Ave | CCTV | $ | 1,700 | 21 | 24 | 2006 | 397 | PVC | 3-Medium |
| Gravity Main | P4120 | 10781-10829 52nd Ave | CCTV | $ | 1,332 | 21 | 24 | 2006 | 311 | PVC | 3-Medium |
| Gravity Main | P4221 | 10855-10913 52nd Ave | CCTV | $ | 1,105 | 21 | 24 | 2005 | 258 | PVC | 3-Medium |
| Gravity Main | P3820 | 5217 Windfield Dr | CCTV | $ | 1,436 | 21 | 24 | 2006 | 336 | PVC | 3-Medium |
| Gravity Main | P3920 | 10621-10657 52nd Ave | CCTV | $ | 1,067 | 21 | 24 | 2006 | 249 | PVC | 3-Medium |
| Gravity Main | P4020 | 10723-10781 52nd Ave | CCTV | $ | 1,407 | 21 | 24 | 2006 | 329 | PVC | 3-Medium |
| Gravity Main | P1125 | 10963-10967 52nd Ave | CCTV | $ | 124 | 21 | 21 | 2005 | 29 | PVC | 3-Medium |
| Gravity Main | P4121 | 10829-10855 52nd Ave | CCTV | $ | 2,096 | 21 | 24 | 2006 | 490 | PVC | 3-Medium |
| Gravity Main | P4420 | 10983 52nd Ave | CCTV | $ | 1,017 | 21 | 21 | 2005 | 238 | RCP | 3-Medium |
| Gravity Main | P2253 | 6322-6342 Henry St | No Action | $ | - | 21 | 8 | 2008 | 224 | PVC | 3-Medium |
| Gravity Main | P2255 | 6301-6308 Henry St | No Action | $ | - | 21 | 8 | 2008 | 160 | PVC | 3-Medium |
| Gravity Main | P2254 | 6308-6322 Henry St | No Action | $ | - | 21 | 8 | 2008 | 137 | PVC | 3-Medium |

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|---|---|---|---|---|---|---|---|---|---|---|---|
| Gravity Main | P2336 | 11215 Valley View Ave | CCTV | $ | 814 | 21 | 10 | 2007 | 217 | PVC | 3-Medium |
| Gravity Main | P1180 | 7003-6981 Lake Michigan Dr | CCTV | $ | 755 | 21 | 10 | 2007 | 201 | PVC | 3-Medium |
| Gravity Main | P2337 | 11215 Valley View Ave | CCTV | $ | 249 | 21 | 10 | 2007 | 66 | PVC | 3-Medium |
| Gravity Main | P4655 | 4427-4419 Lake Michigan Dr | CCTV | $ | 171 | 21 | 8 | 1990 | 46 | VCP | 3-Medium |
| Gravity Main | P4626 | 5053 Lake Michigan Dr | CCTV | $ | 360 | 21 | 10 | 1990 | 96 | VCP | 3-Medium |
| Gravity Main | P1133 | 11367 Whispering Creek Dr | CCTV | $ | 571 | 21 | 8 | 2012 | 152 | PVC | 3-Medium |
| Gravity Main | P4657 | 4415-4419 Lake Michigan Dr | CCTV | $ | 1,355 | 21 | 8 | 1990 | 361 | VCP | 3-Medium |
| Gravity Main | P9516 | 10498 52nd Ave | CCTV | $ | 331 | 21 | 8 | 2006 | 88 | PVC | 3-Medium |
| Gravity Main | P9612 | 10498-10520 52nd Ave | CCTV | $ | 545 | 21 | 8 | 2006 | 145 | PVC | 3-Medium |
| Gravity Main | P9613 | 10520-10498 52nd Ave | CCTV | $ | 1,356 | 21 | 8 | 2006 | 361 | PVC | 3-Medium |
| Gravity Main | P4642 | 4817 Lake Michigan Dr | No Action | $ | - | 21 | 15 | 1987 | 182 | VCP | 3-Medium |
| Gravity Main | P4619 | 52nd Ave | No Action | $ | - | 20 | 18 | 1992 | 147 | VCP | 3-Medium |
| Gravity Main | P2330 | 6946-6936 Lake Michigan Dr | No Action | $ | - | 20 | 10 | 2013 | 310 | VCP | 3-Medium |
| Gravity Main | P2373 | 5969 Lake Michigan Dr | No Action | $ | - | 19 | 18 | 1990 | 460 | VCP | 3-Medium |
| Gravity Main | P1091 | 5366-5310 Pierce St | No Action | $ | - | 19 | 24 | 2015 | 404 | PVC | 3-Medium |
| Gravity Main | P3610 | 5388 Pierce St | No Action | $ | - | 19 | 24 | 2015 | 68 | PVC | 3-Medium |
| Gravity Main | P1720 | 10819-10825 Timberline Dr | No Action | $ | - | 18 | 8 | 2008 | 311 | PVC | 3-Medium |
| Gravity Main | P1966 | 6356-6324 Timber Dr | No Action | $ | - | 18 | 8 | 2004 | 164 | PVC | 3-Medium |
| Gravity Main | P1522 | 10808-10805 Timberline Dr | No Action | $ | - | 18 | 8 | 2008 | 47 | PVC | 3-Medium |
| Gravity Main | P1968 | 6246-6286 Timber Dr | No Action | $ | - | 18 | 8 | 2004 | 225 | PVC | 3-Medium |
| Gravity Main | P9000 | 10815 Timberline Dr | No Action | $ | - | 18 | 8 | 2008 | 33 | PVC | 3-Medium |
| Manhole | 2163 | 10991 64th Ave | No Action | $ | - | 56 | 0 | 1990 | 0 | Concrete (Reinforced) [CR | 2-Low |
| Manhole | 2540 | 6683 Scott St | No Action | $ | - | 56 | 0 | 1992 | 0 | Concrete (Reinforced) [CR | 2-Low |
| Manhole | 4812 | 11008 54th Ave | MH Inspection | $ | 536 | 56 | 0 | 2000 | 0 | Not Known [XXX] | 2-Low |
| Manhole | 4652 | 4473 Lake Michigan Dr | MH Clean + Line | $ | 4,038 | 54 | 0 | 1990 | 0 | Concrete (Reinforced) [CR | 2-Low |
| Manhole | 2191 | 10997 Gayle Ln | No Action | $ | - | 54 | 0 | 1990 | 0 | Concrete (Reinforced) [CR | 2-Low |
| Manhole | 4422 | 11031 52nd Ave | No Action | $ | - | 53 | 0 | 2005 | 0 | Concrete (Reinforced) [CR | 2-Low |
| Manhole | 1782 | 5961 Maple Bend Trl | MH Inspection | $ | 536 | 53 | 0 | 1998 | 0 | Not Known [XXX] | 2-Low |
| Manhole | 1783 | 5936 Maple Bend Trl | MH Inspection | $ | 536 | 53 | 0 | 1998 | 0 | Not Known [XXX] | 2-Low |
| Manhole | 1917 | 7208 Pinevalley Dr | MH Inspection | $ | 536 | 51 | 0 | 2004 | 0 | Not Known [XXX] | 2-Low |
| Manhole | 4618 | 5206 Lake Michigan Dr | No Action | $ | - | 49 | 0 | 2001 | 0 | Concrete (Reinforced) [CR | 2-Low |
| Manhole | 2683 | 11399 Prairie Ave | No Action | $ | - | 49 | 0 | 1993 | 0 | Concrete (Reinforced) [CR | 2-Low |
| Manhole | 4425 | 10999 Woodedge Dr | MH Inspection | $ | 536 | 48 | 0 | 2005 | 0 | Not Known [XXX] | 2-Low |
| Manhole | 3937 | Campus West Apartments | MH Clean + Line | $ | 4,038 | 45 | 0 | 1990 | 0 | Concrete (Reinforced) [CR | 2-Low |
| Manhole | 2786 | 11475 Eagle Nest Ct | No Action | $ | - | 45 | 0 | 1990 | 0 | Concrete (Reinforced) [CR | 2-Low |
| Manhole | 4600 | 11207 56th Ave | No Action | $ | - | 44 | 0 | 1990 | 0 | Concrete (Reinforced) [CR | 2-Low |
| Manhole | 5356 | 4431 Pingree St | MH Inspection | $ | 536 | 44 | 0 | 1991 | 0 | Not Known [XXX] | 2-Low |
| Manhole | 4851 | 4614 Ottawa Creek Dr | MH Inspection | $ | 536 | 44 | 0 | 2012 | 0 | Not Known [XXX] | 2-Low |
| Manhole | 3564 | 4332 Campus View Dr | MH Clean + Line + Repair | $ | 5,377 | 43 | 0 | 1998 | 0 | Concrete (Reinforced) [CR | 2-Low |
| Manhole | 1963 | 6290 Winans St | MH Clean + Line | $ | 4,038 | 43 | 0 | 1990 | 0 | Concrete (Reinforced) [CR | 2-Low |
| Manhole | 5145 | 4750 Rich St | MH Inspection | $ | 536 | 42 | 0 | 1991 | 0 | Not Known [XXX] | 2-Low |
| Manhole | 4631 | Lake Michigan Dr | No Action | $ | - | 42 | 0 | 2000 | 0 | Concrete (Reinforced) [CR | 2-Low |
| Manhole | 2977 | 11682 Wilmington Dr | MH Inspection | $ | 536 | 42 | 0 | 2006 | 0 | Not Known [XXX] | 2-Low |
| Manhole | 4606 | 5543 Lake Michigan Dr | No Action | $ | - | 40 | 0 | 1992 | 0 | Concrete (Reinforced) [CR | 2-Low |
| Manhole | 3820 | 5202 Windfield Dr | MH Inspection | $ | 536 | 40 | 0 | 2006 | 0 | Not Known [XXX] | 2-Low |

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|---|---|---|---|---|---|---|---|---|---|---|---|
| Manhole | 2490 | 5737 Lake Michigan Dr | No Action | $ | - | 38 | 0 | 1990 | 0 | Concrete (Reinforced) [CR | 2-Low |
| Manhole | 4640 | 11127 48th Ave | No Action | $ | - | 38 | 0 | 1987 | 0 | Concrete (Reinforced) [CR | 2-Low |
| Manhole | 2431 | 11293 Valley View Ave | No Action | $ | - | 38 | 0 | 1992 | 0 | Concrete (Reinforced) [CR | 2-Low |
| Manhole | 2385 | 11147 60th Ave | No Action | $ | - | 38 | 0 | 1992 | 0 | Concrete (Reinforced) [CR | 2-Low |
| Manhole | 2225 | 11145 Creekside Ct | MH Inspection | $ | 536 | 38 | 0 | 2004 | 0 | Not Known [XXX] | 2-Low |
| Manhole | 2162 | 11003 64th Ave | No Action | $ | - | 38 | 0 | 1990 | 0 | Concrete (Reinforced) [CR | 2-Low |
| Manhole | 2339 | 11209 Brown St | No Action | $ | - | 38 | 0 | 1990 | 0 | Concrete (Reinforced) [CR | 2-Low |
| Manhole | 1175 | 6812 Joal St | No Action | $ | - | 38 | 0 | 1990 | 0 | Concrete (Reinforced) [CR | 2-Low |
| Manhole | 2062 | 10939 64th Ave | No Action | $ | - | 38 | 0 | 1990 | 0 | Concrete (Reinforced) [CR | 2-Low |
| Manhole | 4980 | 3934 Ravine Dr | No Action | $ | - | 38 | 0 | 1990 | 0 | Concrete (Reinforced) [CR | 2-Low |
| Manhole | 4414 | 5286 Jordan St | No Action | $ | - | 37 | 0 | 1994 | 0 | Concrete (Reinforced) [CR | 2-Low |
| Manhole | 1134 | 11463 48th Ave | MH Inspection | $ | 536 | 37 | 0 | 1991 | 0 | Not Known [XXX] | 2-Low |
| Manhole | 4604 | 5426 Lake Michigan Dr | MH Inspection | $ | 536 | 37 | 0 | 2001 | 0 | Not Known [XXX] | 2-Low |
| Manhole | 2580 | 5735 Ivory Rd | No Action | $ | - | 37 | 0 | 1992 | 0 | Concrete (Reinforced) [CR | 2-Low |
| Manhole | 2581 | 5764 Ivory Rd | No Action | $ | - | 37 | 0 | 1992 | 0 | Concrete (Reinforced) [CR | 2-Low |
| Manhole | 4876 | 11405 40th Ave | MH Inspection | $ | 536 | 36 | 0 | 1990 | 0 | Concrete (Non-reinforced) | 2-Low |
| Gravity Main | P3534 | Copper Beech Townhomes | Full Lining | $ | 15,327 | 36 | 8 | 2005 | 358 | PVC | 2-Low |
| Manhole | 9005 | 6065 Lake Michigan Dr | MH Repair+Lining | $ | 4,574 | 35 | 0 | 1990 | 0 | Concrete (Reinforced) [CR | 2-Low |
| Manhole | 4611 | 5315 Lake Michigan Dr | No Action | $ | - | 35 | 0 | 1987 | 0 | Concrete (Reinforced) [CR | 2-Low |
| Manhole | 2196 | 5798 Forest View Dr | No Action | $ | - | 35 | 0 | 1990 | 0 | Concrete (Reinforced) [CR | 2-Low |
| Manhole | 2034 | 6996 Joal St | No Action | $ | - | 35 | 0 | 1995 | 0 | Concrete (Reinforced) [CR | 2-Low |
| Manhole | 9004 | 6175 Library Ln | MH Repair + Line + Adjust Rim | $ | 7,252 | 35 | 0 | 1990 | 0 | Concrete (Reinforced) [CR | 2-Low |
| Manhole | 4625 | Lake Michigan Dr | No Action | $ | - | 35 | 0 | 1990 | 0 | Concrete (Reinforced) [CR | 2-Low |
| Manhole | 4630 | Lake Michigan Dr | No Action | $ | - | 35 | 0 | 1990 | 0 | Concrete (Reinforced) [CR | 2-Low |
| Manhole | 2392 | 5773 Country View Dr | No Action | $ | - | 35 | 0 | 1992 | 0 | Concrete (Reinforced) [CR | 2-Low |
| Manhole | 5352 | 11821 46th Ave | MH Inspection | $ | 536 | 35 | 0 | 1991 | 0 | Not Known [XXX] | 2-Low |
| Manhole | 4031 | 4950 W Campus Dr | MH Inspection | $ | 536 | 35 | 0 | 1990 | 0 | Not Known [XXX] | 2-Low |
| Manhole | 4619 | 11193 52nd Ave | No Action | $ | - | 35 | 0 | 2001 | 0 | Concrete (Reinforced) [CR | 2-Low |
| Manhole | 3467 | Campus View Housing | MH Adjust Rim | $ | 2,678 | 35 | 0 | 2004 | 0 | Concrete (Reinforced) [CR | 2-Low |
| Manhole | 4310 | 10943 Jordan Ct | MH Inspection | $ | 536 | 35 | 0 | 2000 | 0 | Not Known [XXX] | 2-Low |
| Gravity Main | P9006 | Laker Village Dr | Full Lining | $ | 5,464 | 34 | 12 | 1963 | 85 | VCP | 2-Low |
| Manhole | 4623 | Lake Michigan Dr | No Action | $ | - | 34 | 0 | 1990 | 0 | Concrete (Reinforced) [CR | 2-Low |
| Manhole | 4642 | Lake Michigan Dr | No Action | $ | - | 34 | 0 | 1987 | 0 | Concrete (Reinforced) [CR | 2-Low |
| Manhole | 2335 | 11177 68th Ave | No Action | $ | - | 34 | 0 | 1998 | 0 | Concrete (Reinforced) [CR | 2-Low |
| Manhole | 1164 | 11563 40th Ave | No Action | $ | - | 34 | 0 | 1990 | 0 | Concrete (Reinforced) [CR | 2-Low |
| Manhole | 1169 | 4310 Rich St | No Action | $ | - | 34 | 0 | 1990 | 0 | Concrete (Reinforced) [CR | 2-Low |
| Manhole | 2249 | 6606 Henry St | No Action | $ | - | 34 | 0 | 1990 | 0 | Concrete (Reinforced) [CR | 2-Low |
| Manhole | 2060 | 6406 Martinie Dr | No Action | $ | - | 34 | 0 | 1990 | 0 | Concrete (Reinforced) [CR | 2-Low |
| Manhole | 2533 | 6910 Valley View Ct | No Action | $ | - | 34 | 0 | 1992 | 0 | Concrete (Reinforced) [CR | 2-Low |
| Manhole | 2586 | 5016 Dewpointe Dr | No Action | $ | - | 34 | 0 | 1993 | 0 | Concrete (Reinforced) [CR | 2-Low |
| Manhole | 2588 | 5930 Dewpointe Dr | No Action | $ | - | 34 | 0 | 1993 | 0 | Concrete (Reinforced) [CR | 2-Low |
| Manhole | 2671 | 6180 Crystal Dr | No Action | $ | - | 34 | 0 | 1990 | 0 | Concrete (Reinforced) [CR | 2-Low |
| Manhole | 2690 | 11403 Rosewood Ave | No Action | $ | - | 34 | 0 | 1992 | 0 | Concrete (Reinforced) [CR | 2-Low |
| Manhole | 2691 | 11439 Rosewood Ave | No Action | $ | - | 34 | 0 | 1990 | 0 | Concrete (Reinforced) [CR | 2-Low |
| Manhole | 4875 | 3962 Ravine Dr | No Action | $ | - | 34 | 0 | 1990 | 0 | Concrete (Reinforced) [CR | 2-Low |

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|---|---|---|---|---|---|---|---|---|---|---|---|
| Manhole | 1114 | 10445 48th Ave | MH Inspection | $ | 536 | 34 | 0 | 2001 | 0 | Not Known [XXX] | 2-Low |
| Manhole | 1021 | 10781 52nd Ave | MH Inspection | $ | 536 | 34 | 0 | 2006 | 0 | Not Known [XXX] | 2-Low |
| Manhole | 2987 | 5870 Rich St | MH Clean + Line + Repair | $ | 5,377 | 33 | 0 | 2001 | 0 | Concrete (Reinforced) [CR | 2-Low |
| Manhole | 4984 | 11478 40th Ave | MH Adjust Rim | $ | 2,678 | 33 | 0 | 1990 | 0 | Concrete (Reinforced) [CR | 2-Low |
| Manhole | 2338 | 11215 Valley View Ave | No Action | $ | - | 33 | 0 | 2007 | 0 | Concrete (Reinforced) [CR | 2-Low |
| Manhole | 2030 | 10943 Creekside Dr | No Action | $ | - | 33 | 0 | 1995 | 0 | Concrete (Reinforced) [CR | 2-Low |
| Manhole | 5354 | 4544 Pingree St | MH Inspection | $ | 536 | 33 | 0 | 1991 | 0 | Not Known [XXX] | 2-Low |
| Manhole | 1044 | 11099 Pinecreek Ct | MH Inspection | $ | 536 | 33 | 0 | 2004 | 0 | Not Known [XXX] | 2-Low |
| Manhole | 1079 | 11547 Spruce View Dr | MH Clean + Line | $ | 4,038 | 32 | 0 | 2003 | 0 | Concrete (Reinforced) [CR | 2-Low |
| Manhole | 2115 | 10997 Waterway Dr | MH Inspection | $ | 536 | 32 | 0 | 2001 | 0 | Not Known [XXX] | 2-Low |
| Manhole | 2535 | 11351 Brown St | No Action | $ | - | 32 | 0 | 1992 | 0 | Concrete (Reinforced) [CR | 2-Low |
| Manhole | 2485 | 11271 Rosewood Ave | No Action | $ | - | 32 | 0 | 1990 | 0 | Concrete (Reinforced) [CR | 2-Low |
| Manhole | 2039 | 11025 68th Ave | No Action | $ | - | 32 | 0 | 1990 | 0 | Concrete (Reinforced) [CR | 2-Low |
| Manhole | 2099 | 10975 56th Ave | No Action | $ | - | 32 | 0 | 1990 | 0 | Concrete (Reinforced) [CR | 2-Low |
| Manhole | 2192 | 5578 Forest View Dr | No Action | $ | - | 32 | 0 | 1990 | 0 | Concrete (Reinforced) [CR | 2-Low |
| Gravity Main | P1916 | 7243-7208 Pinevalley Dr | Full Lining | $ | 9,815 | 32 | 8 | 2004 | 229 | PVC | 2-Low |
| Manhole | 4612 | 5255 Lake Michigan Dr | No Action | $ | - | 32 | 0 | 1987 | 0 | Concrete (Reinforced) [CR | 2-Low |
| Manhole | 2097 | 10887 56th Ave | No Action | $ | - | 32 | 0 | 1990 | 0 | Concrete (Reinforced) [CR | 2-Low |
| Manhole | 4601 | 11197 56th Ave | No Action | $ | - | 32 | 0 | 2001 | 0 | Concrete (Reinforced) [CR | 2-Low |
| Manhole | 1951 | 6599 Winans St | MH Clean + Line + Repair | $ | 5,377 | 31 | 0 | 1992 | 0 | Concrete (Reinforced) [CR | 2-Low |
| Manhole | 4533 | 11101 Radcliff Dr | MH Repair+Lining | $ | 4,574 | 31 | 0 | 1966 | 0 | Concrete (Reinforced) [CR | 2-Low |
| Manhole | 4161 | Laker Village Dr | MH Clean + Line + Adjust Rim | $ | 6,716 | 31 | 0 | 1963 | 0 | Concrete (Reinforced) [CR | 2-Low |
| Manhole | 2244 | 6676 Lake Michigan Dr | MH Repair+Lining | $ | 4,574 | 31 | 0 | 1990 | 0 | Concrete (Reinforced) [CR | 2-Low |
| Manhole | 1956 | 6618 Martinie Dr | MH Clean + Line + Adjust Rim | $ | 6,716 | 31 | 0 | 1992 | 0 | Concrete (Reinforced) [CR | 2-Low |
| Manhole | 3860 | 1 Campus Dr | MH Repair + Line + Adjust Rim | $ | 7,252 | 31 | 0 | 1963 | 0 | Concrete (Reinforced) [CR | 2-Low |
| Manhole | 5143 | 11619 48th Ave | MH Inspection | $ | 536 | 31 | 0 | 1991 | 0 | Not Known [XXX] | 2-Low |
| Manhole | 1042 | 10953 Skyway Ln | MH Inspection | $ | 536 | 31 | 0 | 2004 | 0 | Not Known [XXX] | 2-Low |
| Manhole | 1109 | 11071 Radcliff Dr | No Action | $ | - | 31 | 0 | 1966 | 0 | Concrete (Reinforced) [CR | 2-Low |
| Manhole | 4538 | 11004 Radcliff Dr | No Action | $ | - | 31 | 0 | 1966 | 0 | Concrete (Reinforced) [CR | 2-Low |
| Manhole | 4162 | 1 Campus Dr | MH Clean + Line | $ | 4,038 | 31 | 0 | 1963 | 0 | Concrete (Reinforced) [CR | 2-Low |
| Manhole | 4873 | 3967 River Ridge Ct | No Action | $ | - | 31 | 0 | 1990 | 0 | Concrete (Reinforced) [CR | 2-Low |
| Manhole | 1581 | 10565 60th Ave | No Action | $ | - | 31 | 0 | 1992 | 0 | Concrete (Reinforced) [CR | 2-Low |
| Manhole | 4609 | 5421 Lake Michigan Dr | No Action | $ | - | 31 | 0 | 1987 | 0 | Concrete (Reinforced) [CR | 2-Low |
| Manhole | 4613 | 5187 Lake Michigan Dr | No Action | $ | - | 31 | 0 | 1992 | 0 | Concrete (Reinforced) [CR | 2-Low |
| Manhole | 4624 | Lake Michigan Dr | No Action | $ | - | 31 | 0 | 1990 | 0 | Concrete (Reinforced) [CR | 2-Low |
| Manhole | 4656 | 4419 Lake Michigan Dr | No Action | $ | - | 31 | 0 | 1990 | 0 | Concrete (Reinforced) [CR | 2-Low |
| Manhole | 2380 | 11193 60th Ave | No Action | $ | - | 31 | 0 | 1992 | 0 | Concrete (Reinforced) [CR | 2-Low |
| Manhole | 1122 | 10332 Campus View Dr | MH Clean + Line | $ | 4,038 | 31 | 0 | 1998 | 0 | Concrete (Reinforced) [CR | 2-Low |
| Manhole | 2333 | Lake Michigan Dr | No Action | $ | - | 31 | 0 | 1998 | 0 | Concrete (Reinforced) [CR | 2-Low |
| Manhole | 2334 | 68th Ave | No Action | $ | - | 31 | 0 | 1998 | 0 | Concrete (Reinforced) [CR | 2-Low |
| Manhole | 4121 | 10829 52nd Ave | MH Inspection | $ | 536 | 31 | 0 | 2006 | 0 | Not Known [XXX] | 2-Low |
| Manhole | 2436 | 11263 68th Ave | No Action | $ | - | 31 | 0 | 1992 | 0 | Concrete (Reinforced) [CR | 2-Low |
| Manhole | 1840 | 10841 68th Ave | No Action | $ | - | 31 | 0 | 1990 | 0 | Concrete (Reinforced) [CR | 2-Low |
| Manhole | 1841 | 6801 Sunset Dr | No Action | $ | - | 31 | 0 | 1990 | 0 | Concrete (Reinforced) [CR | 2-Low |
| Manhole | 2435 | 11217 68th Ave | No Action | $ | - | 31 | 0 | 1990 | 0 | Concrete (Reinforced) [CR | 2-Low |

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|---|---|---|---|---|---|---|---|---|---|---|---|
| Manhole | 1086 | 10723 60th Ave | No Action | $ | - | 31 | 0 | 1992 | 0 | Concrete (Reinforced) [CR | 2-Low |
| Manhole | 1982 | 10835 60th Ave | No Action | $ | - | 31 | 0 | 1992 | 0 | Concrete (Reinforced) [CR | 2-Low |
| Manhole | 2181 | 11003 60th Ave | No Action | $ | - | 31 | 0 | 1992 | 0 | Concrete (Reinforced) [CR | 2-Low |
| Manhole | 2475 | 11253 60th Ave | No Action | $ | - | 31 | 0 | 1990 | 0 | Concrete (Reinforced) [CR | 2-Low |
| Manhole | 2570 | 11307 60th Ave | No Action | $ | - | 31 | 0 | 1990 | 0 | Concrete (Reinforced) [CR | 2-Low |
| Manhole | 2638 | 11397 Brown St | No Action | $ | - | 31 | 0 | 1992 | 0 | Concrete (Reinforced) [CR | 2-Low |
| Manhole | 2783 | 5934 Frostline Dr | No Action | $ | - | 31 | 0 | 1990 | 0 | Concrete (Reinforced) [CR | 2-Low |
| Manhole | 4030 | 4930 W Campus Dr | No Action | $ | - | 31 | 0 | 1990 | 0 | Concrete (Reinforced) [CR | 2-Low |
| Manhole | 4040 | 4902 W Campus Dr | No Action | $ | - | 31 | 0 | 1990 | 0 | Concrete (Reinforced) [CR | 2-Low |
| Manhole | 4415 | 5278 Jordan St | No Action | $ | - | 31 | 0 | 1994 | 0 | Concrete (Reinforced) [CR | 2-Low |
| Manhole | 2340 | 11233 68th Ave | No Action | $ | - | 31 | 0 | 1998 | 0 | Concrete (Reinforced) [CR | 2-Low |
| Manhole | 2337 | 11215 Valley View Ave | No Action | $ | - | 31 | 0 | 2007 | 0 | Concrete (Reinforced) [CR | 2-Low |
| Manhole | 2364 | WJ Presley Pkwy | MH Inspection | $ | 536 | 31 | 0 | 2000 | 0 | Not Known [XXX] | 2-Low |
| Manhole | 2195 | 5780 Forest View Dr | No Action | $ | - | 31 | 0 | 1990 | 0 | Concrete (Reinforced) [CR | 2-Low |
| Manhole | 1089 | 5812 Country View Dr | No Action | $ | - | 31 | 0 | 1992 | 0 | Concrete (Reinforced) [CR | 2-Low |
| Manhole | 1961 | 10835 64th Ave | No Action | $ | - | 31 | 0 | 1990 | 0 | Concrete (Reinforced) [CR | 2-Low |
| Manhole | 2390 | 5813 Country View Dr | No Action | $ | - | 31 | 0 | 1992 | 0 | Concrete (Reinforced) [CR | 2-Low |
| Manhole | 2631 | 11438 Valley View Ave | No Action | $ | - | 31 | 0 | 1992 | 0 | Concrete (Reinforced) [CR | 2-Low |
| Manhole | 4981 | 3951 River Ridge Ct | MH Adjust Rim | $ | 2,678 | 31 | 0 | 1990 | 0 | Concrete (Reinforced) [CR | 2-Low |
| Manhole | 2121 | 7040 Timbercreek Dr | No Action | $ | - | 31 | 0 | 1995 | 0 | Concrete (Reinforced) [CR | 2-Low |
| Manhole | 2036 | 6868 Joal St | No Action | $ | - | 31 | 0 | 1995 | 0 | Concrete (Reinforced) [CR | 2-Low |
| Manhole | 1823 | 7151 Pine Grove St | MH Inspection | $ | 536 | 31 | 0 | 2004 | 0 | Not Known [XXX] | 2-Low |
| Manhole | 4511 | 5478 Eric St | MH Inspection | $ | 536 | 31 | 0 | 2000 | 0 | Not Known [XXX] | 2-Low |
| Manhole | 2223 | 11127 Creekside Ct | MH Inspection | $ | 536 | 31 | 0 | 2004 | 0 | Not Known [XXX] | 2-Low |
| Manhole | 2988 | 5825 Rich St | MH Clean + Line + Repair | $ | 5,377 | 30 | 0 | 2001 | 0 | Concrete (Reinforced) [CR | 2-Low |
| Manhole | 2542 | 6615 Cherell St | No Action | $ | - | 30 | 0 | 1992 | 0 | Concrete (Reinforced) [CR | 2-Low |
| Manhole | 2368 | 6144 Lake Michigan Dr | MH Inspection | $ | 536 | 30 | 0 | 2000 | 0 | Not Known [XXX] | 2-Low |
| Manhole | 2383 | 5824 Lake Michigan Dr | MH Inspection | $ | 536 | 30 | 0 | 1992 | 0 | Not Known [XXX] | 2-Low |
| Manhole | 2543 | 6603 Cherell St | No Action | $ | - | 30 | 0 | 1992 | 0 | Concrete (Reinforced) [CR | 2-Low |
| Manhole | 1991 | 5702 Lynn Dr | MH Inspection | $ | 536 | 30 | 0 | 2000 | 0 | Not Known [XXX] | 2-Low |
| Manhole | 4607 | 5525 Lake Michigan Dr | No Action | $ | - | 29 | 0 | 1992 | 0 | Concrete (Reinforced) [CR | 2-Low |
| Manhole | 4610 | 5377 Lake Michigan Dr | No Action | $ | - | 29 | 0 | 1987 | 0 | Concrete (Reinforced) [CR | 2-Low |
| Manhole | 2389 | 5850 Country View Dr | No Action | $ | - | 29 | 0 | 1992 | 0 | Concrete (Reinforced) [CR | 2-Low |
| Manhole | 2487 | 5855 Larkspur Ave | No Action | $ | - | 29 | 0 | 1992 | 0 | Concrete (Reinforced) [CR | 2-Low |
| Manhole | 2488 | 11281 Prairie Ave | No Action | $ | - | 29 | 0 | 1992 | 0 | Concrete (Reinforced) [CR | 2-Low |
| Manhole | 2684 | 11425 Prairie Ave | No Action | $ | - | 29 | 0 | 1993 | 0 | Concrete (Reinforced) [CR | 2-Low |
| Manhole | 4813 | 5349 Edgewater Dr | MH Inspection | $ | 536 | 29 | 0 | 2000 | 0 | Not Known [XXX] | 2-Low |
| Gravity Main | P1981 | 10843-10891 60th Ave | No Action | $ | - | 29 | 10 | 1992 | 371 | PVC | 2-Low |
| Gravity Main | P2640 | 6830-6802 Cardinal St | No Action | $ | - | 29 | 8 | 1992 | 119 | PVC | 2-Low |
| Manhole | 9003 | 11018 Creekside Dr | MH Inspection | $ | 536 | 29 | 0 | 1995 | 0 | Not Known [XXX] | 2-Low |
| Manhole | 2531 | 7437 Valley View Ct | MH Inspection | $ | 536 | 29 | 0 | 2000 | 0 | Not Known [XXX] | 2-Low |
| Manhole | 4407 | 10973 Lance Ave | MH Inspection | $ | 536 | 29 | 0 | 2005 | 0 | Not Known [XXX] | 2-Low |
| Gravity Main | P2032 | 7008-7060 Joal St | Upsize | $ | 42,747 | 29 | 8 | 1995 | 143 | PVC | 2-Low |
| Gravity Main | P2033 | 7060-6996 Joal St | Upsize | $ | 95,905 | 29 | 8 | 1995 | 320 | PVC | 2-Low |
| Gravity Main | P2570 | 11307-11253 60th Ave | No Action | $ | - | 28 | 10 | 1990 | 348 | PVC | 2-Low |

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|---|---|---|---|---|---|---|---|---|---|---|---|
| Gravity Main | P2571 | 11361-11307 60th Ave | No Action | $ | - | 28 | 10 | 1990 | 336 | PVC | 2-Low |
| Gravity Main | P1921 | 7022 Aspen St | No Action | $ | - | 28 | 8 | 2000 | 354 | PVC | 2-Low |
| Gravity Main | P2036 | 6868-6812 Joal St | No Action | $ | - | 28 | 8 | 1990 | 279 | PVC | 2-Low |
| Gravity Main | P2081 | 10933-10969 60th Ave | No Action | $ | - | 28 | 10 | 1992 | 233 | PVC | 2-Low |
| Gravity Main | P2080 | 10891-10933 60th Ave | No Action | $ | - | 28 | 10 | 1992 | 324 | PVC | 2-Low |
| Gravity Main | P1113 | 10591 48th Ave | No Action | $ | - | 28 | 10 | 1990 | 414 | PVC | 2-Low |
| Gravity Main | P2034 | 6996-6930 Joal St | No Action | $ | - | 28 | 8 | 1995 | 322 | PVC | 2-Low |
| Manhole | 1953 | 6562 Winans St | MH Clean + Line + Repair | $ | 5,377 | 28 | 0 | 1992 | 0 | Concrete (Reinforced) [CR | 2-Low |
| Manhole | 2515 | 7170 Blue Jay Dr | MH Inspection | $ | 536 | 28 | 0 | 2013 | 0 | Concrete (Reinforced) [CR | 2-Low |
| Manhole | 9518 | 4617 Lake Michigan Dr | MH Inspection | $ | 536 | 28 | 0 | 2012 | 0 | Concrete (Reinforced) [CR | 2-Low |
| Manhole | 2534 | 11301 Brown St | No Action | $ | - | 28 | 0 | 1992 | 0 | Concrete (Reinforced) [CR | 2-Low |
| Manhole | 1033 | 11529 40th Ave | MH Adjust Rim | $ | 2,678 | 28 | 0 | 1990 | 0 | Concrete (Reinforced) [CR | 2-Low |
| Manhole | 4870 | 11253 40th Ave | No Action | $ | - | 28 | 0 | 1990 | 0 | Concrete (Reinforced) [CR | 2-Low |
| Manhole | 22 | 11253 56th Ave | No Action | $ | - | 28 | 0 | 1992 | 0 | Concrete (Reinforced) [CR | 2-Low |
| Manhole | 2358 | 11283 Washington Ave | MH Clean | $ | 803 | 28 | 0 | 2004 | 0 | Concrete (Reinforced) [CR | 2-Low |
| Manhole | 2353 | 11205 64th Ave | No Action | $ | - | 28 | 0 | 1990 | 0 | Concrete (Reinforced) [CR | 2-Low |
| Manhole | 2381 | 5948 Lake Michigan Dr | MH Inspection | $ | 536 | 28 | 0 | 1992 | 0 | Concrete (Reinforced) [CR | 2-Low |
| Manhole | 3560 | 10155 Laker Ln | MH Clean + Line | $ | 4,038 | 28 | 0 | 1998 | 0 | Concrete (Reinforced) [CR | 2-Low |
| Manhole | 2332 | 6936 Lake Michigan Dr | No Action | $ | - | 28 | 0 | 1998 | 0 | Concrete (Reinforced) [CR | 2-Low |
| Manhole | 2241 | 11048 68th Ave | No Action | $ | - | 28 | 0 | 1990 | 0 | Concrete (Reinforced) [CR | 2-Low |
| Manhole | 2291 | Estate Rd | MH Adjust Rim | $ | 2,678 | 28 | 0 | 1990 | 0 | Concrete (Reinforced) [CR | 2-Low |
| Manhole | 5355 | 4488 Pingree St | MH Inspection | $ | 536 | 28 | 0 | 1991 | 0 | Not Known [XXX] | 2-Low |
| Manhole | 4302 | 10917 Lance Ave | MH Inspection | $ | 536 | 28 | 0 | 2005 | 0 | Not Known [XXX] | 2-Low |
| Manhole | 4303 | 10905 Lance Ave | MH Inspection | $ | 536 | 28 | 0 | 2005 | 0 | Not Known [XXX] | 2-Low |
| Gravity Main | P1920 | 7024-7072 Aspen St | No Action | $ | - | 28 | 8 | 2001 | 62 | PVC | 2-Low |
| Gravity Main | P2181 | 11003-11063 60th Ave | No Action | $ | - | 28 | 10 | 1992 | 406 | PVC | 2-Low |
| Gravity Main | P2180 | 10969-11003 60th Ave | No Action | $ | - | 28 | 10 | 1992 | 234 | PVC | 2-Low |
| Gravity Main | P2538 | 6781 Scott St | No Action | $ | - | 28 | 8 | 1992 | 286 | PVC | 2-Low |
| Gravity Main | P2280 | 11063-11147 60th Ave | No Action | $ | - | 28 | 10 | 1992 | 381 | PVC | 2-Low |
| Gravity Main | P4030 | 4930-4902 W Campus Dr | No Action | $ | - | 28 | 8 | 1990 | 315 | PVC | 2-Low |
| Gravity Main | P2475 | 11253-11208 60th Ave | Full Lining | $ | 15,403 | 28 | 10 | 1990 | 288 | PVC | 2-Low |
| Gravity Main | P2250 | 6504-6606 Henry St | No Action | $ | - | 27 | 12 | 1990 | 433 | PVC | 2-Low |
| Gravity Main | P1082 | 6195-6161 Lake Michigan Dr | No Action | $ | - | 27 | 15 | 1990 | 385 | PVC | 2-Low |
| Gravity Main | P2359 | 6261-6195 Lake Michigan Dr | No Action | $ | - | 27 | 15 | 1990 | 330 | PVC | 2-Low |
| Manhole | 4627 | 5065 Lake Michigan Dr | MH Repair+Lining | $ | 4,574 | 27 | 0 | 2005 | 0 | Concrete (Reinforced) [CR | 2-Low |
| Manhole | 2572 | 11397 60th Ave | No Action | $ | - | 27 | 0 | 1990 | 0 | Concrete (Reinforced) [CR | 2-Low |
| Manhole | 2480 | 5881 Lake Michigan Dr | MH Adjust Rim | $ | 2,678 | 27 | 0 | 1990 | 0 | Concrete (Reinforced) [CR | 2-Low |
| Manhole | 3961 | 10555 Laker Village Dr | No Action | $ | - | 27 | 0 | 1963 | 0 | Concrete (Reinforced) [CR | 2-Low |
| Manhole | 1090 | 11113 56th Ave | No Action | $ | - | 27 | 0 | 1990 | 0 | Concrete (Reinforced) [CR | 2-Low |
| Manhole | 2292 | Estate Rd | No Action | $ | - | 27 | 0 | 1990 | 0 | Concrete (Reinforced) [CR | 2-Low |
| Manhole | 2352 | 6433 Lake Michigan Dr | No Action | $ | - | 27 | 0 | 1987 | 0 | Concrete (Reinforced) [CR | 2-Low |
| Manhole | 2356 | 11207 Washington Ave | No Action | $ | - | 27 | 0 | 1987 | 0 | Concrete (Reinforced) [CR | 2-Low |
| Manhole | 2397 | 5696 Country View Dr | No Action | $ | - | 27 | 0 | 1992 | 0 | Concrete (Reinforced) [CR | 2-Low |
| Manhole | 2388 | 5900 Country View Dr | No Action | $ | - | 27 | 0 | 1992 | 0 | Concrete (Reinforced) [CR | 2-Low |
| Manhole | 2541 | 11306 Sheridan Ave | No Action | $ | - | 27 | 0 | 1992 | 0 | Concrete (Reinforced) [CR | 2-Low |

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|---|---|---|---|---|---|---|---|---|---|---|---|
| Manhole | 2682 | 11465 Hunters Meadow Dr | No Action | $ | - | 27 | 0 | 1990 | 0 | Concrete (Reinforced) [CR | 2-Low |
| Manhole | 2781 | 5953 Frostline Dr | No Action | $ | - | 27 | 0 | 1990 | 0 | Concrete (Reinforced) [CR | 2-Low |
| Manhole | 2782 | 5931 Frostline Dr | No Action | $ | - | 27 | 0 | 1990 | 0 | Concrete (Reinforced) [CR | 2-Low |
| Manhole | 4500 | 11155 56th Ave | No Action | $ | - | 27 | 0 | 1990 | 0 | Concrete (Reinforced) [CR | 2-Low |
| Manhole | 3568 | 10383 42nd Ave | No Action | $ | - | 27 | 0 | 2004 | 0 | Concrete (Reinforced) [CR | 2-Low |
| Manhole | 4844 | 11313 48th Ave | No Action | $ | - | 27 | 0 | 2004 | 0 | Concrete (Reinforced) [CR | 2-Low |
| Manhole | 3623 | 5122 Pierce St | MH Inspection | $ | 536 | 27 | 0 | 2006 | 0 | Concrete (Non-reinforced) | 2-Low |
| Manhole | 2770 | 11441 60th Ave | MH Inspection | $ | 536 | 27 | 0 | 1990 | 0 | Not Known [XXX] | 2-Low |
| Gravity Main | P1783 | 5936-5961 Maple Bend Trl | No Action | $ | - | 27 | 8 | 1998 | 133 | PVC | 2-Low |
| Gravity Main | P1682 | 10601-10635 Tallpine Ln | No Action | $ | - | 27 | 8 | 1998 | 239 | PVC | 2-Low |
| Gravity Main | P2433 | 11235 Brown St | No Action | $ | - | 27 | 10 | 1990 | 35 | PVC | 2-Low |
| Gravity Main | P1681 | 10635-10675 Tallpine Ln | No Action | $ | - | 27 | 8 | 1998 | 273 | PVC | 2-Low |
| Gravity Main | P1787 | 5800-5841 Maple Bend Trl | No Action | $ | - | 27 | 8 | 1998 | 230 | PVC | 2-Low |
| Gravity Main | P4031 | 4950-4930 W Campus Dr | No Action | $ | - | 27 | 8 | 1990 | 258 | PVC | 2-Low |
| Gravity Main | P1782 | 5981 Maple Bend Trl | No Action | $ | - | 27 | 8 | 1998 | 229 | PVC | 2-Low |
| Gravity Main | P1789 | 5788 Horizon Ln | No Action | $ | - | 27 | 8 | 1998 | 251 | PVC | 2-Low |
| Gravity Main | P1880 | 10785 Tallpine Ln | No Action | $ | - | 27 | 8 | 1998 | 201 | PVC | 2-Low |
| Gravity Main | P1680 | 10675-10701 Tallpine Ln | No Action | $ | - | 27 | 8 | 1998 | 156 | PVC | 2-Low |
| Gravity Main | P1788 | 10733 Tallpine Ln | No Action | $ | - | 27 | 8 | 1998 | 273 | PVC | 2-Low |
| Gravity Main | P1785 | 5863-5884 Maple Bend Trl | No Action | $ | - | 27 | 8 | 1998 | 122 | PVC | 2-Low |
| Gravity Main | P1881 | 10737 60th Ave | No Action | $ | - | 27 | 8 | 1992 | 284 | PVC | 2-Low |
| Gravity Main | P3930 | Campus West Apartments | No Action | $ | - | 27 | 8 | 2001 | 400 | PVC | 2-Low |
| Gravity Main | P1784 | 5884-5936 Maple Bend Trl | No Action | $ | - | 27 | 8 | 1998 | 299 | PVC | 2-Low |
| Gravity Main | P4032 | 4966 W Campus Dr | No Action | $ | - | 27 | 8 | 2001 | 385 | PVC | 2-Low |
| Manhole | 4639 | 4830 Lake Michigan Dr | MH Inspection | $ | 536 | 26 | 0 | 2001 | 0 | Not Known [XXX] | 2-Low |
| Manhole | 2373 | 11208 60th Ave | No Action | $ | - | 26 | 0 | 1989 | 0 | Concrete (Reinforced) [CR | 2-Low |
| Manhole | 3561 | 10152 Laker Ln | MH Clean + Line + Adjust Rim | $ | 6,716 | 26 | 0 | 1998 | 0 | Concrete (Reinforced) [CR | 2-Low |
| Manhole | 4872 | 11299 40th Ave | No Action | $ | - | 26 | 0 | 1990 | 0 | Concrete (Reinforced) [CR | 2-Low |
| Manhole | 5144 | 4774 Rich St | MH Inspection | $ | 536 | 26 | 0 | 1991 | 0 | Not Known [XXX] | 2-Low |
| Manhole | 1960 | 10729 64th Ave | No Action | $ | - | 26 | 0 | 1990 | 0 | Concrete (Reinforced) [CR | 2-Low |
| Manhole | 2294 | 11017 56th Ave | No Action | $ | - | 26 | 0 | 1990 | 0 | Concrete (Reinforced) [CR | 2-Low |
| Manhole | 2037 | 6802 Joal St | No Action | $ | - | 26 | 0 | 1995 | 0 | Concrete (Reinforced) [CR | 2-Low |
| Manhole | 4983 | 11434 Cadence Ct | MH Adjust Rim | $ | 2,678 | 26 | 0 | 1990 | 0 | Concrete (Reinforced) [CR | 2-Low |
| Manhole | 1788 | 10701 Tallpine Ln | MH Inspection | $ | 536 | 26 | 0 | 1998 | 0 | Not Known [XXX] | 2-Low |
| Manhole | 3840 | 10489 48th Ave | MH Inspection | $ | 536 | 26 | 0 | 2001 | 0 | Not Known [XXX] | 2-Low |
| Gravity Main | P2638 | 11397-11431 Brown St | No Action | $ | - | 26 | 8 | 1992 | 262 | PVC | 2-Low |
| Gravity Main | P2534 | 11301-11235 Brown St | No Action | $ | - | 26 | 8 | 1992 | 383 | PVC | 2-Low |
| Gravity Main | P2539 | 6725-6761 Scott St | No Action | $ | - | 26 | 8 | 1992 | 255 | PVC | 2-Low |
| Gravity Main | P2639 | 11377-11351 Brown St | No Action | $ | - | 26 | 8 | 1992 | 197 | PVC | 2-Low |
| Gravity Main | P2442 | 11248 Avery Ave | No Action | $ | - | 26 | 8 | 1990 | 184 | PVC | 2-Low |
| Gravity Main | P2531 | 7437-7360 Valley View Ct | No Action | $ | - | 26 | 8 | 2000 | 58 | PVC | 2-Low |
| Gravity Main | P2541 | 6636 Scott St | No Action | $ | - | 26 | 8 | 1992 | 295 | PVC | 2-Low |
| Gravity Main | P2630 | 11391-11438 Valley View Ave | No Action | $ | - | 26 | 8 | 1992 | 342 | PVC | 2-Low |
| Gravity Main | P2532 | 7198-6910 Valley View Ct | No Action | $ | - | 26 | 8 | 2000 | 268 | PVC | 2-Low |
| Gravity Main | P2540 | 6683-6725 Scott St | No Action | $ | - | 26 | 8 | 1992 | 319 | PVC | 2-Low |

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|---|---|---|---|---|---|---|---|---|---|---|---|
| Gravity Main | P2430 | 11241-11293 Valley View Ave | No Action | $ | - | 26 | 8 | 1992 | 351 | PVC | 2-Low |
| Gravity Main | P2530 | 7598-7437 Valley View Ct | No Action | $ | - | 26 | 8 | 2000 | 155 | PVC | 2-Low |
| Gravity Main | P2573 | Village Ln | No Action | $ | - | 26 | 8 | 1990 | 324 | PVC | 2-Low |
| Gravity Main | P2533 | 11375 Valley View Ave | No Action | $ | - | 26 | 8 | 1992 | 301 | PVC | 2-Low |
| Gravity Main | P2770 | 11441-11475 60th Ave | No Action | $ | - | 26 | 8 | 1990 | 314 | PVC | 2-Low |
| Gravity Main | P2771 | 11475-11525 60th Ave | No Action | $ | - | 26 | 8 | 1990 | 236 | PVC | 2-Low |
| Gravity Main | P1073 | 7360-7198 Valley View Ct | No Action | $ | - | 26 | 8 | 2000 | 149 | PVC | 2-Low |
| Gravity Main | P2542 | 6615 Cherell St | No Action | $ | - | 26 | 8 | 1992 | 325 | PVC | 2-Low |
| Gravity Main | P2543 | 6603-6615 Cherell St | No Action | $ | - | 26 | 8 | 1992 | 157 | PVC | 2-Low |
| Gravity Main | P2431 | 11321 Valley View Ave | Full Lining | $ | 15,431 | 26 | 8 | 1992 | 360 | PVC | 2-Low |
| Gravity Main | P2027 | 10905 Timberline Dr | No Action | $ | - | 26 | 8 | 1996 | 348 | PVC | 2-Low |
| Gravity Main | P2120 | 11013 Creekside Dr | No Action | $ | - | 26 | 8 | 1995 | 240 | PVC | 2-Low |
| Gravity Main | P2026 | 10979-10929 Timberline Dr | No Action | $ | - | 26 | 8 | 1996 | 351 | PVC | 2-Low |
| Gravity Main | P2030 | 10943-10905 Creekside Dr | No Action | $ | - | 26 | 8 | 1995 | 207 | PVC | 2-Low |
| Gravity Main | P9002 | 7050-7002 Pinevalley Dr | No Action | $ | - | 26 | 8 | 1996 | 165 | PVC | 2-Low |
| Gravity Main | P1826 | 7079 Sunset Dr | No Action | $ | - | 26 | 8 | 1996 | 239 | PVC | 2-Low |
| Gravity Main | P2031 | 7095 Joal St | No Action | $ | - | 26 | 8 | 1995 | 71 | PVC | 2-Low |
| Gravity Main | P2025 | 10989 Timberline Dr | No Action | $ | - | 26 | 8 | 1996 | 145 | PVC | 2-Low |
| Gravity Main | P4241 | 10865-10929 48th Ave | No Action | $ | - | 26 | 12 | 1987 | 297 | PVC | 2-Low |
| Gravity Main | P1963 | 6290-6402 Winans St | No Action | $ | - | 26 | 8 | 1990 | 350 | PVC | 2-Low |
| Gravity Main | P2220 | 11047 Timberline Dr | No Action | $ | - | 26 | 8 | 1996 | 350 | PVC | 2-Low |
| Gravity Main | P4538 | 11035 Stanford Ave | CCTV | $ | 1,312 | 26 | 8 | 1966 | 350 | PVC | 2-Low |
| Gravity Main | P4537 | 11055-11085 Stanford Ave | CCTV | $ | 1,036 | 26 | 8 | 1966 | 276 | PVC | 2-Low |
| Gravity Main | P1111 | 11085 Stanford Ave | CCTV | $ | 515 | 26 | 8 | 1966 | 137 | PVC | 2-Low |
| Manhole | 5042 | 11529 48th Ave | MH Inspection | $ | 536 | 26 | 0 | 1991 | 0 | Not Known [XXX] | 2-Low |
| Manhole | 4120 | 10781 52nd Ave | MH Inspection | $ | 536 | 26 | 0 | 2006 | 0 | Not Known [XXX] | 2-Low |
| Manhole | 5286 | 11773 40th Ave | MH Inspection | $ | 536 | 26 | 0 | 2000 | 0 | Not Known [XXX] | 2-Low |
| Manhole | 1682 | 10601 Tallpine Ln | MH Inspection | $ | 536 | 26 | 0 | 1998 | 0 | Not Known [XXX] | 2-Low |
| Manhole | 1922 | 6994 Aspen St | MH Inspection | $ | 536 | 26 | 0 | 2001 | 0 | Not Known [XXX] | 2-Low |
| Manhole | 1994 | 5796 Lynn Dr | MH Inspection | $ | 536 | 26 | 0 | 2000 | 0 | Not Known [XXX] | 2-Low |
| Manhole | 2091 | 5634 Mary Eliz Dr | MH Inspection | $ | 536 | 26 | 0 | 2000 | 0 | Not Known [XXX] | 2-Low |
| Manhole | 4032 | Campus West Apartments | MH Inspection | $ | 536 | 26 | 0 | 2001 | 0 | Not Known [XXX] | 2-Low |
| Manhole | 4512 | 5452 Eric St | MH Inspection | $ | 536 | 26 | 0 | 2000 | 0 | Not Known [XXX] | 2-Low |
| Manhole | 1132 | 4616 Ottawa Creek Dr | MH Inspection | $ | 536 | 26 | 0 | 2012 | 0 | Concrete (Non-reinforced) | 2-Low |
| Manhole | 4322 | 5176 Circlewood Ln | MH Inspection | $ | 536 | 26 | 0 | 2005 | 0 | Not Known [XXX] | 2-Low |
| Manhole | 4427 | 5193 Woodedge Ct | MH Inspection | $ | 536 | 26 | 0 | 2005 | 0 | Not Known [XXX] | 2-Low |
| Manhole | 1720 | 10819 Timberline Dr | MH Inspection | $ | 536 | 26 | 0 | 2008 | 0 | Not Known [XXX] | 2-Low |
| Gravity Main | P4862 | 4422-4426 Lake Michigan Dr | Upsize | $ | 24,865 | 26 | 12 | 1963 | 83 | CAST IRON | 2-Low |
| Gravity Main | P4440 | 10975-11027 48th Ave | No Action | $ | - | 25 | 12 | 1987 | 319 | PVC | 2-Low |
| Gravity Main | P4540 | 11077-11127 48th Ave | No Action | $ | - | 25 | 12 | 1987 | 299 | PVC | 2-Low |
| Gravity Main | P4441 | 11027-11077 48th Ave | No Action | $ | - | 25 | 12 | 1987 | 299 | PVC | 2-Low |
| Gravity Main | P4142 | 10861-10865 48th Ave | No Action | $ | - | 25 | 12 | 1987 | 417 | PVC | 2-Low |
| Gravity Main | P4140 | 10799 48th Ave | No Action | $ | - | 25 | 10 | 1990 | 241 | PVC | 2-Low |
| Gravity Main | P1112 | 10745 48th Ave | No Action | $ | - | 25 | 10 | 1990 | 197 | PVC | 2-Low |
| Gravity Main | P3842 | 10539-10581 48th Ave | No Action | $ | - | 25 | 10 | 1990 | 381 | PVC | 2-Low |

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|---|---|---|---|---|---|---|---|---|---|---|---|
| Force Main | FM9 | 11431 Brown St | Upsize | $ | 245,009 | 25 | 4 | 1992 | 847 | PVC | 2-Low |
| Gravity Main | P4461 | 4443-4498 Stadium Dr | Point Repair | $ | 9,526 | 24 | 12 | 1963 | 321 | VCP | 2-Low |
| Manhole | 2434 | 11227 68th Ave | No Action | $ | - | 24 | 0 | 1990 | 0 | Concrete (Reinforced) [CR | 2-Low |
| Manhole | 2398 | 5663 Country View Dr | No Action | $ | - | 24 | 0 | 1992 | 0 | Concrete (Reinforced) [CR | 2-Low |
| Manhole | 2399 | 5620 Country View Dr | No Action | $ | - | 24 | 0 | 1992 | 0 | Concrete (Reinforced) [CR | 2-Low |
| Manhole | 2780 | 5965 Frostline Dr | No Action | $ | - | 24 | 0 | 1990 | 0 | Concrete (Reinforced) [CR | 2-Low |
| Manhole | 4871 | 11276 40th Ave | MH Adjust Rim | $ | 2,678 | 24 | 0 | 1990 | 0 | Concrete (Reinforced) [CR | 2-Low |
| Gravity Main | P1581 | 10550 60th Ave | CCTV | $ | 190 | 24 | 10 | 1992 | 51 | PVC | 2-Low |
| Gravity Main | P3740 | 10471-10489 48th Ave | No Action | $ | - | 24 | 10 | 2001 | 285 | PVC | 2-Low |
| Gravity Main | P1081 | 6163 Crystal Dr | No Action | $ | - | 24 | 10 | 1990 | 195 | PVC | 2-Low |
| Gravity Main | P3841 | 10561-10539 48th Ave | No Action | $ | - | 24 | 10 | 1997 | 126 | PVC | 2-Low |
| Gravity Main | P2294 | 11043 56th Ave | No Action | $ | - | 24 | 8 | 1990 | 341 | PVC | 2-Low |
| Gravity Main | P5010 | 11481 54th Ave | No Action | $ | - | 24 | 10 | 2000 | 287 | PVC | 2-Low |
| Gravity Main | P4814 | 5200-5349 Edgewater Dr | No Action | $ | - | 24 | 10 | 2000 | 506 | PVC | 2-Low |
| Gravity Main | P3624 | 5083-5122 Pierce St | No Action | $ | - | 24 | 8 | 2006 | 352 | PVC | 2-Low |
| Gravity Main | P2245 | 6676 Lake Michigan Dr | No Action | $ | - | 24 | 12 | 1990 | 39 | PVC | 2-Low |
| Gravity Main | P5286 | 11773-11717 40th Ave | CCTV | $ | 1,325 | 24 | 10 | 2000 | 353 | PVC | 2-Low |
| Gravity Main | P1116 | 10411-10445 48th Ave | CCTV | $ | 758 | 24 | 10 | 2001 | 202 | PVC | 2-Low |
| Gravity Main | P4983 | 11454 Cadence Ct | CCTV | $ | 1,152 | 24 | 10 | 1990 | 307 | PVC | 2-Low |
| Gravity Main | P5285 | 11717-11654 40th Ave | CCTV | $ | 1,499 | 24 | 10 | 2000 | 400 | PVC | 2-Low |
| Gravity Main | P5287 | 11731 40th Ave | CCTV | $ | 1,495 | 24 | 10 | 2000 | 399 | PVC | 2-Low |
| Gravity Main | P2248 | 6605 Henry St | CCTV | $ | 330 | 24 | 12 | 1990 | 88 | PVC | 2-Low |
| Gravity Main | P3732 | Hillcrest Town Houses | Point Repair | $ | 9,372 | 24 | 8 | 2001 | 313 | PVC | 2-Low |
| Gravity Main | P3733 | 4924-4886 Country Pl S | No Action | $ | - | 24 | 8 | 2001 | 186 | PVC | 2-Low |
| Gravity Main | P2631 | 11485 Valley View Ave | No Action | $ | - | 24 | 8 | 1992 | 280 | PVC | 2-Low |
| Gravity Main | P2678 | 11378 Pebble Dr | No Action | $ | - | 24 | 8 | 1990 | 358 | PVC | 2-Low |
| Gravity Main | P3936 | 4832 W Campus Dr | No Action | $ | - | 24 | 8 | 1990 | 192 | PVC | 2-Low |
| Gravity Main | P2676 | 6047-11498 Pebble Dr | No Action | $ | - | 24 | 8 | 1990 | 168 | PVC | 2-Low |
| Gravity Main | P3731 | 10485 48th Ave | No Action | $ | - | 24 | 8 | 2001 | 136 | PVC | 2-Low |
| Gravity Main | P2675 | 6095-6047 Pebble Dr | No Action | $ | - | 24 | 8 | 1990 | 172 | PVC | 2-Low |
| Gravity Main | P2575 | 6064-6028 Crystal Dr | No Action | $ | - | 24 | 8 | 1990 | 142 | PVC | 2-Low |
| Gravity Main | P2632 | 11497-11495 Brown St | No Action | $ | - | 24 | 8 | 1992 | 272 | PVC | 2-Low |
| Gravity Main | P3931 | Campus West Apartments | No Action | $ | - | 24 | 8 | 2001 | 229 | PVC | 2-Low |
| Gravity Main | P2677 | 11498-11456 Pebble Dr | No Action | $ | - | 24 | 8 | 1990 | 98 | PVC | 2-Low |
| Gravity Main | P3730 | Hillcrest-10485 48th Ave | No Action | $ | - | 24 | 8 | 2001 | 124 | PVC | 2-Low |
| Gravity Main | P2574 | 6028-6003 Crystal Dr | No Action | $ | - | 24 | 8 | 1990 | 103 | PVC | 2-Low |
| Gravity Main | P3933 | Campus West Apartments | No Action | $ | - | 24 | 8 | 1990 | 133 | PVC | 2-Low |
| Gravity Main | P3937 | Campus West Apartments | No Action | $ | - | 24 | 8 | 1990 | 272 | PVC | 2-Low |
| Gravity Main | P3934 | Campus West Apartments | No Action | $ | - | 24 | 8 | 1990 | 30 | PVC | 2-Low |
| Gravity Main | P3734 | 4856 Country Pl S | Full Lining | $ | 12,574 | 24 | 8 | 2001 | 293 | PVC | 2-Low |
| Manhole | 3566 | 4260 Campus View Dr | MH Clean + Line | $ | 4,038 | 24 | 0 | 2004 | 0 | Concrete (Reinforced) [CR | 2-Low |
| Manhole | 3565 | 4270 Campus View Dr | MH Clean + Line | $ | 4,038 | 24 | 0 | 2004 | 0 | Concrete (Reinforced) [CR | 2-Low |
| Manhole | 1041 | 11057 Skyway Ln | MH Inspection | $ | 536 | 24 | 0 | 2004 | 0 | Not Known [XXX] | 2-Low |
| Manhole | 1962 | 6402 Winans St | No Action | $ | - | 24 | 0 | 1990 | 0 | Concrete (Reinforced) [CR | 2-Low |
| Manhole | 2190 | 11027 Gayle Ln | No Action | $ | - | 24 | 0 | 1990 | 0 | Concrete (Reinforced) [CR | 2-Low |

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|---|---|---|---|---|---|---|---|---|---|---|---|
| Manhole | 2280 | 11063 60th Ave | No Action | $ | - | 24 | 0 | 1992 | 0 | Concrete (Reinforced) [CR | 2-Low |
| Manhole | 1781 | 10709 60th Ave | No Action | $ | - | 24 | 0 | 1992 | 0 | Concrete (Reinforced) [CR | 2-Low |
| Manhole | 2393 | 11143 Pleasant Point Dr | No Action | $ | - | 24 | 0 | 1992 | 0 | Concrete (Reinforced) [CR | 2-Low |
| Manhole | 2386 | 5954 Country View Dr | No Action | $ | - | 24 | 0 | 1992 | 0 | Concrete (Reinforced) [CR | 2-Low |
| Manhole | 2391 | 5796 Country View Dr | No Action | $ | - | 24 | 0 | 1992 | 0 | Concrete (Reinforced) [CR | 2-Low |
| Manhole | 1881 | 6175 Red Oak Ln | No Action | $ | - | 24 | 0 | 1992 | 0 | Concrete (Reinforced) [CR | 2-Low |
| Manhole | 2193 | 5752 Forest View Dr | No Action | $ | - | 24 | 0 | 1990 | 0 | Concrete (Reinforced) [CR | 2-Low |
| Manhole | 2681 | 11369 Hunters Meadow Dr | No Action | $ | - | 24 | 0 | 1990 | 0 | Concrete (Reinforced) [CR | 2-Low |
| Manhole | 4416 | 5270 Jordan St | No Action | $ | - | 24 | 0 | 1994 | 0 | Concrete (Reinforced) [CR | 2-Low |
| Manhole | 4417 | 11055 Summer Brook Ct | No Action | $ | - | 24 | 0 | 1994 | 0 | Concrete (Reinforced) [CR | 2-Low |
| Manhole | 4628 | 11143 52nd Ave | No Action | $ | - | 24 | 0 | 1990 | 0 | Concrete (Reinforced) [CR | 2-Low |
| Manhole | 2341 | 6791 Lake Michigan Dr | No Action | $ | - | 24 | 0 | 2001 | 0 | Concrete (Reinforced) [CR | 2-Low |
| Manhole | 2370 | 6052 Lake Michigan Dr | MH Inspection | $ | 536 | 24 | 0 | 2000 | 0 | Not Known [XXX] | 2-Low |
| Manhole | 4603 | 5504 Lake Michigan Dr | MH Inspection | $ | 536 | 24 | 0 | 2001 | 0 | Not Known [XXX] | 2-Low |
| Manhole | 2395 | 11071 Pleasant Point Dr | No Action | $ | - | 24 | 0 | 1992 | 0 | Concrete (Reinforced) [CR | 2-Low |
| Manhole | 2197 | 11059 Pleasant Point Dr | No Action | $ | - | 24 | 0 | 1990 | 0 | Concrete (Reinforced) [CR | 2-Low |
| Manhole | 2387 | 5908 Country View Dr | No Action | $ | - | 24 | 0 | 1992 | 0 | Concrete (Reinforced) [CR | 2-Low |
| Manhole | 4218 | 10705 Douglas Dr | MH Inspection | $ | 536 | 24 | 0 | 2004 | 0 | Not Known [XXX] | 2-Low |
| Gravity Main | P1825 | 10821-10807 Timberline Dr | No Action | $ | - | 23 | 8 | 1996 | 152 | PVC | 2-Low |
| Gravity Main | P4706 | 11329-11297 Commerce Rd | No Action | $ | - | 23 | 8 | 2001 | 229 | PVC | 2-Low |
| Gravity Main | P4701 | 5543 Lake Michigan Dr | CCTV | $ | 1,270 | 23 | 21 | 1990 | 297 | RCP | 2-Low |
| Gravity Main | P2480 | 5903 Lake Michigan Dr | CCTV | $ | 1,001 | 23 | 18 | 1990 | 267 | RCP | 2-Low |
| Gravity Main | P3636 | 4986-5013 Pierce St | No Action | $ | - | 23 | 8 | 2008 | 220 | PVC | 2-Low |
| Gravity Main | P1074 | 6495-6562 Winans St | No Action | $ | - | 23 | 8 | 1992 | 404 | PVC | 2-Low |
| Gravity Main | P1956 | 6618-6694 Martinie Dr | No Action | $ | - | 23 | 8 | 1992 | 225 | PVC | 2-Low |
| Gravity Main | P1952 | 6588-6599 Winans St | No Action | $ | - | 23 | 8 | 1992 | 225 | PVC | 2-Low |
| Gravity Main | P1954 | 6550-6562 Winans St | No Action | $ | - | 23 | 8 | 1992 | 175 | PVC | 2-Low |
| Gravity Main | P3532 | Copper Beech Townhomes | No Action | $ | - | 23 | 8 | 2007 | 240 | PVC | 2-Low |
| Gravity Main | P2054 | 6666 Mista Dr | No Action | $ | - | 23 | 8 | 1995 | 288 | PVC | 2-Low |
| Gravity Main | P4161 | 1 Campus Dr | Full Lining | $ | 20,586 | 23 | 12 | 1963 | 320 | VCP | 2-Low |
| Gravity Main | P4362 | 1 Campus Dr | CCTV and Heavy Cleaning | $ | 1,116 | 23 | 12 | 1963 | 149 | PVC | 2-Low |
| Gravity Main | P2391 | 5796-5773 Country View Dr | CCTV | $ | 636 | 23 | 8 | 1992 | 170 | PVC | 2-Low |
| Gravity Main | P2094 | 6173 Mary Eliz Dr | CCTV | $ | 1,144 | 23 | 8 | 2000 | 305 | PVC | 2-Low |
| Gravity Main | P2096 | 10983 Melanie Dr | CCTV | $ | 530 | 23 | 8 | 2000 | 141 | PVC | 2-Low |
| Gravity Main | P2581 | 5764-5735 Ivory Rd | CCTV | $ | 397 | 23 | 8 | 1992 | 106 | PVC | 2-Low |
| Gravity Main | P2685 | 11441-11425 Prairie Ave | CCTV | $ | 737 | 23 | 8 | 1993 | 197 | PVC | 2-Low |
| Gravity Main | P1994 | 5796-5769 Lynn Dr | CCTV | $ | 770 | 23 | 8 | 2000 | 205 | PVC | 2-Low |
| Gravity Main | P2193 | 5752-5578 Forest View Dr | CCTV | $ | 1,046 | 23 | 8 | 1990 | 279 | PVC | 2-Low |
| Gravity Main | P1085 | 5997 Frostline Dr | CCTV | $ | 199 | 23 | 8 | 1990 | 53 | PVC | 2-Low |
| Gravity Main | P2392 | 5773-5743 Country View Dr | CCTV | $ | 641 | 23 | 8 | 1992 | 171 | PVC | 2-Low |
| Gravity Main | P4941 | 11410-11403 48th Ave | CCTV | $ | 310 | 23 | 8 | 2000 | 83 | PVC | 2-Low |
| Gravity Main | P2486 | 11271 Rosewood Ave | CCTV | $ | 774 | 23 | 8 | 1992 | 206 | PVC | 2-Low |
| Gravity Main | P2095 | 10801-10931 Mary Eliz Ct | CCTV | $ | 1,292 | 23 | 8 | 2000 | 345 | PVC | 2-Low |
| Gravity Main | P2398 | 11115 Estate Ct | CCTV | $ | 1,190 | 23 | 8 | 1990 | 317 | PVC | 2-Low |
| Gravity Main | P5141 | 11581 48th Ave | CCTV | $ | 875 | 23 | 8 | 1991 | 233 | PVC | 2-Low |

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|---|---|---|---|---|---|---|---|---|---|---|---|
| Gravity Main | P2387 | 5908-5954 Country View Dr | CCTV | $ | 1,424 | 23 | 8 | 1992 | 380 | PVC | 2-Low |
| Gravity Main | P2582 | 5804-5764 Ivory Rd | CCTV | $ | 517 | 23 | 8 | 1992 | 138 | PVC | 2-Low |
| Gravity Main | P2590 | 11299 Rosewood Ave | CCTV | $ | 929 | 23 | 8 | 1992 | 248 | PVC | 2-Low |
| Gravity Main | P5147 | 4702-4726 Rich St | CCTV | $ | 1,264 | 23 | 8 | 1991 | 337 | PVC | 2-Low |
| Gravity Main | P2589 | 5957-5930 Dewpointe Dr | CCTV | $ | 684 | 23 | 8 | 1993 | 182 | PVC | 2-Low |
| Gravity Main | P2192 | 5490 Forest View Dr | CCTV | $ | 1,054 | 23 | 8 | 1990 | 281 | PVC | 2-Low |
| Gravity Main | P5145 | 4750-4774 Rich St | CCTV | $ | 1,230 | 23 | 8 | 1991 | 328 | PVC | 2-Low |
| Gravity Main | P2487 | 5855-5802 Larkspur Ave | CCTV | $ | 971 | 23 | 8 | 1992 | 259 | PVC | 2-Low |
| Gravity Main | P2393 | 11171 Pleasant Point Dr | CCTV | $ | 841 | 23 | 8 | 1992 | 224 | PVC | 2-Low |
| Gravity Main | P2591 | 11349 Rosewood Ave | CCTV | $ | 1,468 | 23 | 8 | 1992 | 391 | PVC | 2-Low |
| Gravity Main | P4940 | 11403-11359 48th Ave | CCTV | $ | 1,115 | 23 | 8 | 1987 | 297 | PVC | 2-Low |
| Gravity Main | P2394 | 11091-11143 Pleasant Point Dr | CCTV | $ | 735 | 23 | 8 | 1992 | 196 | PVC | 2-Low |
| Gravity Main | P2195 | 5780-5752 Forest View Dr | CCTV | $ | 779 | 23 | 8 | 1990 | 208 | PVC | 2-Low |
| Gravity Main | P1993 | 5769-5702 Lynn Dr | CCTV | $ | 881 | 23 | 8 | 2000 | 235 | PVC | 2-Low |
| Gravity Main | P2197 | 11025 Pleasant Point Dr | CCTV | $ | 748 | 23 | 8 | 1990 | 199 | PVC | 2-Low |
| Gravity Main | P5144 | 4774-4802 Rich St | CCTV | $ | 1,321 | 23 | 8 | 1991 | 352 | PVC | 2-Low |
| Gravity Main | P2191 | 10997-11027 Gayle Ln | CCTV | $ | 443 | 23 | 8 | 1990 | 118 | PVC | 2-Low |
| Gravity Main | P5350 | 11651 46th Ave | CCTV | $ | 1,284 | 23 | 8 | 1991 | 343 | PVC | 2-Low |
| Gravity Main | P2290 | 11006 Estate Ct | CCTV | $ | 387 | 23 | 8 | 1990 | 103 | PVC | 2-Low |
| Gravity Main | P1992 | 10815 Melanie Dr | CCTV | $ | 383 | 23 | 8 | 2000 | 102 | PVC | 2-Low |
| Gravity Main | P2583 | 5827-5852 Ivory Rd | CCTV | $ | 336 | 23 | 8 | 1992 | 90 | PVC | 2-Low |
| Gravity Main | P5351 | 11731 46th Ave | CCTV | $ | 1,080 | 23 | 8 | 1991 | 288 | PVC | 2-Low |
| Gravity Main | P2291 | Estate Rd | CCTV | $ | 282 | 23 | 8 | 1990 | 75 | PVC | 2-Low |
| Gravity Main | P2090 | 10962-10997 Gayle Ln | CCTV | $ | 1,226 | 23 | 8 | 2000 | 327 | PVC | 2-Low |
| Gravity Main | P2339 | 11209-11235 Brown St | CCTV | $ | 570 | 23 | 10 | 1990 | 152 | PVC | 2-Low |
| Gravity Main | P2488 | 5881 Larkspur Ave | CCTV | $ | 909 | 23 | 8 | 1992 | 242 | PVC | 2-Low |
| Gravity Main | P1990 | 10901-10965 Melanie Dr | CCTV | $ | 979 | 23 | 8 | 2000 | 261 | PVC | 2-Low |
| Gravity Main | P5250 | 11549 46th Ave | CCTV | $ | 1,496 | 23 | 8 | 1991 | 399 | PVC | 2-Low |
| Gravity Main | P4932 | 11407 48th Ave | CCTV | $ | 255 | 23 | 8 | 2001 | 68 | PVC | 2-Low |
| Gravity Main | P2586 | 11361 Prairie Ave | CCTV | $ | 555 | 23 | 8 | 1993 | 148 | PVC | 2-Low |
| Gravity Main | P2338 | 6915 Lake Michigan Dr | CCTV | $ | 1,444 | 23 | 10 | 1990 | 385 | PVC | 2-Low |
| Gravity Main | P5352 | 11821-11761 46th Ave | CCTV | $ | 1,037 | 23 | 8 | 1991 | 277 | PVC | 2-Low |
| Gravity Main | P2683 | 11385 Prairie Ave | CCTV | $ | 905 | 23 | 8 | 1993 | 241 | PVC | 2-Low |
| Gravity Main | P4845 | 11359-11313 48th Ave | CCTV | $ | 1,127 | 23 | 8 | 1987 | 301 | PVC | 2-Low |
| Gravity Main | P2691 | 11439-11403 Rosewood Ave | CCTV | $ | 1,081 | 23 | 8 | 1990 | 288 | PVC | 2-Low |
| Gravity Main | P2093 | 5727-5670 Mary Eliz Dr | CCTV | $ | 551 | 23 | 8 | 2000 | 147 | PVC | 2-Low |
| Gravity Main | P5356 | 4431-4488 Pingree St | CCTV | $ | 1,039 | 23 | 8 | 1991 | 277 | PVC | 2-Low |
| Gravity Main | P2690 | 11391 Rosewood Ave | CCTV | $ | 505 | 23 | 8 | 1992 | 135 | PVC | 2-Low |
| Gravity Main | P2396 | 5743-5696 Country View Dr | CCTV | $ | 671 | 23 | 8 | 1992 | 179 | PVC | 2-Low |
| Gravity Main | P2395 | 11071-11091 Pleasant Point Dr | CCTV | $ | 317 | 23 | 8 | 1992 | 85 | PVC | 2-Low |
| Gravity Main | P4930 | 4991-4896 Allenpark Dr | CCTV | $ | 1,472 | 23 | 8 | 2001 | 393 | PVC | 2-Low |
| Gravity Main | P2397 | 5696-5663 Country View Dr | CCTV | $ | 505 | 23 | 8 | 1992 | 135 | PVC | 2-Low |
| Gravity Main | P5355 | 4488-4544 Pingree St | CCTV | $ | 1,024 | 23 | 8 | 1991 | 273 | PVC | 2-Low |
| Gravity Main | P2190 | 11113 Gayle Ln | CCTV | $ | 995 | 23 | 8 | 1990 | 265 | PVC | 2-Low |
| Gravity Main | P2399 | 5620-5663 Country View Dr | CCTV | $ | 986 | 23 | 8 | 1992 | 263 | PVC | 2-Low |

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|---|---|---|---|---|---|---|---|---|---|---|---|
| Gravity Main | P5354 | 4572 Pingree St | CCTV | $ | 1,045 | 23 | 8 | 1991 | 279 | PVC | 2-Low |
| Gravity Main | P5357 | 4375-4431 Pingree St | CCTV | $ | 1,007 | 23 | 8 | 1991 | 269 | PVC | 2-Low |
| Gravity Main | P2196 | 5798-5780 Forest View Dr | CCTV | $ | 604 | 23 | 8 | 1990 | 161 | PVC | 2-Low |
| Gravity Main | P2585 | 11351-11281 Prairie Ave | CCTV | $ | 1,444 | 23 | 8 | 1992 | 385 | PVC | 2-Low |
| Gravity Main | P2580 | 5735-5701 Ivory Rd | CCTV | $ | 458 | 23 | 8 | 1992 | 122 | PVC | 2-Low |
| Gravity Main | P1991 | 10865 Melanie Dr | CCTV | $ | 1,062 | 23 | 8 | 2000 | 283 | PVC | 2-Low |
| Gravity Main | P4931 | 4854 Allenpark Dr | CCTV | $ | 1,311 | 23 | 8 | 2001 | 350 | PVC | 2-Low |
| Gravity Main | P2588 | 5930-5443 Dewpointe Dr | CCTV | $ | 801 | 23 | 8 | 1993 | 214 | PVC | 2-Low |
| Gravity Main | P2091 | 5673 Mary Eliz Dr | CCTV | $ | 796 | 23 | 8 | 2000 | 212 | PVC | 2-Low |
| Gravity Main | P2092 | 5670-5634 Mary Eliz Dr | CCTV | $ | 686 | 23 | 8 | 2000 | 183 | PVC | 2-Low |
| Gravity Main | P2194 | 10937 Homestead Ln | CCTV | $ | 1,396 | 23 | 8 | 1990 | 372 | PVC | 2-Low |
| Gravity Main | P2587 | 5443-5016 Dewpointe Dr | CCTV | $ | 694 | 23 | 8 | 1993 | 185 | PVC | 2-Low |
| Gravity Main | P2684 | 11425-11399 Prairie Ave | CCTV | $ | 678 | 23 | 8 | 1993 | 181 | PVC | 2-Low |
| Gravity Main | P2386 | 5976 Country View Dr | CCTV | $ | 1,427 | 23 | 8 | 1992 | 381 | PVC | 2-Low |
| Gravity Main | P4984 | 11478-11529 40th Ave | CCTV | $ | 1,177 | 23 | 8 | 1990 | 314 | PVC | 2-Low |
| Gravity Main | P2584 | 5876 Ivory Rd | CCTV | $ | 629 | 23 | 8 | 1992 | 168 | PVC | 2-Low |
| Gravity Main | P1134 | 11463-11443 48th Ave | CCTV | $ | 474 | 23 | 8 | 1991 | 126 | PVC | 2-Low |
| Gravity Main | P5142 | 11607 48th Ave | CCTV | $ | 240 | 23 | 8 | 1991 | 64 | PVC | 2-Low |
| Gravity Main | P5041 | 11483-11463 48th Ave | CCTV | $ | 546 | 23 | 8 | 1991 | 146 | PVC | 2-Low |
| Gravity Main | P5143 | 11619-11613 48th Ave | CCTV | $ | 142 | 23 | 8 | 1991 | 38 | PVC | 2-Low |
| Gravity Main | P5353 | 11859-11821 46th Ave | CCTV | $ | 663 | 23 | 8 | 1991 | 177 | PVC | 2-Low |
| Gravity Main | P2449 | 6561 Lake Michigan Dr | No Action | $ | - | 23 | 8 | 1990 | 250 | PVC | 2-Low |
| Gravity Main | P2445 | 6561-6635 Lake Michigan Dr | No Action | $ | - | 23 | 8 | 1990 | 398 | PVC | 2-Low |
| Gravity Main | P1083 | 6101 Lake Michigan Dr | No Action | $ | - | 23 | 8 | 2003 | 114 | PVC | 2-Low |
| Gravity Main | P2443 | 6633 Lake Michigan Dr | No Action | $ | - | 23 | 8 | 1990 | 83 | PVC | 2-Low |
| Gravity Main | P2444 | 6633 Lake Michigan Dr | No Action | $ | - | 23 | 8 | 1990 | 262 | PVC | 2-Low |
| Gravity Main | P2470 | 6031 Lake Michigan Dr | No Action | $ | - | 23 | 8 | 2003 | 350 | PVC | 2-Low |
| Manhole | 2080 | 10891 60th Ave | No Action | $ | - | 23 | 0 | 1992 | 0 | Concrete (Reinforced) [CR | 2-Low |
| Manhole | 2382 | 5916 Lake Michigan Dr | No Action | $ | - | 23 | 0 | 1992 | 0 | Concrete (Reinforced) [CR | 2-Low |
| Manhole | 4020 | 10723 52nd Ave | MH Inspection | $ | 536 | 23 | 0 | 2006 | 0 | Not Known [XXX] | 2-Low |
| Manhole | 1178 | 5150 Lake Michigan Dr | MH Inspection | $ | 536 | 23 | 0 | 1992 | 0 | Not Known [XXX] | 2-Low |
| Manhole | 4321 | 5163 Circleview Dr | MH Inspection | $ | 536 | 23 | 0 | 2005 | 0 | Not Known [XXX] | 2-Low |
| Manhole | 4323 | 5103 Circleview Dr | MH Inspection | $ | 536 | 23 | 0 | 2005 | 0 | Not Known [XXX] | 2-Low |
| Manhole | 4325 | 10890 Woodedge Dr | MH Inspection | $ | 536 | 23 | 0 | 2005 | 0 | Not Known [XXX] | 2-Low |
| Manhole | 4420 | 10967 52nd Ave | MH Inspection | $ | 536 | 23 | 0 | 2005 | 0 | Not Known [XXX] | 2-Low |
| Manhole | 2384 | 5768 Lake Michigan Dr | MH Inspection | $ | 536 | 23 | 0 | 1992 | 0 | Not Known [XXX] | 2-Low |
| Manhole | 4615 | 5328 Lake Michigan Dr | MH Inspection | $ | 536 | 23 | 0 | 2001 | 0 | Not Known [XXX] | 2-Low |
| Manhole | 5011 | 5499 Edgeway Dr | MH Inspection | $ | 536 | 23 | 0 | 2000 | 0 | Not Known [XXX] | 2-Low |
| Manhole | 2430 | 11241 Valley View Ave | No Action | $ | - | 23 | 0 | 1992 | 0 | Concrete (Reinforced) [CR | 2-Low |
| Manhole | 2539 | 6725 Scott St | No Action | $ | - | 23 | 0 | 1992 | 0 | Concrete (Reinforced) [CR | 2-Low |
| Manhole | 2784 | 5899 Frostline Dr | No Action | $ | - | 23 | 0 | 1990 | 0 | Concrete (Reinforced) [CR | 2-Low |
| Manhole | 4616 | 5316 Lake Michigan Dr | MH Inspection | $ | 536 | 23 | 0 | 2001 | 0 | Not Known [XXX] | 2-Low |
| Manhole | 2787 | 5821 Frostline Dr | No Action | $ | - | 23 | 0 | 1990 | 0 | Concrete (Reinforced) [CR | 2-Low |
| Manhole | 2983 | 11571 60th Ave | MH Inspection | $ | 536 | 23 | 0 | 2006 | 0 | Not Known [XXX] | 2-Low |
| Manhole | 3740 | 10471 48th Ave | MH Inspection | $ | 536 | 23 | 0 | 2001 | 0 | Not Known [XXX] | 2-Low |

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|---|---|---|---|---|---|---|---|---|---|---|---|
| Manhole | 4539 | 4868 Lake Michigan Dr | MH Inspection | $ | 536 | 23 | 0 | 2001 | 0 | Not Known [XXX] | 2-Low |
| Manhole | 1822 | 7112 Pine Grove St | MH Inspection | $ | 536 | 23 | 0 | 2004 | 0 | Not Known [XXX] | 2-Low |
| Manhole | 4202 | 10783 Lance Ave | MH Inspection | $ | 536 | 23 | 0 | 2005 | 0 | Not Known [XXX] | 2-Low |
| Manhole | 4203 | 10701 Lance Ave | MH Inspection | $ | 536 | 23 | 0 | 2005 | 0 | Not Known [XXX] | 2-Low |
| Manhole | 4210 | 10887 Douglas Dr | MH Inspection | $ | 536 | 23 | 0 | 2004 | 0 | Not Known [XXX] | 2-Low |
| Manhole | 4853 | 4687 Ottawa Creek Dr | MH Inspection | $ | 536 | 23 | 0 | 2012 | 0 | Not Known [XXX] | 2-Low |
| Manhole | 4840 | 4878 Becker Dr | MH Inspection | $ | 536 | 23 | 0 | 2004 | 0 | Not Known [XXX] | 2-Low |
| Gravity Main | P1175 | 6812-6802 Joal St | No Action | $ | - | 23 | 8 | 1990 | 43 | PVC | 2-Low |
| Gravity Main | P2055 | 6524-6606 Mista Dr | No Action | $ | - | 23 | 8 | 1995 | 283 | PVC | 2-Low |
| Gravity Main | P2052 | 6710 Mista Dr | No Action | $ | - | 23 | 8 | 1995 | 307 | PVC | 2-Low |
| Gravity Main | P1951 | 6599-6587 Winans St | No Action | $ | - | 23 | 8 | 1992 | 371 | PVC | 2-Low |
| Gravity Main | P2142 | 6799 Mista Dr | No Action | $ | - | 23 | 8 | 1992 | 121 | PVC | 2-Low |
| Gravity Main | P2140 | 6698-6605 Henry St | No Action | $ | - | 23 | 8 | 1992 | 266 | PVC | 2-Low |
| Gravity Main | P1089 | 5812-5850 Country View Dr | CCTV | $ | 712 | 23 | 8 | 1992 | 190 | PVC | 2-Low |
| Gravity Main | P2787 | 5821-5859 Frostline Dr | CCTV | $ | 1,301 | 23 | 8 | 1990 | 347 | PVC | 2-Low |
| Gravity Main | P2593 | 5710-5720 Victoria St | CCTV | $ | 480 | 23 | 8 | 2000 | 128 | PVC | 2-Low |
| Gravity Main | P2785 | 5859-5899 Frostline Dr | CCTV | $ | 629 | 23 | 8 | 1990 | 168 | PVC | 2-Low |
| Gravity Main | P2788 | 11481 Prairie Ave | CCTV | $ | 1,177 | 23 | 8 | 1990 | 314 | PVC | 2-Low |
| Gravity Main | P2781 | 5953-5965 Frostline Dr | CCTV | $ | 448 | 23 | 8 | 1990 | 119 | PVC | 2-Low |
| Gravity Main | P2782 | 5931-5953 Frostline Dr | CCTV | $ | 429 | 23 | 8 | 1990 | 114 | PVC | 2-Low |
| Gravity Main | P4536 | 11191 Stanford Ave | CCTV | $ | 539 | 23 | 8 | 1966 | 144 | VCP | 2-Low |
| Gravity Main | P2681 | 11369-11465 Hunters Meadow Dr | CCTV | $ | 1,257 | 23 | 8 | 1990 | 335 | PVC | 2-Low |
| Gravity Main | P2780 | 5965-5995 Frostline Dr | CCTV | $ | 1,089 | 23 | 8 | 1990 | 291 | PVC | 2-Low |
| Gravity Main | P4535 | 11003-11011 Radcliff Dr | CCTV | $ | 950 | 23 | 8 | 1966 | 253 | VCP | 2-Low |
| Gravity Main | P1109 | 11071-11101 Radcliff Dr | CCTV | $ | 1,139 | 23 | 8 | 1966 | 304 | VCP | 2-Low |
| Gravity Main | P1110 | 11041-11071 Radcliff Dr | CCTV | $ | 1,154 | 23 | 8 | 1966 | 308 | VCP | 2-Low |
| Gravity Main | P4876 | 3994 Ravine Dr | CCTV | $ | 926 | 23 | 8 | 1990 | 247 | PVC | 2-Low |
| Gravity Main | P4533 | 11101-11137 Radcliff Dr | CCTV | $ | 653 | 23 | 8 | 1966 | 174 | VCP | 2-Low |
| Gravity Main | P2390 | 5813-5812 Country View Dr | CCTV | $ | 275 | 23 | 8 | 1992 | 73 | PVC | 2-Low |
| Gravity Main | P4800 | 11307-11253 56th Ave | CCTV | $ | 1,381 | 23 | 8 | 1992 | 368 | PVC | 2-Low |
| Gravity Main | P2790 | 5755-5821 Frostline Dr | CCTV | $ | 608 | 23 | 8 | 1990 | 162 | PVC | 2-Low |
| Gravity Main | P2784 | 5899-5931 Frostline Dr | CCTV | $ | 520 | 23 | 8 | 1990 | 139 | PVC | 2-Low |
| Gravity Main | P2791 | 5711-5755 Frostline Dr | CCTV | $ | 384 | 23 | 8 | 1990 | 102 | PVC | 2-Low |
| Gravity Main | P4802 | 11417-11363 56th Ave | CCTV | $ | 1,382 | 23 | 8 | 1992 | 369 | PVC | 2-Low |
| Gravity Main | P4801 | 11363-11307 56th Ave | CCTV | $ | 1,349 | 23 | 8 | 1992 | 360 | PVC | 2-Low |
| Gravity Main | P2592 | 11293 Cameron Ave | CCTV | $ | 1,133 | 23 | 8 | 2000 | 302 | PVC | 2-Low |
| Gravity Main | P2693 | 11385-11275 Cameron Ave | CCTV | $ | 1,167 | 23 | 8 | 2000 | 311 | PVC | 2-Low |
| Gravity Main | P2783 | 5934-5931 Frostline Dr | CCTV | $ | 548 | 23 | 8 | 1990 | 146 | PVC | 2-Low |
| Gravity Main | P2682 | 11513 Hunters Meadow Dr | CCTV | $ | 1,244 | 23 | 8 | 1990 | 332 | PVC | 2-Low |
| Gravity Main | P4532 | 11137-11151 Radcliff Dr | CCTV | $ | 422 | 23 | 8 | 1966 | 113 | VCP | 2-Low |
| Gravity Main | P2694 | 11409 Cameron Ave | CCTV | $ | 1,157 | 23 | 8 | 2000 | 308 | PVC | 2-Low |
| Gravity Main | P2984 | 11659-11587 Brookland Ct | CCTV | $ | 1,136 | 23 | 8 | 2003 | 303 | PVC | 2-Low |
| Gravity Main | P4534 | 11011-11041 Radcliff Dr | CCTV | $ | 1,111 | 23 | 8 | 1966 | 296 | VCP | 2-Low |
| Gravity Main | P2786 | 11463 Eagle Nest Ct | CCTV | $ | 1,055 | 23 | 8 | 1990 | 281 | PVC | 2-Low |
| Gravity Main | P2695 | 5702-5732 Crabtree St | CCTV | $ | 567 | 23 | 8 | 2000 | 151 | PVC | 2-Low |

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|---|---|---|---|---|---|---|---|---|---|---|---|
| Gravity Main | P2594 | 11235 Cameron Ave | CCTV | $ | 1,170 | 23 | 8 | 2000 | 312 | PVC | 2-Low |
| Gravity Main | P4872 | 3985 River Ridge Ct | CCTV | $ | 606 | 23 | 8 | 1990 | 161 | PVC | 2-Low |
| Gravity Main | P2389 | 5850-5900 Country View Dr | CCTV | $ | 1,197 | 23 | 8 | 1992 | 319 | PVC | 2-Low |
| Gravity Main | P2696 | 11515 Cameron Ave | CCTV | $ | 1,268 | 23 | 8 | 2000 | 338 | PVC | 2-Low |
| Gravity Main | P2692 | 11553-11439 Rosewood Ave | CCTV | $ | 1,243 | 23 | 8 | 1990 | 331 | PVC | 2-Low |
| Gravity Main | P1079 | 11575 Spruce View Dr | CCTV | $ | 725 | 23 | 8 | 2003 | 193 | PVC | 2-Low |
| Gravity Main | P2982 | 11637-11571 60th Ave | No Action | $ | - | 22 | 10 | 2008 | 134 | PVC | 2-Low |
| Gravity Main | P4843 | 4829 Becker Dr | No Action | $ | - | 22 | 8 | 2004 | 401 | PVC | 2-Low |
| Gravity Main | P3813 | 5364-5324 Windfield Dr | No Action | $ | - | 22 | 8 | 2006 | 191 | PVC | 2-Low |
| Gravity Main | P3810 | 5252-5202 Windfield Dr | No Action | $ | - | 22 | 8 | 2006 | 317 | PVC | 2-Low |
| Gravity Main | P4415 | 5278-5270 Jordan St | No Action | $ | - | 22 | 8 | 1994 | 155 | PVC | 2-Low |
| Gravity Main | P4416 | 5270-5202 Jordan St | No Action | $ | - | 22 | 8 | 1994 | 284 | PVC | 2-Low |
| Gravity Main | P2293 | 11091 56th Ave | No Action | $ | - | 22 | 8 | 1990 | 284 | PVC | 2-Low |
| Gravity Main | P4414 | 5286-5278 Jordan St | No Action | $ | - | 22 | 8 | 1994 | 136 | PVC | 2-Low |
| Gravity Main | P9015 | 10830 68th Ave | No Action | $ | - | 22 | 8 | 1990 | 39 | PVC | 2-Low |
| Gravity Main | P9014 | 6803 Sunset Dr | No Action | $ | - | 22 | 8 | 1990 | 30 | PVC | 2-Low |
| Gravity Main | P1090 | 11135 56th Ave | No Action | $ | - | 22 | 8 | 1990 | 281 | PVC | 2-Low |
| Gravity Main | P4413 | 5292-5286 Jordan St | No Action | $ | - | 22 | 8 | 1994 | 135 | PVC | 2-Low |
| Gravity Main | P4340 | 10929-10975 48th Ave | CCTV | $ | 1,242 | 22 | 12 | 1987 | 331 | PVC | 2-Low |
| Gravity Main | P9600 | 11342 Brown St | CCTV | $ | 786 | 22 | 8 | 1992 | 210 | PVC | 2-Low |
| Gravity Main | P2789 | 11453-11463 Prairie Ave | CCTV | $ | 307 | 22 | 8 | 1990 | 82 | PVC | 2-Low |
| Gravity Main | P1919 | 7163-7145 Pinevalley Dr | No Action | $ | - | 22 | 8 | 2004 | 99 | PVC | 2-Low |
| Gravity Main | P1918 | 7187-7163 Pinevalley Dr | No Action | $ | - | 22 | 8 | 2004 | 162 | PVC | 2-Low |
| Gravity Main | P1047 | 7128 Pinevalley Dr | No Action | $ | - | 22 | 10 | 2004 | 278 | PVC | 2-Low |
| Gravity Main | P1823 | 7151-7112 Pine Grove St | No Action | $ | - | 22 | 10 | 2004 | 143 | PVC | 2-Low |
| Manhole | 2590 | 11319 Rosewood Ave | No Action | $ | - | 22 | 0 | 1992 | 0 | Concrete (Reinforced) [CR | 2-Low |
| Manhole | 2633 | 11495 Brown St | No Action | $ | - | 22 | 0 | 1992 | 0 | Concrete (Reinforced) [CR | 2-Low |
| Manhole | 2637 | 11431 Brown St | No Action | $ | - | 22 | 0 | 1992 | 0 | Concrete (Reinforced) [CR | 2-Low |
| Manhole | 5142 | 11613 48th Ave | MH Inspection | $ | 536 | 22 | 0 | 1991 | 0 | Not Known [XXX] | 2-Low |
| Manhole | 5351 | 11761 46th Ave | MH Inspection | $ | 536 | 22 | 0 | 1991 | 0 | Not Known [XXX] | 2-Low |
| Manhole | 1085 | 5995 Frostline Dr | MH Inspection | $ | 536 | 22 | 0 | 1990 | 0 | Not Known [XXX] | 2-Low |
| Manhole | 1784 | 5884 Maple Bend Trl | MH Inspection | $ | 536 | 22 | 0 | 1998 | 0 | Not Known [XXX] | 2-Low |
| Manhole | 1825 | 10821 Timberline Dr | MH Inspection | $ | 536 | 22 | 0 | 1996 | 0 | Not Known [XXX] | 2-Low |
| Manhole | 4810 | Edgewater Dr | MH Inspection | $ | 536 | 22 | 0 | 2000 | 0 | Not Known [XXX] | 2-Low |
| Manhole | 4811 | 11327 Edgewater Dr | MH Inspection | $ | 536 | 22 | 0 | 2000 | 0 | Not Known [XXX] | 2-Low |
| Manhole | 1990 | 10901 Melanie Dr | MH Inspection | $ | 536 | 22 | 0 | 2000 | 0 | Not Known [XXX] | 2-Low |
| Manhole | 2093 | 5727 Mary Eliz Dr | MH Inspection | $ | 536 | 22 | 0 | 2000 | 0 | Not Known [XXX] | 2-Low |
| Manhole | 2095 | 10801 Mary Eliz Ct | MH Inspection | $ | 536 | 22 | 0 | 2000 | 0 | Not Known [XXX] | 2-Low |
| Manhole | 2096 | 10965 Melanie Dr | MH Inspection | $ | 536 | 22 | 0 | 2000 | 0 | Not Known [XXX] | 2-Low |
| Gravity Main | P2572 | 11397-11361 60th Ave | No Action | $ | - | 22 | 10 | 1990 | 149 | PVC | 2-Low |
| Gravity Main | P4519 | 11060-11059 52nd Ave | Full Lining | $ | 7,998 | 22 | 8 | 2006 | 187 | PVC | 2-Low |
| Gravity Main | P2292 | 8420 Estate Rd | No Action | $ | - | 22 | 8 | 1990 | 377 | PVC | 2-Low |
| Gravity Main | P4409 | 5158-5102 Jordan St | No Action | $ | - | 22 | 8 | 2000 | 127 | PVC | 2-Low |
| Gravity Main | P5014 | 5201-5307 Edgeway Dr | No Action | $ | - | 22 | 10 | 2000 | 399 | PVC | 2-Low |
| Gravity Main | P4402 | 5456-5532 Jordan St | No Action | $ | - | 22 | 8 | 1996 | 172 | PVC | 2-Low |

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|---|---|---|---|---|---|---|---|---|---|---|---|
| Gravity Main | P4910 | 11291-11149 54th Ave | No Action | $ | - | 22 | 10 | 2000 | 212 | PVC | 2-Low |
| Gravity Main | P4811 | 11251 Edgewater Dr | No Action | $ | - | 22 | 10 | 2000 | 336 | PVC | 2-Low |
| Gravity Main | P4508 | 5520-5538 Estate Rd | No Action | $ | - | 22 | 8 | 1995 | 121 | PVC | 2-Low |
| Gravity Main | P5013 | 5307-5405 Edgeway Dr | No Action | $ | - | 22 | 10 | 2000 | 292 | PVC | 2-Low |
| Gravity Main | P1127 | 11149-11008 54th Ave | No Action | $ | - | 22 | 10 | 2000 | 421 | PVC | 2-Low |
| Gravity Main | P4505 | 5502-5566 Eric St | No Action | $ | - | 22 | 8 | 2000 | 310 | PVC | 2-Low |
| Gravity Main | P4813 | 5373 Edgewater Dr | No Action | $ | - | 22 | 10 | 2000 | 173 | PVC | 2-Low |
| Gravity Main | P4504 | 5566-5596 Eric St | No Action | $ | - | 22 | 8 | 2000 | 145 | PVC | 2-Low |
| Gravity Main | P4501 | 11150 56th Ave | No Action | $ | - | 22 | 8 | 1990 | 188 | PVC | 2-Low |
| Gravity Main | P4411 | 11043 Jordan Ct | No Action | $ | - | 22 | 8 | 2000 | 307 | PVC | 2-Low |
| Gravity Main | P1086 | 10723-10709 60th Ave | No Action | $ | - | 22 | 8 | 1992 | 151 | PVC | 2-Low |
| Gravity Main | P4512 | 5452-5478 Eric St | No Action | $ | - | 22 | 8 | 2000 | 180 | PVC | 2-Low |
| Gravity Main | P4310 | 10943-10991 Jordan Ct | No Action | $ | - | 22 | 8 | 2000 | 327 | PVC | 2-Low |
| Gravity Main | P4417 | 11027 Summer Brook Ct | No Action | $ | - | 22 | 8 | 1994 | 121 | PVC | 2-Low |
| Gravity Main | P4509 | 5502-5520 Estate Rd | No Action | $ | - | 22 | 8 | 1995 | 110 | PVC | 2-Low |
| Gravity Main | P4506 | 5568-5654 Estate Rd | No Action | $ | - | 22 | 8 | 1995 | 194 | PVC | 2-Low |
| Gravity Main | P1582 | 10537-10565 60th Ave | No Action | $ | - | 22 | 8 | 1992 | 193 | PVC | 2-Low |
| Gravity Main | P5011 | 11839 54th Ave | No Action | $ | - | 22 | 10 | 2000 | 254 | PVC | 2-Low |
| Gravity Main | P4503 | 5596-5560 Eric St | No Action | $ | - | 22 | 8 | 2000 | 154 | PVC | 2-Low |
| Gravity Main | P4401 | 11038 Lance Ave | No Action | $ | - | 22 | 8 | 1996 | 278 | PVC | 2-Low |
| Gravity Main | P4400 | 5557-5532 Jordan St | No Action | $ | - | 22 | 8 | 1996 | 214 | PVC | 2-Low |
| Gravity Main | P4507 | 5538-5568 Estate Rd | No Action | $ | - | 22 | 8 | 1995 | 183 | PVC | 2-Low |
| Gravity Main | P4510 | 5525 Estate Rd | No Action | $ | - | 22 | 8 | 1996 | 169 | PVC | 2-Low |
| Gravity Main | P4418 | 11063-11055 Summer Brook Ct | No Action | $ | - | 22 | 8 | 1994 | 105 | PVC | 2-Low |
| Gravity Main | P4812 | 11365 Edgewater Dr | No Action | $ | - | 22 | 10 | 2000 | 180 | PVC | 2-Low |
| Gravity Main | P4511 | 5478-5502 Eric St | No Action | $ | - | 22 | 8 | 2000 | 144 | PVC | 2-Low |
| Gravity Main | P2035 | 6930-6868 Joal St | No Action | $ | - | 22 | 8 | 1995 | 319 | PVC | 2-Low |
| Gravity Main | P4311 | 10807-10943 Jordan Ct | No Action | $ | - | 22 | 8 | 2000 | 186 | PVC | 2-Low |
| Gravity Main | P2024 | 7130-7100 Timbercreek Dr | No Action | $ | - | 22 | 8 | 2004 | 344 | PVC | 2-Low |
| Gravity Main | P1820 | 10829-10807 Timberline Dr | No Action | $ | - | 22 | 8 | 2008 | 233 | PVC | 2-Low |
| Gravity Main | P2023 | 7144-7130 Timbercreek Dr | No Action | $ | - | 22 | 8 | 2004 | 137 | PVC | 2-Low |
| Gravity Main | P2221 | 11185-11093 Timberline Dr | No Action | $ | - | 22 | 8 | 2004 | 347 | PVC | 2-Low |
| Gravity Main | P2222 | 11199 Timberline Dr | No Action | $ | - | 22 | 8 | 2004 | 97 | PVC | 2-Low |
| Manhole | 1127 | 11149 54th Ave | MH Inspection | $ | 536 | 21 | 0 | 2000 | 0 | Not Known [XXX] | 2-Low |
| Manhole | 4814 | 5200 Edgewater Dr | MH Inspection | $ | 536 | 21 | 0 | 2000 | 0 | Not Known [XXX] | 2-Low |
| Manhole | 4910 | 11291 54th Ave | MH Inspection | $ | 536 | 21 | 0 | 2000 | 0 | Not Known [XXX] | 2-Low |
| Manhole | 5010 | 11671 54th Ave | MH Inspection | $ | 536 | 21 | 0 | 2000 | 0 | Not Known [XXX] | 2-Low |
| Manhole | 2226 | 11122 Creekside Ct | MH Inspection | $ | 536 | 21 | 0 | 2004 | 0 | Not Known [XXX] | 2-Low |
| Manhole | 4408 | 10959 Lance Ave | MH Inspection | $ | 536 | 21 | 0 | 2005 | 0 | Not Known [XXX] | 2-Low |
| Manhole | 4409 | 5158 Jordan St | MH Inspection | $ | 536 | 21 | 0 | 2000 | 0 | Not Known [XXX] | 2-Low |
| Manhole | 9002 | 7050 Pinevalley Dr | MH Inspection | $ | 536 | 21 | 0 | 1996 | 0 | Not Known [XXX] | 2-Low |
| Manhole | 1916 | 7243 Pinevalley Dr | MH Inspection | $ | 536 | 21 | 0 | 2004 | 0 | Not Known [XXX] | 2-Low |
| Gravity Main | P5017 | 11550-11523 53rd Ave | No Action | $ | - | 21 | 8 | 2000 | 205 | PVC | 2-Low |
| Gravity Main | P4707 | 11339 Commerce Rd | No Action | $ | - | 21 | 8 | 2001 | 127 | PVC | 2-Low |
| Gravity Main | P2099 | 10975-11017 56th Ave | No Action | $ | - | 21 | 8 | 1990 | 280 | PVC | 2-Low |

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|---|---|---|---|---|---|---|---|---|---|---|---|
| Gravity Main | P1922 | 6994-7072 Aspen St | No Action | $ | - | 21 | 8 | 2001 | 219 | PVC | 2-Low |
| Gravity Main | P4704 | 11297-11277 Commerce Rd | No Action | $ | - | 21 | 8 | 2001 | 140 | PVC | 2-Low |
| Gravity Main | P5016 | 11523-11547 53rd Ave | No Action | $ | - | 21 | 8 | 2000 | 193 | PVC | 2-Low |
| Gravity Main | P2249 | 6606-6698 Henry St | No Action | $ | - | 21 | 12 | 1990 | 394 | PVC | 2-Low |
| Manhole | 4060 | 4546 W Campus Dr | No Action | $ | - | 21 | 0 | 1963 | 0 | Concrete (Reinforced) [CR | 2-Low |
| Manhole | 4518 | 11059 52nd Ave | No Action | $ | - | 21 | 0 | 1990 | 0 | Concrete (Reinforced) [CR | 2-Low |
| Manhole | 4740 | 11227 48th Ave | No Action | $ | - | 21 | 0 | 1987 | 0 | Concrete (Reinforced) [CR | 2-Low |
| Manhole | 2785 | 5859 Frostline Dr | No Action | $ | - | 21 | 0 | 1990 | 0 | Concrete (Reinforced) [CR | 2-Low |
| Gravity Main | P3932 | Campus West Apartments | No Action | $ | - | 21 | 8 | 1990 | 231 | PVC | 2-Low |
| Gravity Main | P1786 | 5841-5863 Maple Bend Trl | No Action | $ | - | 21 | 8 | 1998 | 123 | PVC | 2-Low |
| Gravity Main | P2244 | 6676 Lake Michigan Dr | Full Lining | $ | 2,775 | 21 | 10 | 1990 | 52 | CAST IRON | 2-Low |
| Gravity Main | P2161 | 11003-11015 64th Ave | No Action | $ | - | 20 | 10 | 1990 | 161 | PVC | 2-Low |
| Gravity Main | P2160 | 11033 64th Ave | No Action | $ | - | 20 | 10 | 1990 | 310 | PVC | 2-Low |
| Gravity Main | P2163 | 10991-11003 64th Ave | No Action | $ | - | 20 | 10 | 1990 | 66 | PVC | 2-Low |
| Gravity Main | P3840 | 10489-10561 48th Ave | CCTV | $ | 1,176 | 20 | 10 | 2001 | 314 | PVC | 2-Low |
| Gravity Main | P3832 | 10511 Country Pl W | CCTV | $ | 1,289 | 20 | 10 | 1997 | 344 | PVC | 2-Low |
| Gravity Main | P4980 | 11428 Cadence Ct | CCTV | $ | 1,017 | 20 | 10 | 1990 | 271 | PVC | 2-Low |
| Gravity Main | P1115 | 10445 48th Ave | CCTV | $ | 800 | 20 | 10 | 2001 | 213 | PVC | 2-Low |
| Gravity Main | P3834 | 4912 Country Pl N | CCTV | $ | 967 | 20 | 10 | 1997 | 258 | PVC | 2-Low |
| Gravity Main | P1114 | 10445-10471 48th Ave | CCTV | $ | 326 | 20 | 10 | 2001 | 87 | PVC | 2-Low |
| Gravity Main | P2491 | 5673 Lake Michigan Dr | Upsize | $ | 79,115 | 20 | 18 | 1990 | 231 | VCP | 2-Low |
| Gravity Main | P2481 | 5864-5836 Larkspur Ave | Upsize | $ | 118,362 | 20 | 18 | 1990 | 345 | VCP | 2-Low |
| Force Main | FM10 | 7053 Sunset Dr | Upsize | $ | 178,922 | 20 | 4 | 2008 | 619 | DUCTILE IRON | 2-Low |
| Gravity Main | P2441 | 11305-11243 Avery Ave | No Action | $ | - | 20 | 8 | 1990 | 321 | PVC | 2-Low |
| Gravity Main | P9011 | 6101 Lake Michigan Dr | No Action | $ | - | 20 | 8 | 2003 | 219 | PVC | 2-Low |
| Gravity Main | P4705 | 11301-11297 Commerce Rd | Full Lining | $ | 15,825 | 20 | 8 | 2001 | 369 | PVC | 2-Low |
| Manhole | 4361 | 1 Campus Dr | MH Repair+Lining | $ | 4,574 | 20 | 0 | 1963 | 0 | Concrete (Reinforced) [CR | 2-Low |
| Manhole | 2360 | 11151 64th Ave | No Action | $ | - | 20 | 0 | 1990 | 0 | Concrete (Reinforced) [CR | 2-Low |
| Manhole | 4608 | 11205 Commerce Rd | No Action | $ | - | 20 | 0 | 1992 | 0 | Concrete (Reinforced) [CR | 2-Low |
| Manhole | 2685 | 11441 Prairie Ave | No Action | $ | - | 20 | 0 | 1993 | 0 | Concrete (Reinforced) [CR | 2-Low |
| Manhole | 2791 | 5711 Frostline Dr | No Action | $ | - | 20 | 0 | 1990 | 0 | Concrete (Reinforced) [CR | 2-Low |
| Manhole | 2033 | 7060 Joal St | No Action | $ | - | 20 | 0 | 1995 | 0 | Concrete (Reinforced) [CR | 2-Low |
| Manhole | 2160 | 11015 64th Ave | No Action | $ | - | 20 | 0 | 1990 | 0 | Concrete (Reinforced) [CR | 2-Low |
| Gravity Main | P2121 | 10969 Creekside Dr | No Action | $ | - | 20 | 8 | 1995 | 302 | PVC | 2-Low |
| Gravity Main | P2228 | 11043-11025 Creekside Dr | No Action | $ | - | 20 | 8 | 1995 | 184 | PVC | 2-Low |
| Gravity Main | P9003 | 7018 Timbercreek Dr | No Action | $ | - | 20 | 8 | 1995 | 180 | PVC | 2-Low |
| Gravity Main | P1827 | 7005-7055 Sunset Dr | No Action | $ | - | 20 | 8 | 1996 | 250 | PVC | 2-Low |
| Gravity Main | P1962 | 10869 64th Ave | No Action | $ | - | 20 | 8 | 1990 | 300 | PVC | 2-Low |
| Gravity Main | P2360 | 11093 64th Ave | No Action | $ | - | 20 | 8 | 1990 | 401 | PVC | 2-Low |
| Gravity Main | P4981 | 3927 Ravine Dr | CCTV | $ | 442 | 20 | 8 | 1990 | 118 | PVC | 2-Low |
| Gravity Main | P4654 | 4477 Lake Michigan Dr | CCTV | $ | 313 | 20 | 8 | 1990 | 84 | PVC | 2-Low |
| Gravity Main | P4650 | 4565 Lake Michigan Dr | CCTV | $ | 1,062 | 20 | 8 | 1990 | 283 | PVC | 2-Low |
| Gravity Main | P4874 | 11375 River Ridge Dr | CCTV | $ | 1,104 | 20 | 8 | 1990 | 294 | PVC | 2-Low |
| Gravity Main | P1136 | 11378-11368 48th Ave | CCTV | $ | 722 | 20 | 8 | 2000 | 193 | PVC | 2-Low |
| Gravity Main | P1135 | 11368-11410 48th Ave | CCTV | $ | 795 | 20 | 8 | 2000 | 212 | PVC | 2-Low |

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| Gravity Main | P1126 | 4477-4473 Lake Michigan Dr | CCTV | $ | 796 | 20 | 8 | 1990 | 212 | PVC | 2-Low |
| Gravity Main | P4875 | 3962-3934 Ravine Dr | CCTV | $ | 683 | 20 | 8 | 1990 | 182 | PVC | 2-Low |
| Gravity Main | P4873 | 11335 River Ridge Dr | CCTV | $ | 1,137 | 20 | 8 | 1990 | 303 | PVC | 2-Low |
| Gravity Main | P4653 | 4477 Lake Michigan Dr | CCTV | $ | 378 | 20 | 8 | 1990 | 101 | PVC | 2-Low |
| Gravity Main | P4840 | 4878-4857 Becker Dr | No Action | $ | - | 20 | 8 | 2004 | 170 | PVC | 2-Low |
| Gravity Main | P2242 | Lake Michigan Dr | No Action | $ | - | 19 | 12 | 1990 | 297 | PVC | 2-Low |
| Gravity Main | P2243 | 6676 Lake Michigan Dr | No Action | $ | - | 19 | 12 | 1990 | 297 | PVC | 2-Low |
| Gravity Main | P3635 | 4997-5013 Pierce St | CCTV | $ | 611 | 19 | 8 | 2014 | 163 | PVC | 2-Low |
| Gravity Main | P3634 | 5013 Pierce St | CCTV | $ | 220 | 19 | 8 | 2014 | 59 | PVC | 2-Low |
| Gravity Main | P3631 | 5045 Pierce St | CCTV | $ | 209 | 19 | 8 | 2014 | 56 | PVC | 2-Low |
| Gravity Main | P1821 | 10836 Timberline Dr | CCTV | $ | 247 | 19 | 8 | 2008 | 66 | PVC | 2-Low |
| Manhole | 1821 | 10807 Timberline Dr | MH Inspection | $ | 536 | 19 | 0 | 1996 | 0 | Not Known [XXX] | 2-Low |
| Manhole | 4617 | 5270 Lake Michigan Dr | MH Inspection | $ | 536 | 19 | 0 | 2001 | 0 | Not Known [XXX] | 2-Low |
| Manhole | 2021 | 7173 Timbercreek Dr | MH Inspection | $ | 536 | 19 | 0 | 2004 | 0 | Not Known [XXX] | 2-Low |
| Manhole | 2026 | 10979 Timberline Dr | MH Inspection | $ | 536 | 19 | 0 | 1996 | 0 | Not Known [XXX] | 2-Low |
| Manhole | 2027 | 10929 Timberline Dr | MH Inspection | $ | 536 | 19 | 0 | 1996 | 0 | Not Known [XXX] | 2-Low |
| Manhole | 2695 | 5702 Crabtree St | MH Inspection | $ | 536 | 19 | 0 | 2000 | 0 | Not Known [XXX] | 2-Low |
| Manhole | 3624 | 5083 Pierce St | MH Inspection | $ | 536 | 19 | 0 | 2006 | 0 | Not Known [XXX] | 2-Low |
| Manhole | 4931 | 4896 Allenpark Dr | MH Inspection | $ | 536 | 19 | 0 | 2001 | 0 | Not Known [XXX] | 2-Low |
| Manhole | 1125 | 10963 52nd Ave | MH Inspection | $ | 536 | 19 | 0 | 2005 | 0 | Not Known [XXX] | 2-Low |
| Manhole | 1130 | 11239 Whispering Creek Dr | MH Inspection | $ | 536 | 19 | 0 | 2012 | 0 | Not Known [XXX] | 2-Low |
| Gravity Main | P2450 | 6561 Lake Michigan Dr | CCTV | $ | 262 | 19 | 8 | 1990 | 70 | PVC | 2-Low |
| Gravity Main | P4878 | 11375-11377 40th Ave | CCTV | $ | 379 | 19 | 8 | 1990 | 101 | PVC | 2-Low |
| Gravity Main | P4539 | 4868-4850 Lake Michigan Dr | CCTV | $ | 1,429 | 19 | 8 | 2001 | 381 | PVC | 2-Low |
| Gravity Main | P2492 | 5677-5673 Lake Michigan Dr | CCTV | $ | 388 | 19 | 8 | 2000 | 103 | PVC | 2-Low |
| Gravity Main | P4877 | 11377-11405 40th Ave | CCTV | $ | 516 | 19 | 8 | 1990 | 138 | PVC | 2-Low |
| Gravity Main | P2246 | 6676 Lake Michigan Dr | CCTV | $ | 1,024 | 19 | 8 | 1992 | 273 | PVC | 2-Low |
| Gravity Main | P1080 | 11562-11547 Spruce View Dr | CCTV | $ | 689 | 19 | 8 | 2003 | 184 | PVC | 2-Low |
| Gravity Main | P4233 | Village Center Dr | No Action | $ | - | 19 | 8 | 2007 | 384 | PVC | 2-Low |
| Gravity Main | P4337 | Northside Dr | No Action | $ | - | 19 | 8 | 2007 | 185 | PVC | 2-Low |
| Gravity Main | P4336 | Northside Dr | No Action | $ | - | 19 | 8 | 2007 | 149 | PVC | 2-Low |
| Gravity Main | P4335 | Northside Dr | No Action | $ | - | 19 | 8 | 2007 | 144 | PVC | 2-Low |
| Gravity Main | P3812 | 5324-5288 Windfield Dr | No Action | $ | - | 19 | 8 | 2006 | 269 | PVC | 2-Low |
| Gravity Main | P4230 | Southtown Dr | No Action | $ | - | 19 | 8 | 2007 | 193 | PVC | 2-Low |
| Gravity Main | P4223 | Southtown Dr | No Action | $ | - | 19 | 8 | 2007 | 93 | PVC | 2-Low |
| Gravity Main | P4330 | Northside Dr | No Action | $ | - | 19 | 8 | 2007 | 193 | PVC | 2-Low |
| Gravity Main | P4135 | Meadows Xing | No Action | $ | - | 19 | 8 | 2008 | 300 | PVC | 2-Low |
| Gravity Main | P3811 | 5288-5252 Windfield Dr | No Action | $ | - | 19 | 8 | 2006 | 218 | PVC | 2-Low |
| Gravity Main | P4134 | Meadows Xing | No Action | $ | - | 19 | 8 | 2008 | 302 | PVC | 2-Low |
| Gravity Main | P4136 | Meadows Xing | No Action | $ | - | 19 | 8 | 2008 | 305 | PVC | 2-Low |
| Gravity Main | P4225 | Southtown Dr | No Action | $ | - | 19 | 8 | 2007 | 149 | PVC | 2-Low |
| Gravity Main | P4329 | Northside Dr | No Action | $ | - | 19 | 8 | 2007 | 98 | PVC | 2-Low |
| Gravity Main | P4334 | Northside Dr | No Action | $ | - | 19 | 8 | 2007 | 248 | PVC | 2-Low |
| Gravity Main | P4132 | Meadows Xing | No Action | $ | - | 19 | 8 | 2008 | 377 | PVC | 2-Low |
| Gravity Main | P4338 | 10897 48th Ave | No Action | $ | - | 19 | 8 | 2007 | 102 | PVC | 2-Low |

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|---|---|---|---|---|---|---|---|---|---|---|---|
| Gravity Main | P1107 | Southtown Dr | No Action | $ | - | 19 | 8 | 2007 | 252 | PVC | 2-Low |
| Gravity Main | P4232 | A273 Village Center Dr | No Action | $ | - | 19 | 8 | 2007 | 328 | PVC | 2-Low |
| Gravity Main | P4224 | Southtown Dr | No Action | $ | - | 19 | 8 | 2007 | 70 | PVC | 2-Low |
| Gravity Main | P3814 | 5396-5364 Windfield Dr | No Action | $ | - | 19 | 8 | 2006 | 188 | PVC | 2-Low |
| Gravity Main | P4130 | Meadows Xing | No Action | $ | - | 19 | 8 | 2008 | 259 | PVC | 2-Low |
| Gravity Main | P4222 | Southtown-Northside Dr | No Action | $ | - | 19 | 8 | 2007 | 320 | PVC | 2-Low |
| Gravity Main | P4137 | Meadows Xing | No Action | $ | - | 19 | 8 | 2008 | 234 | PVC | 2-Low |
| Gravity Main | P4231 | 10897 48th Ave | No Action | $ | - | 19 | 8 | 2007 | 357 | PVC | 2-Low |
| Gravity Main | P4131 | Meadows Xing | No Action | $ | - | 19 | 8 | 2008 | 113 | PVC | 2-Low |
| Gravity Main | P4331 | Northside Dr | Full Lining | $ | 11,838 | 19 | 8 | 2007 | 276 | PVC | 2-Low |
| Gravity Main | P4640 | 11127-11125 48th Ave | No Action | $ | - | 19 | 12 | 1987 | 372 | PVC | 2-Low |
| Gravity Main | P4240 | 10865 48th Ave | No Action | $ | - | 19 | 12 | 1987 | 29 | PVC | 2-Low |
| Gravity Main | P2490 | 5737-5673 Lake Michigan Dr | CCTV | $ | 1,603 | 19 | 18 | 1990 | 428 | VCP | 2-Low |
| Gravity Main | P3860 | 10507 Laker Village Dr | CCTV | $ | 1,328 | 19 | 12 | 1963 | 354 | VCP | 2-Low |
| Gravity Main | P1964 | 10920 64th Ave | No Action | $ | - | 19 | 8 | 2004 | 265 | PVC | 2-Low |
| Gravity Main | P3516 | 5256 Pierce St | CCTV | $ | 135 | 19 | 8 | 2015 | 36 | PVC | 2-Low |
| Gravity Main | P3816 | 10518-10564 Rockfield Rd | CCTV | $ | 818 | 19 | 8 | 2013 | 218 | PVC | 2-Low |
| Gravity Main | P4425 | 10999-10975 Woodedge Dr | CCTV | $ | 1,042 | 19 | 8 | 2005 | 278 | PVC | 2-Low |
| Gravity Main | P4325 | 10890-10811 Woodedge Dr | CCTV | $ | 160 | 19 | 8 | 2005 | 43 | PVC | 2-Low |
| Gravity Main | P4424 | 5104 Jordan St | CCTV | $ | 163 | 19 | 8 | 2005 | 43 | PVC | 2-Low |
| Gravity Main | P3625 | 5050-5083 Pierce St | CCTV | $ | 95 | 19 | 8 | 2014 | 25 | PVC | 2-Low |
| Gravity Main | P4426 | 10963 Woodedge Dr | CCTV | $ | 1,162 | 19 | 8 | 2005 | 310 | PVC | 2-Low |
| Gravity Main | P4321 | 5182 Circleview Dr | CCTV | $ | 694 | 19 | 8 | 2005 | 185 | PVC | 2-Low |
| Gravity Main | P4423 | 5146 Jordan St | CCTV | $ | 1,534 | 19 | 8 | 2005 | 409 | PVC | 2-Low |
| Gravity Main | P1131 | 11266-11239 Whispering Creek Dr | CCTV | $ | 298 | 19 | 8 | 2012 | 79 | PVC | 2-Low |
| Gravity Main | P4747 | 11253-11239 Whispering Creek Dr | CCTV | $ | 421 | 19 | 8 | 2012 | 112 | PVC | 2-Low |
| Gravity Main | P1129 | 11301 Commerce Rd | CCTV | $ | 495 | 19 | 5 | 2001 | 132 | PVC | 2-Low |
| Gravity Main | P1128 | 11301 Commerce Rd | CCTV | $ | 299 | 19 | 5 | 2001 | 80 | PVC | 2-Low |
| Gravity Main | P4427 | 5149 Woodedge Ct | CCTV | $ | 929 | 19 | 8 | 2005 | 248 | PVC | 2-Low |
| Gravity Main | P2446 | 6545-6561 Lake Michigan Dr | CCTV | $ | 650 | 19 | 6 | 1990 | 173 | PVC | 2-Low |
| Gravity Main | P4322 | 10909 Circle Way | CCTV | $ | 1,136 | 19 | 8 | 2005 | 303 | PVC | 2-Low |
| Gravity Main | P9705 | 5360 Windfield Dr | CCTV | $ | 343 | 19 | 8 | 2006 | 91 | PVC | 2-Low |
| Gravity Main | P1130 | 11239-11277 Whispering Creek Dr | CCTV | $ | 81 | 19 | 8 | 2012 | 22 | PVC | 2-Low |
| Gravity Main | P4323 | 5103-5163 Circleview Dr | CCTV | $ | 1,059 | 19 | 8 | 2005 | 282 | PVC | 2-Low |
| Gravity Main | P3612 | 5399 Pierce St | CCTV | $ | 198 | 19 | 8 | 2015 | 53 | PVC | 2-Low |
| Gravity Main | P4324 | 10883 Woodedge Dr | CCTV | $ | 1,069 | 19 | 8 | 2005 | 285 | PVC | 2-Low |
| Gravity Main | P4326 | 5150 Circlewood Ln | CCTV | $ | 821 | 19 | 8 | 2005 | 219 | PVC | 2-Low |
| Gravity Main | P9611 | 10520-10517 52nd Ave | CCTV | $ | 182 | 19 | 8 | 2006 | 48 | PVC | 2-Low |
| Gravity Main | P9502 | 4999-4991 Allenpark Dr | CCTV | $ | 346 | 19 | 8 | 2016 | 92 | PVC | 2-Low |
| Manhole | 4506 | 5568 Estate Rd | No Action | $ | - | 18 | 0 | 1995 | 0 | Concrete (Reinforced) [CR | 2-Low |
| Manhole | 4507 | 5538 Estate Rd | No Action | $ | - | 18 | 0 | 1995 | 0 | Concrete (Reinforced) [CR | 2-Low |
| Manhole | 4400 | 5557 Jordan St | No Action | $ | - | 18 | 0 | 1996 | 0 | Concrete (Reinforced) [CR | 2-Low |
| Manhole | 4508 | 5520 Estate Rd | No Action | $ | - | 18 | 0 | 1995 | 0 | Concrete (Reinforced) [CR | 2-Low |
| Manhole | 4509 | 5502 Estate Rd | No Action | $ | - | 18 | 0 | 1995 | 0 | Concrete (Reinforced) [CR | 2-Low |
| Manhole | 4510 | 5520 Eric St | No Action | $ | - | 18 | 0 | 1996 | 0 | Concrete (Reinforced) [CR | 2-Low |

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|---|---|---|---|---|---|---|---|---|---|---|---|
| Manhole | 1057 | Hawkin St | MH Inspection | $ | 536 | 18 | 0 | 2016 | 0 | Not Known [XXX] | 2-Low |
| Manhole | 2035 | 6930 Joal St | No Action | $ | - | 18 | 0 | 1995 | 0 | Concrete (Reinforced) [CR | 2-Low |
| Manhole | 2336 | 6981 Lake Michigan Dr | No Action | $ | - | 18 | 0 | 2007 | 0 | Concrete (Reinforced) [CR | 2-Low |
| Manhole | 5040 | 11443 48th Ave | MH Inspection | $ | 536 | 18 | 0 | 1991 | 0 | Not Known [XXX] | 2-Low |
| Manhole | 5041 | 11483 48th Ave | MH Inspection | $ | 536 | 18 | 0 | 1991 | 0 | Not Known [XXX] | 2-Low |
| Manhole | 5141 | 4802 Rich St | MH Inspection | $ | 536 | 18 | 0 | 1991 | 0 | Not Known [XXX] | 2-Low |
| Manhole | 5146 | 4726 Rich St | MH Inspection | $ | 536 | 18 | 0 | 1991 | 0 | Not Known [XXX] | 2-Low |
| Manhole | 5147 | 4702 Rich St | MH Inspection | $ | 536 | 18 | 0 | 1991 | 0 | Not Known [XXX] | 2-Low |
| Manhole | 2227 | 11057 Creekside Dr | MH Inspection | $ | 536 | 18 | 0 | 2004 | 0 | Not Known [XXX] | 2-Low |
| Manhole | 4514 | 5402 Eric St | MH Inspection | $ | 536 | 18 | 0 | 2000 | 0 | Not Known [XXX] | 2-Low |
| Manhole | 2495 | 5680 Lake Michigan Dr | MH Inspection | $ | 536 | 18 | 0 | 1992 | 0 | Not Known [XXX] | 2-Low |
| Manhole | 4800 | 11307 56th Ave | MH Inspection | $ | 536 | 18 | 0 | 1992 | 0 | Not Known [XXX] | 2-Low |
| Manhole | 4801 | 11363 56th Ave | MH Inspection | $ | 536 | 18 | 0 | 1992 | 0 | Not Known [XXX] | 2-Low |
| Manhole | LS_60TH-SOUTH | 10550 60th Ave | No Action | $ | - | 18 | 0 | 1992 | 0 | Concrete (Reinforced) [CR | 2-Low |
| Manhole | LS_COUNTY_PARK | 6676 Lake Michigan Dr | No Action | $ | - | 18 | 0 | 1990 | 0 | Concrete (Reinforced) [CR | 2-Low |
| Manhole | 2403 | 8011 Lake Michigan Dr | MH Inspection | $ | 536 | 18 | 0 | 2007 | 0 | Not Known [XXX] | 2-Low |
| Manhole | 1045 | 7145 Pinevalley Dr | MH Inspection | $ | 536 | 18 | 0 | 2004 | 0 | Not Known [XXX] | 2-Low |
| Manhole | 1046 | 7128 Pinevalley Dr | MH Inspection | $ | 536 | 18 | 0 | 2004 | 0 | Not Known [XXX] | 2-Low |
| Manhole | 1047 | 7102 Pinevalley Dr | MH Inspection | $ | 536 | 18 | 0 | 2004 | 0 | Not Known [XXX] | 2-Low |
| Manhole | 1826 | 7055 Sunset Dr | MH Inspection | $ | 536 | 18 | 0 | 1996 | 0 | Not Known [XXX] | 2-Low |
| Manhole | 1918 | 7187 Pinevalley Dr | MH Inspection | $ | 536 | 18 | 0 | 2004 | 0 | Not Known [XXX] | 2-Low |
| Manhole | 2369 | 6098 Lake Michigan Dr | MH Inspection | $ | 536 | 18 | 0 | 2000 | 0 | Not Known [XXX] | 2-Low |
| Manhole | 4602 | 5500 Lake Michigan Dr | MH Inspection | $ | 536 | 18 | 0 | 2001 | 0 | Not Known [XXX] | 2-Low |
| Manhole | 2790 | 5755 Frostline Dr | No Action | $ | - | 18 | 0 | 1990 | 0 | Concrete (Reinforced) [CR | 2-Low |
| Manhole | 2094 | 10931 Mary Eliz Ct | MH Inspection | $ | 536 | 18 | 0 | 2000 | 0 | Not Known [XXX] | 2-Low |
| Manhole | 4201 | 10835 Lance Ave | MH Inspection | $ | 536 | 18 | 0 | 2005 | 0 | Not Known [XXX] | 2-Low |
| Manhole | 4212 | 5305 Sunshine St | MH Inspection | $ | 536 | 18 | 0 | 2004 | 0 | Not Known [XXX] | 2-Low |
| Manhole | 4213 | 5351 Sunshine St | MH Inspection | $ | 536 | 18 | 0 | 2005 | 0 | Not Known [XXX] | 2-Low |
| Manhole | 4311 | 10807 Jordan Ct | MH Inspection | $ | 536 | 18 | 0 | 2000 | 0 | Not Known [XXX] | 2-Low |
| Manhole | 4404 | 5194 Jordan St | MH Inspection | $ | 536 | 18 | 0 | 2000 | 0 | Not Known [XXX] | 2-Low |
| Manhole | 4503 | 5596 Eric St | MH Inspection | $ | 536 | 18 | 0 | 2000 | 0 | Concrete (Reinforced) [CR | 2-Low |
| Manhole | 4504 | 5566 Eric St | MH Inspection | $ | 536 | 18 | 0 | 2000 | 0 | Concrete (Reinforced) [CR | 2-Low |
| Manhole | 4505 | 5502 Eric St | MH Inspection | $ | 536 | 18 | 0 | 2000 | 0 | Concrete (Reinforced) [CR | 2-Low |
| Manhole | 1789 | 5807 Horizon Ln | MH Inspection | $ | 536 | 18 | 0 | 1998 | 0 | Not Known [XXX] | 2-Low |
| Manhole | 1827 | 7005 Sunset Dr | MH Inspection | $ | 536 | 18 | 0 | 1996 | 0 | Not Known [XXX] | 2-Low |
| Manhole | 1880 | 10789 Tallpine Ln | MH Inspection | $ | 536 | 18 | 0 | 1998 | 0 | Not Known [XXX] | 2-Low |
| Manhole | 1923 | 10911 Skylane Ct | MH Inspection | $ | 536 | 18 | 0 | 2004 | 0 | Not Known [XXX] | 2-Low |
| Manhole | 2696 | 11599 Cameron Ave | MH Inspection | $ | 536 | 18 | 0 | 2000 | 0 | Not Known [XXX] | 2-Low |
| Manhole | 4411 | 10991 Jordan Ct | MH Inspection | $ | 536 | 18 | 0 | 2000 | 0 | Not Known [XXX] | 2-Low |
| Manhole | 4412 | 5304 Jordan St | MH Inspection | $ | 536 | 18 | 0 | 2004 | 0 | Not Known [XXX] | 2-Low |
| Manhole | 4413 | 5292 Jordan St | MH Inspection | $ | 536 | 18 | 0 | 2004 | 0 | Not Known [XXX] | 2-Low |
| Manhole | 4419 | 10985 Douglas Dr | MH Inspection | $ | 536 | 18 | 0 | 2004 | 0 | Not Known [XXX] | 2-Low |
| Manhole | 4930 | 4991 Allenpark Dr | MH Inspection | $ | 536 | 18 | 0 | 2001 | 0 | Not Known [XXX] | 2-Low |
| Manhole | 1520 | Pleasant View Ct | MH Inspection | $ | 536 | 18 | 0 | 2008 | 0 | Not Known [XXX] | 2-Low |
| Manhole | 3920 | 10621 52nd Ave | MH Inspection | $ | 536 | 18 | 0 | 2006 | 0 | Not Known [XXX] | 2-Low |

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|---|---|---|---|---|---|---|---|---|---|---|---|
| Manhole | 3921 | 10657 52nd Ave | MH Inspection | $ | 536 | 18 | 0 | 2006 | 0 | Not Known [XXX] | 2-Low |
| Manhole | 4326 | 5176 Circlewood Ln | MH Inspection | $ | 536 | 18 | 0 | 2005 | 0 | Not Known [XXX] | 2-Low |
| Manhole | 5284 | 11654 40th Ave | MH Inspection | $ | 536 | 18 | 0 | 2000 | 0 | Not Known [XXX] | 2-Low |
| Manhole | 2252 | 6342 Henry St | MH Inspection | $ | 536 | 18 | 0 | 2008 | 0 | Not Known [XXX] | 2-Low |
| Manhole | 4707 | 5405 Auto Ct | MH Inspection | $ | 536 | 18 | 0 | 2001 | 0 | Not Known [XXX] | 2-Low |
| Manhole | 3610 | 5392 Pierce St | MH Inspection | $ | 536 | 18 | 0 | 2015 | 0 | Not Known [XXX] | 2-Low |
| Manhole | 3611 | Mystic Wds | MH Inspection | $ | 536 | 18 | 0 | 2015 | 0 | Not Known [XXX] | 2-Low |
| Manhole | 3618 | 5310 Pierce St | MH Inspection | $ | 536 | 18 | 0 | 2015 | 0 | Not Known [XXX] | 2-Low |
| Manhole | 2031 | 10905 Creekside Dr | No Action | $ | - | 18 | 0 | 1995 | 0 | Concrete (Reinforced) [CR | 2-Low |
| Manhole | 2120 | 11025 Creekside Dr | No Action | $ | - | 18 | 0 | 1995 | 0 | Concrete (Reinforced) [CR | 2-Low |
| Manhole | 1043 | 11051 Pinecreek Ct | MH Inspection | $ | 536 | 18 | 0 | 2004 | 0 | Not Known [XXX] | 2-Low |
| Manhole | 1073 | 7360 Valley View Ct | MH Inspection | $ | 536 | 18 | 0 | 2000 | 0 | Not Known [XXX] | 2-Low |
| Manhole | 1680 | 10675 Tallpine Ln | MH Inspection | $ | 536 | 18 | 0 | 1998 | 0 | Not Known [XXX] | 2-Low |
| Manhole | 2090 | 10962 Gayle Ln | MH Inspection | $ | 536 | 18 | 0 | 2000 | 0 | Not Known [XXX] | 2-Low |
| Manhole | 4215 | 5421 Sunshine St | MH Inspection | $ | 536 | 18 | 0 | 2005 | 0 | Not Known [XXX] | 2-Low |
| Manhole | 4216 | 10801 Douglas Dr | MH Inspection | $ | 536 | 18 | 0 | 2004 | 0 | Not Known [XXX] | 2-Low |
| Manhole | 4217 | 10745 Douglas Dr | MH Inspection | $ | 536 | 18 | 0 | 2004 | 0 | Not Known [XXX] | 2-Low |
| Manhole | 4301 | 10925 Lance Ave | MH Inspection | $ | 536 | 18 | 0 | 2005 | 0 | Not Known [XXX] | 2-Low |
| Manhole | 4313 | 10921 Douglas Dr | MH Inspection | $ | 536 | 18 | 0 | 2004 | 0 | Not Known [XXX] | 2-Low |
| Manhole | 4405 | 10993 Lance Ave | MH Inspection | $ | 536 | 18 | 0 | 2005 | 0 | Not Known [XXX] | 2-Low |
| Manhole | 4406 | 10987 Lance Ave | MH Inspection | $ | 536 | 18 | 0 | 2005 | 0 | Not Known [XXX] | 2-Low |
| Manhole | 4423 | 5188 Jordan St | MH Inspection | $ | 536 | 18 | 0 | 2005 | 0 | Not Known [XXX] | 2-Low |
| Manhole | 1964 | 10873 Constant Dr | MH Inspection | $ | 536 | 18 | 0 | 2004 | 0 | Not Known [XXX] | 2-Low |
| Manhole | 2202 | 7546 Waterline Dr | MH Inspection | $ | 536 | 18 | 0 | 2005 | 0 | Not Known [XXX] | 2-Low |
| Manhole | 2203 | 7508 Waterline Dr | MH Inspection | $ | 536 | 18 | 0 | 2005 | 0 | Not Known [XXX] | 2-Low |
| Manhole | 2204 | 7534 Waterline Dr | MH Inspection | $ | 536 | 18 | 0 | 2005 | 0 | Not Known [XXX] | 2-Low |
| Manhole | 2205 | 7596 Waterline Dr | MH Inspection | $ | 536 | 18 | 0 | 2005 | 0 | Not Known [XXX] | 2-Low |
| Manhole | 2307 | 7444 Waterline Dr | MH Inspection | $ | 536 | 18 | 0 | 2005 | 0 | Not Known [XXX] | 2-Low |
| Manhole | 2308 | 7408 Waterline Dr | MH Inspection | $ | 536 | 18 | 0 | 2005 | 0 | Not Known [XXX] | 2-Low |
| Manhole | 2975 | 11698 Wilmington Dr | MH Inspection | $ | 536 | 18 | 0 | 2006 | 0 | Not Known [XXX] | 2-Low |
| Manhole | 2976 | 11691 Wilmington Dr | MH Inspection | $ | 536 | 18 | 0 | 2006 | 0 | Not Known [XXX] | 2-Low |
| Manhole | 1523 | 10809 Timberline Dr | MH Inspection | $ | 536 | 18 | 0 | 2008 | 0 | Not Known [XXX] | 2-Low |
| Manhole | 1620 | 10815 Timberline Dr | MH Inspection | $ | 536 | 18 | 0 | 2008 | 0 | Not Known [XXX] | 2-Low |
| Manhole | 4748 | 11277 Whispering Creek Dr | MH Inspection | $ | 536 | 18 | 0 | 2012 | 0 | Not Known [XXX] | 2-Low |
| Gravity Main | P1176 | 5947-5881 Lake Michigan Dr | Point Repair | $ | 9,990 | 18 | 18 | 1990 | 339 | VCP | 2-Low |
| Gravity Main | P4502 | 5560-5564 Eric St | No Action | $ | - | 18 | 8 | 2000 | 60 | PVC | 2-Low |
| Gravity Main | P2066 | 10920 64th Ave | No Action | $ | - | 18 | 8 | 2004 | 159 | PVC | 2-Low |
| Gravity Main | P2252 | 6342-6402 Henry St | CCTV | $ | 840 | 18 | 8 | 2008 | 224 | PVC | 2-Low |
| Gravity Main | P4746 | 11253 Whispering Creek Dr | CCTV | $ | 247 | 18 | 8 | 2012 | 66 | PVC | 2-Low |
| Gravity Main | P1044 | 11099-11051 Pinecreek Ct | CCTV | $ | 738 | 18 | 8 | 2004 | 197 | PVC | 2-Low |
| Gravity Main | P4745 | 11253 Whispering Creek Dr | CCTV | $ | 434 | 18 | 8 | 2012 | 116 | PVC | 2-Low |
| Gravity Main | P4871 | 11276-11299 40th Ave | CCTV | $ | 1,163 | 18 | 8 | 1990 | 310 | VCP | 2-Low |
| Gravity Main | P4870 | 11253-11276 40th Ave | CCTV | $ | 1,083 | 18 | 8 | 1990 | 289 | VCP | 2-Low |
| Gravity Main | P4629 | 5180 Lake Michigan Dr | CCTV | $ | 1,449 | 18 | 8 | 2012 | 386 | PVC | 2-Low |
| Gravity Main | P1043 | 11010 Pinecreek Ct | CCTV | $ | 805 | 18 | 8 | 2004 | 215 | PVC | 2-Low |

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|---|---|---|---|---|---|---|---|---|---|---|---|
| Gravity Main | P9518 | 11266 Whispering Creek Dr | CCTV | $ | 553 | 18 | 8 | 2012 | 147 | PVC | 2-Low |
| Gravity Main | P2673 | 11433-11359 Ripple Dr | No Action | $ | - | 18 | 10 | 1990 | 317 | PVC | 2-Low |
| Gravity Main | P4412 | 5304-5292 Jordan St | No Action | $ | - | 18 | 8 | 2004 | 128 | PVC | 2-Low |
| Gravity Main | P2672 | 11359-11303 Ripple Dr | No Action | $ | - | 18 | 10 | 1990 | 147 | PVC | 2-Low |
| Gravity Main | P5019 | 11550 53rd Ave | No Action | $ | - | 18 | 8 | 2000 | 179 | PVC | 2-Low |
| Gravity Main | P5018 | 11550 53rd Ave | No Action | $ | - | 18 | 8 | 2000 | 200 | PVC | 2-Low |
| Manhole | 2789 | 11453 Prairie Ave | No Action | $ | - | 18 | 0 | 1990 | 0 | Concrete (Reinforced) [CR | 2-Low |
| Manhole | 1924 | 10989 Skylane Ct | MH Inspection | $ | 536 | 18 | 0 | 2004 | 0 | Not Known [XXX] | 2-Low |
| Manhole | 1925 | 7002 Pinevalley Dr | MH Inspection | $ | 536 | 18 | 0 | 1996 | 0 | Not Known [XXX] | 2-Low |
| Manhole | 3721 | 10517 52nd Ave | MH Inspection | $ | 536 | 18 | 0 | 2006 | 0 | Not Known [XXX] | 2-Low |
| Manhole | 4220 | 10855 52nd Ave | MH Inspection | $ | 536 | 18 | 0 | 2006 | 0 | Not Known [XXX] | 2-Low |
| Gravity Main | P4312 | 10963-10985 Douglas Dr | No Action | $ | - | 17 | 8 | 2004 | 352 | PVC | 2-Low |
| Gravity Main | P4303 | 10905-10917 Lance Ave | No Action | $ | - | 17 | 8 | 2005 | 119 | PVC | 2-Low |
| Gravity Main | P4214 | 5373-5351 Sunshine St | No Action | $ | - | 17 | 8 | 2005 | 76 | PVC | 2-Low |
| Gravity Main | P2670 | 6085-6064 Crystal Dr | No Action | $ | - | 17 | 8 | 1990 | 244 | PVC | 2-Low |
| Gravity Main | P4213 | 5351-5305 Sunshine St | No Action | $ | - | 17 | 8 | 2005 | 147 | PVC | 2-Low |
| Gravity Main | P4216 | 10808 Douglas Dr | No Action | $ | - | 17 | 8 | 2004 | 259 | PVC | 2-Low |
| Gravity Main | P4313 | 10921-10963 Douglas Dr | No Action | $ | - | 17 | 8 | 2004 | 223 | PVC | 2-Low |
| Gravity Main | P4302 | 10917-10934 Lance Ave | No Action | $ | - | 17 | 8 | 2005 | 97 | PVC | 2-Low |
| Gravity Main | P4215 | 5421-5373 Sunshine St | No Action | $ | - | 17 | 8 | 2005 | 156 | PVC | 2-Low |
| Gravity Main | P4407 | 10973-10959 Lance Ave | No Action | $ | - | 17 | 8 | 2005 | 131 | PVC | 2-Low |
| Gravity Main | P4410 | 5102-5304 Jordan St | No Action | $ | - | 17 | 8 | 2004 | 344 | PVC | 2-Low |
| Gravity Main | P3938 | Campus West Apartments | No Action | $ | - | 17 | 8 | 1990 | 136 | PVC | 2-Low |
| Gravity Main | P4218 | 10705-10745 Douglas Dr | No Action | $ | - | 17 | 8 | 2004 | 220 | PVC | 2-Low |
| Gravity Main | P1045 | 7145-7128 Pinevalley Dr | No Action | $ | - | 17 | 8 | 2004 | 97 | PVC | 2-Low |
| Gravity Main | P4748 | 11267 Whispering Creek Dr | No Action | $ | - | 17 | 8 | 2012 | 353 | PVC | 2-Low |
| Gravity Main | P4405 | 10993-10987 Lance Ave | No Action | $ | - | 17 | 8 | 2005 | 75 | PVC | 2-Low |
| Gravity Main | P4212 | 10843 Douglas Dr | No Action | $ | - | 17 | 8 | 2004 | 171 | PVC | 2-Low |
| Gravity Main | P4406 | 10987-10973 Lance Ave | No Action | $ | - | 17 | 8 | 2005 | 124 | PVC | 2-Low |
| Gravity Main | P4301 | 10925-10917 Lance Ave | No Action | $ | - | 17 | 8 | 2005 | 78 | PVC | 2-Low |
| Gravity Main | P4217 | 10745-10801 Douglas Dr | No Action | $ | - | 17 | 8 | 2004 | 216 | PVC | 2-Low |
| Gravity Main | P4211 | 10861-10887 Douglas Dr | No Action | $ | - | 17 | 8 | 2004 | 159 | PVC | 2-Low |
| Gravity Main | P4202 | 10823 Lance Ave | No Action | $ | - | 17 | 8 | 2005 | 213 | PVC | 2-Low |
| Gravity Main | P2633 | 11495 Brown St | No Action | $ | - | 17 | 8 | 1992 | 127 | PVC | 2-Low |
| Gravity Main | P4210 | 10887-10921 Douglas Dr | No Action | $ | - | 17 | 8 | 2004 | 115 | PVC | 2-Low |
| Gravity Main | P4304 | 10943 Jordan Ct | No Action | $ | - | 17 | 8 | 2005 | 327 | PVC | 2-Low |
| Gravity Main | P2674 | 11493 Ripple Dr | No Action | $ | - | 17 | 8 | 1990 | 120 | PVC | 2-Low |
| Gravity Main | P4200 | 10883 Lance Ave | No Action | $ | - | 17 | 8 | 2005 | 393 | PVC | 2-Low |
| Gravity Main | P4201 | 5486 Sunshine St | No Action | $ | - | 17 | 8 | 2005 | 187 | PVC | 2-Low |
| Gravity Main | P4203 | 10701-10783 Lance Ave | No Action | $ | - | 17 | 8 | 2005 | 223 | PVC | 2-Low |
| Gravity Main | P9500 | 10545-10555 Laker Village Dr | CCTV | $ | 230 | 17 | 12 | 1963 | 61 | VCP | 2-Low |
| Manhole | 1785 | 5863 Maple Bend Trl | MH Inspection | $ | 536 | 17 | 0 | 1998 | 0 | Not Known [XXX] | 2-Low |
| Manhole | 1786 | 5841 Maple Bend Trl | MH Inspection | $ | 536 | 17 | 0 | 1998 | 0 | Not Known [XXX] | 2-Low |
| Manhole | 1787 | 5800 Maple Bend Trl | MH Inspection | $ | 536 | 17 | 0 | 1998 | 0 | Not Known [XXX] | 2-Low |
| Gravity Main | P1955 | 6692 Martinie Dr | No Action | $ | - | 17 | 8 | 1992 | 154 | PVC | 2-Low |

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|---|---|---|---|---|---|---|---|---|---|---|---|
| Gravity Main | P4162 | 1 Campus Dr | No Action | $ | - | 17 | 12 | 1963 | 45 | VCP | 2-Low |
| Gravity Main | P4360 | 1 Campus Dr | Full Lining | $ | 8,900 | 17 | 12 | 1963 | 138 | VCP | 2-Low |
| Gravity Main | P4260 | 1 Campus Dr | Full Lining | $ | 11,697 | 17 | 12 | 1963 | 182 | VCP | 2-Low |
| Gravity Main | P2471 | 11289 60th Ave | No Action | $ | - | 17 | 8 | 2003 | 150 | PVC | 2-Low |
| Gravity Main | P2225 | 11145-11127 Creekside Ct | No Action | $ | - | 17 | 8 | 2004 | 189 | PVC | 2-Low |
| Gravity Main | P2634 | 11495 Brown St | No Action | $ | - | 17 | 8 | 1992 | 49 | PVC | 2-Low |
| Gravity Main | P3960 | 10517-10545 Laker Village Dr | Point Repair | $ | 9,526 | 16 | 12 | 1963 | 281 | VCP | 2-Low |
| Gravity Main | P2349 | 6550-6600 Lake Michigan Dr | No Action | $ | - | 16 | 8 | 1993 | 402 | PVC | 2-Low |
| Gravity Main | P2350 | 6474-6550 Lake Michigan Dr | No Action | $ | - | 16 | 8 | 1993 | 398 | PVC | 2-Low |
| Gravity Main | P2351 | 6448-6474 Lake Michigan Dr | No Action | $ | - | 16 | 8 | 2001 | 179 | PVC | 2-Low |
| Gravity Main | P2141 | Allendale Community Park | No Action | $ | - | 16 | 8 | 1992 | 165 | PVC | 2-Low |
| Gravity Main | P4160 | Laker Village Dr | Full Lining | $ | 15,183 | 16 | 12 | 1963 | 236 | VCP | 2-Low |
| Manhole | 4834 | 4998 Allenpark Dr | MH Inspection | $ | 536 | 16 | 0 | 2015 | 0 | Not Known [XXX] | 2-Low |
| Manhole | 4657 | 4415 Lake Michigan Dr | MH Clean + Line | $ | 4,038 | 16 | 0 | 1990 | 0 | Concrete (Reinforced) [CR | 2-Low |
| Gravity Main | P3815 | 10583 Rockfield Rd | No Action | $ | - | 16 | 8 | 2013 | 150 | PVC | 2-Low |
| Gravity Main | P3618 | 5310-5256 Pierce St | No Action | $ | - | 16 | 8 | 2015 | 391 | PVC | 2-Low |
| Gravity Main | P3510 | Mystic Wds | No Action | $ | - | 16 | 8 | 2015 | 58 | PVC | 2-Low |
| Gravity Main | P3632 | 5045 Pierce St | CCTV | $ | 361 | 16 | 8 | 2014 | 96 | PVC | 2-Low |
| Gravity Main | P3737 | Hillcrest Town Houses | CCTV | $ | 1,309 | 16 | 8 | 2014 | 349 | PVC | 2-Low |
| Gravity Main | P3736 | 4967 Pierce St | CCTV | $ | 1,316 | 16 | 8 | 2014 | 351 | PVC | 2-Low |
| Gravity Main | P3735 | 4967-5045 Pierce St | CCTV | $ | 1,309 | 16 | 8 | 2014 | 349 | PVC | 2-Low |
| Gravity Main | P3830 | Campus West Apartments | CCTV | $ | 1,142 | 16 | 8 | 2014 | 304 | PVC | 2-Low |
| Gravity Main | P3738 | Hillcrest Town Houses | CCTV | $ | 1,314 | 16 | 8 | 2014 | 351 | PVC | 2-Low |
| Gravity Main | P3831 | 4964 Country Pl S | CCTV | $ | 1,348 | 16 | 8 | 2014 | 359 | PVC | 2-Low |
| Gravity Main | P1411 | 10581-10603 Learning Ln | No Action | $ | - | 16 | 8 | 2008 | 262 | PVC | 2-Low |
| Gravity Main | P1511 | 10581 Learning Ln | No Action | $ | - | 16 | 8 | 2008 | 383 | PVC | 2-Low |
| Gravity Main | P4419 | 11009 Douglas Dr | No Action | $ | - | 16 | 8 | 2004 | 348 | PVC | 2-Low |
| Gravity Main | P4849 | 4737 Ottawa Creek Dr | CCTV | $ | 1,524 | 16 | 8 | 2012 | 406 | PVC | 2-Low |
| Gravity Main | P1132 | 4616-4614 Ottawa Creek Dr | CCTV | $ | 37 | 16 | 8 | 2012 | 10 | PVC | 2-Low |
| Gravity Main | P4853 | 4687 Ottawa Creek Dr | CCTV | $ | 454 | 16 | 8 | 2012 | 121 | PVC | 2-Low |
| Gravity Main | P4850 | 4657-4616 Ottawa Creek Dr | CCTV | $ | 554 | 16 | 8 | 2012 | 148 | PVC | 2-Low |
| Gravity Main | P4852 | 4683 Ottawa Creek Dr | CCTV | $ | 711 | 16 | 8 | 2012 | 190 | PVC | 2-Low |
| Manhole | 2585 | 11351 Prairie Ave | No Action | $ | - | 15 | 0 | 1993 | 0 | Concrete (Reinforced) [CR | 2-Low |
| Manhole | 2587 | 5443 Dewpointe Dr | No Action | $ | - | 15 | 0 | 1993 | 0 | Concrete (Reinforced) [CR | 2-Low |
| Manhole | 2639 | 11377 Brown St | No Action | $ | - | 15 | 0 | 1992 | 0 | Concrete (Reinforced) [CR | 2-Low |
| Manhole | 4401 | 5532 Jordan St | No Action | $ | - | 15 | 0 | 1996 | 0 | Concrete (Reinforced) [CR | 2-Low |
| Manhole | 4402 | 5456 Jordan St | No Action | $ | - | 15 | 0 | 1996 | 0 | Concrete (Reinforced) [CR | 2-Low |
| Manhole | 5140 | 11565 48th Ave | MH Inspection | $ | 536 | 15 | 0 | 1991 | 0 | Not Known [XXX] | 2-Low |
| Manhole | 2224 | 11127 Creekside Ct | MH Inspection | $ | 536 | 15 | 0 | 2004 | 0 | Not Known [XXX] | 2-Low |
| Manhole | 2772 | 11525 60th Ave | MH Inspection | $ | 536 | 15 | 0 | 1990 | 0 | Not Known [XXX] | 2-Low |
| Manhole | 4802 | 11417 56th Ave | MH Inspection | $ | 536 | 15 | 0 | 1992 | 0 | Not Known [XXX] | 2-Low |
| Manhole | 1919 | 7163 Pinevalley Dr | MH Inspection | $ | 536 | 15 | 0 | 2004 | 0 | Not Known [XXX] | 2-Low |
| Manhole | 3534 | Copper Beech Townhomes | MH Inspection | $ | 536 | 15 | 0 | 2005 | 0 | Not Known [XXX] | 2-Low |
| Manhole | 3627 | 5084 Pierce St | MH Inspection | $ | 536 | 15 | 0 | 2014 | 0 | Not Known [XXX] | 2-Low |
| Manhole | 1820 | 10829 Timberline Dr | MH Inspection | $ | 536 | 15 | 0 | 2008 | 0 | Not Known [XXX] | 2-Low |

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|---|---|---|---|---|---|---|---|---|---|---|---|
| Manhole | 4324 | 10811 Woodedge Dr | MH Inspection | $ | 536 | 15 | 0 | 2005 | 0 | Not Known [XXX] | 2-Low |
| Manhole | 4424 | 5110 Jordan St | MH Inspection | $ | 536 | 15 | 0 | 2005 | 0 | Not Known [XXX] | 2-Low |
| Manhole | 2366 | 6154 Lake Michigan Dr | MH Inspection | $ | 536 | 15 | 0 | 2000 | 0 | Not Known [XXX] | 2-Low |
| Manhole | 2367 | 6164 Lake Michigan Dr | MH Inspection | $ | 536 | 15 | 0 | 2000 | 0 | Not Known [XXX] | 2-Low |
| Manhole | 2460 | 11261 64th Ave | No Action | $ | - | 15 | 0 | 1987 | 0 | Concrete (Reinforced) [CR | 2-Low |
| Manhole | 5357 | 4375 Pingree St | MH Inspection | $ | 536 | 15 | 0 | 1991 | 0 | Not Known [XXX] | 2-Low |
| Manhole | 1992 | 10803 Melanie Dr | MH Inspection | $ | 536 | 15 | 0 | 2000 | 0 | Not Known [XXX] | 2-Low |
| Manhole | 2020 | 7219 Timbercreek Dr | MH Inspection | $ | 536 | 15 | 0 | 2004 | 0 | Not Known [XXX] | 2-Low |
| Manhole | 2022 | 7158 Timbercreek Dr | MH Inspection | $ | 536 | 15 | 0 | 2004 | 0 | Not Known [XXX] | 2-Low |
| Manhole | 2023 | 7144 Timbercreek Dr | MH Inspection | $ | 536 | 15 | 0 | 2004 | 0 | Not Known [XXX] | 2-Low |
| Manhole | 2024 | 7130 Timbercreek Dr | MH Inspection | $ | 536 | 15 | 0 | 2004 | 0 | Not Known [XXX] | 2-Low |
| Manhole | 2025 | 7100 Timbercreek Dr | MH Inspection | $ | 536 | 15 | 0 | 1996 | 0 | Not Known [XXX] | 2-Low |
| Manhole | 2220 | 11093 Timberline Dr | MH Inspection | $ | 536 | 15 | 0 | 1996 | 0 | Not Known [XXX] | 2-Low |
| Manhole | 2221 | 11185 Timberline Dr | MH Inspection | $ | 536 | 15 | 0 | 2004 | 0 | Not Known [XXX] | 2-Low |
| Manhole | 2306 | 7478 Waterline Dr | MH Inspection | $ | 536 | 15 | 0 | 2005 | 0 | Not Known [XXX] | 2-Low |
| Manhole | 2532 | 7198 Valley View Ct | MH Inspection | $ | 536 | 15 | 0 | 2000 | 0 | Not Known [XXX] | 2-Low |
| Manhole | 2592 | 5720 Victoria St | MH Inspection | $ | 536 | 15 | 0 | 2000 | 0 | Not Known [XXX] | 2-Low |
| Manhole | 2593 | 5710 Victoria St | MH Inspection | $ | 536 | 15 | 0 | 2000 | 0 | Not Known [XXX] | 2-Low |
| Manhole | 2594 | 11275 Cameron Ave | MH Inspection | $ | 536 | 15 | 0 | 2000 | 0 | Not Known [XXX] | 2-Low |
| Manhole | 2693 | 11385 Cameron Ave | MH Inspection | $ | 536 | 15 | 0 | 2000 | 0 | Not Known [XXX] | 2-Low |
| Manhole | 2694 | 5732 Crabtree St | MH Inspection | $ | 536 | 15 | 0 | 2000 | 0 | Not Known [XXX] | 2-Low |
| Manhole | 2882 | 11587 Brookland Ct | MH Inspection | $ | 536 | 15 | 0 | 2003 | 0 | Not Known [XXX] | 2-Low |
| Manhole | 3630 | 5045 Pierce St | MH Inspection | $ | 536 | 15 | 0 | 2008 | 0 | Not Known [XXX] | 2-Low |
| Manhole | 3633 | 5013 Pierce St | MH Inspection | $ | 536 | 15 | 0 | 2007 | 0 | Not Known [XXX] | 2-Low |
| Manhole | 3636 | 4986 Pierce St | MH Inspection | $ | 536 | 15 | 0 | 2008 | 0 | Not Known [XXX] | 2-Low |
| Manhole | 4312 | 10963 Douglas Dr | MH Inspection | $ | 536 | 15 | 0 | 2004 | 0 | Not Known [XXX] | 2-Low |
| Manhole | 4410 | 5102 Jordan St | MH Inspection | $ | 536 | 15 | 0 | 2004 | 0 | Not Known [XXX] | 2-Low |
| Manhole | 1724 | 10633 White Birch Dr | MH Inspection | $ | 536 | 15 | 0 | 2008 | 0 | Not Known [XXX] | 2-Low |
| Manhole | 4320 | 10913 52nd Ave | MH Inspection | $ | 536 | 15 | 0 | 2005 | 0 | Not Known [XXX] | 2-Low |
| Manhole | 5285 | 11717 40th Ave | MH Inspection | $ | 536 | 15 | 0 | 2000 | 0 | Not Known [XXX] | 2-Low |
| Manhole | 1824 | 7192 Pine Grove St | MH Inspection | $ | 536 | 15 | 0 | 2004 | 0 | Not Known [XXX] | 2-Low |
| Manhole | 2092 | 5670 Mary Eliz Dr | MH Inspection | $ | 536 | 15 | 0 | 2000 | 0 | Not Known [XXX] | 2-Low |
| Manhole | 2222 | 11178 Creekside Dr | MH Inspection | $ | 536 | 15 | 0 | 2004 | 0 | Not Known [XXX] | 2-Low |
| Manhole | 1721 | 10825 Timberline Dr | MH Inspection | $ | 536 | 15 | 0 | 2008 | 0 | Not Known [XXX] | 2-Low |
| Gravity Main | P2358 | 11283-11245 Washington Ave | No Action | $ | - | 15 | 8 | 2004 | 248 | PVC | 2-Low |
| Gravity Main | P2515 | 7170-7220 Blue Jay Dr | No Action | $ | - | 15 | 8 | 2013 | 253 | PVC | 2-Low |
| Gravity Main | P2224 | 11108 Creekside Dr | No Action | $ | - | 15 | 8 | 2004 | 131 | PVC | 2-Low |
| Gravity Main | P2021 | 7173-7219 Timbercreek Dr | No Action | $ | - | 15 | 8 | 2004 | 209 | PVC | 2-Low |
| Gravity Main | P2223 | 11158 Creekside Dr | No Action | $ | - | 15 | 8 | 2004 | 105 | PVC | 2-Low |
| Gravity Main | P2022 | 7158-7144 Timbercreek Dr | No Action | $ | - | 15 | 8 | 2004 | 121 | PVC | 2-Low |
| Gravity Main | P1721 | 10825-10829 Timberline Dr | No Action | $ | - | 15 | 8 | 2008 | 232 | PVC | 2-Low |
| Gravity Main | P2226 | 11122-11127 Creekside Ct | No Action | $ | - | 15 | 8 | 2004 | 100 | PVC | 2-Low |
| Gravity Main | P1917 | 7208-7187 Pinevalley Dr | No Action | $ | - | 15 | 8 | 2004 | 142 | PVC | 2-Low |
| Gravity Main | P1824 | 7192-7151 Pine Grove St | No Action | $ | - | 15 | 8 | 2004 | 251 | PVC | 2-Low |
| Gravity Main | P1724 | 10633-10601 White Birch Dr | No Action | $ | - | 15 | 8 | 2008 | 178 | PVC | 2-Low |

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|---|---|---|---|---|---|---|---|---|---|---|---|
| Gravity Main | P2020 | 7225 Timbercreek Dr | No Action | $ | - | 15 | 8 | 2004 | 379 | PVC | 2-Low |
| Gravity Main | P1924 | 10989-10911 Skylane Ct | No Action | $ | - | 15 | 8 | 2004 | 245 | PVC | 2-Low |
| Gravity Main | P2227 | 11061 Creekside Dr | No Action | $ | - | 15 | 8 | 2004 | 100 | PVC | 2-Low |
| Gravity Main | P1041 | 11057-10953 Skyway Ln | No Action | $ | - | 15 | 8 | 2004 | 232 | PVC | 2-Low |
| Gravity Main | P1042 | 10873 Skyway Ln | No Action | $ | - | 15 | 8 | 2004 | 228 | PVC | 2-Low |
| Gravity Main | P1923 | 10887 Skylane Ct | No Action | $ | - | 15 | 8 | 2004 | 244 | PVC | 2-Low |
| Gravity Main | P1099 | 10500-10518 Rockfield Rd | CCTV | $ | 576 | 15 | 8 | 2013 | 154 | PVC | 2-Low |
| Gravity Main | P4652 | 4473-4427 Lake Michigan Dr | CCTV | $ | 880 | 15 | 8 | 1990 | 235 | VCP | 2-Low |
| Gravity Main | P4651 | 4535-4473 Lake Michigan Dr | CCTV | $ | 1,261 | 15 | 8 | 1990 | 336 | VCP | 2-Low |
| Gravity Main | P2974 | Norfolk Dr | CCTV | $ | 1,373 | 15 | 8 | 2006 | 366 | PVC | 2-Low |
| Gravity Main | P3616 | 5313-5343 Pierce St | CCTV | $ | 748 | 15 | 8 | 2015 | 199 | PVC | 2-Low |
| Gravity Main | P4836 | 4926 Allenpark Dr | CCTV | $ | 894 | 15 | 8 | 2015 | 238 | PVC | 2-Low |
| Gravity Main | P3617 | 5269-5313 Pierce St | CCTV | $ | 1,009 | 15 | 8 | 2015 | 269 | PVC | 2-Low |
| Gravity Main | P4833 | Becker Dr | CCTV | $ | 704 | 15 | 8 | 2015 | 188 | PVC | 2-Low |
| Gravity Main | P2973 | Norfolk Dr | CCTV | $ | 302 | 15 | 8 | 2006 | 80 | PVC | 2-Low |
| Gravity Main | P1100 | 5401 Pierce St | CCTV | $ | 976 | 15 | 8 | 2013 | 260 | PVC | 2-Low |
| Gravity Main | P1105 | Southtown Dr | CCTV | $ | 794 | 15 | 8 | 2007 | 212 | PVC | 2-Low |
| Gravity Main | P4832 | 11238 Sugarloaf Ave | CCTV | $ | 267 | 15 | 8 | 2015 | 71 | PVC | 2-Low |
| Gravity Main | P2971 | 6142 Balcom Ln | CCTV | $ | 1,421 | 15 | 8 | 2006 | 379 | PVC | 2-Low |
| Gravity Main | P4830 | 11406 Sugarloaf Ave | CCTV | $ | 763 | 15 | 8 | 2015 | 204 | PVC | 2-Low |
| Gravity Main | P4744 | Boltwood Apartments | CCTV | $ | 920 | 15 | 8 | 2012 | 245 | PVC | 2-Low |
| Gravity Main | P1101 | 5378-5270 Crestfield Ln | CCTV | $ | 1,481 | 15 | 8 | 2013 | 395 | PVC | 2-Low |
| Gravity Main | P1172 | 5023 Lake Michigan Dr | CCTV | $ | 920 | 15 | 10 | 2000 | 245 | VCP | 2-Low |
| Gravity Main | P3615 | 5313-5343 Pierce St | CCTV | $ | 881 | 15 | 8 | 2015 | 235 | PVC | 2-Low |
| Gravity Main | P4837 | 11299-11287 University Pkwy | CCTV | $ | 686 | 15 | 8 | 2015 | 183 | PVC | 2-Low |
| Gravity Main | P4831 | 4926 Allenpark Dr | CCTV | $ | 1,307 | 15 | 8 | 2015 | 349 | PVC | 2-Low |
| Gravity Main | P4834 | 4998 Allenpark Dr | CCTV | $ | 804 | 15 | 8 | 2015 | 215 | PVC | 2-Low |
| Gravity Main | P4838 | 11287-11295 University Pkwy | CCTV | $ | 775 | 15 | 8 | 2004 | 207 | PVC | 2-Low |
| Gravity Main | P9506 | 11516 Boyne Blvd | CCTV | $ | 1,313 | 15 | 8 | 2016 | 350 | PVC | 2-Low |
| Gravity Main | P1106 | Southtown Dr | CCTV | $ | 771 | 15 | 8 | 2007 | 206 | PVC | 2-Low |
| Gravity Main | P9704 | 5399 Crestfield Ln | CCTV | $ | 528 | 15 | 8 | 2015 | 141 | PVC | 2-Low |
| Gravity Main | P9503 | 4999 Allenpark Dr | CCTV | $ | 728 | 15 | 8 | 2016 | 194 | PVC | 2-Low |
| Gravity Main | P9702 | 5401-5399 Pierce St | CCTV | $ | 1,092 | 15 | 8 | 2015 | 291 | PVC | 2-Low |
| Gravity Main | P9706 | 5363 Windfield Dr | CCTV | $ | 383 | 15 | 8 | 2006 | 102 | PVC | 2-Low |
| Gravity Main | P9505 | 4923 Allenpark Dr | CCTV | $ | 1,302 | 15 | 8 | 2016 | 347 | PVC | 2-Low |
| Gravity Main | P9507 | 11560 Boyne Blvd | CCTV | $ | 903 | 15 | 8 | 2016 | 241 | PVC | 2-Low |
| Gravity Main | P9504 | 11432 Boyne Blvd | CCTV | $ | 184 | 15 | 8 | 2016 | 49 | PVC | 2-Low |
| Gravity Main | P9510 | 4923-4999 Allenpark Dr | CCTV | $ | 1,304 | 15 | 8 | 2016 | 348 | PVC | 2-Low |
| Gravity Main | P9513 | 4880-4878 Becker Dr | CCTV | $ | 255 | 15 | 6 | 2004 | 68 | PVC | 2-Low |
| Gravity Main | P9514 | Southtown Dr | CCTV | $ | 793 | 15 | 8 | 2007 | 212 | PVC | 2-Low |
| Gravity Main | P9509 | 4999 Allenpark Dr | CCTV | $ | 571 | 15 | 8 | 2016 | 152 | PVC | 2-Low |
| Gravity Main | P9511 | 4923 Allenpark Dr | CCTV | $ | 1,313 | 15 | 8 | 2016 | 350 | PVC | 2-Low |
| Gravity Main | P3608 | 5241 Pierce St | CCTV | $ | 272 | 15 | 8 | 2015 | 72 | PVC | 2-Low |
| Gravity Main | P9616 | 5075 Pierce St | CCTV | $ | 1,210 | 15 | 8 | 2006 | 323 | PVC | 2-Low |
| Gravity Main | P4835 | 4926 Allenpark Dr | CCTV | $ | 758 | 15 | 8 | 2015 | 202 | PVC | 2-Low |

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|---|---|---|---|---|---|---|---|---|---|---|---|
| Gravity Main | P3609 | 5255 Pierce St | CCTV | $ | 687 | 15 | 8 | 2015 | 183 | PVC | 2-Low |
| Gravity Main | P3613 | 5399 Pierce St | CCTV | $ | 419 | 15 | 8 | 2015 | 112 | PVC | 2-Low |
| Gravity Main | P3614 | 5367 Pierce St | CCTV | $ | 1,113 | 15 | 8 | 2015 | 297 | PVC | 2-Low |
| Gravity Main | P9614 | 10520 52nd Ave | CCTV | $ | 406 | 15 | 8 | 2006 | 108 | PVC | 2-Low |
| Gravity Main | P9615 | 10520 52nd Ave | CCTV | $ | 1,272 | 15 | 8 | 2006 | 339 | PVC | 2-Low |
| Gravity Main | P9512 | 4898 Rich St | CCTV | $ | 939 | 15 | 8 | 2016 | 250 | PVC | 2-Low |
| Gravity Main | P9703 | 5398 Crestfield Ln | CCTV | $ | 1,285 | 15 | 8 | 2015 | 343 | PVC | 2-Low |
| Gravity Main | P9517 | 11200 Sugarloaf Ave | CCTV | $ | 437 | 15 | 10 | 2000 | 116 | VCP | 2-Low |
| Manhole | 5250 | 11605 46th Ave | MH Inspection | $ | 536 | 15 | 0 | 1991 | 0 | Not Known [XXX] | 2-Low |
| Manhole | 5350 | Nicholas Dr | MH Inspection | $ | 536 | 15 | 0 | 1991 | 0 | Not Known [XXX] | 2-Low |
| Manhole | 2771 | 11475 60th Ave | MH Inspection | $ | 536 | 15 | 0 | 1990 | 0 | Not Known [XXX] | 2-Low |
| Manhole | 4426 | 10975 Woodedge Dr | MH Inspection | $ | 536 | 15 | 0 | 2005 | 0 | Not Known [XXX] | 2-Low |
| Manhole | 1179 | 6370 Lake Michigan Dr | MH Inspection | $ | 536 | 15 | 0 | 2000 | 0 | Not Known [XXX] | 2-Low |
| Manhole | 2362 | 6394 Lake Michigan Dr | MH Inspection | $ | 536 | 15 | 0 | 2000 | 0 | Not Known [XXX] | 2-Low |
| Manhole | 2363 | 6306 Lake Michigan Dr | MH Inspection | $ | 536 | 15 | 0 | 2000 | 0 | Not Known [XXX] | 2-Low |
| Manhole | 1091 | 5366 Pierce St | MH Inspection | $ | 536 | 15 | 0 | 2015 | 0 | Not Known [XXX] | 2-Low |
| Manhole | 2228 | 11043 Creekside Dr | No Action | $ | - | 15 | 0 | 1995 | 0 | Concrete (Non-reinforced) | 2-Low |
| Manhole | 4932 | 4812 Allenpark Dr | MH Inspection | $ | 536 | 15 | 0 | 2001 | 0 | Not Known [XXX] | 2-Low |
| Manhole | 4940 | 11403 48th Ave | MH Inspection | $ | 536 | 15 | 0 | 2000 | 0 | Not Known [XXX] | 2-Low |
| Manhole | 1116 | 10411 48th Ave | MH Inspection | $ | 536 | 15 | 0 | 2001 | 0 | Not Known [XXX] | 2-Low |
| Manhole | 2253 | 6322 Henry St | MH Inspection | $ | 536 | 15 | 0 | 2008 | 0 | Not Known [XXX] | 2-Low |
| Manhole | 2254 | 6308 Henry St | MH Inspection | $ | 536 | 15 | 0 | 2008 | 0 | Not Known [XXX] | 2-Low |
| Manhole | 4614 | 5350 Lake Michigan Dr | MH Inspection | $ | 536 | 15 | 0 | 2001 | 0 | Not Known [XXX] | 2-Low |
| Manhole | 4703 | 11277 Commerce Rd | MH Inspection | $ | 536 | 15 | 0 | 2001 | 0 | Not Known [XXX] | 2-Low |
| Manhole | 4704 | 11297 Commerce Rd | MH Inspection | $ | 536 | 15 | 0 | 2001 | 0 | Not Known [XXX] | 2-Low |
| Manhole | 4706 | 11329 Commerce Rd | MH Inspection | $ | 536 | 15 | 0 | 2001 | 0 | Not Known [XXX] | 2-Low |
| Manhole | 4200 | 5475 Sunshine St | MH Inspection | $ | 536 | 15 | 0 | 2005 | 0 | Not Known [XXX] | 2-Low |
| Manhole | 4211 | 10861 Douglas Dr | MH Inspection | $ | 536 | 15 | 0 | 2004 | 0 | Not Known [XXX] | 2-Low |
| Manhole | 4214 | 5373 Sunshine St | MH Inspection | $ | 536 | 15 | 0 | 2005 | 0 | Not Known [XXX] | 2-Low |
| Manhole | 1521 | 10805 Timberline Dr | MH Inspection | $ | 536 | 15 | 0 | 2008 | 0 | Not Known [XXX] | 2-Low |
| Manhole | 1522 | 10808 Timberline Dr | MH Inspection | $ | 536 | 15 | 0 | 2008 | 0 | Not Known [XXX] | 2-Low |
| Gravity Main | P9009 | 1 Campus Dr | Full Lining | $ | 4,949 | 15 | 12 | 1963 | 77 | VCP | 2-Low |
| Gravity Main | P4842 | 11240 University Pkwy | CCTV | $ | 347 | 15 | 6 | 2004 | 92 | PVC | 2-Low |
| Gravity Main | P2414 | 7193-7222 Barn Owl Ln | CCTV | $ | 591 | 15 | 8 | 2015 | 158 | PVC | 2-Low |
| Gravity Main | P1071 | 7145-7157 Barn Owl Ln | CCTV | $ | 300 | 15 | 8 | 2015 | 80 | PVC | 2-Low |
| Gravity Main | P2415 | 7157-7193 Barn Owl Ln | CCTV | $ | 1,010 | 15 | 8 | 2015 | 269 | PVC | 2-Low |
| Gravity Main | P2416 | 7168-7157 Barn Owl Ln | CCTV | $ | 785 | 15 | 8 | 2015 | 209 | PVC | 2-Low |
| Gravity Main | P2516 | 7120-7170 Blue Jay Dr | CCTV | $ | 937 | 15 | 8 | 2013 | 250 | PVC | 2-Low |
| Gravity Main | P2418 | 7099-7145 Barn Owl Ln | CCTV | $ | 442 | 15 | 8 | 2015 | 118 | PVC | 2-Low |
| Gravity Main | P4841 | 11240-4880 Becker Dr | CCTV | $ | 313 | 15 | 6 | 2004 | 83 | PVC | 2-Low |
| Gravity Main | P2417 | 7157 Barn Owl Ln | CCTV | $ | 330 | 15 | 8 | 2015 | 88 | PVC | 2-Low |
| Gravity Main | P2419 | 7154 Blue Jay Dr | CCTV | $ | 1,122 | 15 | 8 | 2015 | 299 | PVC | 2-Low |
| Gravity Main | P4627 | 5065-5053 Lake Michigan Dr | CCTV | $ | 1,257 | 15 | 8 | 2005 | 335 | PVC | 2-Low |
| Gravity Main | P1104 | 5057 W Campus Dr | CCTV | $ | 959 | 15 | 8 | 2007 | 256 | PVC | 2-Low |
| Gravity Main | P4851 | 4683 Ottawa Creek Dr | No Action | $ | - | 14 | 8 | 2012 | 73 | PVC | 2-Low |

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|---|---|---|---|---|---|---|---|---|---|---|---|
| Gravity Main | P4839 | 4892 Becker Dr | No Action | $ | - | 13 | 8 | 2004 | 208 | PVC | 2-Low |
| Gravity Main | P1123 | 10556-10555 Laker Village Dr | CCTV | $ | 1,430 | 13 | 12 | 1990 | 381 | VCP | 2-Low |
| Gravity Main | P4332 | Northside Dr | No Action | $ | - | 13 | 8 | 2007 | 181 | PVC | 2-Low |
| Gravity Main | P4333 | Northside Dr | No Action | $ | - | 13 | 8 | 2007 | 229 | PVC | 2-Low |
| Gravity Main | P4133 | Meadows Xing | No Action | $ | - | 13 | 8 | 2008 | 154 | PVC | 2-Low |
| Gravity Main | P2976 | 11691-11682 Wilmington Dr | No Action | $ | - | 12 | 8 | 2006 | 62 | PVC | 2-Low |
| Gravity Main | P2977 | 11682-11666 Wilmington Dr | No Action | $ | - | 12 | 8 | 2006 | 131 | PVC | 2-Low |
| Gravity Main | P1722 | 10828-10825 Timberline Dr | No Action | $ | - | 12 | 8 | 2008 | 203 | PVC | 2-Low |
| Gravity Main | P2975 | 11698-11691 Wilmington Dr | No Action | $ | - | 12 | 8 | 2006 | 252 | PVC | 2-Low |
| Gravity Main | P1969 | 6202-6246 Timber Dr | No Action | $ | - | 12 | 8 | 2004 | 250 | PVC | 2-Low |
| Gravity Main | P1057 | Hawkin St | CCTV | $ | 1,151 | 12 | 10 | 2016 | 307 | PVC | 2-Low |
| Gravity Main | P1055 | Hawkin St | CCTV | $ | 725 | 12 | 10 | 2016 | 193 | PVC | 2-Low |
| Gravity Main | P4520 | 11088-11060 52nd Ave | No Action | $ | - | 12 | 8 | 2006 | 90 | PVC | 2-Low |
| Gravity Main | P2064 | 10928-10926 64th Ave | No Action | $ | - | 12 | 8 | 2004 | 150 | PVC | 2-Low |
| Gravity Main | P1723 | 10828 Timberline Dr | No Action | $ | - | 12 | 8 | 2008 | 172 | PVC | 2-Low |
| Gravity Main | P4639 | 4830-4850 Lake Michigan Dr | No Action | $ | - | 12 | 8 | 2001 | 159 | VCP | 2-Low |
| Gravity Main | P2065 | 10899 Constant Dr | No Action | $ | - | 12 | 8 | 2004 | 155 | PVC | 2-Low |
| Gravity Main | P1410 | 10582-10581 Learning Ln | No Action | $ | - | 9 | 8 | 2008 | 48 | PVC | 2-Low |
| Manhole | 4843 | 4857 Becker Dr | MH Inspection | $ | 536 | 4 | 0 | 2004 | 0 | Not Known [XXX] | 2-Low |
| Manhole | 2245 | 6676 Lake Michigan Dr | No Action | $ | - | 34 | 0 | 1990 | 0 | Concrete (Reinforced) [CR | 1-Negligible |
| Manhole | 2676 | 6047 Pebble Dr | No Action | $ | - | 34 | 0 | 1990 | 0 | Concrete (Reinforced) [CR | 1-Negligible |
| Manhole | 2675 | 6095 Pebble Dr | No Action | $ | - | 33 | 0 | 1990 | 0 | Concrete (Reinforced) [CR | 1-Negligible |
| Manhole | 4641 | 11125 48th Ave | No Action | $ | - | 32 | 0 | 1987 | 0 | Concrete (Reinforced) [CR | 1-Negligible |
| Manhole | 4620 | 5190 Lake Michigan Dr | No Action | $ | - | 31 | 0 | 1992 | 0 | Concrete (Reinforced) [CR | 1-Negligible |
| Manhole | 2194 | 5753 Mary Eliz Dr | MH Inspection | $ | 536 | 31 | 0 | 1990 | 0 | Not Known [XXX] | 1-Negligible |
| Manhole | 4141 | Meadows Xing | No Action | $ | - | 30 | 0 | 2008 | 0 | Concrete (Reinforced) [CR | 1-Negligible |
| Manhole | 2677 | 11498 Pebble Dr | No Action | $ | - | 30 | 0 | 1990 | 0 | Concrete (Reinforced) [CR | 1-Negligible |
| Manhole | 4874 | 11351 River Ridge Dr | No Action | $ | - | 30 | 0 | 1990 | 0 | Concrete (Reinforced) [CR | 1-Negligible |
| Manhole | 1173 | 4442 Lake Michigan Dr | MH Inspection | $ | 536 | 27 | 0 | 1963 | 0 | Not Known [XXX] | 1-Negligible |
| Manhole | 1123 | 10556 Laker Village Dr | No Action | $ | - | 26 | 0 | 1990 | 0 | Concrete (Reinforced) [CR | 1-Negligible |
| Manhole | 2635 | 11495 Brown St | No Action | $ | - | 26 | 0 | 1992 | 0 | Concrete (Reinforced) [CR | 1-Negligible |
| Manhole | 4418 | 11063 Summer Brook Ct | No Action | $ | - | 26 | 0 | 1994 | 0 | Concrete (Reinforced) [CR | 1-Negligible |
| Manhole | 1081 | 11303 Ripple Dr | No Action | $ | - | 26 | 0 | 1990 | 0 | Concrete (Reinforced) [CR | 1-Negligible |
| Manhole | 1952 | 6588 Winans St | No Action | $ | - | 26 | 0 | 1992 | 0 | Concrete (Reinforced) [CR | 1-Negligible |
| Manhole | 2678 | 11456 Pebble Dr | No Action | $ | - | 26 | 0 | 1990 | 0 | Concrete (Reinforced) [CR | 1-Negligible |
| Manhole | 2445 | 6561 Lake Michigan Dr | No Action | $ | - | 26 | 0 | 1990 | 0 | Concrete (Reinforced) [CR | 1-Negligible |
| Manhole | LS_BROWN | 11495 Brown St | No Action | $ | - | 26 | 0 | 1992 | 0 | Concrete (Reinforced) [CR | 1-Negligible |
| Manhole | 2246 | 6676 Lake Michigan Dr | MH Inspection | $ | 536 | 26 | 0 | 1992 | 0 | Not Known [XXX] | 1-Negligible |
| Manhole | 4621 | 5088 Lake Michigan Dr | MH Inspection | $ | 536 | 26 | 0 | 1992 | 0 | Not Known [XXX] | 1-Negligible |
| Manhole | 4747 | 11253 Whispering Creek Dr | MH Inspection | $ | 536 | 26 | 0 | 2012 | 0 | Not Known [XXX] | 1-Negligible |
| Manhole | 4705 | 11301 Commerce Rd | MH Inspection | $ | 536 | 26 | 0 | 2001 | 0 | Not Known [XXX] | 1-Negligible |
| Manhole | 4836 | 4926 Allenpark Dr | MH Inspection | $ | 536 | 26 | 0 | 2015 | 0 | Not Known [XXX] | 1-Negligible |
| Manhole | 1007 | 6161 Lake Michigan Dr | MH Inspection | $ | 536 | 26 | 0 | 1990 | 0 | Not Known [XXX] | 1-Negligible |
| Manhole | 4461 | 4443 Stadium Dr | MH Inspection | $ | 536 | 26 | 0 | 1963 | 0 | Not Known [XXX] | 1-Negligible |
| Manhole | 4462 | 4307 Stadium Dr | MH Inspection | $ | 536 | 26 | 0 | 1963 | 0 | Not Known [XXX] | 1-Negligible |

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|---|---|---|---|---|---|---|---|---|---|---|---|
| Manhole | 4877 | 11377 40th Ave | MH Inspection | $ | 536 | 26 | 0 | 1990 | 0 | Not Known [XXX] | 1-Negligible |
| Manhole | 4878 | 11375 40th Ave | MH Inspection | $ | 536 | 26 | 0 | 1990 | 0 | Not Known [XXX] | 1-Negligible |
| Manhole | 1968 | 6246 Timber Dr | MH Inspection | $ | 536 | 26 | 0 | 2004 | 0 | Not Known [XXX] | 1-Negligible |
| Manhole | 3936 | Campus West Apartments | MH Inspection | $ | 536 | 26 | 0 | 1990 | 0 | Not Known [XXX] | 1-Negligible |
| Manhole | 2348 | 6600 Lake Michigan Dr | MH Inspection | $ | 536 | 26 | 0 | 1993 | 0 | Not Known [XXX] | 1-Negligible |
| Manhole | 3074 | 6104 Balcom Ln | MH Inspection | $ | 536 | 26 | 0 | 2008 | 0 | Not Known [XXX] | 1-Negligible |
| Manhole | 2972 | 6090 Balcom Ln | MH Inspection | $ | 536 | 26 | 0 | 2006 | 0 | Not Known [XXX] | 1-Negligible |
| Manhole | 1113 | 10581 48th Ave | MH Inspection | $ | 536 | 26 | 0 | 1990 | 0 | Not Known [XXX] | 1-Negligible |
| Manhole | 4501 | 5564 Eric St | MH Inspection | $ | 536 | 26 | 0 | 1990 | 0 | Not Known [XXX] | 1-Negligible |
| Manhole | 1176 | 5947 Lake Michigan Dr | No Action | $ | - | 24 | 0 | 1990 | 0 | Concrete (Reinforced) [CR | 1-Negligible |
| Manhole | 4540 | 11077 48th Ave | No Action | $ | - | 24 | 0 | 1987 | 0 | Concrete (Reinforced) [CR | 1-Negligible |
| Manhole | 1126 | 4477 Lake Michigan Dr | MH Adjust Rim | $ | 2,678 | 24 | 0 | 1990 | 0 | Concrete (Reinforced) [CR | 1-Negligible |
| Manhole | 2442 | 6633 Lake Michigan Dr | No Action | $ | - | 24 | 0 | 1990 | 0 | Concrete (Reinforced) [CR | 1-Negligible |
| Manhole | 2443 | 11272 Avery Ave | No Action | $ | - | 24 | 0 | 1990 | 0 | Concrete (Reinforced) [CR | 1-Negligible |
| Manhole | 2446 | 6545 Lake Michigan Dr | No Action | $ | - | 24 | 0 | 1990 | 0 | Concrete (Reinforced) [CR | 1-Negligible |
| Manhole | 2449 | 6561 Lake Michigan Dr | No Action | $ | - | 24 | 0 | 1990 | 0 | Concrete (Reinforced) [CR | 1-Negligible |
| Manhole | 3762 | 1 Campus Dr | No Action | $ | - | 24 | 0 | 1963 | 0 | Concrete (Reinforced) [CR | 1-Negligible |
| Manhole | 3932 | Campus West Apartments | No Action | $ | - | 24 | 0 | 1990 | 0 | Concrete (Reinforced) [CR | 1-Negligible |
| Manhole | 3938 | Campus West Apartments | No Action | $ | - | 24 | 0 | 1990 | 0 | Concrete (Reinforced) [CR | 1-Negligible |
| Manhole | 4160 | Laker Village Dr | No Action | $ | - | 24 | 0 | 1963 | 0 | Concrete (Reinforced) [CR | 1-Negligible |
| Manhole | 4360 | 1 Campus Dr | No Action | $ | - | 24 | 0 | 1963 | 0 | Concrete (Reinforced) [CR | 1-Negligible |
| Manhole | 4654 | 4477 Lake Michigan Dr | MH Adjust Rim | $ | 2,678 | 24 | 0 | 1990 | 0 | Concrete (Reinforced) [CR | 1-Negligible |
| Manhole | 2349 | 6550 Lake Michigan Dr | MH Inspection | $ | 536 | 24 | 0 | 1993 | 0 | Not Known [XXX] | 1-Negligible |
| Manhole | 4140 | 10745 48th Ave | No Action | $ | - | 24 | 0 | 1990 | 0 | Concrete (Reinforced) [CR | 1-Negligible |
| Manhole | 2573 | 6003 Crystal Dr | No Action | $ | - | 24 | 0 | 1990 | 0 | Concrete (Reinforced) [CR | 1-Negligible |
| Manhole | 2574 | 6028 Crystal Dr | No Action | $ | - | 24 | 0 | 1990 | 0 | Concrete (Reinforced) [CR | 1-Negligible |
| Manhole | 2575 | 6064 Crystal Dr | No Action | $ | - | 24 | 0 | 1990 | 0 | Concrete (Reinforced) [CR | 1-Negligible |
| Manhole | 2670 | 6085 Crystal Dr | No Action | $ | - | 24 | 0 | 1990 | 0 | Concrete (Reinforced) [CR | 1-Negligible |
| Manhole | 2672 | 11359 Ripple Dr | No Action | $ | - | 24 | 0 | 1990 | 0 | Concrete (Reinforced) [CR | 1-Negligible |
| Manhole | 2673 | 11433 Ripple Dr | No Action | $ | - | 24 | 0 | 1990 | 0 | Concrete (Reinforced) [CR | 1-Negligible |
| Manhole | 2411 | 11287 Red Hawk Ln | MH Inspection | $ | 536 | 24 | 0 | 2007 | 0 | Not Known [XXX] | 1-Negligible |
| Manhole | 3933 | Campus West Apartments | MH Inspection | $ | 536 | 24 | 0 | 1990 | 0 | Not Known [XXX] | 1-Negligible |
| Manhole | 2344 | 6660 Lake Michigan Dr | MH Inspection | $ | 536 | 24 | 0 | 1993 | 0 | Not Known [XXX] | 1-Negligible |
| Manhole | 3634 | 5013 Pierce St | MH Inspection | $ | 536 | 24 | 0 | 2014 | 0 | Not Known [XXX] | 1-Negligible |
| Manhole | 9702 | 5401 Pierce St | MH Inspection | $ | 536 | 24 | 0 | 2015 | 0 | Not Known [XXX] | 1-Negligible |
| Manhole | 3934 | Campus West Apartments | MH Inspection | $ | 536 | 24 | 0 | 1990 | 0 | Not Known [XXX] | 1-Negligible |
| Manhole | 2010 | 7338 Water View Ln | MH Inspection | $ | 536 | 24 | 0 | 2004 | 0 | Not Known [XXX] | 1-Negligible |
| Manhole | 3760 | 4400 Pierce St | No Action | $ | - | 23 | 0 | 1998 | 0 | Concrete (Reinforced) [CR | 1-Negligible |
| Manhole | 1080 | 11562 Spruce View Dr | No Action | $ | - | 23 | 0 | 2003 | 0 | Concrete (Reinforced) [CR | 1-Negligible |
| Gravity Main | P1173 | 4442-4426 Lake Michigan Dr | CCTV and Heavy Cleaning | $ | 791 | 23 | 8 | 1963 | 105 | PVC | 1-Negligible |
| Manhole | 9609 | Winnie Ln | MH Inspection | $ | 536 | 22 | 0 | 2016 | 0 | Not Known [XXX] | 1-Negligible |
| Manhole | 9610 | Winnie Ln | MH Inspection | $ | 536 | 22 | 0 | 2016 | 0 | Not Known [XXX] | 1-Negligible |
| Manhole | 4335 | Northside Dr | MH Inspection | $ | 536 | 21 | 0 | 2007 | 0 | Not Known [XXX] | 1-Negligible |
| Manhole | 2351 | 6448 Lake Michigan Dr | MH Inspection | $ | 536 | 21 | 0 | 2001 | 0 | Not Known [XXX] | 1-Negligible |
| Manhole | 1912 | 7389 Pinevalley Dr | MH Inspection | $ | 536 | 21 | 0 | 2004 | 0 | Not Known [XXX] | 1-Negligible |

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|---|---|---|---|---|---|---|---|---|---|---|---|
| Manhole | 2674 | 6189 Pebble Dr | No Action | $ | - | 20 | 0 | 1990 | 0 | Concrete (Reinforced) [CR | 1-Negligible |
| Manhole | 2444 | 6635 Lake Michigan Dr | No Action | $ | - | 20 | 0 | 1990 | 0 | Concrete (Reinforced) [CR | 1-Negligible |
| Manhole | 2401 | Placid Waters Dr | MH Inspection | $ | 536 | 20 | 0 | 2009 | 0 | Not Known [XXX] | 1-Negligible |
| Manhole | 4441 | 11027 48th Ave | No Action | $ | - | 19 | 0 | 1987 | 0 | Concrete (Reinforced) [CR | 1-Negligible |
| Manhole | 4650 | 11230 Kistler Dr | No Action | $ | - | 19 | 0 | 1990 | 0 | Concrete (Reinforced) [CR | 1-Negligible |
| Manhole | 4651 | 4535 Lake Michigan Dr | No Action | $ | - | 19 | 0 | 1990 | 0 | Concrete (Reinforced) [CR | 1-Negligible |
| Manhole | 4655 | 4427 Lake Michigan Dr | No Action | $ | - | 19 | 0 | 1990 | 0 | Concrete (Reinforced) [CR | 1-Negligible |
| Manhole | 4701 | 11258 56th Ave | No Action | $ | - | 19 | 0 | 1990 | 0 | Concrete (Reinforced) [CR | 1-Negligible |
| Manhole | 4626 | 5053 Lake Michigan Dr | No Action | $ | - | 19 | 0 | 1990 | 0 | Concrete (Reinforced) [CR | 1-Negligible |
| Manhole | 3761 | 1 Campus Dr | No Action | $ | - | 19 | 0 | 1998 | 0 | Concrete (Reinforced) [CR | 1-Negligible |
| Manhole | 3734 | 4886 Country Pl S | MH Inspection | $ | 536 | 19 | 0 | 2001 | 0 | Not Known [XXX] | 1-Negligible |
| Manhole | 2011 | 7376 Water View Ln | MH Inspection | $ | 536 | 19 | 0 | 2004 | 0 | Not Known [XXX] | 1-Negligible |
| Manhole | 9708 | 5241 Pierce St | MH Inspection | $ | 536 | 19 | 0 | 2015 | 0 | Not Known [XXX] | 1-Negligible |
| Manhole | 3432 | Copper Beech Townhomes | MH Inspection | $ | 536 | 19 | 0 | 2007 | 0 | Not Known [XXX] | 1-Negligible |
| Manhole | 1064 | Marsh Ave | MH Inspection | $ | 536 | 19 | 0 | 2016 | 0 | Not Known [XXX] | 1-Negligible |
| Manhole | 9617 | Marsh Ave | MH Inspection | $ | 536 | 19 | 0 | 2015 | 0 | Not Known [XXX] | 1-Negligible |
| Manhole | 3513 | Mystic Wds | MH Inspection | $ | 536 | 19 | 0 | 2015 | 0 | Not Known [XXX] | 1-Negligible |
| Manhole | 3735 | 4967 Pierce St | MH Inspection | $ | 536 | 18 | 0 | 2014 | 0 | Not Known [XXX] | 1-Negligible |
| Manhole | 9503 | Allenpark Dr | MH Inspection | $ | 536 | 18 | 0 | 2016 | 0 | Not Known [XXX] | 1-Negligible |
| Manhole | 4744 | Boltwood Apartments | MH Inspection | $ | 536 | 18 | 0 | 2012 | 0 | Not Known [XXX] | 1-Negligible |
| Manhole | 4629 | 5128 Lake Michigan Dr | MH Inspection | $ | 536 | 18 | 0 | 2012 | 0 | Not Known [XXX] | 1-Negligible |
| Manhole | 3084 | 11716 60th Ave | MH Inspection | $ | 536 | 18 | 0 | 2014 | 0 | Not Known [XXX] | 1-Negligible |
| Manhole | 9619 | Marsh Ave | MH Inspection | $ | 536 | 18 | 0 | 2015 | 0 | Not Known [XXX] | 1-Negligible |
| Manhole | 3464 | 10073 Laker Ln | MH Inspection | $ | 536 | 18 | 0 | 2007 | 0 | Not Known [XXX] | 1-Negligible |
| Manhole | 2110 | 7395 Watermark Dr | MH Inspection | $ | 536 | 18 | 0 | 2001 | 0 | Not Known [XXX] | 1-Negligible |
| Manhole | 4231 | Southtown Dr | MH Inspection | $ | 536 | 18 | 0 | 2007 | 0 | Not Known [XXX] | 1-Negligible |
| Manhole | 4337 | Northside Dr | MH Inspection | $ | 536 | 18 | 0 | 2007 | 0 | Not Known [XXX] | 1-Negligible |
| Manhole | 3516 | 5256 Pierce St | MH Inspection | $ | 536 | 18 | 0 | 2015 | 0 | Not Known [XXX] | 1-Negligible |
| Manhole | 2300 | 11213 78th Ave | MH Inspection | $ | 536 | 18 | 0 | 2007 | 0 | Not Known [XXX] | 1-Negligible |
| Gravity Main | P2310 | 7388-7408 Waterline Dr | No Action | $ | - | 18 | 8 | 2003 | 169 | PVC | 1-Negligible |
| Gravity Main | P2312 | 7301-7349 Waterline Dr | No Action | $ | - | 18 | 8 | 2003 | 326 | PVC | 1-Negligible |
| Gravity Main | P2113 | 11031-11048 Waterway Dr | No Action | $ | - | 18 | 8 | 2003 | 111 | PVC | 1-Negligible |
| Gravity Main | P2116 | 7224 Water View Ln | No Action | $ | - | 18 | 8 | 2003 | 176 | PVC | 1-Negligible |
| Gravity Main | P2311 | 7349-7388 Waterline Dr | No Action | $ | - | 18 | 8 | 2003 | 274 | PVC | 1-Negligible |
| Gravity Main | P2211 | 7308 Waterline Dr | No Action | $ | - | 18 | 8 | 2003 | 275 | PVC | 1-Negligible |
| Gravity Main | P3436 | Copper Beech Townhomes | No Action | $ | - | 17 | 8 | 2005 | 357 | PVC | 1-Negligible |
| Gravity Main | P3531 | Copper Beech Townhomes | No Action | $ | - | 17 | 8 | 2007 | 278 | PVC | 1-Negligible |
| Manhole | 3517 | 5256 Pierce St | MH Inspection | $ | 536 | 17 | 0 | 2015 | 0 | Not Known [XXX] | 1-Negligible |
| Force Main | FM6 | 7909 Lake Michigan Dr | No Action | $ | - | 16 | 4 | 2007 | 1372 | HDPE | 1-Negligible |
| Gravity Main | P3861 | 1 Campus Dr | CCTV and Heavy Cleaning | $ | 853 | 16 | 8 | 1963 | 114 | PVC | 1-Negligible |
| Manhole | 2500 | 11315 Wake Dr | MH Inspection | $ | 536 | 16 | 0 | 2009 | 0 | Not Known [XXX] | 1-Negligible |
| Manhole | 3361 | S University Dr | MH Inspection | $ | 536 | 16 | 0 | 2007 | 0 | Not Known [XXX] | 1-Negligible |
| Force Main | FM1 | 11562 84th Ave | No Action | $ | - | 16 | 2 | 2009 | 2981 | DUCTILE IRON | 1-Negligible |
| Manhole | 1026 | #N/A | No Action | $ | - | 15 | 0 | 1987 | 0 | Concrete (Reinforced) [CR | 1-Negligible |
| Manhole | 4340 | 10929 48th Ave | No Action | $ | - | 15 | 0 | 1987 | 0 | Concrete (Reinforced) [CR | 1-Negligible |

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|---|---|---|---|---|---|---|---|---|---|---|---|
| Manhole | 3842 | 10539 48th Ave | MH Inspection | $ | 536 | 15 | 0 | 1990 | 0 | Not Known [XXX] | 1-Negligible |
| Manhole | 4833 | Becker Dr | MH Inspection | $ | 536 | 15 | 0 | 2015 | 0 | Not Known [XXX] | 1-Negligible |
| Manhole | 3861 | 1 Campus Dr | MH Inspection | $ | 536 | 15 | 0 | 1963 | 0 | Not Known [XXX] | 1-Negligible |
| Manhole | 4362 | 1 Campus Dr | MH Inspection | $ | 536 | 15 | 0 | 1963 | 0 | Not Known [XXX] | 1-Negligible |
| Manhole | 3562 | 4352 Campus View Dr | No Action | $ | - | 15 | 0 | 1998 | 0 | Concrete (Reinforced) [CR | 1-Negligible |
| Manhole | 3567 | 4260 Campus View Dr | No Action | $ | - | 15 | 0 | 2004 | 0 | Concrete (Reinforced) [CR | 1-Negligible |
| Manhole | 4223 | Southtown Dr | MH Inspection | $ | 536 | 15 | 0 | 2007 | 0 | Not Known [XXX] | 1-Negligible |
| Manhole | 9009 | 1 Campus Dr | MH Inspection | $ | 536 | 15 | 0 | 1963 | 0 | Not Known [XXX] | 1-Negligible |
| Manhole | 5013 | 5307 Edgeway Dr | MH Inspection | $ | 536 | 15 | 0 | 2000 | 0 | Not Known [XXX] | 1-Negligible |
| Manhole | 5014 | 5201 Edgeway Dr | MH Inspection | $ | 536 | 15 | 0 | 2000 | 0 | Not Known [XXX] | 1-Negligible |
| Manhole | 3085 | 11799 Brookridge Dr | MH Inspection | $ | 536 | 15 | 0 | 2014 | 0 | Not Known [XXX] | 1-Negligible |
| Manhole | 3088 | 11667 Brookridge Dr | MH Inspection | $ | 536 | 15 | 0 | 2006 | 0 | Not Known [XXX] | 1-Negligible |
| Force Main | FM7 | 11213-11191 78th Ave | No Action | $ | - | 15 | 4 | 2007 | 132 | HDPE | 1-Negligible |
| Force Main | FM5 | 8081 Lake Michigan Dr | No Action | $ | - | 15 | 4 | 2009 | 958 | HDPE | 1-Negligible |
| Gravity Main | P2111 | 7359-7320 Watermark Dr | No Action | $ | - | 15 | 8 | 2003 | 293 | PVC | 1-Negligible |
| Gravity Main | P2110 | 7395-7359 Watermark Dr | No Action | $ | - | 15 | 8 | 2003 | 287 | PVC | 1-Negligible |
| Manhole | 4519 | 11060 52nd Ave | MH Inspection | $ | 536 | 15 | 0 | 2006 | 0 | Concrete (Reinforced) [CR | 1-Negligible |
| Manhole | 4850 | 4657 Ottawa Creek Dr | MH Inspection | $ | 536 | 15 | 0 | 2012 | 0 | Not Known [XXX] | 1-Negligible |
| Manhole | 3813 | 5364 Windfield Dr | MH Inspection | $ | 536 | 15 | 0 | 2006 | 0 | Not Known [XXX] | 1-Negligible |
| Manhole | 3815 | 10564 Rockfield Rd | MH Inspection | $ | 536 | 15 | 0 | 2013 | 0 | Not Known [XXX] | 1-Negligible |
| Manhole | 3816 | 10518 Rockfield Rd | MH Inspection | $ | 536 | 15 | 0 | 2013 | 0 | Not Known [XXX] | 1-Negligible |
| Manhole | 2492 | 5677 Lake Michigan Dr | MH Inspection | $ | 536 | 15 | 0 | 2000 | 0 | Not Known [XXX] | 1-Negligible |
| Manhole | 4222 | Southtown Dr | MH Inspection | $ | 536 | 15 | 0 | 2007 | 0 | Not Known [XXX] | 1-Negligible |
| Manhole | 4329 | Northside Dr | MH Inspection | $ | 536 | 15 | 0 | 2007 | 0 | Not Known [XXX] | 1-Negligible |
| Manhole | 2255 | 6301 Henry St | MH Inspection | $ | 536 | 15 | 0 | 2008 | 0 | Not Known [XXX] | 1-Negligible |
| Manhole | 4260 | 1 Campus Dr | MH Inspection | $ | 536 | 15 | 0 | 1963 | 0 | Not Known [XXX] | 1-Negligible |
| Manhole | 3616 | 5313 Pierce St | MH Inspection | $ | 536 | 15 | 0 | 2015 | 0 | Not Known [XXX] | 1-Negligible |
| Manhole | 1969 | 6202 Timber Dr | MH Inspection | $ | 536 | 15 | 0 | 2004 | 0 | Not Known [XXX] | 1-Negligible |
| Manhole | 1915 | 7273 Pinevalley Dr | MH Inspection | $ | 536 | 15 | 0 | 2004 | 0 | Not Known [XXX] | 1-Negligible |
| Manhole | 2116 | 7218 Water View Ln | MH Inspection | $ | 536 | 15 | 0 | 2001 | 0 | Not Known [XXX] | 1-Negligible |
| Manhole | 2200 | 11103 Waterpoint Dr | MH Inspection | $ | 536 | 15 | 0 | 2004 | 0 | Not Known [XXX] | 1-Negligible |
| Manhole | 2470 | 11263 60th Ave | MH Inspection | $ | 536 | 15 | 0 | 2003 | 0 | Not Known [XXX] | 1-Negligible |
| Manhole | 2317 | 7273 Lake Michigan Dr | MH Inspection | $ | 536 | 15 | 0 | 2007 | 0 | Not Known [XXX] | 1-Negligible |
| Manhole | 3365 | 10173 42nd Ave | MH Inspection | $ | 536 | 15 | 0 | 2016 | 0 | Not Known [XXX] | 1-Negligible |
| Manhole | 4142 | 10861 48th Ave | No Action | $ | - | 14 | 0 | 1987 | 0 | Concrete (Reinforced) [CR | 1-Negligible |
| Manhole | 1910 | 7517 Water View Ln | MH Inspection | $ | 536 | 14 | 0 | 2004 | 0 | Not Known [XXX] | 1-Negligible |
| Manhole | 1099 | 10500 Rockfield Rd | MH Inspection | $ | 536 | 14 | 0 | 2013 | 0 | Not Known [XXX] | 1-Negligible |
| Manhole | 1100 | 5270 Crestfield Ln | MH Inspection | $ | 536 | 14 | 0 | 2013 | 0 | Not Known [XXX] | 1-Negligible |
| Manhole | 3733 | 4924 Country Pl S | MH Inspection | $ | 536 | 14 | 0 | 2001 | 0 | Not Known [XXX] | 1-Negligible |
| Manhole | 3737 | Hillcrest Town Houses | MH Inspection | $ | 536 | 14 | 0 | 2014 | 0 | Not Known [XXX] | 1-Negligible |
| Manhole | 4849 | 4689 Lake Michigan Dr | MH Inspection | $ | 536 | 14 | 0 | 2012 | 0 | Not Known [XXX] | 1-Negligible |
| Manhole | 4137 | Meadows Xing | MH Inspection | $ | 536 | 14 | 0 | 2008 | 0 | Not Known [XXX] | 1-Negligible |
| Manhole | 4230 | Southtown Dr | MH Inspection | $ | 536 | 14 | 0 | 2007 | 0 | Not Known [XXX] | 1-Negligible |
| Manhole | 4232 | 10897 48th Ave | MH Inspection | $ | 536 | 14 | 0 | 2007 | 0 | Not Known [XXX] | 1-Negligible |
| Manhole | 4336 | Northside Dr | MH Inspection | $ | 536 | 14 | 0 | 2007 | 0 | Not Known [XXX] | 1-Negligible |

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|---|---|---|---|---|---|---|---|---|---|---|---|
| Manhole | 4338 | Northside Dr | MH Inspection | $ | 536 | 14 | 0 | 2007 | 0 | Not Known [XXX] | 1-Negligible |
| Manhole | 9705 | 5360 Windfield Dr | MH Inspection | $ | 536 | 14 | 0 | 2006 | 0 | Not Known [XXX] | 1-Negligible |
| Manhole | 2002 | 10803 Waterpoint Dr | MH Inspection | $ | 536 | 14 | 0 | 2004 | 0 | Not Known [XXX] | 1-Negligible |
| Manhole | 2063 | 10926 64th Ave | MH Inspection | $ | 536 | 14 | 0 | 2004 | 0 | Not Known [XXX] | 1-Negligible |
| Manhole | 2064 | 10928 64th Ave | MH Inspection | $ | 536 | 14 | 0 | 2004 | 0 | Not Known [XXX] | 1-Negligible |
| Manhole | 2065 | 10899 Constant Dr | MH Inspection | $ | 536 | 14 | 0 | 2004 | 0 | Not Known [XXX] | 1-Negligible |
| Manhole | 2982 | 11637 60th Ave | MH Inspection | $ | 536 | 14 | 0 | 2006 | 0 | Not Known [XXX] | 1-Negligible |
| Manhole | 3080 | 11705 60th Ave | MH Inspection | $ | 536 | 14 | 0 | 2008 | 0 | Not Known [XXX] | 1-Negligible |
| Manhole | 4332 | Northside Dr | MH Inspection | $ | 536 | 14 | 0 | 2007 | 0 | Not Known [XXX] | 1-Negligible |
| Manhole | 4334 | Northside Dr | MH Inspection | $ | 536 | 14 | 0 | 2007 | 0 | Not Known [XXX] | 1-Negligible |
| Manhole | 5017 | 11550 53rd Ave | MH Inspection | $ | 536 | 14 | 0 | 2000 | 0 | Not Known [XXX] | 1-Negligible |
| Manhole | 9616 | 5075 Pierce St | MH Inspection | $ | 536 | 14 | 0 | 2006 | 0 | Not Known [XXX] | 1-Negligible |
| Manhole | 9520 | 11547 53rd Ave | MH Inspection | $ | 536 | 14 | 0 | 2010 | 0 | Not Known [XXX] | 1-Negligible |
| Manhole | LS_HIDDEN_SHORES | 7423 Waterline Dr | No Action | $ | - | 14 | 0 | 2003 | 0 | Concrete (Reinforced) [CR | 1-Negligible |
| Manhole | 9506 | 11540 Boyne Blvd | MH Inspection | $ | 536 | 14 | 0 | 2016 | 0 | Not Known [XXX] | 1-Negligible |
| Manhole | 2007 | 7424 Watermark Dr | MH Inspection | $ | 536 | 14 | 0 | 2004 | 0 | Not Known [XXX] | 1-Negligible |
| Manhole | 2009 | 10975 Waterpoint Dr | MH Inspection | $ | 536 | 14 | 0 | 2004 | 0 | Not Known [XXX] | 1-Negligible |
| Manhole | 2971 | 6142 Balcom Ln | MH Inspection | $ | 536 | 14 | 0 | 2006 | 0 | Not Known [XXX] | 1-Negligible |
| Manhole | 2978 | 11666 Wilmington Dr | MH Inspection | $ | 536 | 14 | 0 | 2006 | 0 | Not Known [XXX] | 1-Negligible |
| Manhole | 3532 | Copper Beech Townhomes | MH Inspection | $ | 536 | 14 | 0 | 2007 | 0 | Not Known [XXX] | 1-Negligible |
| Manhole | 3625 | 5050 Pierce St | MH Inspection | $ | 536 | 14 | 0 | 2014 | 0 | Not Known [XXX] | 1-Negligible |
| Manhole | 1072 | 7680 Lake Michigan Dr | MH Inspection | $ | 536 | 14 | 0 | 2007 | 0 | Not Known [XXX] | 1-Negligible |
| Manhole | 1075 | 7634 Lake Michigan Dr | MH Inspection | $ | 536 | 14 | 0 | 2007 | 0 | Not Known [XXX] | 1-Negligible |
| Manhole | 2304 | 11127 Waterpoint Dr | MH Inspection | $ | 536 | 14 | 0 | 2005 | 0 | Not Known [XXX] | 1-Negligible |
| Manhole | 1119 | S University Dr | MH Inspection | $ | 536 | 14 | 0 | 2016 | 0 | Not Known [XXX] | 1-Negligible |
| Manhole | 3511 | Mystic Wds | MH Inspection | $ | 536 | 14 | 0 | 2015 | 0 | Not Known [XXX] | 1-Negligible |
| Manhole | 3512 | Mystic Wds | MH Inspection | $ | 536 | 14 | 0 | 2015 | 0 | Not Known [XXX] | 1-Negligible |
| Manhole | 1066 | Marsh Ave | MH Inspection | $ | 536 | 14 | 0 | 2016 | 0 | Not Known [XXX] | 1-Negligible |
| Manhole | 3360 | 10033 Laker Ln | MH Inspection | $ | 536 | 14 | 0 | 2007 | 0 | Not Known [XXX] | 1-Negligible |
| Manhole | 2008 | 7412 Watermark Dr | MH Inspection | $ | 536 | 14 | 0 | 2004 | 0 | Not Known [XXX] | 1-Negligible |
| Manhole | 3465 | Laker Ln | MH Inspection | $ | 536 | 14 | 0 | 2007 | 0 | Not Known [XXX] | 1-Negligible |
| Manhole | 1092 | 5122 Pierce St | MH Inspection | $ | 536 | 14 | 0 | 2014 | 0 | Not Known [XXX] | 1-Negligible |
| Manhole | 1093 | 5122 Pierce St | MH Inspection | $ | 536 | 14 | 0 | 2014 | 0 | Not Known [XXX] | 1-Negligible |
| Manhole | 3434 | Copper Beech Townhomes | MH Inspection | $ | 536 | 14 | 0 | 2007 | 0 | Not Known [XXX] | 1-Negligible |
| Manhole | 2302 | 7738 Lake Michigan Dr | MH Inspection | $ | 536 | 14 | 0 | 2007 | 0 | Not Known [XXX] | 1-Negligible |
| Manhole | 3369 | S University Dr | MH Inspection | $ | 536 | 14 | 0 | 2016 | 0 | Not Known [XXX] | 1-Negligible |
| Gravity Main | P2986 | 5890 Rich St | CCTV | $ | 717 | 14 | 8 | 2003 | 191 | PVC | 1-Negligible |
| Gravity Main | P3083 | 11714-11727 60th Ave | CCTV | $ | 201 | 14 | 8 | 1990 | 54 | PVC | 1-Negligible |
| Gravity Main | P2987 | 5870-5882 Rich St | CCTV | $ | 294 | 14 | 8 | 2003 | 78 | PVC | 1-Negligible |
| Gravity Main | P2985 | 11697-11659 Brookland Ct | CCTV | $ | 634 | 14 | 8 | 2003 | 169 | PVC | 1-Negligible |
| Gravity Main | P2988 | 5825-5870 Rich St | CCTV | $ | 1,058 | 14 | 8 | 2003 | 282 | PVC | 1-Negligible |
| Gravity Main | P2989 | 11645 Spruce View Dr | CCTV | $ | 1,270 | 14 | 8 | 2003 | 339 | PVC | 1-Negligible |
| Gravity Main | P3073 | 6196-6104 Balcom Ln | No Action | $ | - | 14 | 10 | 2008 | 360 | PVC | 1-Negligible |
| Gravity Main | P3078 | 6082-6063 Rossfield Ct | No Action | $ | - | 14 | 10 | 2008 | 217 | PVC | 1-Negligible |
| Gravity Main | P3075 | 6054-6112 Balcom Ln | No Action | $ | - | 14 | 10 | 2008 | 97 | PVC | 1-Negligible |

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|---|---|---|---|---|---|---|---|---|---|---|---|
| Gravity Main | P3079 | 11705 60th Ave | No Action | $ | - | 14 | 10 | 2008 | 291 | PVC | 1-Negligible |
| Gravity Main | P3076 | 6014 Balcom Ln | No Action | $ | - | 14 | 10 | 2008 | 121 | PVC | 1-Negligible |
| Gravity Main | P3074 | 6104-6054 Balcom Ln | Full Lining | $ | 10,532 | 14 | 10 | 2008 | 197 | PVC | 1-Negligible |
| Gravity Main | P2315 | 7410 Lake Michigan Dr | No Action | $ | - | 14 | 8 | 2003 | 213 | PVC | 1-Negligible |
| Gravity Main | P2306 | 7478-7444 Waterline Dr | No Action | $ | - | 14 | 10 | 2005 | 125 | PVC | 1-Negligible |
| Gravity Main | P2204 | 7534-7596 Waterline Dr | No Action | $ | - | 14 | 10 | 2005 | 350 | PVC | 1-Negligible |
| Gravity Main | P2202 | 7546-7508 Waterline Dr | No Action | $ | - | 14 | 10 | 2005 | 102 | PVC | 1-Negligible |
| Gravity Main | P2307 | 7444-7408 Waterline Dr | No Action | $ | - | 14 | 10 | 2005 | 137 | PVC | 1-Negligible |
| Gravity Main | P2203 | 7508-7534 Waterline Dr | No Action | $ | - | 14 | 10 | 2005 | 155 | PVC | 1-Negligible |
| Gravity Main | P2201 | 7546 Waterline Dr | No Action | $ | - | 14 | 10 | 2005 | 115 | PVC | 1-Negligible |
| Gravity Main | P3080 | 11705-11637 60th Ave | No Action | $ | - | 13 | 8 | 2008 | 404 | PVC | 1-Negligible |
| Gravity Main | P2410 | 11247-11211 Red Hawk Ln | No Action | $ | - | 13 | 8 | 2007 | 238 | PVC | 1-Negligible |
| Gravity Main | P3175 | 11827 Andrews Ave | No Action | $ | - | 13 | 8 | 2008 | 395 | PVC | 1-Negligible |
| Gravity Main | P3177 | 11718 Andrews Ave | No Action | $ | - | 13 | 8 | 2008 | 190 | PVC | 1-Negligible |
| Gravity Main | P3171 | 6162-6068 Kingsbury Ct | No Action | $ | - | 13 | 8 | 2008 | 391 | PVC | 1-Negligible |
| Gravity Main | P3176 | 11775-11738 Andrews Ave | No Action | $ | - | 13 | 8 | 2008 | 168 | PVC | 1-Negligible |
| Gravity Main | P3173 | 6042-6002 Kingsbury Ct | No Action | $ | - | 13 | 8 | 2008 | 141 | PVC | 1-Negligible |
| Gravity Main | P2511 | 11347-11309 Red Hawk Ln | No Action | $ | - | 13 | 8 | 2007 | 145 | PVC | 1-Negligible |
| Gravity Main | P2318 | 11223 Red Hawk Ln | No Action | $ | - | 13 | 8 | 2007 | 289 | PVC | 1-Negligible |
| Gravity Main | P2512 | 11373 Red Hawk Ln | No Action | $ | - | 13 | 8 | 2007 | 335 | PVC | 1-Negligible |
| Gravity Main | P3172 | 6068-6042 Kingsbury Ct | No Action | $ | - | 13 | 8 | 2008 | 100 | PVC | 1-Negligible |
| Gravity Main | P1915 | 7273-7243 Pinevalley Dr | No Action | $ | - | 13 | 8 | 2004 | 226 | PVC | 1-Negligible |
| Gravity Main | P2013 | 7491-7517 Water View Ln | No Action | $ | - | 13 | 8 | 2004 | 100 | PVC | 1-Negligible |
| Gravity Main | P1913 | 7303-7273 Pinevalley Dr | No Action | $ | - | 13 | 8 | 2004 | 201 | PVC | 1-Negligible |
| Gravity Main | P1810 | 7328 Pinevalley Dr | No Action | $ | - | 13 | 8 | 2004 | 240 | PVC | 1-Negligible |
| Manhole | 4653 | 4477 Lake Michigan Dr | No Action | $ | - | 13 | 0 | 1990 | 0 | Concrete (Reinforced) [CR | 1-Negligible |
| Manhole | 2243 | 6676 Lake Michigan Dr | No Action | $ | - | 13 | 0 | 1990 | 0 | Concrete (Reinforced) [CR | 1-Negligible |
| Manhole | 2484 | 5836 Larkspur Ave | MH Adjust Rim | $ | 2,678 | 13 | 0 | 1990 | 0 | Concrete (Reinforced) [CR | 1-Negligible |
| Manhole | 2493 | 11255 56th Ave | MH Adjust Rim | $ | 2,678 | 13 | 0 | 1990 | 0 | Concrete (Reinforced) [CR | 1-Negligible |
| Manhole | 1911 | 7593 Water View Ln | MH Inspection | $ | 536 | 13 | 0 | 2004 | 0 | Not Known [XXX] | 1-Negligible |
| Manhole | 2530 | 7598 Valley View Ct | MH Inspection | $ | 536 | 13 | 0 | 2000 | 0 | Not Known [XXX] | 1-Negligible |
| Manhole | 1067 | Marsh Ave | MH Inspection | $ | 536 | 13 | 0 | 2016 | 0 | Not Known [XXX] | 1-Negligible |
| Manhole | 2416 | 7168 Barn Owl Ln | MH Inspection | $ | 536 | 13 | 0 | 2015 | 0 | Not Known [XXX] | 1-Negligible |
| Manhole | 9509 | 4999 Allenpark Dr | MH Inspection | $ | 536 | 13 | 0 | 2016 | 0 | Not Known [XXX] | 1-Negligible |
| Manhole | 4830 | 4926 Becker Dr | MH Inspection | $ | 536 | 13 | 0 | 2015 | 0 | Not Known [XXX] | 1-Negligible |
| Manhole | 4832 | Becker Dr | MH Inspection | $ | 536 | 13 | 0 | 2015 | 0 | Not Known [XXX] | 1-Negligible |
| Manhole | 4130 | Meadows Xing | MH Inspection | $ | 536 | 13 | 0 | 2008 | 0 | Not Known [XXX] | 1-Negligible |
| Manhole | 4133 | Meadows Xing | MH Inspection | $ | 536 | 13 | 0 | 2008 | 0 | Not Known [XXX] | 1-Negligible |
| Manhole | 9703 | 5398 Crestfield Ln | MH Inspection | $ | 536 | 13 | 0 | 2015 | 0 | Not Known [XXX] | 1-Negligible |
| Manhole | 9704 | 5360 Windfield Dr | MH Inspection | $ | 536 | 13 | 0 | 2015 | 0 | Not Known [XXX] | 1-Negligible |
| Manhole | 9707 | 10439 52nd Ave | MH Inspection | $ | 536 | 13 | 0 | 2015 | 0 | Not Known [XXX] | 1-Negligible |
| Manhole | 3373 | 10130 42nd Ave | MH Inspection | $ | 536 | 13 | 0 | 2016 | 0 | Not Known [XXX] | 1-Negligible |
| Manhole | 2003 | 7560 Watermark Dr | MH Inspection | $ | 536 | 13 | 0 | 2004 | 0 | Not Known [XXX] | 1-Negligible |
| Manhole | 3535 | Copper Beech Townhomes | MH Inspection | $ | 536 | 13 | 0 | 2005 | 0 | Not Known [XXX] | 1-Negligible |
| Manhole | 1068 | Marsh Ave | MH Inspection | $ | 536 | 13 | 0 | 2016 | 0 | Not Known [XXX] | 1-Negligible |

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|---|---|---|---|---|---|---|---|---|---|---|---|
| Manhole | 2301 | 11191 78th Ave | MH Inspection | $ | 536 | 13 | 0 | 2007 | 0 | Not Known [XXX] | 1-Negligible |
| Manhole | 2402 | 8100 Placid Waters Dr | MH Inspection | $ | 536 | 13 | 0 | 2009 | 0 | Not Known [XXX] | 1-Negligible |
| Manhole | 2501 | 11578 84th Ave | MH Inspection | $ | 536 | 13 | 0 | 2009 | 0 | Not Known [XXX] | 1-Negligible |
| Gravity Main | P3627 | 5084-5050 Pierce St | CCTV | $ | 712 | 12 | 8 | 2014 | 190 | PVC | 1-Negligible |
| Gravity Main | P3761 | 1 Campus Dr | CCTV | $ | 1,304 | 12 | 12 | 1963 | 348 | VCP | 1-Negligible |
| Gravity Main | P1097 | 5050-5084 Pierce St | CCTV | $ | 540 | 12 | 8 | 2014 | 144 | PVC | 1-Negligible |
| Gravity Main | P3762 | 1 Campus Dr | CCTV | $ | 1,299 | 12 | 12 | 1963 | 347 | VCP | 1-Negligible |
| Manhole | 9600 | 11358 Brown St | No Action | $ | - | 12 | 0 | 1992 | 0 | Concrete (Reinforced) [CR | 1-Negligible |
| Manhole | 2350 | 6474 Lake Michigan Dr | MH Inspection | $ | 536 | 12 | 0 | 1993 | 0 | Not Known [XXX] | 1-Negligible |
| Manhole | 9614 | 10520 52nd Ave | MH Inspection | $ | 536 | 12 | 0 | 2006 | 0 | Not Known [XXX] | 1-Negligible |
| Manhole | 1051 | 10911 Waterway Dr | MH Inspection | $ | 536 | 12 | 0 | 2004 | 0 | Not Known [XXX] | 1-Negligible |
| Manhole | 1083 | 6101 Lake Michigan Dr | MH Inspection | $ | 536 | 12 | 0 | 2003 | 0 | Not Known [XXX] | 1-Negligible |
| Manhole | 9700 | 5399 Pierce St | MH Inspection | $ | 536 | 12 | 0 | 2015 | 0 | Not Known [XXX] | 1-Negligible |
| Manhole | 4837 | 11299 University Pkwy | MH Inspection | $ | 536 | 12 | 0 | 2015 | 0 | Not Known [XXX] | 1-Negligible |
| Manhole | 2111 | 7359 Watermark Dr | MH Inspection | $ | 536 | 12 | 0 | 2001 | 0 | Not Known [XXX] | 1-Negligible |
| Manhole | 3518 | 5298 Pierce St | MH Inspection | $ | 536 | 12 | 0 | 2015 | 0 | Not Known [XXX] | 1-Negligible |
| Manhole | 9618 | Marsh Ave | MH Inspection | $ | 536 | 12 | 0 | 2015 | 0 | Not Known [XXX] | 1-Negligible |
| Force Main | FM2 | 11445 Wake Dr | Upsize | $ | 495,869 | 12 | 3 | 2009 | 1715 | DUCTILE IRON | 1-Negligible |
| Gravity Main | P2301 | 7772 Lake Michigan Dr | Point Repair | $ | 9,372 | 12 | 8 | 2007 | 386 | PVC | 1-Negligible |
| Gravity Main | P2308 | 7408-7423 Waterline Dr | No Action | $ | - | 12 | 10 | 2003 | 225 | PVC | 1-Negligible |
| Gravity Main | P2210 | 11048-11103 Waterway Dr | No Action | $ | - | 11 | 8 | 2003 | 333 | PVC | 1-Negligible |
| Gravity Main | P3430 | Copper Beech Townhomes | No Action | $ | - | 11 | 8 | 2007 | 198 | PVC | 1-Negligible |
| Gravity Main | P3533 | Copper Beech Townhomes | No Action | $ | - | 11 | 8 | 2007 | 74 | PVC | 1-Negligible |
| Gravity Main | P3537 | Copper Beech Townhomes | No Action | $ | - | 11 | 8 | 2005 | 241 | PVC | 1-Negligible |
| Gravity Main | P3431 | Copper Beech Townhomes | No Action | $ | - | 11 | 8 | 2007 | 189 | PVC | 1-Negligible |
| Gravity Main | P3434 | Copper Beech Townhomes | No Action | $ | - | 11 | 8 | 2007 | 182 | PVC | 1-Negligible |
| Gravity Main | P3433 | Copper Beech Townhomes | No Action | $ | - | 11 | 8 | 2007 | 196 | PVC | 1-Negligible |
| Gravity Main | P3536 | Copper Beech Townhomes | No Action | $ | - | 11 | 8 | 2005 | 361 | PVC | 1-Negligible |
| Gravity Main | P3437 | Copper Beech Townhomes | No Action | $ | - | 11 | 8 | 2005 | 318 | PVC | 1-Negligible |
| Gravity Main | P3432 | Copper Beech Townhomes | No Action | $ | - | 11 | 8 | 2007 | 273 | PVC | 1-Negligible |
| Gravity Main | P1102 | Copper Beech Townhomes | No Action | $ | - | 11 | 8 | 2007 | 181 | PVC | 1-Negligible |
| Gravity Main | P3530 | Copper Beech Townhomes | No Action | $ | - | 11 | 8 | 2007 | 75 | PVC | 1-Negligible |
| Gravity Main | P1103 | Copper Beech Townhomes | No Action | $ | - | 11 | 8 | 2005 | 195 | PVC | 1-Negligible |
| Gravity Main | P2114 | 11015-11031 Waterway Dr | No Action | $ | - | 11 | 8 | 2003 | 144 | PVC | 1-Negligible |
| Gravity Main | P2115 | 10997-11015 Waterway Dr | No Action | $ | - | 11 | 8 | 2003 | 296 | PVC | 1-Negligible |
| Gravity Main | P2112 | 7310 Watermark Dr | No Action | $ | - | 11 | 8 | 2003 | 163 | PVC | 1-Negligible |
| Gravity Main | P1049 | 7277 Water View Ln | No Action | $ | - | 11 | 8 | 2003 | 199 | PVC | 1-Negligible |
| Gravity Main | P2313 | 11142 Waterway Dr | No Action | $ | - | 11 | 8 | 2003 | 236 | PVC | 1-Negligible |
| Gravity Main | P3760 | 4411 Pierce St | CCTV | $ | 1,392 | 11 | 12 | 1998 | 371 | VCP | 1-Negligible |
| Gravity Main | P2309 | 7423 Waterline Dr | CCTV | $ | 58 | 11 | 10 | 2003 | 16 | PVC | 1-Negligible |
| Gravity Main | P3563 | 4355-4352 Campus View Dr | CCTV | $ | 1,448 | 11 | 8 | 1998 | 386 | PVC | 1-Negligible |
| Manhole | 4241 | 10865 48th Ave | No Action | $ | - | 11 | 0 | 1987 | 0 | Concrete (Reinforced) [CR | 1-Negligible |
| Manhole | 2066 | 10920 64th Ave | MH Inspection | $ | 536 | 11 | 0 | 2004 | 0 | Not Known [XXX] | 1-Negligible |
| Manhole | 2201 | 11149 Waterpoint Dr | MH Inspection | $ | 536 | 11 | 0 | 2005 | 0 | Not Known [XXX] | 1-Negligible |
| Manhole | 2318 | 11211 Red Hawk Ln | MH Inspection | $ | 536 | 11 | 0 | 2007 | 0 | Not Known [XXX] | 1-Negligible |

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|---|---|---|---|---|---|---|---|---|---|---|---|
| Manhole | 3086 | 11799 Brookridge Dr | MH Inspection | $ | 536 | 11 | 0 | 2006 | 0 | Not Known [XXX] | 1-Negligible |
| Manhole | 3180 | 11755 60th Ave | MH Inspection | $ | 536 | 11 | 0 | 2008 | 0 | Not Known [XXX] | 1-Negligible |
| Manhole | 1107 | Southtown Dr | MH Inspection | $ | 536 | 11 | 0 | 2007 | 0 | Not Known [XXX] | 1-Negligible |
| Manhole | 3631 | 5045 Pierce St | MH Inspection | $ | 536 | 11 | 0 | 2014 | 0 | Not Known [XXX] | 1-Negligible |
| Manhole | 3632 | 5045 Pierce St | MH Inspection | $ | 536 | 11 | 0 | 2014 | 0 | Not Known [XXX] | 1-Negligible |
| Manhole | 3635 | 4997 Pierce St | MH Inspection | $ | 536 | 11 | 0 | 2014 | 0 | Not Known [XXX] | 1-Negligible |
| Manhole | 3810 | 5252 Windfield Dr | MH Inspection | $ | 536 | 11 | 0 | 2006 | 0 | Not Known [XXX] | 1-Negligible |
| Manhole | 3833 | 10506 Country Pl W | MH Inspection | $ | 536 | 11 | 0 | 1997 | 0 | Not Known [XXX] | 1-Negligible |
| Manhole | 3841 | 10561 48th Ave | MH Inspection | $ | 536 | 11 | 0 | 1997 | 0 | Not Known [XXX] | 1-Negligible |
| Manhole | 4132 | Meadows Xing | MH Inspection | $ | 536 | 11 | 0 | 2008 | 0 | Not Known [XXX] | 1-Negligible |
| Manhole | 4224 | Southtown Dr | MH Inspection | $ | 536 | 11 | 0 | 2007 | 0 | Not Known [XXX] | 1-Negligible |
| Manhole | 4328 | Northside Dr | MH Inspection | $ | 536 | 11 | 0 | 2007 | 0 | Not Known [XXX] | 1-Negligible |
| Manhole | 4330 | Northside Dr | MH Inspection | $ | 536 | 11 | 0 | 2007 | 0 | Not Known [XXX] | 1-Negligible |
| Manhole | 4745 | Boltwood Apartments | MH Inspection | $ | 536 | 11 | 0 | 2012 | 0 | Not Known [XXX] | 1-Negligible |
| Manhole | 4746 | 11253 Whispering Creek Dr | MH Inspection | $ | 536 | 11 | 0 | 2012 | 0 | Not Known [XXX] | 1-Negligible |
| Manhole | 9000 | 10815 Timberline Dr | MH Inspection | $ | 536 | 11 | 0 | 2008 | 0 | Not Known [XXX] | 1-Negligible |
| Manhole | 9514 | Meadows Xing | MH Inspection | $ | 536 | 11 | 0 | 2007 | 0 | Not Known [XXX] | 1-Negligible |
| Manhole | 9007 | 1 Campus Dr | MH Inspection | $ | 536 | 11 | 0 | 1963 | 0 | Not Known [XXX] | 1-Negligible |
| Manhole | 3960 | 10517 Laker Village Dr | MH Inspection | $ | 536 | 11 | 0 | 1963 | 0 | Not Known [XXX] | 1-Negligible |
| Manhole | 5353 | 11859 46th Ave | MH Inspection | $ | 536 | 11 | 0 | 1991 | 0 | Not Known [XXX] | 1-Negligible |
| Manhole | 1071 | 7145 Barn Owl Ln | MH Inspection | $ | 536 | 11 | 0 | 2015 | 0 | Not Known [XXX] | 1-Negligible |
| Manhole | 2414 | 7193 Barn Owl Ln | MH Inspection | $ | 536 | 11 | 0 | 2015 | 0 | Not Known [XXX] | 1-Negligible |
| Manhole | 2415 | 7157 Barn Owl Ln | MH Inspection | $ | 536 | 11 | 0 | 2015 | 0 | Not Known [XXX] | 1-Negligible |
| Manhole | 2418 | 7099 Barn Owl Ln | MH Inspection | $ | 536 | 11 | 0 | 2015 | 0 | Not Known [XXX] | 1-Negligible |
| Manhole | 2419 | 7210 Blue Jay Dr | MH Inspection | $ | 536 | 11 | 0 | 2015 | 0 | Not Known [XXX] | 1-Negligible |
| Manhole | 3614 | 5343 Pierce St | MH Inspection | $ | 536 | 11 | 0 | 2015 | 0 | Not Known [XXX] | 1-Negligible |
| Manhole | 9502 | 4999 Allenpark Dr | MH Inspection | $ | 536 | 11 | 0 | 2016 | 0 | Not Known [XXX] | 1-Negligible |
| Manhole | 4835 | Becker Dr | MH Inspection | $ | 536 | 11 | 0 | 2015 | 0 | Not Known [XXX] | 1-Negligible |
| Manhole | 3466 | 10239 42nd Ave | No Action | $ | - | 11 | 0 | 2004 | 0 | Concrete (Reinforced) [CR | 1-Negligible |
| Manhole | 3563 | 4355 Campus View Dr | No Action | $ | - | 11 | 0 | 1998 | 0 | Concrete (Reinforced) [CR | 1-Negligible |
| Manhole | 2114 | 11015 Waterway Dr | MH Inspection | $ | 536 | 11 | 0 | 2001 | 0 | Not Known [XXX] | 1-Negligible |
| Manhole | 2973 | Norfolk Dr | MH Inspection | $ | 536 | 11 | 0 | 2006 | 0 | Not Known [XXX] | 1-Negligible |
| Manhole | 2974 | Norfolk Dr | MH Inspection | $ | 536 | 11 | 0 | 2006 | 0 | Not Known [XXX] | 1-Negligible |
| Manhole | 9011 | 6101 Lake Michigan Dr | MH Inspection | $ | 536 | 11 | 0 | 2003 | 0 | Concrete (Reinforced) [CR | 1-Negligible |
| Manhole | 9508 | 6223 Lake Michigan Dr | MH Inspection | $ | 536 | 11 | 0 | 1998 | 0 | Concrete (Reinforced) [CR | 1-Negligible |
| Manhole | 1513 | Timberline Dr | MH Inspection | $ | 536 | 11 | 0 | 2008 | 0 | Not Known [XXX] | 1-Negligible |
| Manhole | 1106 | Southtown Dr | MH Inspection | $ | 536 | 11 | 0 | 2007 | 0 | Not Known [XXX] | 1-Negligible |
| Manhole | 1914 | 10877 Pinevalley Ct | MH Inspection | $ | 536 | 11 | 0 | 2004 | 0 | Not Known [XXX] | 1-Negligible |
| Manhole | 1993 | 5769 Lynn Dr | MH Inspection | $ | 536 | 11 | 0 | 2000 | 0 | Not Known [XXX] | 1-Negligible |
| Manhole | 2012 | 7431 Water View Ln | MH Inspection | $ | 536 | 11 | 0 | 2004 | 0 | Not Known [XXX] | 1-Negligible |
| Manhole | 2014 | 10969 Waterway Dr | MH Inspection | $ | 536 | 11 | 0 | 2004 | 0 | Not Known [XXX] | 1-Negligible |
| Manhole | 2015 | 7204 Bittersweet Ct | MH Inspection | $ | 536 | 11 | 0 | 2004 | 0 | Not Known [XXX] | 1-Negligible |
| Manhole | 2310 | 7388 Waterline Dr | MH Inspection | $ | 536 | 11 | 0 | 2001 | 0 | Not Known [XXX] | 1-Negligible |
| Manhole | 2311 | 7349 Waterline Dr | MH Inspection | $ | 536 | 11 | 0 | 2001 | 0 | Not Known [XXX] | 1-Negligible |
| Manhole | 2312 | 7301 Waterline Dr | MH Inspection | $ | 536 | 11 | 0 | 2001 | 0 | Not Known [XXX] | 1-Negligible |

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|---|---|---|---|---|---|---|---|---|---|---|---|
| Manhole | 2410 | 11247 Red Hawk Ln | MH Inspection | $ | 536 | 11 | 0 | 2007 | 0 | Not Known [XXX] | 1-Negligible |
| Manhole | 4304 | 10934 Lance Ave | MH Inspection | $ | 536 | 11 | 0 | 2005 | 0 | Not Known [XXX] | 1-Negligible |
| Manhole | 4520 | 11088 52nd Ave | MH Inspection | $ | 536 | 11 | 0 | 2006 | 0 | Not Known [XXX] | 1-Negligible |
| Manhole | 9706 | 5363 Windfield Dr | MH Inspection | $ | 536 | 11 | 0 | 2006 | 0 | Not Known [XXX] | 1-Negligible |
| Manhole | 3082 | 11727 60th Ave | MH Inspection | $ | 536 | 11 | 0 | 2008 | 0 | Not Known [XXX] | 1-Negligible |
| Manhole | 3181 | 11777 60th Ave | MH Inspection | $ | 536 | 11 | 0 | 2008 | 0 | Not Known [XXX] | 1-Negligible |
| Manhole | 4331 | Northside Dr | MH Inspection | $ | 536 | 11 | 0 | 2007 | 0 | Not Known [XXX] | 1-Negligible |
| Manhole | 4333 | Northside Dr | MH Inspection | $ | 536 | 11 | 0 | 2007 | 0 | Not Known [XXX] | 1-Negligible |
| Manhole | 1128 | 11301 Commerce Rd | MH Inspection | $ | 536 | 11 | 0 | 2001 | 0 | Not Known [XXX] | 1-Negligible |
| Manhole | 1129 | 11301 Commerce Rd | MH Inspection | $ | 536 | 11 | 0 | 2001 | 0 | Not Known [XXX] | 1-Negligible |
| Manhole | 5015 | 11547 53rd Ave | MH Inspection | $ | 536 | 11 | 0 | 2000 | 0 | Not Known [XXX] | 1-Negligible |
| Manhole | 5016 | 11523 53rd Ave | MH Inspection | $ | 536 | 11 | 0 | 2000 | 0 | Not Known [XXX] | 1-Negligible |
| Manhole | 5018 | 11550 53rd Ave | MH Inspection | $ | 536 | 11 | 0 | 2000 | 0 | Not Known [XXX] | 1-Negligible |
| Manhole | 5019 | 5224 Rich St | MH Inspection | $ | 536 | 11 | 0 | 2000 | 0 | Not Known [XXX] | 1-Negligible |
| Manhole | 3711 | #N/A | MH Inspection | $ | 536 | 11 | 0 | 2001 | 0 | Not Known [XXX] | 1-Negligible |
| Manhole | 9613 | 10520 52nd Ave | MH Inspection | $ | 536 | 11 | 0 | 2006 | 0 | Not Known [XXX] | 1-Negligible |
| Manhole | 9615 | 10520 52nd Ave | MH Inspection | $ | 536 | 11 | 0 | 2006 | 0 | Not Known [XXX] | 1-Negligible |
| Manhole | LS_TIMBERLINE | 7060 Sunset Dr | MH Inspection | $ | 536 | 11 | 0 | 2008 | 0 | 0 | 1-Negligible |
| Manhole | 3570 | 10246 42nd Ave | MH Inspection | $ | 536 | 11 | 0 | 2004 | 0 | Not Known [XXX] | 1-Negligible |
| Manhole | 2309 | 7423 Waterline Dr | MH Inspection | $ | 536 | 11 | 0 | 2001 | 0 | Not Known [XXX] | 1-Negligible |
| Manhole | 3533 | Copper Beech Townhomes | MH Inspection | $ | 536 | 11 | 0 | 2007 | 0 | Not Known [XXX] | 1-Negligible |
| Manhole | 2001 | 7584 Watermark Dr | MH Inspection | $ | 536 | 11 | 0 | 2004 | 0 | Not Known [XXX] | 1-Negligible |
| Manhole | 2316 | 7347 Lake Michigan Dr | MH Inspection | $ | 536 | 11 | 0 | 2007 | 0 | Not Known [XXX] | 1-Negligible |
| Manhole | 2303 | 7588 Lake Michigan Dr | MH Inspection | $ | 536 | 11 | 0 | 2005 | 0 | Not Known [XXX] | 1-Negligible |
| Manhole | 3615 | 5313 Pierce St | MH Inspection | $ | 536 | 11 | 0 | 2015 | 0 | Not Known [XXX] | 1-Negligible |
| Manhole | 3617 | 5269 Pierce St | MH Inspection | $ | 536 | 11 | 0 | 2015 | 0 | Not Known [XXX] | 1-Negligible |
| Manhole | 9505 | Allenpark Dr | MH Inspection | $ | 536 | 11 | 0 | 2016 | 0 | Not Known [XXX] | 1-Negligible |
| Manhole | 2113 | 11031 Waterway Dr | MH Inspection | $ | 536 | 11 | 0 | 2001 | 0 | Not Known [XXX] | 1-Negligible |
| Manhole | 2984 | 11659 Brookland Ct | MH Inspection | $ | 536 | 11 | 0 | 2003 | 0 | Not Known [XXX] | 1-Negligible |
| Manhole | 1411 | 10581 Learning Ln | MH Inspection | $ | 536 | 11 | 0 | 2008 | 0 | Not Known [XXX] | 1-Negligible |
| Manhole | 1410 | 10582 Learning Ln | MH Inspection | $ | 536 | 11 | 0 | 2008 | 0 | Not Known [XXX] | 1-Negligible |
| Manhole | 3362 | S University Dr | MH Inspection | $ | 536 | 11 | 0 | 2007 | 0 | Not Known [XXX] | 1-Negligible |
| Manhole | 3368 | S University Dr | MH Inspection | $ | 536 | 11 | 0 | 2007 | 0 | Not Known [XXX] | 1-Negligible |
| Manhole | 3531 | Copper Beech Townhomes | MH Inspection | $ | 536 | 11 | 0 | 2007 | 0 | Not Known [XXX] | 1-Negligible |
| Manhole | 3637 | 4962 Pierce St | MH Inspection | $ | 536 | 11 | 0 | 2008 | 0 | Not Known [XXX] | 1-Negligible |
| Manhole | 2313 | 7280 Lake Michigan Dr | MH Inspection | $ | 536 | 11 | 0 | 2001 | 0 | Not Known [XXX] | 1-Negligible |
| Manhole | 2314 | 7280 Lake Michigan Dr | MH Inspection | $ | 536 | 11 | 0 | 2001 | 0 | Not Known [XXX] | 1-Negligible |
| Manhole | 3083 | 11714 60th Ave | MH Inspection | $ | 536 | 11 | 0 | 2014 | 0 | Not Known [XXX] | 1-Negligible |
| Manhole | 1121 | 10095 42nd Ave | MH Inspection | $ | 536 | 11 | 0 | 2016 | 0 | Not Known [XXX] | 1-Negligible |
| Manhole | 3363 | S University Dr | MH Inspection | $ | 536 | 11 | 0 | 2016 | 0 | Not Known [XXX] | 1-Negligible |
| Manhole | 3366 | 10173 42nd Ave | MH Inspection | $ | 536 | 11 | 0 | 2016 | 0 | Not Known [XXX] | 1-Negligible |
| Manhole | 3374 | 10100 42nd Ave | MH Inspection | $ | 536 | 11 | 0 | 2016 | 0 | Not Known [XXX] | 1-Negligible |
| Manhole | 2413 | 7222 Barn Owl Ln | MH Inspection | $ | 536 | 11 | 0 | 2015 | 0 | Not Known [XXX] | 1-Negligible |
| Manhole | 9605 | 10776 78th Ave | MH Inspection | $ | 536 | 11 | 0 | 2016 | 0 | Not Known [XXX] | 1-Negligible |
| Manhole | 9606 | 10774 78th Ave | MH Inspection | $ | 536 | 11 | 0 | 2016 | 0 | Not Known [XXX] | 1-Negligible |

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|---|---|---|---|---|---|---|---|---|---|---|---|
| Manhole | 1512 | 10603 Learning Ln | MH Inspection | $ | 536 | 11 | 0 | 2008 | 0 | Not Known [XXX] | 1-Negligible |
| Manhole | 1095 | 5122 Pierce St | MH Inspection | $ | 536 | 11 | 0 | 2014 | 0 | Not Known [XXX] | 1-Negligible |
| Manhole | 1097 | 5050 Pierce St | MH Inspection | $ | 536 | 11 | 0 | 2014 | 0 | Not Known [XXX] | 1-Negligible |
| Manhole | 1102 | Copper Beech Townhomes | MH Inspection | $ | 536 | 11 | 0 | 2007 | 0 | Not Known [XXX] | 1-Negligible |
| Manhole | 1103 | Copper Beech Townhomes | MH Inspection | $ | 536 | 11 | 0 | 2005 | 0 | Not Known [XXX] | 1-Negligible |
| Manhole | 1811 | 10801 Pinevalley Ct | MH Inspection | $ | 536 | 11 | 0 | 2004 | 0 | Not Known [XXX] | 1-Negligible |
| Manhole | 1812 | 10798 Learning Ln | MH Inspection | $ | 536 | 11 | 0 | 2004 | 0 | Not Known [XXX] | 1-Negligible |
| Manhole | 2970 | 6178 Balcom Ln | MH Inspection | $ | 536 | 11 | 0 | 2006 | 0 | Not Known [XXX] | 1-Negligible |
| Manhole | 3430 | Copper Beech Townhomes | MH Inspection | $ | 536 | 11 | 0 | 2007 | 0 | Not Known [XXX] | 1-Negligible |
| Manhole | 3364 | 10149 42nd Ave | MH Inspection | $ | 536 | 11 | 0 | 2016 | 0 | Not Known [XXX] | 1-Negligible |
| Manhole | 3370 | S University Dr | MH Inspection | $ | 536 | 11 | 0 | 2016 | 0 | Not Known [XXX] | 1-Negligible |
| Manhole | 3371 | 10111 42nd Ave | MH Inspection | $ | 536 | 11 | 0 | 2016 | 0 | Not Known [XXX] | 1-Negligible |
| Manhole | 3510 | Mystic Wds | MH Inspection | $ | 536 | 11 | 0 | 2015 | 0 | Not Known [XXX] | 1-Negligible |
| Manhole | 3514 | Mystic Wds | MH Inspection | $ | 536 | 11 | 0 | 2015 | 0 | Not Known [XXX] | 1-Negligible |
| Manhole | 3515 | Mystic Wds | MH Inspection | $ | 536 | 11 | 0 | 2015 | 0 | Not Known [XXX] | 1-Negligible |
| Gravity Main | P2002 | 10803-10975 Waterpoint Dr | No Action | $ | - | 11 | 10 | 2004 | 334 | PVC | 1-Negligible |
| Gravity Main | P2009 | 10975-11017 Waterpoint Dr | No Action | $ | - | 11 | 10 | 2004 | 317 | PVC | 1-Negligible |
| Gravity Main | P2200 | 11103-11149 Waterpoint Dr | No Action | $ | - | 11 | 10 | 2004 | 142 | PVC | 1-Negligible |
| Gravity Main | P2100 | 11017-11057 Waterpoint Dr | No Action | $ | - | 11 | 10 | 2004 | 183 | PVC | 1-Negligible |
| Gravity Main | P3569 | 10281 42nd Ave | CCTV | $ | 1,090 | 11 | 12 | 2004 | 291 | PVC | 1-Negligible |
| Gravity Main | P3410 | Mystic Wds | No Action | $ | - | 10 | 8 | 2015 | 84 | PVC | 1-Negligible |
| Gravity Main | P3512 | Mystic Wds | No Action | $ | - | 10 | 8 | 2015 | 164 | PVC | 1-Negligible |
| Gravity Main | P3513 | Mystic Wds | No Action | $ | - | 10 | 8 | 2015 | 359 | PVC | 1-Negligible |
| Gravity Main | P3412 | Mystic Wds | No Action | $ | - | 10 | 8 | 2015 | 327 | PVC | 1-Negligible |
| Manhole | 1844 | New Options High School | MH Inspection | $ | 536 | 10 | 0 | 1990 | 0 | Not Known [XXX] | 1-Negligible |
| Manhole | 2417 | 7157 Barn Owl Ln | MH Inspection | $ | 536 | 10 | 0 | 2015 | 0 | Not Known [XXX] | 1-Negligible |
| Manhole | 3930 | Campus West Apartments | MH Inspection | $ | 536 | 10 | 0 | 2001 | 0 | Not Known [XXX] | 1-Negligible |
| Manhole | 3436 | Copper Beech Townhomes | MH Inspection | $ | 536 | 10 | 0 | 2005 | 0 | Not Known [XXX] | 1-Negligible |
| Manhole | 2989 | 11677 Spruce View Dr | MH Inspection | $ | 536 | 10 | 0 | 2001 | 0 | Not Known [XXX] | 1-Negligible |
| Manhole | 3462 | 10000 Laker Ln | MH Inspection | $ | 536 | 10 | 0 | 2006 | 0 | Not Known [XXX] | 1-Negligible |
| Gravity Main | P1122 | 4406 Pierce St | CCTV | $ | 1,119 | 10 | 12 | 1998 | 299 | VCP | 1-Negligible |
| Gravity Main | P3570 | 10246 42nd Ave | CCTV | $ | 257 | 10 | 12 | 2004 | 69 | PVC | 1-Negligible |
| Gravity Main | P2979 | 11627-11666 Wilmington Dr | No Action | $ | - | 10 | 8 | 2006 | 314 | PVC | 1-Negligible |
| Gravity Main | P2006 | 7461-7488 Watermark Dr | No Action | $ | - | 10 | 8 | 2004 | 223 | PVC | 1-Negligible |
| Gravity Main | P2304 | 11127-11149 Waterpoint Dr | No Action | $ | - | 10 | 8 | 2005 | 305 | PVC | 1-Negligible |
| Gravity Main | P2000 | 7592 Watermark Dr | No Action | $ | - | 10 | 10 | 2004 | 136 | PVC | 1-Negligible |
| Gravity Main | P2005 | 7488-7523 Watermark Dr | No Action | $ | - | 10 | 8 | 2004 | 266 | PVC | 1-Negligible |
| Gravity Main | P3077 | 6095-6082 Rossfield Ct | CCTV | $ | 762 | 10 | 10 | 2008 | 203 | PVC | 1-Negligible |
| Force Main | FM4 | 8130 Placid Waters Dr | No Action | $ | - | 10 | 4 | 2009 | 789 | HDPE | 1-Negligible |
| Gravity Main | P1075 | 7634-7588 Lake Michigan Dr | No Action | $ | - | 10 | 8 | 2005 | 319 | PVC | 1-Negligible |
| Manhole | 4131 | Meadows Xing | MH Inspection | $ | 536 | 10 | 0 | 2008 | 0 | Not Known [XXX] | 1-Negligible |
| Manhole | 4134 | Meadows Xing | MH Inspection | $ | 536 | 10 | 0 | 2008 | 0 | Not Known [XXX] | 1-Negligible |
| Manhole | 9507 | 4920 Rich St | MH Inspection | $ | 536 | 10 | 0 | 2016 | 0 | Not Known [XXX] | 1-Negligible |
| Manhole | 9510 | 4923 Allenpark Dr | MH Inspection | $ | 536 | 10 | 0 | 2016 | 0 | Not Known [XXX] | 1-Negligible |
| Manhole | 9511 | 4923 Allenpark Dr | MH Inspection | $ | 536 | 10 | 0 | 2016 | 0 | Not Known [XXX] | 1-Negligible |

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|---|---|---|---|---|---|---|---|---|---|---|---|
| Manhole | 9512 | 4898 Rich St | MH Inspection | $ | 536 | 10 | 0 | 2016 | 0 | Not Known [XXX] | 1-Negligible |
| Manhole | 3372 | 10133 42nd Ave | MH Inspection | $ | 536 | 10 | 0 | 2016 | 0 | Not Known [XXX] | 1-Negligible |
| Manhole | 9010 | 10744 S Campus Dr | MH Inspection | $ | 536 | 10 | 0 | 1990 | 0 | Not Known [XXX] | 1-Negligible |
| Manhole | 1048 | 7340 Water View Ln | MH Inspection | $ | 536 | 10 | 0 | 2004 | 0 | Not Known [XXX] | 1-Negligible |
| Manhole | 2986 | 5882 Rich St | MH Inspection | $ | 536 | 10 | 0 | 2001 | 0 | Not Known [XXX] | 1-Negligible |
| Manhole | 1069 | Marsh Ave | MH Inspection | $ | 536 | 10 | 0 | 2016 | 0 | Not Known [XXX] | 1-Negligible |
| Manhole | 1070 | Marsh Ave | MH Inspection | $ | 536 | 10 | 0 | 2016 | 0 | Not Known [XXX] | 1-Negligible |
| Manhole | 2000 | 10931 Waterpoint Dr | MH Inspection | $ | 536 | 10 | 0 | 2016 | 0 | Not Known [XXX] | 1-Negligible |
| Manhole | 3461 | 10001 Laker Ln | MH Inspection | $ | 536 | 10 | 0 | 2004 | 0 | Not Known [XXX] | 1-Negligible |
| Gravity Main | P2514 | 7220-7270 Blue Jay Dr | CCTV | $ | 930 | 9 | 8 | 2007 | 248 | PVC | 1-Negligible |
| Gravity Main | P3086 | 11799-11795 Brookridge Dr | CCTV | $ | 296 | 9 | 8 | 2006 | 79 | PVC | 1-Negligible |
| Gravity Main | P3568 | 4256 Campus View Dr | CCTV | $ | 1,277 | 9 | 8 | 2004 | 340 | PVC | 1-Negligible |
| Gravity Main | P3088 | 5893 Rich St | CCTV | $ | 744 | 9 | 8 | 2006 | 198 | PVC | 1-Negligible |
| Gravity Main | P3087 | 11795-11667 Brookridge Dr | CCTV | $ | 1,263 | 9 | 8 | 2006 | 337 | PVC | 1-Negligible |
| Gravity Main | P3373 | 10130-10133 42nd Ave | CCTV | $ | 338 | 9 | 8 | 2016 | 90 | PVC | 1-Negligible |
| Force Main | FM3 | 11275 Wake Dr | No Action | $ | - | 9 | 3 | 2009 | 334 | DUCTILE IRON | 1-Negligible |
| Gravity Main | P1510 | 10580-10581 Learning Ln | No Action | $ | - | 9 | 8 | 2008 | 175 | PVC | 1-Negligible |
| Manhole | 4831 | 4926 Becker Dr | MH Inspection | $ | 536 | 9 | 0 | 2015 | 0 | Not Known [XXX] | 1-Negligible |
| Manhole | 1950 | 6587 Winans St | No Action | $ | - | 9 | 0 | 1992 | 0 | Concrete (Reinforced) [CR | 1-Negligible |
| Manhole | 3736 | 4967 Pierce St | MH Inspection | $ | 536 | 9 | 0 | 2014 | 0 | Not Known [XXX] | 1-Negligible |
| Gravity Main | P3561 | 10152-10155 Laker Ln | CCTV | $ | 1,135 | 8 | 12 | 1998 | 303 | VCP | 1-Negligible |
| Manhole | 4460 | 4498 Stadium Dr | No Action | $ | - | 8 | 0 | 1963 | 0 | Concrete (Reinforced) [CR | 1-Negligible |
| Manhole | 2013 | 7491 Water View Ln | MH Inspection | $ | 536 | 8 | 0 | 2004 | 0 | Not Known [XXX] | 1-Negligible |
| Manhole | 9611 | 10520 52nd Ave | MH Inspection | $ | 536 | 8 | 0 | 2006 | 0 | Not Known [XXX] | 1-Negligible |
| Manhole | 1105 | 5057 W Campus Dr | MH Inspection | $ | 536 | 8 | 0 | 2007 | 0 | Not Known [XXX] | 1-Negligible |
| Manhole | 1810 | 10800 Pinevalley Ct | MH Inspection | $ | 536 | 8 | 0 | 2004 | 0 | Not Known [XXX] | 1-Negligible |
| Manhole | 2207 | 11005 Island Ct | MH Inspection | $ | 536 | 8 | 0 | 2005 | 0 | Not Known [XXX] | 1-Negligible |
| Manhole | 2210 | 11048 Waterway Dr | MH Inspection | $ | 536 | 8 | 0 | 2001 | 0 | Not Known [XXX] | 1-Negligible |
| Manhole | 2211 | 11103 Waterway Dr | MH Inspection | $ | 536 | 8 | 0 | 2001 | 0 | Not Known [XXX] | 1-Negligible |
| Gravity Main | P2314 | 7280 Lake Michigan Dr | No Action | $ | - | 8 | 8 | 2003 | 98 | PVC | 1-Negligible |
| Gravity Main | P3560 | 10281 Laker Ln | CCTV | $ | 1,111 | 8 | 12 | 1998 | 296 | VCP | 1-Negligible |
| Gravity Main | P1029 | 4264 Campus View Dr | CCTV | $ | 212 | 8 | 12 | 2004 | 57 | VCP | 1-Negligible |
| Gravity Main | P3564 | 4332-4352 Campus View Dr | CCTV | $ | 400 | 8 | 12 | 1998 | 107 | VCP | 1-Negligible |
| Gravity Main | P3565 | 4270-4332 Campus View Dr | CCTV | $ | 1,128 | 8 | 12 | 2004 | 301 | VCP | 1-Negligible |
| Gravity Main | P3562 | 10150 Laker Ln | CCTV | $ | 741 | 8 | 12 | 1998 | 198 | VCP | 1-Negligible |
| Manhole | 4225 | Southtown Dr | MH Inspection | $ | 536 | 7 | 0 | 2007 | 0 | Not Known [XXX] | 1-Negligible |
| Manhole | 4638 | 4850 Lake Michigan Dr | MH Inspection | $ | 536 | 7 | 0 | 2001 | 0 | Not Known [XXX] | 1-Negligible |
| Manhole | 1131 | 11266 Whispering Creek Dr | MH Inspection | $ | 536 | 7 | 0 | 2012 | 0 | Not Known [XXX] | 1-Negligible |
| Manhole | 1133 | 11367 Whispering Creek Dr | MH Inspection | $ | 536 | 7 | 0 | 2012 | 0 | Not Known [XXX] | 1-Negligible |
| Manhole | 1722 | 10828 Timberline Dr | MH Inspection | $ | 536 | 7 | 0 | 2008 | 0 | Not Known [XXX] | 1-Negligible |
| Manhole | 2365 | 6218 Lake Michigan Dr | MH Inspection | $ | 536 | 7 | 0 | 2000 | 0 | Not Known [XXX] | 1-Negligible |
| Manhole | 4502 | 5560 Eric St | MH Inspection | $ | 536 | 7 | 0 | 2000 | 0 | Not Known [XXX] | 1-Negligible |
| Manhole | 4838 | 11287 University Pkwy | MH Inspection | $ | 536 | 7 | 0 | 2004 | 0 | Not Known [XXX] | 1-Negligible |
| Manhole | 5012 | 5405 Edgeway Dr | MH Inspection | $ | 536 | 7 | 0 | 2000 | 0 | Not Known [XXX] | 1-Negligible |
| Manhole | 1049 | 7272 Water View Ln | MH Inspection | $ | 536 | 7 | 0 | 2001 | 0 | Not Known [XXX] | 1-Negligible |

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|---|---|---|---|---|---|---|---|---|---|---|---|
| Manhole | 1094 | 5122 Pierce St | MH Inspection | $ | 536 | 7 | 0 | 2014 | 0 | Not Known [XXX] | 1-Negligible |
| Manhole | 1101 | 5378 Crestfield Ln | MH Inspection | $ | 536 | 7 | 0 | 2013 | 0 | Not Known [XXX] | 1-Negligible |
| Manhole | 3073 | 6196 Balcom Ln | MH Inspection | $ | 536 | 7 | 0 | 2008 | 0 | Not Known [XXX] | 1-Negligible |
| Manhole | 2100 | 11017 Waterpoint Dr | MH Inspection | $ | 536 | 7 | 0 | 2004 | 0 | Not Known [XXX] | 1-Negligible |
| Manhole | 9607 | Winnie Ln | MH Inspection | $ | 536 | 7 | 0 | 2016 | 0 | Not Known [XXX] | 1-Negligible |
| Gravity Main | P2205 | 7596-7478 Waterline Dr | No Action | $ | - | 7 | 10 | 2005 | 92 | PVC | 1-Negligible |
| Gravity Main | P3464 | 10073-10119 Laker Ln | CCTV | $ | 94 | 7 | 10 | 2007 | 25 | PVC | 1-Negligible |
| Gravity Main | P3360 | 10033-10073 Laker Ln | CCTV | $ | 1,106 | 7 | 10 | 2007 | 295 | PVC | 1-Negligible |
| Gravity Main | P3463 | 10119-10000 Laker Ln | CCTV | $ | 839 | 7 | 10 | 2006 | 224 | PVC | 1-Negligible |
| Gravity Main | P3462 | 10000 Laker Ln | CCTV | $ | 364 | 7 | 10 | 2006 | 97 | PVC | 1-Negligible |
| Gravity Main | P3361 | S University Dr | CCTV | $ | 644 | 7 | 10 | 2007 | 172 | PVC | 1-Negligible |
| Gravity Main | P3460 | 10000-10152 Laker Ln | CCTV | $ | 1,009 | 7 | 10 | 2004 | 269 | PVC | 1-Negligible |
| Gravity Main | P3170 | 6185-6162 Kingsbury Ct | No Action | $ | - | 7 | 8 | 2008 | 107 | PVC | 1-Negligible |
| Gravity Main | P1072 | 7680-7634 Lake Michigan Dr | No Action | $ | - | 7 | 8 | 2007 | 304 | PVC | 1-Negligible |
| Gravity Main | P2411 | 11287-11247 Red Hawk Ln | No Action | $ | - | 7 | 8 | 2007 | 235 | PVC | 1-Negligible |
| Gravity Main | P2510 | 11309-11287 Red Hawk Ln | No Action | $ | - | 7 | 8 | 2007 | 151 | PVC | 1-Negligible |
| Gravity Main | P2412 | 7140 Barn Owl Dr | No Action | $ | - | 7 | 8 | 2007 | 262 | PVC | 1-Negligible |
| Gravity Main | P2316 | 7347-7409 Lake Michigan Dr | No Action | $ | - | 7 | 8 | 2007 | 287 | PVC | 1-Negligible |
| Gravity Main | P3082 | 11727-11705 60th Ave | No Action | $ | - | 7 | 8 | 2008 | 290 | PVC | 1-Negligible |
| Gravity Main | P3174 | 6093-6002 Kingsbury Ct | No Action | $ | - | 7 | 8 | 2008 | 121 | PVC | 1-Negligible |
| Gravity Main | P3180 | 11755-11727 60th Ave | No Action | $ | - | 7 | 8 | 2008 | 255 | PVC | 1-Negligible |
| Gravity Main | P3181 | 11777-11755 60th Ave | No Action | $ | - | 7 | 8 | 2008 | 241 | PVC | 1-Negligible |
| Gravity Main | P2513 | 7296-7270 Blue Jay Dr | No Action | $ | - | 7 | 8 | 2007 | 155 | PVC | 1-Negligible |
| Gravity Main | P2302 | 7738-7680 Lake Michigan Dr | No Action | $ | - | 7 | 8 | 2007 | 347 | PVC | 1-Negligible |
| Gravity Main | P1124 | 1 Campus Dr | CCTV | $ | 1,445 | 7 | 12 | 1990 | 385 | VCP | 1-Negligible |
| Manhole | 2140 | 6698 Henry St | No Action | $ | - | 7 | 0 | 1992 | 0 | Concrete (Reinforced) [CR | 1-Negligible |
| Manhole | 3814 | 5396 Windfield Dr | MH Inspection | $ | 536 | 7 | 0 | 2006 | 0 | Not Known [XXX] | 1-Negligible |
| Manhole | 1135 | 11368 48th Ave | MH Inspection | $ | 536 | 7 | 0 | 2000 | 0 | Not Known [XXX] | 1-Negligible |
| Manhole | 9504 | Allenpark Dr | MH Inspection | $ | 536 | 7 | 0 | 2016 | 0 | Not Known [XXX] | 1-Negligible |
| Manhole | 1104 | 5057 W Campus Dr | MH Inspection | $ | 536 | 7 | 0 | 2007 | 0 | Not Known [XXX] | 1-Negligible |
| Manhole | 1913 | 7303 Pinevalley Dr | MH Inspection | $ | 536 | 7 | 0 | 2004 | 0 | Not Known [XXX] | 1-Negligible |
| Manhole | 2016 | 7240 Bittersweet Ct | MH Inspection | $ | 536 | 7 | 0 | 2004 | 0 | Not Known [XXX] | 1-Negligible |
| Manhole | 2017 | 7294 Bittersweet Ct | MH Inspection | $ | 536 | 7 | 0 | 2004 | 0 | Not Known [XXX] | 1-Negligible |
| Manhole | 2112 | 7320 Watermark Dr | MH Inspection | $ | 536 | 7 | 0 | 2001 | 0 | Not Known [XXX] | 1-Negligible |
| Manhole | 2206 | 11087 Island Ct | MH Inspection | $ | 536 | 7 | 0 | 2005 | 0 | Not Known [XXX] | 1-Negligible |
| Manhole | 2513 | 7296 Blue Jay Dr | MH Inspection | $ | 536 | 7 | 0 | 2007 | 0 | Not Known [XXX] | 1-Negligible |
| Manhole | 3832 | 4968 Country Pl S | MH Inspection | $ | 536 | 7 | 0 | 1997 | 0 | Not Known [XXX] | 1-Negligible |
| Manhole | 3834 | 4915 Country Pl N | MH Inspection | $ | 536 | 7 | 0 | 1997 | 0 | Not Known [XXX] | 1-Negligible |
| Manhole | 3931 | Campus West Apartments | MH Inspection | $ | 536 | 7 | 0 | 2001 | 0 | Not Known [XXX] | 1-Negligible |
| Manhole | 4135 | Meadows Xing | MH Inspection | $ | 536 | 7 | 0 | 2008 | 0 | Not Known [XXX] | 1-Negligible |
| Manhole | 4136 | Meadows Xing | MH Inspection | $ | 536 | 7 | 0 | 2008 | 0 | Not Known [XXX] | 1-Negligible |
| Manhole | 4233 | Village Center Dr | MH Inspection | $ | 536 | 7 | 0 | 2007 | 0 | Not Known [XXX] | 1-Negligible |
| Manhole | 1096 | 5050 Pierce St | MH Inspection | $ | 536 | 7 | 0 | 2014 | 0 | Not Known [XXX] | 1-Negligible |
| Manhole | 2412 | 7232 Barn Owl Ln | MH Inspection | $ | 536 | 7 | 0 | 2007 | 0 | Not Known [XXX] | 1-Negligible |
| Manhole | 2981 | 11531 Wilmington Dr | MH Inspection | $ | 536 | 7 | 0 | 2006 | 0 | Not Known [XXX] | 1-Negligible |

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|---|---|---|---|---|---|---|---|---|---|---|---|
| Manhole | 3079 | 6063 Rossfield Ct | MH Inspection | $ | 536 | 7 | 0 | 2008 | 0 | Not Known [XXX] | 1-Negligible |
| Manhole | 2315 | 7409 Lake Michigan Dr | MH Inspection | $ | 536 | 7 | 0 | 2001 | 0 | Not Known [XXX] | 1-Negligible |
| Manhole | 3536 | Copper Beech Townhomes | MH Inspection | $ | 536 | 7 | 0 | 2005 | 0 | Not Known [XXX] | 1-Negligible |
| Manhole | 1065 | Marsh Ave | MH Inspection | $ | 536 | 7 | 0 | 2016 | 0 | Not Known [XXX] | 1-Negligible |
| Manhole | 9603 | 10687 Poppy Ln | MH Inspection | $ | 536 | 7 | 0 | 2016 | 0 | Not Known [XXX] | 1-Negligible |
| Manhole | 9604 | Poppy Ln | MH Inspection | $ | 536 | 7 | 0 | 2016 | 0 | Not Known [XXX] | 1-Negligible |
| Manhole | 3463 | 10119 Laker Ln | MH Inspection | $ | 536 | 7 | 0 | 2006 | 0 | Not Known [XXX] | 1-Negligible |
| Gravity Main | P2012 | 7431-7491 Water View Ln | No Action | $ | - | 7 | 8 | 2004 | 231 | PVC | 1-Negligible |
| Gravity Main | P2206 | 11141 Island Ct | No Action | $ | - | 7 | 8 | 2005 | 361 | PVC | 1-Negligible |
| Gravity Main | P2010 | 7338-7272 Water View Ln | No Action | $ | - | 7 | 8 | 2004 | 141 | PVC | 1-Negligible |
| Gravity Main | P1911 | 7458 Water View Ln | No Action | $ | - | 7 | 8 | 2004 | 66 | PVC | 1-Negligible |
| Gravity Main | P2207 | 11005-11087 Island Ct | No Action | $ | - | 7 | 8 | 2005 | 247 | PVC | 1-Negligible |
| Gravity Main | P1811 | 10801-10800 Pinevalley Ct | No Action | $ | - | 7 | 8 | 2004 | 90 | PVC | 1-Negligible |
| Gravity Main | P2016 | 7240-7204 Bittersweet Ct | No Action | $ | - | 7 | 8 | 2004 | 112 | PVC | 1-Negligible |
| Gravity Main | P2014 | 10961 Waterway Dr | No Action | $ | - | 7 | 8 | 2004 | 129 | PVC | 1-Negligible |
| Gravity Main | P1914 | 10851 Pinevalley Ct | No Action | $ | - | 7 | 8 | 2004 | 247 | PVC | 1-Negligible |
| Gravity Main | P1048 | 7340-7376 Water View Ln | No Action | $ | - | 7 | 8 | 2004 | 139 | PVC | 1-Negligible |
| Gravity Main | P2017 | 7294-7240 Bittersweet Ct | No Action | $ | - | 7 | 8 | 2004 | 166 | PVC | 1-Negligible |
| Gravity Main | P2981 | 11637 60th Ave | No Action | $ | - | 7 | 8 | 2006 | 323 | PVC | 1-Negligible |
| Gravity Main | P1051 | 10831 Waterway Dr | No Action | $ | - | 7 | 8 | 2004 | 166 | PVC | 1-Negligible |
| Gravity Main | P1050 | 7239-7204 Bittersweet Ct | No Action | $ | - | 7 | 8 | 2004 | 153 | PVC | 1-Negligible |
| Gravity Main | P3519 | Mystic Wds | CCTV | $ | 1,088 | 7 | 8 | 2015 | 290 | PVC | 1-Negligible |
| Gravity Main | P3368 | S University Dr | CCTV | $ | 838 | 7 | 10 | 2007 | 224 | PVC | 1-Negligible |
| Gravity Main | P3515 | Mystic Wds | CCTV | $ | 589 | 7 | 8 | 2015 | 157 | PVC | 1-Negligible |
| Gravity Main | P1095 | 5122-5050 Pierce St | CCTV | $ | 775 | 7 | 8 | 2014 | 207 | PVC | 1-Negligible |
| Gravity Main | P3514 | Mystic Wds | CCTV | $ | 97 | 7 | 8 | 2015 | 26 | PVC | 1-Negligible |
| Gravity Main | P3517 | 5256 Pierce St | CCTV | $ | 622 | 7 | 8 | 2015 | 166 | PVC | 1-Negligible |
| Gravity Main | P1094 | 5122 Pierce St | CCTV | $ | 599 | 7 | 8 | 2014 | 160 | PVC | 1-Negligible |
| Gravity Main | P1092 | 5122 Pierce St | CCTV | $ | 509 | 7 | 8 | 2014 | 136 | PVC | 1-Negligible |
| Gravity Main | P1062 | 7598 Watermark Dr | CCTV | $ | 1,332 | 7 | 10 | 2016 | 355 | PVC | 1-Negligible |
| Gravity Main | P3465 | Laker Ln | CCTV | $ | 989 | 7 | 8 | 2007 | 264 | PVC | 1-Negligible |
| Gravity Main | P3372 | 10133 42nd Ave | CCTV | $ | 1,247 | 7 | 10 | 2016 | 332 | PVC | 1-Negligible |
| Gravity Main | P1063 | 7598 Watermark Dr | CCTV | $ | 244 | 7 | 10 | 2016 | 65 | PVC | 1-Negligible |
| Gravity Main | P1070 | 10931 Waterpoint Dr | CCTV | $ | 504 | 7 | 10 | 2016 | 134 | PVC | 1-Negligible |
| Gravity Main | P1093 | 5122 Pierce St | CCTV | $ | 991 | 7 | 8 | 2014 | 264 | PVC | 1-Negligible |
| Gravity Main | P1061 | Marsh Ave | CCTV | $ | 1,290 | 7 | 10 | 2016 | 344 | PVC | 1-Negligible |
| Gravity Main | P3626 | 5050 Pierce St | CCTV | $ | 393 | 7 | 8 | 2014 | 105 | PVC | 1-Negligible |
| Gravity Main | P3362 | S University Dr | CCTV | $ | 849 | 7 | 10 | 2007 | 226 | PVC | 1-Negligible |
| Gravity Main | P3518 | 5298-5256 Pierce St | CCTV | $ | 468 | 7 | 8 | 2015 | 125 | PVC | 1-Negligible |
| Gravity Main | P2972 | 6090-6142 Balcom Ln | CCTV | $ | 773 | 7 | 8 | 2006 | 206 | PVC | 1-Negligible |
| Gravity Main | P3461 | 10001-10000 Laker Ln | CCTV | $ | 751 | 7 | 8 | 2004 | 200 | PVC | 1-Negligible |
| Gravity Main | P1096 | 5050 Pierce St | CCTV | $ | 454 | 7 | 8 | 2014 | 121 | PVC | 1-Negligible |
| Gravity Main | P1060 | Marsh Ave | CCTV | $ | 308 | 7 | 10 | 2016 | 82 | PVC | 1-Negligible |
| Gravity Main | P1059 | Marsh Ave | CCTV | $ | 343 | 7 | 10 | 2016 | 91 | PVC | 1-Negligible |
| Gravity Main | P2970 | 6178-6142 Balcom Ln | CCTV | $ | 532 | 7 | 8 | 2006 | 142 | PVC | 1-Negligible |

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Gravity Main | P2003 | 7568 Watermark Dr | No Action | $ | - | 6 | 8 | 2004 | 136 | PVC | 1-Negligible |
| Gravity Main | P9604 | Poppy Ln | CCTV | $ | 630 | 6 | 8 | 2016 | 168 | PVC | 1-Negligible |
| Gravity Main | P2413 | 7222-7232 Barn Owl Ln | CCTV | $ | 361 | 6 | 8 | 2015 | 96 | PVC | 1-Negligible |
| Gravity Main | P9602 | 10691 Poppy Ln | CCTV | $ | 537 | 6 | 8 | 2016 | 143 | PVC | 1-Negligible |
| Gravity Main | P9607 | 10746 78th Ave | CCTV | $ | 1,333 | 6 | 8 | 2016 | 356 | PVC | 1-Negligible |
| Gravity Main | P9610 | Winnie Ln | CCTV | $ | 458 | 6 | 8 | 2016 | 122 | PVC | 1-Negligible |
| Gravity Main | P9603 | 10687-10691 Poppy Ln | CCTV | $ | 963 | 6 | 8 | 2016 | 257 | PVC | 1-Negligible |
| Gravity Main | P3466 | 10261 42nd Ave | CCTV | $ | 1,148 | 6 | 8 | 2004 | 306 | VCP | 1-Negligible |
| Gravity Main | P1064 | 7599 Watermark Dr | CCTV | $ | 259 | 6 | 8 | 2016 | 69 | PVC | 1-Negligible |
| Gravity Main | P1066 | 7599 Watermark Dr | CCTV | $ | 359 | 6 | 8 | 2016 | 96 | PVC | 1-Negligible |
| Gravity Main | P2303 | 7586 Lake Michigan Dr | CCTV | $ | 1,191 | 6 | 8 | 2005 | 318 | PVC | 1-Negligible |
| Gravity Main | P3567 | 4260 Campus View Dr | CCTV | $ | 277 | 6 | 8 | 2004 | 74 | PVC | 1-Negligible |
| Gravity Main | P1054 | Hawkin St | CCTV | $ | 537 | 6 | 8 | 2016 | 143 | PVC | 1-Negligible |
| Gravity Main | P1065 | 7599 Watermark Dr | CCTV | $ | 517 | 6 | 8 | 2016 | 138 | PVC | 1-Negligible |
| Gravity Main | P9609 | Winnie Ln | CCTV | $ | 1,043 | 6 | 8 | 2016 | 278 | PVC | 1-Negligible |
| Gravity Main | P9608 | Winnie Ln | CCTV | $ | 608 | 6 | 8 | 2016 | 162 | PVC | 1-Negligible |
| Gravity Main | P9605 | 10776-10774 78th Ave | CCTV | $ | 702 | 6 | 8 | 2016 | 187 | PVC | 1-Negligible |
| Gravity Main | P1121 | 10095-10133 42nd Ave | CCTV | $ | 1,053 | 6 | 8 | 2016 | 281 | PVC | 1-Negligible |
| Gravity Main | P1119 | S University Dr | CCTV | $ | 128 | 6 | 8 | 2016 | 34 | PVC | 1-Negligible |
| Gravity Main | P3374 | 10100-10130 42nd Ave | CCTV | $ | 906 | 6 | 8 | 2016 | 242 | PVC | 1-Negligible |
| Gravity Main | P3364 | 10149 42nd Ave | CCTV | $ | 221 | 6 | 8 | 2016 | 59 | PVC | 1-Negligible |
| Gravity Main | P3363 | S University Dr | CCTV | $ | 133 | 6 | 8 | 2016 | 35 | PVC | 1-Negligible |
| Gravity Main | P1058 | Marsh Ave | CCTV | $ | 313 | 6 | 8 | 2016 | 83 | PVC | 1-Negligible |
| Gravity Main | P9606 | 10774 78th Ave | CCTV | $ | 1,018 | 6 | 8 | 2016 | 271 | PVC | 1-Negligible |
| Gravity Main | P3370 | S University Dr | CCTV | $ | 689 | 6 | 8 | 2016 | 184 | PVC | 1-Negligible |
| Gravity Main | P3085 | 11799 Brookridge Dr | CCTV | $ | 1,145 | 6 | 8 | 2014 | 305 | PVC | 1-Negligible |
| Gravity Main | P3084 | 11716-11714 60th Ave | CCTV | $ | 948 | 6 | 8 | 2014 | 253 | PVC | 1-Negligible |
| Gravity Main | P3371 | 10111 42nd Ave | CCTV | $ | 1,079 | 6 | 8 | 2016 | 288 | PVC | 1-Negligible |
| Gravity Main | P3366 | 10173 42nd Ave | CCTV | $ | 687 | 6 | 8 | 2016 | 183 | PVC | 1-Negligible |
| Gravity Main | P3365 | 10173-10149 42nd Ave | CCTV | $ | 741 | 6 | 8 | 2016 | 198 | PVC | 1-Negligible |
| Gravity Main | P3369 | S University Dr | CCTV | $ | 261 | 6 | 8 | 2016 | 70 | PVC | 1-Negligible |
| Gravity Main | P9617 | Marsh Ave | CCTV | $ | 753 | 6 | 8 | 2015 | 201 | PVC | 1-Negligible |
| Gravity Main | P3467 | 10223 42nd Ave | CCTV | $ | 908 | 6 | 8 | 2004 | 242 | VCP | 1-Negligible |
| Gravity Main | P1067 | Marsh Ave | CCTV | $ | 271 | 6 | 8 | 2016 | 72 | PVC | 1-Negligible |
| Gravity Main | P1069 | Marsh Ave | CCTV | $ | 857 | 6 | 8 | 2016 | 229 | PVC | 1-Negligible |
| Gravity Main | P1068 | Marsh Ave | CCTV | $ | 326 | 6 | 8 | 2016 | 87 | PVC | 1-Negligible |
| Gravity Main | P1052 | Hawkin St | CCTV | $ | 424 | 6 | 8 | 2016 | 113 | PVC | 1-Negligible |
| Gravity Main | P1053 | Hawkin St | CCTV | $ | 382 | 6 | 8 | 2016 | 102 | PVC | 1-Negligible |
| Gravity Main | P9619 | Marsh Ave | CCTV | $ | 799 | 6 | 8 | 2015 | 213 | PVC | 1-Negligible |
| Gravity Main | P9618 | Marsh Ave | CCTV | $ | 549 | 6 | 8 | 2015 | 146 | PVC | 1-Negligible |
| Manhole | 2247 | 6605 Henry St | No Action | $ | - | 5 | 0 | 1990 | 0 | Concrete (Reinforced) [CR | 1-Negligible |
| Manhole | 2491 | 5673 Lake Michigan Dr | No Action | $ | - | 5 | 0 | 1990 | 0 | Concrete (Reinforced) [CR | 1-Negligible |
| Manhole | 1842 | 10798 68th Ave | MH Inspection | $ | 536 | 5 | 0 | 1990 | 0 | Not Known [XXX] | 1-Negligible |
| Manhole | 3732 | 10485 48th Ave | MH Inspection | $ | 536 | 5 | 0 | 2001 | 0 | Not Known [XXX] | 1-Negligible |
| Manhole | 2051 | 6754 Mista Dr | No Action | $ | - | 5 | 0 | 1995 | 0 | Concrete (Reinforced) [CR | 1-Negligible |

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Manhole | 9701 | 5399 Pierce St | MH Inspection | $ | 536 | 5 | 0 | 2015 | 0 | Not Known [XXX] | 1-Negligible |
| Manhole | 3078 | 6082 Rossfield Ct | MH Inspection | $ | 536 | 5 | 0 | 2008 | 0 | Not Known [XXX] | 1-Negligible |
| Manhole | 3173 | 6042 Kingsbury Ct | MH Inspection | $ | 536 | 5 | 0 | 2008 | 0 | Not Known [XXX] | 1-Negligible |
| Manhole | 3730 | Hillcrest Town Houses | MH Inspection | $ | 536 | 5 | 0 | 2001 | 0 | Not Known [XXX] | 1-Negligible |
| Manhole | 3738 | 4954 Country Pl S | MH Inspection | $ | 536 | 5 | 0 | 2014 | 0 | Not Known [XXX] | 1-Negligible |
| Manhole | 3170 | 6185 Kingsbury Ct | MH Inspection | $ | 536 | 5 | 0 | 2008 | 0 | Not Known [XXX] | 1-Negligible |
| Manhole | 3171 | 6162 Kingsbury Ct | MH Inspection | $ | 536 | 5 | 0 | 2008 | 0 | Not Known [XXX] | 1-Negligible |
| Manhole | 3172 | 6068 Kingsbury Ct | MH Inspection | $ | 536 | 5 | 0 | 2008 | 0 | Not Known [XXX] | 1-Negligible |
| Manhole | 2004 | 7523 Watermark Dr | MH Inspection | $ | 536 | 5 | 0 | 2004 | 0 | Not Known [XXX] | 1-Negligible |
| Manhole | 2005 | 7488 Watermark Dr | MH Inspection | $ | 536 | 5 | 0 | 2004 | 0 | Not Known [XXX] | 1-Negligible |
| Manhole | 2006 | 7461 Watermark Dr | MH Inspection | $ | 536 | 5 | 0 | 2004 | 0 | Not Known [XXX] | 1-Negligible |
| Manhole | 2979 | 11627 Wilmington Dr | MH Inspection | $ | 536 | 5 | 0 | 2006 | 0 | Not Known [XXX] | 1-Negligible |
| Manhole | 1053 | Hawkin St | MH Inspection | $ | 536 | 5 | 0 | 2016 | 0 | Not Known [XXX] | 1-Negligible |
| Manhole | 1054 | Hawkin St | MH Inspection | $ | 536 | 5 | 0 | 2016 | 0 | Not Known [XXX] | 1-Negligible |
| Manhole | 1055 | Hawkin St | MH Inspection | $ | 536 | 5 | 0 | 2016 | 0 | Not Known [XXX] | 1-Negligible |
| Manhole | 1058 | Marsh Ave | MH Inspection | $ | 536 | 5 | 0 | 2016 | 0 | Not Known [XXX] | 1-Negligible |
| Manhole | 1059 | Marsh Ave | MH Inspection | $ | 536 | 5 | 0 | 2016 | 0 | Not Known [XXX] | 1-Negligible |
| Manhole | 1060 | Marsh Ave | MH Inspection | $ | 536 | 5 | 0 | 2016 | 0 | Not Known [XXX] | 1-Negligible |
| Manhole | 1061 | Marsh Ave | MH Inspection | $ | 536 | 5 | 0 | 2016 | 0 | Not Known [XXX] | 1-Negligible |
| Manhole | 1062 | Marsh Ave | MH Inspection | $ | 536 | 5 | 0 | 2016 | 0 | Not Known [XXX] | 1-Negligible |
| Manhole | 1063 | Marsh Ave | MH Inspection | $ | 536 | 5 | 0 | 2016 | 0 | Not Known [XXX] | 1-Negligible |
| Manhole | 9602 | 10691 Poppy Ln | MH Inspection | $ | 536 | 5 | 0 | 2016 | 0 | Not Known [XXX] | 1-Negligible |
| Manhole | 3431 | Copper Beech Townhomes | MH Inspection | $ | 536 | 5 | 0 | 2007 | 0 | Not Known [XXX] | 1-Negligible |
| Manhole | 3433 | Copper Beech Townhomes | MH Inspection | $ | 536 | 5 | 0 | 2007 | 0 | Not Known [XXX] | 1-Negligible |
| Manhole | 3437 | Copper Beech Townhomes | MH Inspection | $ | 536 | 5 | 0 | 2005 | 0 | Not Known [XXX] | 1-Negligible |
| Manhole | 3438 | Copper Beech Townhomes | MH Inspection | $ | 536 | 5 | 0 | 2005 | 0 | Not Known [XXX] | 1-Negligible |
| Manhole | 3530 | Copper Beech Townhomes | MH Inspection | $ | 536 | 5 | 0 | 2007 | 0 | Not Known [XXX] | 1-Negligible |
| Manhole | 2980 | 11531 Wilmington Dr | MH Inspection | $ | 536 | 5 | 0 | 2006 | 0 | Not Known [XXX] | 1-Negligible |
| Manhole | 3537 | Copper Beech Townhomes | MH Inspection | $ | 536 | 5 | 0 | 2005 | 0 | Not Known [XXX] | 1-Negligible |
| Manhole | 1009 | 7588 Lake Michigan Dr | MH Inspection | $ | 536 | 5 | 0 | 2005 | 0 | Not Known [XXX] | 1-Negligible |
| Manhole | 1511 | 10581 Learning Ln | MH Inspection | $ | 536 | 5 | 0 | 2008 | 0 | Not Known [XXX] | 1-Negligible |
| Manhole | 3410 | Mystic Wds | MH Inspection | $ | 536 | 5 | 0 | 2015 | 0 | Not Known [XXX] | 1-Negligible |
| Manhole | 3411 | Mystic Wds | MH Inspection | $ | 536 | 5 | 0 | 2015 | 0 | Not Known [XXX] | 1-Negligible |
| Manhole | 3412 | Mystic Wds | MH Inspection | $ | 536 | 5 | 0 | 2015 | 0 | Not Known [XXX] | 1-Negligible |
| Gravity Main | P3535 | Copper Beech Townhomes | No Action | $ | - | 5 | 8 | 2008 | 156 | PVC | 1-Negligible |
| Gravity Main | P3438 | Copper Beech Townhomes | No Action | $ | - | 5 | 8 | 2005 | 252 | PVC | 1-Negligible |
| Manhole | 9500 | 10545 Laker Village Dr | No Action | $ | - | 4 | 0 | 1963 | 0 | Concrete (Reinforced) [CR | 1-Negligible |
| Manhole | 2052 | 6654 Mista Ct | No Action | $ | - | 4 | 0 | 1995 | 0 | Concrete (Reinforced) [CR | 1-Negligible |
| Manhole | 2055 | 6524 Mista Dr | No Action | $ | - | 4 | 0 | 1995 | 0 | Concrete (Reinforced) [CR | 1-Negligible |
| Manhole | 2141 | Allendale Community Park | No Action | $ | - | 4 | 0 | 1992 | 0 | Concrete (Reinforced) [CR | 1-Negligible |
| Manhole | 2142 | 6799 Mista Dr | No Action | $ | - | 4 | 0 | 1992 | 0 | Concrete (Reinforced) [CR | 1-Negligible |
| Manhole | 1723 | 10601 White Birch Dr | MH Inspection | $ | 536 | 4 | 0 | 2008 | 0 | Not Known [XXX] | 1-Negligible |
| Manhole | 4839 | 11295 University Pkwy | MH Inspection | $ | 536 | 4 | 0 | 2004 | 0 | Not Known [XXX] | 1-Negligible |
| Manhole | 1050 | 7239 Bittersweet Ct | MH Inspection | $ | 536 | 4 | 0 | 2004 | 0 | Not Known [XXX] | 1-Negligible |
| Manhole | 2101 | 11057 Waterpoint Dr | MH Inspection | $ | 536 | 4 | 0 | 2004 | 0 | Not Known [XXX] | 1-Negligible |

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Gravity Main | P2101 | 11057-11103 Waterpoint Dr | No Action | $ | - | 4 | 10 | 2004 | 287 | PVC | 1-Negligible |
| Gravity Main | P2001 | 7583 Watermark Dr | No Action | $ | - | 4 | 10 | 2004 | 51 | PVC | 1-Negligible |
| Gravity Main | P3511 | Mystic Wds | No Action | $ | - | 4 | 8 | 2015 | 209 | PVC | 1-Negligible |
| Gravity Main | P1812 | 10798 Learning Ln | No Action | $ | - | 4 | 6 | 2004 | 100 | PVC | 1-Negligible |
| Gravity Main | P3411 | Mystic Wds | No Action | $ | - | 4 | 8 | 2015 | 35 | PVC | 1-Negligible |
| Gravity Main | P2007 | 7424-7461 Watermark Dr | No Action | $ | - | 4 | 8 | 2004 | 281 | PVC | 1-Negligible |
| Gravity Main | P2978 | 11666-11531 Wilmington Dr | No Action | $ | - | 4 | 8 | 2006 | 111 | PVC | 1-Negligible |
| Gravity Main | P2008 | 7412-7424 Watermark Dr | No Action | $ | - | 4 | 8 | 2004 | 101 | PVC | 1-Negligible |
| Gravity Main | P2004 | 7523-7560 Watermark Dr | No Action | $ | - | 4 | 8 | 2004 | 290 | PVC | 1-Negligible |
| Manhole | 1112 | 10745 48th Ave | No Action | $ | - | 4 | 0 | 1990 | 0 | Concrete (Reinforced) [CR | 1-Negligible |
| Manhole | 2481 | 5864 Larkspur Ave | MH Adjust Rim | $ | 2,678 | 4 | 0 | 1990 | 0 | Concrete (Reinforced) [CR | 1-Negligible |
| Manhole | 2472 | 6161 Library Ln | MH Clean + Line | $ | 4,038 | 4 | 0 | 1998 | 0 | Concrete (Reinforced) [CR | 1-Negligible |
| Manhole | 1955 | 6694 Martinie Dr | No Action | $ | - | 4 | 0 | 1992 | 0 | Concrete (Reinforced) [CR | 1-Negligible |
| Manhole | 1954 | 6550 Winans St | No Action | $ | - | 4 | 0 | 1992 | 0 | Concrete (Reinforced) [CR | 1-Negligible |
| Manhole | 1124 | 10769 S Campus Dr | No Action | $ | - | 4 | 0 | 1990 | 0 | Concrete (Reinforced) [CR | 1-Negligible |
| Manhole | 2054 | 6606 Mista Dr | No Action | $ | - | 4 | 0 | 1995 | 0 | Concrete (Reinforced) [CR | 1-Negligible |
| Manhole | 4240 | 10865 48th Ave | MH Inspection | $ | 536 | 4 | 0 | 1987 | 0 | Concrete (Reinforced) [CR | 1-Negligible |
| Manhole | 3087 | 11795 Brookridge Dr | MH Inspection | $ | 536 | 4 | 0 | 2006 | 0 | Not Known [XXX] | 1-Negligible |
| Manhole | 3177 | 11738 Andrews Ave | MH Inspection | $ | 536 | 4 | 0 | 2008 | 0 | Not Known [XXX] | 1-Negligible |
| Manhole | 9517 | Becker Dr | MH Inspection | $ | 536 | 4 | 0 | 2000 | 0 | Not Known [XXX] | 1-Negligible |
| Manhole | 4941 | 11410 48th Ave | MH Inspection | $ | 536 | 4 | 0 | 2000 | 0 | Not Known [XXX] | 1-Negligible |
| Manhole | 1115 | 10445 48th Ave | MH Inspection | $ | 536 | 4 | 0 | 2001 | 0 | Not Known [XXX] | 1-Negligible |
| Manhole | 2516 | 7120 Blue Jay Dr | MH Inspection | $ | 536 | 4 | 0 | 2013 | 0 | Not Known [XXX] | 1-Negligible |
| Manhole | 3811 | 5288 Windfield Dr | MH Inspection | $ | 536 | 4 | 0 | 2006 | 0 | Not Known [XXX] | 1-Negligible |
| Manhole | 3812 | 5324 Windfield Dr | MH Inspection | $ | 536 | 4 | 0 | 2006 | 0 | Not Known [XXX] | 1-Negligible |
| Manhole | 1136 | 11378 48th Ave | MH Inspection | $ | 536 | 4 | 0 | 2000 | 0 | Not Known [XXX] | 1-Negligible |
| Manhole | 2511 | 11347 Red Hawk Ln | MH Inspection | $ | 536 | 4 | 0 | 2007 | 0 | Not Known [XXX] | 1-Negligible |
| Manhole | 2512 | 7270 Blue Jay Dr | MH Inspection | $ | 536 | 4 | 0 | 2007 | 0 | Not Known [XXX] | 1-Negligible |
| Manhole | 2514 | 7220 Blue Jay Dr | MH Inspection | $ | 536 | 4 | 0 | 2007 | 0 | Not Known [XXX] | 1-Negligible |
| Manhole | 2985 | 11697 Brookland Ct | MH Inspection | $ | 536 | 4 | 0 | 2003 | 0 | Not Known [XXX] | 1-Negligible |
| Manhole | 3075 | 6054 Balcom Ln | MH Inspection | $ | 536 | 4 | 0 | 2008 | 0 | Not Known [XXX] | 1-Negligible |
| Manhole | 3076 | 6112 Balcom Ln | MH Inspection | $ | 536 | 4 | 0 | 2008 | 0 | Not Known [XXX] | 1-Negligible |
| Manhole | 3831 | Campus West Apartments | MH Inspection | $ | 536 | 4 | 0 | 2014 | 0 | Not Known [XXX] | 1-Negligible |
| Manhole | 3626 | 5050 Pierce St | MH Inspection | $ | 536 | 4 | 0 | 2014 | 0 | Not Known [XXX] | 1-Negligible |
| Manhole | 5287 | 11773 40th Ave | MH Inspection | $ | 536 | 4 | 0 | 2000 | 0 | Not Known [XXX] | 1-Negligible |
| Manhole | 1052 | Hawkin St | MH Inspection | $ | 536 | 4 | 0 | 2016 | 0 | Not Known [XXX] | 1-Negligible |
| Manhole | 9608 | Winnie Ln | MH Inspection | $ | 536 | 4 | 0 | 2016 | 0 | Not Known [XXX] | 1-Negligible |
| Manhole | 3460 | 10000 Laker Ln | MH Inspection | $ | 536 | 4 | 0 | 2004 | 0 | Not Known [XXX] | 1-Negligible |
| Gravity Main | P2317 | 7273-7347 Lake Michigan Dr | No Action | $ | - | 3 | 8 | 2007 | 292 | PVC | 1-Negligible |
| Gravity Main | P2980 | 11531 Wilmington Dr | No Action | $ | - | 3 | 8 | 2006 | 59 | PVC | 1-Negligible |
| Manhole | 1843 | New Options High School | MH Inspection | $ | 536 | 2 | 0 | 1990 | 0 | Not Known [XXX] | 1-Negligible |
| Manhole | 9006 | Laker Village Dr | No Action | $ | - | 2 | 0 | 1963 | 0 | Concrete (Reinforced) [CR | 1-Negligible |
| Manhole | 2450 | 6561 Lake Michigan Dr | No Action | $ | - | 2 | 0 | 1990 | 0 | Concrete (Reinforced) [CR | 1-Negligible |
| Manhole | 2634 | 11495 Brown St | No Action | $ | - | 2 | 0 | 1992 | 0 | Concrete (Reinforced) [CR | 1-Negligible |
| Manhole | 2471 | 11289 60th Ave | MH Inspection | $ | 536 | 2 | 0 | 2003 | 0 | Not Known [XXX] | 1-Negligible |

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Manhole | 2473 | 6182 Library Ln | MH Inspection | $ | 536 | 2 | 0 | 1998 | 0 | Not Known [XXX] | 1-Negligible |
| Manhole | 2474 | 6223 Lake Michigan Dr | MH Inspection | $ | 536 | 2 | 0 | 1998 | 0 | Not Known [XXX] | 1-Negligible |
| Manhole | 2510 | 11309 Red Hawk Ln | MH Inspection | $ | 536 | 2 | 0 | 2007 | 0 | Not Known [XXX] | 1-Negligible |
| Manhole | 3077 | 6095 Rossfield Ct | MH Inspection | $ | 536 | 2 | 0 | 2008 | 0 | Not Known [XXX] | 1-Negligible |
| Manhole | 3174 | 6093 Kingsbury Ct | MH Inspection | $ | 536 | 2 | 0 | 2008 | 0 | Not Known [XXX] | 1-Negligible |
| Manhole | 3175 | 6002 Kingsbury Ct | MH Inspection | $ | 536 | 2 | 0 | 2008 | 0 | Not Known [XXX] | 1-Negligible |
| Manhole | 3176 | 11775 Andrews Ave | MH Inspection | $ | 536 | 2 | 0 | 2008 | 0 | Not Known [XXX] | 1-Negligible |
| Manhole | 3830 | Campus West Apartments | MH Inspection | $ | 536 | 2 | 0 | 2014 | 0 | Not Known [XXX] | 1-Negligible |
| Manhole | 3519 | Mystic Wds | MH Inspection | $ | 536 | 0 | 0 | 2015 | 0 | Not Known [XXX] | 1-Negligible |

**APPENDIX I – Critical Asset Evaluation Structure**

Table I-1: InfoMaster Manhole Unit Cost Structure
Table I-2: InfoMaster Wastewater Pipeline Unit Cost Structure

## Table I-1: INFOMASTER MANHOLE UNIT COST STRUCTURE

Date: 10/18/2017 (updated 5/2/2017)

| OBJECT ID | Index | Rehab. Method | Unit | Unit Cost | Access Diameter | Material |
|---|---|---|---|---|---|---|
| 0 | 1 | MH INSPECTION | $each | $ 515.00 | | |
| 1 | 2 | ADJUST RIM | $each | $ 2,214.50 | | |
| 2 | 3 | ADJUST RIM | $each | $ 2,575.00 | 48 | |
| 3 | 4 | ADJUST RIM | $each | $ 2,935.50 | 60 | |
| 4 | 5 | MH CLEAN | $each | $ 515.00 | | |
| 5 | 6 | MH CLEAN | $each | $ 772.50 | 48 | |
| 6 | 7 | MH CLEAN | $each | $ 1,030.00 | 60 | |
| 7 | 8 | MH LINE | $each | $ 1,555.30 | | |
| 8 | 9 | MH LINE | $each | $ 3,110.60 | 48 | |
| 9 | 10 | MH LINE | $each | $ 3,883.10 | 60 | |
| 10 | 11 | MH REPAIR | $each | $ 1,030.00 | | |
| 11 | 12 | MH REPAIR | $each | $ 1,287.50 | 48 | |
| 12 | 13 | MH REPAIR | $each | $ 1,545.00 | 60 | |
| 13 | 14 | MH REPLACEMENT | $each | $ 3,605.00 | | |
| 14 | 15 | MH REPLACEMENT | $each | $ 5,150.00 | 48 | |
| 15 | 16 | MH REPLACEMENT | $each | $ 7,725.00 | 60 | |
| 17 | 18 | NO ACTION | $each | $ - | | |
| 18 | 19 | Outfall Clean | $each | $ 515.00 | | |
| 19 | 20 | Outfall Replace | $each | $ 2,060.00 | 6 | |
| 20 | 21 | Outfall Replace | $each | $ 2,060.00 | 8 | |
| 21 | 22 | Outfall Replace | $each | $ 2,163.00 | 10 | |
| 22 | 23 | Outfall Replace | $each | $ 2,163.00 | 12 | |
| 23 | 24 | Outfall Replace | $each | $ 2,163.00 | 15 | |
| 24 | 25 | Outfall Replace | $each | $ 2,332.95 | 18 | |
| 25 | 26 | Outfall Replace | $each | $ 2,389.60 | 21 | |
| 26 | 27 | Outfall Replace | $each | $ 2,590.45 | 24 | |
| 27 | 28 | Outfall Replace | $each | $ 2,590.45 | 30 | |
| 28 | 29 | Outfall Replace | $each | $ 3,193.00 | 36 | |
| 29 | 30 | Outfall Replace | $each | $ 4,017.00 | 42 | |
| 30 | 31 | Outfall Replace | $each | $ 4,017.00 | 48 | |
| 31 | 32 | Outfall Replace | $each | $ 2,060.00 | 6 | VCP |
| 32 | 33 | Outfall Replace | $each | $ 2,060.00 | 8 | VCP |
| 33 | 34 | Outfall Replace | $each | $ 2,163.00 | 10 | VCP |
| 34 | 35 | Outfall Replace | $each | $ 2,163.00 | 12 | VCP |
| 35 | 36 | Outfall Replace | $each | $ 2,163.00 | 15 | VCP |
| 36 | 37 | Outfall Replace | $each | $ 2,332.95 | 18 | VCP |
| 37 | 38 | Outfall Replace | $each | $ 2,389.60 | 21 | VCP |
| 38 | 39 | Outfall Replace | $each | $ 2,590.45 | 24 | VCP |
| 39 | 40 | Outfall Replace | $each | $ 2,590.45 | 30 | VCP |
| 40 | 41 | Outfall Replace | $each | $ 3,193.00 | 36 | VCP |
| 41 | 42 | Outfall Replace | $each | $ 4,017.00 | 42 | VCP |
| 42 | 43 | Outfall Replace | $each | $ 4,017.00 | 48 | VCP |
| 43 | 44 | Outfall Replace | $each | $ 2,060.00 | 6 | RCP |

| OBJECT ID | Index | Rehab. Method | Unit | Unit Cost | Access Diameter | Material |
|---|---|---|---|---|---|---|
| 44 | 45 | Outfall Replace | $each | $ 2,060.00 | 8 | RCP |
| 45 | 46 | Outfall Replace | $each | $ 2,163.00 | 10 | RCP |
| 46 | 47 | Outfall Replace | $each | $ 2,163.00 | 12 | RCP |
| 47 | 48 | Outfall Replace | $each | $ 2,163.00 | 15 | RCP |
| 48 | 49 | Outfall Replace | $each | $ 2,332.95 | 18 | RCP |
| 49 | 50 | Outfall Replace | $each | $ 2,389.60 | 21 | RCP |
| 50 | 51 | Outfall Replace | $each | $ 2,590.45 | 24 | RCP |
| 51 | 52 | Outfall Replace | $each | $ 2,590.45 | 30 | RCP |
| 52 | 53 | Outfall Replace | $each | $ 3,193.00 | 36 | RCP |
| 53 | 54 | Outfall Replace | $each | $ 4,017.00 | 42 | RCP |
| 54 | 55 | Outfall Replace | $each | $ 4,017.00 | 48 | RCP |
| 55 | 56 | Outfall Replace | $each | $ 2,060.00 | 6 | PVC |
| 56 | 57 | Outfall Replace | $each | $ 2,060.00 | 8 | PVC |
| 57 | 58 | Outfall Replace | $each | $ 2,163.00 | 10 | PVC |
| 58 | 59 | Outfall Replace | $each | $ 2,163.00 | 12 | PVC |
| 59 | 60 | Outfall Replace | $each | $ 2,163.00 | 15 | PVC |
| 60 | 61 | Outfall Replace | $each | $ 2,332.95 | 18 | PVC |
| 61 | 62 | Outfall Replace | $each | $ 2,389.60 | 21 | PVC |
| 62 | 63 | Outfall Replace | $each | $ 2,590.45 | 24 | PVC |
| 63 | 64 | Outfall Replace | $each | $ 2,590.45 | 30 | PVC |
| 64 | 65 | Outfall Replace | $each | $ 3,193.00 | 36 | PVC |
| 65 | 66 | Outfall Replace | $each | $ 4,017.00 | 42 | PVC |
| 66 | 67 | Outfall Replace | $each | $ 4,017.00 | 48 | PVC |
| 67 | 68 | Outfall Replace | $each | $ 2,060.00 | 6 | HDPE |
| 68 | 69 | Outfall Replace | $each | $ 2,060.00 | 8 | HDPE |
| 69 | 70 | Outfall Replace | $each | $ 2,163.00 | 10 | HDPE |
| 70 | 71 | Outfall Replace | $each | $ 2,163.00 | 12 | HDPE |
| 71 | 72 | Outfall Replace | $each | $ 2,163.00 | 15 | HDPE |
| 72 | 73 | Outfall Replace | $each | $ 2,332.95 | 18 | HDPE |
| 73 | 74 | Outfall Replace | $each | $ 2,389.60 | 21 | HDPE |
| 74 | 75 | Outfall Replace | $each | $ 2,590.45 | 24 | HDPE |
| 75 | 76 | Outfall Replace | $each | $ 2,590.45 | 30 | HDPE |
| 76 | 77 | Outfall Replace | $each | $ 3,193.00 | 36 | HDPE |
| 77 | 78 | Outfall Replace | $each | $ 4,017.00 | 42 | HDPE |
| 78 | 79 | Outfall Replace | $each | $ 4,017.00 | 48 | HDPE |
| 79 | 80 | Outfall Replace | $each | $ 2,060.00 | 6 | RPM |
| 80 | 81 | Outfall Replace | $each | $ 2,060.00 | 8 | RPM |
| 81 | 82 | Outfall Replace | $each | $ 2,163.00 | 10 | RPM |
| 82 | 83 | Outfall Replace | $each | $ 2,163.00 | 12 | RPM |
| 83 | 84 | Outfall Replace | $each | $ 2,163.00 | 15 | RPM |
| 84 | 85 | Outfall Replace | $each | $ 2,332.95 | 18 | RPM |
| 85 | 86 | Outfall Replace | $each | $ 2,389.60 | 21 | RPM |
| 86 | 87 | Outfall Replace | $each | $ 2,590.45 | 24 | RPM |
| 87 | 88 | Outfall Replace | $each | $ 2,590.45 | 30 | RPM |
| 88 | 89 | Outfall Replace | $each | $ 3,193.00 | 36 | RPM |

| OBJECT ID | Index | Rehab. Method | Unit | Unit Cost | Access Diameter | Material |
|---|---|---|---|---|---|---|
| 89 | 90 | Outfall Replace | $each | $ 4,017.00 | 42 | RPM |
| 90 | 91 | Outfall Replace | $each | $ 4,017.00 | 48 | RPM |
| 91 | 92 | CVE Replace | $each | $ 566.50 | 6 | |
| 92 | 93 | CVE Replace | $each | $ 618.00 | 8 | |
| 93 | 94 | CVE Replace | $each | $ 643.75 | 10 | |
| 94 | 95 | CVE Replace | $each | $ 669.50 | 12 | |
| 95 | 96 | CVE Replace | $each | $ 695.25 | 15 | |
| 96 | 97 | CVE Replace | $each | $ 721.00 | 18 | |
| 97 | 98 | CVE Replace | $each | $ 772.50 | 21 | |
| 98 | 99 | CVE Replace | $each | $ 824.00 | 24 | |
| 99 | 100 | CVE Replace | $each | $ 1,030.00 | 30 | |
| 100 | 101 | CVE Replace | $each | $ 1,545.00 | 36 | |
| 101 | 102 | CVE Replace | $each | $ 1,854.00 | 42 | |
| 102 | 103 | CVE Replace | $each | $ 2,060.00 | 48 | |
| 103 | 104 | CVE Replace | $each | $ 566.50 | 6 | VCP |
| 104 | 105 | CVE Replace | $each | $ 618.00 | 8 | VCP |
| 105 | 106 | CVE Replace | $each | $ 643.75 | 10 | VCP |
| 106 | 107 | CVE Replace | $each | $ 669.50 | 12 | VCP |
| 107 | 108 | CVE Replace | $each | $ 695.25 | 15 | VCP |
| 108 | 109 | CVE Replace | $each | $ 721.00 | 18 | VCP |
| 109 | 110 | CVE Replace | $each | $ 772.50 | 21 | VCP |
| 110 | 111 | CVE Replace | $each | $ 824.00 | 24 | VCP |
| 111 | 112 | CVE Replace | $each | $ 1,030.00 | 30 | VCP |
| 112 | 113 | CVE Replace | $each | $ 1,545.00 | 36 | VCP |
| 113 | 114 | CVE Replace | $each | $ 1,854.00 | 42 | VCP |
| 114 | 115 | CVE Replace | $each | $ 2,060.00 | 48 | VCP |
| 115 | 116 | CVE Replace | $each | $ 566.50 | 6 | RCP |
| 116 | 117 | CVE Replace | $each | $ 618.00 | 8 | RCP |
| 117 | 118 | CVE Replace | $each | $ 643.75 | 10 | RCP |
| 118 | 119 | CVE Replace | $each | $ 669.50 | 12 | RCP |
| 119 | 120 | CVE Replace | $each | $ 695.25 | 15 | RCP |
| 120 | 121 | CVE Replace | $each | $ 721.00 | 18 | RCP |
| 121 | 122 | CVE Replace | $each | $ 772.50 | 21 | RCP |
| 122 | 123 | CVE Replace | $each | $ 824.00 | 24 | RCP |
| 123 | 124 | CVE Replace | $each | $ 1,030.00 | 30 | RCP |
| 124 | 125 | CVE Replace | $each | $ 1,545.00 | 36 | RCP |
| 125 | 126 | CVE Replace | $each | $ 1,854.00 | 42 | RCP |
| 126 | 127 | CVE Replace | $each | $ 2,060.00 | 48 | RCP |
| 127 | 128 | CVE Replace | $each | $ 566.50 | 6 | PVC |
| 128 | 129 | CVE Replace | $each | $ 618.00 | 8 | PVC |
| 129 | 130 | CVE Replace | $each | $ 643.75 | 10 | PVC |
| 130 | 131 | CVE Replace | $each | $ 669.50 | 12 | PVC |
| 131 | 132 | CVE Replace | $each | $ 695.25 | 15 | PVC |
| 132 | 133 | CVE Replace | $each | $ 721.00 | 18 | PVC |
| 133 | 134 | CVE Replace | $each | $ 772.50 | 21 | PVC |

| OBJECT ID | Index | Rehab. Method | Unit | Unit Cost | Access Diameter | Material |
|---|---|---|---|---|---|---|
| 134 | 135 | CVE Replace | $each | $ 824.00 | 24 | PVC |
| 135 | 136 | CVE Replace | $each | $ 1,030.00 | 30 | PVC |
| 136 | 137 | CVE Replace | $each | $ 1,545.00 | 36 | PVC |
| 137 | 138 | CVE Replace | $each | $ 1,854.00 | 42 | PVC |
| 138 | 139 | CVE Replace | $each | $ 2,060.00 | 48 | PVC |
| 139 | 140 | CVE Replace | $each | $ 566.50 | 6 | HDPE |
| 140 | 141 | CVE Replace | $each | $ 618.00 | 8 | HDPE |
| 141 | 142 | CVE Replace | $each | $ 643.75 | 10 | HDPE |
| 142 | 143 | CVE Replace | $each | $ 669.50 | 12 | HDPE |
| 143 | 144 | CVE Replace | $each | $ 695.25 | 15 | HDPE |
| 144 | 145 | CVE Replace | $each | $ 721.00 | 18 | HDPE |
| 145 | 146 | CVE Replace | $each | $ 772.50 | 21 | HDPE |
| 146 | 147 | CVE Replace | $each | $ 824.00 | 24 | HDPE |
| 147 | 148 | CVE Replace | $each | $ 1,030.00 | 30 | HDPE |
| 148 | 149 | CVE Replace | $each | $ 1,545.00 | 36 | HDPE |
| 149 | 150 | CVE Replace | $each | $ 1,854.00 | 42 | HDPE |
| 150 | 151 | CVE Replace | $each | $ 2,060.00 | 48 | HDPE |
| 151 | 152 | CVE Replace | $each | $ 566.50 | 6 | RPM |
| 152 | 153 | CVE Replace | $each | $ 618.00 | 8 | RPM |
| 153 | 154 | CVE Replace | $each | $ 643.75 | 10 | RPM |
| 154 | 155 | CVE Replace | $each | $ 669.50 | 12 | RPM |
| 155 | 156 | CVE Replace | $each | $ 695.25 | 15 | RPM |
| 156 | 157 | CVE Replace | $each | $ 721.00 | 18 | RPM |
| 157 | 158 | CVE Replace | $each | $ 772.50 | 21 | RPM |
| 158 | 159 | CVE Replace | $each | $ 824.00 | 24 | RPM |
| 159 | 160 | CVE Replace | $each | $ 1,030.00 | 30 | RPM |
| 160 | 161 | CVE Replace | $each | $ 1,545.00 | 36 | RPM |
| 161 | 162 | CVE Replace | $each | $ 1,854.00 | 42 | RPM |
| 162 | 163 | CVE Replace | $each | $ 2,060.00 | 48 | RPM |
| 163 | 164 | Outfall Repair and Reset | $each | $ 1,030.00 | 6 | |
| 164 | 165 | Outfall Repair and Reset | $each | $ 1,030.00 | 8 | |
| 165 | 166 | Outfall Repair and Reset | $each | $ 1,081.50 | 10 | |
| 166 | 167 | Outfall Repair and Reset | $each | $ 1,081.50 | 12 | |
| 167 | 168 | Outfall Repair and Reset | $each | $ 1,081.50 | 15 | |
| 168 | 169 | Outfall Repair and Reset | $each | $ 1,166.48 | 18 | |
| 169 | 170 | Outfall Repair and Reset | $each | $ 1,194.80 | 21 | |
| 170 | 171 | Outfall Repair and Reset | $each | $ 1,295.23 | 24 | |
| 171 | 172 | Outfall Repair and Reset | $each | $ 1,295.23 | 30 | |
| 172 | 173 | Outfall Repair and Reset | $each | $ 1,596.50 | 36 | |
| 173 | 174 | Outfall Repair and Reset | $each | $ 2,008.50 | 42 | |
| 174 | 175 | Outfall Repair and Reset | $each | $ 2,008.50 | 48 | |
| 175 | 176 | Outfall Repair and Reset | $each | $ 1,030.00 | 6 | VCP |
| 176 | 177 | Outfall Repair and Reset | $each | $ 1,030.00 | 8 | VCP |
| 177 | 178 | Outfall Repair and Reset | $each | $ 1,081.50 | 10 | VCP |
| 178 | 179 | Outfall Repair and Reset | $each | $ 1,081.50 | 12 | VCP |

| OBJECT ID | Index | Rehab. Method | Unit | Unit Cost | Access Diameter | Material |
|---|---|---|---|---|---|---|
| 179 | 180 | Outfall Repair and Reset | $each | $ 1,081.50 | 15 | VCP |
| 180 | 181 | Outfall Repair and Reset | $each | $ 1,166.48 | 18 | VCP |
| 181 | 182 | Outfall Repair and Reset | $each | $ 1,194.80 | 21 | VCP |
| 182 | 183 | Outfall Repair and Reset | $each | $ 1,295.23 | 24 | VCP |
| 183 | 184 | Outfall Repair and Reset | $each | $ 1,295.23 | 30 | VCP |
| 184 | 185 | Outfall Repair and Reset | $each | $ 1,596.50 | 36 | VCP |
| 185 | 186 | Outfall Repair and Reset | $each | $ 2,008.50 | 42 | VCP |
| 186 | 187 | Outfall Repair and Reset | $each | $ 2,008.50 | 48 | VCP |
| 187 | 188 | Outfall Repair and Reset | $each | $ 1,030.00 | 6 | RCP |
| 188 | 189 | Outfall Repair and Reset | $each | $ 1,030.00 | 8 | RCP |
| 189 | 190 | Outfall Repair and Reset | $each | $ 1,081.50 | 10 | RCP |
| 190 | 191 | Outfall Repair and Reset | $each | $ 1,081.50 | 12 | RCP |
| 191 | 192 | Outfall Repair and Reset | $each | $ 1,081.50 | 15 | RCP |
| 192 | 193 | Outfall Repair and Reset | $each | $ 1,166.48 | 18 | RCP |
| 193 | 194 | Outfall Repair and Reset | $each | $ 1,194.80 | 21 | RCP |
| 194 | 195 | Outfall Repair and Reset | $each | $ 1,295.23 | 24 | RCP |
| 195 | 196 | Outfall Repair and Reset | $each | $ 1,295.23 | 30 | RCP |
| 196 | 197 | Outfall Repair and Reset | $each | $ 1,596.50 | 36 | RCP |
| 197 | 198 | Outfall Repair and Reset | $each | $ 2,008.50 | 42 | RCP |
| 198 | 199 | Outfall Repair and Reset | $each | $ 2,008.50 | 48 | RCP |
| 199 | 200 | Outfall Repair and Reset | $each | $ 1,030.00 | 6 | PVC |
| 200 | 201 | Outfall Repair and Reset | $each | $ 1,030.00 | 8 | PVC |
| 201 | 202 | Outfall Repair and Reset | $each | $ 1,081.50 | 10 | PVC |
| 202 | 203 | Outfall Repair and Reset | $each | $ 1,081.50 | 12 | PVC |
| 203 | 204 | Outfall Repair and Reset | $each | $ 1,081.50 | 15 | PVC |
| 204 | 205 | Outfall Repair and Reset | $each | $ 1,166.48 | 18 | PVC |
| 205 | 206 | Outfall Repair and Reset | $each | $ 1,194.80 | 21 | PVC |
| 206 | 207 | Outfall Repair and Reset | $each | $ 1,295.23 | 24 | PVC |
| 207 | 208 | Outfall Repair and Reset | $each | $ 1,295.23 | 30 | PVC |
| 208 | 209 | Outfall Repair and Reset | $each | $ 1,596.50 | 36 | PVC |
| 209 | 210 | Outfall Repair and Reset | $each | $ 2,008.50 | 42 | PVC |
| 210 | 211 | Outfall Repair and Reset | $each | $ 2,008.50 | 48 | PVC |
| 211 | 212 | Outfall Repair and Reset | $each | $ 1,030.00 | 6 | HDPE |
| 212 | 213 | Outfall Repair and Reset | $each | $ 1,030.00 | 8 | HDPE |
| 213 | 214 | Outfall Repair and Reset | $each | $ 1,081.50 | 10 | HDPE |
| 214 | 215 | Outfall Repair and Reset | $each | $ 1,081.50 | 12 | HDPE |
| 215 | 216 | Outfall Repair and Reset | $each | $ 1,081.50 | 15 | HDPE |
| 216 | 217 | Outfall Repair and Reset | $each | $ 1,166.48 | 18 | HDPE |
| 217 | 218 | Outfall Repair and Reset | $each | $ 1,194.80 | 21 | HDPE |
| 218 | 219 | Outfall Repair and Reset | $each | $ 1,295.23 | 24 | HDPE |
| 219 | 220 | Outfall Repair and Reset | $each | $ 1,295.23 | 30 | HDPE |
| 220 | 221 | Outfall Repair and Reset | $each | $ 1,596.50 | 36 | HDPE |
| 221 | 222 | Outfall Repair and Reset | $each | $ 2,008.50 | 42 | HDPE |
| 222 | 223 | Outfall Repair and Reset | $each | $ 2,008.50 | 48 | HDPE |
| 223 | 224 | Outfall Repair and Reset | $each | $ 1,030.00 | 6 | RPM |

| OBJECT ID | Index | Rehab. Method | Unit | Unit Cost | Access Diameter | Material |
|---|---|---|---|---|---|---|
| 224 | 225 | Outfall Repair and Reset | $each | $ 1,030.00 | 8 | RPM |
| 225 | 226 | Outfall Repair and Reset | $each | $ 1,081.50 | 10 | RPM |
| 226 | 227 | Outfall Repair and Reset | $each | $ 1,081.50 | 12 | RPM |
| 227 | 228 | Outfall Repair and Reset | $each | $ 1,081.50 | 15 | RPM |
| 228 | 229 | Outfall Repair and Reset | $each | $ 1,166.48 | 18 | RPM |
| 229 | 230 | Outfall Repair and Reset | $each | $ 1,194.80 | 21 | RPM |
| 230 | 231 | Outfall Repair and Reset | $each | $ 1,295.23 | 24 | RPM |
| 231 | 232 | Outfall Repair and Reset | $each | $ 1,295.23 | 30 | RPM |
| 232 | 233 | Outfall Repair and Reset | $each | $ 1,596.50 | 36 | RPM |
| 233 | 234 | Outfall Repair and Reset | $each | $ 2,008.50 | 42 | RPM |
| 234 | 235 | Outfall Repair and Reset | $each | $ 2,008.50 | 48 | RPM |

## Table I-2: INFOMASTER WASTEWATER PIPELINE UNIT COST STRUCTURE

Date: 10/18/2017 (updated 05/02/2017)

| OBJECT ID | Index | Rehab. Method | Unit | Unit Cost | Size (in) | Material | Setup Cost |
|---|---|---|---|---|---|---|---|
| 1 | 100 | CCTV AND CLEANING | $/unit length | $ 3.61 | | | 0 |
| 2 | 101 | CCTV AND CLEANING | $/unit length | $ 3.61 | 3 | | 0 |
| 3 | 102 | CCTV AND CLEANING | $/unit length | $ 3.61 | 4 | | 0 |
| 4 | 103 | CCTV AND CLEANING | $/unit length | $ 3.61 | 6 | | 0 |
| 5 | 104 | CCTV AND CLEANING | $/unit length | $ 3.61 | 8 | | 0 |
| 6 | 105 | CCTV AND CLEANING | $/unit length | $ 3.61 | 10 | | 0 |
| 7 | 106 | CCTV AND CLEANING | $/unit length | $ 3.61 | 12 | | 0 |
| 8 | 107 | CCTV AND CLEANING | $/unit length | $ 3.61 | 15 | | 0 |
| 9 | 108 | CCTV AND CLEANING | $/unit length | $ 3.61 | 18 | | 0 |
| 10 | 109 | CCTV AND CLEANING | $/unit length | $ 4.12 | 24 | | 0 |
| 11 | 110 | CCTV AND CLEANING | $/unit length | $ 4.12 | 30 | | 0 |
| 12 | 111 | CCTV AND CLEANING | $/unit length | $ 4.12 | 36 | | 0 |
| 13 | 112 | CCTV AND CLEANING | $/unit length | $ 4.12 | 42 | | 0 |
| 14 | 113 | CCTV AND CLEANING | $/unit length | $ 4.12 | 48 | | 0 |
| 15 | 115 | FULL LINING | $/unit length | $ 41.20 | 6 | | 0 |
| 16 | 116 | FULL LINING | $/unit length | $ 41.20 | 8 | | 0 |
| 17 | 117 | FULL LINING | $/unit length | $ 51.50 | 10 | | 0 |
| 18 | 118 | FULL LINING | $/unit length | $ 61.80 | 12 | | 0 |
| 19 | 119 | FULL LINING | $/unit length | $ 72.10 | 15 | | 0 |
| 20 | 120 | FULL LINING | $/unit length | $ 82.40 | 18 | | 0 |
| 21 | 121 | FULL LINING | $/unit length | $ 97.85 | 21 | | 0 |
| 22 | 122 | FULL LINING | $/unit length | $ 108.15 | 24 | | 0 |
| 23 | 123 | FULL LINING | $/unit length | $ 149.35 | 30 | | 0 |
| 24 | 124 | FULL LINING | $/unit length | $ 190.55 | 36 | | 0 |
| 25 | 125 | FULL LINING | $/unit length | $ 247.20 | 42 | | 0 |
| 26 | 126 | FULL LINING | $/unit length | $ 293.55 | 48 | | 0 |
| 27 | 127 | REPLACEMENT | $/unit length | $ 278.10 | | PVC | 0 |
| 28 | 128 | REPLACEMENT | $/unit length | $ 278.10 | 6 | PVC | 0 |
| 29 | 129 | REPLACEMENT | $/unit length | $ 278.10 | 8 | PVC | 0 |
| 30 | 130 | REPLACEMENT | $/unit length | $ 288.40 | 10 | PVC | 0 |
| 31 | 131 | REPLACEMENT | $/unit length | $ 288.40 | 12 | PVC | 0 |
| 32 | 132 | REPLACEMENT | $/unit length | $ 288.40 | 15 | PVC | 0 |
| 33 | 133 | REPLACEMENT | $/unit length | $ 319.30 | 18 | PVC | 0 |
| 34 | 134 | REPLACEMENT | $/unit length | $ 329.60 | 21 | PVC | 0 |
| 35 | 135 | REPLACEMENT | $/unit length | $ 339.90 | 24 | PVC | 0 |
| 36 | 136 | REPLACEMENT | $/unit length | $ 339.90 | 30 | PVC | 0 |
| 37 | 137 | REPLACEMENT | $/unit length | $ 432.60 | 36 | PVC | 0 |
| 38 | 138 | REPLACEMENT | $/unit length | $ 566.50 | 42 | PVC | 0 |
| 39 | 139 | REPLACEMENT | $/unit length | $ 566.50 | 48 | PVC | 0 |
| 40 | 140 | REPLACEMENT | $/unit length | $ 278.10 | | Unknown | 0 |
| 41 | 141 | REPLACEMENT | $/unit length | $ 278.10 | 6 | Unknown | 0 |
| 42 | 142 | REPLACEMENT | $/unit length | $ 278.10 | 8 | Unknown | 0 |
| 43 | 143 | REPLACEMENT | $/unit length | $ 288.40 | 10 | Unknown | 0 |

| OBJECT ID | Index | Rehab. Method | Unit | Unit Cost | Size (in) | Material | Setup Cost |
|---|---|---|---|---|---|---|---|
| 44 | 144 | REPLACEMENT | $/unit length | $ 288.40 | 12 | Unknown | 0 |
| 45 | 145 | REPLACEMENT | $/unit length | $ 288.40 | 15 | Unknown | 0 |
| 46 | 146 | REPLACEMENT | $/unit length | $ 319.30 | 18 | Unknown | 0 |
| 47 | 147 | REPLACEMENT | $/unit length | $ 329.60 | 21 | Unknown | 0 |
| 48 | 148 | REPLACEMENT | $/unit length | $ 339.90 | 24 | Unknown | 0 |
| 49 | 149 | REPLACEMENT | $/unit length | $ 339.90 | 30 | Unknown | 0 |
| 50 | 150 | REPLACEMENT | $/unit length | $ 432.60 | 36 | Unknown | 0 |
| 51 | 151 | REPLACEMENT | $/unit length | $ 566.50 | 42 | Unknown | 0 |
| 52 | 152 | REPLACEMENT | $/unit length | $ 566.50 | 48 | Unknown | 0 |
| 53 | 153 | REPLACEMENT | $/unit length | $ 278.10 | | CMP | 0 |
| 54 | 154 | REPLACEMENT | $/unit length | $ 278.10 | 6 | CMP | 0 |
| 55 | 155 | REPLACEMENT | $/unit length | $ 278.10 | 8 | CMP | 0 |
| 56 | 156 | REPLACEMENT | $/unit length | $ 288.40 | 10 | CMP | 0 |
| 57 | 157 | REPLACEMENT | $/unit length | $ 288.40 | 12 | CMP | 0 |
| 58 | 158 | REPLACEMENT | $/unit length | $ 288.40 | 15 | CMP | 0 |
| 59 | 159 | REPLACEMENT | $/unit length | $ 319.30 | 18 | CMP | 0 |
| 60 | 160 | REPLACEMENT | $/unit length | $ 329.60 | 21 | CMP | 0 |
| 61 | 161 | REPLACEMENT | $/unit length | $ 339.90 | 24 | CMP | 0 |
| 62 | 162 | REPLACEMENT | $/unit length | $ 339.90 | 30 | CMP | 0 |
| 63 | 163 | REPLACEMENT | $/unit length | $ 432.60 | 36 | CMP | 0 |
| 64 | 164 | REPLACEMENT | $/unit length | $ 566.50 | 42 | CMP | 0 |
| 65 | 165 | REPLACEMENT | $/unit length | $ 566.50 | 48 | CMP | 0 |
| 66 | 166 | REPLACEMENT | $/unit length | $ 278.10 | | RCP | 0 |
| 67 | 167 | REPLACEMENT | $/unit length | $ 278.10 | 6 | RCP | 0 |
| 68 | 168 | REPLACEMENT | $/unit length | $ 278.10 | 8 | RCP | 0 |
| 69 | 169 | REPLACEMENT | $/unit length | $ 288.40 | 10 | RCP | 0 |
| 70 | 170 | REPLACEMENT | $/unit length | $ 288.40 | 12 | RCP | 0 |
| 71 | 171 | REPLACEMENT | $/unit length | $ 288.40 | 15 | RCP | 0 |
| 72 | 172 | REPLACEMENT | $/unit length | $ 319.30 | 18 | RCP | 0 |
| 73 | 173 | REPLACEMENT | $/unit length | $ 329.60 | 21 | RCP | 0 |
| 74 | 174 | REPLACEMENT | $/unit length | $ 339.90 | 24 | RCP | 0 |
| 75 | 175 | REPLACEMENT | $/unit length | $ 339.90 | 30 | RCP | 0 |
| 76 | 176 | REPLACEMENT | $/unit length | $ 432.60 | 36 | RCP | 0 |
| 77 | 177 | REPLACEMENT | $/unit length | $ 566.50 | 42 | RCP | 0 |
| 78 | 178 | REPLACEMENT | $/unit length | $ 566.50 | 48 | RCP | 0 |
| 79 | 179 | REPLACEMENT | $/unit length | $ 278.10 | | HDPE | 0 |
| 80 | 180 | REPLACEMENT | $/unit length | $ 278.10 | 6 | HDPE | 0 |
| 81 | 181 | REPLACEMENT | $/unit length | $ 298.70 | 8 | HDPE | 0 |
| 82 | 182 | REPLACEMENT | $/unit length | $ 298.70 | 10 | HDPE | 0 |
| 83 | 183 | REPLACEMENT | $/unit length | $ 309.00 | 12 | HDPE | 0 |
| 84 | 184 | REPLACEMENT | $/unit length | $ 329.60 | 15 | HDPE | 0 |
| 85 | 185 | REPLACEMENT | $/unit length | $ 329.60 | 18 | HDPE | 0 |
| 86 | 186 | REPLACEMENT | $/unit length | $ 339.90 | 21 | HDPE | 0 |
| 87 | 187 | REPLACEMENT | $/unit length | $ 422.30 | 24 | HDPE | 0 |
| 88 | 188 | REPLACEMENT | $/unit length | $ 442.90 | 30 | HDPE | 0 |

| OBJECT ID | Index | Rehab. Method | Unit | Unit Cost | Size (in) | Material | Setup Cost |
|---|---|---|---|---|---|---|---|
| 89 | 189 | REPLACEMENT | $/unit length | $ 484.10 | 36 | HDPE | 0 |
| 90 | 190 | REPLACEMENT | $/unit length | $ 566.50 | 42 | HDPE | 0 |
| 91 | 191 | REPLACEMENT | $/unit length | $ 566.50 | 48 | HDPE | 0 |
| 92 | 192 | REPLACEMENT | $/unit length | $ 278.10 | | PVC TRUSS | 0 |
| 93 | 193 | REPLACEMENT | $/unit length | $ 278.10 | 6 | PVC TRUSS | 0 |
| 94 | 194 | REPLACEMENT | $/unit length | $ 298.70 | 8 | PVC TRUSS | 0 |
| 95 | 195 | REPLACEMENT | $/unit length | $ 298.70 | 10 | PVC TRUSS | 0 |
| 96 | 196 | REPLACEMENT | $/unit length | $ 309.00 | 12 | PVC TRUSS | 0 |
| 97 | 197 | REPLACEMENT | $/unit length | $ 329.60 | 15 | PVC TRUSS | 0 |
| 98 | 198 | REPLACEMENT | $/unit length | $ 329.60 | 18 | PVC TRUSS | 0 |
| 99 | 199 | REPLACEMENT | $/unit length | $ 339.90 | 21 | PVC TRUSS | 0 |
| 100 | 200 | REPLACEMENT | $/unit length | $ 422.30 | 24 | PVC TRUSS | 0 |
| 101 | 201 | REPLACEMENT | $/unit length | $ 442.90 | 30 | PVC TRUSS | 0 |
| 102 | 202 | REPLACEMENT | $/unit length | $ 484.10 | 36 | PVC TRUSS | 0 |
| 103 | 203 | REPLACEMENT | $/unit length | $ 566.50 | 42 | PVC TRUSS | 0 |
| 104 | 204 | REPLACEMENT | $/unit length | $ 566.50 | 48 | PVC TRUSS | 0 |
| 105 | 205 | REPLACEMENT | $/unit length | $ 288.40 | | DUCTILE IRON | 0 |
| 106 | 206 | REPLACEMENT | $/unit length | $ 288.40 | 4 | DUCTILE IRON | 0 |
| 107 | 207 | REPLACEMENT | $/unit length | $ 309.00 | 6 | DUCTILE IRON | 0 |
| 108 | 208 | REPLACEMENT | $/unit length | $ 309.00 | 8 | DUCTILE IRON | 0 |
| 109 | 209 | REPLACEMENT | $/unit length | $ 329.60 | 10 | DUCTILE IRON | 0 |
| 110 | 210 | REPLACEMENT | $/unit length | $ 350.20 | 12 | DUCTILE IRON | 0 |
| 111 | 211 | REPLACEMENT | $/unit length | $ 350.20 | 15 | DUCTILE IRON | 0 |
| 112 | 212 | REPLACEMENT | $/unit length | $ 360.50 | 18 | DUCTILE IRON | 0 |
| 113 | 213 | REPLACEMENT | $/unit length | $ 453.20 | 24 | DUCTILE IRON | 0 |
| 114 | 214 | REPLACEMENT | $/unit length | $ 484.10 | 30 | DUCTILE IRON | 0 |
| 115 | 215 | REPLACEMENT | $/unit length | $ 535.60 | 36 | DUCTILE IRON | 0 |
| 116 | 216 | REPLACEMENT | $/unit length | $ 643.75 | 42 | DUCTILE IRON | 0 |
| 117 | 217 | REPLACEMENT | $/unit length | $ 643.75 | 48 | DUCTILE IRON | 0 |
| 118 | 192 | REPLACEMENT | $/unit length | $ 278.10 | | RPM | 0 |
| 119 | 193 | REPLACEMENT | $/unit length | $ 278.10 | 6 | RPM | 0 |
| 120 | 194 | REPLACEMENT | $/unit length | $ 298.70 | 8 | RPM | 0 |
| 121 | 195 | REPLACEMENT | $/unit length | $ 298.70 | 10 | RPM | 0 |
| 122 | 196 | REPLACEMENT | $/unit length | $ 309.00 | 12 | RPM | 0 |
| 123 | 197 | REPLACEMENT | $/unit length | $ 329.60 | 15 | RPM | 0 |
| 124 | 198 | REPLACEMENT | $/unit length | $ 329.60 | 18 | RPM | 0 |
| 125 | 199 | REPLACEMENT | $/unit length | $ 339.90 | 21 | RPM | 0 |
| 126 | 200 | REPLACEMENT | $/unit length | $ 422.30 | 24 | RPM | 0 |
| 127 | 201 | REPLACEMENT | $/unit length | $ 442.90 | 30 | RPM | 0 |
| 128 | 202 | REPLACEMENT | $/unit length | $ 484.10 | 36 | RPM | 0 |
| 129 | 203 | REPLACEMENT | $/unit length | $ 566.50 | 42 | RPM | 0 |
| 130 | 204 | REPLACEMENT | $/unit length | $ 566.50 | 48 | RPM | 0 |
| 131 | 218 | REPLACEMENT | $/unit length | $ 278.10 | | VCP | 0 |
| 132 | 219 | REPLACEMENT | $/unit length | $ 278.10 | 6 | VCP | 0 |
| 133 | 220 | REPLACEMENT | $/unit length | $ 298.70 | 8 | VCP | 0 |

| OBJECT ID | Index | Rehab. Method | Unit | Unit Cost | Size (in) | Material | Setup Cost |
|---|---|---|---|---|---|---|---|
| 134 | 221 | REPLACEMENT | $/unit length | $ 298.70 | 10 | VCP | 0 |
| 135 | 222 | REPLACEMENT | $/unit length | $ 309.00 | 12 | VCP | 0 |
| 136 | 223 | REPLACEMENT | $/unit length | $ 329.60 | 15 | VCP | 0 |
| 137 | 224 | REPLACEMENT | $/unit length | $ 329.60 | 18 | VCP | 0 |
| 138 | 225 | REPLACEMENT | $/unit length | $ 422.30 | 24 | VCP | 0 |
| 139 | 226 | REPLACEMENT | $/unit length | $ 442.90 | 30 | VCP | 0 |
| 140 | 227 | REPLACEMENT | $/unit length | $ 484.10 | 36 | VCP | 0 |
| 141 | 228 | REPLACEMENT | $/unit length | $ 566.50 | 42 | VCP | 0 |
| 142 | 229 | REPLACEMENT | $/unit length | $ 566.50 | 48 | VCP | 0 |
| 143 | 230 | REPLACEMENT | $/unit length | $ 288.40 |  | CAST IRON | 0 |
| 144 | 231 | REPLACEMENT | $/unit length | $ 309.00 | 6 | CAST IRON | 0 |
| 145 | 232 | REPLACEMENT | $/unit length | $ 309.00 | 8 | CAST IRON | 0 |
| 146 | 233 | REPLACEMENT | $/unit length | $ 329.60 | 10 | CAST IRON | 0 |
| 147 | 234 | REPLACEMENT | $/unit length | $ 350.20 | 12 | CAST IRON | 0 |
| 148 | 235 | REPLACEMENT | $/unit length | $ 350.20 | 15 | CAST IRON | 0 |
| 149 | 236 | REPLACEMENT | $/unit length | $ 360.50 | 18 | CAST IRON | 0 |
| 150 | 237 | REPLACEMENT | $/unit length | $ 453.20 | 24 | CAST IRON | 0 |
| 151 | 238 | REPLACEMENT | $/unit length | $ 484.10 | 30 | CAST IRON | 0 |
| 152 | 239 | REPLACEMENT | $/unit length | $ 535.60 | 36 | CAST IRON | 0 |
| 153 | 240 | REPLACEMENT | $/unit length | $ 643.75 | 42 | CAST IRON | 0 |
| 154 | 241 | REPLACEMENT | $/unit length | $ 643.75 | 48 | CAST IRON | 0 |
| 155 | 242 | 80/20 LINING AND REPLACEMENT | $/unit length | $ 123.60 |  | PVC | 0 |
| 156 | 243 | 80/20 LINING AND REPLACEMENT | $/unit length | $ 123.60 | 6 | PVC | 0 |
| 157 | 244 | 80/20 LINING AND REPLACEMENT | $/unit length | $ 123.60 | 8 | PVC | 0 |
| 158 | 245 | 80/20 LINING AND REPLACEMENT | $/unit length | $ 133.90 | 10 | PVC | 0 |
| 159 | 246 | 80/20 LINING AND REPLACEMENT | $/unit length | $ 144.20 | 12 | PVC | 0 |
| 160 | 247 | 80/20 LINING AND REPLACEMENT | $/unit length | $ 154.50 | 15 | PVC | 0 |
| 161 | 248 | 80/20 LINING AND REPLACEMENT | $/unit length | $ 175.10 | 18 | PVC | 0 |
| 162 | 249 | 80/20 LINING AND REPLACEMENT | $/unit length | $ 185.40 | 21 | PVC | 0 |
| 163 | 250 | 80/20 LINING AND REPLACEMENT | $/unit length | $ 185.40 | 24 | PVC | 0 |
| 164 | 251 | 80/20 LINING AND REPLACEMENT | $/unit length | $ 247.20 | 30 | PVC | 0 |
| 165 | 252 | 80/20 LINING AND REPLACEMENT | $/unit length | $ 309.00 | 36 | PVC | 0 |
| 166 | 253 | 80/20 LINING AND REPLACEMENT | $/unit length | $ 422.30 | 42 | PVC | 0 |
| 167 | 254 | 80/20 LINING AND REPLACEMENT | $/unit length | $ 484.10 | 48 | PVC | 0 |
| 168 | 255 | 80/20 LINING AND REPLACEMENT | $/unit length | $ 123.60 |  | Unknown | 0 |
| 169 | 256 | 80/20 LINING AND REPLACEMENT | $/unit length | $ 123.60 | 6 | Unknown | 0 |
| 170 | 257 | 80/20 LINING AND REPLACEMENT | $/unit length | $ 123.60 | 8 | Unknown | 0 |
| 171 | 258 | 80/20 LINING AND REPLACEMENT | $/unit length | $ 133.90 | 10 | Unknown | 0 |
| 172 | 259 | 80/20 LINING AND REPLACEMENT | $/unit length | $ 144.20 | 12 | Unknown | 0 |
| 173 | 260 | 80/20 LINING AND REPLACEMENT | $/unit length | $ 154.50 | 15 | Unknown | 0 |
| 174 | 261 | 80/20 LINING AND REPLACEMENT | $/unit length | $ 175.10 | 18 | Unknown | 0 |
| 175 | 262 | 80/20 LINING AND REPLACEMENT | $/unit length | $ 185.40 | 21 | Unknown | 0 |
| 176 | 263 | 80/20 LINING AND REPLACEMENT | $/unit length | $ 185.40 | 24 | Unknown | 0 |
| 177 | 264 | 80/20 LINING AND REPLACEMENT | $/unit length | $ 247.20 | 30 | Unknown | 0 |
| 178 | 265 | 80/20 LINING AND REPLACEMENT | $/unit length | $ 309.00 | 36 | Unknown | 0 |

| OBJECT ID | Index | Rehab. Method | Unit | Unit Cost | Size (in) | Material | Setup Cost |
|---|---|---|---|---|---|---|---|
| 179 | 266 | 80/20 LINING AND REPLACEMENT | $/unit length | $ 422.30 | 42 | Unknown | 0 |
| 180 | 267 | 80/20 LINING AND REPLACEMENT | $/unit length | $ 484.10 | 48 | Unknown | 0 |
| 181 | 268 | 80/20 LINING AND REPLACEMENT | $/unit length | $ 123.60 | | CMP | 0 |
| 182 | 269 | 80/20 LINING AND REPLACEMENT | $/unit length | $ 123.60 | 6 | CMP | 0 |
| 183 | 270 | 80/20 LINING AND REPLACEMENT | $/unit length | $ 123.60 | 8 | CMP | 0 |
| 184 | 271 | 80/20 LINING AND REPLACEMENT | $/unit length | $ 133.90 | 10 | CMP | 0 |
| 185 | 272 | 80/20 LINING AND REPLACEMENT | $/unit length | $ 144.20 | 12 | CMP | 0 |
| 186 | 273 | 80/20 LINING AND REPLACEMENT | $/unit length | $ 154.50 | 15 | CMP | 0 |
| 187 | 274 | 80/20 LINING AND REPLACEMENT | $/unit length | $ 175.10 | 18 | CMP | 0 |
| 188 | 275 | 80/20 LINING AND REPLACEMENT | $/unit length | $ 185.40 | 21 | CMP | 0 |
| 189 | 276 | 80/20 LINING AND REPLACEMENT | $/unit length | $ 185.40 | 24 | CMP | 0 |
| 190 | 277 | 80/20 LINING AND REPLACEMENT | $/unit length | $ 247.20 | 30 | CMP | 0 |
| 191 | 278 | 80/20 LINING AND REPLACEMENT | $/unit length | $ 309.00 | 36 | CMP | 0 |
| 192 | 279 | 80/20 LINING AND REPLACEMENT | $/unit length | $ 422.30 | 42 | CMP | 0 |
| 193 | 280 | 80/20 LINING AND REPLACEMENT | $/unit length | $ 484.10 | 48 | CMP | 0 |
| 194 | 281 | 80/20 LINING AND REPLACEMENT | $/unit length | $ 123.60 | | RCP | 0 |
| 195 | 282 | 80/20 LINING AND REPLACEMENT | $/unit length | $ 123.60 | 6 | RCP | 0 |
| 196 | 283 | 80/20 LINING AND REPLACEMENT | $/unit length | $ 123.60 | 8 | RCP | 0 |
| 197 | 284 | 80/20 LINING AND REPLACEMENT | $/unit length | $ 133.90 | 10 | RCP | 0 |
| 198 | 285 | 80/20 LINING AND REPLACEMENT | $/unit length | $ 144.20 | 12 | RCP | 0 |
| 199 | 286 | 80/20 LINING AND REPLACEMENT | $/unit length | $ 154.50 | 15 | RCP | 0 |
| 200 | 287 | 80/20 LINING AND REPLACEMENT | $/unit length | $ 175.10 | 18 | RCP | 0 |
| 201 | 288 | 80/20 LINING AND REPLACEMENT | $/unit length | $ 185.40 | 21 | RCP | 0 |
| 202 | 289 | 80/20 LINING AND REPLACEMENT | $/unit length | $ 185.40 | 24 | RCP | 0 |
| 203 | 290 | 80/20 LINING AND REPLACEMENT | $/unit length | $ 247.20 | 30 | RCP | 0 |
| 204 | 291 | 80/20 LINING AND REPLACEMENT | $/unit length | $ 309.00 | 36 | RCP | 0 |
| 205 | 292 | 80/20 LINING AND REPLACEMENT | $/unit length | $ 422.30 | 42 | RCP | 0 |
| 206 | 293 | 80/20 LINING AND REPLACEMENT | $/unit length | $ 484.10 | 48 | RCP | 0 |
| 207 | 294 | 80/20 LINING AND REPLACEMENT | $/unit length | $ 123.60 | | PVC TRUSS | 0 |
| 208 | 295 | 80/20 LINING AND REPLACEMENT | $/unit length | $ 123.60 | 6 | PVC TRUSS | 0 |
| 209 | 296 | 80/20 LINING AND REPLACEMENT | $/unit length | $ 123.60 | 8 | PVC TRUSS | 0 |
| 210 | 297 | 80/20 LINING AND REPLACEMENT | $/unit length | $ 133.90 | 10 | PVC TRUSS | 0 |
| 211 | 298 | 80/20 LINING AND REPLACEMENT | $/unit length | $ 144.20 | 12 | PVC TRUSS | 0 |
| 212 | 299 | 80/20 LINING AND REPLACEMENT | $/unit length | $ 154.50 | 15 | PVC TRUSS | 0 |
| 213 | 300 | 80/20 LINING AND REPLACEMENT | $/unit length | $ 175.10 | 18 | PVC TRUSS | 0 |
| 214 | 301 | 80/20 LINING AND REPLACEMENT | $/unit length | $ 185.40 | 21 | PVC TRUSS | 0 |
| 215 | 302 | 80/20 LINING AND REPLACEMENT | $/unit length | $ 185.40 | 24 | PVC TRUSS | 0 |
| 216 | 303 | 80/20 LINING AND REPLACEMENT | $/unit length | $ 247.20 | 30 | PVC TRUSS | 0 |
| 217 | 304 | 80/20 LINING AND REPLACEMENT | $/unit length | $ 309.00 | 36 | PVC TRUSS | 0 |
| 218 | 305 | 80/20 LINING AND REPLACEMENT | $/unit length | $ 422.30 | 42 | PVC TRUSS | 0 |
| 219 | 306 | 80/20 LINING AND REPLACEMENT | $/unit length | $ 484.10 | 48 | PVC TRUSS | 0 |
| 220 | 307 | 80/20 LINING AND REPLACEMENT | $/unit length | $ 123.60 | | HDPE | 0 |
| 221 | 308 | 80/20 LINING AND REPLACEMENT | $/unit length | $ 123.60 | 6 | HDPE | 0 |
| 222 | 309 | 80/20 LINING AND REPLACEMENT | $/unit length | $ 123.60 | 8 | HDPE | 0 |
| 223 | 310 | 80/20 LINING AND REPLACEMENT | $/unit length | $ 133.90 | 10 | HDPE | 0 |

| OBJECT ID | Index | Rehab. Method | Unit | Unit Cost | Size (in) | Material | Setup Cost |
|---|---|---|---|---|---|---|---|
| 224 | 311 | 80/20 LINING AND REPLACEMENT | $/unit length | $ 144.20 | 12 | HDPE | 0 |
| 225 | 312 | 80/20 LINING AND REPLACEMENT | $/unit length | $ 164.80 | 15 | HDPE | 0 |
| 226 | 313 | 80/20 LINING AND REPLACEMENT | $/unit length | $ 175.10 | 18 | HDPE | 0 |
| 227 | 314 | 80/20 LINING AND REPLACEMENT | $/unit length | $ 195.70 | 21 | HDPE | 0 |
| 228 | 315 | 80/20 LINING AND REPLACEMENT | $/unit length | $ 206.00 | 24 | HDPE | 0 |
| 229 | 316 | 80/20 LINING AND REPLACEMENT | $/unit length | $ 267.80 | 30 | HDPE | 0 |
| 230 | 317 | 80/20 LINING AND REPLACEMENT | $/unit length | $ 319.30 | 36 | HDPE | 0 |
| 231 | 318 | 80/20 LINING AND REPLACEMENT | $/unit length | $ 422.30 | 42 | HDPE | 0 |
| 232 | 319 | 80/20 LINING AND REPLACEMENT | $/unit length | $ 484.10 | 48 | HDPE | 0 |
| 233 | 294 | 80/20 LINING AND REPLACEMENT | $/unit length | $ 123.60 | | RPM | 0 |
| 234 | 295 | 80/20 LINING AND REPLACEMENT | $/unit length | $ 123.60 | 6 | RPM | 0 |
| 235 | 296 | 80/20 LINING AND REPLACEMENT | $/unit length | $ 123.60 | 8 | RPM | 0 |
| 236 | 297 | 80/20 LINING AND REPLACEMENT | $/unit length | $ 133.90 | 10 | RPM | 0 |
| 237 | 298 | 80/20 LINING AND REPLACEMENT | $/unit length | $ 144.20 | 12 | RPM | 0 |
| 238 | 299 | 80/20 LINING AND REPLACEMENT | $/unit length | $ 154.50 | 15 | RPM | 0 |
| 239 | 300 | 80/20 LINING AND REPLACEMENT | $/unit length | $ 175.10 | 18 | RPM | 0 |
| 240 | 301 | 80/20 LINING AND REPLACEMENT | $/unit length | $ 185.40 | 21 | RPM | 0 |
| 241 | 302 | 80/20 LINING AND REPLACEMENT | $/unit length | $ 185.40 | 24 | RPM | 0 |
| 242 | 303 | 80/20 LINING AND REPLACEMENT | $/unit length | $ 247.20 | 30 | RPM | 0 |
| 243 | 304 | 80/20 LINING AND REPLACEMENT | $/unit length | $ 309.00 | 36 | RPM | 0 |
| 244 | 305 | 80/20 LINING AND REPLACEMENT | $/unit length | $ 422.30 | 42 | RPM | 0 |
| 245 | 306 | 80/20 LINING AND REPLACEMENT | $/unit length | $ 484.10 | 48 | RPM | 0 |
| 246 | 320 | 80/20 LINING AND REPLACEMENT | $/unit length | $ 123.60 | | DUCTILE IRON | 0 |
| 247 | 321 | 80/20 LINING AND REPLACEMENT | $/unit length | $ 123.60 | 6 | DUCTILE IRON | 0 |
| 248 | 322 | 80/20 LINING AND REPLACEMENT | $/unit length | $ 123.60 | 8 | DUCTILE IRON | 0 |
| 249 | 323 | 80/20 LINING AND REPLACEMENT | $/unit length | $ 133.90 | 10 | DUCTILE IRON | 0 |
| 250 | 324 | 80/20 LINING AND REPLACEMENT | $/unit length | $ 154.50 | 12 | DUCTILE IRON | 0 |
| 251 | 325 | 80/20 LINING AND REPLACEMENT | $/unit length | $ 164.80 | 15 | DUCTILE IRON | 0 |
| 252 | 326 | 80/20 LINING AND REPLACEMENT | $/unit length | $ 175.10 | 18 | DUCTILE IRON | 0 |
| 253 | 327 | 80/20 LINING AND REPLACEMENT | $/unit length | $ 195.70 | 21 | DUCTILE IRON | 0 |
| 254 | 328 | 80/20 LINING AND REPLACEMENT | $/unit length | $ 216.30 | 24 | DUCTILE IRON | 0 |
| 255 | 329 | 80/20 LINING AND REPLACEMENT | $/unit length | $ 267.80 | 30 | DUCTILE IRON | 0 |
| 256 | 330 | 80/20 LINING AND REPLACEMENT | $/unit length | $ 329.60 | 36 | DUCTILE IRON | 0 |
| 257 | 331 | 80/20 LINING AND REPLACEMENT | $/unit length | $ 463.50 | 42 | DUCTILE IRON | 0 |
| 258 | 332 | 80/20 LINING AND REPLACEMENT | $/unit length | $ 545.90 | 48 | DUCTILE IRON | 0 |
| 259 | 333 | 80/20 LINING AND REPLACEMENT | $/unit length | $ 123.60 | | VCP | 0 |
| 260 | 334 | 80/20 LINING AND REPLACEMENT | $/unit length | $ 123.60 | 6 | VCP | 0 |
| 261 | 335 | 80/20 LINING AND REPLACEMENT | $/unit length | $ 123.60 | 8 | VCP | 0 |
| 262 | 336 | 80/20 LINING AND REPLACEMENT | $/unit length | $ 133.90 | 10 | VCP | 0 |
| 263 | 337 | 80/20 LINING AND REPLACEMENT | $/unit length | $ 144.20 | 12 | VCP | 0 |
| 264 | 338 | 80/20 LINING AND REPLACEMENT | $/unit length | $ 154.50 | 15 | VCP | 0 |
| 265 | 339 | 80/20 LINING AND REPLACEMENT | $/unit length | $ 175.10 | 18 | VCP | 0 |
| 266 | 340 | 80/20 LINING AND REPLACEMENT | $/unit length | $ 185.40 | 21 | VCP | 0 |
| 267 | 341 | 80/20 LINING AND REPLACEMENT | $/unit length | $ 185.40 | 24 | VCP | 0 |
| 268 | 342 | 80/20 LINING AND REPLACEMENT | $/unit length | $ 247.20 | 30 | VCP | 0 |

| OBJECT ID | Index | Rehab. Method | Unit | Unit Cost | Size (in) | Material | Setup Cost |
|---|---|---|---|---|---|---|---|
| 269 | 343 | 80/20 LINING AND REPLACEMENT | $/unit length | $ 309.00 | 36 | VCP | 0 |
| 270 | 344 | 80/20 LINING AND REPLACEMENT | $/unit length | $ 422.30 | 42 | VCP | 0 |
| 271 | 345 | 80/20 LINING AND REPLACEMENT | $/unit length | $ 484.10 | 48 | VCP | 0 |
| 272 | 346 | 80/20 LINING AND REPLACEMENT | $/unit length | $ 123.60 | 6 | CAST IRON | 0 |
| 273 | 347 | 80/20 LINING AND REPLACEMENT | $/unit length | $ 123.60 | 8 | CAST IRON | 0 |
| 274 | 348 | 80/20 LINING AND REPLACEMENT | $/unit length | $ 133.90 | 10 | CAST IRON | 0 |
| 275 | 349 | 80/20 LINING AND REPLACEMENT | $/unit length | $ 154.50 | 12 | CAST IRON | 0 |
| 276 | 350 | 80/20 LINING AND REPLACEMENT | $/unit length | $ 164.80 | 15 | CAST IRON | 0 |
| 277 | 351 | 80/20 LINING AND REPLACEMENT | $/unit length | $ 185.40 | 18 | CAST IRON | 0 |
| 278 | 352 | 80/20 LINING AND REPLACEMENT | $/unit length | $ 216.30 | 24 | CAST IRON | 0 |
| 279 | 353 | 80/20 LINING AND REPLACEMENT | $/unit length | $ 216.30 | 30 | CAST IRON | 0 |
| 280 | 354 | 80/20 LINING AND REPLACEMENT | $/unit length | $ 278.10 | 36 | CAST IRON | 0 |
| 281 | 355 | 80/20 LINING AND REPLACEMENT | $/unit length | $ 401.70 | 42 | CAST IRON | 0 |
| 282 | 356 | 80/20 LINING AND REPLACEMENT | $/unit length | $ 494.40 | 48 | CAST IRON | 0 |
| 283 | 357 | POINT REPAIR | $/unit length | $ 278.10 | | | 5000 |
| 284 | 358 | POINT REPAIR | $/unit length | $ 278.10 | 6 | | 5000 |
| 285 | 359 | POINT REPAIR | $/unit length | $ 278.10 | 8 | | 5000 |
| 286 | 360 | POINT REPAIR | $/unit length | $ 288.40 | 10 | | 5000 |
| 287 | 361 | POINT REPAIR | $/unit length | $ 288.40 | 12 | | 5000 |
| 288 | 362 | POINT REPAIR | $/unit length | $ 288.40 | 15 | | 5000 |
| 289 | 363 | POINT REPAIR | $/unit length | $ 319.30 | 18 | | 5000 |
| 290 | 364 | POINT REPAIR | $/unit length | $ 329.60 | 21 | | 5000 |
| 291 | 365 | POINT REPAIR | $/unit length | $ 339.90 | 24 | | 5000 |
| 292 | 366 | POINT REPAIR | $/unit length | $ 339.90 | 24 | | 5000 |
| 293 | 367 | POINT REPAIR | $/unit length | $ 339.90 | 36 | | 5000 |
| 294 | 368 | POINT REPAIR | $/unit length | $ 432.60 | 42 | | 5000 |
| 295 | 369 | POINT REPAIR | $/unit length | $ 813.70 | 48 | | 5000 |
| 296 | 370 | CCTV AND HEAVY CLEANING | $/unit length | $ 7.21 | | | 0 |
| 297 | 371 | CCTV AND HEAVY CLEANING | $/unit length | $ 7.21 | 3 | | 0 |
| 298 | 372 | CCTV AND HEAVY CLEANING | $/unit length | $ 7.21 | 4 | | 0 |
| 299 | 373 | CCTV AND HEAVY CLEANING | $/unit length | $ 7.21 | 6 | | 0 |
| 300 | 374 | CCTV AND HEAVY CLEANING | $/unit length | $ 7.21 | 8 | | 0 |
| 301 | 375 | CCTV AND HEAVY CLEANING | $/unit length | $ 7.21 | 10 | | 0 |
| 302 | 376 | CCTV AND HEAVY CLEANING | $/unit length | $ 7.21 | 12 | | 0 |
| 303 | 377 | CCTV AND HEAVY CLEANING | $/unit length | $ 7.21 | 15 | | 0 |
| 304 | 378 | CCTV AND HEAVY CLEANING | $/unit length | $ 7.21 | 18 | | 0 |
| 305 | 379 | CCTV AND HEAVY CLEANING | $/unit length | $ 8.24 | 24 | | 0 |
| 306 | 380 | CCTV AND HEAVY CLEANING | $/unit length | $ 8.24 | 30 | | 0 |
| 307 | 381 | CCTV AND HEAVY CLEANING | $/unit length | $ 8.24 | 36 | | 0 |
| 308 | 382 | CCTV AND HEAVY CLEANING | $/unit length | $ 8.24 | 42 | | 0 |
| 309 | 383 | CCTV AND HEAVY CLEANING | $/unit length | $ 8.24 | 48 | | 0 |
| 310 | 384 | FM - 20% Replacement | $/unit length | $ 288.40 | | | 0 |
| 311 | 385 | FM - 20% Replacement | $/unit length | $ 288.40 | 4 | | 0 |
| 312 | 386 | FM - 20% Replacement | $/unit length | $ 309.00 | 6 | | 0 |
| 313 | 387 | FM - 20% Replacement | $/unit length | $ 309.00 | 8 | | 0 |

| OBJECT ID | Index | Rehab. Method | Unit | Unit Cost | Size (in) | Material | Setup Cost |
|---|---|---|---|---|---|---|---|
| 314 | 388 | FM - 20% Replacement | $/unit length | $ 329.60 | 10 | | 0 |
| 315 | 389 | FM - 20% Replacement | $/unit length | $ 350.20 | 12 | | 0 |
| 316 | 390 | FM - 20% Replacement | $/unit length | $ 350.20 | 15 | | 0 |
| 317 | 391 | FM - 20% Replacement | $/unit length | $ 360.50 | 18 | | 0 |
| 318 | 392 | FM - 20% Replacement | $/unit length | $ 453.20 | 24 | | 0 |

**APPENDIX J – CIP Recommendations for Addressing Assets over Time**

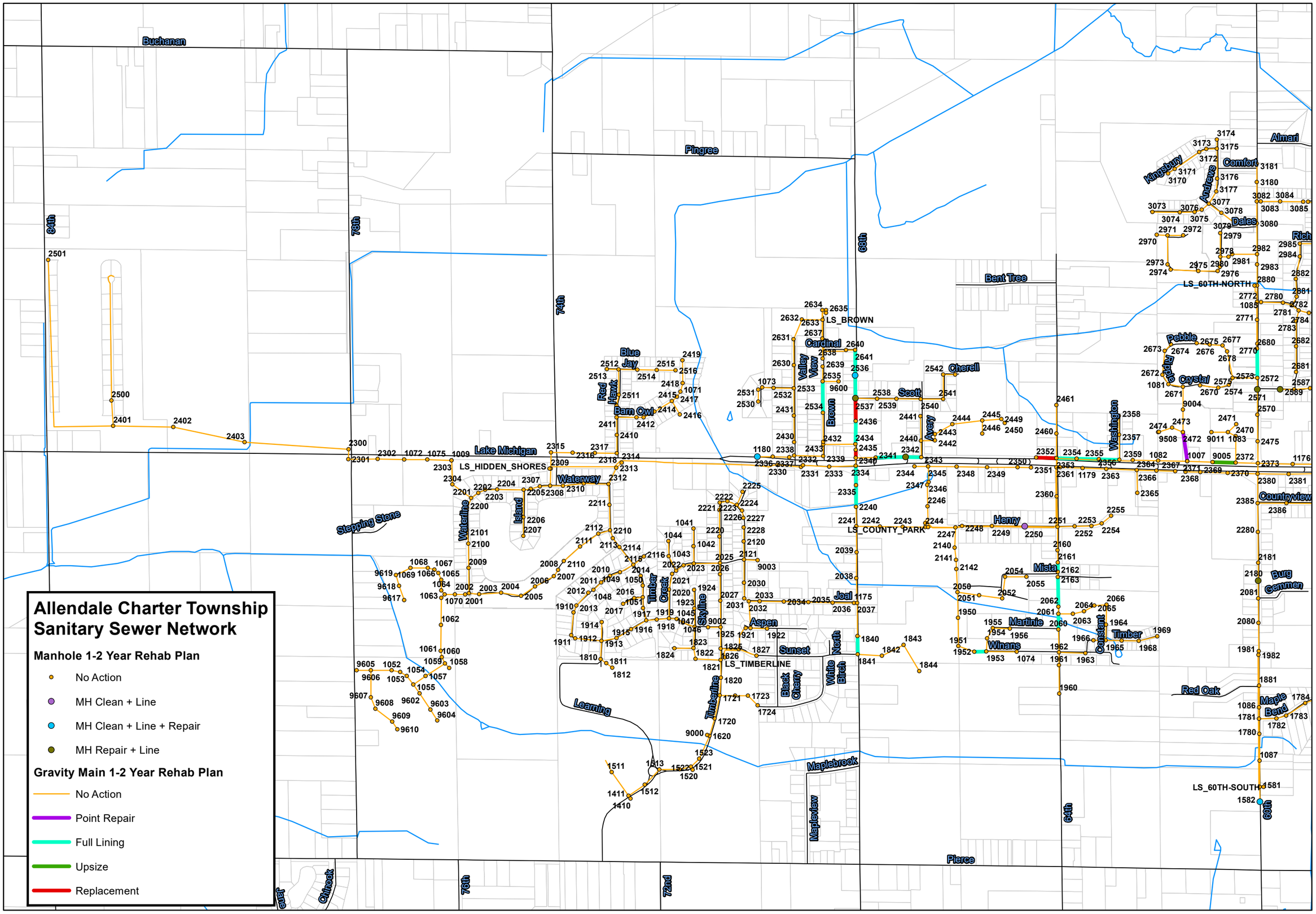
Table J-1: Capital Improvement Plan Summary Table 1-2 Year
Figure J-1A: Capital Improvement Plan Map 1-2 Year
Figure J-1B: Capital Improvement Plan Map 1-2 Year
Table J-2: Capital Improvement Plan Summary Table 3-5 Year
Figure J-2: Capital Improvement Plan Map 3-5 Year
Table J-3: 1-5 Year Capital Improvement Plan Cost Structure by Year
Table J-4: Capital Improvement Plan Summary Table 6-20 Year
Figure J-3: Capital Improvement Plan Map 6-20 Year

**Table J-1. Capital Improvement Plan Summary Table: 1-2 Year Rehabilitation**

| Asset | ID | Address | Total Cost | Normalized Risk | Size (in) | Year Constructed | Length (ft) | Risk (By Grading) | Rehab Actions | Year |
|---|---|---|---|---|---|---|---|---|---|---|
| Manhole | 1153 | 4400 Knollwood Dr | $5,377.42 | 100 | 0 | 1987 | 0 | 5-Extreme | MH Clean + Line + Repair | 2 |
| Gravity Main | P2342 | 6679-6791 Lake Michigan Dr | $16,873.47 | 100 | 8 | 1990 | 394 | 5-Extreme | Full Lining | 2 |
| Manhole | 2582 | 5804 Ivory Rd | $5,377.42 | 97 | 0 | 1992 | 0 | 5-Extreme | MH Clean + Line + Repair | 2 |
| Gravity Main | P2472 | 6132 Library Ln | $19,466.31 | 95 | 10 | 1999 | 389 | 5-Extreme | Point Repair | 1 |
| Gravity Main | P2680 | 11435-11397 60th Ave | $20,746.36 | 94 | 10 | 1990 | 387 | 5-Extreme | Full Lining | 2 |
| Gravity Main | P2536 | 11397-11303 68th Ave | $12,927.23 | 94 | 8 | 1992 | 302 | 5-Extreme | Full Lining | 2 |
| Manhole | 4845 | 11359 48th Ave | $5,377.42 | 93 | 0 | 1987 | 0 | 5-Extreme | MH Clean + Line + Repair | 2 |
| Manhole | 2180 | 10969 60th Ave | $4,574.02 | 88 | 0 | 1992 | 0 | 5-Extreme | MH Repair+Lining | 2 |
| Gravity Main | P9007 | 1 Campus Dr | $12,889.44 | 87 | 12 | 1963 | 201 | 5-Extreme | Full Lining | 2 |
| Manhole | 1180 | 7003 Lake Michigan Dr | $5,377.42 | 86 | 0 | 2007 | 0 | 5-Extreme | MH Clean + Line + Repair | 2 |
| Gravity Main | P2335 | 11177-11115 68th Ave | $18,402.44 | 81 | 12 | 1990 | 286 | 5-Extreme | Full Lining | 2 |
| Gravity Main | P4635 | Lake Michigan Dr | $6,572.28 | 80 | 12 | 2000 | 102 | 5-Extreme | Full Lining | 2 |
| Manhole | 2342 | 6679 Lake Michigan Dr | $4,574.02 | 80 | 0 | 1990 | 0 | 5-Extreme | MH Repair+Lining | 2 |
| Gravity Main | P2343 | 6667-6679 Lake Michigan Dr | $8,796.65 | 79 | 8 | 1990 | 205 | 5-Extreme | Full Lining | 2 |
| Gravity Main | P4605 | 5382-5426 Lake Michigan Dr | $14,103.93 | 79 | 8 | 2001 | 329 | 5-Extreme | Full Lining | 2 |
| Gravity Main | P2060 | 6406-6431 Martinie Dr | $8,913.92 | 77 | 8 | 1990 | 208 | 5-Extreme | Full Lining | 2 |
| Gravity Main | P2435 | 11217-11233 68th Ave | $35,778.28 | 77 | 18 | 1990 | 108 | 5-Extreme | Replacement | 2 |
| Gravity Main | P2334 | 11189 68th Ave | $16,185.35 | 76 | 12 | 1999 | 252 | 5-Extreme | Full Lining | 2 |
| Manhole | 4862 | 4422 Lake Michigan Dr | $4,574.02 | 76 | 0 | 1963 | 0 | 5-Extreme | MH Repair+Lining | 2 |
| Manhole | 1582 | 10537 60th Ave | $5,377.42 | 75 | 0 | 1992 | 0 | 5-Extreme | MH Clean + Line + Repair | 2 |
| Manhole | 4622 | 5187 Lake Michigan Dr | $4,574.02 | 75 | 0 | 1990 | 0 | 5-Extreme | MH Repair+Lining | 2 |
| Gravity Main | P2641 | 11404 68th Ave | $14,274.35 | 74 | 8 | 1992 | 333 | 5-Extreme | Full Lining | 2 |
| Gravity Main | P2352 | 6401 Lake Michigan Dr | $77,584.27 | 74 | 8 | 1987 | 268 | 5-Extreme | Replacement | 2 |
| Gravity Main | P2356 | 6299 Lake Michigan Dr | $11,632.60 | 74 | 8 | 1987 | 271 | 5-Extreme | Full Lining | 2 |
| Gravity Main | P2354 | 6387 Lake Michigan Dr | $11,345.52 | 74 | 8 | 1987 | 265 | 5-Extreme | Full Lining | 2 |
| Gravity Main | P2355 | 6341-6387 Lake Michigan Dr | $12,539.17 | 74 | 8 | 1987 | 293 | 5-Extreme | Full Lining | 2 |
| Gravity Main | P4603 | 5504-5500 Lake Michigan Dr | $12,899.21 | 74 | 8 | 2001 | 301 | 5-Extreme | Full Lining | 2 |
| Gravity Main | P4604 | 5426-5504 Lake Michigan Dr | $13,033.77 | 74 | 8 | 2001 | 304 | 5-Extreme | Full Lining | 2 |
| Gravity Main | P2537 | 11303-11263 68th Ave | $86,537.52 | 73 | 8 | 1992 | 299 | 5-Extreme | Replacement | 2 |
| Gravity Main | P2436 | 11263-11227 68th Ave | $13,064.79 | 73 | 8 | 1992 | 305 | 5-Extreme | Full Lining | 2 |
| Gravity Main | P1841 | 10823 68th Ave | $10,311.13 | 72 | 8 | 1990 | 241 | 5-Extreme | Full Lining | 2 |
| Gravity Main | P4600 | 11229 56th Ave | $16,016.27 | 72 | 10 | 1990 | 299 | 5-Extreme | Full Lining | 2 |
| Gravity Main | P2162 | 11007 64th Ave | $6,644.16 | 72 | 10 | 1990 | 124 | 5-Extreme | Full Lining | 2 |
| Gravity Main | P2535 | 11351-11301 Brown St | $17,590.44 | 72 | 8 | 1992 | 411 | 5-Extreme | Full Lining | 2 |
| Manhole | 4537 | 11055 Stanford Ave | $5,377.42 | 71 | 0 | 1966 | 0 | 5-Extreme | MH Clean + Line + Repair | 2 |
| Gravity Main | P2062 | 10939-10991 64th Ave | $16,787.50 | 71 | 8 | 1990 | 392 | 5-Extreme | Full Lining | 2 |
| Manhole | 1110 | 11041 Radcliff Dr | $4,574.02 | 71 | 0 | 1966 | 0 | 5-Extreme | MH Repair+Lining | 2 |
| Manhole | 2571 | 11361 60th Ave | $4,574.02 | 71 | 0 | 1990 | 0 | 5-Extreme | MH Repair+Lining | 2 |
| Manhole | 2536 | 11397 68th Ave | $5,377.42 | 69 | 0 | 1992 | 0 | 5-Extreme | MH Clean + Line + Repair | 2 |
| Gravity Main | P4460 | 4645 W Campus Dr | $20,674.49 | 69 | 12 | 1963 | 322 | 5-Extreme | Full Lining | 2 |
| Gravity Main | P4462 | 4307-4443 Stadium Dr | $20,743.93 | 68 | 12 | 1963 | 323 | 5-Extreme | Full Lining | 2 |
| Gravity Main | P1953 | 6562-6588 Winans St | $6,663.62 | 68 | 8 | 1992 | 156 | 5-Extreme | Full Lining | 2 |
| Manhole | 2537 | 11303 68th Ave | $4,574.02 | 68 | 0 | 1992 | 0 | 5-Extreme | MH Repair+Lining | 2 |
| Manhole | 2250 | 6504 Henry St | $4,038.42 | 65 | 0 | 1990 | 0 | 5-Extreme | MH Clean + Line | 2 |

**Table J-1. Capital Improvement Plan Summary Table: 1-2 Year Rehabilitation**

| Asset | ID | Address | Total Cost | Normalized Risk | Size (in) | Year Constructed | Length (ft) | Risk (By Grading) | Rehab Actions | Year |
|---|---|---|---|---|---|---|---|---|---|---|
| Manhole | 2589 | 5957 Dewpointe Dr | $4,574.02 | 63 | 0 | 1993 | 0 | 5-Extreme | MH Repair+Lining | 2 |




## Allendale Charter Township Sanitary Sewer Network

**Manhole 1-2 Year Rehab Plan**

- No Action
- MH Clean + Line
- MH Clean + Line + Repair
- MH Repair + Line

**Gravity Main 1-2 Year Rehab Plan**

- No Action
- Point Repair
- Full Lining
- Upsize
- Replacement

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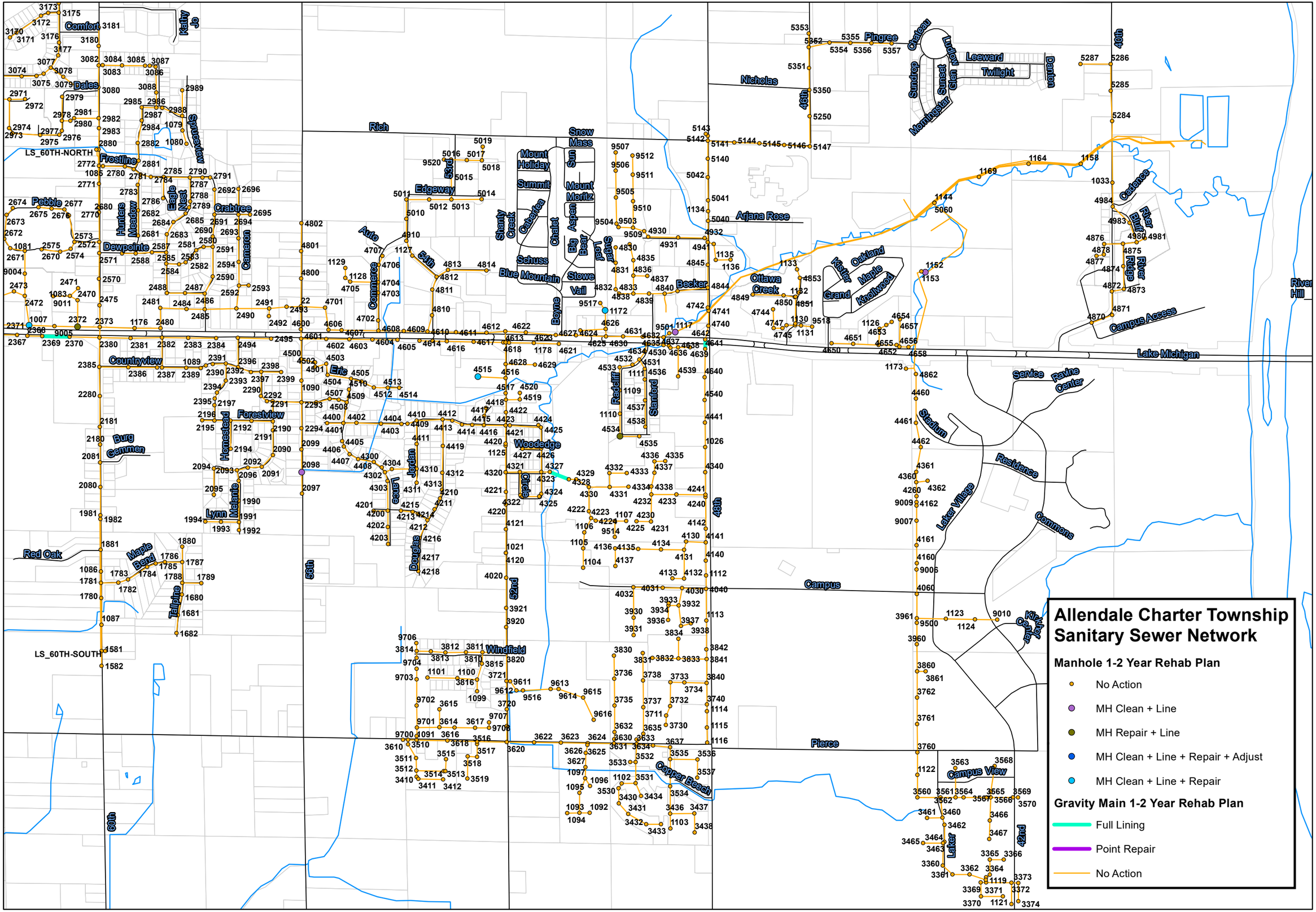
# Capital Improvement Plan 1-2 Year Plan (WEST)

Allendale Charter Township, Michigan

| DRAWN BY | DATE |
|---|---|
| KCS | 1/9/2019 |
| PROJECT NO. | SCALE |
| 814975 | 1:13,500 |
| FILE LOCATION | |
| SOURCES | |

NORTH
0 560 1,120
SCALE IN FEET

FIGURE
J-1A




# Allendale Charter Township Sanitary Sewer Network

## Manhole 1-2 Year Rehab Plan

- No Action
- MH Clean + Line
- MH Repair + Line
- MH Clean + Line + Repair + Adjust
- MH Clean + Line + Repair

## Gravity Main 1-2 Year Rehab Plan

- Full Lining
- Point Repair
- No Action

FLEIS&VANDENBRINK
DESIGN. BUILD. OPERATE.

Capital Improvement Plan
1-2 Year Plan (EAST)

Allendale Charter Township, Michigan

| DRAWN BY | DATE |
|---|---|
| KCS | 1/9/2019 |
| PROJECT NO. | SCALE |
| 814975 | 1:13,500 |
| FILE LOCATION | |
| SOURCES | |

NORTH
0 560 1,120
SCALE IN FEET

FIGURE
J-1B

**Table J-2. Capital Improvement Plan Summary Table: 3-5 Year Rehabilitation**

| Asset | ID | Address | Total Cost | Normalized Risk | Size (in) | Year Constructed | Length (ft) | Risk (By Grading) | Rehab Actions | Year |
|---|---|---|---|---|---|---|---|---|---|---|
| Manhole | 2632 | 11497 Brown St | $5,377.42 | 68 | 0 | 1992 | 0 | 4-High | MH Clean + Line + Repair | 4 |
| Manhole | 2371 | 6161 Lake Michigan Dr | $5,377.42 | 67 | 0 | 1990 | 0 | 4-High | MH Clean + Line + Repair | 4 |
| Manhole | 1082 | 6195 Lake Michigan Dr | $4,574.02 | 67 | 0 | 1990 | 0 | 4-High | MH Repair+Lining | 4 |
| Manhole | 1117 | 4861 Lake Michigan Dr | $4,038.42 | 65 | 0 | 1990 | 0 | 4-High | MH Clean + Line | 4 |
| Manhole | 2242 | 11048 68th Ave | $8,055.42 | 64 | 0 | 1990 | 0 | 4-High | MH Clean + Line + Repair +Adjust | 4 |
| Manhole | 2372 | 6039 Lake Michigan Dr | $4,574.02 | 63 | 0 | 1990 | 0 | 4-High | MH Repair+Lining | 4 |
| Manhole | 4515 | 11127 52nd Ave | $5,377.42 | 63 | 0 | 1997 | 0 | 4-High | MH Clean + Line + Repair | 4 |
| Manhole | 2359 | 6261 Lake Michigan Dr | $4,574.02 | 61 | 0 | 1990 | 0 | 4-High | MH Repair+Lining | 4 |
| Manhole | 1152 | 4400 Knollwood Dr | $4,038.42 | 60 | 0 | 1987 | 0 | 4-High | MH Clean + Line | 4 |
| Manhole | 1074 | 6495 Winans St | $5,377.42 | 60 | 0 | 1992 | 0 | 4-High | MH Clean + Line + Repair | 4 |
| Manhole | 1172 | Becker Dr | $5,377.42 | 60 | 0 | 2000 | 0 | 4-High | MH Clean + Line + Repair | 4 |
| Gravity Main | P1910 | 7517-7593 Water View Ln | $12,912.97 | 58 | 8 | 2004 | 301 | 4-High | Full Lining | 4 |
| Gravity Main | P2011 | 7376-7338 Water View Ln | $6,286.12 | 58 | 8 | 2004 | 147 | 4-High | Full Lining | 4 |
| Gravity Main | P1912 | 7389-7303 Pinevalley Dr | $14,766.18 | 58 | 8 | 2004 | 345 | 4-High | Full Lining | 4 |
| Gravity Main | P2015 | 7244 Bittersweet Ct | $6,071.77 | 58 | 8 | 2004 | 142 | 4-High | Full Lining | 4 |
| Manhole | 4534 | 11011 Radcliff Dr | $4,574.02 | 57 | 0 | 1966 | 0 | 4-High | MH Repair+Lining | 4 |
| Gravity Main | P2369 | 6098-6052 Lake Michigan Dr | $15,415.76 | 50 | 8 | 2000 | 360 | 4-High | Full Lining | 4 |
| Gravity Main | P4641 | 4806 Lake Michigan Dr | $7,915.87 | 50 | 12 | 1987 | 123 | 4-High | Full Lining | 4 |
| Manhole | 2098 | 10929 56th Ave | $4,038.42 | 49 | 0 | 1990 | 0 | 4-High | MH Clean + Line | 4 |
| Gravity Main | P2348 | 6600-6660 Lake Michigan Dr | $9,371.50 | 47 | 8 | 1993 | 374 | 4-High | Point Repair | 3 |
| Gravity Main | P4328 | 10924 Woodedge Dr | $11,447.05 | 44 | 8 | 2007 | 267 | 4-High | Full Lining | 4 |

**Allendale Charter Township**
**Sanitary Sewer Network**

**Manhole 3-5 Year Rehab Plan**

- No Action
- MH Clean + Line
- MH Repair + Line
- MH Clean + Line + Repair +Adjust
- MH Clean + Line + Repair

**Gravity Main 3-5 Year Rehab**

- No Action
- Full Lining
- Point Repair

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# Capital Improvement Plan 3-5 Year Plan

Allendale Charter Township, Michigan

| DRAWN BY | DATE |
|---|---|
| KCS | 1/9/2019 |
| PROJECT NO. | SCALE |
| 814975 | 1:25,000 |
| FILE LOCATION | |
| SOURCES | |

NORTH

0 1,000 2,000

SCALE IN FEET

FIGURE

J-2

**Table J-3. 5-Year Capital Improvement Plan: Rehabilitation**

| Year | Asset | ID | Address | Rehab Actions | Cost | Year1 | Year2 | Year3 | Year4 | Year5 |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | Gravity Main | P2472 | 6132 Library Ln | Point Repair | $ 19,466 | $ 19,466 | $ - | $ - | $ - | $ - |
| 2 | Gravity Main | P2680 | 60th Ave | Full Lining | $ 20,746 | $ - | $ 21,369 | $ - | $ - | $ - |
| 2 | Gravity Main | P2536 | 68th Ave | Full Lining | $ 12,927 | $ - | $ 13,315 | $ - | $ - | $ - |
| 2 | Gravity Main | P2335 | 68th Ave | Full Lining | $ 18,402 | $ - | $ 18,955 | $ - | $ - | $ - |
| 2 | Gravity Main | P2343 | Michigan Dr | Full Lining | $ 8,797 | $ - | $ 9,061 | $ - | $ - | $ - |
| 2 | Gravity Main | P4605 | Michigan Dr | Full Lining | $ 14,104 | $ - | $ 14,527 | $ - | $ - | $ - |
| 2 | Gravity Main | P2060 | Martinie Dr | Full Lining | $ 8,914 | $ - | $ 9,181 | $ - | $ - | $ - |
| 2 | Gravity Main | P2354 | Michigan Dr | Full Lining | $ 11,346 | $ - | $ 11,686 | $ - | $ - | $ - |
| 2 | Gravity Main | P2355 | Michigan Dr | Full Lining | $ 12,539 | $ - | $ 12,915 | $ - | $ - | $ - |
| 2 | Gravity Main | P4603 | Michigan Dr | Full Lining | $ 12,899 | $ - | $ 13,286 | $ - | $ - | $ - |
| 2 | Gravity Main | P4604 | Michigan Dr | Full Lining | $ 13,034 | $ - | $ 13,425 | $ - | $ - | $ - |
| 2 | Gravity Main | P1841 | 10823 68th Ave | Full Lining | $ 10,311 | $ - | $ 10,620 | $ - | $ - | $ - |
| 2 | Gravity Main | P4600 | 11229 56th Ave | Full Lining | $ 16,016 | $ - | $ 16,497 | $ - | $ - | $ - |
| 2 | Gravity Main | P2162 | 11007 64th Ave | Full Lining | $ 6,644 | $ - | $ 6,843 | $ - | $ - | $ - |
| 2 | Gravity Main | P2535 | Brown St | Full Lining | $ 17,590 | $ - | $ 18,118 | $ - | $ - | $ - |
| 2 | Gravity Main | P2062 | 64th Ave | Full Lining | $ 16,787 | $ - | $ 17,291 | $ - | $ - | $ - |
| 2 | Gravity Main | P1953 | Winans St | Full Lining | $ 6,664 | $ - | $ 6,864 | $ - | $ - | $ - |
| 2 | Gravity Main | P2342 | Michigan Dr | Full Lining | $ 16,873 | $ - | $ 17,380 | $ - | $ - | $ - |
| 2 | Gravity Main | P4635 | Lake Michigan Dr | Full Lining | $ 6,572 | $ - | $ 6,769 | $ - | $ - | $ - |
| 2 | Gravity Main | P2334 | 11189 68th Ave | Full Lining | $ 16,185 | $ - | $ 16,671 | $ - | $ - | $ - |
| 2 | Gravity Main | P2641 | 11404 68th Ave | Full Lining | $ 14,274 | $ - | $ 14,703 | $ - | $ - | $ - |
| 2 | Gravity Main | P2356 | Michigan Dr | Full Lining | $ 11,633 | $ - | $ 11,982 | $ - | $ - | $ - |
| 2 | Gravity Main | P2436 | 68th Ave | Full Lining | $ 13,065 | $ - | $ 13,457 | $ - | $ - | $ - |
| 2 | Gravity Main | P4462 | Stadium Dr | Full Lining | $ 20,744 | $ - | $ 21,366 | $ - | $ - | $ - |
| 2 | Gravity Main | P2435 | 68th Ave | Replacement | $ 35,778 | $ - | $ 36,852 | $ - | $ - | $ - |
| 2 | Manhole | 4862 | Michigan Dr | MH Repair+Lining | $ 4,574 | $ - | $ 4,711 | $ - | $ - | $ - |
| 2 | Gravity Main | P2352 | Michigan Dr | Replacement | $ 77,584 | $ - | $ 79,912 | $ - | $ - | $ - |
| 2 | Gravity Main | P4460 | Dr | Full Lining | $ 20,674 | $ - | $ 21,295 | $ - | $ - | $ - |
| 2 | Manhole | 2180 | 10969 60th Ave | MH Repair+Lining | $ 4,574 | $ - | $ 4,711 | $ - | $ - | $ - |
| 2 | Manhole | 1153 | Dr | MH Clean + Line + Repair | $ 5,377 | $ - | $ 5,539 | $ - | $ - | $ - |
| 2 | Manhole | 2582 | 5804 Ivory Rd | MH Clean + Line + Repair | $ 5,377 | $ - | $ 5,539 | $ - | $ - | $ - |
| 2 | Manhole | 4845 | 11359 48th Ave | MH Clean + Line + Repair | $ 5,377 | $ - | $ 5,539 | $ - | $ - | $ - |
| 2 | Gravity Main | P9007 | 1 Campus Dr | Full Lining | $ 12,889 | $ - | $ 13,276 | $ - | $ - | $ - |
| 2 | Manhole | 1180 | Michigan Dr | MH Clean + Line + Repair | $ 5,377 | $ - | $ 5,539 | $ - | $ - | $ - |
| 2 | Manhole | 2342 | Michigan Dr | MH Repair+Lining | $ 4,574 | $ - | $ 4,711 | $ - | $ - | $ - |
| 2 | Manhole | 1582 | 10537 60th Ave | MH Clean + Line + Repair | $ 5,377 | $ - | $ 5,539 | $ - | $ - | $ - |
| 2 | Manhole | 4622 | Michigan Dr | MH Repair+Lining | $ 4,574 | $ - | $ 4,711 | $ - | $ - | $ - |
| 2 | Gravity Main | P2537 | 68th Ave | Replacement | $ 86,538 | $ - | $ 89,134 | $ - | $ - | $ - |
| 2 | Manhole | 4537 | Ave | MH Clean + Line + Repair | $ 5,377 | $ - | $ 5,539 | $ - | $ - | $ - |
| 2 | Manhole | 1110 | 11041 Radcliff Dr | MH Repair+Lining | $ 4,574 | $ - | $ 4,711 | $ - | $ - | $ - |
| 2 | Manhole | 2571 | 11361 60th Ave | MH Repair+Lining | $ 4,574 | $ - | $ 4,711 | $ - | $ - | $ - |
| 2 | Manhole | 2536 | 11397 68th Ave | MH Clean + Line + Repair | $ 5,377 | $ - | $ 5,539 | $ - | $ - | $ - |
| 2 | Manhole | 2537 | 11303 68th Ave | MH Repair+Lining | $ 4,574 | $ - | $ 4,711 | $ - | $ - | $ - |
| 2 | Manhole | 2250 | 6504 Henry St | MH Clean + Line | $ 4,038 | $ - | $ 4,160 | $ - | $ - | $ - |

**Table J-3. 5-Year Capital Improvement Plan: Rehabilitation**

| Year | Asset | ID | Address | Rehab Actions | Cost | Year1 | Year2 | Year3 | Year4 | Year5 |
|---|---|---|---|---|---|---|---|---|---|---|
| 2 | Manhole | 2589 | Dr | MH Repair+Lining | $ 4,574 | $ - | $ 4,711 | $ - | $ - | $ - |
| 4 | Gravity Main | P1912 | Pinevalley Dr | Full Lining | $ 14,766 | $ - | $ - | $ - | $ 16,135 | $ - |
| 4 | Gravity Main | P2015 | Ct | Full Lining | $ 6,072 | $ - | $ - | $ - | $ 6,635 | $ - |
| 4 | Gravity Main | P4641 | Michigan Dr | Full Lining | $ 7,916 | $ - | $ - | $ - | $ 8,650 | $ - |
| 3 | Gravity Main | P2348 | Michigan Dr | Point Repair | $ 9,372 | $ - | $ - | $ 9,942 | $ - | $ - |
| 4 | Gravity Main | P4328 | Dr | Full Lining | $ 11,447 | $ - | $ - | $ - | $ 12,509 | $ - |
| 4 | Gravity Main | P1910 | View Ln | Full Lining | $ 12,913 | $ - | $ - | $ - | $ 14,110 | $ - |
| 4 | Gravity Main | P2011 | View Ln | Full Lining | $ 6,286 | $ - | $ - | $ - | $ 6,869 | $ - |
| 4 | Gravity Main | P2369 | Michigan Dr | Full Lining | $ 15,416 | $ - | $ - | $ - | $ 16,845 | $ - |
| 4 | Manhole | 2632 | 11497 Brown St | MH Clean + Line + Repair | $ 5,377 | $ - | $ - | $ - | $ 5,876 | $ - |
| 4 | Manhole | 2371 | Michigan Dr | MH Clean + Line + Repair | $ 5,377 | $ - | $ - | $ - | $ 5,876 | $ - |
| 4 | Manhole | 1082 | Michigan Dr | MH Repair+Lining | $ 4,574 | $ - | $ - | $ - | $ 4,998 | $ - |
| 4 | Manhole | 1117 | Michigan Dr | MH Clean + Line | $ 4,038 | $ - | $ - | $ - | $ 4,413 | $ - |
| 4 | Manhole | 2242 | 11048 68th Ave | MH Clean + Line + Repair +Adjust | $ 8,055 | $ - | $ - | $ - | $ 8,802 | $ - |
| 4 | Manhole | 2372 | Michigan Dr | MH Repair+Lining | $ 4,574 | $ - | $ - | $ - | $ 4,998 | $ - |
| 4 | Manhole | 4515 | 11127 52nd Ave | MH Clean + Line + Repair | $ 5,377 | $ - | $ - | $ - | $ 5,876 | $ - |
| 4 | Manhole | 2359 | Michigan Dr | MH Repair+Lining | $ 4,574 | $ - | $ - | $ - | $ 4,998 | $ - |
| 4 | Manhole | 1152 | Dr | MH Clean + Line | $ 4,038 | $ - | $ - | $ - | $ 4,413 | $ - |
| 4 | Manhole | 1074 | 6495 Winans St | MH Clean + Line + Repair | $ 5,377 | $ - | $ - | $ - | $ 5,876 | $ - |
| 4 | Manhole | 1172 | Becker Dr | MH Clean + Line + Repair | $ 5,377 | $ - | $ - | $ - | $ 5,876 | $ - |
| 4 | Manhole | 4534 | 11011 Radcliff Dr | MH Repair+Lining | $ 4,574 | $ - | $ - | $ - | $ 4,998 | $ - |
| 4 | Manhole | 2098 | 10929 56th Ave | MH Clean + Line | $ 4,038 | $ - | $ - | $ - | $ 4,413 | $ - |
| | | | | | **TOTAL:** | $ 19,466 | $ 637,369 | $ 9,942 | $ 153,167 | $ - |

**Table J-4. Capital Improvement Plan Summary Table: 6-20 Year Rehabilitation**

**6-10 Year Rehabilitation**

| Asset | ID | Address | Total Cost | Normalized Risk | Size (in) | Year Constructed | Length (ft) | Risk (By Grading) | Rehab Actions |
|---|---|---|---|---|---|---|---|---|---|
| Manhole | 2788 | 11463 Prairie Ave | $ 4,038 | 65 | 0 | 1990 | 0 | 3-Medium | MH Clean + Line |
| Manhole | 2248 | 6698 Henry St | $ 4,574 | 63 | 0 | 1990 | 0 | 3-Medium | MH Repair+Lining |
| Manhole | 2630 | 11391 Valley View Ave | $ 4,038 | 62 | 0 | 1992 | 0 | 3-Medium | MH Clean + Line |
| Manhole | 4421 | 5202 Jordan St | $ 4,574 | 60 | 0 | 2005 | 0 | 3-Medium | MH Repair+Lining |
| Manhole | 2361 | 11195 64th Ave | $ 4,038 | 60 | 0 | 1990 | 0 | 3-Medium | MH Clean + Line |
| Manhole | 2081 | 10933 60th Ave | $ 4,574 | 60 | 0 | 1992 | 0 | 3-Medium | MH Repair+Lining |
| Manhole | 2357 | 11245 Washington Ave | $ 4,574 | 60 | 0 | 2004 | 0 | 3-Medium | MH Repair+Lining |
| Manhole | 2354 | 6387 Lake Michigan Dr | $ 4,038 | 60 | 0 | 1987 | 0 | 3-Medium | MH Clean + Line |
| Manhole | 2396 | 5743 Country View Dr | $ 4,038 | 60 | 0 | 1992 | 0 | 3-Medium | MH Clean + Line |
| Manhole | 2461 | 11315 64th Ave | $ 4,574 | 60 | 0 | 1987 | 0 | 3-Medium | MH Repair+Lining |
| Manhole | 2330 | 6946 Lake Michigan Dr | $ 4,574 | 57 | 0 | 2013 | 0 | 3-Medium | MH Repair+Lining |
| Manhole | 2394 | 11091 Pleasant Point Dr | $ 4,574 | 56 | 0 | 1992 | 0 | 3-Medium | MH Repair+Lining |
| Manhole | 2343 | 6667 Lake Michigan Dr | $ 4,038 | 56 | 0 | 1990 | 0 | 3-Medium | MH Clean + Line |
| Manhole | 2680 | 11435 60th Ave | $ 4,574 | 54 | 0 | 1990 | 0 | 3-Medium | MH Repair+Lining |
| Manhole | 2433 | 11235 Brown St | $ 4,038 | 54 | 0 | 1990 | 0 | 3-Medium | MH Clean + Line |
| Manhole | 2641 | 6802 Cardinal St | $ 4,574 | 52 | 0 | 1992 | 0 | 3-Medium | MH Repair+Lining |
| Manhole | 2161 | 11003 64th Ave | $ 4,574 | 51 | 0 | 1990 | 0 | 3-Medium | MH Repair+Lining |
| Manhole | 2486 | 5802 Larkspur Ave | $ 4,038 | 51 | 0 | 1992 | 0 | 3-Medium | MH Clean + Line |
| Manhole | 2355 | 6341 Lake Michigan Dr | $ 4,038 | 49 | 0 | 1987 | 0 | 3-Medium | MH Clean + Line |
| Gravity Main | P3633 | 5013-5045 Pierce St | $ 12,644 | 43 | 8 | 2008 | 295 | 3-Medium | Full Lining |
| Gravity Main | P2637 | 11431-11495 Brown St | $ 10,588 | 45 | 8 | 1992 | 247 | 3-Medium | Full Lining |
| Gravity Main | P4141 | 10857 48th Ave | $ 9,571 | 45 | 10 | 1987 | 179 | 3-Medium | Full Lining |
| | TOTAL: | | $ 114,889 | | | | | | |

**11-15 Year Rehabilitation**

| Asset | ID | Address | Total Cost | Normalized Risk | Size (in) | Year Constructed | Length (ft) | Risk (By Grading) | Rehab Actions |
|---|---|---|---|---|---|---|---|---|---|
| Manhole | 2432 | 11235 Brown St | $ 5,377 | 49 | 0 | 1990 | 0 | 3-Medium | MH Clean + Line + Repair |
| Manhole | 2583 | 5827 Ivory Rd | $ 4,574 | 49 | 0 | 1992 | 0 | 3-Medium | MH Repair+Lining |
| Manhole | 1921 | 7072 Aspen St | $ 4,574 | 49 | 0 | 2001 | 0 | 3-Medium | MH Repair+Lining |
| Manhole | 2441 | 11305 Avery Ave | $ 4,574 | 49 | 0 | 1990 | 0 | 3-Medium | MH Repair+Lining |
| Manhole | 2538 | 6761 Scott St | $ 4,038 | 48 | 0 | 1992 | 0 | 3-Medium | MH Clean + Line |
| Gravity Main | P4040 | 10745 48th Ave | $ 9,476 | 47 | 10 | 1990 | 177 | 3-Medium | Full Lining |
| Gravity Main | P1925 | 10853 Timberline Dr | $ 12,002 | 45 | 8 | 1996 | 280 | 3-Medium | Full Lining |
| Gravity Main | P3833 | 4801 Country Pl S | $ 14,775 | 43 | 10 | 1997 | 370 | 3-Medium | Point Repair |
| Manhole | 4536 | 11085 Stanford Ave | $ 4,574 | 43 | 0 | 1966 | 0 | 3-Medium | MH Repair+Lining |
| Gravity Main | P4060 | 4547 W Campus Dr | $ 9,526 | 42 | 12 | 1963 | 321 | 3-Medium | Point Repair |
| Gravity Main | P3961 | 4546 W Campus Dr | $ 9,526 | 42 | 12 | 1963 | 320 | 3-Medium | Point Repair |
| Gravity Main | P3637 | 4962-4986 Pierce St | $ 9,683 | 42 | 8 | 2008 | 226 | 3-Medium | Full Lining |
| Gravity Main | P4361 | 1 Campus Dr | $ 21,262 | 42 | 12 | 1963 | 331 | 3-Medium | Full Lining |
| | TOTAL: | | $ 113,961 | | | | | | |

**16-20 Year Rehabilitation**

| Asset | ID | Address | Total Cost | Normalized Risk | Size (in) | Year Constructed | Length (ft) | Risk (By Grading) | Rehab Actions |
|---|---|---|---|---|---|---|---|---|---|
| Manhole | 4535 | 11003 Radcliff Dr | $ 5,377 | 51 | 0 | 1966 | 0 | 3-Medium | MH Clean + Line + Repair |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Manhole | 2640 | 6830 Cardinal St | $ 4,574 | 49 | 0 | 1992 | 0 | 3-Medium | MH Repair+Lining |
| Gravity Main | P2247 | 6698 Henry St | $ 9,526 | 43 | 12 | 1990 | 359 | 3-Medium | Point Repair |
| Gravity Main | P1982 | 10809 60th Ave | $ 17,351 | 46 | 8 | 1992 | 405 | 3-Medium | Full Lining |
| Gravity Main | P3630 | 5045-5083 Pierce St | $ 14,837 | 43 | 8 | 2008 | 346 | 3-Medium | Full Lining |
| Gravity Main | P2635 | 11495 Brown St | $ 10,152 | 42 | 8 | 1992 | 35 | 3-Medium | Replacement |
| Manhole | 1920 | 7024 Aspen St | $ 4,574 | 42 | 0 | 2001 | 0 | 3-Medium | MH Repair+Lining |
| Manhole | 2591 | 5701 Ivory Rd | $ 4,574 | 42 | 0 | 1992 | 0 | 3-Medium | MH Repair+Lining |
| Manhole | 2494 | 11195 Northgate Ave | $ 4,038 | 42 | 0 | 1992 | 0 | 3-Medium | MH Clean + Line |
| Manhole | 2440 | 11243 Avery Ave | $ 4,574 | 40 | 0 | 1990 | 0 | 3-Medium | MH Repair+Lining |
| Manhole | 4532 | 11137 Radcliff Dr | $ 4,574 | 39 | 0 | 1966 | 0 | 3-Medium | MH Repair+Lining |
| Manhole | 1981 | 10843 60th Ave | $ 4,574 | 38 | 0 | 1992 | 0 | 3-Medium | MH Repair+Lining |
| Manhole | 2032 | 7008 Joal St | $ 4,574 | 38 | 0 | 1995 | 0 | 3-Medium | MH Repair+Lining |
| Manhole | 3569 | 10281 42nd Ave | $ 4,574 | 37 | 0 | 2004 | 0 | 3-Medium | MH Repair+Lining |
| Gravity Main | P9010 | 10744-10769 S Campus Dr | $ 9,526 | 36 | 12 | 1990 | 292 | 3-Medium | Point Repair |
| Manhole | 2290 | 11057 Gayle Ln | $ 6,716 | 33 | 0 | 1990 | 0 | 3-Medium | MH Clean + Line + Adjust Rim |
| | TOTAL: | | $ 114,116 | | | | | | |
| | | | | | | | | | |
| | | Known 6-20 Year Rehab Cost | $ 342,966 | | | | | | |
| | | Anticipated Additional Pipe Rehabilitation | $ 2,762,901 | | | | | | |
| | | Anticipated Manhole Rehabilitation | $ 406,614 | | | | | | |
| | | **Total Estimated 6-20 year Rehabilitation Cost** | **$ 3,512,481** | | | | | | |

**Allendale Charter Township**
**Sanitary Sewer Network**

**Manhole 6-20 Year Rehab Plan**

- No Action
- MH Clean + Line
- MH Repair + Line
- MH Clean + Line + Repair
- MH Clean + Line + Adjust Rim

**Gravity Main 6-20 Year Rehab Plan**

- No Action
- Point Repair
- Full Lining
- Replacement
- Upsize

FLEIS&VANDENBRINK
DESIGN. BUILD. OPERATE.

# Capital Improvement Plan 6-20 Year Plan

Allendale Charter Township, Michigan

| DRAWN BY | DATE |
|---|---|
| KCS | 1/9/2019 |
| PROJECT NO. | SCALE |
| 814975 | 1:25,000 |

FILE LOCATION

SOURCES

NORTH

0 1,000 2,000

SCALE IN FEET

FIGURE

J-3

**APPENDIX K – O&M Recommendations for Addressing Assets over Time**

Table K-1: Operation and Maintenance Plan Summary Table 1-2 Year
Table K-2: Operation and Maintenance Plan Summary Table 3-5 Year
Figure K-1a: Operation and Maintenance Plan Map 1-5 Year - West
Figure K-1b: Operation and Maintenance Plan Map 1-5 Year - East
Table K-3: 1-5 Year Operation and Maintenance Cost Structure by Year

| Table K-1. Collection System Maintenance Summary Table: 1-2 Year | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| **Asset** | **ID** | **Address** | **Total Cost** | **Normalized Risk** | **Size (in)** | **Year Constructed** | **Length (ft)** | **Risk (By Grading)** | **Rehab Actions** | **Year** |
| Manhole | 4636 | 4866 Lake Michigan Dr | $535.60 | 68 | 0 | 2001 | 0 | 5-Extreme | MH Inspection | 1 |

**Table K-2. Collection System Maintenance Summary Table: 3-5 Year**

| Asset | ID | Address | Total Cost | Normalized Risk | Size (in) | Year Constructed | Length (ft) | Risk (By Grading) | Rehab Actions | Year |
|---|---|---|---|---|---|---|---|---|---|---|
| Manhole | 3621 | 10431 52nd Ave | $535.60 | 63 | 0 | 2006 | 0 | 3-Medium | MH Inspection | 4 |
| Manhole | 3619 | 5256 Pierce St | $803.40 | 60 | 0 | 2015 | 0 | 3-Medium | MH Clean | 5 |
| Manhole | 4221 | 10855 52nd Ave | $535.60 | 60 | 0 | 2005 | 0 | 3-Medium | MH Inspection | 4 |
| Manhole | 2331 | 6940 Lake Michigan Dr | $535.60 | 59 | 0 | 1998 | 0 | 3-Medium | MH Inspection | 4 |
| Manhole | 1681 | 10635 Tallpine Ln | $535.60 | 54 | 0 | 1998 | 0 | 3-Medium | MH Inspection | 4 |
| Manhole | 2880 | 11555 60th Ave | $535.60 | 52 | 0 | 2006 | 0 | 3-Medium | MH Inspection | 4 |
| Manhole | 2251 | 6402 Henry St | $803.40 | 51 | 0 | 2008 | 0 | 3-Medium | MH Clean | 5 |
| Manhole | 1965 | 6324 Timber Dr | $535.60 | 51 | 0 | 2004 | 0 | 3-Medium | MH Inspection | 4 |
| Manhole | 4403 | 5312 Jordan St | $535.60 | 46 | 0 | 2000 | 0 | 3-Medium | MH Inspection | 4 |
| Manhole | 2584 | 5852 Ivory Rd | $803.40 | 46 | 0 | 1992 | 0 | 3-Medium | MH Clean | 5 |
| Manhole | 2347 | 6656 Lake Michigan Dr | $535.60 | 44 | 0 | 1992 | 0 | 3-Medium | MH Inspection | 4 |
| Manhole | 4605 | 5382 Lake Michigan Dr | $535.60 | 42 | 0 | 2001 | 0 | 3-Medium | MH Inspection | 4 |
| Manhole | 3622 | 5160 Pierce St | $535.60 | 41 | 0 | 2006 | 0 | 3-Medium | MH Inspection | 4 |
| Manhole | 2881 | 11530 Brookland Ct | $535.60 | 41 | 0 | 1990 | 0 | 3-Medium | MH Inspection | 4 |
| Manhole | 3720 | 10463 52nd Ave | $535.60 | 40 | 0 | 2006 | 0 | 3-Medium | MH Inspection | 4 |
| Manhole | 4327 | 10924 Woodedge Dr | $535.60 | 40 | 0 | 2007 | 0 | 3-Medium | MH Inspection | 4 |
| Manhole | 2346 | 6652 Lake Michigan Dr | $535.60 | 37 | 0 | 1992 | 0 | 3-Medium | MH Inspection | 4 |
| Manhole | 4513 | 5424 Eric St | $535.60 | 37 | 0 | 2000 | 0 | 3-Medium | MH Inspection | 4 |
| Manhole | 1966 | 6356 Timber Dr | $535.60 | 37 | 0 | 2004 | 0 | 3-Medium | MH Inspection | 4 |
| Manhole | 1967 | 6286 Timber Dr | $535.60 | 37 | 0 | 2004 | 0 | 3-Medium | MH Inspection | 4 |
| Manhole | 3620 | 5202 Pierce St | $535.60 | 35 | 0 | 2006 | 0 | 3-Medium | MH Inspection | 4 |
| Manhole | 4300 | 10938 Lance Ave | $535.60 | 35 | 0 | 2005 | 0 | 3-Medium | MH Inspection | 4 |
| Gravity Main | P4530 | 11181-11195 Radcliff Dr | $371.86 | 34 | 10 | 1966 | 99 | 3-Medium | CCTV | 3 |
| Manhole | 2345 | 6660 Lake Michigan Dr | $535.60 | 34 | 0 | 1993 | 0 | 3-Medium | MH Inspection | 4 |
| Manhole | 4852 | 11317 Whispering Creek Dr | $535.60 | 34 | 0 | 2012 | 0 | 3-Medium | MH Inspection | 4 |
| Manhole | 2692 | 11553 Rosewood Ave | $535.60 | 32 | 0 | 1990 | 0 | 3-Medium | MH Inspection | 4 |
| Manhole | 4702 | 11225 Commerce Rd | $535.60 | 32 | 0 | 2001 | 0 | 3-Medium | MH Inspection | 4 |
| Manhole | 4637 | 4864 Lake Michigan Dr | $535.60 | 32 | 0 | 2001 | 0 | 3-Medium | MH Inspection | 4 |
| Manhole | 9516 | 10498 52nd Ave | $535.60 | 32 | 0 | 2006 | 0 | 3-Medium | MH Inspection | 4 |
| Gravity Main | P4517 | 11075-11111 52nd Ave | $847.63 | 32 | 21 | 1990 | 198 | 3-Medium | CCTV | 3 |
| Gravity Main | P4516 | 11111-11143 52nd Ave | $791.54 | 32 | 21 | 1990 | 185 | 3-Medium | CCTV | 3 |
| Gravity Main | P4518 | 11059-11075 52nd Ave | $369.22 | 32 | 21 | 1990 | 86 | 3-Medium | CCTV | 3 |
| Gravity Main | P4658 | 4395-4379 Lake Michigan Dr | $365.10 | 31 | 8 | 1990 | 97 | 3-Medium | CCTV | 3 |
| Gravity Main | P4702 | 11225-11205 Commerce Rd | $509.72 | 30 | 8 | 2001 | 136 | 3-Medium | CCTV | 3 |
| Gravity Main | P5284 | 11654-11615 40th Ave | $932.11 | 30 | 10 | 2000 | 249 | 3-Medium | CCTV | 3 |
| Gravity Main | P1032 | 11611-11615 40th Ave | $106.02 | 30 | 12 | 1990 | 28 | 3-Medium | CCTV | 3 |
| Gravity Main | P1034 | 11601-11611 40th Ave | $261.93 | 30 | 12 | 1990 | 70 | 3-Medium | CCTV | 3 |
| Gravity Main | P5040 | 11443-11403 48th Ave | $1,054.33 | 29 | 8 | 1987 | 281 | 3-Medium | CCTV | 3 |
| Gravity Main | P4844 | 11313-11269 48th Ave | $976.40 | 29 | 8 | 1987 | 260 | 3-Medium | CCTV | 3 |
| Gravity Main | P1033 | 11529-11601 40th Ave | $1,732.87 | 29 | 8 | 1990 | 462 | 3-Medium | CCTV | 3 |
| Gravity Main | P2461 | 11315-11261 64th Ave | $1,402.54 | 28 | 8 | 1987 | 374 | 3-Medium | CCTV | 3 |
| Gravity Main | P2882 | 11587-11530 Brookland Ct | $871.11 | 28 | 8 | 1990 | 232 | 3-Medium | CCTV | 3 |
| Gravity Main | P4531 | 11151-11181 Radcliff Dr | $474.87 | 28 | 8 | 1966 | 127 | 3-Medium | CCTV | 3 |
| Gravity Main | P2881 | 11541 Brookland Ct | $484.86 | 28 | 8 | 1990 | 129 | 3-Medium | CCTV | 3 |
| Gravity Main | P2772 | 11525-11555 60th Ave | $806.76 | 28 | 8 | 1990 | 215 | 3-Medium | CCTV | 3 |
| Gravity Main | P4742 | 11269-11261 48th Ave | $167.00 | 28 | 8 | 1987 | 45 | 3-Medium | CCTV | 3 |
| Gravity Main | P4656 | 4419-4395 Lake Michigan Dr | $450.80 | 28 | 12 | 1990 | 120 | 3-Medium | CCTV | 3 |
| Gravity Main | P3620 | 10415 52nd Ave | $901.69 | 27 | 24 | 2006 | 211 | 3-Medium | CCTV | 3 |
| Gravity Main | P3621 | 10431-10463 52nd Ave | $945.50 | 27 | 24 | 2006 | 221 | 3-Medium | CCTV | 3 |
| Gravity Main | P3720 | 10463-10517 52nd Ave | $1,582.87 | 27 | 24 | 2006 | 370 | 3-Medium | CCTV | 3 |
| Gravity Main | P2485 | 5751 Lake Michigan Dr | $1,569.21 | 27 | 18 | 1990 | 418 | 3-Medium | CCTV | 3 |
| Gravity Main | P4700 | 11258 56th Ave | $1,197.52 | 27 | 18 | 1990 | 319 | 3-Medium | CCTV | 3 |
| Gravity Main | P5042 | 11529-11483 48th Ave | $1,138.19 | 26 | 8 | 1991 | 304 | 3-Medium | CCTV | 3 |
| Gravity Main | P5140 | 11565-11529 48th Ave | $912.08 | 26 | 8 | 1991 | 243 | 3-Medium | CCTV | 3 |
| Gravity Main | P4740 | 11227-11261 48th Ave | $748.58 | 26 | 15 | 1987 | 200 | 3-Medium | CCTV | 3 |
| Gravity Main | P5146 | 4726-4750 Rich St | $1,232.14 | 26 | 8 | 1991 | 329 | 3-Medium | CCTV | 3 |
| Gravity Main | P4422 | 11031-11059 52nd Ave | $711.60 | 26 | 21 | 1990 | 166 | 3-Medium | CCTV | 3 |
| Gravity Main | P3622 | 5160-5202 Pierce St | $1,353.89 | 26 | 8 | 2006 | 361 | 3-Medium | CCTV | 3 |

| Table K-2. Collection System Maintenance Summary Table: 3-5 Year | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Asset | ID | Address | Total Cost | Normalized Risk | Size (in) | Year Constructed | Length (ft) | Risk (By Grading) | Rehab Actions | Year |
| Gravity Main | P2380 | 11193-11208 60th Ave | $519.27 | 25 | 10 | 1989 | 138 | 3-Medium | CCTV | 3 |
| Gravity Main | P2495 | 5680 Lake Michigan Dr | $1,642.60 | 25 | 8 | 1992 | 438 | 3-Medium | CCTV | 3 |
| Gravity Main | P2494 | 11149 Northgate Ave | $1,447.78 | 25 | 8 | 1992 | 386 | 3-Medium | CCTV | 3 |
| Gravity Main | P2365 | WJ Presley Pkwy | $1,124.80 | 25 | 8 | 2000 | 300 | 3-Medium | CCTV | 3 |
| Gravity Main | P2473A | 6194 Library Ln | $690.43 | 25 | 8 | 1998 | 184 | 3-Medium | CCTV | 3 |
| Gravity Main | P2347 | 6656-6676 Lake Michigan Dr | $1,063.23 | 25 | 8 | 1992 | 284 | 3-Medium | CCTV | 3 |
| Gravity Main | P4637 | 4864-4866 Lake Michigan Dr | $112.94 | 25 | 8 | 2001 | 30 | 3-Medium | CCTV | 3 |
| Gravity Main | P4638 | 4850-4864 Lake Michigan Dr | $373.84 | 25 | 8 | 2001 | 100 | 3-Medium | CCTV | 3 |
| Gravity Main | P2346 | 6652-6656 Lake Michigan Dr | $141.46 | 25 | 8 | 1992 | 38 | 3-Medium | CCTV | 3 |
| Gravity Main | P2388 | 11147 Richard Ave | $1,480.50 | 25 | 8 | 1992 | 395 | 3-Medium | CCTV | 3 |
| Gravity Main | P2460 | 11261-11205 64th Ave | $1,217.47 | 25 | 8 | 1987 | 325 | 3-Medium | CCTV | 3 |
| Gravity Main | P2345 | 6660-6652 Lake Michigan Dr | $779.06 | 25 | 8 | 1993 | 208 | 3-Medium | CCTV | 3 |
| Gravity Main | P2362 | 11194 64th Ave | $180.23 | 25 | 8 | 2000 | 48 | 3-Medium | CCTV | 3 |
| Gravity Main | P4421 | 11015 52nd Ave | $737.51 | 23 | 21 | 2005 | 172 | 3-Medium | CCTV | 3 |
| Gravity Main | P3721 | 10547 52nd Ave | $1,605.85 | 23 | 24 | 2006 | 375 | 3-Medium | CCTV | 3 |
| Gravity Main | P2493 | 11255-11253 56th Ave | $708.78 | 22 | 18 | 1990 | 189 | 3-Medium | CCTV | 3 |
| Gravity Main | P2484 | 11271 Rosewood Ave | $905.18 | 22 | 18 | 1990 | 241 | 3-Medium | CCTV | 3 |
| Manhole | 9612 | 10498 52nd Ave | $535.60 | 22 | 0 | 2006 | 0 | 3-Medium | MH Inspection | 4 |
| Gravity Main | P4320 | 10913-10963 52nd Ave | $1,494.29 | 22 | 21 | 2005 | 349 | 3-Medium | CCTV | 3 |
| Gravity Main | P3921 | 10657-10723 52nd Ave | $1,699.50 | 21 | 24 | 2006 | 397 | 3-Medium | CCTV | 3 |
| Gravity Main | P4120 | 10781-10829 52nd Ave | $1,331.63 | 21 | 24 | 2006 | 311 | 3-Medium | CCTV | 3 |
| Gravity Main | P4221 | 10855-10913 52nd Ave | $1,104.50 | 21 | 24 | 2005 | 258 | 3-Medium | CCTV | 3 |
| Gravity Main | P3820 | 5217 Windfield Dr | $1,435.99 | 21 | 24 | 2006 | 336 | 3-Medium | CCTV | 3 |
| Gravity Main | P3920 | 10621-10657 52nd Ave | $1,067.39 | 21 | 24 | 2006 | 249 | 3-Medium | CCTV | 3 |
| Gravity Main | P4020 | 10723-10781 52nd Ave | $1,406.61 | 21 | 24 | 2006 | 329 | 3-Medium | CCTV | 3 |
| Gravity Main | P1125 | 10963-10967 52nd Ave | $124.46 | 21 | 21 | 2005 | 29 | 3-Medium | CCTV | 3 |
| Gravity Main | P4121 | 10829-10855 52nd Ave | $2,096.18 | 21 | 24 | 2006 | 490 | 3-Medium | CCTV | 3 |
| Gravity Main | P4420 | 10983 52nd Ave | $1,017.34 | 21 | 21 | 2005 | 238 | 3-Medium | CCTV | 3 |
| Gravity Main | P2336 | 11215 Valley View Ave | $814.00 | 21 | 10 | 2007 | 217 | 3-Medium | CCTV | 3 |
| Gravity Main | P1180 | 7003-6981 Lake Michigan Dr | $754.92 | 21 | 10 | 2007 | 201 | 3-Medium | CCTV | 3 |
| Gravity Main | P2337 | 11215 Valley View Ave | $248.72 | 21 | 10 | 2007 | 66 | 3-Medium | CCTV | 3 |
| Gravity Main | P4655 | 4427-4419 Lake Michigan Dr | $171.24 | 21 | 8 | 1990 | 46 | 3-Medium | CCTV | 3 |
| Gravity Main | P4626 | 5053 Lake Michigan Dr | $359.70 | 21 | 10 | 1990 | 96 | 3-Medium | CCTV | 3 |
| Gravity Main | P1133 | 11367 Whispering Creek Dr | $570.82 | 21 | 8 | 2012 | 152 | 3-Medium | CCTV | 3 |
| Gravity Main | P4657 | 4415-4419 Lake Michigan Dr | $1,354.84 | 21 | 8 | 1990 | 361 | 3-Medium | CCTV | 3 |
| Gravity Main | P9516 | 10498 52nd Ave | $331.24 | 21 | 8 | 2006 | 88 | 3-Medium | CCTV | 3 |
| Gravity Main | P9612 | 10498-10520 52nd Ave | $545.06 | 21 | 8 | 2006 | 145 | 3-Medium | CCTV | 3 |
| Gravity Main | P9613 | 10520-10498 52nd Ave | $1,355.53 | 21 | 8 | 2006 | 361 | 3-Medium | CCTV | 3 |
| Manhole | 4812 | 11008 54th Ave | $535.60 | 56 | 0 | 2000 | 0 | 2-Low | MH Inspection | 4 |
| Manhole | 1782 | 5961 Maple Bend Trl | $535.60 | 53 | 0 | 1998 | 0 | 2-Low | MH Inspection | 4 |
| Manhole | 1783 | 5936 Maple Bend Trl | $535.60 | 53 | 0 | 1998 | 0 | 2-Low | MH Inspection | 4 |
| Manhole | 1917 | 7208 Pinevalley Dr | $535.60 | 51 | 0 | 2004 | 0 | 2-Low | MH Inspection | 4 |
| Manhole | 4425 | 10999 Woodedge Dr | $535.60 | 48 | 0 | 2005 | 0 | 2-Low | MH Inspection | 4 |
| Manhole | 5356 | 4431 Pingree St | $535.60 | 44 | 0 | 1991 | 0 | 2-Low | MH Inspection | 4 |
| Manhole | 4851 | 4614 Ottawa Creek Dr | $535.60 | 44 | 0 | 2012 | 0 | 2-Low | MH Inspection | 4 |
| Manhole | 5145 | 4750 Rich St | $535.60 | 42 | 0 | 1991 | 0 | 2-Low | MH Inspection | 4 |
| Manhole | 2977 | 11682 Wilmington Dr | $535.60 | 42 | 0 | 2006 | 0 | 2-Low | MH Inspection | 4 |
| Manhole | 3820 | 5202 Windfield Dr | $535.60 | 40 | 0 | 2006 | 0 | 2-Low | MH Inspection | 4 |
| Manhole | 2225 | 11145 Creekside Ct | $535.60 | 38 | 0 | 2004 | 0 | 2-Low | MH Inspection | 4 |
| Manhole | 1134 | 11463 48th Ave | $535.60 | 37 | 0 | 1991 | 0 | 2-Low | MH Inspection | 4 |
| Manhole | 4604 | 5426 Lake Michigan Dr | $535.60 | 37 | 0 | 2001 | 0 | 2-Low | MH Inspection | 4 |
| Manhole | 4876 | 11405 40th Ave | $535.60 | 36 | 0 | 1990 | 0 | 2-Low | MH Inspection | 4 |
| Manhole | 5352 | 11821 46th Ave | $535.60 | 35 | 0 | 1991 | 0 | 2-Low | MH Inspection | 4 |
| Manhole | 4031 | 4950 W Campus Dr | $535.60 | 35 | 0 | 1990 | 0 | 2-Low | MH Inspection | 4 |
| Manhole | 4310 | 10943 Jordan Ct | $535.60 | 35 | 0 | 2000 | 0 | 2-Low | MH Inspection | 4 |
| Manhole | 1114 | 10445 48th Ave | $535.60 | 34 | 0 | 2001 | 0 | 2-Low | MH Inspection | 4 |
| Manhole | 1021 | 10781 52nd Ave | $535.60 | 34 | 0 | 2006 | 0 | 2-Low | MH Inspection | 4 |
| Manhole | 5354 | 4544 Pingree St | $535.60 | 33 | 0 | 1991 | 0 | 2-Low | MH Inspection | 4 |

| Table K-2. Collection System Maintenance Summary Table: 3-5 Year | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Asset | ID | Address | Total Cost | Normalized Risk | Size (in) | Year Constructed | Length (ft) | Risk (By Grading) | Rehab Actions | Year |
| Manhole | 1044 | 11099 Pinecreek Ct | $535.60 | 33 | 0 | 2004 | 0 | 2-Low | MH Inspection | 4 |
| Manhole | 2115 | 10997 Waterway Dr | $535.60 | 32 | 0 | 2001 | 0 | 2-Low | MH Inspection | 4 |
| Manhole | 5143 | 11619 48th Ave | $535.60 | 31 | 0 | 1991 | 0 | 2-Low | MH Inspection | 4 |
| Manhole | 1042 | 10953 Skyway Ln | $535.60 | 31 | 0 | 2004 | 0 | 2-Low | MH Inspection | 4 |
| Manhole | 4121 | 10829 52nd Ave | $535.60 | 31 | 0 | 2006 | 0 | 2-Low | MH Inspection | 4 |
| Manhole | 2364 | WJ Presley Pkwy | $535.60 | 31 | 0 | 2000 | 0 | 2-Low | MH Inspection | 4 |
| Manhole | 1823 | 7151 Pine Grove St | $535.60 | 31 | 0 | 2004 | 0 | 2-Low | MH Inspection | 4 |
| Manhole | 4511 | 5478 Eric St | $535.60 | 31 | 0 | 2000 | 0 | 2-Low | MH Inspection | 4 |
| Manhole | 2223 | 11127 Creekside Ct | $535.60 | 31 | 0 | 2004 | 0 | 2-Low | MH Inspection | 4 |
| Manhole | 2368 | 6144 Lake Michigan Dr | $535.60 | 30 | 0 | 2000 | 0 | 2-Low | MH Inspection | 4 |
| Manhole | 2383 | 5824 Lake Michigan Dr | $535.60 | 30 | 0 | 1992 | 0 | 2-Low | MH Inspection | 4 |
| Manhole | 1991 | 5702 Lynn Dr | $535.60 | 30 | 0 | 2000 | 0 | 2-Low | MH Inspection | 4 |
| Manhole | 4813 | 5349 Edgewater Dr | $535.60 | 29 | 0 | 2000 | 0 | 2-Low | MH Inspection | 4 |
| Manhole | 9003 | 11018 Creekside Dr | $535.60 | 29 | 0 | 1995 | 0 | 2-Low | MH Inspection | 4 |
| Manhole | 2531 | 7437 Valley View Ct | $535.60 | 29 | 0 | 2000 | 0 | 2-Low | MH Inspection | 4 |
| Manhole | 4407 | 10973 Lance Ave | $535.60 | 29 | 0 | 2005 | 0 | 2-Low | MH Inspection | 4 |
| Manhole | 2358 | 11283 Washington Ave | $803.40 | 28 | 0 | 2004 | 0 | 2-Low | MH Clean | 5 |
| Manhole | 2515 | 7170 Blue Jay Dr | $535.60 | 28 | 0 | 2013 | 0 | 2-Low | MH Inspection | 4 |
| Manhole | 9518 | 4617 Lake Michigan Dr | $535.60 | 28 | 0 | 2012 | 0 | 2-Low | MH Inspection | 4 |
| Manhole | 2381 | 5948 Lake Michigan Dr | $535.60 | 28 | 0 | 1992 | 0 | 2-Low | MH Inspection | 4 |
| Manhole | 5355 | 4488 Pingree St | $535.60 | 28 | 0 | 1991 | 0 | 2-Low | MH Inspection | 4 |
| Manhole | 4302 | 10917 Lance Ave | $535.60 | 28 | 0 | 2005 | 0 | 2-Low | MH Inspection | 4 |
| Manhole | 4303 | 10905 Lance Ave | $535.60 | 28 | 0 | 2005 | 0 | 2-Low | MH Inspection | 4 |
| Manhole | 3623 | 5122 Pierce St | $535.60 | 27 | 0 | 2006 | 0 | 2-Low | MH Inspection | 4 |
| Manhole | 2770 | 11441 60th Ave | $535.60 | 27 | 0 | 1990 | 0 | 2-Low | MH Inspection | 4 |
| Manhole | 4639 | 4830 Lake Michigan Dr | $535.60 | 26 | 0 | 2001 | 0 | 2-Low | MH Inspection | 4 |
| Manhole | 5144 | 4774 Rich St | $535.60 | 26 | 0 | 1991 | 0 | 2-Low | MH Inspection | 4 |
| Manhole | 1788 | 10701 Tallpine Ln | $535.60 | 26 | 0 | 1998 | 0 | 2-Low | MH Inspection | 4 |
| Manhole | 3840 | 10489 48th Ave | $535.60 | 26 | 0 | 2001 | 0 | 2-Low | MH Inspection | 4 |
| Gravity Main | P4538 | 11035 Stanford Ave | $1,311.97 | 26 | 8 | 1966 | 350 | 2-Low | CCTV | 3 |
| Gravity Main | P4537 | 11055-11085 Stanford Ave | $1,035.69 | 26 | 8 | 1966 | 276 | 2-Low | CCTV | 3 |
| Gravity Main | P1111 | 11085 Stanford Ave | $514.53 | 26 | 8 | 1966 | 137 | 2-Low | CCTV | 3 |
| Manhole | 5042 | 11529 48th Ave | $535.60 | 26 | 0 | 1991 | 0 | 2-Low | MH Inspection | 4 |
| Manhole | 4120 | 10781 52nd Ave | $535.60 | 26 | 0 | 2006 | 0 | 2-Low | MH Inspection | 4 |
| Manhole | 5286 | 11773 40th Ave | $535.60 | 26 | 0 | 2000 | 0 | 2-Low | MH Inspection | 4 |
| Manhole | 1682 | 10601 Tallpine Ln | $535.60 | 26 | 0 | 1998 | 0 | 2-Low | MH Inspection | 4 |
| Manhole | 1922 | 6994 Aspen St | $535.60 | 26 | 0 | 2001 | 0 | 2-Low | MH Inspection | 4 |
| Manhole | 1994 | 5796 Lynn Dr | $535.60 | 26 | 0 | 2000 | 0 | 2-Low | MH Inspection | 4 |
| Manhole | 2091 | 5634 Mary Eliz Dr | $535.60 | 26 | 0 | 2000 | 0 | 2-Low | MH Inspection | 4 |
| Manhole | 4032 | Campus West Apartments | $535.60 | 26 | 0 | 2001 | 0 | 2-Low | MH Inspection | 4 |
| Manhole | 4512 | 5452 Eric St | $535.60 | 26 | 0 | 2000 | 0 | 2-Low | MH Inspection | 4 |
| Manhole | 1132 | 4616 Ottawa Creek Dr | $535.60 | 26 | 0 | 2012 | 0 | 2-Low | MH Inspection | 4 |
| Manhole | 4322 | 5176 Circlewood Ln | $535.60 | 26 | 0 | 2005 | 0 | 2-Low | MH Inspection | 4 |
| Manhole | 4427 | 5193 Woodedge Ct | $535.60 | 26 | 0 | 2005 | 0 | 2-Low | MH Inspection | 4 |
| Manhole | 1720 | 10819 Timberline Dr | $535.60 | 26 | 0 | 2008 | 0 | 2-Low | MH Inspection | 4 |
| Gravity Main | P1581 | 10550 60th Ave | $190.33 | 24 | 10 | 1992 | 51 | 2-Low | CCTV | 3 |
| Gravity Main | P5286 | 11773-11717 40th Ave | $1,324.76 | 24 | 10 | 2000 | 353 | 2-Low | CCTV | 3 |
| Gravity Main | P1116 | 10411-10445 48th Ave | $757.78 | 24 | 10 | 2001 | 202 | 2-Low | CCTV | 3 |
| Gravity Main | P4983 | 11454 Cadence Ct | $1,151.78 | 24 | 10 | 1990 | 307 | 2-Low | CCTV | 3 |
| Gravity Main | P5285 | 11717-11654 40th Ave | $1,498.91 | 24 | 10 | 2000 | 400 | 2-Low | CCTV | 3 |
| Gravity Main | P5287 | 11731 40th Ave | $1,495.50 | 24 | 10 | 2000 | 399 | 2-Low | CCTV | 3 |
| Gravity Main | P2248 | 6605 Henry St | $329.93 | 24 | 12 | 1990 | 88 | 2-Low | CCTV | 3 |
| Manhole | 1041 | 11057 Skyway Ln | $535.60 | 24 | 0 | 2004 | 0 | 2-Low | MH Inspection | 4 |
| Manhole | 2370 | 6052 Lake Michigan Dr | $535.60 | 24 | 0 | 2000 | 0 | 2-Low | MH Inspection | 4 |
| Manhole | 4603 | 5504 Lake Michigan Dr | $535.60 | 24 | 0 | 2001 | 0 | 2-Low | MH Inspection | 4 |
| Manhole | 4218 | 10705 Douglas Dr | $535.60 | 24 | 0 | 2004 | 0 | 2-Low | MH Inspection | 4 |
| Gravity Main | P4701 | 5543 Lake Michigan Dr | $1,270.04 | 23 | 21 | 1990 | 297 | 2-Low | CCTV | 3 |
| Gravity Main | P2480 | 5903 Lake Michigan Dr | $1,000.90 | 23 | 18 | 1990 | 267 | 2-Low | CCTV | 3 |

**Table K-2. Collection System Maintenance Summary Table: 3-5 Year**

| Asset | ID | Address | Total Cost | Normalized Risk | Size (in) | Year Constructed | Length (ft) | Risk (By Grading) | Rehab Actions | Year |
|---|---|---|---|---|---|---|---|---|---|---|
| Gravity Main | P2391 | 5796-5773 Country View Dr | $635.73 | 23 | 8 | 1992 | 170 | 2-Low | CCTV | 3 |
| Gravity Main | P2094 | 6173 Mary Eliz Dr | $1,143.59 | 23 | 8 | 2000 | 305 | 2-Low | CCTV | 3 |
| Gravity Main | P2096 | 10983 Melanie Dr | $530.01 | 23 | 8 | 2000 | 141 | 2-Low | CCTV | 3 |
| Gravity Main | P2581 | 5764-5735 Ivory Rd | $396.87 | 23 | 8 | 1992 | 106 | 2-Low | CCTV | 3 |
| Gravity Main | P2685 | 11441-11425 Prairie Ave | $737.24 | 23 | 8 | 1993 | 197 | 2-Low | CCTV | 3 |
| Gravity Main | P1994 | 5796-5769 Lynn Dr | $769.92 | 23 | 8 | 2000 | 205 | 2-Low | CCTV | 3 |
| Gravity Main | P2193 | 5752-5578 Forest View Dr | $1,045.66 | 23 | 8 | 1990 | 279 | 2-Low | CCTV | 3 |
| Gravity Main | P1085 | 5997 Frostline Dr | $199.22 | 23 | 8 | 1990 | 53 | 2-Low | CCTV | 3 |
| Gravity Main | P2392 | 5773-5743 Country View Dr | $641.02 | 23 | 8 | 1992 | 171 | 2-Low | CCTV | 3 |
| Gravity Main | P4941 | 11410-11403 48th Ave | $309.97 | 23 | 8 | 2000 | 83 | 2-Low | CCTV | 3 |
| Gravity Main | P2486 | 11271 Rosewood Ave | $774.22 | 23 | 8 | 1992 | 206 | 2-Low | CCTV | 3 |
| Gravity Main | P2095 | 10801-10931 Mary Eliz Ct | $1,292.29 | 23 | 8 | 2000 | 345 | 2-Low | CCTV | 3 |
| Gravity Main | P2398 | 11115 Estate Ct | $1,190.43 | 23 | 8 | 1990 | 317 | 2-Low | CCTV | 3 |
| Gravity Main | P5141 | 11581 48th Ave | $875.34 | 23 | 8 | 1991 | 233 | 2-Low | CCTV | 3 |
| Gravity Main | P2387 | 5908-5954 Country View Dr | $1,424.47 | 23 | 8 | 1992 | 380 | 2-Low | CCTV | 3 |
| Gravity Main | P2582 | 5804-5764 Ivory Rd | $516.61 | 23 | 8 | 1992 | 138 | 2-Low | CCTV | 3 |
| Gravity Main | P2590 | 11299 Rosewood Ave | $928.98 | 23 | 8 | 1992 | 248 | 2-Low | CCTV | 3 |
| Gravity Main | P5147 | 4702-4726 Rich St | $1,263.54 | 23 | 8 | 1991 | 337 | 2-Low | CCTV | 3 |
| Gravity Main | P2589 | 5957-5930 Dewpointe Dr | $683.87 | 23 | 8 | 1993 | 182 | 2-Low | CCTV | 3 |
| Gravity Main | P2192 | 5490 Forest View Dr | $1,053.78 | 23 | 8 | 1990 | 281 | 2-Low | CCTV | 3 |
| Gravity Main | P5145 | 4750-4774 Rich St | $1,230.19 | 23 | 8 | 1991 | 328 | 2-Low | CCTV | 3 |
| Gravity Main | P2487 | 5855-5802 Larkspur Ave | $971.48 | 23 | 8 | 1992 | 259 | 2-Low | CCTV | 3 |
| Gravity Main | P2393 | 11171 Pleasant Point Dr | $841.33 | 23 | 8 | 1992 | 224 | 2-Low | CCTV | 3 |
| Gravity Main | P2591 | 11349 Rosewood Ave | $1,467.96 | 23 | 8 | 1992 | 391 | 2-Low | CCTV | 3 |
| Gravity Main | P4940 | 11403-11359 48th Ave | $1,115.33 | 23 | 8 | 1987 | 297 | 2-Low | CCTV | 3 |
| Gravity Main | P2394 | 11091-11143 Pleasant Point D | $735.29 | 23 | 8 | 1992 | 196 | 2-Low | CCTV | 3 |
| Gravity Main | P2195 | 5780-5752 Forest View Dr | $779.06 | 23 | 8 | 1990 | 208 | 2-Low | CCTV | 3 |
| Gravity Main | P1993 | 5769-5702 Lynn Dr | $881.19 | 23 | 8 | 2000 | 235 | 2-Low | CCTV | 3 |
| Gravity Main | P2197 | 11025 Pleasant Point Dr | $747.96 | 23 | 8 | 1990 | 199 | 2-Low | CCTV | 3 |
| Gravity Main | P5144 | 4774-4802 Rich St | $1,320.56 | 23 | 8 | 1991 | 352 | 2-Low | CCTV | 3 |
| Gravity Main | P2191 | 10997-11027 Gayle Ln | $442.80 | 23 | 8 | 1990 | 118 | 2-Low | CCTV | 3 |
| Gravity Main | P5350 | 11651 46th Ave | $1,284.49 | 23 | 8 | 1991 | 343 | 2-Low | CCTV | 3 |
| Gravity Main | P2290 | 11006 Estate Ct | $387.06 | 23 | 8 | 1990 | 103 | 2-Low | CCTV | 3 |
| Gravity Main | P1992 | 10815 Melanie Dr | $383.39 | 23 | 8 | 2000 | 102 | 2-Low | CCTV | 3 |
| Gravity Main | P2583 | 5827-5852 Ivory Rd | $335.70 | 23 | 8 | 1992 | 90 | 2-Low | CCTV | 3 |
| Gravity Main | P5351 | 11731 46th Ave | $1,080.15 | 23 | 8 | 1991 | 288 | 2-Low | CCTV | 3 |
| Gravity Main | P2291 | Estate Rd | $281.71 | 23 | 8 | 1990 | 75 | 2-Low | CCTV | 3 |
| Gravity Main | P2090 | 10962-10997 Gayle Ln | $1,226.23 | 23 | 8 | 2000 | 327 | 2-Low | CCTV | 3 |
| Gravity Main | P2339 | 11209-11235 Brown St | $569.77 | 23 | 10 | 1990 | 152 | 2-Low | CCTV | 3 |
| Gravity Main | P2488 | 5881 Larkspur Ave | $908.63 | 23 | 8 | 1992 | 242 | 2-Low | CCTV | 3 |
| Gravity Main | P1990 | 10901-10965 Melanie Dr | $978.66 | 23 | 8 | 2000 | 261 | 2-Low | CCTV | 3 |
| Gravity Main | P5250 | 11549 46th Ave | $1,495.77 | 23 | 8 | 1991 | 399 | 2-Low | CCTV | 3 |
| Gravity Main | P4932 | 11407 48th Ave | $254.98 | 23 | 8 | 2001 | 68 | 2-Low | CCTV | 3 |
| Gravity Main | P2586 | 11361 Prairie Ave | $555.29 | 23 | 8 | 1993 | 148 | 2-Low | CCTV | 3 |
| Gravity Main | P2338 | 6915 Lake Michigan Dr | $1,444.11 | 23 | 10 | 1990 | 385 | 2-Low | CCTV | 3 |
| Gravity Main | P5352 | 11821-11761 46th Ave | $1,037.14 | 23 | 8 | 1991 | 277 | 2-Low | CCTV | 3 |
| Gravity Main | P2683 | 11385 Prairie Ave | $904.69 | 23 | 8 | 1993 | 241 | 2-Low | CCTV | 3 |
| Gravity Main | P4845 | 11359-11313 48th Ave | $1,127.05 | 23 | 8 | 1987 | 301 | 2-Low | CCTV | 3 |
| Gravity Main | P2691 | 11439-11403 Rosewood Ave | $1,080.87 | 23 | 8 | 1990 | 288 | 2-Low | CCTV | 3 |
| Gravity Main | P2093 | 5727-5670 Mary Eliz Dr | $550.90 | 23 | 8 | 2000 | 147 | 2-Low | CCTV | 3 |
| Gravity Main | P5356 | 4431-4488 Pingree St | $1,039.18 | 23 | 8 | 1991 | 277 | 2-Low | CCTV | 3 |
| Gravity Main | P2690 | 11391 Rosewood Ave | $504.87 | 23 | 8 | 1992 | 135 | 2-Low | CCTV | 3 |
| Gravity Main | P2396 | 5743-5696 Country View Dr | $670.76 | 23 | 8 | 1992 | 179 | 2-Low | CCTV | 3 |
| Gravity Main | P2395 | 11071-11091 Pleasant Point D | $317.45 | 23 | 8 | 1992 | 85 | 2-Low | CCTV | 3 |
| Gravity Main | P4930 | 4991-4896 Allenpark Dr | $1,472.09 | 23 | 8 | 2001 | 393 | 2-Low | CCTV | 3 |
| Gravity Main | P2397 | 5696-5663 Country View Dr | $505.04 | 23 | 8 | 1992 | 135 | 2-Low | CCTV | 3 |
| Gravity Main | P5355 | 4488-4544 Pingree St | $1,024.27 | 23 | 8 | 1991 | 273 | 2-Low | CCTV | 3 |
| Gravity Main | P2190 | 11113 Gayle Ln | $994.92 | 23 | 8 | 1990 | 265 | 2-Low | CCTV | 3 |

| Table K-2. Collection System Maintenance Summary Table: 3-5 Year | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Asset | ID | Address | Total Cost | Normalized Risk | Size (in) | Year Constructed | Length (ft) | Risk (By Grading) | Rehab Actions | Year |
| Gravity Main | P2399 | 5620-5663 Country View Dr | $986.11 | 23 | 8 | 1992 | 263 | 2-Low | CCTV | 3 |
| Gravity Main | P5354 | 4572 Pingree St | $1,045.06 | 23 | 8 | 1991 | 279 | 2-Low | CCTV | 3 |
| Gravity Main | P5357 | 4375-4431 Pingree St | $1,007.08 | 23 | 8 | 1991 | 269 | 2-Low | CCTV | 3 |
| Gravity Main | P2196 | 5798-5780 Forest View Dr | $604.47 | 23 | 8 | 1990 | 161 | 2-Low | CCTV | 3 |
| Gravity Main | P2585 | 11351-11281 Prairie Ave | $1,443.86 | 23 | 8 | 1992 | 385 | 2-Low | CCTV | 3 |
| Gravity Main | P2580 | 5735-5701 Ivory Rd | $457.95 | 23 | 8 | 1992 | 122 | 2-Low | CCTV | 3 |
| Gravity Main | P1991 | 10865 Melanie Dr | $1,062.18 | 23 | 8 | 2000 | 283 | 2-Low | CCTV | 3 |
| Gravity Main | P4931 | 4854 Allenpark Dr | $1,311.48 | 23 | 8 | 2001 | 350 | 2-Low | CCTV | 3 |
| Gravity Main | P2588 | 5930-5443 Dewpointe Dr | $800.73 | 23 | 8 | 1993 | 214 | 2-Low | CCTV | 3 |
| Gravity Main | P2091 | 5673 Mary Eliz Dr | $795.80 | 23 | 8 | 2000 | 212 | 2-Low | CCTV | 3 |
| Gravity Main | P2092 | 5670-5634 Mary Eliz Dr | $685.75 | 23 | 8 | 2000 | 183 | 2-Low | CCTV | 3 |
| Gravity Main | P2194 | 10937 Homestead Ln | $1,396.06 | 23 | 8 | 1990 | 372 | 2-Low | CCTV | 3 |
| Gravity Main | P2587 | 5443-5016 Dewpointe Dr | $693.68 | 23 | 8 | 1993 | 185 | 2-Low | CCTV | 3 |
| Gravity Main | P2684 | 11425-11399 Prairie Ave | $678.18 | 23 | 8 | 1993 | 181 | 2-Low | CCTV | 3 |
| Gravity Main | P2386 | 5976 Country View Dr | $1,427.22 | 23 | 8 | 1992 | 381 | 2-Low | CCTV | 3 |
| Gravity Main | P4984 | 11478-11529 40th Ave | $1,176.58 | 23 | 8 | 1990 | 314 | 2-Low | CCTV | 3 |
| Gravity Main | P2584 | 5876 Ivory Rd | $628.89 | 23 | 8 | 1992 | 168 | 2-Low | CCTV | 3 |
| Gravity Main | P1134 | 11463-11443 48th Ave | $474.06 | 23 | 8 | 1991 | 126 | 2-Low | CCTV | 3 |
| Gravity Main | P5142 | 11607 48th Ave | $240.18 | 23 | 8 | 1991 | 64 | 2-Low | CCTV | 3 |
| Gravity Main | P5041 | 11483-11463 48th Ave | $545.66 | 23 | 8 | 1991 | 146 | 2-Low | CCTV | 3 |
| Gravity Main | P5143 | 11619-11613 48th Ave | $141.52 | 23 | 8 | 1991 | 38 | 2-Low | CCTV | 3 |
| Gravity Main | P5353 | 11859-11821 46th Ave | $663.15 | 23 | 8 | 1991 | 177 | 2-Low | CCTV | 3 |
| Gravity Main | P4362 | 1 Campus Dr | $1,115.69 | 23 | 12 | 1963 | 149 | 2-Low | CCTV and Heavy Cleaning | 3 |
| Manhole | 4020 | 10723 52nd Ave | $535.60 | 23 | 0 | 2006 | 0 | 2-Low | MH Inspection | 4 |
| Manhole | 1178 | 5150 Lake Michigan Dr | $535.60 | 23 | 0 | 1992 | 0 | 2-Low | MH Inspection | 4 |
| Manhole | 4321 | 5163 Circleview Dr | $535.60 | 23 | 0 | 2005 | 0 | 2-Low | MH Inspection | 4 |
| Manhole | 4323 | 5103 Circleview Dr | $535.60 | 23 | 0 | 2005 | 0 | 2-Low | MH Inspection | 4 |
| Manhole | 4325 | 10890 Woodedge Dr | $535.60 | 23 | 0 | 2005 | 0 | 2-Low | MH Inspection | 4 |
| Manhole | 4420 | 10967 52nd Ave | $535.60 | 23 | 0 | 2005 | 0 | 2-Low | MH Inspection | 4 |
| Manhole | 2384 | 5768 Lake Michigan Dr | $535.60 | 23 | 0 | 1992 | 0 | 2-Low | MH Inspection | 4 |
| Manhole | 4615 | 5328 Lake Michigan Dr | $535.60 | 23 | 0 | 2001 | 0 | 2-Low | MH Inspection | 4 |
| Manhole | 5011 | 5499 Edgeway Dr | $535.60 | 23 | 0 | 2000 | 0 | 2-Low | MH Inspection | 4 |
| Manhole | 4616 | 5316 Lake Michigan Dr | $535.60 | 23 | 0 | 2001 | 0 | 2-Low | MH Inspection | 4 |
| Manhole | 2983 | 11571 60th Ave | $535.60 | 23 | 0 | 2006 | 0 | 2-Low | MH Inspection | 4 |
| Manhole | 3740 | 10471 48th Ave | $535.60 | 23 | 0 | 2001 | 0 | 2-Low | MH Inspection | 4 |
| Manhole | 4539 | 4868 Lake Michigan Dr | $535.60 | 23 | 0 | 2001 | 0 | 2-Low | MH Inspection | 4 |
| Manhole | 1822 | 7112 Pine Grove St | $535.60 | 23 | 0 | 2004 | 0 | 2-Low | MH Inspection | 4 |
| Manhole | 4202 | 10783 Lance Ave | $535.60 | 23 | 0 | 2005 | 0 | 2-Low | MH Inspection | 4 |
| Manhole | 4203 | 10701 Lance Ave | $535.60 | 23 | 0 | 2005 | 0 | 2-Low | MH Inspection | 4 |
| Manhole | 4210 | 10887 Douglas Dr | $535.60 | 23 | 0 | 2004 | 0 | 2-Low | MH Inspection | 4 |
| Manhole | 4853 | 4687 Ottawa Creek Dr | $535.60 | 23 | 0 | 2012 | 0 | 2-Low | MH Inspection | 4 |
| Manhole | 4840 | 4878 Becker Dr | $535.60 | 23 | 0 | 2004 | 0 | 2-Low | MH Inspection | 4 |
| Gravity Main | P1089 | 5812-5850 Country View Dr | $711.72 | 23 | 8 | 1992 | 190 | 2-Low | CCTV | 3 |
| Gravity Main | P2787 | 5821-5859 Frostline Dr | $1,301.35 | 23 | 8 | 1990 | 347 | 2-Low | CCTV | 3 |
| Gravity Main | P2593 | 5710-5720 Victoria St | $479.76 | 23 | 8 | 2000 | 128 | 2-Low | CCTV | 3 |
| Gravity Main | P2785 | 5859-5899 Frostline Dr | $628.74 | 23 | 8 | 1990 | 168 | 2-Low | CCTV | 3 |
| Gravity Main | P2788 | 11481 Prairie Ave | $1,176.76 | 23 | 8 | 1990 | 314 | 2-Low | CCTV | 3 |
| Gravity Main | P2781 | 5953-5965 Frostline Dr | $447.79 | 23 | 8 | 1990 | 119 | 2-Low | CCTV | 3 |
| Gravity Main | P2782 | 5931-5953 Frostline Dr | $428.66 | 23 | 8 | 1990 | 114 | 2-Low | CCTV | 3 |
| Gravity Main | P4536 | 11191 Stanford Ave | $538.75 | 23 | 8 | 1966 | 144 | 2-Low | CCTV | 3 |
| Gravity Main | P2681 | 1369-11465 Hunters Meadow I | $1,256.61 | 23 | 8 | 1990 | 335 | 2-Low | CCTV | 3 |
| Gravity Main | P2780 | 5965-5995 Frostline Dr | $1,089.47 | 23 | 8 | 1990 | 291 | 2-Low | CCTV | 3 |
| Gravity Main | P4535 | 11003-11011 Radcliff Dr | $949.89 | 23 | 8 | 1966 | 253 | 2-Low | CCTV | 3 |
| Gravity Main | P1109 | 11071-11101 Radcliff Dr | $1,139.04 | 23 | 8 | 1966 | 304 | 2-Low | CCTV | 3 |
| Gravity Main | P1110 | 11041-11071 Radcliff Dr | $1,154.17 | 23 | 8 | 1966 | 308 | 2-Low | CCTV | 3 |
| Gravity Main | P4876 | 3994 Ravine Dr | $925.84 | 23 | 8 | 1990 | 247 | 2-Low | CCTV | 3 |
| Gravity Main | P4533 | 11101-11137 Radcliff Dr | $653.11 | 23 | 8 | 1966 | 174 | 2-Low | CCTV | 3 |
| Gravity Main | P2390 | 5813-5812 Country View Dr | $275.37 | 23 | 8 | 1992 | 73 | 2-Low | CCTV | 3 |

**Table K-2. Collection System Maintenance Summary Table: 3-5 Year**

| Asset | ID | Address | Total Cost | Normalized Risk | Size (in) | Year Constructed | Length (ft) | Risk (By Grading) | Rehab Actions | Year |
|---|---|---|---|---|---|---|---|---|---|---|
| Gravity Main | P4800 | 11307-11253 56th Ave | $1,381.04 | 23 | 8 | 1992 | 368 | 2-Low | CCTV | 3 |
| Gravity Main | P2790 | 5755-5821 Frostline Dr | $608.14 | 23 | 8 | 1990 | 162 | 2-Low | CCTV | 3 |
| Gravity Main | P2784 | 5899-5931 Frostline Dr | $520.29 | 23 | 8 | 1990 | 139 | 2-Low | CCTV | 3 |
| Gravity Main | P2791 | 5711-5755 Frostline Dr | $383.78 | 23 | 8 | 1990 | 102 | 2-Low | CCTV | 3 |
| Gravity Main | P4802 | 11417-11363 56th Ave | $1,382.10 | 23 | 8 | 1992 | 369 | 2-Low | CCTV | 3 |
| Gravity Main | P4801 | 11363-11307 56th Ave | $1,348.68 | 23 | 8 | 1992 | 360 | 2-Low | CCTV | 3 |
| Gravity Main | P2592 | 11293 Cameron Ave | $1,132.51 | 23 | 8 | 2000 | 302 | 2-Low | CCTV | 3 |
| Gravity Main | P2693 | 11385-11275 Cameron Ave | $1,167.08 | 23 | 8 | 2000 | 311 | 2-Low | CCTV | 3 |
| Gravity Main | P2783 | 5934-5931 Frostline Dr | $547.91 | 23 | 8 | 1990 | 146 | 2-Low | CCTV | 3 |
| Gravity Main | P2682 | 11513 Hunters Meadow Dr | $1,244.04 | 23 | 8 | 1990 | 332 | 2-Low | CCTV | 3 |
| Gravity Main | P4532 | 11137-11151 Radcliff Dr | $422.45 | 23 | 8 | 1966 | 113 | 2-Low | CCTV | 3 |
| Gravity Main | P2694 | 11409 Cameron Ave | $1,156.62 | 23 | 8 | 2000 | 308 | 2-Low | CCTV | 3 |
| Gravity Main | P2984 | 11659-11587 Brookland Ct | $1,136.45 | 23 | 8 | 2003 | 303 | 2-Low | CCTV | 3 |
| Gravity Main | P4534 | 11011-11041 Radcliff Dr | $1,110.57 | 23 | 8 | 1966 | 296 | 2-Low | CCTV | 3 |
| Gravity Main | P2786 | 11463 Eagle Nest Ct | $1,055.02 | 23 | 8 | 1990 | 281 | 2-Low | CCTV | 3 |
| Gravity Main | P2695 | 5702-5732 Crabtree St | $567.32 | 23 | 8 | 2000 | 151 | 2-Low | CCTV | 3 |
| Gravity Main | P2594 | 11235 Cameron Ave | $1,169.71 | 23 | 8 | 2000 | 312 | 2-Low | CCTV | 3 |
| Gravity Main | P4872 | 3985 River Ridge Ct | $605.59 | 23 | 8 | 1990 | 161 | 2-Low | CCTV | 3 |
| Gravity Main | P2389 | 5850-5900 Country View Dr | $1,197.12 | 23 | 8 | 1992 | 319 | 2-Low | CCTV | 3 |
| Gravity Main | P2696 | 11515 Cameron Ave | $1,267.82 | 23 | 8 | 2000 | 338 | 2-Low | CCTV | 3 |
| Gravity Main | P2692 | 11553-11439 Rosewood Ave | $1,243.02 | 23 | 8 | 1990 | 331 | 2-Low | CCTV | 3 |
| Gravity Main | P1079 | 11575 Spruce View Dr | $725.35 | 23 | 8 | 2003 | 193 | 2-Low | CCTV | 3 |
| Gravity Main | P4340 | 10929-10975 48th Ave | $1,241.92 | 22 | 12 | 1987 | 331 | 2-Low | CCTV | 3 |
| Gravity Main | P9600 | 11342 Brown St | $785.85 | 22 | 8 | 1992 | 210 | 2-Low | CCTV | 3 |
| Gravity Main | P2789 | 11453-11463 Prairie Ave | $307.08 | 22 | 8 | 1990 | 82 | 2-Low | CCTV | 3 |
| Manhole | 5142 | 11613 48th Ave | $535.60 | 22 | 0 | 1991 | 0 | 2-Low | MH Inspection | 4 |
| Manhole | 5351 | 11761 46th Ave | $535.60 | 22 | 0 | 1991 | 0 | 2-Low | MH Inspection | 4 |
| Manhole | 1085 | 5995 Frostline Dr | $535.60 | 22 | 0 | 1990 | 0 | 2-Low | MH Inspection | 4 |
| Manhole | 1784 | 5884 Maple Bend Trl | $535.60 | 22 | 0 | 1998 | 0 | 2-Low | MH Inspection | 4 |
| Manhole | 1825 | 10821 Timberline Dr | $535.60 | 22 | 0 | 1996 | 0 | 2-Low | MH Inspection | 4 |
| Manhole | 4810 | Edgewater Dr | $535.60 | 22 | 0 | 2000 | 0 | 2-Low | MH Inspection | 4 |
| Manhole | 4811 | 11327 Edgewater Dr | $535.60 | 22 | 0 | 2000 | 0 | 2-Low | MH Inspection | 4 |
| Manhole | 1990 | 10901 Melanie Dr | $535.60 | 22 | 0 | 2000 | 0 | 2-Low | MH Inspection | 4 |
| Manhole | 2093 | 5727 Mary Eliz Dr | $535.60 | 22 | 0 | 2000 | 0 | 2-Low | MH Inspection | 4 |
| Manhole | 2095 | 10801 Mary Eliz Ct | $535.60 | 22 | 0 | 2000 | 0 | 2-Low | MH Inspection | 4 |
| Manhole | 2096 | 10965 Melanie Dr | $535.60 | 22 | 0 | 2000 | 0 | 2-Low | MH Inspection | 4 |
| Manhole | 1127 | 11149 54th Ave | $535.60 | 21 | 0 | 2000 | 0 | 2-Low | MH Inspection | 4 |
| Manhole | 4814 | 5200 Edgewater Dr | $535.60 | 21 | 0 | 2000 | 0 | 2-Low | MH Inspection | 4 |
| Manhole | 4910 | 11291 54th Ave | $535.60 | 21 | 0 | 2000 | 0 | 2-Low | MH Inspection | 4 |
| Manhole | 5010 | 11671 54th Ave | $535.60 | 21 | 0 | 2000 | 0 | 2-Low | MH Inspection | 4 |
| Manhole | 2226 | 11122 Creekside Ct | $535.60 | 21 | 0 | 2004 | 0 | 2-Low | MH Inspection | 4 |
| Manhole | 4408 | 10959 Lance Ave | $535.60 | 21 | 0 | 2005 | 0 | 2-Low | MH Inspection | 4 |
| Manhole | 4409 | 5158 Jordan St | $535.60 | 21 | 0 | 2000 | 0 | 2-Low | MH Inspection | 4 |
| Manhole | 9002 | 7050 Pinevalley Dr | $535.60 | 21 | 0 | 1996 | 0 | 2-Low | MH Inspection | 4 |
| Manhole | 1916 | 7243 Pinevalley Dr | $535.60 | 21 | 0 | 2004 | 0 | 2-Low | MH Inspection | 4 |
| Gravity Main | P3840 | 10489-10561 48th Ave | $1,176.41 | 20 | 10 | 2001 | 314 | 2-Low | CCTV | 3 |
| Gravity Main | P3832 | 10511 Country Pl W | $1,288.60 | 20 | 10 | 1997 | 344 | 2-Low | CCTV | 3 |
| Gravity Main | P4980 | 11428 Cadence Ct | $1,017.24 | 20 | 10 | 1990 | 271 | 2-Low | CCTV | 3 |
| Gravity Main | P1115 | 10445 48th Ave | $799.81 | 20 | 10 | 2001 | 213 | 2-Low | CCTV | 3 |
| Gravity Main | P3834 | 4912 Country Pl N | $966.51 | 20 | 10 | 1997 | 258 | 2-Low | CCTV | 3 |
| Gravity Main | P1114 | 10445-10471 48th Ave | $325.92 | 20 | 10 | 2001 | 87 | 2-Low | CCTV | 3 |
| Gravity Main | P4981 | 3927 Ravine Dr | $442.36 | 20 | 8 | 1990 | 118 | 2-Low | CCTV | 3 |
| Gravity Main | P4654 | 4477 Lake Michigan Dr | $313.21 | 20 | 8 | 1990 | 84 | 2-Low | CCTV | 3 |
| Gravity Main | P4650 | 4565 Lake Michigan Dr | $1,061.90 | 20 | 8 | 1990 | 283 | 2-Low | CCTV | 3 |
| Gravity Main | P4874 | 11375 River Ridge Dr | $1,103.71 | 20 | 8 | 1990 | 294 | 2-Low | CCTV | 3 |
| Gravity Main | P1136 | 11378-11368 48th Ave | $722.29 | 20 | 8 | 2000 | 193 | 2-Low | CCTV | 3 |
| Gravity Main | P1135 | 11368-11410 48th Ave | $795.04 | 20 | 8 | 2000 | 212 | 2-Low | CCTV | 3 |
| Gravity Main | P1126 | 4477-4473 Lake Michigan Dr | $796.11 | 20 | 8 | 1990 | 212 | 2-Low | CCTV | 3 |

**Table K-2. Collection System Maintenance Summary Table: 3-5 Year**

| Asset | ID | Address | Total Cost | Normalized Risk | Size (in) | Year Constructed | Length (ft) | Risk (By Grading) | Rehab Actions | Year |
|---|---|---|---|---|---|---|---|---|---|---|
| Gravity Main | P4875 | 3962-3934 Ravine Dr | $683.29 | 20 | 8 | 1990 | 182 | 2-Low | CCTV | 3 |
| Gravity Main | P4873 | 11335 River Ridge Dr | $1,136.86 | 20 | 8 | 1990 | 303 | 2-Low | CCTV | 3 |
| Gravity Main | P4653 | 4477 Lake Michigan Dr | $378.01 | 20 | 8 | 1990 | 101 | 2-Low | CCTV | 3 |
| Gravity Main | P3635 | 4997-5013 Pierce St | $610.69 | 19 | 8 | 2014 | 163 | 2-Low | CCTV | 3 |
| Gravity Main | P3634 | 5013 Pierce St | $220.42 | 19 | 8 | 2014 | 59 | 2-Low | CCTV | 3 |
| Gravity Main | P3631 | 5045 Pierce St | $208.93 | 19 | 8 | 2014 | 56 | 2-Low | CCTV | 3 |
| Gravity Main | P1821 | 10836 Timberline Dr | $246.95 | 19 | 8 | 2008 | 66 | 2-Low | CCTV | 3 |
| Manhole | 1821 | 10807 Timberline Dr | $535.60 | 19 | 0 | 1996 | 0 | 2-Low | MH Inspection | 4 |
| Manhole | 4617 | 5270 Lake Michigan Dr | $535.60 | 19 | 0 | 2001 | 0 | 2-Low | MH Inspection | 4 |
| Manhole | 2021 | 7173 Timbercreek Dr | $535.60 | 19 | 0 | 2004 | 0 | 2-Low | MH Inspection | 4 |
| Manhole | 2026 | 10979 Timberline Dr | $535.60 | 19 | 0 | 1996 | 0 | 2-Low | MH Inspection | 4 |
| Manhole | 2027 | 10929 Timberline Dr | $535.60 | 19 | 0 | 1996 | 0 | 2-Low | MH Inspection | 4 |
| Manhole | 2695 | 5702 Crabtree St | $535.60 | 19 | 0 | 2000 | 0 | 2-Low | MH Inspection | 4 |
| Manhole | 3624 | 5083 Pierce St | $535.60 | 19 | 0 | 2006 | 0 | 2-Low | MH Inspection | 4 |
| Manhole | 4931 | 4896 Allenpark Dr | $535.60 | 19 | 0 | 2001 | 0 | 2-Low | MH Inspection | 4 |
| Manhole | 1125 | 10963 52nd Ave | $535.60 | 19 | 0 | 2005 | 0 | 2-Low | MH Inspection | 4 |
| Manhole | 1130 | 11239 Whispering Creek Dr | $535.60 | 19 | 0 | 2012 | 0 | 2-Low | MH Inspection | 4 |
| Gravity Main | P2450 | 6561 Lake Michigan Dr | $261.58 | 19 | 8 | 1990 | 70 | 2-Low | CCTV | 3 |
| Gravity Main | P4878 | 11375-11377 40th Ave | $379.45 | 19 | 8 | 1990 | 101 | 2-Low | CCTV | 3 |
| Gravity Main | P4539 | 4868-4850 Lake Michigan Dr | $1,429.28 | 19 | 8 | 2001 | 381 | 2-Low | CCTV | 3 |
| Gravity Main | P2492 | 5677-5673 Lake Michigan Dr | $388.11 | 19 | 8 | 2000 | 103 | 2-Low | CCTV | 3 |
| Gravity Main | P4877 | 11377-11405 40th Ave | $516.24 | 19 | 8 | 1990 | 138 | 2-Low | CCTV | 3 |
| Gravity Main | P2246 | 6676 Lake Michigan Dr | $1,023.58 | 19 | 8 | 1992 | 273 | 2-Low | CCTV | 3 |
| Gravity Main | P1080 | 11562-11547 Spruce View Dr | $688.69 | 19 | 8 | 2003 | 184 | 2-Low | CCTV | 3 |
| Gravity Main | P2490 | 5737-5673 Lake Michigan Dr | $1,603.46 | 19 | 18 | 1990 | 428 | 2-Low | CCTV | 3 |
| Gravity Main | P3860 | 10507 Laker Village Dr | $1,327.52 | 19 | 12 | 1963 | 354 | 2-Low | CCTV | 3 |
| Gravity Main | P3516 | 5256 Pierce St | $135.23 | 19 | 8 | 2015 | 36 | 2-Low | CCTV | 3 |
| Gravity Main | P3816 | 10518-10564 Rockfield Rd | $817.71 | 19 | 8 | 2013 | 218 | 2-Low | CCTV | 3 |
| Gravity Main | P4425 | 10999-10975 Woodedge Dr | $1,041.54 | 19 | 8 | 2005 | 278 | 2-Low | CCTV | 3 |
| Gravity Main | P4325 | 10890-10811 Woodedge Dr | $160.29 | 19 | 8 | 2005 | 43 | 2-Low | CCTV | 3 |
| Gravity Main | P4424 | 5104 Jordan St | $163.01 | 19 | 8 | 2005 | 43 | 2-Low | CCTV | 3 |
| Gravity Main | P3625 | 5050-5083 Pierce St | $95.20 | 19 | 8 | 2014 | 25 | 2-Low | CCTV | 3 |
| Gravity Main | P4426 | 10963 Woodedge Dr | $1,162.21 | 19 | 8 | 2005 | 310 | 2-Low | CCTV | 3 |
| Gravity Main | P4321 | 5182 Circleview Dr | $693.92 | 19 | 8 | 2005 | 185 | 2-Low | CCTV | 3 |
| Gravity Main | P4423 | 5146 Jordan St | $1,534.06 | 19 | 8 | 2005 | 409 | 2-Low | CCTV | 3 |
| Gravity Main | P1131 | .266-11239 Whispering Creek | $297.93 | 19 | 8 | 2012 | 79 | 2-Low | CCTV | 3 |
| Gravity Main | P4747 | .253-11239 Whispering Creek | $421.01 | 19 | 8 | 2012 | 112 | 2-Low | CCTV | 3 |
| Gravity Main | P1129 | 11301 Commerce Rd | $495.30 | 19 | 5 | 2001 | 132 | 2-Low | CCTV | 3 |
| Gravity Main | P1128 | 11301 Commerce Rd | $299.43 | 19 | 5 | 2001 | 80 | 2-Low | CCTV | 3 |
| Gravity Main | P4427 | 5149 Woodedge Ct | $928.63 | 19 | 8 | 2005 | 248 | 2-Low | CCTV | 3 |
| Gravity Main | P2446 | 6545-6561 Lake Michigan Dr | $650.33 | 19 | 6 | 1990 | 173 | 2-Low | CCTV | 3 |
| Gravity Main | P4322 | 10909 Circle Way | $1,136.39 | 19 | 8 | 2005 | 303 | 2-Low | CCTV | 3 |
| Gravity Main | P9705 | 5360 Windfield Dr | $342.66 | 19 | 8 | 2006 | 91 | 2-Low | CCTV | 3 |
| Gravity Main | P1130 | .239-11277 Whispering Creek | $81.13 | 19 | 8 | 2012 | 22 | 2-Low | CCTV | 3 |
| Gravity Main | P4323 | 5103-5163 Circleview Dr | $1,059.04 | 19 | 8 | 2005 | 282 | 2-Low | CCTV | 3 |
| Gravity Main | P3612 | 5399 Pierce St | $198.14 | 19 | 8 | 2015 | 53 | 2-Low | CCTV | 3 |
| Gravity Main | P4324 | 10883 Woodedge Dr | $1,069.46 | 19 | 8 | 2005 | 285 | 2-Low | CCTV | 3 |
| Gravity Main | P4326 | 5150 Circlewood Ln | $820.54 | 19 | 8 | 2005 | 219 | 2-Low | CCTV | 3 |
| Gravity Main | P9611 | 10520-10517 52nd Ave | $181.73 | 19 | 8 | 2006 | 48 | 2-Low | CCTV | 3 |
| Gravity Main | P9502 | 4999-4991 Allenpark Dr | $345.71 | 19 | 8 | 2016 | 92 | 2-Low | CCTV | 3 |
| Manhole | 1057 | Hawkin St | $535.60 | 18 | 0 | 2016 | 0 | 2-Low | MH Inspection | 4 |
| Manhole | 5040 | 11443 48th Ave | $535.60 | 18 | 0 | 1991 | 0 | 2-Low | MH Inspection | 4 |
| Manhole | 5041 | 11483 48th Ave | $535.60 | 18 | 0 | 1991 | 0 | 2-Low | MH Inspection | 4 |
| Manhole | 5141 | 4802 Rich St | $535.60 | 18 | 0 | 1991 | 0 | 2-Low | MH Inspection | 4 |
| Manhole | 5146 | 4726 Rich St | $535.60 | 18 | 0 | 1991 | 0 | 2-Low | MH Inspection | 4 |
| Manhole | 5147 | 4702 Rich St | $535.60 | 18 | 0 | 1991 | 0 | 2-Low | MH Inspection | 4 |
| Manhole | 2227 | 11057 Creekside Dr | $535.60 | 18 | 0 | 2004 | 0 | 2-Low | MH Inspection | 4 |
| Manhole | 4514 | 5402 Eric St | $535.60 | 18 | 0 | 2000 | 0 | 2-Low | MH Inspection | 4 |

| Table K-2. Collection System Maintenance Summary Table: 3-5 Year | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Asset | ID | Address | Total Cost | Normalized Risk | Size (in) | Year Constructed | Length (ft) | Risk (By Grading) | Rehab Actions | Year |
| Manhole | 2495 | 5680 Lake Michigan Dr | $535.60 | 18 | 0 | 1992 | 0 | 2-Low | MH Inspection | 4 |
| Manhole | 4800 | 11307 56th Ave | $535.60 | 18 | 0 | 1992 | 0 | 2-Low | MH Inspection | 4 |
| Manhole | 4801 | 11363 56th Ave | $535.60 | 18 | 0 | 1992 | 0 | 2-Low | MH Inspection | 4 |
| Manhole | 2403 | 8011 Lake Michigan Dr | $535.60 | 18 | 0 | 2007 | 0 | 2-Low | MH Inspection | 4 |
| Manhole | 1045 | 7145 Pinevalley Dr | $535.60 | 18 | 0 | 2004 | 0 | 2-Low | MH Inspection | 4 |
| Manhole | 1046 | 7128 Pinevalley Dr | $535.60 | 18 | 0 | 2004 | 0 | 2-Low | MH Inspection | 4 |
| Manhole | 1047 | 7102 Pinevalley Dr | $535.60 | 18 | 0 | 2004 | 0 | 2-Low | MH Inspection | 4 |
| Manhole | 1826 | 7055 Sunset Dr | $535.60 | 18 | 0 | 1996 | 0 | 2-Low | MH Inspection | 4 |
| Manhole | 1918 | 7187 Pinevalley Dr | $535.60 | 18 | 0 | 2004 | 0 | 2-Low | MH Inspection | 4 |
| Manhole | 2369 | 6098 Lake Michigan Dr | $535.60 | 18 | 0 | 2000 | 0 | 2-Low | MH Inspection | 4 |
| Manhole | 4602 | 5500 Lake Michigan Dr | $535.60 | 18 | 0 | 2001 | 0 | 2-Low | MH Inspection | 4 |
| Manhole | 2094 | 10931 Mary Eliz Ct | $535.60 | 18 | 0 | 2000 | 0 | 2-Low | MH Inspection | 4 |
| Manhole | 4201 | 10835 Lance Ave | $535.60 | 18 | 0 | 2005 | 0 | 2-Low | MH Inspection | 4 |
| Manhole | 4212 | 5305 Sunshine St | $535.60 | 18 | 0 | 2004 | 0 | 2-Low | MH Inspection | 4 |
| Manhole | 4213 | 5351 Sunshine St | $535.60 | 18 | 0 | 2005 | 0 | 2-Low | MH Inspection | 4 |
| Manhole | 4311 | 10807 Jordan Ct | $535.60 | 18 | 0 | 2000 | 0 | 2-Low | MH Inspection | 4 |
| Manhole | 4404 | 5194 Jordan St | $535.60 | 18 | 0 | 2000 | 0 | 2-Low | MH Inspection | 4 |
| Manhole | 4503 | 5596 Eric St | $535.60 | 18 | 0 | 2000 | 0 | 2-Low | MH Inspection | 4 |
| Manhole | 4504 | 5566 Eric St | $535.60 | 18 | 0 | 2000 | 0 | 2-Low | MH Inspection | 4 |
| Manhole | 4505 | 5502 Eric St | $535.60 | 18 | 0 | 2000 | 0 | 2-Low | MH Inspection | 4 |
| Manhole | 1789 | 5807 Horizon Ln | $535.60 | 18 | 0 | 1998 | 0 | 2-Low | MH Inspection | 4 |
| Manhole | 1827 | 7005 Sunset Dr | $535.60 | 18 | 0 | 1996 | 0 | 2-Low | MH Inspection | 4 |
| Manhole | 1880 | 10789 Tallpine Ln | $535.60 | 18 | 0 | 1998 | 0 | 2-Low | MH Inspection | 4 |
| Manhole | 1923 | 10911 Skylane Ct | $535.60 | 18 | 0 | 2004 | 0 | 2-Low | MH Inspection | 4 |
| Manhole | 2696 | 11599 Cameron Ave | $535.60 | 18 | 0 | 2000 | 0 | 2-Low | MH Inspection | 4 |
| Manhole | 4411 | 10991 Jordan Ct | $535.60 | 18 | 0 | 2000 | 0 | 2-Low | MH Inspection | 4 |
| Manhole | 4412 | 5304 Jordan St | $535.60 | 18 | 0 | 2004 | 0 | 2-Low | MH Inspection | 4 |
| Manhole | 4413 | 5292 Jordan St | $535.60 | 18 | 0 | 2004 | 0 | 2-Low | MH Inspection | 4 |
| Manhole | 4419 | 10985 Douglas Dr | $535.60 | 18 | 0 | 2004 | 0 | 2-Low | MH Inspection | 4 |
| Manhole | 4930 | 4991 Allenpark Dr | $535.60 | 18 | 0 | 2001 | 0 | 2-Low | MH Inspection | 4 |
| Manhole | 1520 | Pleasant View Ct | $535.60 | 18 | 0 | 2008 | 0 | 2-Low | MH Inspection | 4 |
| Manhole | 3920 | 10621 52nd Ave | $535.60 | 18 | 0 | 2006 | 0 | 2-Low | MH Inspection | 4 |
| Manhole | 3921 | 10657 52nd Ave | $535.60 | 18 | 0 | 2006 | 0 | 2-Low | MH Inspection | 4 |
| Manhole | 4326 | 5176 Circlewood Ln | $535.60 | 18 | 0 | 2005 | 0 | 2-Low | MH Inspection | 4 |
| Manhole | 5284 | 11654 40th Ave | $535.60 | 18 | 0 | 2000 | 0 | 2-Low | MH Inspection | 4 |
| Manhole | 2252 | 6342 Henry St | $535.60 | 18 | 0 | 2008 | 0 | 2-Low | MH Inspection | 4 |
| Manhole | 4707 | 5405 Auto Ct | $535.60 | 18 | 0 | 2001 | 0 | 2-Low | MH Inspection | 4 |
| Manhole | 3610 | 5392 Pierce St | $535.60 | 18 | 0 | 2015 | 0 | 2-Low | MH Inspection | 4 |
| Manhole | 3611 | Mystic Wds | $535.60 | 18 | 0 | 2015 | 0 | 2-Low | MH Inspection | 4 |
| Manhole | 3618 | 5310 Pierce St | $535.60 | 18 | 0 | 2015 | 0 | 2-Low | MH Inspection | 4 |
| Manhole | 1043 | 11051 Pinecreek Ct | $535.60 | 18 | 0 | 2004 | 0 | 2-Low | MH Inspection | 4 |
| Manhole | 1073 | 7360 Valley View Ct | $535.60 | 18 | 0 | 2000 | 0 | 2-Low | MH Inspection | 4 |
| Manhole | 1680 | 10675 Tallpine Ln | $535.60 | 18 | 0 | 1998 | 0 | 2-Low | MH Inspection | 4 |
| Manhole | 2090 | 10962 Gayle Ln | $535.60 | 18 | 0 | 2000 | 0 | 2-Low | MH Inspection | 4 |
| Manhole | 4215 | 5421 Sunshine St | $535.60 | 18 | 0 | 2005 | 0 | 2-Low | MH Inspection | 4 |
| Manhole | 4216 | 10801 Douglas Dr | $535.60 | 18 | 0 | 2004 | 0 | 2-Low | MH Inspection | 4 |
| Manhole | 4217 | 10745 Douglas Dr | $535.60 | 18 | 0 | 2004 | 0 | 2-Low | MH Inspection | 4 |
| Manhole | 4301 | 10925 Lance Ave | $535.60 | 18 | 0 | 2005 | 0 | 2-Low | MH Inspection | 4 |
| Manhole | 4313 | 10921 Douglas Dr | $535.60 | 18 | 0 | 2004 | 0 | 2-Low | MH Inspection | 4 |
| Manhole | 4405 | 10993 Lance Ave | $535.60 | 18 | 0 | 2005 | 0 | 2-Low | MH Inspection | 4 |
| Manhole | 4406 | 10987 Lance Ave | $535.60 | 18 | 0 | 2005 | 0 | 2-Low | MH Inspection | 4 |
| Manhole | 4423 | 5188 Jordan St | $535.60 | 18 | 0 | 2005 | 0 | 2-Low | MH Inspection | 4 |
| Manhole | 1964 | 10873 Constant Dr | $535.60 | 18 | 0 | 2004 | 0 | 2-Low | MH Inspection | 4 |
| Manhole | 2202 | 7546 Waterline Dr | $535.60 | 18 | 0 | 2005 | 0 | 2-Low | MH Inspection | 4 |
| Manhole | 2203 | 7508 Waterline Dr | $535.60 | 18 | 0 | 2005 | 0 | 2-Low | MH Inspection | 4 |
| Manhole | 2204 | 7534 Waterline Dr | $535.60 | 18 | 0 | 2005 | 0 | 2-Low | MH Inspection | 4 |
| Manhole | 2205 | 7596 Waterline Dr | $535.60 | 18 | 0 | 2005 | 0 | 2-Low | MH Inspection | 4 |
| Manhole | 2307 | 7444 Waterline Dr | $535.60 | 18 | 0 | 2005 | 0 | 2-Low | MH Inspection | 4 |

| Table K-2. Collection System Maintenance Summary Table: 3-5 Year | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Asset | ID | Address | Total Cost | Normalized Risk | Size (in) | Year Constructed | Length (ft) | Risk (By Grading) | Rehab Actions | Year |
| Manhole | 2308 | 7408 Waterline Dr | $535.60 | 18 | 0 | 2005 | 0 | 2-Low | MH Inspection | 4 |
| Manhole | 2975 | 11698 Wilmington Dr | $535.60 | 18 | 0 | 2006 | 0 | 2-Low | MH Inspection | 4 |
| Manhole | 2976 | 11691 Wilmington Dr | $535.60 | 18 | 0 | 2006 | 0 | 2-Low | MH Inspection | 4 |
| Manhole | 1523 | 10809 Timberline Dr | $535.60 | 18 | 0 | 2008 | 0 | 2-Low | MH Inspection | 4 |
| Manhole | 1620 | 10815 Timberline Dr | $535.60 | 18 | 0 | 2008 | 0 | 2-Low | MH Inspection | 4 |
| Manhole | 4748 | 11277 Whispering Creek Dr | $535.60 | 18 | 0 | 2012 | 0 | 2-Low | MH Inspection | 4 |
| Gravity Main | P2252 | 6342-6402 Henry St | $839.64 | 18 | 8 | 2008 | 224 | 2-Low | CCTV | 3 |
| Gravity Main | P4746 | 11253 Whispering Creek Dr | $246.54 | 18 | 8 | 2012 | 66 | 2-Low | CCTV | 3 |
| Gravity Main | P1044 | 11099-11051 Pinecreek Ct | $738.27 | 18 | 8 | 2004 | 197 | 2-Low | CCTV | 3 |
| Gravity Main | P4745 | 11253 Whispering Creek Dr | $433.78 | 18 | 8 | 2012 | 116 | 2-Low | CCTV | 3 |
| Gravity Main | P4871 | 11276-11299 40th Ave | $1,163.01 | 18 | 8 | 1990 | 310 | 2-Low | CCTV | 3 |
| Gravity Main | P4870 | 11253-11276 40th Ave | $1,083.45 | 18 | 8 | 1990 | 289 | 2-Low | CCTV | 3 |
| Gravity Main | P4629 | 5180 Lake Michigan Dr | $1,448.69 | 18 | 8 | 2012 | 386 | 2-Low | CCTV | 3 |
| Gravity Main | P1043 | 11010 Pinecreek Ct | $805.30 | 18 | 8 | 2004 | 215 | 2-Low | CCTV | 3 |
| Gravity Main | P9518 | 11266 Whispering Creek Dr | $553.05 | 18 | 8 | 2012 | 147 | 2-Low | CCTV | 3 |
| Manhole | 1924 | 10989 Skylane Ct | $535.60 | 18 | 0 | 2004 | 0 | 2-Low | MH Inspection | 4 |
| Manhole | 1925 | 7002 Pinevalley Dr | $535.60 | 18 | 0 | 1996 | 0 | 2-Low | MH Inspection | 4 |
| Manhole | 3721 | 10517 52nd Ave | $535.60 | 18 | 0 | 2006 | 0 | 2-Low | MH Inspection | 4 |
| Manhole | 4220 | 10855 52nd Ave | $535.60 | 18 | 0 | 2006 | 0 | 2-Low | MH Inspection | 4 |
| Gravity Main | P9500 | 10545-10555 Laker Village Dr | $229.96 | 17 | 12 | 1963 | 61 | 2-Low | CCTV | 3 |
| Manhole | 1785 | 5863 Maple Bend Trl | $535.60 | 17 | 0 | 1998 | 0 | 2-Low | MH Inspection | 4 |
| Manhole | 1786 | 5841 Maple Bend Trl | $535.60 | 17 | 0 | 1998 | 0 | 2-Low | MH Inspection | 4 |
| Manhole | 1787 | 5800 Maple Bend Trl | $535.60 | 17 | 0 | 1998 | 0 | 2-Low | MH Inspection | 4 |
| Manhole | 4834 | 4998 Allenpark Dr | $535.60 | 16 | 0 | 2015 | 0 | 2-Low | MH Inspection | 4 |
| Gravity Main | P3632 | 5045 Pierce St | $361.34 | 16 | 8 | 2014 | 96 | 2-Low | CCTV | 3 |
| Gravity Main | P3737 | Hillcrest Town Houses | $1,308.94 | 16 | 8 | 2014 | 349 | 2-Low | CCTV | 3 |
| Gravity Main | P3736 | 4967 Pierce St | $1,316.42 | 16 | 8 | 2014 | 351 | 2-Low | CCTV | 3 |
| Gravity Main | P3735 | 4967-5045 Pierce St | $1,308.88 | 16 | 8 | 2014 | 349 | 2-Low | CCTV | 3 |
| Gravity Main | P3830 | Campus West Apartments | $1,141.83 | 16 | 8 | 2014 | 304 | 2-Low | CCTV | 3 |
| Gravity Main | P3738 | Hillcrest Town Houses | $1,314.40 | 16 | 8 | 2014 | 351 | 2-Low | CCTV | 3 |
| Gravity Main | P3831 | 4964 Country Pl S | $1,348.09 | 16 | 8 | 2014 | 359 | 2-Low | CCTV | 3 |
| Gravity Main | P4849 | 4737 Ottawa Creek Dr | $1,523.79 | 16 | 8 | 2012 | 406 | 2-Low | CCTV | 3 |
| Gravity Main | P1132 | 4616-4614 Ottawa Creek Dr | $37.29 | 16 | 8 | 2012 | 10 | 2-Low | CCTV | 3 |
| Gravity Main | P4853 | 4687 Ottawa Creek Dr | $453.76 | 16 | 8 | 2012 | 121 | 2-Low | CCTV | 3 |
| Gravity Main | P4850 | 4657-4616 Ottawa Creek Dr | $554.42 | 16 | 8 | 2012 | 148 | 2-Low | CCTV | 3 |
| Gravity Main | P4852 | 4683 Ottawa Creek Dr | $710.81 | 16 | 8 | 2012 | 190 | 2-Low | CCTV | 3 |
| Manhole | 5140 | 11565 48th Ave | $535.60 | 15 | 0 | 1991 | 0 | 2-Low | MH Inspection | 4 |
| Manhole | 2224 | 11127 Creekside Ct | $535.60 | 15 | 0 | 2004 | 0 | 2-Low | MH Inspection | 4 |
| Manhole | 2772 | 11525 60th Ave | $535.60 | 15 | 0 | 1990 | 0 | 2-Low | MH Inspection | 4 |
| Manhole | 4802 | 11417 56th Ave | $535.60 | 15 | 0 | 1992 | 0 | 2-Low | MH Inspection | 4 |
| Manhole | 1919 | 7163 Pinevalley Dr | $535.60 | 15 | 0 | 2004 | 0 | 2-Low | MH Inspection | 4 |
| Manhole | 3534 | Copper Beech Townhomes | $535.60 | 15 | 0 | 2005 | 0 | 2-Low | MH Inspection | 4 |
| Manhole | 3627 | 5084 Pierce St | $535.60 | 15 | 0 | 2014 | 0 | 2-Low | MH Inspection | 4 |
| Manhole | 1820 | 10829 Timberline Dr | $535.60 | 15 | 0 | 2008 | 0 | 2-Low | MH Inspection | 4 |
| Manhole | 4324 | 10811 Woodedge Dr | $535.60 | 15 | 0 | 2005 | 0 | 2-Low | MH Inspection | 4 |
| Manhole | 4424 | 5110 Jordan St | $535.60 | 15 | 0 | 2005 | 0 | 2-Low | MH Inspection | 4 |
| Manhole | 2366 | 6154 Lake Michigan Dr | $535.60 | 15 | 0 | 2000 | 0 | 2-Low | MH Inspection | 4 |
| Manhole | 2367 | 6164 Lake Michigan Dr | $535.60 | 15 | 0 | 2000 | 0 | 2-Low | MH Inspection | 4 |
| Manhole | 5357 | 4375 Pingree St | $535.60 | 15 | 0 | 1991 | 0 | 2-Low | MH Inspection | 4 |
| Manhole | 1992 | 10803 Melanie Dr | $535.60 | 15 | 0 | 2000 | 0 | 2-Low | MH Inspection | 4 |
| Manhole | 2020 | 7219 Timbercreek Dr | $535.60 | 15 | 0 | 2004 | 0 | 2-Low | MH Inspection | 4 |
| Manhole | 2022 | 7158 Timbercreek Dr | $535.60 | 15 | 0 | 2004 | 0 | 2-Low | MH Inspection | 4 |
| Manhole | 2023 | 7144 Timbercreek Dr | $535.60 | 15 | 0 | 2004 | 0 | 2-Low | MH Inspection | 4 |
| Manhole | 2024 | 7130 Timbercreek Dr | $535.60 | 15 | 0 | 2004 | 0 | 2-Low | MH Inspection | 4 |
| Manhole | 2025 | 7100 Timbercreek Dr | $535.60 | 15 | 0 | 1996 | 0 | 2-Low | MH Inspection | 4 |
| Manhole | 2220 | 11093 Timberline Dr | $535.60 | 15 | 0 | 1996 | 0 | 2-Low | MH Inspection | 4 |
| Manhole | 2221 | 11185 Timberline Dr | $535.60 | 15 | 0 | 2004 | 0 | 2-Low | MH Inspection | 4 |
| Manhole | 2306 | 7478 Waterline Dr | $535.60 | 15 | 0 | 2005 | 0 | 2-Low | MH Inspection | 4 |

| Table K-2. Collection System Maintenance Summary Table: 3-5 Year | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Asset | ID | Address | Total Cost | Normalized Risk | Size (in) | Year Constructed | Length (ft) | Risk (By Grading) | Rehab Actions | Year |
| Manhole | 2532 | 7198 Valley View Ct | $535.60 | 15 | 0 | 2000 | 0 | 2-Low | MH Inspection | 4 |
| Manhole | 2592 | 5720 Victoria St | $535.60 | 15 | 0 | 2000 | 0 | 2-Low | MH Inspection | 4 |
| Manhole | 2593 | 5710 Victoria St | $535.60 | 15 | 0 | 2000 | 0 | 2-Low | MH Inspection | 4 |
| Manhole | 2594 | 11275 Cameron Ave | $535.60 | 15 | 0 | 2000 | 0 | 2-Low | MH Inspection | 4 |
| Manhole | 2693 | 11385 Cameron Ave | $535.60 | 15 | 0 | 2000 | 0 | 2-Low | MH Inspection | 4 |
| Manhole | 2694 | 5732 Crabtree St | $535.60 | 15 | 0 | 2000 | 0 | 2-Low | MH Inspection | 4 |
| Manhole | 2882 | 11587 Brookland Ct | $535.60 | 15 | 0 | 2003 | 0 | 2-Low | MH Inspection | 4 |
| Manhole | 3630 | 5045 Pierce St | $535.60 | 15 | 0 | 2008 | 0 | 2-Low | MH Inspection | 4 |
| Manhole | 3633 | 5013 Pierce St | $535.60 | 15 | 0 | 2007 | 0 | 2-Low | MH Inspection | 4 |
| Manhole | 3636 | 4986 Pierce St | $535.60 | 15 | 0 | 2008 | 0 | 2-Low | MH Inspection | 4 |
| Manhole | 4312 | 10963 Douglas Dr | $535.60 | 15 | 0 | 2004 | 0 | 2-Low | MH Inspection | 4 |
| Manhole | 4410 | 5102 Jordan St | $535.60 | 15 | 0 | 2004 | 0 | 2-Low | MH Inspection | 4 |
| Manhole | 1724 | 10633 White Birch Dr | $535.60 | 15 | 0 | 2008 | 0 | 2-Low | MH Inspection | 4 |
| Manhole | 4320 | 10913 52nd Ave | $535.60 | 15 | 0 | 2005 | 0 | 2-Low | MH Inspection | 4 |
| Manhole | 5285 | 11717 40th Ave | $535.60 | 15 | 0 | 2000 | 0 | 2-Low | MH Inspection | 4 |
| Manhole | 1824 | 7192 Pine Grove St | $535.60 | 15 | 0 | 2004 | 0 | 2-Low | MH Inspection | 4 |
| Manhole | 2092 | 5670 Mary Eliz Dr | $535.60 | 15 | 0 | 2000 | 0 | 2-Low | MH Inspection | 4 |
| Manhole | 2222 | 11178 Creekside Dr | $535.60 | 15 | 0 | 2004 | 0 | 2-Low | MH Inspection | 4 |
| Manhole | 1721 | 10825 Timberline Dr | $535.60 | 15 | 0 | 2008 | 0 | 2-Low | MH Inspection | 4 |
| Gravity Main | P1099 | 10500-10518 Rockfield Rd | $576.03 | 15 | 8 | 2013 | 154 | 2-Low | CCTV | 3 |
| Gravity Main | P4652 | 4473-4427 Lake Michigan Dr | $879.80 | 15 | 8 | 1990 | 235 | 2-Low | CCTV | 3 |
| Gravity Main | P4651 | 4535-4473 Lake Michigan Dr | $1,261.05 | 15 | 8 | 1990 | 336 | 2-Low | CCTV | 3 |
| Gravity Main | P2974 | Norfolk Dr | $1,373.12 | 15 | 8 | 2006 | 366 | 2-Low | CCTV | 3 |
| Gravity Main | P3616 | 5313-5343 Pierce St | $748.02 | 15 | 8 | 2015 | 199 | 2-Low | CCTV | 3 |
| Gravity Main | P4836 | 4926 Allenpark Dr | $893.53 | 15 | 8 | 2015 | 238 | 2-Low | CCTV | 3 |
| Gravity Main | P3617 | 5269-5313 Pierce St | $1,008.74 | 15 | 8 | 2015 | 269 | 2-Low | CCTV | 3 |
| Gravity Main | P4833 | Becker Dr | $703.99 | 15 | 8 | 2015 | 188 | 2-Low | CCTV | 3 |
| Gravity Main | P2973 | Norfolk Dr | $301.55 | 15 | 8 | 2006 | 80 | 2-Low | CCTV | 3 |
| Gravity Main | P1100 | 5401 Pierce St | $976.46 | 15 | 8 | 2013 | 260 | 2-Low | CCTV | 3 |
| Gravity Main | P1105 | Southtown Dr | $793.63 | 15 | 8 | 2007 | 212 | 2-Low | CCTV | 3 |
| Gravity Main | P4832 | 11238 Sugarloaf Ave | $267.21 | 15 | 8 | 2015 | 71 | 2-Low | CCTV | 3 |
| Gravity Main | P2971 | 6142 Balcom Ln | $1,421.03 | 15 | 8 | 2006 | 379 | 2-Low | CCTV | 3 |
| Gravity Main | P4830 | 11406 Sugarloaf Ave | $763.35 | 15 | 8 | 2015 | 204 | 2-Low | CCTV | 3 |
| Gravity Main | P4744 | Boltwood Apartments | $920.40 | 15 | 8 | 2012 | 245 | 2-Low | CCTV | 3 |
| Gravity Main | P1101 | 5378-5270 Crestfield Ln | $1,481.45 | 15 | 8 | 2013 | 395 | 2-Low | CCTV | 3 |
| Gravity Main | P1172 | 5023 Lake Michigan Dr | $920.38 | 15 | 10 | 2000 | 245 | 2-Low | CCTV | 3 |
| Gravity Main | P3615 | 5313-5343 Pierce St | $880.77 | 15 | 8 | 2015 | 235 | 2-Low | CCTV | 3 |
| Gravity Main | P4837 | 11299-11287 University Pkwy | $685.81 | 15 | 8 | 2015 | 183 | 2-Low | CCTV | 3 |
| Gravity Main | P4831 | 4926 Allenpark Dr | $1,307.23 | 15 | 8 | 2015 | 349 | 2-Low | CCTV | 3 |
| Gravity Main | P4834 | 4998 Allenpark Dr | $804.46 | 15 | 8 | 2015 | 215 | 2-Low | CCTV | 3 |
| Gravity Main | P4838 | 11287-11295 University Pkwy | $775.13 | 15 | 8 | 2004 | 207 | 2-Low | CCTV | 3 |
| Gravity Main | P9506 | 11516 Boyne Blvd | $1,313.14 | 15 | 8 | 2016 | 350 | 2-Low | CCTV | 3 |
| Gravity Main | P1106 | Southtown Dr | $770.97 | 15 | 8 | 2007 | 206 | 2-Low | CCTV | 3 |
| Gravity Main | P9704 | 5399 Crestfield Ln | $527.92 | 15 | 8 | 2015 | 141 | 2-Low | CCTV | 3 |
| Gravity Main | P9503 | 4999 Allenpark Dr | $728.39 | 15 | 8 | 2016 | 194 | 2-Low | CCTV | 3 |
| Gravity Main | P9702 | 5401-5399 Pierce St | $1,091.81 | 15 | 8 | 2015 | 291 | 2-Low | CCTV | 3 |
| Gravity Main | P9706 | 5363 Windfield Dr | $382.80 | 15 | 8 | 2006 | 102 | 2-Low | CCTV | 3 |
| Gravity Main | P9505 | 4923 Allenpark Dr | $1,301.58 | 15 | 8 | 2016 | 347 | 2-Low | CCTV | 3 |
| Gravity Main | P9507 | 11560 Boyne Blvd | $902.95 | 15 | 8 | 2016 | 241 | 2-Low | CCTV | 3 |
| Gravity Main | P9504 | 11432 Boyne Blvd | $184.10 | 15 | 8 | 2016 | 49 | 2-Low | CCTV | 3 |
| Gravity Main | P9510 | 4923-4999 Allenpark Dr | $1,303.95 | 15 | 8 | 2016 | 348 | 2-Low | CCTV | 3 |
| Gravity Main | P9513 | 4880-4878 Becker Dr | $255.47 | 15 | 6 | 2004 | 68 | 2-Low | CCTV | 3 |
| Gravity Main | P9514 | Southtown Dr | $793.28 | 15 | 8 | 2007 | 212 | 2-Low | CCTV | 3 |
| Gravity Main | P9509 | 4999 Allenpark Dr | $571.30 | 15 | 8 | 2016 | 152 | 2-Low | CCTV | 3 |
| Gravity Main | P9511 | 4923 Allenpark Dr | $1,312.53 | 15 | 8 | 2016 | 350 | 2-Low | CCTV | 3 |
| Gravity Main | P3608 | 5241 Pierce St | $271.62 | 15 | 8 | 2015 | 72 | 2-Low | CCTV | 3 |
| Gravity Main | P9616 | 5075 Pierce St | $1,210.41 | 15 | 8 | 2006 | 323 | 2-Low | CCTV | 3 |
| Gravity Main | P4835 | 4926 Allenpark Dr | $758.46 | 15 | 8 | 2015 | 202 | 2-Low | CCTV | 3 |

| Table K-2. Collection System Maintenance Summary Table: 3-5 Year | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Asset | ID | Address | Total Cost | Normalized Risk | Size (in) | Year Constructed | Length (ft) | Risk (By Grading) | Rehab Actions | Year |
| Gravity Main | P3609 | 5255 Pierce St | $686.70 | 15 | 8 | 2015 | 183 | 2-Low | CCTV | 3 |
| Gravity Main | P3613 | 5399 Pierce St | $418.82 | 15 | 8 | 2015 | 112 | 2-Low | CCTV | 3 |
| Gravity Main | P3614 | 5367 Pierce St | $1,112.93 | 15 | 8 | 2015 | 297 | 2-Low | CCTV | 3 |
| Gravity Main | P9614 | 10520 52nd Ave | $406.10 | 15 | 8 | 2006 | 108 | 2-Low | CCTV | 3 |
| Gravity Main | P9615 | 10520 52nd Ave | $1,272.02 | 15 | 8 | 2006 | 339 | 2-Low | CCTV | 3 |
| Gravity Main | P9512 | 4898 Rich St | $938.58 | 15 | 8 | 2016 | 250 | 2-Low | CCTV | 3 |
| Gravity Main | P9703 | 5398 Crestfield Ln | $1,285.46 | 15 | 8 | 2015 | 343 | 2-Low | CCTV | 3 |
| Gravity Main | P9517 | 11200 Sugarloaf Ave | $436.68 | 15 | 10 | 2000 | 116 | 2-Low | CCTV | 3 |
| Manhole | 5250 | 11605 46th Ave | $535.60 | 15 | 0 | 1991 | 0 | 2-Low | MH Inspection | 4 |
| Manhole | 5350 | Nicholas Dr | $535.60 | 15 | 0 | 1991 | 0 | 2-Low | MH Inspection | 4 |
| Manhole | 2771 | 11475 60th Ave | $535.60 | 15 | 0 | 1990 | 0 | 2-Low | MH Inspection | 4 |
| Manhole | 4426 | 10975 Woodedge Dr | $535.60 | 15 | 0 | 2005 | 0 | 2-Low | MH Inspection | 4 |
| Manhole | 1179 | 6370 Lake Michigan Dr | $535.60 | 15 | 0 | 2000 | 0 | 2-Low | MH Inspection | 4 |
| Manhole | 2362 | 6394 Lake Michigan Dr | $535.60 | 15 | 0 | 2000 | 0 | 2-Low | MH Inspection | 4 |
| Manhole | 2363 | 6306 Lake Michigan Dr | $535.60 | 15 | 0 | 2000 | 0 | 2-Low | MH Inspection | 4 |
| Manhole | 1091 | 5366 Pierce St | $535.60 | 15 | 0 | 2015 | 0 | 2-Low | MH Inspection | 4 |
| Manhole | 4932 | 4812 Allenpark Dr | $535.60 | 15 | 0 | 2001 | 0 | 2-Low | MH Inspection | 4 |
| Manhole | 4940 | 11403 48th Ave | $535.60 | 15 | 0 | 2000 | 0 | 2-Low | MH Inspection | 4 |
| Manhole | 1116 | 10411 48th Ave | $535.60 | 15 | 0 | 2001 | 0 | 2-Low | MH Inspection | 4 |
| Manhole | 2253 | 6322 Henry St | $535.60 | 15 | 0 | 2008 | 0 | 2-Low | MH Inspection | 4 |
| Manhole | 2254 | 6308 Henry St | $535.60 | 15 | 0 | 2008 | 0 | 2-Low | MH Inspection | 4 |
| Manhole | 4614 | 5350 Lake Michigan Dr | $535.60 | 15 | 0 | 2001 | 0 | 2-Low | MH Inspection | 4 |
| Manhole | 4703 | 11277 Commerce Rd | $535.60 | 15 | 0 | 2001 | 0 | 2-Low | MH Inspection | 4 |
| Manhole | 4704 | 11297 Commerce Rd | $535.60 | 15 | 0 | 2001 | 0 | 2-Low | MH Inspection | 4 |
| Manhole | 4706 | 11329 Commerce Rd | $535.60 | 15 | 0 | 2001 | 0 | 2-Low | MH Inspection | 4 |
| Manhole | 4200 | 5475 Sunshine St | $535.60 | 15 | 0 | 2005 | 0 | 2-Low | MH Inspection | 4 |
| Manhole | 4211 | 10861 Douglas Dr | $535.60 | 15 | 0 | 2004 | 0 | 2-Low | MH Inspection | 4 |
| Manhole | 4214 | 5373 Sunshine St | $535.60 | 15 | 0 | 2005 | 0 | 2-Low | MH Inspection | 4 |
| Manhole | 1521 | 10805 Timberline Dr | $535.60 | 15 | 0 | 2008 | 0 | 2-Low | MH Inspection | 4 |
| Manhole | 1522 | 10808 Timberline Dr | $535.60 | 15 | 0 | 2008 | 0 | 2-Low | MH Inspection | 4 |
| Gravity Main | P4842 | 11240 University Pkwy | $346.81 | 15 | 6 | 2004 | 92 | 2-Low | CCTV | 3 |
| Gravity Main | P2414 | 7193-7222 Barn Owl Ln | $591.21 | 15 | 8 | 2015 | 158 | 2-Low | CCTV | 3 |
| Gravity Main | P1071 | 7145-7157 Barn Owl Ln | $300.04 | 15 | 8 | 2015 | 80 | 2-Low | CCTV | 3 |
| Gravity Main | P2415 | 7157-7193 Barn Owl Ln | $1,010.40 | 15 | 8 | 2015 | 269 | 2-Low | CCTV | 3 |
| Gravity Main | P2416 | 7168-7157 Barn Owl Ln | $785.22 | 15 | 8 | 2015 | 209 | 2-Low | CCTV | 3 |
| Gravity Main | P2516 | 7120-7170 Blue Jay Dr | $936.51 | 15 | 8 | 2013 | 250 | 2-Low | CCTV | 3 |
| Gravity Main | P2418 | 7099-7145 Barn Owl Ln | $441.99 | 15 | 8 | 2015 | 118 | 2-Low | CCTV | 3 |
| Gravity Main | P4841 | 11240-4880 Becker Dr | $312.91 | 15 | 6 | 2004 | 83 | 2-Low | CCTV | 3 |
| Gravity Main | P2417 | 7157 Barn Owl Ln | $329.51 | 15 | 8 | 2015 | 88 | 2-Low | CCTV | 3 |
| Gravity Main | P2419 | 7154 Blue Jay Dr | $1,121.61 | 15 | 8 | 2015 | 299 | 2-Low | CCTV | 3 |
| Gravity Main | P4627 | 5065-5053 Lake Michigan Dr | $1,257.07 | 15 | 8 | 2005 | 335 | 2-Low | CCTV | 3 |
| Gravity Main | P1104 | 5057 W Campus Dr | $958.89 | 15 | 8 | 2007 | 256 | 2-Low | CCTV | 3 |
| Gravity Main | P1123 | 10556-10555 Laker Village Dr | $1,429.68 | 13 | 12 | 1990 | 381 | 2-Low | CCTV | 3 |
| Gravity Main | P1057 | Hawkin St | $1,150.82 | 12 | 10 | 2016 | 307 | 2-Low | CCTV | 3 |
| Gravity Main | P1055 | Hawkin St | $725.50 | 12 | 10 | 2016 | 193 | 2-Low | CCTV | 3 |
| Manhole | 4843 | 4857 Becker Dr | $535.60 | 4 | 0 | 2004 | 0 | 2-Low | MH Inspection | 4 |
| Manhole | 2194 | 5753 Mary Eliz Dr | $535.60 | 31 | 0 | 1990 | 0 | 1-Negligible | MH Inspection | 4 |
| Manhole | 1173 | 4442 Lake Michigan Dr | $535.60 | 27 | 0 | 1963 | 0 | 1-Negligible | MH Inspection | 4 |
| Manhole | 2246 | 6676 Lake Michigan Dr | $535.60 | 26 | 0 | 1992 | 0 | 1-Negligible | MH Inspection | 4 |
| Manhole | 4621 | 5088 Lake Michigan Dr | $535.60 | 26 | 0 | 1992 | 0 | 1-Negligible | MH Inspection | 4 |
| Manhole | 4747 | 11253 Whispering Creek Dr | $535.60 | 26 | 0 | 2012 | 0 | 1-Negligible | MH Inspection | 4 |
| Manhole | 4705 | 11301 Commerce Rd | $535.60 | 26 | 0 | 2001 | 0 | 1-Negligible | MH Inspection | 4 |
| Manhole | 4836 | 4926 Allenpark Dr | $535.60 | 26 | 0 | 2015 | 0 | 1-Negligible | MH Inspection | 4 |
| Manhole | 1007 | 6161 Lake Michigan Dr | $535.60 | 26 | 0 | 1990 | 0 | 1-Negligible | MH Inspection | 4 |
| Manhole | 4461 | 4443 Stadium Dr | $535.60 | 26 | 0 | 1963 | 0 | 1-Negligible | MH Inspection | 4 |
| Manhole | 4462 | 4307 Stadium Dr | $535.60 | 26 | 0 | 1963 | 0 | 1-Negligible | MH Inspection | 4 |
| Manhole | 4877 | 11377 40th Ave | $535.60 | 26 | 0 | 1990 | 0 | 1-Negligible | MH Inspection | 4 |
| Manhole | 4878 | 11375 40th Ave | $535.60 | 26 | 0 | 1990 | 0 | 1-Negligible | MH Inspection | 4 |

| Table K-2. Collection System Maintenance Summary Table: 3-5 Year | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Asset | ID | Address | Total Cost | Normalized Risk | Size (in) | Year Constructed | Length (ft) | Risk (By Grading) | Rehab Actions | Year |
| Manhole | 1968 | 6246 Timber Dr | $535.60 | 26 | 0 | 2004 | 0 | 1-Negligible | MH Inspection | 4 |
| Manhole | 3936 | Campus West Apartments | $535.60 | 26 | 0 | 1990 | 0 | 1-Negligible | MH Inspection | 4 |
| Manhole | 2348 | 6600 Lake Michigan Dr | $535.60 | 26 | 0 | 1993 | 0 | 1-Negligible | MH Inspection | 4 |
| Manhole | 3074 | 6104 Balcom Ln | $535.60 | 26 | 0 | 2008 | 0 | 1-Negligible | MH Inspection | 4 |
| Manhole | 2972 | 6090 Balcom Ln | $535.60 | 26 | 0 | 2006 | 0 | 1-Negligible | MH Inspection | 4 |
| Manhole | 1113 | 10581 48th Ave | $535.60 | 26 | 0 | 1990 | 0 | 1-Negligible | MH Inspection | 4 |
| Manhole | 4501 | 5564 Eric St | $535.60 | 26 | 0 | 1990 | 0 | 1-Negligible | MH Inspection | 4 |
| Manhole | 2349 | 6550 Lake Michigan Dr | $535.60 | 24 | 0 | 1993 | 0 | 1-Negligible | MH Inspection | 4 |
| Manhole | 2411 | 11287 Red Hawk Ln | $535.60 | 24 | 0 | 2007 | 0 | 1-Negligible | MH Inspection | 4 |
| Manhole | 3933 | Campus West Apartments | $535.60 | 24 | 0 | 1990 | 0 | 1-Negligible | MH Inspection | 4 |
| Manhole | 2344 | 6660 Lake Michigan Dr | $535.60 | 24 | 0 | 1993 | 0 | 1-Negligible | MH Inspection | 4 |
| Manhole | 3634 | 5013 Pierce St | $535.60 | 24 | 0 | 2014 | 0 | 1-Negligible | MH Inspection | 4 |
| Manhole | 9702 | 5401 Pierce St | $535.60 | 24 | 0 | 2015 | 0 | 1-Negligible | MH Inspection | 4 |
| Manhole | 3934 | Campus West Apartments | $535.60 | 24 | 0 | 1990 | 0 | 1-Negligible | MH Inspection | 4 |
| Manhole | 2010 | 7338 Water View Ln | $535.60 | 24 | 0 | 2004 | 0 | 1-Negligible | MH Inspection | 4 |
| Gravity Main | P1173 | 4442-4426 Lake Michigan Dr | $790.66 | 23 | 8 | 1963 | 105 | 1-Negligible | CCTV and Heavy Cleaning | 3 |
| Manhole | 9609 | Winnie Ln | $535.60 | 22 | 0 | 2016 | 0 | 1-Negligible | MH Inspection | 4 |
| Manhole | 9610 | Winnie Ln | $535.60 | 22 | 0 | 2016 | 0 | 1-Negligible | MH Inspection | 4 |
| Manhole | 4335 | Northside Dr | $535.60 | 21 | 0 | 2007 | 0 | 1-Negligible | MH Inspection | 4 |
| Manhole | 2351 | 6448 Lake Michigan Dr | $535.60 | 21 | 0 | 2001 | 0 | 1-Negligible | MH Inspection | 4 |
| Manhole | 1912 | 7389 Pinevalley Dr | $535.60 | 21 | 0 | 2004 | 0 | 1-Negligible | MH Inspection | 4 |
| Manhole | 2401 | Placid Waters Dr | $535.60 | 20 | 0 | 2009 | 0 | 1-Negligible | MH Inspection | 4 |
| Manhole | 3734 | 4886 Country Pl S | $535.60 | 19 | 0 | 2001 | 0 | 1-Negligible | MH Inspection | 4 |
| Manhole | 2011 | 7376 Water View Ln | $535.60 | 19 | 0 | 2004 | 0 | 1-Negligible | MH Inspection | 4 |
| Manhole | 9708 | 5241 Pierce St | $535.60 | 19 | 0 | 2015 | 0 | 1-Negligible | MH Inspection | 4 |
| Manhole | 3432 | Copper Beech Townhomes | $535.60 | 19 | 0 | 2007 | 0 | 1-Negligible | MH Inspection | 4 |
| Manhole | 1064 | Marsh Ave | $535.60 | 19 | 0 | 2016 | 0 | 1-Negligible | MH Inspection | 4 |
| Manhole | 9617 | Marsh Ave | $535.60 | 19 | 0 | 2015 | 0 | 1-Negligible | MH Inspection | 4 |
| Manhole | 3513 | Mystic Wds | $535.60 | 19 | 0 | 2015 | 0 | 1-Negligible | MH Inspection | 4 |
| Manhole | 3735 | 4967 Pierce St | $535.60 | 18 | 0 | 2014 | 0 | 1-Negligible | MH Inspection | 4 |
| Manhole | 9503 | Allenpark Dr | $535.60 | 18 | 0 | 2016 | 0 | 1-Negligible | MH Inspection | 4 |
| Manhole | 4744 | Boltwood Apartments | $535.60 | 18 | 0 | 2012 | 0 | 1-Negligible | MH Inspection | 4 |
| Manhole | 4629 | 5128 Lake Michigan Dr | $535.60 | 18 | 0 | 2012 | 0 | 1-Negligible | MH Inspection | 4 |
| Manhole | 3084 | 11716 60th Ave | $535.60 | 18 | 0 | 2014 | 0 | 1-Negligible | MH Inspection | 4 |
| Manhole | 9619 | Marsh Ave | $535.60 | 18 | 0 | 2015 | 0 | 1-Negligible | MH Inspection | 4 |
| Manhole | 3464 | 10073 Laker Ln | $535.60 | 18 | 0 | 2007 | 0 | 1-Negligible | MH Inspection | 4 |
| Manhole | 2110 | 7395 Watermark Dr | $535.60 | 18 | 0 | 2001 | 0 | 1-Negligible | MH Inspection | 4 |
| Manhole | 4231 | Southtown Dr | $535.60 | 18 | 0 | 2007 | 0 | 1-Negligible | MH Inspection | 4 |
| Manhole | 4337 | Northside Dr | $535.60 | 18 | 0 | 2007 | 0 | 1-Negligible | MH Inspection | 4 |
| Manhole | 3516 | 5256 Pierce St | $535.60 | 18 | 0 | 2015 | 0 | 1-Negligible | MH Inspection | 4 |
| Manhole | 2300 | 11213 78th Ave | $535.60 | 18 | 0 | 2007 | 0 | 1-Negligible | MH Inspection | 4 |
| Manhole | 3517 | 5256 Pierce St | $535.60 | 17 | 0 | 2015 | 0 | 1-Negligible | MH Inspection | 4 |
| Gravity Main | P3861 | 1 Campus Dr | $853.42 | 16 | 8 | 1963 | 114 | 1-Negligible | CCTV and Heavy Cleaning | 3 |
| Manhole | 2500 | 11315 Wake Dr | $535.60 | 16 | 0 | 2009 | 0 | 1-Negligible | MH Inspection | 4 |
| Manhole | 3361 | S University Dr | $535.60 | 16 | 0 | 2007 | 0 | 1-Negligible | MH Inspection | 4 |
| Manhole | 3842 | 10539 48th Ave | $535.60 | 15 | 0 | 1990 | 0 | 1-Negligible | MH Inspection | 4 |
| Manhole | 4833 | Becker Dr | $535.60 | 15 | 0 | 2015 | 0 | 1-Negligible | MH Inspection | 4 |
| Manhole | 3861 | 1 Campus Dr | $535.60 | 15 | 0 | 1963 | 0 | 1-Negligible | MH Inspection | 4 |
| Manhole | 4362 | 1 Campus Dr | $535.60 | 15 | 0 | 1963 | 0 | 1-Negligible | MH Inspection | 4 |
| Manhole | 4223 | Southtown Dr | $535.60 | 15 | 0 | 2007 | 0 | 1-Negligible | MH Inspection | 4 |
| Manhole | 9009 | 1 Campus Dr | $535.60 | 15 | 0 | 1963 | 0 | 1-Negligible | MH Inspection | 4 |
| Manhole | 5013 | 5307 Edgeway Dr | $535.60 | 15 | 0 | 2000 | 0 | 1-Negligible | MH Inspection | 4 |
| Manhole | 5014 | 5201 Edgeway Dr | $535.60 | 15 | 0 | 2000 | 0 | 1-Negligible | MH Inspection | 4 |
| Manhole | 3085 | 11799 Brookridge Dr | $535.60 | 15 | 0 | 2014 | 0 | 1-Negligible | MH Inspection | 4 |
| Manhole | 3088 | 11667 Brookridge Dr | $535.60 | 15 | 0 | 2006 | 0 | 1-Negligible | MH Inspection | 4 |
| Manhole | 4519 | 11060 52nd Ave | $535.60 | 15 | 0 | 2006 | 0 | 1-Negligible | MH Inspection | 4 |
| Manhole | 4850 | 4657 Ottawa Creek Dr | $535.60 | 15 | 0 | 2012 | 0 | 1-Negligible | MH Inspection | 4 |
| Manhole | 3813 | 5364 Windfield Dr | $535.60 | 15 | 0 | 2006 | 0 | 1-Negligible | MH Inspection | 4 |

| Table K-2. Collection System Maintenance Summary Table: 3-5 Year | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Asset | ID | Address | Total Cost | Normalized Risk | Size (in) | Year Constructed | Length (ft) | Risk (By Grading) | Rehab Actions | Year |
| Manhole | 3815 | 10564 Rockfield Rd | $535.60 | 15 | 0 | 2013 | 0 | 1-Negligible | MH Inspection | 4 |
| Manhole | 3816 | 10518 Rockfield Rd | $535.60 | 15 | 0 | 2013 | 0 | 1-Negligible | MH Inspection | 4 |
| Manhole | 2492 | 5677 Lake Michigan Dr | $535.60 | 15 | 0 | 2000 | 0 | 1-Negligible | MH Inspection | 4 |
| Manhole | 4222 | Southtown Dr | $535.60 | 15 | 0 | 2007 | 0 | 1-Negligible | MH Inspection | 4 |
| Manhole | 4329 | Northside Dr | $535.60 | 15 | 0 | 2007 | 0 | 1-Negligible | MH Inspection | 4 |
| Manhole | 2255 | 6301 Henry St | $535.60 | 15 | 0 | 2008 | 0 | 1-Negligible | MH Inspection | 4 |
| Manhole | 4260 | 1 Campus Dr | $535.60 | 15 | 0 | 1963 | 0 | 1-Negligible | MH Inspection | 4 |
| Manhole | 3616 | 5313 Pierce St | $535.60 | 15 | 0 | 2015 | 0 | 1-Negligible | MH Inspection | 4 |
| Manhole | 1969 | 6202 Timber Dr | $535.60 | 15 | 0 | 2004 | 0 | 1-Negligible | MH Inspection | 4 |
| Manhole | 1915 | 7273 Pinevalley Dr | $535.60 | 15 | 0 | 2004 | 0 | 1-Negligible | MH Inspection | 4 |
| Manhole | 2116 | 7218 Water View Ln | $535.60 | 15 | 0 | 2001 | 0 | 1-Negligible | MH Inspection | 4 |
| Manhole | 2200 | 11103 Waterpoint Dr | $535.60 | 15 | 0 | 2004 | 0 | 1-Negligible | MH Inspection | 4 |
| Manhole | 2470 | 11263 60th Ave | $535.60 | 15 | 0 | 2003 | 0 | 1-Negligible | MH Inspection | 4 |
| Manhole | 2317 | 7273 Lake Michigan Dr | $535.60 | 15 | 0 | 2007 | 0 | 1-Negligible | MH Inspection | 4 |
| Manhole | 3365 | 10173 42nd Ave | $535.60 | 15 | 0 | 2016 | 0 | 1-Negligible | MH Inspection | 4 |
| Manhole | 1910 | 7517 Water View Ln | $535.60 | 14 | 0 | 2004 | 0 | 1-Negligible | MH Inspection | 4 |
| Manhole | 1099 | 10500 Rockfield Rd | $535.60 | 14 | 0 | 2013 | 0 | 1-Negligible | MH Inspection | 4 |
| Manhole | 1100 | 5270 Crestfield Ln | $535.60 | 14 | 0 | 2013 | 0 | 1-Negligible | MH Inspection | 4 |
| Manhole | 3733 | 4924 Country Pl S | $535.60 | 14 | 0 | 2001 | 0 | 1-Negligible | MH Inspection | 4 |
| Manhole | 3737 | Hillcrest Town Houses | $535.60 | 14 | 0 | 2014 | 0 | 1-Negligible | MH Inspection | 4 |
| Manhole | 4849 | 4689 Lake Michigan Dr | $535.60 | 14 | 0 | 2012 | 0 | 1-Negligible | MH Inspection | 4 |
| Manhole | 4137 | Meadows Xing | $535.60 | 14 | 0 | 2008 | 0 | 1-Negligible | MH Inspection | 4 |
| Manhole | 4230 | Southtown Dr | $535.60 | 14 | 0 | 2007 | 0 | 1-Negligible | MH Inspection | 4 |
| Manhole | 4232 | 10897 48th Ave | $535.60 | 14 | 0 | 2007 | 0 | 1-Negligible | MH Inspection | 4 |
| Manhole | 4336 | Northside Dr | $535.60 | 14 | 0 | 2007 | 0 | 1-Negligible | MH Inspection | 4 |
| Manhole | 4338 | Northside Dr | $535.60 | 14 | 0 | 2007 | 0 | 1-Negligible | MH Inspection | 4 |
| Manhole | 9705 | 5360 Windfield Dr | $535.60 | 14 | 0 | 2006 | 0 | 1-Negligible | MH Inspection | 4 |
| Manhole | 2002 | 10803 Waterpoint Dr | $535.60 | 14 | 0 | 2004 | 0 | 1-Negligible | MH Inspection | 4 |
| Manhole | 2063 | 10926 64th Ave | $535.60 | 14 | 0 | 2004 | 0 | 1-Negligible | MH Inspection | 4 |
| Manhole | 2064 | 10928 64th Ave | $535.60 | 14 | 0 | 2004 | 0 | 1-Negligible | MH Inspection | 4 |
| Manhole | 2065 | 10899 Constant Dr | $535.60 | 14 | 0 | 2004 | 0 | 1-Negligible | MH Inspection | 4 |
| Manhole | 2982 | 11637 60th Ave | $535.60 | 14 | 0 | 2006 | 0 | 1-Negligible | MH Inspection | 4 |
| Manhole | 3080 | 11705 60th Ave | $535.60 | 14 | 0 | 2008 | 0 | 1-Negligible | MH Inspection | 4 |
| Manhole | 4332 | Northside Dr | $535.60 | 14 | 0 | 2007 | 0 | 1-Negligible | MH Inspection | 4 |
| Manhole | 4334 | Northside Dr | $535.60 | 14 | 0 | 2007 | 0 | 1-Negligible | MH Inspection | 4 |
| Manhole | 5017 | 11550 53rd Ave | $535.60 | 14 | 0 | 2000 | 0 | 1-Negligible | MH Inspection | 4 |
| Manhole | 9616 | 5075 Pierce St | $535.60 | 14 | 0 | 2006 | 0 | 1-Negligible | MH Inspection | 4 |
| Manhole | 9520 | 11547 53rd Ave | $535.60 | 14 | 0 | 2010 | 0 | 1-Negligible | MH Inspection | 4 |
| Manhole | 9506 | 11540 Boyne Blvd | $535.60 | 14 | 0 | 2016 | 0 | 1-Negligible | MH Inspection | 4 |
| Manhole | 2007 | 7424 Watermark Dr | $535.60 | 14 | 0 | 2004 | 0 | 1-Negligible | MH Inspection | 4 |
| Manhole | 2009 | 10975 Waterpoint Dr | $535.60 | 14 | 0 | 2004 | 0 | 1-Negligible | MH Inspection | 4 |
| Manhole | 2971 | 6142 Balcom Ln | $535.60 | 14 | 0 | 2006 | 0 | 1-Negligible | MH Inspection | 4 |
| Manhole | 2978 | 11666 Wilmington Dr | $535.60 | 14 | 0 | 2006 | 0 | 1-Negligible | MH Inspection | 4 |
| Manhole | 3532 | Copper Beech Townhomes | $535.60 | 14 | 0 | 2007 | 0 | 1-Negligible | MH Inspection | 4 |
| Manhole | 3625 | 5050 Pierce St | $535.60 | 14 | 0 | 2014 | 0 | 1-Negligible | MH Inspection | 4 |
| Manhole | 1072 | 7680 Lake Michigan Dr | $535.60 | 14 | 0 | 2007 | 0 | 1-Negligible | MH Inspection | 4 |
| Manhole | 1075 | 7634 Lake Michigan Dr | $535.60 | 14 | 0 | 2007 | 0 | 1-Negligible | MH Inspection | 4 |
| Manhole | 2304 | 11127 Waterpoint Dr | $535.60 | 14 | 0 | 2005 | 0 | 1-Negligible | MH Inspection | 4 |
| Manhole | 1119 | S University Dr | $535.60 | 14 | 0 | 2016 | 0 | 1-Negligible | MH Inspection | 4 |
| Manhole | 3511 | Mystic Wds | $535.60 | 14 | 0 | 2015 | 0 | 1-Negligible | MH Inspection | 4 |
| Manhole | 3512 | Mystic Wds | $535.60 | 14 | 0 | 2015 | 0 | 1-Negligible | MH Inspection | 4 |
| Manhole | 1066 | Marsh Ave | $535.60 | 14 | 0 | 2016 | 0 | 1-Negligible | MH Inspection | 4 |
| Manhole | 3360 | 10033 Laker Ln | $535.60 | 14 | 0 | 2007 | 0 | 1-Negligible | MH Inspection | 4 |
| Manhole | 2008 | 7412 Watermark Dr | $535.60 | 14 | 0 | 2004 | 0 | 1-Negligible | MH Inspection | 4 |
| Manhole | 3465 | Laker Ln | $535.60 | 14 | 0 | 2007 | 0 | 1-Negligible | MH Inspection | 4 |
| Manhole | 1092 | 5122 Pierce St | $535.60 | 14 | 0 | 2014 | 0 | 1-Negligible | MH Inspection | 4 |
| Manhole | 1093 | 5122 Pierce St | $535.60 | 14 | 0 | 2014 | 0 | 1-Negligible | MH Inspection | 4 |
| Manhole | 3434 | Copper Beech Townhomes | $535.60 | 14 | 0 | 2007 | 0 | 1-Negligible | MH Inspection | 4 |

| Table K-2. Collection System Maintenance Summary Table: 3-5 Year | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Asset | ID | Address | Total Cost | Normalized Risk | Size (in) | Year Constructed | Length (ft) | Risk (By Grading) | Rehab Actions | Year |
| Manhole | 2302 | 7738 Lake Michigan Dr | $535.60 | 14 | 0 | 2007 | 0 | 1-Negligible | MH Inspection | 4 |
| Manhole | 3369 | S University Dr | $535.60 | 14 | 0 | 2016 | 0 | 1-Negligible | MH Inspection | 4 |
| Gravity Main | P2986 | 5890 Rich St | $716.80 | 14 | 8 | 2003 | 191 | 1-Negligible | CCTV | 3 |
| Gravity Main | P3083 | 11714-11727 60th Ave | $201.11 | 14 | 8 | 1990 | 54 | 1-Negligible | CCTV | 3 |
| Gravity Main | P2987 | 5870-5882 Rich St | $294.20 | 14 | 8 | 2003 | 78 | 1-Negligible | CCTV | 3 |
| Gravity Main | P2985 | 11697-11659 Brookland Ct | $634.42 | 14 | 8 | 2003 | 169 | 1-Negligible | CCTV | 3 |
| Gravity Main | P2988 | 5825-5870 Rich St | $1,058.28 | 14 | 8 | 2003 | 282 | 1-Negligible | CCTV | 3 |
| Gravity Main | P2989 | 11645 Spruce View Dr | $1,270.20 | 14 | 8 | 2003 | 339 | 1-Negligible | CCTV | 3 |
| Manhole | 1911 | 7593 Water View Ln | $535.60 | 13 | 0 | 2004 | 0 | 1-Negligible | MH Inspection | 4 |
| Manhole | 2530 | 7598 Valley View Ct | $535.60 | 13 | 0 | 2000 | 0 | 1-Negligible | MH Inspection | 4 |
| Manhole | 1067 | Marsh Ave | $535.60 | 13 | 0 | 2016 | 0 | 1-Negligible | MH Inspection | 4 |
| Manhole | 2416 | 7168 Barn Owl Ln | $535.60 | 13 | 0 | 2015 | 0 | 1-Negligible | MH Inspection | 4 |
| Manhole | 9509 | 4999 Allenpark Dr | $535.60 | 13 | 0 | 2016 | 0 | 1-Negligible | MH Inspection | 4 |
| Manhole | 4830 | 4926 Becker Dr | $535.60 | 13 | 0 | 2015 | 0 | 1-Negligible | MH Inspection | 4 |
| Manhole | 4832 | Becker Dr | $535.60 | 13 | 0 | 2015 | 0 | 1-Negligible | MH Inspection | 4 |
| Manhole | 4130 | Meadows Xing | $535.60 | 13 | 0 | 2008 | 0 | 1-Negligible | MH Inspection | 4 |
| Manhole | 4133 | Meadows Xing | $535.60 | 13 | 0 | 2008 | 0 | 1-Negligible | MH Inspection | 4 |
| Manhole | 9703 | 5398 Crestfield Ln | $535.60 | 13 | 0 | 2015 | 0 | 1-Negligible | MH Inspection | 4 |
| Manhole | 9704 | 5360 Windfield Dr | $535.60 | 13 | 0 | 2015 | 0 | 1-Negligible | MH Inspection | 4 |
| Manhole | 9707 | 10439 52nd Ave | $535.60 | 13 | 0 | 2015 | 0 | 1-Negligible | MH Inspection | 4 |
| Manhole | 3373 | 10130 42nd Ave | $535.60 | 13 | 0 | 2016 | 0 | 1-Negligible | MH Inspection | 4 |
| Manhole | 2003 | 7560 Watermark Dr | $535.60 | 13 | 0 | 2004 | 0 | 1-Negligible | MH Inspection | 4 |
| Manhole | 3535 | Copper Beech Townhomes | $535.60 | 13 | 0 | 2005 | 0 | 1-Negligible | MH Inspection | 4 |
| Manhole | 1068 | Marsh Ave | $535.60 | 13 | 0 | 2016 | 0 | 1-Negligible | MH Inspection | 4 |
| Manhole | 2301 | 11191 78th Ave | $535.60 | 13 | 0 | 2007 | 0 | 1-Negligible | MH Inspection | 4 |
| Manhole | 2402 | 8100 Placid Waters Dr | $535.60 | 13 | 0 | 2009 | 0 | 1-Negligible | MH Inspection | 4 |
| Manhole | 2501 | 11578 84th Ave | $535.60 | 13 | 0 | 2009 | 0 | 1-Negligible | MH Inspection | 4 |
| Gravity Main | P3627 | 5084-5050 Pierce St | $711.84 | 12 | 8 | 2014 | 190 | 1-Negligible | CCTV | 3 |
| Gravity Main | P3761 | 1 Campus Dr | $1,304.10 | 12 | 12 | 1963 | 348 | 1-Negligible | CCTV | 3 |
| Gravity Main | P1097 | 5050-5084 Pierce St | $540.00 | 12 | 8 | 2014 | 144 | 1-Negligible | CCTV | 3 |
| Gravity Main | P3762 | 1 Campus Dr | $1,299.38 | 12 | 12 | 1963 | 347 | 1-Negligible | CCTV | 3 |
| Manhole | 2350 | 6474 Lake Michigan Dr | $535.60 | 12 | 0 | 1993 | 0 | 1-Negligible | MH Inspection | 4 |
| Manhole | 9614 | 10520 52nd Ave | $535.60 | 12 | 0 | 2006 | 0 | 1-Negligible | MH Inspection | 4 |
| Manhole | 1051 | 10911 Waterway Dr | $535.60 | 12 | 0 | 2004 | 0 | 1-Negligible | MH Inspection | 4 |
| Manhole | 1083 | 6101 Lake Michigan Dr | $535.60 | 12 | 0 | 2003 | 0 | 1-Negligible | MH Inspection | 4 |
| Manhole | 9700 | 5399 Pierce St | $535.60 | 12 | 0 | 2015 | 0 | 1-Negligible | MH Inspection | 4 |
| Manhole | 4837 | 11299 University Pkwy | $535.60 | 12 | 0 | 2015 | 0 | 1-Negligible | MH Inspection | 4 |
| Manhole | 2111 | 7359 Watermark Dr | $535.60 | 12 | 0 | 2001 | 0 | 1-Negligible | MH Inspection | 4 |
| Manhole | 3518 | 5298 Pierce St | $535.60 | 12 | 0 | 2015 | 0 | 1-Negligible | MH Inspection | 4 |
| Manhole | 9618 | Marsh Ave | $535.60 | 12 | 0 | 2015 | 0 | 1-Negligible | MH Inspection | 4 |
| Gravity Main | P3760 | 4411 Pierce St | $1,391.51 | 11 | 12 | 1998 | 371 | 1-Negligible | CCTV | 3 |
| Gravity Main | P2309 | 7423 Waterline Dr | $58.23 | 11 | 10 | 2003 | 16 | 1-Negligible | CCTV | 3 |
| Gravity Main | P3563 | 4355-4352 Campus View Dr | $1,447.98 | 11 | 8 | 1998 | 386 | 1-Negligible | CCTV | 3 |
| Manhole | 2066 | 10920 64th Ave | $535.60 | 11 | 0 | 2004 | 0 | 1-Negligible | MH Inspection | 4 |
| Manhole | 2201 | 11149 Waterpoint Dr | $535.60 | 11 | 0 | 2005 | 0 | 1-Negligible | MH Inspection | 4 |
| Manhole | 2318 | 11211 Red Hawk Ln | $535.60 | 11 | 0 | 2007 | 0 | 1-Negligible | MH Inspection | 4 |
| Manhole | 3086 | 11799 Brookridge Dr | $535.60 | 11 | 0 | 2006 | 0 | 1-Negligible | MH Inspection | 4 |
| Manhole | 3180 | 11755 60th Ave | $535.60 | 11 | 0 | 2008 | 0 | 1-Negligible | MH Inspection | 4 |
| Manhole | 1107 | Southtown Dr | $535.60 | 11 | 0 | 2007 | 0 | 1-Negligible | MH Inspection | 4 |
| Manhole | 3631 | 5045 Pierce St | $535.60 | 11 | 0 | 2014 | 0 | 1-Negligible | MH Inspection | 4 |
| Manhole | 3632 | 5045 Pierce St | $535.60 | 11 | 0 | 2014 | 0 | 1-Negligible | MH Inspection | 4 |
| Manhole | 3635 | 4997 Pierce St | $535.60 | 11 | 0 | 2014 | 0 | 1-Negligible | MH Inspection | 4 |
| Manhole | 3810 | 5252 Windfield Dr | $535.60 | 11 | 0 | 2006 | 0 | 1-Negligible | MH Inspection | 4 |
| Manhole | 3833 | 10506 Country Pl W | $535.60 | 11 | 0 | 1997 | 0 | 1-Negligible | MH Inspection | 4 |
| Manhole | 3841 | 10561 48th Ave | $535.60 | 11 | 0 | 1997 | 0 | 1-Negligible | MH Inspection | 4 |
| Manhole | 4132 | Meadows Xing | $535.60 | 11 | 0 | 2008 | 0 | 1-Negligible | MH Inspection | 4 |
| Manhole | 4224 | Southtown Dr | $535.60 | 11 | 0 | 2007 | 0 | 1-Negligible | MH Inspection | 4 |
| Manhole | 4328 | Northside Dr | $535.60 | 11 | 0 | 2007 | 0 | 1-Negligible | MH Inspection | 4 |

| Table K-2. Collection System Maintenance Summary Table: 3-5 Year | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Asset | ID | Address | Total Cost | Normalized Risk | Size (in) | Year Constructed | Length (ft) | Risk (By Grading) | Rehab Actions | Year |
| Manhole | 4330 | Northside Dr | $535.60 | 11 | 0 | 2007 | 0 | 1-Negligible | MH Inspection | 4 |
| Manhole | 4745 | Boltwood Apartments | $535.60 | 11 | 0 | 2012 | 0 | 1-Negligible | MH Inspection | 4 |
| Manhole | 4746 | 11253 Whispering Creek Dr | $535.60 | 11 | 0 | 2012 | 0 | 1-Negligible | MH Inspection | 4 |
| Manhole | 9000 | 10815 Timberline Dr | $535.60 | 11 | 0 | 2008 | 0 | 1-Negligible | MH Inspection | 4 |
| Manhole | 9514 | Meadows Xing | $535.60 | 11 | 0 | 2007 | 0 | 1-Negligible | MH Inspection | 4 |
| Manhole | 9007 | 1 Campus Dr | $535.60 | 11 | 0 | 1963 | 0 | 1-Negligible | MH Inspection | 4 |
| Manhole | 3960 | 10517 Laker Village Dr | $535.60 | 11 | 0 | 1963 | 0 | 1-Negligible | MH Inspection | 4 |
| Manhole | 5353 | 11859 46th Ave | $535.60 | 11 | 0 | 1991 | 0 | 1-Negligible | MH Inspection | 4 |
| Manhole | 1071 | 7145 Barn Owl Ln | $535.60 | 11 | 0 | 2015 | 0 | 1-Negligible | MH Inspection | 4 |
| Manhole | 2414 | 7193 Barn Owl Ln | $535.60 | 11 | 0 | 2015 | 0 | 1-Negligible | MH Inspection | 4 |
| Manhole | 2415 | 7157 Barn Owl Ln | $535.60 | 11 | 0 | 2015 | 0 | 1-Negligible | MH Inspection | 4 |
| Manhole | 2418 | 7099 Barn Owl Ln | $535.60 | 11 | 0 | 2015 | 0 | 1-Negligible | MH Inspection | 4 |
| Manhole | 2419 | 7210 Blue Jay Dr | $535.60 | 11 | 0 | 2015 | 0 | 1-Negligible | MH Inspection | 4 |
| Manhole | 3614 | 5343 Pierce St | $535.60 | 11 | 0 | 2015 | 0 | 1-Negligible | MH Inspection | 4 |
| Manhole | 9502 | 4999 Allenpark Dr | $535.60 | 11 | 0 | 2016 | 0 | 1-Negligible | MH Inspection | 4 |
| Manhole | 4835 | Becker Dr | $535.60 | 11 | 0 | 2015 | 0 | 1-Negligible | MH Inspection | 4 |
| Manhole | 2114 | 11015 Waterway Dr | $535.60 | 11 | 0 | 2001 | 0 | 1-Negligible | MH Inspection | 4 |
| Manhole | 2973 | Norfolk Dr | $535.60 | 11 | 0 | 2006 | 0 | 1-Negligible | MH Inspection | 4 |
| Manhole | 2974 | Norfolk Dr | $535.60 | 11 | 0 | 2006 | 0 | 1-Negligible | MH Inspection | 4 |
| Manhole | 9011 | 6101 Lake Michigan Dr | $535.60 | 11 | 0 | 2003 | 0 | 1-Negligible | MH Inspection | 4 |
| Manhole | 9508 | 6223 Lake Michigan Dr | $535.60 | 11 | 0 | 1998 | 0 | 1-Negligible | MH Inspection | 4 |
| Manhole | 1513 | Timberline Dr | $535.60 | 11 | 0 | 2008 | 0 | 1-Negligible | MH Inspection | 4 |
| Manhole | 1106 | Southtown Dr | $535.60 | 11 | 0 | 2007 | 0 | 1-Negligible | MH Inspection | 4 |
| Manhole | 1914 | 10877 Pinevalley Ct | $535.60 | 11 | 0 | 2004 | 0 | 1-Negligible | MH Inspection | 4 |
| Manhole | 1993 | 5769 Lynn Dr | $535.60 | 11 | 0 | 2000 | 0 | 1-Negligible | MH Inspection | 4 |
| Manhole | 2012 | 7431 Water View Ln | $535.60 | 11 | 0 | 2004 | 0 | 1-Negligible | MH Inspection | 4 |
| Manhole | 2014 | 10969 Waterway Dr | $535.60 | 11 | 0 | 2004 | 0 | 1-Negligible | MH Inspection | 4 |
| Manhole | 2015 | 7204 Bittersweet Ct | $535.60 | 11 | 0 | 2004 | 0 | 1-Negligible | MH Inspection | 4 |
| Manhole | 2310 | 7388 Waterline Dr | $535.60 | 11 | 0 | 2001 | 0 | 1-Negligible | MH Inspection | 4 |
| Manhole | 2311 | 7349 Waterline Dr | $535.60 | 11 | 0 | 2001 | 0 | 1-Negligible | MH Inspection | 4 |
| Manhole | 2312 | 7301 Waterline Dr | $535.60 | 11 | 0 | 2001 | 0 | 1-Negligible | MH Inspection | 4 |
| Manhole | 2410 | 11247 Red Hawk Ln | $535.60 | 11 | 0 | 2007 | 0 | 1-Negligible | MH Inspection | 4 |
| Manhole | 4304 | 10934 Lance Ave | $535.60 | 11 | 0 | 2005 | 0 | 1-Negligible | MH Inspection | 4 |
| Manhole | 4520 | 11088 52nd Ave | $535.60 | 11 | 0 | 2006 | 0 | 1-Negligible | MH Inspection | 4 |
| Manhole | 9706 | 5363 Windfield Dr | $535.60 | 11 | 0 | 2006 | 0 | 1-Negligible | MH Inspection | 4 |
| Manhole | 3082 | 11727 60th Ave | $535.60 | 11 | 0 | 2008 | 0 | 1-Negligible | MH Inspection | 4 |
| Manhole | 3181 | 11777 60th Ave | $535.60 | 11 | 0 | 2008 | 0 | 1-Negligible | MH Inspection | 4 |
| Manhole | 4331 | Northside Dr | $535.60 | 11 | 0 | 2007 | 0 | 1-Negligible | MH Inspection | 4 |
| Manhole | 4333 | Northside Dr | $535.60 | 11 | 0 | 2007 | 0 | 1-Negligible | MH Inspection | 4 |
| Manhole | 1128 | 11301 Commerce Rd | $535.60 | 11 | 0 | 2001 | 0 | 1-Negligible | MH Inspection | 4 |
| Manhole | 1129 | 11301 Commerce Rd | $535.60 | 11 | 0 | 2001 | 0 | 1-Negligible | MH Inspection | 4 |
| Manhole | 5015 | 11547 53rd Ave | $535.60 | 11 | 0 | 2000 | 0 | 1-Negligible | MH Inspection | 4 |
| Manhole | 5016 | 11523 53rd Ave | $535.60 | 11 | 0 | 2000 | 0 | 1-Negligible | MH Inspection | 4 |
| Manhole | 5018 | 11550 53rd Ave | $535.60 | 11 | 0 | 2000 | 0 | 1-Negligible | MH Inspection | 4 |
| Manhole | 5019 | 5224 Rich St | $535.60 | 11 | 0 | 2000 | 0 | 1-Negligible | MH Inspection | 4 |
| Manhole | 3711 | #N/A | $535.60 | 11 | 0 | 2001 | 0 | 1-Negligible | MH Inspection | 4 |
| Manhole | 9613 | 10520 52nd Ave | $535.60 | 11 | 0 | 2006 | 0 | 1-Negligible | MH Inspection | 4 |
| Manhole | 9615 | 10520 52nd Ave | $535.60 | 11 | 0 | 2006 | 0 | 1-Negligible | MH Inspection | 4 |
| Manhole | LS_TIMBERLINE | 7060 Sunset Dr | $535.60 | 11 | 0 | 2008 | 0 | 1-Negligible | MH Inspection | 4 |
| Manhole | 3570 | 10246 42nd Ave | $535.60 | 11 | 0 | 2004 | 0 | 1-Negligible | MH Inspection | 4 |
| Manhole | 2309 | 7423 Waterline Dr | $535.60 | 11 | 0 | 2001 | 0 | 1-Negligible | MH Inspection | 4 |
| Manhole | 3533 | Copper Beech Townhomes | $535.60 | 11 | 0 | 2007 | 0 | 1-Negligible | MH Inspection | 4 |
| Manhole | 2001 | 7584 Watermark Dr | $535.60 | 11 | 0 | 2004 | 0 | 1-Negligible | MH Inspection | 4 |
| Manhole | 2316 | 7347 Lake Michigan Dr | $535.60 | 11 | 0 | 2007 | 0 | 1-Negligible | MH Inspection | 4 |
| Manhole | 2303 | 7588 Lake Michigan Dr | $535.60 | 11 | 0 | 2005 | 0 | 1-Negligible | MH Inspection | 4 |
| Manhole | 3615 | 5313 Pierce St | $535.60 | 11 | 0 | 2015 | 0 | 1-Negligible | MH Inspection | 4 |
| Manhole | 3617 | 5269 Pierce St | $535.60 | 11 | 0 | 2015 | 0 | 1-Negligible | MH Inspection | 4 |
| Manhole | 9505 | Allenpark Dr | $535.60 | 11 | 0 | 2016 | 0 | 1-Negligible | MH Inspection | 4 |

| Table K-2. Collection System Maintenance Summary Table: 3-5 Year | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Asset | ID | Address | Total Cost | Normalized Risk | Size (in) | Year Constructed | Length (ft) | Risk (By Grading) | Rehab Actions | Year |
| Manhole | 2113 | 11031 Waterway Dr | $535.60 | 11 | 0 | 2001 | 0 | 1-Negligible | MH Inspection | 4 |
| Manhole | 2984 | 11659 Brookland Ct | $535.60 | 11 | 0 | 2003 | 0 | 1-Negligible | MH Inspection | 4 |
| Manhole | 1411 | 10581 Learning Ln | $535.60 | 11 | 0 | 2008 | 0 | 1-Negligible | MH Inspection | 4 |
| Manhole | 1410 | 10582 Learning Ln | $535.60 | 11 | 0 | 2008 | 0 | 1-Negligible | MH Inspection | 4 |
| Manhole | 3362 | S University Dr | $535.60 | 11 | 0 | 2007 | 0 | 1-Negligible | MH Inspection | 4 |
| Manhole | 3368 | S University Dr | $535.60 | 11 | 0 | 2007 | 0 | 1-Negligible | MH Inspection | 4 |
| Manhole | 3531 | Copper Beech Townhomes | $535.60 | 11 | 0 | 2007 | 0 | 1-Negligible | MH Inspection | 4 |
| Manhole | 3637 | 4962 Pierce St | $535.60 | 11 | 0 | 2008 | 0 | 1-Negligible | MH Inspection | 4 |
| Manhole | 2313 | 7280 Lake Michigan Dr | $535.60 | 11 | 0 | 2001 | 0 | 1-Negligible | MH Inspection | 4 |
| Manhole | 2314 | 7280 Lake Michigan Dr | $535.60 | 11 | 0 | 2001 | 0 | 1-Negligible | MH Inspection | 4 |
| Manhole | 3083 | 11714 60th Ave | $535.60 | 11 | 0 | 2014 | 0 | 1-Negligible | MH Inspection | 4 |
| Manhole | 1121 | 10095 42nd Ave | $535.60 | 11 | 0 | 2016 | 0 | 1-Negligible | MH Inspection | 4 |
| Manhole | 3363 | S University Dr | $535.60 | 11 | 0 | 2016 | 0 | 1-Negligible | MH Inspection | 4 |
| Manhole | 3366 | 10173 42nd Ave | $535.60 | 11 | 0 | 2016 | 0 | 1-Negligible | MH Inspection | 4 |
| Manhole | 3374 | 10100 42nd Ave | $535.60 | 11 | 0 | 2016 | 0 | 1-Negligible | MH Inspection | 4 |
| Manhole | 2413 | 7222 Barn Owl Ln | $535.60 | 11 | 0 | 2015 | 0 | 1-Negligible | MH Inspection | 4 |
| Manhole | 9605 | 10776 78th Ave | $535.60 | 11 | 0 | 2016 | 0 | 1-Negligible | MH Inspection | 4 |
| Manhole | 9606 | 10774 78th Ave | $535.60 | 11 | 0 | 2016 | 0 | 1-Negligible | MH Inspection | 4 |
| Manhole | 1512 | 10603 Learning Ln | $535.60 | 11 | 0 | 2008 | 0 | 1-Negligible | MH Inspection | 4 |
| Manhole | 1095 | 5122 Pierce St | $535.60 | 11 | 0 | 2014 | 0 | 1-Negligible | MH Inspection | 4 |
| Manhole | 1097 | 5050 Pierce St | $535.60 | 11 | 0 | 2014 | 0 | 1-Negligible | MH Inspection | 4 |
| Manhole | 1102 | Copper Beech Townhomes | $535.60 | 11 | 0 | 2007 | 0 | 1-Negligible | MH Inspection | 4 |
| Manhole | 1103 | Copper Beech Townhomes | $535.60 | 11 | 0 | 2005 | 0 | 1-Negligible | MH Inspection | 4 |
| Manhole | 1811 | 10801 Pinevalley Ct | $535.60 | 11 | 0 | 2004 | 0 | 1-Negligible | MH Inspection | 4 |
| Manhole | 1812 | 10798 Learning Ln | $535.60 | 11 | 0 | 2004 | 0 | 1-Negligible | MH Inspection | 4 |
| Manhole | 2970 | 6178 Balcom Ln | $535.60 | 11 | 0 | 2006 | 0 | 1-Negligible | MH Inspection | 4 |
| Manhole | 3430 | Copper Beech Townhomes | $535.60 | 11 | 0 | 2007 | 0 | 1-Negligible | MH Inspection | 4 |
| Manhole | 3364 | 10149 42nd Ave | $535.60 | 11 | 0 | 2016 | 0 | 1-Negligible | MH Inspection | 4 |
| Manhole | 3370 | S University Dr | $535.60 | 11 | 0 | 2016 | 0 | 1-Negligible | MH Inspection | 4 |
| Manhole | 3371 | 10111 42nd Ave | $535.60 | 11 | 0 | 2016 | 0 | 1-Negligible | MH Inspection | 4 |
| Manhole | 3510 | Mystic Wds | $535.60 | 11 | 0 | 2015 | 0 | 1-Negligible | MH Inspection | 4 |
| Manhole | 3514 | Mystic Wds | $535.60 | 11 | 0 | 2015 | 0 | 1-Negligible | MH Inspection | 4 |
| Manhole | 3515 | Mystic Wds | $535.60 | 11 | 0 | 2015 | 0 | 1-Negligible | MH Inspection | 4 |
| Gravity Main | P3569 | 10281 42nd Ave | $1,089.97 | 11 | 12 | 2004 | 291 | 1-Negligible | CCTV | 3 |
| Manhole | 1844 | New Options High School | $535.60 | 10 | 0 | 1990 | 0 | 1-Negligible | MH Inspection | 4 |
| Manhole | 2417 | 7157 Barn Owl Ln | $535.60 | 10 | 0 | 2015 | 0 | 1-Negligible | MH Inspection | 4 |
| Manhole | 3930 | Campus West Apartments | $535.60 | 10 | 0 | 2001 | 0 | 1-Negligible | MH Inspection | 4 |
| Manhole | 3436 | Copper Beech Townhomes | $535.60 | 10 | 0 | 2005 | 0 | 1-Negligible | MH Inspection | 4 |
| Manhole | 2989 | 11677 Spruce View Dr | $535.60 | 10 | 0 | 2001 | 0 | 1-Negligible | MH Inspection | 4 |
| Manhole | 3462 | 10000 Laker Ln | $535.60 | 10 | 0 | 2006 | 0 | 1-Negligible | MH Inspection | 4 |
| Gravity Main | P1122 | 4406 Pierce St | $1,119.40 | 10 | 12 | 1998 | 299 | 1-Negligible | CCTV | 3 |
| Gravity Main | P3570 | 10246 42nd Ave | $256.99 | 10 | 12 | 2004 | 69 | 1-Negligible | CCTV | 3 |
| Gravity Main | P3077 | 6095-6082 Rossfield Ct | $762.05 | 10 | 10 | 2008 | 203 | 1-Negligible | CCTV | 3 |
| Manhole | 4131 | Meadows Xing | $535.60 | 10 | 0 | 2008 | 0 | 1-Negligible | MH Inspection | 4 |
| Manhole | 4134 | Meadows Xing | $535.60 | 10 | 0 | 2008 | 0 | 1-Negligible | MH Inspection | 4 |
| Manhole | 9507 | 4920 Rich St | $535.60 | 10 | 0 | 2016 | 0 | 1-Negligible | MH Inspection | 4 |
| Manhole | 9510 | 4923 Allenpark Dr | $535.60 | 10 | 0 | 2016 | 0 | 1-Negligible | MH Inspection | 4 |
| Manhole | 9511 | 4923 Allenpark Dr | $535.60 | 10 | 0 | 2016 | 0 | 1-Negligible | MH Inspection | 4 |
| Manhole | 9512 | 4898 Rich St | $535.60 | 10 | 0 | 2016 | 0 | 1-Negligible | MH Inspection | 4 |
| Manhole | 3372 | 10133 42nd Ave | $535.60 | 10 | 0 | 2016 | 0 | 1-Negligible | MH Inspection | 4 |
| Manhole | 9010 | 10744 S Campus Dr | $535.60 | 10 | 0 | 1990 | 0 | 1-Negligible | MH Inspection | 4 |
| Manhole | 1048 | 7340 Water View Ln | $535.60 | 10 | 0 | 2004 | 0 | 1-Negligible | MH Inspection | 4 |
| Manhole | 2986 | 5882 Rich St | $535.60 | 10 | 0 | 2001 | 0 | 1-Negligible | MH Inspection | 4 |
| Manhole | 1069 | Marsh Ave | $535.60 | 10 | 0 | 2016 | 0 | 1-Negligible | MH Inspection | 4 |
| Manhole | 1070 | Marsh Ave | $535.60 | 10 | 0 | 2016 | 0 | 1-Negligible | MH Inspection | 4 |
| Manhole | 2000 | 10931 Waterpoint Dr | $535.60 | 10 | 0 | 2016 | 0 | 1-Negligible | MH Inspection | 4 |
| Manhole | 3461 | 10001 Laker Ln | $535.60 | 10 | 0 | 2004 | 0 | 1-Negligible | MH Inspection | 4 |
| Gravity Main | P2514 | 7220-7270 Blue Jay Dr | $930.37 | 9 | 8 | 2007 | 248 | 1-Negligible | CCTV | 3 |

| Table K-2. Collection System Maintenance Summary Table: 3-5 Year | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Asset | ID | Address | Total Cost | Normalized Risk | Size (in) | Year Constructed | Length (ft) | Risk (By Grading) | Rehab Actions | Year |
| Gravity Main | P3086 | 11799-11795 Brookridge Dr | $295.58 | 9 | 8 | 2006 | 79 | 1-Negligible | CCTV | 3 |
| Gravity Main | P3568 | 4256 Campus View Dr | $1,276.80 | 9 | 8 | 2004 | 340 | 1-Negligible | CCTV | 3 |
| Gravity Main | P3088 | 5893 Rich St | $744.35 | 9 | 8 | 2006 | 198 | 1-Negligible | CCTV | 3 |
| Gravity Main | P3087 | 11795-11667 Brookridge Dr | $1,263.16 | 9 | 8 | 2006 | 337 | 1-Negligible | CCTV | 3 |
| Gravity Main | P3373 | 10130-10133 42nd Ave | $338.05 | 9 | 8 | 2016 | 90 | 1-Negligible | CCTV | 3 |
| Manhole | 4831 | 4926 Becker Dr | $535.60 | 9 | 0 | 2015 | 0 | 1-Negligible | MH Inspection | 4 |
| Manhole | 3736 | 4967 Pierce St | $535.60 | 9 | 0 | 2014 | 0 | 1-Negligible | MH Inspection | 4 |
| Gravity Main | P3561 | 10152-10155 Laker Ln | $1,134.84 | 8 | 12 | 1998 | 303 | 1-Negligible | CCTV | 3 |
| Manhole | 2013 | 7491 Water View Ln | $535.60 | 8 | 0 | 2004 | 0 | 1-Negligible | MH Inspection | 4 |
| Manhole | 9611 | 10520 52nd Ave | $535.60 | 8 | 0 | 2006 | 0 | 1-Negligible | MH Inspection | 4 |
| Manhole | 1105 | 5057 W Campus Dr | $535.60 | 8 | 0 | 2007 | 0 | 1-Negligible | MH Inspection | 4 |
| Manhole | 1810 | 10800 Pinevalley Ct | $535.60 | 8 | 0 | 2004 | 0 | 1-Negligible | MH Inspection | 4 |
| Manhole | 2207 | 11005 Island Ct | $535.60 | 8 | 0 | 2005 | 0 | 1-Negligible | MH Inspection | 4 |
| Manhole | 2210 | 11048 Waterway Dr | $535.60 | 8 | 0 | 2001 | 0 | 1-Negligible | MH Inspection | 4 |
| Manhole | 2211 | 11103 Waterway Dr | $535.60 | 8 | 0 | 2001 | 0 | 1-Negligible | MH Inspection | 4 |
| Gravity Main | P3560 | 10281 Laker Ln | $1,110.88 | 8 | 12 | 1998 | 296 | 1-Negligible | CCTV | 3 |
| Gravity Main | P1029 | 4264 Campus View Dr | $211.88 | 8 | 12 | 2004 | 57 | 1-Negligible | CCTV | 3 |
| Gravity Main | P3564 | 4332-4352 Campus View Dr | $400.06 | 8 | 12 | 1998 | 107 | 1-Negligible | CCTV | 3 |
| Gravity Main | P3565 | 4270-4332 Campus View Dr | $1,127.88 | 8 | 12 | 2004 | 301 | 1-Negligible | CCTV | 3 |
| Gravity Main | P3562 | 10150 Laker Ln | $741.22 | 8 | 12 | 1998 | 198 | 1-Negligible | CCTV | 3 |
| Manhole | 4225 | Southtown Dr | $535.60 | 7 | 0 | 2007 | 0 | 1-Negligible | MH Inspection | 4 |
| Manhole | 4638 | 4850 Lake Michigan Dr | $535.60 | 7 | 0 | 2001 | 0 | 1-Negligible | MH Inspection | 4 |
| Manhole | 1131 | 11266 Whispering Creek Dr | $535.60 | 7 | 0 | 2012 | 0 | 1-Negligible | MH Inspection | 4 |
| Manhole | 1133 | 11367 Whispering Creek Dr | $535.60 | 7 | 0 | 2012 | 0 | 1-Negligible | MH Inspection | 4 |
| Manhole | 1722 | 10828 Timberline Dr | $535.60 | 7 | 0 | 2008 | 0 | 1-Negligible | MH Inspection | 4 |
| Manhole | 2365 | 6218 Lake Michigan Dr | $535.60 | 7 | 0 | 2000 | 0 | 1-Negligible | MH Inspection | 4 |
| Manhole | 4502 | 5560 Eric St | $535.60 | 7 | 0 | 2000 | 0 | 1-Negligible | MH Inspection | 4 |
| Manhole | 4838 | 11287 University Pkwy | $535.60 | 7 | 0 | 2004 | 0 | 1-Negligible | MH Inspection | 4 |
| Manhole | 5012 | 5405 Edgeway Dr | $535.60 | 7 | 0 | 2000 | 0 | 1-Negligible | MH Inspection | 4 |
| Manhole | 1049 | 7272 Water View Ln | $535.60 | 7 | 0 | 2001 | 0 | 1-Negligible | MH Inspection | 4 |
| Manhole | 1094 | 5122 Pierce St | $535.60 | 7 | 0 | 2014 | 0 | 1-Negligible | MH Inspection | 4 |
| Manhole | 1101 | 5378 Crestfield Ln | $535.60 | 7 | 0 | 2013 | 0 | 1-Negligible | MH Inspection | 4 |
| Manhole | 3073 | 6196 Balcom Ln | $535.60 | 7 | 0 | 2008 | 0 | 1-Negligible | MH Inspection | 4 |
| Manhole | 2100 | 11017 Waterpoint Dr | $535.60 | 7 | 0 | 2004 | 0 | 1-Negligible | MH Inspection | 4 |
| Manhole | 9607 | Winnie Ln | $535.60 | 7 | 0 | 2016 | 0 | 1-Negligible | MH Inspection | 4 |
| Gravity Main | P3464 | 10073-10119 Laker Ln | $94.08 | 7 | 10 | 2007 | 25 | 1-Negligible | CCTV | 3 |
| Gravity Main | P3360 | 10033-10073 Laker Ln | $1,105.84 | 7 | 10 | 2007 | 295 | 1-Negligible | CCTV | 3 |
| Gravity Main | P3463 | 10119-10000 Laker Ln | $838.63 | 7 | 10 | 2006 | 224 | 1-Negligible | CCTV | 3 |
| Gravity Main | P3462 | 10000 Laker Ln | $363.79 | 7 | 10 | 2006 | 97 | 1-Negligible | CCTV | 3 |
| Gravity Main | P3361 | S University Dr | $644.30 | 7 | 10 | 2007 | 172 | 1-Negligible | CCTV | 3 |
| Gravity Main | P3460 | 10000-10152 Laker Ln | $1,008.57 | 7 | 10 | 2004 | 269 | 1-Negligible | CCTV | 3 |
| Gravity Main | P1124 | 1 Campus Dr | $1,444.94 | 7 | 12 | 1990 | 385 | 1-Negligible | CCTV | 3 |
| Manhole | 3814 | 5396 Windfield Dr | $535.60 | 7 | 0 | 2006 | 0 | 1-Negligible | MH Inspection | 4 |
| Manhole | 1135 | 11368 48th Ave | $535.60 | 7 | 0 | 2000 | 0 | 1-Negligible | MH Inspection | 4 |
| Manhole | 9504 | Allenpark Dr | $535.60 | 7 | 0 | 2016 | 0 | 1-Negligible | MH Inspection | 4 |
| Manhole | 1104 | 5057 W Campus Dr | $535.60 | 7 | 0 | 2007 | 0 | 1-Negligible | MH Inspection | 4 |
| Manhole | 1913 | 7303 Pinevalley Dr | $535.60 | 7 | 0 | 2004 | 0 | 1-Negligible | MH Inspection | 4 |
| Manhole | 2016 | 7240 Bittersweet Ct | $535.60 | 7 | 0 | 2004 | 0 | 1-Negligible | MH Inspection | 4 |
| Manhole | 2017 | 7294 Bittersweet Ct | $535.60 | 7 | 0 | 2004 | 0 | 1-Negligible | MH Inspection | 4 |
| Manhole | 2112 | 7320 Watermark Dr | $535.60 | 7 | 0 | 2001 | 0 | 1-Negligible | MH Inspection | 4 |
| Manhole | 2206 | 11087 Island Ct | $535.60 | 7 | 0 | 2005 | 0 | 1-Negligible | MH Inspection | 4 |
| Manhole | 2513 | 7296 Blue Jay Dr | $535.60 | 7 | 0 | 2007 | 0 | 1-Negligible | MH Inspection | 4 |
| Manhole | 3832 | 4968 Country Pl S | $535.60 | 7 | 0 | 1997 | 0 | 1-Negligible | MH Inspection | 4 |
| Manhole | 3834 | 4915 Country Pl N | $535.60 | 7 | 0 | 1997 | 0 | 1-Negligible | MH Inspection | 4 |
| Manhole | 3931 | Campus West Apartments | $535.60 | 7 | 0 | 2001 | 0 | 1-Negligible | MH Inspection | 4 |
| Manhole | 4135 | Meadows Xing | $535.60 | 7 | 0 | 2008 | 0 | 1-Negligible | MH Inspection | 4 |
| Manhole | 4136 | Meadows Xing | $535.60 | 7 | 0 | 2008 | 0 | 1-Negligible | MH Inspection | 4 |
| Manhole | 4233 | Village Center Dr | $535.60 | 7 | 0 | 2007 | 0 | 1-Negligible | MH Inspection | 4 |

| Table K-2. Collection System Maintenance Summary Table: 3-5 Year | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Asset | ID | Address | Total Cost | Normalized Risk | Size (in) | Year Constructed | Length (ft) | Risk (By Grading) | Rehab Actions | Year |
| Manhole | 1096 | 5050 Pierce St | $535.60 | 7 | 0 | 2014 | 0 | 1-Negligible | MH Inspection | 4 |
| Manhole | 2412 | 7232 Barn Owl Ln | $535.60 | 7 | 0 | 2007 | 0 | 1-Negligible | MH Inspection | 4 |
| Manhole | 2981 | 11531 Wilmington Dr | $535.60 | 7 | 0 | 2006 | 0 | 1-Negligible | MH Inspection | 4 |
| Manhole | 3079 | 6063 Rossfield Ct | $535.60 | 7 | 0 | 2008 | 0 | 1-Negligible | MH Inspection | 4 |
| Manhole | 2315 | 7409 Lake Michigan Dr | $535.60 | 7 | 0 | 2001 | 0 | 1-Negligible | MH Inspection | 4 |
| Manhole | 3536 | Copper Beech Townhomes | $535.60 | 7 | 0 | 2005 | 0 | 1-Negligible | MH Inspection | 4 |
| Manhole | 1065 | Marsh Ave | $535.60 | 7 | 0 | 2016 | 0 | 1-Negligible | MH Inspection | 4 |
| Manhole | 9603 | 10687 Poppy Ln | $535.60 | 7 | 0 | 2016 | 0 | 1-Negligible | MH Inspection | 4 |
| Manhole | 9604 | Poppy Ln | $535.60 | 7 | 0 | 2016 | 0 | 1-Negligible | MH Inspection | 4 |
| Manhole | 3463 | 10119 Laker Ln | $535.60 | 7 | 0 | 2006 | 0 | 1-Negligible | MH Inspection | 4 |
| Gravity Main | P3519 | Mystic Wds | $1,088.14 | 7 | 8 | 2015 | 290 | 1-Negligible | CCTV | 3 |
| Gravity Main | P3368 | S University Dr | $838.35 | 7 | 10 | 2007 | 224 | 1-Negligible | CCTV | 3 |
| Gravity Main | P3515 | Mystic Wds | $589.25 | 7 | 8 | 2015 | 157 | 1-Negligible | CCTV | 3 |
| Gravity Main | P1095 | 5122-5050 Pierce St | $775.05 | 7 | 8 | 2014 | 207 | 1-Negligible | CCTV | 3 |
| Gravity Main | P3514 | Mystic Wds | $96.86 | 7 | 8 | 2015 | 26 | 1-Negligible | CCTV | 3 |
| Gravity Main | P3517 | 5256 Pierce St | $621.86 | 7 | 8 | 2015 | 166 | 1-Negligible | CCTV | 3 |
| Gravity Main | P1094 | 5122 Pierce St | $599.21 | 7 | 8 | 2014 | 160 | 1-Negligible | CCTV | 3 |
| Gravity Main | P1092 | 5122 Pierce St | $508.84 | 7 | 8 | 2014 | 136 | 1-Negligible | CCTV | 3 |
| Gravity Main | P1062 | 7598 Watermark Dr | $1,331.51 | 7 | 10 | 2016 | 355 | 1-Negligible | CCTV | 3 |
| Gravity Main | P3465 | Laker Ln | $988.76 | 7 | 8 | 2007 | 264 | 1-Negligible | CCTV | 3 |
| Gravity Main | P3372 | 10133 42nd Ave | $1,246.72 | 7 | 10 | 2016 | 332 | 1-Negligible | CCTV | 3 |
| Gravity Main | P1063 | 7598 Watermark Dr | $243.54 | 7 | 10 | 2016 | 65 | 1-Negligible | CCTV | 3 |
| Gravity Main | P1070 | 10931 Waterpoint Dr | $503.86 | 7 | 10 | 2016 | 134 | 1-Negligible | CCTV | 3 |
| Gravity Main | P1093 | 5122 Pierce St | $991.31 | 7 | 8 | 2014 | 264 | 1-Negligible | CCTV | 3 |
| Gravity Main | P1061 | Marsh Ave | $1,289.73 | 7 | 10 | 2016 | 344 | 1-Negligible | CCTV | 3 |
| Gravity Main | P3626 | 5050 Pierce St | $392.56 | 7 | 8 | 2014 | 105 | 1-Negligible | CCTV | 3 |
| Gravity Main | P3362 | S University Dr | $849.04 | 7 | 10 | 2007 | 226 | 1-Negligible | CCTV | 3 |
| Gravity Main | P3518 | 5298-5256 Pierce St | $468.23 | 7 | 8 | 2015 | 125 | 1-Negligible | CCTV | 3 |
| Gravity Main | P2972 | 6090-6142 Balcom Ln | $772.75 | 7 | 8 | 2006 | 206 | 1-Negligible | CCTV | 3 |
| Gravity Main | P3461 | 10001-10000 Laker Ln | $750.71 | 7 | 8 | 2004 | 200 | 1-Negligible | CCTV | 3 |
| Gravity Main | P1096 | 5050 Pierce St | $453.82 | 7 | 8 | 2014 | 121 | 1-Negligible | CCTV | 3 |
| Gravity Main | P1060 | Marsh Ave | $308.42 | 7 | 10 | 2016 | 82 | 1-Negligible | CCTV | 3 |
| Gravity Main | P1059 | Marsh Ave | $342.91 | 7 | 10 | 2016 | 91 | 1-Negligible | CCTV | 3 |
| Gravity Main | P2970 | 6178-6142 Balcom Ln | $532.04 | 7 | 8 | 2006 | 142 | 1-Negligible | CCTV | 3 |
| Gravity Main | P9604 | Poppy Ln | $630.19 | 6 | 8 | 2016 | 168 | 1-Negligible | CCTV | 3 |
| Gravity Main | P2413 | 7222-7232 Barn Owl Ln | $361.04 | 6 | 8 | 2015 | 96 | 1-Negligible | CCTV | 3 |
| Gravity Main | P9602 | 10691 Poppy Ln | $536.64 | 6 | 8 | 2016 | 143 | 1-Negligible | CCTV | 3 |
| Gravity Main | P9607 | 10746 78th Ave | $1,333.30 | 6 | 8 | 2016 | 356 | 1-Negligible | CCTV | 3 |
| Gravity Main | P9610 | Winnie Ln | $458.01 | 6 | 8 | 2016 | 122 | 1-Negligible | CCTV | 3 |
| Gravity Main | P9603 | 10687-10691 Poppy Ln | $962.82 | 6 | 8 | 2016 | 257 | 1-Negligible | CCTV | 3 |
| Gravity Main | P3466 | 10261 42nd Ave | $1,147.87 | 6 | 8 | 2004 | 306 | 1-Negligible | CCTV | 3 |
| Gravity Main | P1064 | 7599 Watermark Dr | $259.16 | 6 | 8 | 2016 | 69 | 1-Negligible | CCTV | 3 |
| Gravity Main | P1066 | 7599 Watermark Dr | $358.96 | 6 | 8 | 2016 | 96 | 1-Negligible | CCTV | 3 |
| Gravity Main | P2303 | 7586 Lake Michigan Dr | $1,190.73 | 6 | 8 | 2005 | 318 | 1-Negligible | CCTV | 3 |
| Gravity Main | P3567 | 4260 Campus View Dr | $277.13 | 6 | 8 | 2004 | 74 | 1-Negligible | CCTV | 3 |
| Gravity Main | P1054 | Hawkin St | $537.14 | 6 | 8 | 2016 | 143 | 1-Negligible | CCTV | 3 |
| Gravity Main | P1065 | 7599 Watermark Dr | $516.88 | 6 | 8 | 2016 | 138 | 1-Negligible | CCTV | 3 |
| Gravity Main | P9609 | Winnie Ln | $1,043.48 | 6 | 8 | 2016 | 278 | 1-Negligible | CCTV | 3 |
| Gravity Main | P9608 | Winnie Ln | $608.02 | 6 | 8 | 2016 | 162 | 1-Negligible | CCTV | 3 |
| Gravity Main | P9605 | 10776-10774 78th Ave | $702.43 | 6 | 8 | 2016 | 187 | 1-Negligible | CCTV | 3 |
| Gravity Main | P1121 | 10095-10133 42nd Ave | $1,053.41 | 6 | 8 | 2016 | 281 | 1-Negligible | CCTV | 3 |
| Gravity Main | P1119 | S University Dr | $127.75 | 6 | 8 | 2016 | 34 | 1-Negligible | CCTV | 3 |
| Gravity Main | P3374 | 10100-10130 42nd Ave | $905.79 | 6 | 8 | 2016 | 242 | 1-Negligible | CCTV | 3 |
| Gravity Main | P3364 | 10149 42nd Ave | $221.48 | 6 | 8 | 2016 | 59 | 1-Negligible | CCTV | 3 |
| Gravity Main | P3363 | S University Dr | $132.78 | 6 | 8 | 2016 | 35 | 1-Negligible | CCTV | 3 |
| Gravity Main | P1058 | Marsh Ave | $312.73 | 6 | 8 | 2016 | 83 | 1-Negligible | CCTV | 3 |
| Gravity Main | P9606 | 10774 78th Ave | $1,017.98 | 6 | 8 | 2016 | 271 | 1-Negligible | CCTV | 3 |
| Gravity Main | P3370 | S University Dr | $689.28 | 6 | 8 | 2016 | 184 | 1-Negligible | CCTV | 3 |

| Table K-2. Collection System Maintenance Summary Table: 3-5 Year | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Asset | ID | Address | Total Cost | Normalized Risk | Size (in) | Year Constructed | Length (ft) | Risk (By Grading) | Rehab Actions | Year |
| Gravity Main | P3085 | 11799 Brookridge Dr | $1,145.46 | 6 | 8 | 2014 | 305 | 1-Negligible | CCTV | 3 |
| Gravity Main | P3084 | 11716-11714 60th Ave | $948.15 | 6 | 8 | 2014 | 253 | 1-Negligible | CCTV | 3 |
| Gravity Main | P3371 | 10111 42nd Ave | $1,078.93 | 6 | 8 | 2016 | 288 | 1-Negligible | CCTV | 3 |
| Gravity Main | P3366 | 10173 42nd Ave | $687.33 | 6 | 8 | 2016 | 183 | 1-Negligible | CCTV | 3 |
| Gravity Main | P3365 | 10173-10149 42nd Ave | $741.03 | 6 | 8 | 2016 | 198 | 1-Negligible | CCTV | 3 |
| Gravity Main | P3369 | S University Dr | $260.93 | 6 | 8 | 2016 | 70 | 1-Negligible | CCTV | 3 |
| Gravity Main | P9617 | Marsh Ave | $753.30 | 6 | 8 | 2015 | 201 | 1-Negligible | CCTV | 3 |
| Gravity Main | P3467 | 10223 42nd Ave | $908.43 | 6 | 8 | 2004 | 242 | 1-Negligible | CCTV | 3 |
| Gravity Main | P1067 | Marsh Ave | $271.17 | 6 | 8 | 2016 | 72 | 1-Negligible | CCTV | 3 |
| Gravity Main | P1069 | Marsh Ave | $856.99 | 6 | 8 | 2016 | 229 | 1-Negligible | CCTV | 3 |
| Gravity Main | P1068 | Marsh Ave | $325.62 | 6 | 8 | 2016 | 87 | 1-Negligible | CCTV | 3 |
| Gravity Main | P1052 | Hawkin St | $424.42 | 6 | 8 | 2016 | 113 | 1-Negligible | CCTV | 3 |
| Gravity Main | P1053 | Hawkin St | $381.85 | 6 | 8 | 2016 | 102 | 1-Negligible | CCTV | 3 |
| Gravity Main | P9619 | Marsh Ave | $798.54 | 6 | 8 | 2015 | 213 | 1-Negligible | CCTV | 3 |
| Gravity Main | P9618 | Marsh Ave | $548.70 | 6 | 8 | 2015 | 146 | 1-Negligible | CCTV | 3 |
| Manhole | 1842 | 10798 68th Ave | $535.60 | 5 | 0 | 1990 | 0 | 1-Negligible | MH Inspection | 4 |
| Manhole | 3732 | 10485 48th Ave | $535.60 | 5 | 0 | 2001 | 0 | 1-Negligible | MH Inspection | 4 |
| Manhole | 9701 | 5399 Pierce St | $535.60 | 5 | 0 | 2015 | 0 | 1-Negligible | MH Inspection | 4 |
| Manhole | 3078 | 6082 Rossfield Ct | $535.60 | 5 | 0 | 2008 | 0 | 1-Negligible | MH Inspection | 4 |
| Manhole | 3173 | 6042 Kingsbury Ct | $535.60 | 5 | 0 | 2008 | 0 | 1-Negligible | MH Inspection | 4 |
| Manhole | 3730 | Hillcrest Town Houses | $535.60 | 5 | 0 | 2001 | 0 | 1-Negligible | MH Inspection | 4 |
| Manhole | 3738 | 4954 Country Pl S | $535.60 | 5 | 0 | 2014 | 0 | 1-Negligible | MH Inspection | 4 |
| Manhole | 3170 | 6185 Kingsbury Ct | $535.60 | 5 | 0 | 2008 | 0 | 1-Negligible | MH Inspection | 4 |
| Manhole | 3171 | 6162 Kingsbury Ct | $535.60 | 5 | 0 | 2008 | 0 | 1-Negligible | MH Inspection | 4 |
| Manhole | 3172 | 6068 Kingsbury Ct | $535.60 | 5 | 0 | 2008 | 0 | 1-Negligible | MH Inspection | 4 |
| Manhole | 2004 | 7523 Watermark Dr | $535.60 | 5 | 0 | 2004 | 0 | 1-Negligible | MH Inspection | 4 |
| Manhole | 2005 | 7488 Watermark Dr | $535.60 | 5 | 0 | 2004 | 0 | 1-Negligible | MH Inspection | 4 |
| Manhole | 2006 | 7461 Watermark Dr | $535.60 | 5 | 0 | 2004 | 0 | 1-Negligible | MH Inspection | 4 |
| Manhole | 2979 | 11627 Wilmington Dr | $535.60 | 5 | 0 | 2006 | 0 | 1-Negligible | MH Inspection | 4 |
| Manhole | 1053 | Hawkin St | $535.60 | 5 | 0 | 2016 | 0 | 1-Negligible | MH Inspection | 4 |
| Manhole | 1054 | Hawkin St | $535.60 | 5 | 0 | 2016 | 0 | 1-Negligible | MH Inspection | 4 |
| Manhole | 1055 | Hawkin St | $535.60 | 5 | 0 | 2016 | 0 | 1-Negligible | MH Inspection | 4 |
| Manhole | 1058 | Marsh Ave | $535.60 | 5 | 0 | 2016 | 0 | 1-Negligible | MH Inspection | 4 |
| Manhole | 1059 | Marsh Ave | $535.60 | 5 | 0 | 2016 | 0 | 1-Negligible | MH Inspection | 4 |
| Manhole | 1060 | Marsh Ave | $535.60 | 5 | 0 | 2016 | 0 | 1-Negligible | MH Inspection | 4 |
| Manhole | 1061 | Marsh Ave | $535.60 | 5 | 0 | 2016 | 0 | 1-Negligible | MH Inspection | 4 |
| Manhole | 1062 | Marsh Ave | $535.60 | 5 | 0 | 2016 | 0 | 1-Negligible | MH Inspection | 4 |
| Manhole | 1063 | Marsh Ave | $535.60 | 5 | 0 | 2016 | 0 | 1-Negligible | MH Inspection | 4 |
| Manhole | 9602 | 10691 Poppy Ln | $535.60 | 5 | 0 | 2016 | 0 | 1-Negligible | MH Inspection | 4 |
| Manhole | 3431 | Copper Beech Townhomes | $535.60 | 5 | 0 | 2007 | 0 | 1-Negligible | MH Inspection | 4 |
| Manhole | 3433 | Copper Beech Townhomes | $535.60 | 5 | 0 | 2007 | 0 | 1-Negligible | MH Inspection | 4 |
| Manhole | 3437 | Copper Beech Townhomes | $535.60 | 5 | 0 | 2005 | 0 | 1-Negligible | MH Inspection | 4 |
| Manhole | 3438 | Copper Beech Townhomes | $535.60 | 5 | 0 | 2005 | 0 | 1-Negligible | MH Inspection | 4 |
| Manhole | 3530 | Copper Beech Townhomes | $535.60 | 5 | 0 | 2007 | 0 | 1-Negligible | MH Inspection | 4 |
| Manhole | 2980 | 11531 Wilmington Dr | $535.60 | 5 | 0 | 2006 | 0 | 1-Negligible | MH Inspection | 4 |
| Manhole | 3537 | Copper Beech Townhomes | $535.60 | 5 | 0 | 2005 | 0 | 1-Negligible | MH Inspection | 4 |
| Manhole | 1009 | 7588 Lake Michigan Dr | $535.60 | 5 | 0 | 2005 | 0 | 1-Negligible | MH Inspection | 4 |
| Manhole | 1511 | 10581 Learning Ln | $535.60 | 5 | 0 | 2008 | 0 | 1-Negligible | MH Inspection | 4 |
| Manhole | 3410 | Mystic Wds | $535.60 | 5 | 0 | 2015 | 0 | 1-Negligible | MH Inspection | 4 |
| Manhole | 3411 | Mystic Wds | $535.60 | 5 | 0 | 2015 | 0 | 1-Negligible | MH Inspection | 4 |
| Manhole | 3412 | Mystic Wds | $535.60 | 5 | 0 | 2015 | 0 | 1-Negligible | MH Inspection | 4 |
| Manhole | 1723 | 10601 White Birch Dr | $535.60 | 4 | 0 | 2008 | 0 | 1-Negligible | MH Inspection | 4 |
| Manhole | 4839 | 11295 University Pkwy | $535.60 | 4 | 0 | 2004 | 0 | 1-Negligible | MH Inspection | 4 |
| Manhole | 1050 | 7239 Bittersweet Ct | $535.60 | 4 | 0 | 2004 | 0 | 1-Negligible | MH Inspection | 4 |
| Manhole | 2101 | 11057 Waterpoint Dr | $535.60 | 4 | 0 | 2004 | 0 | 1-Negligible | MH Inspection | 4 |
| Manhole | 4240 | 10865 48th Ave | $535.60 | 4 | 0 | 1987 | 0 | 1-Negligible | MH Inspection | 4 |
| Manhole | 3087 | 11795 Brookridge Dr | $535.60 | 4 | 0 | 2006 | 0 | 1-Negligible | MH Inspection | 4 |
| Manhole | 3177 | 11738 Andrews Ave | $535.60 | 4 | 0 | 2008 | 0 | 1-Negligible | MH Inspection | 4 |

| Table K-2. Collection System Maintenance Summary Table: 3-5 Year | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Asset | ID | Address | Total Cost | Normalized Risk | Size (in) | Year Constructed | Length (ft) | Risk (By Grading) | Rehab Actions | Year |
| Manhole | 9517 | Becker Dr | $535.60 | 4 | 0 | 2000 | 0 | 1-Negligible | MH Inspection | 4 |
| Manhole | 4941 | 11410 48th Ave | $535.60 | 4 | 0 | 2000 | 0 | 1-Negligible | MH Inspection | 4 |
| Manhole | 1115 | 10445 48th Ave | $535.60 | 4 | 0 | 2001 | 0 | 1-Negligible | MH Inspection | 4 |
| Manhole | 2516 | 7120 Blue Jay Dr | $535.60 | 4 | 0 | 2013 | 0 | 1-Negligible | MH Inspection | 4 |
| Manhole | 3811 | 5288 Windfield Dr | $535.60 | 4 | 0 | 2006 | 0 | 1-Negligible | MH Inspection | 4 |
| Manhole | 3812 | 5324 Windfield Dr | $535.60 | 4 | 0 | 2006 | 0 | 1-Negligible | MH Inspection | 4 |
| Manhole | 1136 | 11378 48th Ave | $535.60 | 4 | 0 | 2000 | 0 | 1-Negligible | MH Inspection | 4 |
| Manhole | 2511 | 11347 Red Hawk Ln | $535.60 | 4 | 0 | 2007 | 0 | 1-Negligible | MH Inspection | 4 |
| Manhole | 2512 | 7270 Blue Jay Dr | $535.60 | 4 | 0 | 2007 | 0 | 1-Negligible | MH Inspection | 4 |
| Manhole | 2514 | 7220 Blue Jay Dr | $535.60 | 4 | 0 | 2007 | 0 | 1-Negligible | MH Inspection | 4 |
| Manhole | 2985 | 11697 Brookland Ct | $535.60 | 4 | 0 | 2003 | 0 | 1-Negligible | MH Inspection | 4 |
| Manhole | 3075 | 6054 Balcom Ln | $535.60 | 4 | 0 | 2008 | 0 | 1-Negligible | MH Inspection | 4 |
| Manhole | 3076 | 6112 Balcom Ln | $535.60 | 4 | 0 | 2008 | 0 | 1-Negligible | MH Inspection | 4 |
| Manhole | 3831 | Campus West Apartments | $535.60 | 4 | 0 | 2014 | 0 | 1-Negligible | MH Inspection | 4 |
| Manhole | 3626 | 5050 Pierce St | $535.60 | 4 | 0 | 2014 | 0 | 1-Negligible | MH Inspection | 4 |
| Manhole | 5287 | 11773 40th Ave | $535.60 | 4 | 0 | 2000 | 0 | 1-Negligible | MH Inspection | 4 |
| Manhole | 1052 | Hawkin St | $535.60 | 4 | 0 | 2016 | 0 | 1-Negligible | MH Inspection | 4 |
| Manhole | 9608 | Winnie Ln | $535.60 | 4 | 0 | 2016 | 0 | 1-Negligible | MH Inspection | 4 |
| Manhole | 3460 | 10000 Laker Ln | $535.60 | 4 | 0 | 2004 | 0 | 1-Negligible | MH Inspection | 4 |
| Manhole | 1843 | New Options High School | $535.60 | 2 | 0 | 1990 | 0 | 1-Negligible | MH Inspection | 4 |
| Manhole | 2471 | 11289 60th Ave | $535.60 | 2 | 0 | 2003 | 0 | 1-Negligible | MH Inspection | 4 |
| Manhole | 2473 | 6182 Library Ln | $535.60 | 2 | 0 | 1998 | 0 | 1-Negligible | MH Inspection | 4 |
| Manhole | 2474 | 6223 Lake Michigan Dr | $535.60 | 2 | 0 | 1998 | 0 | 1-Negligible | MH Inspection | 4 |
| Manhole | 2510 | 11309 Red Hawk Ln | $535.60 | 2 | 0 | 2007 | 0 | 1-Negligible | MH Inspection | 4 |
| Manhole | 3077 | 6095 Rossfield Ct | $535.60 | 2 | 0 | 2008 | 0 | 1-Negligible | MH Inspection | 4 |
| Manhole | 3174 | 6093 Kingsbury Ct | $535.60 | 2 | 0 | 2008 | 0 | 1-Negligible | MH Inspection | 4 |
| Manhole | 3175 | 6002 Kingsbury Ct | $535.60 | 2 | 0 | 2008 | 0 | 1-Negligible | MH Inspection | 4 |
| Manhole | 3176 | 11775 Andrews Ave | $535.60 | 2 | 0 | 2008 | 0 | 1-Negligible | MH Inspection | 4 |
| Manhole | 3830 | Campus West Apartments | $535.60 | 2 | 0 | 2014 | 0 | 1-Negligible | MH Inspection | 4 |
| Manhole | 3519 | Mystic Wds | $535.60 | 0 | 0 | 2015 | 0 | 1-Negligible | MH Inspection | 4 |

# Allendale Charter Township Sanitary Sewer Network

**Manhole 1-5 Year Maintenance Plan**

- No Action
- MH Inspection
- MH Clean

**Gravity Main 1-5 Year Maintenance Plan**

- No Action
- CCTV
- CCTV and Heavy Cleaning

Buchanan
Pingree
Bent Tree
Almari
Stepping Stone
Lake Michigan
Maplebrook
Pierce
Learning
Red Oak
Countryview
LS_HIDDEN_SHORES
LS_BROWN
LS_TIMBERLINE
LS_COUNTY_PARK
LS_60TH-NORTH
LS_60TH-SOUTH
Waterline
Waterway
Island
Watermark
Timber Creek
Skyline
Aspen
Sunset
Pinevalley
Valley View
Cardinal
Brown
Scott
Avery
Cherell
Blue Jay
Red Hawk
Joal
North
Black Cherry
White Birch
Timberline
Washington
Henry
Mista
Martinie
Winans
Constant
Timber
Kingsbury
Andrews
Comfort
Baicom
Dales
Frostline
Pebble
Ridge
Crystal
Burg
Gemmen
Maple Bend
94th
78th
76th
74th
72nd
68th
64th
60th

FLEIS&VANDENBRINK
DESIGN. BUILD. OPERATE.

Operation and Maintenance
1-5 Year Plan (WEST)

Allendale Charter Township, Michigan

| DRAWN BY | DATE |
|---|---|
| KCS | 1/9/2019 |
| PROJECT NO. | SCALE |
| 814975 | 1:13,500 |
| FILE LOCATION | |
| SOURCES | |

NORTH
0 560 1,120
SCALE IN FEET

FIGURE
K-1A

FLEIS&VANDENBRINK
DESIGN. BUILD. OPERATE.

# Operation and Maintenance 1-5 Year Plan (EAST)

Allendale Charter Township, Michigan

| DRAWN BY | DATE |
|---|---|
| KCS | 1/9/2019 |
| PROJECT NO. | SCALE |
| 814975 | 1:13,500 |
| FILE LOCATION | |
| SOURCES | |

## Allendale Charter Township Sanitary Sewer Network

**Manhole 1-5 Year Maintenance Plan**

- No Action
- MH Inspection
- MH Clean

**Gravity Main 1-5 Year Maintenance Plan**

- No Action
- CCTV
- CCTV and Heavy Cleaning

NORTH

0 560 1,120

SCALE IN FEET

FIGURE K-1B

**Table K-3. Preventative Maintenance Inspection Plan**

| Year | Asset | ID | Address | Rehab Actions | Cost | 2018 | 2019 | 2020 | 2021 | 2022 |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | Manhole | 4636 | 4866 Lake Michigan Dr | MH Inspection | $ 536 | $ 535.60 | $ - | $ - | $ - | $ - |
| 3 | Gravity Main | P4530 | 11181-11195 Radcliff Dr | CCTV | $ 372 | $ - | $ - | $ 395 | $ - | $ - |
| 3 | Gravity Main | P4517 | 11075-11111 52nd Ave | CCTV | $ 848 | $ - | $ - | $ 899 | $ - | $ - |
| 3 | Gravity Main | P4516 | 11111-11143 52nd Ave | CCTV | $ 792 | $ - | $ - | $ 840 | $ - | $ - |
| 3 | Gravity Main | P4518 | 11059-11075 52nd Ave | CCTV | $ 369 | $ - | $ - | $ 392 | $ - | $ - |
| 3 | Gravity Main | P4658 | Dr | CCTV | $ 365 | $ - | $ - | $ 387 | $ - | $ - |
| 3 | Gravity Main | P4702 | Rd | CCTV | $ 510 | $ - | $ - | $ 541 | $ - | $ - |
| 3 | Gravity Main | P5284 | 11654-11615 40th Ave | CCTV | $ 932 | $ - | $ - | $ 989 | $ - | $ - |
| 3 | Gravity Main | P1032 | 11611-11615 40th Ave | CCTV | $ 106 | $ - | $ - | $ 112 | $ - | $ - |
| 3 | Gravity Main | P1034 | 11601-11611 40th Ave | CCTV | $ 262 | $ - | $ - | $ 278 | $ - | $ - |
| 3 | Gravity Main | P5040 | 11443-11403 48th Ave | CCTV | $ 1,054 | $ - | $ - | $ 1,119 | $ - | $ - |
| 3 | Gravity Main | P4844 | 11313-11269 48th Ave | CCTV | $ 976 | $ - | $ - | $ 1,036 | $ - | $ - |
| 3 | Gravity Main | P1033 | 11529-11601 40th Ave | CCTV | $ 1,733 | $ - | $ - | $ 1,838 | $ - | $ - |
| 3 | Gravity Main | P2461 | 11315-11261 64th Ave | CCTV | $ 1,403 | $ - | $ - | $ 1,488 | $ - | $ - |
| 3 | Gravity Main | P2882 | 11587-11530 Brookland Ct | CCTV | $ 871 | $ - | $ - | $ 924 | $ - | $ - |
| 3 | Gravity Main | P4531 | 11151-11181 Radcliff Dr | CCTV | $ 475 | $ - | $ - | $ 504 | $ - | $ - |
| 3 | Gravity Main | P2881 | 11541 Brookland Ct | CCTV | $ 485 | $ - | $ - | $ 514 | $ - | $ - |
| 3 | Gravity Main | P2772 | 11525-11555 60th Ave | CCTV | $ 807 | $ - | $ - | $ 856 | $ - | $ - |
| 3 | Gravity Main | P4742 | 11269-11261 48th Ave | CCTV | $ 167 | $ - | $ - | $ 177 | $ - | $ - |
| 3 | Gravity Main | P4656 | Dr | CCTV | $ 451 | $ - | $ - | $ 478 | $ - | $ - |
| 3 | Gravity Main | P3620 | 10415 52nd Ave | CCTV | $ 902 | $ - | $ - | $ 957 | $ - | $ - |
| 3 | Gravity Main | P3621 | 10431-10463 52nd Ave | CCTV | $ 945 | $ - | $ - | $ 1,003 | $ - | $ - |
| 3 | Gravity Main | P3720 | 10463-10517 52nd Ave | CCTV | $ 1,583 | $ - | $ - | $ 1,679 | $ - | $ - |
| 3 | Gravity Main | P2485 | 5751 Lake Michigan Dr | CCTV | $ 1,569 | $ - | $ - | $ 1,665 | $ - | $ - |
| 3 | Gravity Main | P4700 | 11258 56th Ave | CCTV | $ 1,198 | $ - | $ - | $ 1,270 | $ - | $ - |
| 3 | Gravity Main | P5042 | 11529-11483 48th Ave | CCTV | $ 1,138 | $ - | $ - | $ 1,208 | $ - | $ - |
| 3 | Gravity Main | P5140 | 11565-11529 48th Ave | CCTV | $ 912 | $ - | $ - | $ 968 | $ - | $ - |
| 3 | Gravity Main | P4740 | 11227-11261 48th Ave | CCTV | $ 749 | $ - | $ - | $ 794 | $ - | $ - |
| 3 | Gravity Main | P5146 | 4726-4750 Rich St | CCTV | $ 1,232 | $ - | $ - | $ 1,307 | $ - | $ - |
| 3 | Gravity Main | P4422 | 11031-11059 52nd Ave | CCTV | $ 712 | $ - | $ - | $ 755 | $ - | $ - |
| 3 | Gravity Main | P3622 | 5160-5202 Pierce St | CCTV | $ 1,354 | $ - | $ - | $ 1,436 | $ - | $ - |
| 3 | Gravity Main | P2380 | 11193-11208 60th Ave | CCTV | $ 519 | $ - | $ - | $ 551 | $ - | $ - |
| 3 | Gravity Main | P2495 | 5680 Lake Michigan Dr | CCTV | $ 1,643 | $ - | $ - | $ 1,743 | $ - | $ - |
| 3 | Gravity Main | P2494 | 11149 Northgate Ave | CCTV | $ 1,448 | $ - | $ - | $ 1,536 | $ - | $ - |
| 3 | Gravity Main | P2365 | WJ Presley Pkwy | CCTV | $ 1,125 | $ - | $ - | $ 1,193 | $ - | $ - |
| 3 | Gravity Main | P2473A | 6194 Library Ln | CCTV | $ 690 | $ - | $ - | $ 732 | $ - | $ - |
| 3 | Gravity Main | P2347 | Dr | CCTV | $ 1,063 | $ - | $ - | $ 1,128 | $ - | $ - |
| 3 | Gravity Main | P4637 | Dr | CCTV | $ 113 | $ - | $ - | $ 120 | $ - | $ - |
| 3 | Gravity Main | P4638 | Dr | CCTV | $ 374 | $ - | $ - | $ 397 | $ - | $ - |
| 3 | Gravity Main | P2346 | Dr | CCTV | $ 141 | $ - | $ - | $ 150 | $ - | $ - |
| 3 | Gravity Main | P2388 | 11147 Richard Ave | CCTV | $ 1,481 | $ - | $ - | $ 1,571 | $ - | $ - |
| 3 | Gravity Main | P2460 | 11261-11205 64th Ave | CCTV | $ 1,217 | $ - | $ - | $ 1,292 | $ - | $ - |
| 3 | Gravity Main | P2345 | Dr | CCTV | $ 779 | $ - | $ - | $ 827 | $ - | $ - |
| 3 | Gravity Main | P2362 | 11194 64th Ave | CCTV | $ 180 | $ - | $ - | $ 191 | $ - | $ - |

**Table K-3. Preventative Maintenance Inspection Plan**

| Year | Asset | ID | Address | Rehab Actions | Cost | 2018 | 2019 | 2020 | 2021 | 2022 |
|---|---|---|---|---|---|---|---|---|---|---|
| 3 | Gravity Main | P4421 | 11015 52nd Ave | CCTV | $ 738 | $ - | $ - | $ 782 | $ - | $ - |
| 3 | Gravity Main | P3721 | 10547 52nd Ave | CCTV | $ 1,606 | $ - | $ - | $ 1,704 | $ - | $ - |
| 3 | Gravity Main | P2493 | 11255-11253 56th Ave | CCTV | $ 709 | $ - | $ - | $ 752 | $ - | $ - |
| 3 | Gravity Main | P2484 | 11271 Rosewood Ave | CCTV | $ 905 | $ - | $ - | $ 960 | $ - | $ - |
| 3 | Gravity Main | P4320 | 10913-10963 52nd Ave | CCTV | $ 1,494 | $ - | $ - | $ 1,585 | $ - | $ - |
| 3 | Gravity Main | P3921 | 10657-10723 52nd Ave | CCTV | $ 1,700 | $ - | $ - | $ 1,803 | $ - | $ - |
| 3 | Gravity Main | P4120 | 10781-10829 52nd Ave | CCTV | $ 1,332 | $ - | $ - | $ 1,413 | $ - | $ - |
| 3 | Gravity Main | P4221 | 10855-10913 52nd Ave | CCTV | $ 1,105 | $ - | $ - | $ 1,172 | $ - | $ - |
| 3 | Gravity Main | P3820 | 5217 Windfield Dr | CCTV | $ 1,436 | $ - | $ - | $ 1,523 | $ - | $ - |
| 3 | Gravity Main | P3920 | 10621-10657 52nd Ave | CCTV | $ 1,067 | $ - | $ - | $ 1,132 | $ - | $ - |
| 3 | Gravity Main | P4020 | 10723-10781 52nd Ave | CCTV | $ 1,407 | $ - | $ - | $ 1,492 | $ - | $ - |
| 3 | Gravity Main | P1125 | 10963-10967 52nd Ave | CCTV | $ 124 | $ - | $ - | $ 132 | $ - | $ - |
| 3 | Gravity Main | P4121 | 10829-10855 52nd Ave | CCTV | $ 2,096 | $ - | $ - | $ 2,224 | $ - | $ - |
| 3 | Gravity Main | P4420 | 10983 52nd Ave | CCTV | $ 1,017 | $ - | $ - | $ 1,079 | $ - | $ - |
| 3 | Gravity Main | P2336 | 11215 Valley View Ave | CCTV | $ 814 | $ - | $ - | $ 864 | $ - | $ - |
| 3 | Gravity Main | P1180 | Dr | CCTV | $ 755 | $ - | $ - | $ 801 | $ - | $ - |
| 3 | Gravity Main | P2337 | 11215 Valley View Ave | CCTV | $ 249 | $ - | $ - | $ 264 | $ - | $ - |
| 3 | Gravity Main | P4655 | Dr | CCTV | $ 171 | $ - | $ - | $ 182 | $ - | $ - |
| 3 | Gravity Main | P4626 | 5053 Lake Michigan Dr | CCTV | $ 360 | $ - | $ - | $ 382 | $ - | $ - |
| 3 | Gravity Main | P1133 | Dr | CCTV | $ 571 | $ - | $ - | $ 606 | $ - | $ - |
| 3 | Gravity Main | P4657 | Dr | CCTV | $ 1,355 | $ - | $ - | $ 1,437 | $ - | $ - |
| 3 | Gravity Main | P9516 | 10498 52nd Ave | CCTV | $ 331 | $ - | $ - | $ 351 | $ - | $ - |
| 3 | Gravity Main | P9612 | 10498-10520 52nd Ave | CCTV | $ 545 | $ - | $ - | $ 578 | $ - | $ - |
| 3 | Gravity Main | P9613 | 10520-10498 52nd Ave | CCTV | $ 1,356 | $ - | $ - | $ 1,438 | $ - | $ - |
| 3 | Gravity Main | P4538 | 11035 Stanford Ave | CCTV | $ 1,312 | $ - | $ - | $ 1,392 | $ - | $ - |
| 3 | Gravity Main | P4537 | 11055-11085 Stanford Ave | CCTV | $ 1,036 | $ - | $ - | $ 1,099 | $ - | $ - |
| 3 | Gravity Main | P1111 | 11085 Stanford Ave | CCTV | $ 515 | $ - | $ - | $ 546 | $ - | $ - |
| 3 | Gravity Main | P1581 | 10550 60th Ave | CCTV | $ 190 | $ - | $ - | $ 202 | $ - | $ - |
| 3 | Gravity Main | P5286 | 11773-11717 40th Ave | CCTV | $ 1,325 | $ - | $ - | $ 1,405 | $ - | $ - |
| 3 | Gravity Main | P1116 | 10411-10445 48th Ave | CCTV | $ 758 | $ - | $ - | $ 804 | $ - | $ - |
| 3 | Gravity Main | P4983 | 11454 Cadence Ct | CCTV | $ 1,152 | $ - | $ - | $ 1,222 | $ - | $ - |
| 3 | Gravity Main | P5285 | 11717-11654 40th Ave | CCTV | $ 1,499 | $ - | $ - | $ 1,590 | $ - | $ - |
| 3 | Gravity Main | P5287 | 11731 40th Ave | CCTV | $ 1,495 | $ - | $ - | $ 1,587 | $ - | $ - |
| 3 | Gravity Main | P2248 | 6605 Henry St | CCTV | $ 330 | $ - | $ - | $ 350 | $ - | $ - |
| 3 | Gravity Main | P4701 | 5543 Lake Michigan Dr | CCTV | $ 1,270 | $ - | $ - | $ 1,347 | $ - | $ - |
| 3 | Gravity Main | P2480 | 5903 Lake Michigan Dr | CCTV | $ 1,001 | $ - | $ - | $ 1,062 | $ - | $ - |
| 3 | Gravity Main | P2391 | Dr | CCTV | $ 636 | $ - | $ - | $ 674 | $ - | $ - |
| 3 | Gravity Main | P2094 | 6173 Mary Eliz Dr | CCTV | $ 1,144 | $ - | $ - | $ 1,213 | $ - | $ - |
| 3 | Gravity Main | P2096 | 10983 Melanie Dr | CCTV | $ 530 | $ - | $ - | $ 562 | $ - | $ - |
| 3 | Gravity Main | P2581 | 5764-5735 Ivory Rd | CCTV | $ 397 | $ - | $ - | $ 421 | $ - | $ - |
| 3 | Gravity Main | P2685 | 11441-11425 Prairie Ave | CCTV | $ 737 | $ - | $ - | $ 782 | $ - | $ - |
| 3 | Gravity Main | P1994 | 5796-5769 Lynn Dr | CCTV | $ 770 | $ - | $ - | $ 817 | $ - | $ - |
| 3 | Gravity Main | P2193 | 5752-5578 Forest View Dr | CCTV | $ 1,046 | $ - | $ - | $ 1,109 | $ - | $ - |
| 3 | Gravity Main | P1085 | 5997 Frostline Dr | CCTV | $ 199 | $ - | $ - | $ 211 | $ - | $ - |

**Table K-3. Preventative Maintenance Inspection Plan**

| Year | Asset | ID | Address | Rehab Actions | Cost | 2018 | 2019 | 2020 | 2021 | 2022 |
|---|---|---|---|---|---|---|---|---|---|---|
| 3 | Gravity Main | P2392 | Dr | CCTV | $ 641 | $ - | $ - | $ 680 | $ - | $ - |
| 3 | Gravity Main | P4941 | 11410-11403 48th Ave | CCTV | $ 310 | $ - | $ - | $ 329 | $ - | $ - |
| 3 | Gravity Main | P2486 | 11271 Rosewood Ave | CCTV | $ 774 | $ - | $ - | $ 821 | $ - | $ - |
| 3 | Gravity Main | P2095 | 10801-10931 Mary Eliz Ct | CCTV | $ 1,292 | $ - | $ - | $ 1,371 | $ - | $ - |
| 3 | Gravity Main | P2398 | 11115 Estate Ct | CCTV | $ 1,190 | $ - | $ - | $ 1,263 | $ - | $ - |
| 3 | Gravity Main | P5141 | 11581 48th Ave | CCTV | $ 875 | $ - | $ - | $ 929 | $ - | $ - |
| 3 | Gravity Main | P2387 | Dr | CCTV | $ 1,424 | $ - | $ - | $ 1,511 | $ - | $ - |
| 3 | Gravity Main | P2582 | 5804-5764 Ivory Rd | CCTV | $ 517 | $ - | $ - | $ 548 | $ - | $ - |
| 3 | Gravity Main | P2590 | 11299 Rosewood Ave | CCTV | $ 929 | $ - | $ - | $ 986 | $ - | $ - |
| 3 | Gravity Main | P5147 | 4702-4726 Rich St | CCTV | $ 1,264 | $ - | $ - | $ 1,340 | $ - | $ - |
| 3 | Gravity Main | P2589 | 5957-5930 Dewpointe Dr | CCTV | $ 684 | $ - | $ - | $ 726 | $ - | $ - |
| 3 | Gravity Main | P2192 | 5490 Forest View Dr | CCTV | $ 1,054 | $ - | $ - | $ 1,118 | $ - | $ - |
| 3 | Gravity Main | P5145 | 4750-4774 Rich St | CCTV | $ 1,230 | $ - | $ - | $ 1,305 | $ - | $ - |
| 3 | Gravity Main | P2487 | 5855-5802 Larkspur Ave | CCTV | $ 971 | $ - | $ - | $ 1,031 | $ - | $ - |
| 3 | Gravity Main | P2393 | 11171 Pleasant Point Dr | CCTV | $ 841 | $ - | $ - | $ 893 | $ - | $ - |
| 3 | Gravity Main | P2591 | 11349 Rosewood Ave | CCTV | $ 1,468 | $ - | $ - | $ 1,557 | $ - | $ - |
| 3 | Gravity Main | P4940 | 11403-11359 48th Ave | CCTV | $ 1,115 | $ - | $ - | $ 1,183 | $ - | $ - |
| 3 | Gravity Main | P2394 | Point Dr | CCTV | $ 735 | $ - | $ - | $ 780 | $ - | $ - |
| 3 | Gravity Main | P2195 | 5780-5752 Forest View Dr | CCTV | $ 779 | $ - | $ - | $ 827 | $ - | $ - |
| 3 | Gravity Main | P1993 | 5769-5702 Lynn Dr | CCTV | $ 881 | $ - | $ - | $ 935 | $ - | $ - |
| 3 | Gravity Main | P2197 | 11025 Pleasant Point Dr | CCTV | $ 748 | $ - | $ - | $ 794 | $ - | $ - |
| 3 | Gravity Main | P5144 | 4774-4802 Rich St | CCTV | $ 1,321 | $ - | $ - | $ 1,401 | $ - | $ - |
| 3 | Gravity Main | P2191 | 10997-11027 Gayle Ln | CCTV | $ 443 | $ - | $ - | $ 470 | $ - | $ - |
| 3 | Gravity Main | P5350 | 11651 46th Ave | CCTV | $ 1,284 | $ - | $ - | $ 1,363 | $ - | $ - |
| 3 | Gravity Main | P2290 | 11006 Estate Ct | CCTV | $ 387 | $ - | $ - | $ 411 | $ - | $ - |
| 3 | Gravity Main | P1992 | 10815 Melanie Dr | CCTV | $ 383 | $ - | $ - | $ 407 | $ - | $ - |
| 3 | Gravity Main | P2583 | 5827-5852 Ivory Rd | CCTV | $ 336 | $ - | $ - | $ 356 | $ - | $ - |
| 3 | Gravity Main | P5351 | 11731 46th Ave | CCTV | $ 1,080 | $ - | $ - | $ 1,146 | $ - | $ - |
| 3 | Gravity Main | P2291 | Estate Rd | CCTV | $ 282 | $ - | $ - | $ 299 | $ - | $ - |
| 3 | Gravity Main | P2090 | 10962-10997 Gayle Ln | CCTV | $ 1,226 | $ - | $ - | $ 1,301 | $ - | $ - |
| 3 | Gravity Main | P2339 | 11209-11235 Brown St | CCTV | $ 570 | $ - | $ - | $ 604 | $ - | $ - |
| 3 | Gravity Main | P2488 | 5881 Larkspur Ave | CCTV | $ 909 | $ - | $ - | $ 964 | $ - | $ - |
| 3 | Gravity Main | P1990 | 10901-10965 Melanie Dr | CCTV | $ 979 | $ - | $ - | $ 1,038 | $ - | $ - |
| 3 | Gravity Main | P5250 | 11549 46th Ave | CCTV | $ 1,496 | $ - | $ - | $ 1,587 | $ - | $ - |
| 3 | Gravity Main | P4932 | 11407 48th Ave | CCTV | $ 255 | $ - | $ - | $ 271 | $ - | $ - |
| 3 | Gravity Main | P2586 | 11361 Prairie Ave | CCTV | $ 555 | $ - | $ - | $ 589 | $ - | $ - |
| 3 | Gravity Main | P2338 | 6915 Lake Michigan Dr | CCTV | $ 1,444 | $ - | $ - | $ 1,532 | $ - | $ - |
| 3 | Gravity Main | P5352 | 11821-11761 46th Ave | CCTV | $ 1,037 | $ - | $ - | $ 1,100 | $ - | $ - |
| 3 | Gravity Main | P2683 | 11385 Prairie Ave | CCTV | $ 905 | $ - | $ - | $ 960 | $ - | $ - |
| 3 | Gravity Main | P4845 | 11359-11313 48th Ave | CCTV | $ 1,127 | $ - | $ - | $ 1,196 | $ - | $ - |
| 3 | Gravity Main | P2691 | Ave | CCTV | $ 1,081 | $ - | $ - | $ 1,147 | $ - | $ - |
| 3 | Gravity Main | P2093 | 5727-5670 Mary Eliz Dr | CCTV | $ 551 | $ - | $ - | $ 584 | $ - | $ - |
| 3 | Gravity Main | P5356 | 4431-4488 Pingree St | CCTV | $ 1,039 | $ - | $ - | $ 1,102 | $ - | $ - |
| 3 | Gravity Main | P2690 | 11391 Rosewood Ave | CCTV | $ 505 | $ - | $ - | $ 536 | $ - | $ - |

**Table K-3. Preventative Maintenance Inspection Plan**

| Year | Asset | ID | Address | Rehab Actions | Cost | 2018 | 2019 | 2020 | 2021 | 2022 |
|---|---|---|---|---|---|---|---|---|---|---|
| 3 | Gravity Main | P2396 | Dr | CCTV | $ 671 | $ - | $ - | $ 712 | $ - | $ - |
| 3 | Gravity Main | P2395 | Point Dr | CCTV | $ 317 | $ - | $ - | $ 337 | $ - | $ - |
| 3 | Gravity Main | P4930 | 4991-4896 Allenpark Dr | CCTV | $ 1,472 | $ - | $ - | $ 1,562 | $ - | $ - |
| 3 | Gravity Main | P2397 | Dr | CCTV | $ 505 | $ - | $ - | $ 536 | $ - | $ - |
| 3 | Gravity Main | P5355 | 4488-4544 Pingree St | CCTV | $ 1,024 | $ - | $ - | $ 1,087 | $ - | $ - |
| 3 | Gravity Main | P2190 | 11113 Gayle Ln | CCTV | $ 995 | $ - | $ - | $ 1,056 | $ - | $ - |
| 3 | Gravity Main | P2399 | Dr | CCTV | $ 986 | $ - | $ - | $ 1,046 | $ - | $ - |
| 3 | Gravity Main | P5354 | 4572 Pingree St | CCTV | $ 1,045 | $ - | $ - | $ 1,109 | $ - | $ - |
| 3 | Gravity Main | P5357 | 4375-4431 Pingree St | CCTV | $ 1,007 | $ - | $ - | $ 1,068 | $ - | $ - |
| 3 | Gravity Main | P2196 | 5798-5780 Forest View Dr | CCTV | $ 604 | $ - | $ - | $ 641 | $ - | $ - |
| 3 | Gravity Main | P2585 | 11351-11281 Prairie Ave | CCTV | $ 1,444 | $ - | $ - | $ 1,532 | $ - | $ - |
| 3 | Gravity Main | P2580 | 5735-5701 Ivory Rd | CCTV | $ 458 | $ - | $ - | $ 486 | $ - | $ - |
| 3 | Gravity Main | P1991 | 10865 Melanie Dr | CCTV | $ 1,062 | $ - | $ - | $ 1,127 | $ - | $ - |
| 3 | Gravity Main | P4931 | 4854 Allenpark Dr | CCTV | $ 1,311 | $ - | $ - | $ 1,391 | $ - | $ - |
| 3 | Gravity Main | P2588 | 5930-5443 Dewpointe Dr | CCTV | $ 801 | $ - | $ - | $ 849 | $ - | $ - |
| 3 | Gravity Main | P2091 | 5673 Mary Eliz Dr | CCTV | $ 796 | $ - | $ - | $ 844 | $ - | $ - |
| 3 | Gravity Main | P2092 | 5670-5634 Mary Eliz Dr | CCTV | $ 686 | $ - | $ - | $ 728 | $ - | $ - |
| 3 | Gravity Main | P2194 | 10937 Homestead Ln | CCTV | $ 1,396 | $ - | $ - | $ 1,481 | $ - | $ - |
| 3 | Gravity Main | P2587 | 5443-5016 Dewpointe Dr | CCTV | $ 694 | $ - | $ - | $ 736 | $ - | $ - |
| 3 | Gravity Main | P2684 | 11425-11399 Prairie Ave | CCTV | $ 678 | $ - | $ - | $ 719 | $ - | $ - |
| 3 | Gravity Main | P2386 | 5976 Country View Dr | CCTV | $ 1,427 | $ - | $ - | $ 1,514 | $ - | $ - |
| 3 | Gravity Main | P4984 | 11478-11529 40th Ave | CCTV | $ 1,177 | $ - | $ - | $ 1,248 | $ - | $ - |
| 3 | Gravity Main | P2584 | 5876 Ivory Rd | CCTV | $ 629 | $ - | $ - | $ 667 | $ - | $ - |
| 3 | Gravity Main | P1134 | 11463-11443 48th Ave | CCTV | $ 474 | $ - | $ - | $ 503 | $ - | $ - |
| 3 | Gravity Main | P5142 | 11607 48th Ave | CCTV | $ 240 | $ - | $ - | $ 255 | $ - | $ - |
| 3 | Gravity Main | P5041 | 11483-11463 48th Ave | CCTV | $ 546 | $ - | $ - | $ 579 | $ - | $ - |
| 3 | Gravity Main | P5143 | 11619-11613 48th Ave | CCTV | $ 142 | $ - | $ - | $ 150 | $ - | $ - |
| 3 | Gravity Main | P5353 | 11859-11821 46th Ave | CCTV | $ 663 | $ - | $ - | $ 704 | $ - | $ - |
| 3 | Gravity Main | P4362 | 1 Campus Dr | CCTV and Heavy Cleaning | $ 1,116 | $ - | $ - | $ 1,184 | $ - | $ - |
| 3 | Gravity Main | P1089 | Dr | CCTV | $ 712 | $ - | $ - | $ 755 | $ - | $ - |
| 3 | Gravity Main | P2787 | 5821-5859 Frostline Dr | CCTV | $ 1,301 | $ - | $ - | $ 1,381 | $ - | $ - |
| 3 | Gravity Main | P2593 | 5710-5720 Victoria St | CCTV | $ 480 | $ - | $ - | $ 509 | $ - | $ - |
| 3 | Gravity Main | P2785 | 5859-5899 Frostline Dr | CCTV | $ 629 | $ - | $ - | $ 667 | $ - | $ - |
| 3 | Gravity Main | P2788 | 11481 Prairie Ave | CCTV | $ 1,177 | $ - | $ - | $ 1,248 | $ - | $ - |
| 3 | Gravity Main | P2781 | 5953-5965 Frostline Dr | CCTV | $ 448 | $ - | $ - | $ 475 | $ - | $ - |
| 3 | Gravity Main | P2782 | 5931-5953 Frostline Dr | CCTV | $ 429 | $ - | $ - | $ 455 | $ - | $ - |
| 3 | Gravity Main | P4536 | 11191 Stanford Ave | CCTV | $ 539 | $ - | $ - | $ 572 | $ - | $ - |
| 3 | Gravity Main | P2681 | Meadow Dr | CCTV | $ 1,257 | $ - | $ - | $ 1,333 | $ - | $ - |
| 3 | Gravity Main | P2780 | 5965-5995 Frostline Dr | CCTV | $ 1,089 | $ - | $ - | $ 1,156 | $ - | $ - |
| 3 | Gravity Main | P4535 | 11003-11011 Radcliff Dr | CCTV | $ 950 | $ - | $ - | $ 1,008 | $ - | $ - |
| 3 | Gravity Main | P1109 | 11071-11101 Radcliff Dr | CCTV | $ 1,139 | $ - | $ - | $ 1,208 | $ - | $ - |
| 3 | Gravity Main | P1110 | 11041-11071 Radcliff Dr | CCTV | $ 1,154 | $ - | $ - | $ 1,224 | $ - | $ - |
| 3 | Gravity Main | P4876 | 3994 Ravine Dr | CCTV | $ 926 | $ - | $ - | $ 982 | $ - | $ - |
| 3 | Gravity Main | P4533 | 11101-11137 Radcliff Dr | CCTV | $ 653 | $ - | $ - | $ 693 | $ - | $ - |

**Table K-3. Preventative Maintenance Inspection Plan**

| Year | Asset | ID | Address | Rehab Actions | Cost | 2018 | 2019 | 2020 | 2021 | 2022 |
|---|---|---|---|---|---|---|---|---|---|---|
| 3 | Gravity Main | P2390 | Dr | CCTV | $ 275 | $ - | $ - | $ 292 | $ - | $ - |
| 3 | Gravity Main | P4800 | 11307-11253 56th Ave | CCTV | $ 1,381 | $ - | $ - | $ 1,465 | $ - | $ - |
| 3 | Gravity Main | P2790 | 5755-5821 Frostline Dr | CCTV | $ 608 | $ - | $ - | $ 645 | $ - | $ - |
| 3 | Gravity Main | P2784 | 5899-5931 Frostline Dr | CCTV | $ 520 | $ - | $ - | $ 552 | $ - | $ - |
| 3 | Gravity Main | P2791 | 5711-5755 Frostline Dr | CCTV | $ 384 | $ - | $ - | $ 407 | $ - | $ - |
| 3 | Gravity Main | P4802 | 11417-11363 56th Ave | CCTV | $ 1,382 | $ - | $ - | $ 1,466 | $ - | $ - |
| 3 | Gravity Main | P4801 | 11363-11307 56th Ave | CCTV | $ 1,349 | $ - | $ - | $ 1,431 | $ - | $ - |
| 3 | Gravity Main | P2592 | 11293 Cameron Ave | CCTV | $ 1,133 | $ - | $ - | $ 1,201 | $ - | $ - |
| 3 | Gravity Main | P2693 | Ave | CCTV | $ 1,167 | $ - | $ - | $ 1,238 | $ - | $ - |
| 3 | Gravity Main | P2783 | 5934-5931 Frostline Dr | CCTV | $ 548 | $ - | $ - | $ 581 | $ - | $ - |
| 3 | Gravity Main | P2682 | 11513 Hunters Meadow Dr | CCTV | $ 1,244 | $ - | $ - | $ 1,320 | $ - | $ - |
| 3 | Gravity Main | P4532 | 11137-11151 Radcliff Dr | CCTV | $ 422 | $ - | $ - | $ 448 | $ - | $ - |
| 3 | Gravity Main | P2694 | 11409 Cameron Ave | CCTV | $ 1,157 | $ - | $ - | $ 1,227 | $ - | $ - |
| 3 | Gravity Main | P2984 | 11659-11587 Brookland Ct | CCTV | $ 1,136 | $ - | $ - | $ 1,206 | $ - | $ - |
| 3 | Gravity Main | P4534 | 11011-11041 Radcliff Dr | CCTV | $ 1,111 | $ - | $ - | $ 1,178 | $ - | $ - |
| 3 | Gravity Main | P2786 | 11463 Eagle Nest Ct | CCTV | $ 1,055 | $ - | $ - | $ 1,119 | $ - | $ - |
| 3 | Gravity Main | P2695 | 5702-5732 Crabtree St | CCTV | $ 567 | $ - | $ - | $ 602 | $ - | $ - |
| 3 | Gravity Main | P2594 | 11235 Cameron Ave | CCTV | $ 1,170 | $ - | $ - | $ 1,241 | $ - | $ - |
| 3 | Gravity Main | P4872 | 3985 River Ridge Ct | CCTV | $ 606 | $ - | $ - | $ 642 | $ - | $ - |
| 3 | Gravity Main | P2389 | Dr | CCTV | $ 1,197 | $ - | $ - | $ 1,270 | $ - | $ - |
| 3 | Gravity Main | P2696 | 11515 Cameron Ave | CCTV | $ 1,268 | $ - | $ - | $ 1,345 | $ - | $ - |
| 3 | Gravity Main | P2692 | Ave | CCTV | $ 1,243 | $ - | $ - | $ 1,319 | $ - | $ - |
| 3 | Gravity Main | P1079 | 11575 Spruce View Dr | CCTV | $ 725 | $ - | $ - | $ 770 | $ - | $ - |
| 3 | Gravity Main | P4340 | 10929-10975 48th Ave | CCTV | $ 1,242 | $ - | $ - | $ 1,318 | $ - | $ - |
| 3 | Gravity Main | P9600 | 11342 Brown St | CCTV | $ 786 | $ - | $ - | $ 834 | $ - | $ - |
| 3 | Gravity Main | P2789 | 11453-11463 Prairie Ave | CCTV | $ 307 | $ - | $ - | $ 326 | $ - | $ - |
| 3 | Gravity Main | P3840 | 10489-10561 48th Ave | CCTV | $ 1,176 | $ - | $ - | $ 1,248 | $ - | $ - |
| 3 | Gravity Main | P3832 | 10511 Country Pl W | CCTV | $ 1,289 | $ - | $ - | $ 1,367 | $ - | $ - |
| 3 | Gravity Main | P4980 | 11428 Cadence Ct | CCTV | $ 1,017 | $ - | $ - | $ 1,079 | $ - | $ - |
| 3 | Gravity Main | P1115 | 10445 48th Ave | CCTV | $ 800 | $ - | $ - | $ 849 | $ - | $ - |
| 3 | Gravity Main | P3834 | 4912 Country Pl N | CCTV | $ 967 | $ - | $ - | $ 1,025 | $ - | $ - |
| 3 | Gravity Main | P1114 | 10445-10471 48th Ave | CCTV | $ 326 | $ - | $ - | $ 346 | $ - | $ - |
| 3 | Gravity Main | P4981 | 3927 Ravine Dr | CCTV | $ 442 | $ - | $ - | $ 469 | $ - | $ - |
| 3 | Gravity Main | P4654 | 4477 Lake Michigan Dr | CCTV | $ 313 | $ - | $ - | $ 332 | $ - | $ - |
| 3 | Gravity Main | P4650 | 4565 Lake Michigan Dr | CCTV | $ 1,062 | $ - | $ - | $ 1,127 | $ - | $ - |
| 3 | Gravity Main | P4874 | 11375 River Ridge Dr | CCTV | $ 1,104 | $ - | $ - | $ 1,171 | $ - | $ - |
| 3 | Gravity Main | P1136 | 11378-11368 48th Ave | CCTV | $ 722 | $ - | $ - | $ 766 | $ - | $ - |
| 3 | Gravity Main | P1135 | 11368-11410 48th Ave | CCTV | $ 795 | $ - | $ - | $ 843 | $ - | $ - |
| 3 | Gravity Main | P1126 | Dr | CCTV | $ 796 | $ - | $ - | $ 845 | $ - | $ - |
| 3 | Gravity Main | P4875 | 3962-3934 Ravine Dr | CCTV | $ 683 | $ - | $ - | $ 725 | $ - | $ - |
| 3 | Gravity Main | P4873 | 11335 River Ridge Dr | CCTV | $ 1,137 | $ - | $ - | $ 1,206 | $ - | $ - |
| 3 | Gravity Main | P4653 | 4477 Lake Michigan Dr | CCTV | $ 378 | $ - | $ - | $ 401 | $ - | $ - |
| 3 | Gravity Main | P3635 | 4997-5013 Pierce St | CCTV | $ 611 | $ - | $ - | $ 648 | $ - | $ - |
| 3 | Gravity Main | P3634 | 5013 Pierce St | CCTV | $ 220 | $ - | $ - | $ 234 | $ - | $ - |

**Table K-3. Preventative Maintenance Inspection Plan**

| Year | Asset | ID | Address | Rehab Actions | Cost | 2018 | 2019 | 2020 | 2021 | 2022 |
|---|---|---|---|---|---|---|---|---|---|---|
| 3 | Gravity Main | P3631 | 5045 Pierce St | CCTV | $ 209 | $ - | $ - | $ 222 | $ - | $ - |
| 3 | Gravity Main | P1821 | 10836 Timberline Dr | CCTV | $ 247 | $ - | $ - | $ 262 | $ - | $ - |
| 3 | Gravity Main | P2450 | 6561 Lake Michigan Dr | CCTV | $ 262 | $ - | $ - | $ 278 | $ - | $ - |
| 3 | Gravity Main | P4878 | 11375-11377 40th Ave | CCTV | $ 379 | $ - | $ - | $ 403 | $ - | $ - |
| 3 | Gravity Main | P4539 | Dr | CCTV | $ 1,429 | $ - | $ - | $ 1,516 | $ - | $ - |
| 3 | Gravity Main | P2492 | Dr | CCTV | $ 388 | $ - | $ - | $ 412 | $ - | $ - |
| 3 | Gravity Main | P4877 | 11377-11405 40th Ave | CCTV | $ 516 | $ - | $ - | $ 548 | $ - | $ - |
| 3 | Gravity Main | P2246 | 6676 Lake Michigan Dr | CCTV | $ 1,024 | $ - | $ - | $ 1,086 | $ - | $ - |
| 3 | Gravity Main | P1080 | Dr | CCTV | $ 689 | $ - | $ - | $ 731 | $ - | $ - |
| 3 | Gravity Main | P2490 | Dr | CCTV | $ 1,603 | $ - | $ - | $ 1,701 | $ - | $ - |
| 3 | Gravity Main | P3860 | 10507 Laker Village Dr | CCTV | $ 1,328 | $ - | $ - | $ 1,408 | $ - | $ - |
| 3 | Gravity Main | P3516 | 5256 Pierce St | CCTV | $ 135 | $ - | $ - | $ 143 | $ - | $ - |
| 3 | Gravity Main | P3816 | 10518-10564 Rockfield Rd | CCTV | $ 818 | $ - | $ - | $ 868 | $ - | $ - |
| 3 | Gravity Main | P4425 | Dr | CCTV | $ 1,042 | $ - | $ - | $ 1,105 | $ - | $ - |
| 3 | Gravity Main | P4325 | Dr | CCTV | $ 160 | $ - | $ - | $ 170 | $ - | $ - |
| 3 | Gravity Main | P4424 | 5104 Jordan St | CCTV | $ 163 | $ - | $ - | $ 173 | $ - | $ - |
| 3 | Gravity Main | P3625 | 5050-5083 Pierce St | CCTV | $ 95 | $ - | $ - | $ 101 | $ - | $ - |
| 3 | Gravity Main | P4426 | 10963 Woodedge Dr | CCTV | $ 1,162 | $ - | $ - | $ 1,233 | $ - | $ - |
| 3 | Gravity Main | P4321 | 5182 Circleview Dr | CCTV | $ 694 | $ - | $ - | $ 736 | $ - | $ - |
| 3 | Gravity Main | P4423 | 5146 Jordan St | CCTV | $ 1,534 | $ - | $ - | $ 1,627 | $ - | $ - |
| 3 | Gravity Main | P1131 | Creek Dr | CCTV | $ 298 | $ - | $ - | $ 316 | $ - | $ - |
| 3 | Gravity Main | P4747 | Creek Dr | CCTV | $ 421 | $ - | $ - | $ 447 | $ - | $ - |
| 3 | Gravity Main | P1129 | 11301 Commerce Rd | CCTV | $ 495 | $ - | $ - | $ 525 | $ - | $ - |
| 3 | Gravity Main | P1128 | 11301 Commerce Rd | CCTV | $ 299 | $ - | $ - | $ 318 | $ - | $ - |
| 3 | Gravity Main | P4427 | 5149 Woodedge Ct | CCTV | $ 929 | $ - | $ - | $ 985 | $ - | $ - |
| 3 | Gravity Main | P2446 | Dr | CCTV | $ 650 | $ - | $ - | $ 690 | $ - | $ - |
| 3 | Gravity Main | P4322 | 10909 Circle Way | CCTV | $ 1,136 | $ - | $ - | $ 1,206 | $ - | $ - |
| 3 | Gravity Main | P9705 | 5360 Windfield Dr | CCTV | $ 343 | $ - | $ - | $ 364 | $ - | $ - |
| 3 | Gravity Main | P1130 | Creek Dr | CCTV | $ 81 | $ - | $ - | $ 86 | $ - | $ - |
| 3 | Gravity Main | P4323 | 5103-5163 Circleview Dr | CCTV | $ 1,059 | $ - | $ - | $ 1,124 | $ - | $ - |
| 3 | Gravity Main | P3612 | 5399 Pierce St | CCTV | $ 198 | $ - | $ - | $ 210 | $ - | $ - |
| 3 | Gravity Main | P4324 | 10883 Woodedge Dr | CCTV | $ 1,069 | $ - | $ - | $ 1,135 | $ - | $ - |
| 3 | Gravity Main | P4326 | 5150 Circlewood Ln | CCTV | $ 821 | $ - | $ - | $ 871 | $ - | $ - |
| 3 | Gravity Main | P9611 | 10520-10517 52nd Ave | CCTV | $ 182 | $ - | $ - | $ 193 | $ - | $ - |
| 3 | Gravity Main | P9502 | 4999-4991 Allenpark Dr | CCTV | $ 346 | $ - | $ - | $ 367 | $ - | $ - |
| 3 | Gravity Main | P2252 | 6342-6402 Henry St | CCTV | $ 840 | $ - | $ - | $ 891 | $ - | $ - |
| 3 | Gravity Main | P4746 | Dr | CCTV | $ 247 | $ - | $ - | $ 262 | $ - | $ - |
| 3 | Gravity Main | P1044 | 11099-11051 Pinecreek Ct | CCTV | $ 738 | $ - | $ - | $ 783 | $ - | $ - |
| 3 | Gravity Main | P4745 | Dr | CCTV | $ 434 | $ - | $ - | $ 460 | $ - | $ - |
| 3 | Gravity Main | P4871 | 11276-11299 40th Ave | CCTV | $ 1,163 | $ - | $ - | $ 1,234 | $ - | $ - |
| 3 | Gravity Main | P4870 | 11253-11276 40th Ave | CCTV | $ 1,083 | $ - | $ - | $ 1,149 | $ - | $ - |
| 3 | Gravity Main | P4629 | 5180 Lake Michigan Dr | CCTV | $ 1,449 | $ - | $ - | $ 1,537 | $ - | $ - |
| 3 | Gravity Main | P1043 | 11010 Pinecreek Ct | CCTV | $ 805 | $ - | $ - | $ 854 | $ - | $ - |
| 3 | Gravity Main | P9518 | Dr | CCTV | $ 553 | $ - | $ - | $ 587 | $ - | $ - |

**Table K-3. Preventative Maintenance Inspection Plan**

| Year | Asset | ID | Address | Rehab Actions | Cost | 2018 | 2019 | 2020 | 2021 | 2022 |
|---|---|---|---|---|---|---|---|---|---|---|
| 3 | Gravity Main | P9500 | Dr | CCTV | $ 230 | $ - | $ - | $ 244 | $ - | $ - |
| 3 | Gravity Main | P3632 | 5045 Pierce St | CCTV | $ 361 | $ - | $ - | $ 383 | $ - | $ - |
| 3 | Gravity Main | P3737 | Hillcrest Town Houses | CCTV | $ 1,309 | $ - | $ - | $ 1,389 | $ - | $ - |
| 3 | Gravity Main | P3736 | 4967 Pierce St | CCTV | $ 1,316 | $ - | $ - | $ 1,397 | $ - | $ - |
| 3 | Gravity Main | P3735 | 4967-5045 Pierce St | CCTV | $ 1,309 | $ - | $ - | $ 1,389 | $ - | $ - |
| 3 | Gravity Main | P3830 | Campus West Apartments | CCTV | $ 1,142 | $ - | $ - | $ 1,211 | $ - | $ - |
| 3 | Gravity Main | P3738 | Hillcrest Town Houses | CCTV | $ 1,314 | $ - | $ - | $ 1,394 | $ - | $ - |
| 3 | Gravity Main | P3831 | 4964 Country Pl S | CCTV | $ 1,348 | $ - | $ - | $ 1,430 | $ - | $ - |
| 3 | Gravity Main | P4849 | 4737 Ottawa Creek Dr | CCTV | $ 1,524 | $ - | $ - | $ 1,617 | $ - | $ - |
| 3 | Gravity Main | P1132 | Dr | CCTV | $ 37 | $ - | $ - | $ 40 | $ - | $ - |
| 3 | Gravity Main | P4853 | 4687 Ottawa Creek Dr | CCTV | $ 454 | $ - | $ - | $ 481 | $ - | $ - |
| 3 | Gravity Main | P4850 | Dr | CCTV | $ 554 | $ - | $ - | $ 588 | $ - | $ - |
| 3 | Gravity Main | P4852 | 4683 Ottawa Creek Dr | CCTV | $ 711 | $ - | $ - | $ 754 | $ - | $ - |
| 3 | Gravity Main | P1099 | 10500-10518 Rockfield Rd | CCTV | $ 576 | $ - | $ - | $ 611 | $ - | $ - |
| 3 | Gravity Main | P4652 | Dr | CCTV | $ 880 | $ - | $ - | $ 933 | $ - | $ - |
| 3 | Gravity Main | P4651 | Dr | CCTV | $ 1,261 | $ - | $ - | $ 1,338 | $ - | $ - |
| 3 | Gravity Main | P2974 | Norfolk Dr | CCTV | $ 1,373 | $ - | $ - | $ 1,457 | $ - | $ - |
| 3 | Gravity Main | P3616 | 5313-5343 Pierce St | CCTV | $ 748 | $ - | $ - | $ 794 | $ - | $ - |
| 3 | Gravity Main | P4836 | 4926 Allenpark Dr | CCTV | $ 894 | $ - | $ - | $ 948 | $ - | $ - |
| 3 | Gravity Main | P3617 | 5269-5313 Pierce St | CCTV | $ 1,009 | $ - | $ - | $ 1,070 | $ - | $ - |
| 3 | Gravity Main | P4833 | Becker Dr | CCTV | $ 704 | $ - | $ - | $ 747 | $ - | $ - |
| 3 | Gravity Main | P2973 | Norfolk Dr | CCTV | $ 302 | $ - | $ - | $ 320 | $ - | $ - |
| 3 | Gravity Main | P1100 | 5401 Pierce St | CCTV | $ 976 | $ - | $ - | $ 1,036 | $ - | $ - |
| 3 | Gravity Main | P1105 | Southtown Dr | CCTV | $ 794 | $ - | $ - | $ 842 | $ - | $ - |
| 3 | Gravity Main | P4832 | 11238 Sugarloaf Ave | CCTV | $ 267 | $ - | $ - | $ 283 | $ - | $ - |
| 3 | Gravity Main | P2971 | 6142 Balcom Ln | CCTV | $ 1,421 | $ - | $ - | $ 1,508 | $ - | $ - |
| 3 | Gravity Main | P4830 | 11406 Sugarloaf Ave | CCTV | $ 763 | $ - | $ - | $ 810 | $ - | $ - |
| 3 | Gravity Main | P4744 | Boltwood Apartments | CCTV | $ 920 | $ - | $ - | $ 976 | $ - | $ - |
| 3 | Gravity Main | P1101 | 5378-5270 Crestfield Ln | CCTV | $ 1,481 | $ - | $ - | $ 1,572 | $ - | $ - |
| 3 | Gravity Main | P1172 | 5023 Lake Michigan Dr | CCTV | $ 920 | $ - | $ - | $ 976 | $ - | $ - |
| 3 | Gravity Main | P3615 | 5313-5343 Pierce St | CCTV | $ 881 | $ - | $ - | $ 934 | $ - | $ - |
| 3 | Gravity Main | P4837 | Pkwy | CCTV | $ 686 | $ - | $ - | $ 728 | $ - | $ - |
| 3 | Gravity Main | P4831 | 4926 Allenpark Dr | CCTV | $ 1,307 | $ - | $ - | $ 1,387 | $ - | $ - |
| 3 | Gravity Main | P4834 | 4998 Allenpark Dr | CCTV | $ 804 | $ - | $ - | $ 853 | $ - | $ - |
| 3 | Gravity Main | P4838 | Pkwy | CCTV | $ 775 | $ - | $ - | $ 822 | $ - | $ - |
| 3 | Gravity Main | P9506 | 11516 Boyne Blvd | CCTV | $ 1,313 | $ - | $ - | $ 1,393 | $ - | $ - |
| 3 | Gravity Main | P1106 | Southtown Dr | CCTV | $ 771 | $ - | $ - | $ 818 | $ - | $ - |
| 3 | Gravity Main | P9704 | 5399 Crestfield Ln | CCTV | $ 528 | $ - | $ - | $ 560 | $ - | $ - |
| 3 | Gravity Main | P9503 | 4999 Allenpark Dr | CCTV | $ 728 | $ - | $ - | $ 773 | $ - | $ - |
| 3 | Gravity Main | P9702 | 5401-5399 Pierce St | CCTV | $ 1,092 | $ - | $ - | $ 1,158 | $ - | $ - |
| 3 | Gravity Main | P9706 | 5363 Windfield Dr | CCTV | $ 383 | $ - | $ - | $ 406 | $ - | $ - |
| 3 | Gravity Main | P9505 | 4923 Allenpark Dr | CCTV | $ 1,302 | $ - | $ - | $ 1,381 | $ - | $ - |
| 3 | Gravity Main | P9507 | 11560 Boyne Blvd | CCTV | $ 903 | $ - | $ - | $ 958 | $ - | $ - |
| 3 | Gravity Main | P9504 | 11432 Boyne Blvd | CCTV | $ 184 | $ - | $ - | $ 195 | $ - | $ - |

**Table K-3. Preventative Maintenance Inspection Plan**

| Year | Asset | ID | Address | Rehab Actions | Cost | 2018 | 2019 | 2020 | 2021 | 2022 |
|---|---|---|---|---|---|---|---|---|---|---|
| 3 | Gravity Main | P9510 | 4923-4999 Allenpark Dr | CCTV | $ 1,304 | $ - | $ - | $ 1,383 | $ - | $ - |
| 3 | Gravity Main | P9513 | 4880-4878 Becker Dr | CCTV | $ 255 | $ - | $ - | $ 271 | $ - | $ - |
| 3 | Gravity Main | P9514 | Southtown Dr | CCTV | $ 793 | $ - | $ - | $ 842 | $ - | $ - |
| 3 | Gravity Main | P9509 | 4999 Allenpark Dr | CCTV | $ 571 | $ - | $ - | $ 606 | $ - | $ - |
| 3 | Gravity Main | P9511 | 4923 Allenpark Dr | CCTV | $ 1,313 | $ - | $ - | $ 1,392 | $ - | $ - |
| 3 | Gravity Main | P3608 | 5241 Pierce St | CCTV | $ 272 | $ - | $ - | $ 288 | $ - | $ - |
| 3 | Gravity Main | P9616 | 5075 Pierce St | CCTV | $ 1,210 | $ - | $ - | $ 1,284 | $ - | $ - |
| 3 | Gravity Main | P4835 | 4926 Allenpark Dr | CCTV | $ 758 | $ - | $ - | $ 805 | $ - | $ - |
| 3 | Gravity Main | P3609 | 5255 Pierce St | CCTV | $ 687 | $ - | $ - | $ 729 | $ - | $ - |
| 3 | Gravity Main | P3613 | 5399 Pierce St | CCTV | $ 419 | $ - | $ - | $ 444 | $ - | $ - |
| 3 | Gravity Main | P3614 | 5367 Pierce St | CCTV | $ 1,113 | $ - | $ - | $ 1,181 | $ - | $ - |
| 3 | Gravity Main | P9614 | 10520 52nd Ave | CCTV | $ 406 | $ - | $ - | $ 431 | $ - | $ - |
| 3 | Gravity Main | P9615 | 10520 52nd Ave | CCTV | $ 1,272 | $ - | $ - | $ 1,349 | $ - | $ - |
| 3 | Gravity Main | P9512 | 4898 Rich St | CCTV | $ 939 | $ - | $ - | $ 996 | $ - | $ - |
| 3 | Gravity Main | P9703 | 5398 Crestfield Ln | CCTV | $ 1,285 | $ - | $ - | $ 1,364 | $ - | $ - |
| 3 | Gravity Main | P9517 | 11200 Sugarloaf Ave | CCTV | $ 437 | $ - | $ - | $ 463 | $ - | $ - |
| 3 | Gravity Main | P4842 | 11240 University Pkwy | CCTV | $ 347 | $ - | $ - | $ 368 | $ - | $ - |
| 3 | Gravity Main | P2414 | 7193-7222 Barn Owl Ln | CCTV | $ 591 | $ - | $ - | $ 627 | $ - | $ - |
| 3 | Gravity Main | P1071 | 7145-7157 Barn Owl Ln | CCTV | $ 300 | $ - | $ - | $ 318 | $ - | $ - |
| 3 | Gravity Main | P2415 | 7157-7193 Barn Owl Ln | CCTV | $ 1,010 | $ - | $ - | $ 1,072 | $ - | $ - |
| 3 | Gravity Main | P2416 | 7168-7157 Barn Owl Ln | CCTV | $ 785 | $ - | $ - | $ 833 | $ - | $ - |
| 3 | Gravity Main | P2516 | 7120-7170 Blue Jay Dr | CCTV | $ 937 | $ - | $ - | $ 994 | $ - | $ - |
| 3 | Gravity Main | P2418 | 7099-7145 Barn Owl Ln | CCTV | $ 442 | $ - | $ - | $ 469 | $ - | $ - |
| 3 | Gravity Main | P4841 | 11240-4880 Becker Dr | CCTV | $ 313 | $ - | $ - | $ 332 | $ - | $ - |
| 3 | Gravity Main | P2417 | 7157 Barn Owl Ln | CCTV | $ 330 | $ - | $ - | $ 350 | $ - | $ - |
| 3 | Gravity Main | P2419 | 7154 Blue Jay Dr | CCTV | $ 1,122 | $ - | $ - | $ 1,190 | $ - | $ - |
| 3 | Gravity Main | P4627 | Dr | CCTV | $ 1,257 | $ - | $ - | $ 1,334 | $ - | $ - |
| 3 | Gravity Main | P1104 | 5057 W Campus Dr | CCTV | $ 959 | $ - | $ - | $ 1,017 | $ - | $ - |
| 3 | Gravity Main | P1123 | Dr | CCTV | $ 1,430 | $ - | $ - | $ 1,517 | $ - | $ - |
| 3 | Gravity Main | P1057 | Hawkin St | CCTV | $ 1,151 | $ - | $ - | $ 1,221 | $ - | $ - |
| 3 | Gravity Main | P1055 | Hawkin St | CCTV | $ 725 | $ - | $ - | $ 770 | $ - | $ - |
| 3 | Gravity Main | P1173 | Dr | CCTV and Heavy Cleaning | $ 791 | $ - | $ - | $ 839 | $ - | $ - |
| 3 | Gravity Main | P3861 | 1 Campus Dr | CCTV and Heavy Cleaning | $ 853 | $ - | $ - | $ 905 | $ - | $ - |
| 3 | Gravity Main | P2986 | 5890 Rich St | CCTV | $ 717 | $ - | $ - | $ 760 | $ - | $ - |
| 3 | Gravity Main | P3083 | 11714-11727 60th Ave | CCTV | $ 201 | $ - | $ - | $ 213 | $ - | $ - |
| 3 | Gravity Main | P2987 | 5870-5882 Rich St | CCTV | $ 294 | $ - | $ - | $ 312 | $ - | $ - |
| 3 | Gravity Main | P2985 | 11697-11659 Brookland Ct | CCTV | $ 634 | $ - | $ - | $ 673 | $ - | $ - |
| 3 | Gravity Main | P2988 | 5825-5870 Rich St | CCTV | $ 1,058 | $ - | $ - | $ 1,123 | $ - | $ - |
| 3 | Gravity Main | P2989 | 11645 Spruce View Dr | CCTV | $ 1,270 | $ - | $ - | $ 1,348 | $ - | $ - |
| 3 | Gravity Main | P3627 | 5084-5050 Pierce St | CCTV | $ 712 | $ - | $ - | $ 755 | $ - | $ - |
| 3 | Gravity Main | P3761 | 1 Campus Dr | CCTV | $ 1,304 | $ - | $ - | $ 1,384 | $ - | $ - |
| 3 | Gravity Main | P1097 | 5050-5084 Pierce St | CCTV | $ 540 | $ - | $ - | $ 573 | $ - | $ - |
| 3 | Gravity Main | P3762 | 1 Campus Dr | CCTV | $ 1,299 | $ - | $ - | $ 1,379 | $ - | $ - |
| 3 | Gravity Main | P3760 | 4411 Pierce St | CCTV | $ 1,392 | $ - | $ - | $ 1,476 | $ - | $ - |

**Table K-3. Preventative Maintenance Inspection Plan**

| Year | Asset | ID | Address | Rehab Actions | Cost | 2018 | 2019 | 2020 | 2021 | 2022 |
|---|---|---|---|---|---|---|---|---|---|---|
| 3 | Gravity Main | P2309 | 7423 Waterline Dr | CCTV | $ 58 | $ - | $ - | $ 62 | $ - | $ - |
| 3 | Gravity Main | P3563 | Dr | CCTV | $ 1,448 | $ - | $ - | $ 1,536 | $ - | $ - |
| 3 | Gravity Main | P3569 | 10281 42nd Ave | CCTV | $ 1,090 | $ - | $ - | $ 1,156 | $ - | $ - |
| 3 | Gravity Main | P1122 | 4406 Pierce St | CCTV | $ 1,119 | $ - | $ - | $ 1,188 | $ - | $ - |
| 3 | Gravity Main | P3570 | 10246 42nd Ave | CCTV | $ 257 | $ - | $ - | $ 273 | $ - | $ - |
| 3 | Gravity Main | P3077 | 6095-6082 Rossfield Ct | CCTV | $ 762 | $ - | $ - | $ 808 | $ - | $ - |
| 3 | Gravity Main | P2514 | 7220-7270 Blue Jay Dr | CCTV | $ 930 | $ - | $ - | $ 987 | $ - | $ - |
| 3 | Gravity Main | P3086 | Dr | CCTV | $ 296 | $ - | $ - | $ 314 | $ - | $ - |
| 3 | Gravity Main | P3568 | 4256 Campus View Dr | CCTV | $ 1,277 | $ - | $ - | $ 1,355 | $ - | $ - |
| 3 | Gravity Main | P3088 | 5893 Rich St | CCTV | $ 744 | $ - | $ - | $ 790 | $ - | $ - |
| 3 | Gravity Main | P3087 | Dr | CCTV | $ 1,263 | $ - | $ - | $ 1,340 | $ - | $ - |
| 3 | Gravity Main | P3373 | 10130-10133 42nd Ave | CCTV | $ 338 | $ - | $ - | $ 359 | $ - | $ - |
| 3 | Gravity Main | P3561 | 10152-10155 Laker Ln | CCTV | $ 1,135 | $ - | $ - | $ 1,204 | $ - | $ - |
| 3 | Gravity Main | P3560 | 10281 Laker Ln | CCTV | $ 1,111 | $ - | $ - | $ 1,179 | $ - | $ - |
| 3 | Gravity Main | P1029 | 4264 Campus View Dr | CCTV | $ 212 | $ - | $ - | $ 225 | $ - | $ - |
| 3 | Gravity Main | P3564 | Dr | CCTV | $ 400 | $ - | $ - | $ 424 | $ - | $ - |
| 3 | Gravity Main | P3565 | Dr | CCTV | $ 1,128 | $ - | $ - | $ 1,197 | $ - | $ - |
| 3 | Gravity Main | P3562 | 10150 Laker Ln | CCTV | $ 741 | $ - | $ - | $ 786 | $ - | $ - |
| 3 | Gravity Main | P3464 | 10073-10119 Laker Ln | CCTV | $ 94 | $ - | $ - | $ 100 | $ - | $ - |
| 3 | Gravity Main | P3360 | 10033-10073 Laker Ln | CCTV | $ 1,106 | $ - | $ - | $ 1,173 | $ - | $ - |
| 3 | Gravity Main | P3463 | 10119-10000 Laker Ln | CCTV | $ 839 | $ - | $ - | $ 890 | $ - | $ - |
| 3 | Gravity Main | P3462 | 10000 Laker Ln | CCTV | $ 364 | $ - | $ - | $ 386 | $ - | $ - |
| 3 | Gravity Main | P3361 | S University Dr | CCTV | $ 644 | $ - | $ - | $ 684 | $ - | $ - |
| 3 | Gravity Main | P3460 | 10000-10152 Laker Ln | CCTV | $ 1,009 | $ - | $ - | $ 1,070 | $ - | $ - |
| 3 | Gravity Main | P1124 | 1 Campus Dr | CCTV | $ 1,445 | $ - | $ - | $ 1,533 | $ - | $ - |
| 3 | Gravity Main | P3519 | Mystic Wds | CCTV | $ 1,088 | $ - | $ - | $ 1,154 | $ - | $ - |
| 3 | Gravity Main | P3368 | S University Dr | CCTV | $ 838 | $ - | $ - | $ 889 | $ - | $ - |
| 3 | Gravity Main | P3515 | Mystic Wds | CCTV | $ 589 | $ - | $ - | $ 625 | $ - | $ - |
| 3 | Gravity Main | P1095 | 5122-5050 Pierce St | CCTV | $ 775 | $ - | $ - | $ 822 | $ - | $ - |
| 3 | Gravity Main | P3514 | Mystic Wds | CCTV | $ 97 | $ - | $ - | $ 103 | $ - | $ - |
| 3 | Gravity Main | P3517 | 5256 Pierce St | CCTV | $ 622 | $ - | $ - | $ 660 | $ - | $ - |
| 3 | Gravity Main | P1094 | 5122 Pierce St | CCTV | $ 599 | $ - | $ - | $ 636 | $ - | $ - |
| 3 | Gravity Main | P1092 | 5122 Pierce St | CCTV | $ 509 | $ - | $ - | $ 540 | $ - | $ - |
| 3 | Gravity Main | P1062 | 7598 Watermark Dr | CCTV | $ 1,332 | $ - | $ - | $ 1,413 | $ - | $ - |
| 3 | Gravity Main | P3465 | Laker Ln | CCTV | $ 989 | $ - | $ - | $ 1,049 | $ - | $ - |
| 3 | Gravity Main | P3372 | 10133 42nd Ave | CCTV | $ 1,247 | $ - | $ - | $ 1,323 | $ - | $ - |
| 3 | Gravity Main | P1063 | 7598 Watermark Dr | CCTV | $ 244 | $ - | $ - | $ 258 | $ - | $ - |
| 3 | Gravity Main | P1070 | 10931 Waterpoint Dr | CCTV | $ 504 | $ - | $ - | $ 535 | $ - | $ - |
| 3 | Gravity Main | P1093 | 5122 Pierce St | CCTV | $ 991 | $ - | $ - | $ 1,052 | $ - | $ - |
| 3 | Gravity Main | P1061 | Marsh Ave | CCTV | $ 1,290 | $ - | $ - | $ 1,368 | $ - | $ - |
| 3 | Gravity Main | P3626 | 5050 Pierce St | CCTV | $ 393 | $ - | $ - | $ 416 | $ - | $ - |
| 3 | Gravity Main | P3362 | S University Dr | CCTV | $ 849 | $ - | $ - | $ 901 | $ - | $ - |
| 3 | Gravity Main | P3518 | 5298-5256 Pierce St | CCTV | $ 468 | $ - | $ - | $ 497 | $ - | $ - |
| 3 | Gravity Main | P2972 | 6090-6142 Balcom Ln | CCTV | $ 773 | $ - | $ - | $ 820 | $ - | $ - |

**Table K-3. Preventative Maintenance Inspection Plan**

| Year | Asset | ID | Address | Rehab Actions | Cost | 2018 | 2019 | 2020 | 2021 | 2022 |
|---|---|---|---|---|---|---|---|---|---|---|
| 3 | Gravity Main | P3461 | 10001-10000 Laker Ln | CCTV | $ 751 | $ - | $ - | $ 796 | $ - | $ - |
| 3 | Gravity Main | P1096 | 5050 Pierce St | CCTV | $ 454 | $ - | $ - | $ 481 | $ - | $ - |
| 3 | Gravity Main | P1060 | Marsh Ave | CCTV | $ 308 | $ - | $ - | $ 327 | $ - | $ - |
| 3 | Gravity Main | P1059 | Marsh Ave | CCTV | $ 343 | $ - | $ - | $ 364 | $ - | $ - |
| 3 | Gravity Main | P2970 | 6178-6142 Balcom Ln | CCTV | $ 532 | $ - | $ - | $ 564 | $ - | $ - |
| 3 | Gravity Main | P9604 | Poppy Ln | CCTV | $ 630 | $ - | $ - | $ 669 | $ - | $ - |
| 3 | Gravity Main | P2413 | 7222-7232 Barn Owl Ln | CCTV | $ 361 | $ - | $ - | $ 383 | $ - | $ - |
| 3 | Gravity Main | P9602 | 10691 Poppy Ln | CCTV | $ 537 | $ - | $ - | $ 569 | $ - | $ - |
| 3 | Gravity Main | P9607 | 10746 78th Ave | CCTV | $ 1,333 | $ - | $ - | $ 1,415 | $ - | $ - |
| 3 | Gravity Main | P9610 | Winnie Ln | CCTV | $ 458 | $ - | $ - | $ 486 | $ - | $ - |
| 3 | Gravity Main | P9603 | 10687-10691 Poppy Ln | CCTV | $ 963 | $ - | $ - | $ 1,021 | $ - | $ - |
| 3 | Gravity Main | P3466 | 10261 42nd Ave | CCTV | $ 1,148 | $ - | $ - | $ 1,218 | $ - | $ - |
| 3 | Gravity Main | P1064 | 7599 Watermark Dr | CCTV | $ 259 | $ - | $ - | $ 275 | $ - | $ - |
| 3 | Gravity Main | P1066 | 7599 Watermark Dr | CCTV | $ 359 | $ - | $ - | $ 381 | $ - | $ - |
| 3 | Gravity Main | P2303 | 7586 Lake Michigan Dr | CCTV | $ 1,191 | $ - | $ - | $ 1,263 | $ - | $ - |
| 3 | Gravity Main | P3567 | 4260 Campus View Dr | CCTV | $ 277 | $ - | $ - | $ 294 | $ - | $ - |
| 3 | Gravity Main | P1054 | Hawkin St | CCTV | $ 537 | $ - | $ - | $ 570 | $ - | $ - |
| 3 | Gravity Main | P1065 | 7599 Watermark Dr | CCTV | $ 517 | $ - | $ - | $ 548 | $ - | $ - |
| 3 | Gravity Main | P9609 | Winnie Ln | CCTV | $ 1,043 | $ - | $ - | $ 1,107 | $ - | $ - |
| 3 | Gravity Main | P9608 | Winnie Ln | CCTV | $ 608 | $ - | $ - | $ 645 | $ - | $ - |
| 3 | Gravity Main | P9605 | 10776-10774 78th Ave | CCTV | $ 702 | $ - | $ - | $ 745 | $ - | $ - |
| 3 | Gravity Main | P1121 | 10095-10133 42nd Ave | CCTV | $ 1,053 | $ - | $ - | $ 1,118 | $ - | $ - |
| 3 | Gravity Main | P1119 | S University Dr | CCTV | $ 128 | $ - | $ - | $ 136 | $ - | $ - |
| 3 | Gravity Main | P3374 | 10100-10130 42nd Ave | CCTV | $ 906 | $ - | $ - | $ 961 | $ - | $ - |
| 3 | Gravity Main | P3364 | 10149 42nd Ave | CCTV | $ 221 | $ - | $ - | $ 235 | $ - | $ - |
| 3 | Gravity Main | P3363 | S University Dr | CCTV | $ 133 | $ - | $ - | $ 141 | $ - | $ - |
| 3 | Gravity Main | P1058 | Marsh Ave | CCTV | $ 313 | $ - | $ - | $ 332 | $ - | $ - |
| 3 | Gravity Main | P9606 | 10774 78th Ave | CCTV | $ 1,018 | $ - | $ - | $ 1,080 | $ - | $ - |
| 3 | Gravity Main | P3370 | S University Dr | CCTV | $ 689 | $ - | $ - | $ 731 | $ - | $ - |
| 3 | Gravity Main | P3085 | 11799 Brookridge Dr | CCTV | $ 1,145 | $ - | $ - | $ 1,215 | $ - | $ - |
| 3 | Gravity Main | P3084 | 11716-11714 60th Ave | CCTV | $ 948 | $ - | $ - | $ 1,006 | $ - | $ - |
| 3 | Gravity Main | P3371 | 10111 42nd Ave | CCTV | $ 1,079 | $ - | $ - | $ 1,145 | $ - | $ - |
| 3 | Gravity Main | P3366 | 10173 42nd Ave | CCTV | $ 687 | $ - | $ - | $ 729 | $ - | $ - |
| 3 | Gravity Main | P3365 | 10173-10149 42nd Ave | CCTV | $ 741 | $ - | $ - | $ 786 | $ - | $ - |
| 3 | Gravity Main | P3369 | S University Dr | CCTV | $ 261 | $ - | $ - | $ 277 | $ - | $ - |
| 3 | Gravity Main | P9617 | Marsh Ave | CCTV | $ 753 | $ - | $ - | $ 799 | $ - | $ - |
| 3 | Gravity Main | P3467 | 10223 42nd Ave | CCTV | $ 908 | $ - | $ - | $ 964 | $ - | $ - |
| 3 | Gravity Main | P1067 | Marsh Ave | CCTV | $ 271 | $ - | $ - | $ 288 | $ - | $ - |
| 3 | Gravity Main | P1069 | Marsh Ave | CCTV | $ 857 | $ - | $ - | $ 909 | $ - | $ - |
| 3 | Gravity Main | P1068 | Marsh Ave | CCTV | $ 326 | $ - | $ - | $ 345 | $ - | $ - |
| 3 | Gravity Main | P1052 | Hawkin St | CCTV | $ 424 | $ - | $ - | $ 450 | $ - | $ - |
| 3 | Gravity Main | P1053 | Hawkin St | CCTV | $ 382 | $ - | $ - | $ 405 | $ - | $ - |
| 3 | Gravity Main | P9619 | Marsh Ave | CCTV | $ 799 | $ - | $ - | $ 847 | $ - | $ - |
| 3 | Gravity Main | P9618 | Marsh Ave | CCTV | $ 549 | $ - | $ - | $ 582 | $ - | $ - |

**Table K-3. Preventative Maintenance Inspection Plan**

| Year | Asset | ID | Address | Rehab Actions | Cost | 2018 | 2019 | 2020 | 2021 | 2022 |
|---|---|---|---|---|---|---|---|---|---|---|
| 4 | Manhole | 3621 | 10431 52nd Ave | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 4221 | 10855 52nd Ave | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 2331 | 6940 Lake Michigan Dr | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 1681 | 10635 Tallpine Ln | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 2880 | 11555 60th Ave | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 1965 | 6324 Timber Dr | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 4403 | 5312 Jordan St | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 2347 | 6656 Lake Michigan Dr | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 4605 | 5382 Lake Michigan Dr | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 3622 | 5160 Pierce St | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 2881 | 11530 Brookland Ct | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 3720 | 10463 52nd Ave | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 4327 | 10924 Woodedge Dr | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 2346 | 6652 Lake Michigan Dr | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 4513 | 5424 Eric St | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 1966 | 6356 Timber Dr | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 1967 | 6286 Timber Dr | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 3620 | 5202 Pierce St | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 4300 | 10938 Lance Ave | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 2345 | 6660 Lake Michigan Dr | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 4852 | Dr | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 2692 | 11553 Rosewood Ave | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 4702 | 11225 Commerce Rd | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 4637 | 4864 Lake Michigan Dr | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 9516 | 10498 52nd Ave | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 9612 | 10498 52nd Ave | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 4812 | 11008 54th Ave | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 1782 | 5961 Maple Bend Trl | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 1783 | 5936 Maple Bend Trl | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 1917 | 7208 Pinevalley Dr | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 4425 | 10999 Woodedge Dr | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 5356 | 4431 Pingree St | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 4851 | 4614 Ottawa Creek Dr | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 5145 | 4750 Rich St | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 2977 | 11682 Wilmington Dr | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 3820 | 5202 Windfield Dr | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 2225 | 11145 Creekside Ct | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 1134 | 11463 48th Ave | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 4604 | 5426 Lake Michigan Dr | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 4876 | 11405 40th Ave | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 5352 | 11821 46th Ave | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 4031 | 4950 W Campus Dr | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 4310 | 10943 Jordan Ct | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 1114 | 10445 48th Ave | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |

**Table K-3. Preventative Maintenance Inspection Plan**

| Year | Asset | ID | Address | Rehab Actions | Cost | 2018 | 2019 | 2020 | 2021 | 2022 |
|---|---|---|---|---|---|---|---|---|---|---|
| 4 | Manhole | 1021 | 10781 52nd Ave | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 5354 | 4544 Pingree St | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 1044 | 11099 Pinecreek Ct | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 2115 | 10997 Waterway Dr | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 5143 | 11619 48th Ave | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 1042 | 10953 Skyway Ln | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 4121 | 10829 52nd Ave | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 2364 | WJ Presley Pkwy | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 1823 | 7151 Pine Grove St | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 4511 | 5478 Eric St | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 2223 | 11127 Creekside Ct | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 2368 | 6144 Lake Michigan Dr | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 2383 | 5824 Lake Michigan Dr | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 1991 | 5702 Lynn Dr | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 4813 | 5349 Edgewater Dr | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 9003 | 11018 Creekside Dr | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 2531 | 7437 Valley View Ct | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 4407 | 10973 Lance Ave | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 2515 | 7170 Blue Jay Dr | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 9518 | 4617 Lake Michigan Dr | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 2381 | 5948 Lake Michigan Dr | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 5355 | 4488 Pingree St | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 4302 | 10917 Lance Ave | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 4303 | 10905 Lance Ave | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 3623 | 5122 Pierce St | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 2770 | 11441 60th Ave | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 4639 | 4830 Lake Michigan Dr | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 5144 | 4774 Rich St | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 1788 | 10701 Tallpine Ln | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 3840 | 10489 48th Ave | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 5042 | 11529 48th Ave | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 4120 | 10781 52nd Ave | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 5286 | 11773 40th Ave | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 1682 | 10601 Tallpine Ln | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 1922 | 6994 Aspen St | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 1994 | 5796 Lynn Dr | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 2091 | 5634 Mary Eliz Dr | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 4032 | Campus West Apartments | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 4512 | 5452 Eric St | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 1132 | 4616 Ottawa Creek Dr | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 4322 | 5176 Circlewood Ln | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 4427 | 5193 Woodedge Ct | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 1720 | 10819 Timberline Dr | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 1041 | 11057 Skyway Ln | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |

**Table K-3. Preventative Maintenance Inspection Plan**

| Year | Asset | ID | Address | Rehab Actions | Cost | 2018 | 2019 | 2020 | 2021 | 2022 |
|---|---|---|---|---|---|---|---|---|---|---|
| 4 | Manhole | 2370 | 6052 Lake Michigan Dr | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 4603 | 5504 Lake Michigan Dr | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 4218 | 10705 Douglas Dr | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 4020 | 10723 52nd Ave | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 1178 | 5150 Lake Michigan Dr | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 4321 | 5163 Circleview Dr | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 4323 | 5103 Circleview Dr | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 4325 | 10890 Woodedge Dr | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 4420 | 10967 52nd Ave | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 2384 | 5768 Lake Michigan Dr | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 4615 | 5328 Lake Michigan Dr | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 5011 | 5499 Edgeway Dr | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 4616 | 5316 Lake Michigan Dr | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 2983 | 11571 60th Ave | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 3740 | 10471 48th Ave | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 4539 | 4868 Lake Michigan Dr | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 1822 | 7112 Pine Grove St | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 4202 | 10783 Lance Ave | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 4203 | 10701 Lance Ave | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 4210 | 10887 Douglas Dr | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 4853 | 4687 Ottawa Creek Dr | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 4840 | 4878 Becker Dr | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 5142 | 11613 48th Ave | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 5351 | 11761 46th Ave | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 1085 | 5995 Frostline Dr | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 1784 | 5884 Maple Bend Trl | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 1825 | 10821 Timberline Dr | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 4810 | Edgewater Dr | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 4811 | 11327 Edgewater Dr | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 1990 | 10901 Melanie Dr | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 2093 | 5727 Mary Eliz Dr | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 2095 | 10801 Mary Eliz Ct | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 2096 | 10965 Melanie Dr | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 1127 | 11149 54th Ave | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 4814 | 5200 Edgewater Dr | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 4910 | 11291 54th Ave | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 5010 | 11671 54th Ave | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 2226 | 11122 Creekside Ct | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 4408 | 10959 Lance Ave | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 4409 | 5158 Jordan St | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 9002 | 7050 Pinevalley Dr | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 1916 | 7243 Pinevalley Dr | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 1821 | 10807 Timberline Dr | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 4617 | 5270 Lake Michigan Dr | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |

**Table K-3. Preventative Maintenance Inspection Plan**

| Year | Asset | ID | Address | Rehab Actions | Cost | 2018 | 2019 | 2020 | 2021 | 2022 |
|---|---|---|---|---|---|---|---|---|---|---|
| 4 | Manhole | 2021 | 7173 Timbercreek Dr | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 2026 | 10979 Timberline Dr | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 2027 | 10929 Timberline Dr | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 2695 | 5702 Crabtree St | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 3624 | 5083 Pierce St | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 4931 | 4896 Allenpark Dr | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 1125 | 10963 52nd Ave | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 1130 | Dr | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 1057 | Hawkin St | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 5040 | 11443 48th Ave | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 5041 | 11483 48th Ave | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 5141 | 4802 Rich St | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 5146 | 4726 Rich St | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 5147 | 4702 Rich St | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 2227 | 11057 Creekside Dr | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 4514 | 5402 Eric St | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 2495 | 5680 Lake Michigan Dr | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 4800 | 11307 56th Ave | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 4801 | 11363 56th Ave | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 2403 | 8011 Lake Michigan Dr | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 1045 | 7145 Pinevalley Dr | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 1046 | 7128 Pinevalley Dr | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 1047 | 7102 Pinevalley Dr | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 1826 | 7055 Sunset Dr | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 1918 | 7187 Pinevalley Dr | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 2369 | 6098 Lake Michigan Dr | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 4602 | 5500 Lake Michigan Dr | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 2094 | 10931 Mary Eliz Ct | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 4201 | 10835 Lance Ave | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 4212 | 5305 Sunshine St | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 4213 | 5351 Sunshine St | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 4311 | 10807 Jordan Ct | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 4404 | 5194 Jordan St | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 4503 | 5596 Eric St | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 4504 | 5566 Eric St | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 4505 | 5502 Eric St | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 1789 | 5807 Horizon Ln | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 1827 | 7005 Sunset Dr | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 1880 | 10789 Tallpine Ln | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 1923 | 10911 Skylane Ct | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 2696 | 11599 Cameron Ave | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 4411 | 10991 Jordan Ct | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 4412 | 5304 Jordan St | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 4413 | 5292 Jordan St | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |

**Table K-3. Preventative Maintenance Inspection Plan**

| Year | Asset | ID | Address | Rehab Actions | Cost | 2018 | 2019 | 2020 | 2021 | 2022 |
|---|---|---|---|---|---|---|---|---|---|---|
| 4 | Manhole | 4419 | 10985 Douglas Dr | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 4930 | 4991 Allenpark Dr | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 1520 | Pleasant View Ct | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 3920 | 10621 52nd Ave | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 3921 | 10657 52nd Ave | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 4326 | 5176 Circlewood Ln | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 5284 | 11654 40th Ave | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 2252 | 6342 Henry St | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 4707 | 5405 Auto Ct | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 3610 | 5392 Pierce St | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 3611 | Mystic Wds | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 3618 | 5310 Pierce St | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 1043 | 11051 Pinecreek Ct | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 1073 | 7360 Valley View Ct | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 1680 | 10675 Tallpine Ln | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 2090 | 10962 Gayle Ln | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 4215 | 5421 Sunshine St | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 4216 | 10801 Douglas Dr | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 4217 | 10745 Douglas Dr | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 4301 | 10925 Lance Ave | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 4313 | 10921 Douglas Dr | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 4405 | 10993 Lance Ave | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 4406 | 10987 Lance Ave | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 4423 | 5188 Jordan St | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 1964 | 10873 Constant Dr | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 2202 | 7546 Waterline Dr | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 2203 | 7508 Waterline Dr | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 2204 | 7534 Waterline Dr | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 2205 | 7596 Waterline Dr | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 2307 | 7444 Waterline Dr | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 2308 | 7408 Waterline Dr | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 2975 | 11698 Wilmington Dr | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 2976 | 11691 Wilmington Dr | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 1523 | 10809 Timberline Dr | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 1620 | 10815 Timberline Dr | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 4748 | Dr | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 1924 | 10989 Skylane Ct | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 1925 | 7002 Pinevalley Dr | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 3721 | 10517 52nd Ave | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 4220 | 10855 52nd Ave | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 1785 | 5863 Maple Bend Trl | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 1786 | 5841 Maple Bend Trl | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 1787 | 5800 Maple Bend Trl | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 4834 | 4998 Allenpark Dr | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |

**Table K-3. Preventative Maintenance Inspection Plan**

| Year | Asset | ID | Address | Rehab Actions | Cost | 2018 | 2019 | 2020 | 2021 | 2022 |
|---|---|---|---|---|---|---|---|---|---|---|
| 4 | Manhole | 5140 | 11565 48th Ave | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 2224 | 11127 Creekside Ct | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 2772 | 11525 60th Ave | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 4802 | 11417 56th Ave | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 1919 | 7163 Pinevalley Dr | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 3534 | Copper Beech Townhomes | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 3627 | 5084 Pierce St | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 1820 | 10829 Timberline Dr | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 4324 | 10811 Woodedge Dr | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 4424 | 5110 Jordan St | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 2366 | 6154 Lake Michigan Dr | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 2367 | 6164 Lake Michigan Dr | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 5357 | 4375 Pingree St | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 1992 | 10803 Melanie Dr | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 2020 | 7219 Timbercreek Dr | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 2022 | 7158 Timbercreek Dr | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 2023 | 7144 Timbercreek Dr | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 2024 | 7130 Timbercreek Dr | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 2025 | 7100 Timbercreek Dr | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 2220 | 11093 Timberline Dr | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 2221 | 11185 Timberline Dr | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 2306 | 7478 Waterline Dr | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 2532 | 7198 Valley View Ct | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 2592 | 5720 Victoria St | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 2593 | 5710 Victoria St | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 2594 | 11275 Cameron Ave | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 2693 | 11385 Cameron Ave | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 2694 | 5732 Crabtree St | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 2882 | 11587 Brookland Ct | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 3630 | 5045 Pierce St | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 3633 | 5013 Pierce St | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 3636 | 4986 Pierce St | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 4312 | 10963 Douglas Dr | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 4410 | 5102 Jordan St | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 1724 | 10633 White Birch Dr | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 4320 | 10913 52nd Ave | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 5285 | 11717 40th Ave | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 1824 | 7192 Pine Grove St | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 2092 | 5670 Mary Eliz Dr | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 2222 | 11178 Creekside Dr | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 1721 | 10825 Timberline Dr | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 5250 | 11605 46th Ave | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 5350 | Nicholas Dr | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 2771 | 11475 60th Ave | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |

**Table K-3. Preventative Maintenance Inspection Plan**

| Year | Asset | ID | Address | Rehab Actions | Cost | 2018 | 2019 | 2020 | 2021 | 2022 |
|---|---|---|---|---|---|---|---|---|---|---|
| 4 | Manhole | 4426 | 10975 Woodedge Dr | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 1179 | 6370 Lake Michigan Dr | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 2362 | 6394 Lake Michigan Dr | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 2363 | 6306 Lake Michigan Dr | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 1091 | 5366 Pierce St | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 4932 | 4812 Allenpark Dr | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 4940 | 11403 48th Ave | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 1116 | 10411 48th Ave | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 2253 | 6322 Henry St | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 2254 | 6308 Henry St | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 4614 | 5350 Lake Michigan Dr | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 4703 | 11277 Commerce Rd | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 4704 | 11297 Commerce Rd | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 4706 | 11329 Commerce Rd | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 4200 | 5475 Sunshine St | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 4211 | 10861 Douglas Dr | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 4214 | 5373 Sunshine St | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 1521 | 10805 Timberline Dr | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 1522 | 10808 Timberline Dr | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 4843 | 4857 Becker Dr | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 2194 | 5753 Mary Eliz Dr | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 1173 | 4442 Lake Michigan Dr | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 2246 | 6676 Lake Michigan Dr | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 4621 | 5088 Lake Michigan Dr | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 4747 | Dr | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 4705 | 11301 Commerce Rd | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 4836 | 4926 Allenpark Dr | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 1007 | 6161 Lake Michigan Dr | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 4461 | 4443 Stadium Dr | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 4462 | 4307 Stadium Dr | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 4877 | 11377 40th Ave | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 4878 | 11375 40th Ave | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 1968 | 6246 Timber Dr | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 3936 | Campus West Apartments | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 2348 | 6600 Lake Michigan Dr | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 3074 | 6104 Balcom Ln | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 2972 | 6090 Balcom Ln | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 1113 | 10581 48th Ave | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 4501 | 5564 Eric St | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 2349 | 6550 Lake Michigan Dr | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 2411 | 11287 Red Hawk Ln | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 3933 | Campus West Apartments | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 2344 | 6660 Lake Michigan Dr | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 3634 | 5013 Pierce St | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |

**Table K-3. Preventative Maintenance Inspection Plan**

| Year | Asset | ID | Address | Rehab Actions | Cost | 2018 | 2019 | 2020 | 2021 | 2022 |
|---|---|---|---|---|---|---|---|---|---|---|
| 4 | Manhole | 9702 | 5401 Pierce St | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 3934 | Campus West Apartments | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 2010 | 7338 Water View Ln | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 9609 | Winnie Ln | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 9610 | Winnie Ln | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 4335 | Northside Dr | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 2351 | 6448 Lake Michigan Dr | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 1912 | 7389 Pinevalley Dr | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 2401 | Placid Waters Dr | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 3734 | 4886 Country Pl S | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 2011 | 7376 Water View Ln | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 9708 | 5241 Pierce St | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 3432 | Copper Beech Townhomes | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 1064 | Marsh Ave | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 9617 | Marsh Ave | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 3513 | Mystic Wds | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 3735 | 4967 Pierce St | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 9503 | Allenpark Dr | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 4744 | Boltwood Apartments | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 4629 | 5128 Lake Michigan Dr | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 3084 | 11716 60th Ave | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 9619 | Marsh Ave | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 3464 | 10073 Laker Ln | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 2110 | 7395 Watermark Dr | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 4231 | Southtown Dr | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 4337 | Northside Dr | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 3516 | 5256 Pierce St | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 2300 | 11213 78th Ave | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 3517 | 5256 Pierce St | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 2500 | 11315 Wake Dr | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 3361 | S University Dr | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 3842 | 10539 48th Ave | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 4833 | Becker Dr | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 3861 | 1 Campus Dr | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 4362 | 1 Campus Dr | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 4223 | Southtown Dr | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 9009 | 1 Campus Dr | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 5013 | 5307 Edgeway Dr | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 5014 | 5201 Edgeway Dr | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 3085 | 11799 Brookridge Dr | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 3088 | 11667 Brookridge Dr | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 4519 | 11060 52nd Ave | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 4850 | 4657 Ottawa Creek Dr | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 3813 | 5364 Windfield Dr | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |

**Table K-3. Preventative Maintenance Inspection Plan**

| Year | Asset | ID | Address | Rehab Actions | Cost | 2018 | 2019 | 2020 | 2021 | 2022 |
|---|---|---|---|---|---|---|---|---|---|---|
| 4 | Manhole | 3815 | 10564 Rockfield Rd | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 3816 | 10518 Rockfield Rd | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 2492 | 5677 Lake Michigan Dr | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 4222 | Southtown Dr | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 4329 | Northside Dr | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 2255 | 6301 Henry St | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 4260 | 1 Campus Dr | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 3616 | 5313 Pierce St | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 1969 | 6202 Timber Dr | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 1915 | 7273 Pinevalley Dr | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 2116 | 7218 Water View Ln | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 2200 | 11103 Waterpoint Dr | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 2470 | 11263 60th Ave | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 2317 | 7273 Lake Michigan Dr | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 3365 | 10173 42nd Ave | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 1910 | 7517 Water View Ln | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 1099 | 10500 Rockfield Rd | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 1100 | 5270 Crestfield Ln | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 3733 | 4924 Country Pl S | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 3737 | Hillcrest Town Houses | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 4849 | 4689 Lake Michigan Dr | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 4137 | Meadows Xing | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 4230 | Southtown Dr | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 4232 | 10897 48th Ave | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 4336 | Northside Dr | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 4338 | Northside Dr | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 9705 | 5360 Windfield Dr | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 2002 | 10803 Waterpoint Dr | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 2063 | 10926 64th Ave | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 2064 | 10928 64th Ave | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 2065 | 10899 Constant Dr | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 2982 | 11637 60th Ave | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 3080 | 11705 60th Ave | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 4332 | Northside Dr | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 4334 | Northside Dr | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 5017 | 11550 53rd Ave | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 9616 | 5075 Pierce St | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 9520 | 11547 53rd Ave | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 9506 | 11540 Boyne Blvd | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 2007 | 7424 Watermark Dr | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 2009 | 10975 Waterpoint Dr | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 2971 | 6142 Balcom Ln | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 2978 | 11666 Wilmington Dr | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 3532 | Copper Beech Townhomes | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |

**Table K-3. Preventative Maintenance Inspection Plan**

| Year | Asset | ID | Address | Rehab Actions | Cost | 2018 | 2019 | 2020 | 2021 | 2022 |
|---|---|---|---|---|---|---|---|---|---|---|
| 4 | Manhole | 3625 | 5050 Pierce St | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 1072 | 7680 Lake Michigan Dr | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 1075 | 7634 Lake Michigan Dr | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 2304 | 11127 Waterpoint Dr | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 1119 | S University Dr | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 3511 | Mystic Wds | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 3512 | Mystic Wds | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 1066 | Marsh Ave | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 3360 | 10033 Laker Ln | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 2008 | 7412 Watermark Dr | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 3465 | Laker Ln | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 1092 | 5122 Pierce St | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 1093 | 5122 Pierce St | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 3434 | Copper Beech Townhomes | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 2302 | 7738 Lake Michigan Dr | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 3369 | S University Dr | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 1911 | 7593 Water View Ln | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 2530 | 7598 Valley View Ct | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 1067 | Marsh Ave | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 2416 | 7168 Barn Owl Ln | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 9509 | 4999 Allenpark Dr | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 4830 | 4926 Becker Dr | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 4832 | Becker Dr | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 4130 | Meadows Xing | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 4133 | Meadows Xing | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 9703 | 5398 Crestfield Ln | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 9704 | 5360 Windfield Dr | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 9707 | 10439 52nd Ave | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 3373 | 10130 42nd Ave | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 2003 | 7560 Watermark Dr | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 3535 | Copper Beech Townhomes | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 1068 | Marsh Ave | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 2301 | 11191 78th Ave | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 2402 | 8100 Placid Waters Dr | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 2501 | 11578 84th Ave | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 2350 | 6474 Lake Michigan Dr | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 9614 | 10520 52nd Ave | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 1051 | 10911 Waterway Dr | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 1083 | 6101 Lake Michigan Dr | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 9700 | 5399 Pierce St | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 4837 | 11299 University Pkwy | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 2111 | 7359 Watermark Dr | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 3518 | 5298 Pierce St | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 9618 | Marsh Ave | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |

**Table K-3. Preventative Maintenance Inspection Plan**

| Year | Asset | ID | Address | Rehab Actions | Cost | 2018 | 2019 | 2020 | 2021 | 2022 |
|---|---|---|---|---|---|---|---|---|---|---|
| 4 | Manhole | 2066 | 10920 64th Ave | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 2201 | 11149 Waterpoint Dr | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 2318 | 11211 Red Hawk Ln | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 3086 | 11799 Brookridge Dr | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 3180 | 11755 60th Ave | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 1107 | Southtown Dr | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 3631 | 5045 Pierce St | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 3632 | 5045 Pierce St | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 3635 | 4997 Pierce St | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 3810 | 5252 Windfield Dr | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 3833 | 10506 Country Pl W | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 3841 | 10561 48th Ave | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 4132 | Meadows Xing | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 4224 | Southtown Dr | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 4328 | Northside Dr | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 4330 | Northside Dr | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 4745 | Boltwood Apartments | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 4746 | Dr | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 9000 | 10815 Timberline Dr | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 9514 | Meadows Xing | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 9007 | 1 Campus Dr | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 3960 | 10517 Laker Village Dr | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 5353 | 11859 46th Ave | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 1071 | 7145 Barn Owl Ln | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 2414 | 7193 Barn Owl Ln | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 2415 | 7157 Barn Owl Ln | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 2418 | 7099 Barn Owl Ln | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 2419 | 7210 Blue Jay Dr | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 3614 | 5343 Pierce St | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 9502 | 4999 Allenpark Dr | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 4835 | Becker Dr | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 2114 | 11015 Waterway Dr | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 2973 | Norfolk Dr | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 2974 | Norfolk Dr | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 9011 | 6101 Lake Michigan Dr | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 9508 | 6223 Lake Michigan Dr | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 1513 | Timberline Dr | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 1106 | Southtown Dr | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 1914 | 10877 Pinevalley Ct | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 1993 | 5769 Lynn Dr | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 2012 | 7431 Water View Ln | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 2014 | 10969 Waterway Dr | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 2015 | 7204 Bittersweet Ct | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 2310 | 7388 Waterline Dr | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |

**Table K-3. Preventative Maintenance Inspection Plan**

| Year | Asset | ID | Address | Rehab Actions | Cost | 2018 | 2019 | 2020 | 2021 | 2022 |
|---|---|---|---|---|---|---|---|---|---|---|
| 4 | Manhole | 2311 | 7349 Waterline Dr | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 2312 | 7301 Waterline Dr | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 2410 | 11247 Red Hawk Ln | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 4304 | 10934 Lance Ave | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 4520 | 11088 52nd Ave | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 9706 | 5363 Windfield Dr | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 3082 | 11727 60th Ave | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 3181 | 11777 60th Ave | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 4331 | Northside Dr | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 4333 | Northside Dr | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 1128 | 11301 Commerce Rd | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 1129 | 11301 Commerce Rd | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 5015 | 11547 53rd Ave | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 5016 | 11523 53rd Ave | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 5018 | 11550 53rd Ave | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 5019 | 5224 Rich St | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 3711 | #N/A | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 9613 | 10520 52nd Ave | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 9615 | 10520 52nd Ave | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | LS_TIMBERLINE | 7060 Sunset Dr | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 3570 | 10246 42nd Ave | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 2309 | 7423 Waterline Dr | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 3533 | Copper Beech Townhomes | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 2001 | 7584 Watermark Dr | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 2316 | 7347 Lake Michigan Dr | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 2303 | 7588 Lake Michigan Dr | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 3615 | 5313 Pierce St | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 3617 | 5269 Pierce St | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 9505 | Allenpark Dr | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 2113 | 11031 Waterway Dr | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 2984 | 11659 Brookland Ct | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 1411 | 10581 Learning Ln | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 1410 | 10582 Learning Ln | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 3362 | S University Dr | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 3368 | S University Dr | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 3531 | Copper Beech Townhomes | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 3637 | 4962 Pierce St | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 2313 | 7280 Lake Michigan Dr | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 2314 | 7280 Lake Michigan Dr | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 3083 | 11714 60th Ave | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 1121 | 10095 42nd Ave | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 3363 | S University Dr | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 3366 | 10173 42nd Ave | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |

**Table K-3. Preventative Maintenance Inspection Plan**

| Year | Asset | ID | Address | Rehab Actions | Cost | 2018 | 2019 | 2020 | 2021 | 2022 |
|---|---|---|---|---|---|---|---|---|---|---|
| 4 | Manhole | 3374 | 10100 42nd Ave | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 2413 | 7222 Barn Owl Ln | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 9605 | 10776 78th Ave | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 9606 | 10774 78th Ave | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 1512 | 10603 Learning Ln | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 1095 | 5122 Pierce St | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 1097 | 5050 Pierce St | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 1102 | Copper Beech Townhomes | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 1103 | Copper Beech Townhomes | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 1811 | 10801 Pinevalley Ct | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 1812 | 10798 Learning Ln | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 2970 | 6178 Balcom Ln | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 3430 | Copper Beech Townhomes | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 3364 | 10149 42nd Ave | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 3370 | S University Dr | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 3371 | 10111 42nd Ave | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 3510 | Mystic Wds | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 3514 | Mystic Wds | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 3515 | Mystic Wds | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 1844 | New Options High School | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 2417 | 7157 Barn Owl Ln | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 3930 | Campus West Apartments | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 3436 | Copper Beech Townhomes | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 2989 | 11677 Spruce View Dr | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 3462 | 10000 Laker Ln | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 4131 | Meadows Xing | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 4134 | Meadows Xing | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 9507 | 4920 Rich St | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 9510 | 4923 Allenpark Dr | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 9511 | 4923 Allenpark Dr | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 9512 | 4898 Rich St | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 3372 | 10133 42nd Ave | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 9010 | 10744 S Campus Dr | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 1048 | 7340 Water View Ln | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 2986 | 5882 Rich St | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 1069 | Marsh Ave | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 1070 | Marsh Ave | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 2000 | 10931 Waterpoint Dr | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 3461 | 10001 Laker Ln | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 4831 | 4926 Becker Dr | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 3736 | 4967 Pierce St | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |

**Table K-3. Preventative Maintenance Inspection Plan**

| Year | Asset | ID | Address | Rehab Actions | Cost | 2018 | 2019 | 2020 | 2021 | 2022 |
|---|---|---|---|---|---|---|---|---|---|---|
| 4 | Manhole | 2013 | 7491 Water View Ln | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 9611 | 10520 52nd Ave | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 1105 | 5057 W Campus Dr | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 1810 | 10800 Pinevalley Ct | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 2207 | 11005 Island Ct | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 2210 | 11048 Waterway Dr | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 2211 | 11103 Waterway Dr | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 4225 | Southtown Dr | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 4638 | 4850 Lake Michigan Dr | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 1131 | 11266 Whispering Creek Dr | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 1133 | 11367 Whispering Creek Dr | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 1722 | 10828 Timberline Dr | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 2365 | 6218 Lake Michigan Dr | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 4502 | 5560 Eric St | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 4838 | 11287 University Pkwy | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 5012 | 5405 Edgeway Dr | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 1049 | 7272 Water View Ln | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 1094 | 5122 Pierce St | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 1101 | 5378 Crestfield Ln | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 3073 | 6196 Balcom Ln | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 2100 | 11017 Waterpoint Dr | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 9607 | Winnie Ln | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 3814 | 5396 Windfield Dr | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 1135 | 11368 48th Ave | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 9504 | Allenpark Dr | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 1104 | 5057 W Campus Dr | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 1913 | 7303 Pinevalley Dr | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 2016 | 7240 Bittersweet Ct | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 2017 | 7294 Bittersweet Ct | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 2112 | 7320 Watermark Dr | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 2206 | 11087 Island Ct | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 2513 | 7296 Blue Jay Dr | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 3832 | 4968 Country Pl S | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 3834 | 4915 Country Pl N | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 3931 | Campus West Apartments | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 4135 | Meadows Xing | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 4136 | Meadows Xing | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 4233 | Village Center Dr | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 1096 | 5050 Pierce St | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 2412 | 7232 Barn Owl Ln | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 2981 | 11531 Wilmington Dr | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 3079 | 6063 Rossfield Ct | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 2315 | 7409 Lake Michigan Dr | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |

**Table K-3. Preventative Maintenance Inspection Plan**

| Year | Asset | ID | Address | Rehab Actions | Cost | 2018 | 2019 | 2020 | 2021 | 2022 |
|---|---|---|---|---|---|---|---|---|---|---|
| 4 | Manhole | 3536 | Copper Beech Townhomes | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 1065 | Marsh Ave | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 9603 | 10687 Poppy Ln | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 9604 | Poppy Ln | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 3463 | 10119 Laker Ln | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 1842 | 10798 68th Ave | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 3732 | 10485 48th Ave | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 9701 | 5399 Pierce St | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 3078 | 6082 Rossfield Ct | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 3173 | 6042 Kingsbury Ct | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 3730 | Hillcrest Town Houses | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 3738 | 4954 Country Pl S | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 3170 | 6185 Kingsbury Ct | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 3171 | 6162 Kingsbury Ct | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 3172 | 6068 Kingsbury Ct | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 2004 | 7523 Watermark Dr | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 2005 | 7488 Watermark Dr | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 2006 | 7461 Watermark Dr | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 2979 | 11627 Wilmington Dr | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 1053 | Hawkin St | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 1054 | Hawkin St | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 1055 | Hawkin St | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 1058 | Marsh Ave | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 1059 | Marsh Ave | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 1060 | Marsh Ave | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 1061 | Marsh Ave | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 1062 | Marsh Ave | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 1063 | Marsh Ave | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 9602 | 10691 Poppy Ln | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 3431 | Copper Beech Townhomes | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 3433 | Copper Beech Townhomes | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 3437 | Copper Beech Townhomes | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 3438 | Copper Beech Townhomes | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 3530 | Copper Beech Townhomes | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 2980 | 11531 Wilmington Dr | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 3537 | Copper Beech Townhomes | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 1009 | 7588 Lake Michigan Dr | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 1511 | 10581 Learning Ln | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 3410 | Mystic Wds | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 3411 | Mystic Wds | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |

**Table K-3. Preventative Maintenance Inspection Plan**

| Year | Asset | ID | Address | Rehab Actions | Cost | 2018 | 2019 | 2020 | 2021 | 2022 |
|---|---|---|---|---|---|---|---|---|---|---|
| 4 | Manhole | 3412 | Mystic Wds | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 1723 | 10601 White Birch Dr | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 4839 | 11295 University Pkwy | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 1050 | 7239 Bittersweet Ct | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 2101 | 11057 Waterpoint Dr | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 4240 | 10865 48th Ave | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 3087 | 11795 Brookridge Dr | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 3177 | 11738 Andrews Ave | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 9517 | Becker Dr | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 4941 | 11410 48th Ave | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 1115 | 10445 48th Ave | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 2516 | 7120 Blue Jay Dr | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 3811 | 5288 Windfield Dr | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 3812 | 5324 Windfield Dr | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 1136 | 11378 48th Ave | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 2511 | 11347 Red Hawk Ln | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 2512 | 7270 Blue Jay Dr | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 2514 | 7220 Blue Jay Dr | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 2985 | 11697 Brookland Ct | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 3075 | 6054 Balcom Ln | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 3076 | 6112 Balcom Ln | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 3831 | Campus West Apartments | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 3626 | 5050 Pierce St | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 5287 | 11773 40th Ave | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 1052 | Hawkin St | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 9608 | Winnie Ln | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 3460 | 10000 Laker Ln | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 1843 | New Options High School | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 2471 | 11289 60th Ave | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 2473 | 6182 Library Ln | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 2474 | 6223 Lake Michigan Dr | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 2510 | 11309 Red Hawk Ln | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 3077 | 6095 Rossfield Ct | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 3174 | 6093 Kingsbury Ct | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 3175 | 6002 Kingsbury Ct | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 3176 | 11775 Andrews Ave | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 3830 | Campus West Apartments | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 4 | Manhole | 3519 | Mystic Wds | MH Inspection | $ 536 | $ - | $ - | $ - | $ 585 | $ - |
| 5 | Manhole | 3619 | 5256 Pierce St | MH Clean | $ 803 | $ - | $ - | $ - | $ - | $ 904 |
| 5 | Manhole | 2251 | 6402 Henry St | MH Clean | $ 803 | $ - | $ - | $ - | $ - | $ 904 |
| 5 | Manhole | 2584 | 5852 Ivory Rd | MH Clean | $ 803 | $ - | $ - | $ - | $ - | $ 904 |
| 5 | Manhole | 2358 | 11283 Washington Ave | MH Clean | $ 803 | $ - | $ - | $ - | $ - | $ 904 |
| | | | | **TOTAL:** | **$ 729,170** | **$ 535.60** | **$ -** | **$ 378,097** | **$ 403,247** | **$ 3,617** |

# APPENDIX C

Current NPDES Permit

# PERMIT NO. MI0057679

# *STATE OF MICHIGAN*
# *DEPARTMENT OF ENVIRONMENTAL QUALITY*

## AUTHORIZATION TO DISCHARGE UNDER THE NATIONAL POLLUTANT DISCHARGE ELIMINATION SYSTEM

In compliance with the provisions of the Federal Water Pollution Control Act, 33 U.S.C., Section 1251 *et seq*., as amended; Part 31, Water Resources Protection, of the Natural Resources and Environmental Protection Act, 1994 PA 451, as amended (NREPA); Part 41, Sewerage Systems, of the NREPA; and Michigan Executive Order 2011-1,

**Allendale Charter Township**
11624 40th Avenue
Allendale, MI 49401

is authorized to discharge from the **Allendale Township Wastewater Treatment Plant** located at

11624 40th Avenue
Allendale, MI 49401

designated as **Allendale Twp WWTP**

to the receiving water named the Grand River in accordance with effluent limitations, monitoring requirements, and other conditions set forth in this permit.

This permit is based on a complete application submitted on March 26, 2015, as amended through April 25, 2015.

**This permit takes effect on October 1, 2018**. The provisions of this permit are severable. After notice and opportunity for a hearing, this permit may be modified, suspended, or revoked in whole or in part during its term in accordance with applicable laws and rules. On its effective date, this permit shall supersede National Pollutant Discharge Elimination System (NPDES) Permit No. MI0057679 (expiring October 1, 2015).

This permit and the authorization to discharge shall expire at midnight on **October 1, 2020**. In order to receive authorization to discharge beyond the date of expiration, the permittee shall submit an application that contains such information, forms, and fees as are required by the Michigan Department of Environmental Quality (Department) by **April 4, 2020**.

**Issued:** September 26, 2018

Original signed by Christine Alexander
Christine Alexander, Manager
Permits Section
Water Resources Division

## PERMIT FEE REQUIREMENTS

In accordance with Section 324.3120 of the NREPA, the permittee shall make payment of an annual permit fee to the Department for each October 1 the permit is in effect regardless of occurrence of discharge. The permittee shall submit the fee in response to the Department's annual notice. The fee shall be postmarked by January 15 for notices mailed by December 1. The fee is due no later than 45 days after receiving the notice for notices mailed after December 1.

**Annual Permit Fee Classification:** Municipal Major, less than 10 MGD (Individual Permit)

In accordance with Section 324.3132 of the NREPA, the permittee shall make payment of an annual biosolids land application fee to the Department if the permittee land applies biosolids. In response to the Department's annual notice, the permittee shall submit the fee, which shall be postmarked no later than January 31 of each year.

## CONTACT INFORMATION

Unless specified otherwise, all contact with the Department required by this permit shall be made to the Grand Rapids District Office of the Water Resources Division. The Grand Rapids District Office is located at State Office Building, Fifth Floor, 350 Ottawa Ave NW, Unit 10, Grand Rapids, MI 49503-2341, Telephone: 616-356-0500, Fax: 616-356-0202.

## CONTESTED CASE INFORMATION

Any person who is aggrieved by this permit may file a sworn petition with the Michigan Administrative Hearing System within the Michigan Department of Licensing and Regulatory Affairs, c/o the Michigan Department of Environmental Quality, setting forth the conditions of the permit which are being challenged and specifying the grounds for the challenge. The Department of Licensing and Regulatory Affairs may reject any petition filed more than 60 days after issuance as being untimely.

## PART I

# Section A. Limitations and Monitoring Requirements

## 1. Final Effluent Limitations, Monitoring Point 001A

During the period beginning on the effective date of this permit and lasting until the expiration date of this permit, the permittee is authorized to discharge treated municipal wastewater from Monitoring Point 001A through Outfall 001. Outfall 001 discharges to the Grand River at Latitude 42.98056, Longitude -85.87500. Such discharge shall be limited and monitored by the permittee as specified below.

| | Maximum Limits for Quantity or Loading | | | | Maximum Limits for Quality or Concentration | | | | Monitoring | Sample |
|---|---|---|---|---|---|---|---|---|---|---|
| **Parameter** | **Monthly** | **7-Day** | **Daily** | **Units** | **Monthly** | **7-Day** | **Daily** | **Units** | **Frequency** | **Type** |
| Flow | (report) | --- | (report) | MGD | --- | | --- | --- | Daily | Report Total Daily Flow |
| Carbonaceous Biochemical Oxygen Demand ($CBOD_5$) | 500 | 800 | (report) | lbs/day | 25 | 40 | (report) | mg/l | 5x Weekly | 24-Hr Composite |
| Total Suspended Solids (TSS) | 600 | 900 | (report) | lbs/day | 30 | 45 | (report) | mg/l | 5x Weekly | 24-Hr Composite |
| Ammonia Nitrogen (as N) | | | | | | | | | | |
| May - September | --- | --- | --- | --- | (report) | --- | (report) | mg/l | Monthly | 24-Hr Composite |
| Total Phosphorus (as P) | 20 | --- | (report) | lbs/day | 1.0 | --- | (report) | mg/l | 5x Weekly | 24-Hr Composite |
| Fecal Coliform Bacteria | --- | --- | --- | --- | 200 | 400 | (report) | cts/100 ml | 5x Weekly | Grab |
| Total Residual Chlorine | --- | --- | --- | --- | --- | --- | 38 | µg/L | 5x Weekly | Grab |
| Total Mercury | | | | | | | | | | |
| Corrected | (report) | --- | (report) | lbs/day | (report) | --- | (report) | ng/l | Quarterly | Calculation |
| Uncorrected | --- | --- | --- | --- | --- | --- | (report) | ng/l | Quarterly | Grab |
| Field Duplicate | --- | --- | --- | --- | --- | --- | (report) | ng/l | Quarterly | Grab |
| Field Blank | --- | --- | --- | --- | --- | --- | (report) | ng/l | Quarterly | Preparation |
| Laboratory Method Blank | --- | --- | --- | --- | --- | --- | (report) | ng/l | Quarterly | Preparation |
| | | | | | **Minimum % Monthly** | | **Minimum % Daily** | | | |
| $CBOD_5$ Minimum % Removal | --- | --- | --- | --- | 85 | --- | (report) | % | Monthly | Calculation |
| TSS Minimum % Removal | --- | --- | --- | --- | 85 | --- | (report) | % | Monthly | Calculation |
| | | | | | **Minimum Daily** | | **Maximum Daily** | | | |
| pH | --- | --- | --- | --- | 6.5 | --- | 9.0 | S.U. | 5xWeekly | Grab |
| Dissolved Oxygen | --- | --- | --- | --- | 4.0 | --- | --- | mg/l | 5xWeekly | Grab |

The following design flow was used in determining the above limitations, but is not to be considered a limitation or actual capacity: 2.4 MGD.

a. Narrative Standard
The receiving water shall contain no turbidity, color, oil films, floating solids, foams, settleable solids, or deposits as a result of this discharge in unnatural quantities which are or may become injurious to any designated use.

**PART I**

## Section A. Limitations and Monitoring Requirements

b. Sampling Locations
Samples for $CBOD_5$, TSS, Ammonia Nitrogen, and Total Phosphorus shall be taken prior to disinfection. Samples for Fecal Coliform Bacteria, Total Residual Chlorine, Total Mercury, pH, and Dissolved Oxygen shall be taken after disinfection. The Department may approve alternate sampling locations that are demonstrated by the permittee to be representative of the effluent.

c. Quarterly Monitoring
Quarterly samples shall be taken during the months of January, April, July, and October. If the facility does not discharge during these months, the permittee shall sample the next discharge occurring during the period in question. If the facility does not discharge during the period in question, a sample is not required for that period. For any month in which a sample is not taken, the permittee shall enter "*G" on the Discharge Monitoring Report (DMR). (For purposes of reporting on the Daily tab of the DMR, the permittee shall enter “*G” on the first day of the month only).

d. Total Residual Chlorine (TRC)
Compliance with the TRC limit shall be determined on the basis of one or more grab samples. If more than one (1) sample per day is taken, the additional samples shall be collected in near equal intervals over at least eight (8) hours. The samples shall be analyzed immediately upon collection and the average reported as the daily concentration. Samples shall be analyzed in accordance with Part II.B.2. of this permit.

e. Percent Removal Requirements
These requirements shall be calculated based on the monthly (30-day) effluent $CBOD_5$ and TSS concentrations and the monthly influent concentrations for approximately the same period.

f. Total Mercury Testing and Additional Reporting Requirements
The analytical protocol for total mercury shall be in accordance with EPA Method 1631, Revision E, "Mercury in Water by Oxidation, Purge and Trap, and Cold Vapor Atomic Fluorescence Spectrometry." The quantification level for total mercury shall be 0.5 ng/l, unless a higher level is appropriate because of sample matrix interference. Justification for higher quantification levels shall be submitted to the Department within 30 days of such determination.

The use of clean technique sampling procedures is required unless the permittee can demonstrate to the Department that an alternate sampling procedure is representative of the discharge. Guidance for clean technique sampling is contained in EPA Method 1669, Sampling Ambient Water for Trace Metals at EPA Water Quality Criteria Levels (Sampling Guidance), EPA-821-R96-001, July 1996. Information and data documenting the permittee's sampling and analytical protocols and data acceptability shall be submitted to the Department upon request.

In order to demonstrate compliance with EPA Method 1631E and EPA Method 1669, the permittee shall report, on the daily sheet, the analytical results of all field blanks and field duplicates collected in conjunction with each sampling event, as well as laboratory method blanks when used for blank correction. The permittee shall collect at least one (1) field blank and at least one (1) field duplicate per sampling event. If more than ten (10) samples are collected during a sampling event, the permittee shall collect at least one (1) additional field blank AND field duplicate for every ten (10) samples collected. Only field blanks or laboratory method blanks may be used to calculate a concentration lower than the actual sample analytical results (i.e., a blank correction). Only one (1) blank (field OR laboratory method) may be used for blank correction of a given sample result, and only if the blank meets the quality control acceptance criteria. If blank correction is not performed on a given sample analytical result, the permittee shall report under "Total Mercury – Corrected" the same value reported under "Total Mercury – Uncorrected." The field duplicate is for quality control purposes only; its analytical result shall not be averaged with the sample result.

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# Section A. Limitations and Monitoring Requirements

The Department will review the mercury monitoring data using the reasonable potential process described in R 323.1211 of the Michigan Administrative Code to determine if there is a reasonable potential for the Water Quality Standard of 1.3 ng/l of total mercury to be exceeded in the effluent. If it is determined that the effluent has a reasonable potential to exceed 1.3 ng/l of total mercury, upon written notification by the Department, the permittee shall resume the Pollutant Minimization Program for Total Mercury in accordance with the provisions of Part I.A.4. of this permit. If, at any time during the life of the permit, the final effluent concentration exceeds 5 ng/l, the permittee shall notify the Department at the time of its next regular monthly monitoring report and shall resume the Pollutant Minimization Program for Total Mercury contained in Part I.A.4. of this permit.

## 2. Quantification Levels and Analytical Methods for Selected Parameters

Quantification levels (QLs) are specified for selected parameters in the table below. These QLs shall be considered the maximum acceptable unless a higher QL is appropriate because of sample matrix interference. Justification for higher QLs shall be submitted to the Department within 30 days of such determination. Where necessary to help ensure that the QLs specified can be achieved, analytical methods may also be specified in the table below. The sampling procedures, preservation and handling, and analytical protocol for all monitoring conducted in compliance with this permit, including monitoring conducted to meet the requirements of the application for permit reissuance, shall be in accordance with the methods specified in the table below, or in accordance with Part II.B.2. of this permit if no method is specified in the table below, unless an alternate method is approved by the Department. With the exception of total mercury, all units are in ug/l. The table is continued on the following page:

| Parameter | QL | Units | Analytical Method |
|---|---|---|---|
| 1,2-Diphenylhydrazine (as Azobenzene) | 3.0 | ug/l | |
| 2,4,6-Trichlorophenol | 5.0 | ug/l | |
| 2,4-Dinitrophenol | 19 | ug/l | |
| 3,3'-Dichlorobenzidine | 1.5 | ug/l | EPA Method 605 |
| 4,4'-DDD | 0.05 | ug/l | EPA Method 608 |
| 4,4'-DDE | 0.01 | ug/l | EPA Method 608 |
| 4,4'-DDT | 0.01 | ug/l | EPA Method 608 |
| Acrylonitrile | 1.0 | ug/l | |
| Aldrin | 0.01 | ug/l | EPA Method 608 |
| Alpha-Hexachlorocyclohexane | 0.01 | ug/l | EPA Method 608 |
| Antimony, Total | 1 | ug/l | |
| Arsenic, Total | 1 | ug/l | |
| Barium, Total | 5 | ug/l | |
| Benzidine | 0.1 | ug/l | EPA Method 605 |
| Beryllium, Total | 1 | ug/l | |
| Beta-Hexachlorocyclohexane | 0.01 | ug/l | EPA Method 608 |
| Bis (2-Chloroethyl) Ether | 1.0 | ug/l | |
| Boron, Total | 20 | ug/l | |
| Cadmium, Total | 0.2 | ug/l | |
| Chlordane | 0.01 | ug/l | EPA Method 608 |
| Chromium, Hexavalent | 5 | ug/l | |
| Chromium, Total | 10 | ug/l | |
| Copper, Total | 1 | ug/l | |
| Cyanide, Available | 2 | ug/l | EPA Method OIA 1677 |
| Cyanide, Total | 5 | ug/l | |
| Delta-Hexachlorocyclohexane | 0.01 | ug/l | EPA Method 608 |
| Dieldrin | 0.01 | ug/l | EPA Method 608 |

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# Section A. Limitations and Monitoring Requirements

| Parameter | QL | Units | Analytical Method |
|---|---|---|---|
| Di-N-Butyl Phthalate | 9.0 | ug/l | |
| Endosulfan I | 0.01 | ug/l | EPA Method 608 |
| Endosulfan II | 0.01 | ug/l | EPA Method 608 |
| Endosulfan Sulfate | 0.01 | ug/l | EPA Method 608 |
| Endrin | 0.01 | ug/l | EPA Method 608 |
| Endrin Aldehyde | 0.01 | ug/l | EPA Method 608 |
| Fluoranthene | 1.0 | ug/l | |
| Heptachlor | 0.01 | ug/l | EPA Method 608 |
| Heptachlor Epoxide | 0.01 | ug/l | EPA Method 608 |
| Hexachlorobenzene | 0.01 | ug/l | EPA Method 612 |
| Hexachlorobutadiene | 0.01 | ug/l | EPA Method 612 |
| Hexachlorocyclopentadiene | 0.01 | ug/l | EPA Method 612 |
| Hexachloroethane | 5.0 | ug/l | |
| Lead, Total | 1 | ug/l | |
| Lindane | 0.01 | ug/l | EPA Method 608 |
| Lithium, Total | 10 | ug/l | |
| Mercury, Total | 0.5 | **ng/l** | EPA Method 1631E |
| Nickel, Total | 5 | ug/l | |
| PCB-1016 | 0.1 | ug/l | EPA Method 608 |
| PCB-1221 | 0.1 | ug/l | EPA Method 608 |
| PCB-1232 | 0.1 | ug/l | EPA Method 608 |
| PCB-1242 | 0.1 | ug/l | EPA Method 608 |
| PCB-1248 | 0.1 | ug/l | EPA Method 608 |
| PCB-1254 | 0.1 | ug/l | EPA Method 608 |
| PCB-1260 | 0.1 | ug/l | EPA Method 608 |
| Pentachlorophenol | 1.8 | ug/l | |
| Phenanthrene | 1.0 | ug/l | |
| Selenium, Total | 1.0 | ug/l | |
| Silver, Total | 0.5 | ug/l | |
| Strontium, Total | 1000 | ug/l | |
| Sulfides, Dissolved | 20 | ug/l | |
| Thallium, Total | 1 | ug/l | |
| Toxaphene | 0.1 | ug/l | EPA Method 608 |
| Vinyl Chloride | 0.25 | ug/l | |
| Zinc, Total | 10 | ug/l | |

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# Section A. Limitations and Monitoring Requirements

## 3. Additional Monitoring Requirements

As a condition of this permit, the permittee shall monitor the discharge from monitoring point 001A for the constituents listed below. This monitoring is an application requirement of 40 CFR 122.21(j), effective December 2, 1999. Testing shall be conducted in December 2018, April 2019, August 2019, and January 2020. Grab samples shall be collected for total mercury, available cyanide, total phenols, and the Volatile Organic Compounds identified below. For all other parameters, 24-hour composite samples shall be collected.

Test species for whole effluent toxicity monitoring shall include fathead minnow **and** either *Daphnia magna, Daphnia pulex* or *Ceriodaphnia dubia*, for a total of four (4) tests on each species. Testing and reporting procedures shall follow procedures contained in EPA-821-R-02-012, "Methods for Measuring the Acute Toxicity of Effluents and Receiving Waters to Freshwater and Marine Organisms" (Fifth Edition). When the effluent ammonia nitrogen (as N) concentration is greater than 5 mg/l, the pH of the toxicity test shall be maintained at the pH of the effluent at the time of sample collection. Toxicity test data acceptability is contingent upon the validation of the test method by the testing laboratory. Such validation shall be submitted to the Department upon request.

The results of such additional monitoring shall be submitted with the application for reissuance (see the cover page of this permit for the application due date). The permittee shall notify the Department within 14 days of completing the monitoring for each month specified above in accordance with Part II.C.5. Additional reporting requirements are specified in Part II.C.11. The permittee shall report to the Department any whole effluent toxicity test results greater than 1.0 $TU_A$ or 1.0 $TU_C$ within five (5) days of becoming aware of the result. If, upon review of the analysis, it is determined that additional requirements are needed to protect the receiving waters in accordance with applicable water quality standards, the permit may then be modified by the Department in accordance with applicable laws and rules.

Whole Effluent Toxicity

| | |
|---|---|
| acute toxicity | chronic toxicity |

Hardness

calcium carbonate

Metals (Total Recoverable), Cyanide and Total Phenols

| | | | |
|---|---|---|---|
| antimony | arsenic | available cyanide | barium |
| beryllium | boron | cadmium | chromium |
| copper | lead | nickel | selenium |
| silver | thallium | zinc | |
| total phenolic compounds | | | |

Volatile Organic Compounds

| | | | |
|---|---|---|---|
| acrolein | acrylonitrile | benzene | bromoform |
| carbon tetrachloride | chlorobenzene | chlorodibromomethane | chloroethane |
| 2-chloroethylvinyl ether | chloroform | dichlorobromomethane | 1,1-dichloroethane |
| 1,2-dichloroethane | trans-1,2-dichloroethylene | 1,1-dichloroethylene | 1,2-dichloropropane |
| 1,3-dichloropropylene | ethylbenzene | methyl bromide | methyl chloride |
| methylene chloride | 1,1,2,2-tetrachloroethane | tetrachloroethylene | toluene |
| 1,1,1-trichloroethane | 1,1,2-trichloroethane | trichloroethylene | vinyl chloride |

Acid-Extractable Compounds

| | | | |
|---|---|---|---|
| 4-chloro-3-methylphenol | 2-chlorophenol | 2,4-dichlorophenol | 2,4-dimethylphenol |
| 4,6-dinitro-o-cresol | 2,4-dinitrophenol | 2-nitrophenol | 4-nitrophenol |
| Pentachlorophenol | phenol | 2,4,6-trichlorophenol | |

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Base/Neutral Compounds

| | | | |
|---|---|---|---|
| acenaphthene | acenaphthylene | anthracene | benzidine |
| benzo(a)anthracene | benzo(a)pyrene | 3,4-benzofluoranthene | benzo(ghi)perylene |
| benzo(k)fluoranthene | bis(2-chloroethoxy)methane | bis(2-chloroethyl)ether | bis(2-chloroisopropyl)ether |
| bis(2-ethylhexyl)phthalate | 4-bromophenyl phenyl ether | butyl benzyl phthalate | 2-chloronaphthalene |
| 4-chlorophenyl phenyl ether | chrysene | di-n-butyl phthalate | di-n-octyl phthalate |
| dibenzo(a,h)anthracene | 1,2-dichlorobenzene | 1,3-dichlorobenzene | 1,4-dichlorobenzene |
| 3,3'-dichlorobenzidine | diethyl phthalate | dimethyl phthalate | 2,4-dinitrotoluene |
| 2,6-dinitrotoluene | 1,2-diphenylhydrazine | fluoranthene | fluorene |
| Hexachlorobenzene | hexachlorobutadiene | hexachlorocyclo-pentadiene | hexachloroethane |
| indeno(1,2,3-cd)pyrene | isophorone | naphthalene | nitrobenzene |
| n-nitrosodi-n-propylamine | n-nitrosodimethylamine | n-nitrosodiphenylamine | phenanthrene |
| pyrene | 1,2,4-trichlorobenzene | | |

## 4. Pollutant Minimization Program for Total Mercury

This condition is required, upon written notification by the Department or if the permittee notifies the Department that the final effluent concentration of total mercury has exceeded 5 ng/l, as specified in Part I.A.1. The goal of the Pollutant Minimization Program is to maintain the effluent concentration of total mercury at or below 1.3 ng/l. The permittee upon notification shall resume implementation of the Pollutant Minimization Program approved on April 1, 2006, and modifications thereto, to proceed towards the goal. The Pollutant Minimization Program shall include the following:

a. an annual review and semi-annual monitoring of potential sources of mercury entering the wastewater collection system;

b. a program for quarterly monitoring of influent and periodic monitoring of sludge for mercury; and

c. implementation of reasonable cost-effective control measures when sources of mercury are discovered. Factors to be considered include significance of sources, economic considerations, and technical and treatability considerations.

The Pollutant Minimization Program shall be implemented upon approval by the Department.

On or before March 31 of each year following approval of the Pollutant Minimization Program, the permittee shall submit a status report for the previous calendar year to the Department that includes 1) the monitoring results for the previous year, 2) an updated list of potential mercury sources, and 3) a summary of all actions taken to reduce or eliminate identified sources of mercury.

Any information generated as a result of the Pollutant Minimization Program set forth in this permit may be used to support a request to modify the approved program or to demonstrate that the Pollutant Minimization Program requirement has been completed satisfactorily.

A request for modification of the approved program and supporting documentation shall be submitted in writing to the Department for review and approval. The Department may approve modifications to the approved program (approval of a program modification does not require a permit modification), including a reduction in the frequency of the requirements under items a. and b.

This permit may be modified in accordance with applicable laws and rules to include additional mercury conditions and/or limitations as necessary.

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# Section A. Limitations and Monitoring Requirements

## 5. Untreated or Partially Treated Sewage Discharge Reporting and Testing Requirements

In accordance with Section 324.3112a of the NREPA, if untreated sewage, including sanitary sewer overflows (SSO) and combined sewer overflows (CSO), or partially treated sewage is directly or indirectly discharged from a sewer system onto land or into the waters of the state, the entity responsible for the sewer system shall immediately, but not more than 24 hours after the discharge begins, notify, by telephone, the Department, local health departments, a daily newspaper of general circulation in the county in which the permittee is located, and a daily newspaper of general circulation in the county or counties in which the municipalities whose waters may be affected by the discharge are located that the discharge is occurring.

The permittee shall also annually contact municipalities, including the superintendent of a public drinking water supply with potentially affected intakes, whose waters may be affected by the permittee's discharge of combined sewage, and if those municipalities wish to be notified in the same manner as specified above, the permittee shall provide such notification. Such notification shall also include a daily newspaper in the county of the affected municipality.

At the conclusion of the discharge, written notification shall be submitted in accordance with and on the "Report of Discharge Form" available via the internet at: http://www.deq.state.mi.us/csosso/ , or, alternatively for combined sewer overflow discharges, in accordance with notification procedures approved by the Department.

In addition, in accordance with Section 324.3112a of the NREPA, each time a discharge of untreated sewage or partially treated sewage occurs, the permittee shall test the affected waters for *Escherichia coli* to assess the risk to the public health as a result of the discharge and shall provide the test results to the affected local county health departments and to the Department. The testing shall be done at locations specified by each affected local county health department but shall not exceed 10 tests for each separate discharge event. The affected local county health department may waive this testing requirement, if it determines that such testing is not needed to assess the risk to the public health as a result of the discharge event. The results of this testing shall be submitted with the written notification required above, or, if the results are not yet available, submit them as soon as they become available. This testing is not required, if the testing has been waived by the local health department, or if the discharge(s) did not affect surface waters.

Permittees accepting sanitary or municipal sewage from other sewage collection systems are encouraged to notify the owners of those systems of the above reporting and testing requirements.

## 6. Facility Contact

The "Facility Contact" was specified in the application. The permittee may replace the facility contact at any time, and shall notify the Department in writing within 10 days after replacement (including the name, address and telephone number of the new facility contact).

a. The facility contact shall be (or a duly authorized representative of this person):
   - for a corporation, a principal executive officer of at least the level of vice president; or a designated representative if the representative is responsible for the overall operation of the facility from which the discharge originates, as described in the permit application or other NPDES form,
   - for a partnership, a general partner,
   - for a sole proprietorship, the proprietor, or
   - for a municipal, state, or other public facility, either a principal executive officer, the mayor, village president, city or village manager or other duly authorized employee.

b. A person is a duly authorized representative only if:
- the authorization is made in writing to the Department by a person described in paragraph a. of this section; and
- the authorization specifies either an individual or a position having responsibility for the overall operation of the regulated facility or activity such as the position of plant manager, operator of a well or a well field, superintendent, position of equivalent responsibility, or an individual or position having overall responsibility for environmental matters for the facility (a duly authorized representative may thus be either a named individual or any individual occupying a named position).

Nothing in this section releases the permittee from properly submitting reports and forms as required by law.

## 7. Monthly Operating Reports

Part 41 of Act 451 of 1994 as amended, specifically Section 324.4106 and associated R 299.2953, requires that the permittee file with the Department, on forms prescribed by the Department, operating reports showing the effectiveness of the treatment facility operation and the quantity and quality of liquid wastes discharged into waters of the state.

Within 30 days of the effective date of this permit, the permittee shall submit to the Department a revised treatment facility monitoring program to address monitoring requirement changes reflected in this permit, or submit justification explaining why monitoring requirement changes reflected in this permit do not necessitate revisions to the treatment facility monitoring program. The permittee shall implement the revised treatment facility monitoring program upon approval from the Department. Applicable forms and guidance are available on the Department's web site at http://www.michigan.gov/deq/0,1607,7-135-3313_44117---,00.html. The permittee may use alternate forms if they are consistent with the approved treatment facility monitoring program. Unless the Department provides written notification to the permittee that monthly submittal of operating reports is required, operating reports that result from implementation of the approved treatment facility monitoring program shall be maintained on site for a minimum of three (3) years and shall be made available to the Department for review upon request.

## 8. Asset Management

The permittee shall at all times properly operate and maintain all facilities (i.e., the sewer system and treatment works as defined in Part 41 of the NREPA), and control systems installed or used by the permittee to operate the sewer system and treatment works and achieve and maintain compliance with the conditions of this permit (also see Part II.D.3 of this permit). The requirements of an Asset Management Program function to achieve the goals of effective performance, adequate funding, and adequate operator staffing and training. Asset management is a planning process for ensuring that optimum value is gained for each asset and that financial resources are available to rehabilitate and replace those assets when necessary. Asset management is centered on a framework of five (5) core elements: the current state of the assets; the required sustainable level of service; the assets critical to sustained performance; the minimum life-cycle costs; and the best long-term funding strategy.

a. Asset Management Program Requirements
On or before July 1, 2019, the permittee shall submit to the Department an Asset Management Plan for review and approval. An approvable Asset Management Plan shall contain a schedule for the development and implementation of an Asset Management Program that meets the requirements outlined below in 1) – 4). A copy of any Asset Management Program requirements already completed by the permittee should be submitted as part of the Asset Management Plan. Upon approval by the Department the permittee shall implement the Asset Management Plan. (The permittee may choose to include the Operation and Maintenance Manual required under Part II.C.14. of this permit as part of their Asset Management Program).

**PART I**

## Section A. Limitations and Monitoring Requirements

1) *Maintenance Staff.* The permittee shall provide an adequate staff to carry out the operation, maintenance, repair, and testing functions required to ensure compliance with the terms and conditions of this permit. The level of staffing needed shall be determined by taking into account the work involved in operating the sewer system and treatment works, planning for and conducting maintenance, and complying with this permit.

2) *Collection System Map.* The permittee shall complete a map of the sewer collection system it owns and operates. The map shall be of sufficient detail and at a scale to allow easy interpretation. The collection system information shown on the map shall be based on current conditions and shall be kept up-to-date and available for review by the Department. **Note: Items below referencing combined sewer systems are not applicable to separate sewer systems.** Such map(s) shall include but not be limited to the following:

a) all sanitary sewer lines and related manholes;

b) all combined sewer lines, related manholes, catch basins and CSO regulators;

c) all known or suspected connections between the sanitary sewer or combined sewer and storm drain systems;

d) all outfalls, including the treatment plant outfall(s), combined sewer treatment facility outfalls, untreated CSOs, and any known SSOs;

e) all pump stations and force mains;

f) the wastewater treatment facility(ies), including all treatment processes;

g) all surface waters (labeled);

h) other major appurtenances such as inverted siphons and air release valves;

i) a numbering system which uniquely identifies manholes, catch basins, overflow points, regulators and outfalls;

j) the scale and a north arrow;

k) the pipe diameter, date of installation, type of material, distance between manholes, and the direction of flow; and

l) the manhole interior material, rim elevation (optional), and invert elevations.

3) *Inventory and assessment of fixed assets.* The permittee shall complete an inventory and assessment of operations-related fixed assets. Fixed assets are assets that are normally stationary (e.g., pumps, blowers, and buildings). The inventory and assessment shall be based on current conditions and shall be kept up-to-date and available for review by the Department.

a) The fixed asset inventory shall include the following:

(1) a brief description of the fixed asset, its design capacity (e.g., pump: 120 gallons per minute), its level of redundancy, and its tag number if applicable;

(2) the location of the fixed asset;

(3) the year the fixed asset was installed;

(4) the present condition of the fixed asset (e.g., excellent, good, fair, poor); and

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## Section A. Limitations and Monitoring Requirements

(5) the current fixed asset (replacement) cost in dollars for year specified in accordance with approved schedules;

b) The fixed asset assessment shall include a "Business Risk Evaluation" that combines the probability of failure of the fixed asset and the criticality of the fixed asset, as follows:

(1) Rate the probability of failure of the fixed asset on a scale of 1-5 (low to high) using criteria such as maintenance history, failure history, and remaining percentage of useful life (or years remaining);

(2) Rate the criticality of the fixed asset on a scale of 1-5 (low to high) based on the consequence of failure versus the desired level of service for the facility; and

(3) Compute the Business Risk Factor of the fixed asset by multiplying the failure rating from (1) by the criticality rating from (2).

4) *Operation, Maintenance & Replacement (OM&R) Budget and Rate Sufficiency for the Sewer System and Treatment Works.* The permittee shall complete an assessment of its user rates and replacement fund, including the following:

a) beginning and end dates of fiscal year;

b) name of the department, committee, board, or other organization that sets rates for the operation of the sewer system and treatment works;

c) amount in the permittee's replacement fund in dollars for year specified in accordance with approved schedules;

d) replacement fund strategy of all assets with a useful life of 20 years or less;

e) expenditures for maintenance, corrective action and capital improvement taken during the fiscal year;

f) OM&R budget for the fiscal year; and

g) rate calculation demonstrating sufficient revenues to cover OM&R expenses. If the rate calculation shows there are insufficient revenues to cover OM&R expenses, the permittee shall document, within three (3) fiscal years after submittal of the Asset Management Plan, that there is at least one rate adjustment that reduces the revenue gap by at least 10 percent. The permittee may prepare and submit an alternate plan, subject to Department approval, for addressing the revenue gap. The ultimate goal of the Asset Management Program is to ensure sufficient revenues to cover OM&R expenses.

b. Annual Reporting

The permittee shall develop a written report that summarizes asset management activities completed during the previous year and planned for the upcoming year. The written report shall be submitted to the Department on or before July 1 of each year. The written report shall include:

1) a description of the staffing levels maintained during the year;

2) a description of inspections and maintenance activities conducted and corrective actions taken during the previous year;

3) expenditures for collection system maintenance activities, treatment works maintenance activities, corrective actions, and capital improvement during the previous year;

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## Section A. Limitations and Monitoring Requirements

4) a summary of assets/areas identified for inspection/action (including capital improvement) in the upcoming year based on the five (5) core elements and the Business Risk Factors;

5) a maintenance budget and capital improvement budget for the upcoming year that take into account implementation of an effective Asset Management Program that meets the five (5) core elements;

6) an updated asset inventory based on the original submission; and

7) an updated OM&R budget with an updated rate schedule that includes the amount of insufficient revenues, if any

## 9. Discharge Monitoring Report – Quality Assurance Study Program

The permittee shall participate in the Discharge Monitoring Report – Quality Assurance (DMR-QA) Study Program. The purpose of the DMR-QA Study Program is to annually evaluate the proficiency of all in-house and/or contract laboratory(ies) that perform, on behalf of the facility authorized to discharge under this permit, the analytical testing required under this permit. In accordance with Section 308 of the Clean Water Act (33 U.S.C. § 1318); and R 323.2138 and R 323.2154 of Part 21, Wastewater Discharge Permits, promulgated under Part 31 of the NREPA, participation in the DMR-QA Study Program is required for all major facilities, and for minor facilities selected for participation by the Department.

Annually and in accordance with DMR-QA Study Program requirements and submittal due dates, the permittee shall submit to the Michigan DMR-QA Study Program state coordinator all documentation required by the DMR-QA Study. DMR-QA Study Program participation is required only for the analytes required under this permit and only when those analytes are also identified in the DMR-QA Study.

If the permitted facility's status as a major facility should change, participation in the DMR-QA Study Program may be reevaluated. Questions concerning participation in the DMR-QA Study Program should be directed to the Michigan DMR-QA Study Program state coordinator.

All forms and instructions required for participation in the DMR-QA Study Program, including submittal due dates and state coordinator contact information, can be found at http://www.epa.gov/compliance/discharge-monitoring-report-quality-assurance-study-program.

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## Section B. Storm Water Pollution Prevention

Section B. Storm Water Pollution Prevention is not required for this permit.

**PART I**

## Section C. Industrial Waste Pretreatment Program

### 1. Michigan Industrial Pretreatment Program

a. The permittee shall implement the Michigan Industrial Pretreatment Program (MIPP) approved on September 19, 1994, and any subsequent modifications approved up to the issuance of this permit.

b. The permittee shall comply with R 323.2301 through R 323.2317 of the Michigan Administrative Code (Part 23 Rules) and the approved MIPP.

c. The permittee shall have the legal authority and necessary interjurisdictional agreements that provide the basis for the implementation and enforcement of the approved MIPP throughout the service area. The legal authority and necessary interjurisdictional agreements shall include, at a minimum, the authority to carry out the activities specified in R 323.2306(a).

d. The permittee shall develop procedures which describe, in sufficient detail, program commitments which enable implementation of the approved MIPP and the Part 23 Rules in accordance with R 323.2306(c).

e. The permittee shall establish an interjurisdictional agreement (or comparable document) with all tributary governmental jurisdictions. Each interjurisdictional agreement shall contain, at a minimum, the following:

1) identification of the agency responsible for the implementation and enforcement of the approved MIPP within the tributary governmental jurisdiction's boundaries; and

2) the provision of the legal authority which provides the basis for the implementation and enforcement of the approved MIPP within the tributary governmental jurisdiction's boundaries.

f. The permittee shall prohibit discharges that:

1) cause, in whole or in part, the permittee's failure to comply with any condition of this permit or the NREPA;

2) restrict, in whole or in part, the permittee's management of biosolids;

3) cause, in whole or in part, operational problems at the treatment facility or in its collection system;

4) violate any of the general or specific prohibitions identified in R 323.2303(1) and (2);

5) violate categorical standards identified in R 323.2311; and

6) violate local limits established in accordance with R 323.2303(4).

g. The permittee shall maintain a list of its nondomestic users that meet the criteria of a significant industrial user as identified in R 323.2302(cc).

h. The permittee shall develop an enforcement response plan which describes, in sufficient detail, program commitments which will enable the enforcement of the approved MIPP and the Part 23 Rules in accordance with R 323.2306(g).

i. The Department may require modifications to the approved MIPP which are necessary to ensure compliance with the Part 23 Rules in accordance with R 323.2309.

j. The permittee shall not implement changes or modifications to the approved MIPP without notification to the Department.

**PART I**

## Section C. Industrial Waste Pretreatment Program

k. The permittee shall maintain an adequate revenue structure and staffing level for effective implementation of the approved MIPP.

l. The permittee shall develop and maintain, for a minimum of three (3) years, all records and information necessary to determine nondomestic user compliance with the Part 23 Rules and the approved MIPP. This period of retention shall be extended during the course of any unresolved enforcement action or litigation regarding a nondomestic user or when requested by the Department or the United States Environmental Protection Agency. All of the aforementioned records and information shall be made available upon request for inspection and copying by the Department and the United States Environmental Protection Agency.

m. The permittee shall evaluate the approved MIPP for compliance with the Part 23 Rules and the prohibitions set forth in item f. above. Based upon this evaluation, the permittee shall propose to the Department all necessary changes or modifications to the approved MIPP no later than the next Industrial Pretreatment Program Annual Report due date (see item o. below).

n. The permittee shall develop and enforce local limits to implement the prohibitions set forth in item f. above. Local limits shall be based upon data representative of actual conditions demonstrated in a maximum allowable headworks loading analysis.

o. On or before April 1st of each year, the permittee shall submit to the Department, as required by R 323.2310(8), an Industrial Pretreatment Program Annual Report on the status of program implementation and enforcement activities. The reporting period shall begin on January 1st and end on December 31st. At a minimum, the Industrial Pretreatment Program Annual Report shall include:

1) the Pretreatment Program Reports data identified in Appendix A to 40 CFR Part 127 – NPDES Electronic Reporting;

2) a summary of changes to the approved MIPP that have not been previously reported to the Department;

3) a summary of results of all the sampling and analyses performed of the wastewater treatment plant's influent, effluent, and biosolids conducted in accordance with approved methods during the reporting period. The summary shall include the monthly average, daily maximum, quantification level, and number of samples analyzed for each pollutant. At a minimum, the results of analyses for all locally limited parameters for at least one monitoring event that tests influent, effluent and biosolids during the reporting period shall be submitted with each report, unless otherwise required by the Department. Sample collection shall be at intervals sufficient to provide pollutant removal rates, unless the pollutant is not measurable; and

4) any other relevant information requested by the Department.

**PART I**

# Section D. Residuals Management Program

## 1. Residuals Management Program for Land Application of Biosolids

The permittee is authorized to land-apply bulk biosolids or prepare bulk biosolids for land application in accordance with the permittee's approved Residuals Management Program (RMP) approved on October 20, 2006, and approved modifications thereto, in accordance with the requirements established in R 323.2401 through R 323.2418 of the Michigan Administrative Code (Part 24 Rules). The approved RMP, and any approved modifications thereto, are enforceable requirements of this permit. Incineration, landfilling and other residual disposal activities shall be conducted in accordance with Part II.D.7. of this permit. The Part 24 Rules can be obtained via the internet (http://www.michigan.gov/deq/ and on the left side of the screen click on Water, Biosolids & Industrial Pretreatment, Biosolids then click on Biosolids Laws and Rules Information which is under the Laws & Rules banner in the center of the screen).

a. Annual Report
On or before October 30 of each year, the permittee shall submit an annual report to the Department for the previous fiscal year of October 1 through September 30. The report shall be submitted electronically via the Department's MiWaters system at https://miwaters.deq.state.mi.us. At a minimum, the report shall contain:

1) a certification that current residuals management practices are in accordance with the approved RMP, or a proposal for modification to the approved RMP; and

2) a completed Biosolids Annual Report Form, available at https://miwaters.deq.state.mi.us.

b. Modifications to the Approved RMP
Prior to implementation of modifications to the RMP, the permittee shall submit proposed modifications to the Department for approval. The approved modification shall become effective upon the date of approval. Upon written notification, the Department may impose additional requirements and/or limitations to the approved RMP as necessary to protect public health and the environment from any adverse effect of a pollutant in the biosolids.

c. Record Keeping
Records required by the Part 24 Rules shall be kept for a minimum of five years. However, the records documenting cumulative loading for sites subject to cumulative pollutant loading rates shall be kept as long as the site receives biosolids.

d. Contact Information
RMP-related submittals shall be made to the Department.

## PART II

Part II may include terms and /or conditions not applicable to discharges covered under this permit.

# Section A. Definitions

**Acute toxic unit ($TU_A$)** means $100/LC_{50}$ where the $LC_{50}$ is determined from a whole effluent toxicity (WET) test which produces a result that is statistically or graphically estimated to be lethal to 50% of the test organisms.

**Annual monitoring frequency** refers to a calendar year beginning on January 1 and ending on December 31. When required by this permit, an analytical result, reading, value or observation shall be reported for that period if a discharge occurs during that period.

**Authorized public agency** means a state, local, or county agency that is designated pursuant to the provisions of section 9110 of Part 91 of the NREPA to implement soil erosion and sedimentation control requirements with regard to construction activities undertaken by that agency.

**Best management practices (BMPs)** means structural devices or nonstructural practices that are designed to prevent pollutants from entering into storm water, to direct the flow of storm water, or to treat polluted storm water.

**Bioaccumulative chemical of concern (BCC)** means a chemical which, upon entering the surface waters, by itself or as its toxic transformation product, accumulates in aquatic organisms by a human health bioaccumulation factor of more than 1000 after considering metabolism and other physiochemical properties that might enhance or inhibit bioaccumulation. The human health bioaccumulation factor shall be derived according to R 323.1057(5). Chemicals with half-lives of less than 8 weeks in the water column, sediment, and biota are not BCCs. The minimum bioaccumulation concentration factor (BAF) information needed to define an organic chemical as a BCC is either a field-measured BAF or a BAF derived using the biota-sediment accumulation factor (BSAF) methodology. The minimum BAF information needed to define an inorganic chemical as a BCC, including an organometal, is either a field-measured BAF or a laboratory-measured bioconcentration factor (BCF). The BCCs to which these rules apply are identified in Table 5 of R 323.1057 of the Water Quality Standards.

**Biosolids** are the solid, semisolid, or liquid residues generated during the treatment of sanitary sewage or domestic sewage in a treatment works. This includes, but is not limited to, scum or solids removed in primary, secondary, or advanced wastewater treatment processes and a derivative of the removed scum or solids.

**Bulk biosolids** means biosolids that are not sold or given away in a bag or other container for application to a lawn or home garden.

**Certificate of Coverage (COC)** is a document, issued by the Department, which authorizes a discharge under a general permit.

**Chronic toxic unit ($TU_C$ )** means $100/MATC$ or $100/IC_{25}$, where the maximum acceptable toxicant concentration (MATC) and $IC_{25}$ are expressed as a percent effluent in the test medium.

**Class B biosolids** refers to material that has met the Class B pathogen reduction requirements or equivalent treatment by a Process to Significantly Reduce Pathogens (PSRP) in accordance with the Part 24 Rules. Processes include aerobic digestion, composting, anaerobic digestion, lime stabilization and air drying.

**Combined sewer system** is a sewer system in which storm water runoff is combined with sanitary wastes.

**PART II**

# Section A. Definitions

**Daily concentration** is the sum of the concentrations of the individual samples of a parameter divided by the number of samples taken during any calendar day. The daily concentration will be used to determine compliance with any maximum and minimum daily concentration limitations (except for pH and dissolved oxygen). When required by the permit, report the maximum calculated daily concentration for the month in the "MAXIMUM" column under "QUALITY OR CONCENTRATION" on the Discharge Monitoring Reports (DMRs).

For pH, report the maximum value of any *individual* sample taken during the month in the "MAXIMUM" column under "QUALITY OR CONCENTRATION" on the DMRs and the minimum value of any *individual* sample taken during the month in the "MINIMUM" column under "QUALITY OR CONCENTRATION" on the DMRs. For dissolved oxygen, report the minimum concentration of any *individual* sample in the "MINIMUM" column under "QUALITY OR CONCENTRATION" on the DMRs.

**Daily loading** is the total discharge by weight of a parameter discharged during any calendar day. This value is calculated by multiplying the daily concentration by the total daily flow and by the appropriate conversion factor. The daily loading will be used to determine compliance with any maximum daily loading limitations. When required by the permit, report the maximum calculated daily loading for the month in the "MAXIMUM" column under "QUANTITY OR LOADING" on the DMRs.

**Daily monitoring frequency** refers to a 24-hour day. When required by this permit, an analytical result, reading, value or observation shall be reported for that period if a discharge occurs during that period.

**Department** means the Michigan Department of Environmental Quality.

**Detection level** means the lowest concentration or amount of the target analyte that can be determined to be different from zero by a single measurement at a stated level of probability.

**Discharge** means the addition of any waste, waste effluent, wastewater, pollutant, or any combination thereof to any surface water of the state.

**$EC_{50}$** means a statistically or graphically estimated concentration that is expected to cause 1 or more specified effects in 50% of a group of organisms under specified conditions.

**Fecal coliform bacteria monthly**
FOR WWSLs THAT COLLECT AND STORE WASTEWATER AND ARE AUTHORIZED TO DISCHARGE ONLY IN THE SPRING AND/OR FALL ON AN INTERMITTENT BASIS – Fecal coliform bacteria monthly is the geometric mean of all daily concentrations determined during a discharge event. Days on which no daily concentration is determined shall not be used to determine the calculated monthly value. The calculated monthly value will be used to determine compliance with the maximum monthly fecal coliform bacteria limitations. When required by the permit, report the calculated monthly value in the "AVERAGE" column under "QUALITY OR CONCENTRATION" on the DMR. If the period in which the discharge event occurred was partially in each of two months, the calculated monthly value shall be reported on the DMR of the month in which the last day of discharge occurred.

FOR ALL OTHER DISCHARGES – Fecal coliform bacteria monthly is the geometric mean of all daily concentrations determined during a reporting month. Days on which no daily concentration is determined shall not be used to determine the calculated monthly value. The calculated monthly value will be used to determine compliance with the maximum monthly fecal coliform bacteria limitations. When required by the permit, report the calculated monthly value in the "AVERAGE" column under "QUALITY OR CONCENTRATION" on the DMR.

**PART II**

# Section A. Definitions

**Fecal coliform bacteria 7-day**
FOR WWSLs THAT COLLECT AND STORE WASTEWATER AND ARE AUTHORIZED TO DISCHARGE ONLY IN THE SPRING AND/OR FALL ON AN INTERMITTENT BASIS – Fecal coliform bacteria 7-day is the geometric mean of the daily concentrations determined during any 7 consecutive days of discharge during a discharge event. If the number of daily concentrations determined during the discharge event is less than 7 days, the number of actual daily concentrations determined shall be used for the calculation. Days on which no daily concentration is determined shall not be used to determine the value. The calculated 7-day value will be used to determine compliance with the maximum 7-day fecal coliform bacteria limitations. When required by the permit, report the maximum calculated 7-day geometric mean value for the month in the "MAXIMUM" column under "QUALITY OR CONCENTRATION" on the DMRs. If the 7-day period was partially in each of two months, the value shall be reported on the DMR of the month in which the last day of discharge occurred.

FOR ALL OTHER DISCHARGES – Fecal coliform bacteria 7-day is the geometric mean of the daily concentrations determined during any 7 consecutive days in a reporting month. If the number of daily concentrations determined is less than 7, the actual number of daily concentrations determined shall be used for the calculation. Days on which no daily concentration is determined shall not be used to determine the value. The calculated 7-day value will be used to determine compliance with the maximum 7-day fecal coliform bacteria limitations. When required by the permit, report the maximum calculated 7-day geometric mean for the month in the "MAXIMUM" column under "QUALITY OR CONCENTRATION" on the DMRs. The first calculation shall be made on day 7 of the reporting month, and the last calculation shall be made on the last day of the reporting month.

**Flow-proportioned sample** is a composite sample with the sample volume proportional to the effluent flow.

**General permit** means a National Pollutant Discharge Elimination System permit issued authorizing a category of similar discharges.

**Geometric mean** is the average of the logarithmic values of a base 10 data set, converted back to a base 10 number.

**Grab sample** is a single sample taken at neither a set time nor flow.

**$IC_{25}$** means the toxicant concentration that would cause a 25% reduction in a nonquantal biological measurement for the test population.

**Illicit connection** means a physical connection to a municipal separate storm sewer system that primarily conveys non-storm water discharges other than uncontaminated groundwater into the storm sewer; or a physical connection not authorized or permitted by the local authority, where a local authority requires authorization or a permit for physical connections.

**Illicit discharge** means any discharge to, or seepage into, a municipal separate storm sewer system that is not composed entirely of storm water or uncontaminated groundwater. Illicit discharges include non-storm water discharges through pipes or other physical connections; dumping of motor vehicle fluids, household hazardous wastes, domestic animal wastes, or litter; collection and intentional dumping of grass clippings or leaf litter; or unauthorized discharges of sewage, industrial waste, restaurant wastes, or any other non-storm water waste directly into a separate storm sewer.

**Individual permit** means a site-specific NPDES permit.

**Inlet** means a catch basin, roof drain, conduit, drain tile, retention pond riser pipe, sump pump, or other point where storm water or wastewater enters into a closed conveyance system prior to discharge off site or into waters of the state.

**PART II**

## Section A. Definitions

**Interference** is a discharge which, alone or in conjunction with a discharge or discharges from other sources, both: 1) inhibits or disrupts the POTW, its treatment processes or operations, or its sludge processes, use or disposal; and 2) therefore, is a cause of a violation of any requirement of the POTW's NPDES permit (including an increase in the magnitude or duration of a violation) or, of the prevention of sewage sludge use or disposal in compliance with the following statutory provisions and regulations or permits issued thereunder (or more stringent state or local regulations): Section 405 of the Clean Water Act, the Solid Waste Disposal Act (SWDA) (including Title II, more commonly referred to as the Resource Conservation and Recovery Act (RCRA), and including state regulations contained in any state sludge management plan prepared pursuant to Subtitle D of the SWDA), the Clean Air Act, the Toxic Substances Control Act, and the Marine Protection, Research and Sanctuaries Act. [This definition does not apply to sample matrix interference].

**Land application** means spraying or spreading biosolids or a biosolids derivative onto the land surface, injecting below the land surface, or incorporating into the soil so that the biosolids or biosolids derivative can either condition the soil or fertilize crops or vegetation grown in the soil.

**$LC_{50}$** means a statistically or graphically estimated concentration that is expected to be lethal to 50% of a group of organisms under specified conditions.

**Maximum acceptable toxicant concentration (MATC)** means the concentration obtained by calculating the geometric mean of the lower and upper chronic limits from a chronic test. A lower chronic limit is the highest tested concentration that did not cause the occurrence of a specific adverse effect. An upper chronic limit is the lowest tested concentration which did cause the occurrence of a specific adverse effect and above which all tested concentrations caused such an occurrence.

**Maximum extent practicable** means implementation of best management practices by a public body to comply with an approved storm water management program as required by a national permit for a municipal separate storm sewer system, in a manner that is environmentally beneficial, technically feasible, and within the public body's legal authority.

**MGD** means million gallons per day.

**Monthly concentration** is the sum of the daily concentrations determined during a reporting period divided by the number of daily concentrations determined. The calculated monthly concentration will be used to determine compliance with any maximum monthly concentration limitations. Days with no discharge shall not be used to determine the value. When required by the permit, report the calculated monthly concentration in the "AVERAGE" column under "QUALITY OR CONCENTRATION" on the DMR.

For minimum percent removal requirements, the monthly influent concentration and the monthly effluent concentration shall be determined. The calculated monthly percent removal, which is equal to 100 times the quantity [1 minus the quantity (monthly effluent concentration divided by the monthly influent concentration)], shall be reported in the "MINIMUM" column under "QUALITY OR CONCENTRATION" on the DMRs.

**Monthly loading** is the sum of the daily loadings of a parameter divided by the number of daily loadings determined during a reporting period. The calculated monthly loading will be used to determine compliance with any maximum monthly loading limitations. Days with no discharge shall not be used to determine the value. When required by the permit, report the calculated monthly loading in the "AVERAGE" column under "QUANTITY OR LOADING" on the DMR.

**Monthly monitoring frequency** refers to a calendar month. When required by this permit, an analytical result, reading, value or observation shall be reported for that period if a discharge occurs during that period.

**Municipal separate storm sewer** means a conveyance or system of conveyances designed or used for collecting or conveying storm water which is not a combined sewer and which is not part of a publicly-owned treatment works as defined in the Code of Federal Regulations at 40 CFR 122.2.

PART II

## Section A. Definitions

**Municipal separate storm sewer system (MS4)** means all separate storm sewers that are owned or operated by the United States, a state, city, village, township, county, district, association, or other public body created by or pursuant to state law, having jurisdiction over disposal of sewage, industrial wastes, storm water, or other wastes, including special districts under state law, such as a sewer district, flood control district, or drainage district, or similar entity, or a designated or approved management agency under Section 208 of the Federal Act that discharges to the waters of the state. This term includes systems similar to separate storm sewer systems in municipalities, such as systems at military bases, large hospital or prison complexes, and highways and other thoroughfares. The term does not include separate storm sewers in very discrete areas, such as individual buildings.

**National Pretreatment Standards** are the regulations promulgated by or to be promulgated by the Federal Environmental Protection Agency pursuant to Section 307(b) and (c) of the Federal Act. The standards establish nationwide limits for specific industrial categories for discharge to a POTW.

**No observed adverse effect level (NOAEL)** means the highest tested dose or concentration of a substance which results in no observed adverse effect in exposed test organisms where higher doses or concentrations result in an adverse effect.

**Noncontact cooling water** is water used for cooling which does not come into direct contact with any raw material, intermediate product, by-product, waste product or finished product.

**Nondomestic user** is any discharger to a POTW that discharges wastes other than or in addition to water-carried wastes from toilet, kitchen, laundry, bathing or other facilities used for household purposes.

**Outfall** is the location at which a point source discharge enters the surface waters of the state.

**Part 91 agency** means an agency that is designated by a county board of commissioners pursuant to the provisions of section 9105 of Part 91 of the NREPA; an agency that is designated by a city, village, or township in accordance with the provisions of section 9106 of Part 91 of the NREPA; or the Department for soil erosion and sedimentation activities under Part 615, Part 631, or Part 632 pursuant to the provisions of section 9115 of Part 91 of the NREPA.

**Part 91 permit** means a soil erosion and sedimentation control permit issued by a Part 91 agency pursuant to the provisions of Part 91 of the NREPA.

**Partially treated sewage** is any sewage, sewage and storm water, or sewage and wastewater, from domestic or industrial sources that is treated to a level less than that required by the permittee's National Pollutant Discharge Elimination System permit, or that is not treated to national secondary treatment standards for wastewater, including discharges to surface waters from retention treatment facilities.

**Point of discharge** is the location of a point source discharge where storm water is discharged directly into a separate storm sewer system.

**Point source discharge** means a discharge from any discernible, confined, discrete conveyance, including but not limited to any pipe, ditch, channel, tunnel, conduit, well, discrete fissure, container, or rolling stock. Changing the surface of land or establishing grading patterns on land will result in a point source discharge where the runoff from the site is ultimately discharged to waters of the state.

**Polluting material** means any material, in solid or liquid form, identified as a polluting material under the Part 5 Rules (R 324.2001 through R 324.2009 of the Michigan Administrative Code).

**POTW** is a publicly owned treatment work.

**Pretreatment** is reducing the amount of pollutants, eliminating pollutants, or altering the nature of pollutant properties to a less harmful state prior to discharge into a public sewer. The reduction or alteration can be by physical, chemical, or biological processes, process changes, or by other means. Dilution is not considered pretreatment unless expressly authorized by an applicable National Pretreatment Standard for a particular industrial category.

## PART II

# Section A. Definitions

**Public** (as used in the MS4 individual permit) means all persons who potentially could affect the authorized storm water discharges, including, but not limited to, residents, visitors to the area, public employees, businesses, industries, and construction contractors and developers.

**Public body** means the United States; the state of Michigan; a city, village, township, county, school district, public college or university, or single-purpose governmental agency; or any other body which is created by federal or state statute or law.

**Qualified Personnel** means an individual who meets qualifications acceptable to the Department and who is authorized by an Industrial Storm Water Certified Operator to collect the storm water sample.

**Qualifying storm event** means a storm event causing greater than 0.1 inch of rainfall and occurring at least 72 hours after the previous measurable storm event that also caused greater than 0.1 inch of rainfall. Upon request, the Department may approve an alternate definition meeting the condition of a qualifying storm event.

**Quantification level** means the measurement of the concentration of a contaminant obtained by using a specified laboratory procedure calculated at a specified concentration above the detection level. It is considered the lowest concentration at which a particular contaminant can be quantitatively measured using a specified laboratory procedure for monitoring of the contaminant.

**Quarterly monitoring frequency** refers to a three month period, defined as January through March, April through June, July through September, and October through December. When required by this permit, an analytical result, reading, value or observation shall be reported for that period if a discharge occurs during that period.

**Regional Administrator** is the Region 5 Administrator, U.S. EPA, located at R-19J, 77 W. Jackson Blvd., Chicago, Illinois 60604.

**Regulated area** means the permittee's urbanized area, where urbanized area is defined as a place and its adjacent densely-populated territory that together have a minimum population of 50,000 people as defined by the United States Bureau of the Census and as determined by the latest available decennial census.

**Secondary containment structure** means a unit, other than the primary container, in which significant materials are packaged or held, which is required by State or Federal law to prevent the escape of significant materials by gravity into sewers, drains, or otherwise directly or indirectly into any sewer system or to the surface or ground waters of this state.

**Separate storm sewer system** means a system of drainage, including, but not limited to, roads, catch basins, curbs, gutters, parking lots, ditches, conduits, pumping devices, or man-made channels, which is not a combined sewer where storm water mixes with sanitary wastes, and is not part of a POTW.

**Significant industrial user** is a nondomestic user that: 1) is subject to Categorical Pretreatment Standards under 40 CFR 403.6 and 40 CFR Chapter I, Subchapter N; or 2) discharges an average of 25,000 gallons per day or more of process wastewater to a POTW (excluding sanitary, noncontact cooling and boiler blowdown wastewater); contributes a process waste stream which makes up five (5) percent or more of the average dry weather hydraulic or organic capacity of the POTW treatment plant; or is designated as such by the permittee as defined in 40 CFR 403.12(a) on the basis that the industrial user has a reasonable potential for adversely affecting the POTW's treatment plant operation or violating any pretreatment standard or requirement (in accordance with 40 CFR 403.8(f)(6)).

**PART II**

## Section A. Definitions

**Significant materials** Significant Materials means any material which could degrade or impair water quality, including but not limited to: raw materials; fuels; solvents, detergents, and plastic pellets; finished materials such as metallic products; hazardous substances designated under Section 101(14) of Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) (see 40 CFR 372.65); any chemical the facility is required to report pursuant to Section 313 of Emergency Planning and Community Right-to-Know Act (EPCRA); polluting materials as identified under the Part 5 Rules (R 324.2001 through R 324.2009 of the Michigan Administrative Code); Hazardous Wastes as defined in Part 111 of the NREPA; fertilizers; pesticides; and waste products such as ashes, slag, and sludge that have the potential to be released with storm water discharges.

**Significant spills and significant leaks** means any release of a polluting material reportable under the Part 5 Rules (R 324.2001 through R 324.2009 of the Michigan Administrative Code).

**Special-use area** means secondary containment structures required by state or federal law; lands on Michigan's List of Sites of Environmental Contamination pursuant to Part 201, Environmental Remediation, of the NREPA; and/or areas with other activities that may contribute pollutants to the storm water for which the Department determines monitoring is needed.

**Stoichiometric** means the quantity of a reagent calculated to be necessary and sufficient for a given chemical reaction.

**Storm water** means storm water runoff, snow melt runoff, surface runoff and drainage, and non-storm water included under the conditions of this permit.

**Storm water discharge point** is the location where the point source discharge of storm water is directed to surface waters of the state or to a separate storm sewer. It includes the location of all point source discharges where storm water exits the facility, including *outfalls* which discharge directly to surface waters of the state, and *points of discharge* which discharge directly into separate storm sewer systems.

**SWPPP** means the Storm Water Pollution Prevention Plan prepared in accordance with this permit.

**Tier I value** means a value for aquatic life, human health or wildlife calculated under R 323.1057 of the Water Quality Standards using a tier I toxicity database.

**Tier II value** means a value for aquatic life, human health or wildlife calculated under R 323.1057 of the Water Quality Standards using a tier II toxicity database.

**Total maximum daily loads (TMDLs)** are required by the Federal Act for waterbodies that do not meet water quality standards. TMDLs represent the maximum daily load of a pollutant that a waterbody can assimilate and meet water quality standards, and an allocation of that load among point sources, nonpoint sources, and a margin of safety.

**Toxicity reduction evaluation (TRE)** means a site-specific study conducted in a stepwise process designed to identify the causative agents of effluent toxicity, isolate the sources of toxicity, evaluate the effectiveness of toxicity control options, and then confirm the reduction in effluent toxicity.

**Water Quality Standards** means the Part 4 Water Quality Standards promulgated pursuant to Part 31 of the NREPA, being R 323.1041 through R 323.1117 of the Michigan Administrative Code.

**Weekly monitoring frequency** refers to a calendar week which begins on Sunday and ends on Saturday. When required by this permit, an analytical result, reading, value or observation shall be reported for that period if a discharge occurs during that period.

**WWSL** is a wastewater stabilization lagoon.

**WWSL discharge event** is a discrete occurrence during which effluent is discharged to the surface water up to 10 days of a consecutive 14 day period.

## PART II

# Section A. Definitions

**3-portion composite sample** is a sample consisting of three equal-volume grab samples collected at equal intervals over an 8-hour period.

**7-day concentration**
FOR WWSLs THAT COLLECT AND STORE WASTEWATER AND ARE AUTHORIZED TO DISCHARGE ONLY IN THE SPRING AND/OR FALL ON AN INTERMITTENT BASIS – The 7-day concentration is the sum of the daily concentrations determined during any 7 consecutive days of discharge during a WWSL discharge event divided by the number of daily concentrations determined. If the number of daily concentrations determined during the WWSL discharge event is less than 7 days, the number of actual daily concentrations determined shall be used for the calculation. The calculated 7-day concentration will be used to determine compliance with any maximum 7-day concentration limitations. When required by the permit, report the maximum calculated 7-day concentration for the WWSL discharge event in the "MAXIMUM" column under "QUALITY OR CONCENTRATION" on the DMR. If the WWSL discharge event was partially in each of two months, the value shall be reported on the DMR of the month in which the last day of discharge occurred.

FOR ALL OTHER DISCHARGES – The 7-day concentration is the sum of the daily concentrations determined during any 7 consecutive days in a reporting month divided by the number of daily concentrations determined. If the number of daily concentrations determined is less than 7, the actual number of daily concentrations determined shall be used for the calculation. The calculated 7-day concentration will be used to determine compliance with any maximum 7-day concentration limitations in the reporting month. When required by the permit, report the maximum calculated 7-day concentration for the month in the "MAXIMUM" column under "QUALITY OR CONCENTRATION" on the DMR. The first 7-day calculation shall be made on day 7 of the reporting month, and the last calculation shall be made on the last day of the reporting month.

**7-day loading**
FOR WWSLs THAT COLLECT AND STORE WASTEWATER AND ARE AUTHORIZED TO DISCHARGE ONLY IN THE SPRING AND/OR FALL ON AN INTERMITTENT BASIS – The 7-day loading is the sum of the daily loadings determined during any 7 consecutive days of discharge during a WWSL discharge event divided by the number of daily loadings determined. If the number of daily loadings determined during the WWSL discharge event is less than 7 days, the number of actual daily loadings determined shall be used for the calculation. The calculated 7-day loading will be used to determine compliance with any maximum 7-day loading limitations. When required by the permit, report the maximum calculated 7-day loading for the WWSL discharge event in the "MAXIMUM" column under "QUANTITY OR LOADING" on the DMR. If the WWSL discharge event was partially in each of two months, the value shall be reported on the DMR of the month in which the last day of discharge occurred.

FOR ALL OTHER DISCHARGES – The 7-day loading is the sum of the daily loadings determined during any 7 consecutive days in a reporting month divided by the number of daily loadings determined. If the number of daily loadings determined is less than 7, the actual number of daily loadings determined shall be used for the calculation. The calculated 7-day loading will be used to determine compliance with any maximum 7-day loading limitations in the reporting month. When required by the permit, report the maximum calculated 7-day loading for the month in the "MAXIMUM" column under "QUANTITY OR LOADING" on the DMR. The first 7-day calculation shall be made on day 7 of the reporting month, and the last calculation shall be made on the last day of the reporting month.

**24-hour composite sample** is a flow-proportioned composite sample consisting of hourly or more frequent portions that are taken over a 24-hour period. A time-proportioned composite sample may be used upon approval of the Department if the permittee demonstrates it is representative of the discharge.

PART II

# Section B. Monitoring Procedures

## 1. Representative Samples

Samples and measurements taken as required herein shall be representative of the volume and nature of the monitored discharge.

## 2. Test Procedures

Test procedures for the analysis of pollutants shall conform to regulations promulgated pursuant to Section 304(h) of the Federal Act (40 CFR Part 136 – Guidelines Establishing Test Procedures for the Analysis of Pollutants), unless specified otherwise in this permit. **Test procedures used shall be sufficiently sensitive to determine compliance with applicable effluent limitations**. Requests to use test procedures not promulgated under 40 CFR Part 136 for pollutant monitoring required by this permit shall be made in accordance with the Alternate Test Procedures regulations specified in 40 CFR 136.4. These requests shall be submitted to the Manager of the Permits Section, Water Resources Division, Michigan Department of Environmental Quality, P.O. Box 30458, Lansing, Michigan, 48909-7958. The permittee may use such procedures upon approval.

The permittee shall periodically calibrate and perform maintenance procedures on all analytical instrumentation at intervals to ensure accuracy of measurements. The calibration and maintenance shall be performed as part of the permittee's laboratory Quality Control/Quality Assurance program.

## 3. Instrumentation

The permittee shall periodically calibrate and perform maintenance procedures on all monitoring instrumentation at intervals to ensure accuracy of measurements.

## 4. Recording Results

For each measurement or sample taken pursuant to the requirements of this permit, the permittee shall record the following information: 1) the exact place, date, and time of measurement or sampling; 2) the person(s) who performed the measurement or sample collection; 3) the dates the analyses were performed; 4) the person(s) who performed the analyses; 5) the analytical techniques or methods used; 6) the date of and person responsible for equipment calibration; and 7) the results of all required analyses.

## 5. Records Retention

All records and information resulting from the monitoring activities required by this permit including all records of analyses performed and calibration and maintenance of instrumentation and recordings from continuous monitoring instrumentation shall be retained for a minimum of three (3) years, or longer if requested by the Regional Administrator or the Department.

**PART II**

# Section C. Reporting Requirements

## 1. Start-up Notification

If the permittee will not discharge during the first 60 days following the effective date of this permit, the permittee shall notify the Department within 14 days following the effective date of this permit, and then 60 days prior to the commencement of the discharge.

## 2. Submittal Requirements for Self-Monitoring Data

Part 31 of the NREPA (specifically Section 324.3110(7)); and R 323.2155(2) of Part 21, Wastewater Discharge Permits, promulgated under Part 31 of the NREPA, allow the Department to specify the forms to be utilized for reporting the required self-monitoring data. Unless instructed on the effluent limitations page to conduct "Retained Self-Monitoring," the permittee shall submit self-monitoring data via the Department's MiWaters system.

The permittee shall utilize the information provided on the MiWaters website, located at https://miwaters.deq.state.mi.us, to access and submit the electronic forms. Both monthly summary and daily data shall be submitted to the Department no later than the 20th day of the month following each month of the authorized discharge period(s). The permittee may be allowed to submit the electronic forms after this date if the Department has granted an extension to the submittal date.

## 3. Retained Self-Monitoring Requirements

If instructed on the effluent limits page (or otherwise authorized by the Department in accordance with the provisions of this permit) to conduct retained self-monitoring, the permittee shall maintain a year-to-date log of retained self-monitoring results and, upon request, provide such log for inspection to the staff of the Department. Retained self-monitoring results are public information and shall be promptly provided to the public upon request.

The permittee shall certify, in writing, to the Department, on or before January 10th (April 1st for animal feeding operation facilities) of each year, that: 1) all retained self-monitoring requirements have been complied with and a year-to-date log has been maintained; and 2) the application on which this permit is based still accurately describes the discharge. With this annual certification, the permittee shall submit a summary of the previous year's monitoring data. The summary shall include maximum values for samples to be reported as daily maximums and/or monthly maximums and minimum values for any daily minimum samples.

Retained self-monitoring may be denied to a permittee by notification in writing from the Department. In such cases, the permittee shall submit self-monitoring data in accordance with Part II.C.2., above. Such a denial may be rescinded by the Department upon written notification to the permittee. Reissuance or modification of this permit or reissuance or modification of an individual permittee's authorization to discharge shall not affect previous approval or denial for retained self-monitoring unless the Department provides notification in writing to the permittee.

## 4. Additional Monitoring by Permittee

If the permittee monitors any pollutant at the location(s) designated herein more frequently than required by this permit, using approved analytical methods as specified above, the results of such monitoring shall be included in the calculation and reporting of the values required in the Discharge Monitoring Report. Such increased frequency shall also be indicated.

Monitoring required pursuant to Part 41 of the NREPA or Rule 35 of the Mobile Home Park Commission Act (Act 96 of the Public Acts of 1987) for assurance of proper facility operation shall be submitted as required by the Departmen

**PART II**

# Section C. Reporting Requirements

## 5. Compliance Dates Notification

Within 14 days of every compliance date specified in this permit, the permittee shall submit a *written* notification to the Department indicating whether or not the particular requirement was accomplished. If the requirement was not accomplished, the notification shall include an explanation of the failure to accomplish the requirement, actions taken or planned by the permittee to correct the situation, and an estimate of when the requirement will be accomplished. If a written report is required to be submitted by a specified date and the permittee accomplishes this, a separate written notification is not required.

## 6. Noncompliance Notification

Compliance with all applicable requirements set forth in the Federal Act, Parts 31 and 41 of the NREPA, and related regulations and rules is required. All instances of noncompliance shall be reported as follows:

a. 24-Hour Reporting
Any noncompliance which may endanger health or the environment (including maximum and/or minimum daily concentration discharge limitation exceedances) shall be reported, verbally, within 24 hours from the time the permittee becomes aware of the noncompliance. A written submission shall also be provided within five (5) days.

b. Other Reporting
The permittee shall report, in writing, all other instances of noncompliance not described in a. above at the time monitoring reports are submitted; or, in the case of retained self-monitoring, within five (5) days from the time the permittee becomes aware of the noncompliance.

Written reporting shall include: 1) a description of the discharge and cause of noncompliance; and 2) the period of noncompliance, including exact dates and times, or, if not yet corrected, the anticipated time the noncompliance is expected to continue, and the steps taken to reduce, eliminate and prevent recurrence of the noncomplying discharge.

## 7. Spill Notification

The permittee shall immediately report any release of any polluting material which occurs to the surface waters or groundwaters of the state, unless the permittee has determined that the release is not in excess of the threshold reporting quantities specified in the Part 5 Rules (R 324.2001 through R 324.2009 of the Michigan Administrative Code), by calling the Department at the number indicated on the second page of this permit (or, if this is a general permit, on the COC); or, if the notice is provided after regular working hours, call the Department's 24-hour Pollution Emergency Alerting System telephone number, 1-800-292-4706 (calls from **out-of-state** dial 1-517-373-7660).

Within ten (10) days of the release, the permittee shall submit to the Department a full written explanation as to the cause of the release, the discovery of the release, response (clean-up and/or recovery) measures taken, and preventive measures taken or a schedule for completion of measures to be taken to prevent reoccurrence of similar releases.

**PART II**

## Section C. Reporting Requirements

## 8. Upset Noncompliance Notification

If a process "upset" (defined as an exceptional incident in which there is unintentional and temporary noncompliance with technology based permit effluent limitations because of factors beyond the reasonable control of the permittee) has occurred, the permittee who wishes to establish the affirmative defense of upset, shall notify the Department by telephone within 24 hours of becoming aware of such conditions; and within five (5) days, provide in writing, the following information:

a. that an upset occurred and that the permittee can identify the specific cause(s) of the upset;

b. that the permitted wastewater treatment facility was, at the time, being properly operated and maintained (note that an upset does not include noncompliance to the extent caused by operational error, improperly designed treatment facilities, inadequate treatment facilities, lack of preventive maintenance, or careless or improper operation); and

c. that the permittee has specified and taken action on all responsible steps to minimize or correct any adverse impact in the environment resulting from noncompliance with this permit.

No determination made during administrative review of claims that noncompliance was caused by upset, and before an action for noncompliance, is final administrative action subject to judicial review.

In any enforcement proceedings, the permittee, seeking to establish the occurrence of an upset, has the burden of proof.

## 9. Bypass Prohibition and Notification

a. Bypass Prohibition
Bypass is prohibited, and the Department may take an enforcement action, unless:

1) bypass was unavoidable to prevent loss of life, personal injury, or severe property damage;

2) there were no feasible alternatives to the bypass, such as the use of auxiliary treatment facilities, retention of untreated wastes, or maintenance during normal periods of equipment downtime. This condition is not satisfied if adequate backup equipment should have been installed in the exercise of reasonable engineering judgment to prevent a bypass; and

3) the permittee submitted notices as required under 9.b. or 9.c. below.

b. Notice of Anticipated Bypass
If the permittee knows in advance of the need for a bypass, it shall submit prior notice to the Department, if possible at least ten (10) days before the date of the bypass, and provide information about the anticipated bypass as required by the Department. The Department may approve an anticipated bypass, after considering its adverse effects, if it will meet the three (3) conditions listed in 9.a. above.

c. Notice of Unanticipated Bypass
The permittee shall submit notice to the Department of an unanticipated bypass by calling the Department at the number indicated on the second page of this permit (if the notice is provided after regular working hours, use the following number: 1-800-292-4706) as soon as possible, but no later than 24 hours from the time the permittee becomes aware of the circumstances.

**PART II**

## Section C. Reporting Requirements

d. Written Report of Bypass
A written submission shall be provided within five (5) working days of commencing any bypass to the Department, and at additional times as directed by the Department. The written submission shall contain a description of the bypass and its cause; the period of bypass, including exact dates and times, and if the bypass has not been corrected, the anticipated time it is expected to continue; steps taken or planned to reduce, eliminate, and prevent reoccurrence of the bypass; and other information as required by the Department.

e. Bypass Not Exceeding Limitations
The permittee may allow any bypass to occur which does not cause effluent limitations to be exceeded, but only if it also is for essential maintenance to ensure efficient operation. These bypasses are not subject to the provisions of 9.a., 9.b., 9.c., and 9.d., above. This provision does not relieve the permittee of any notification responsibilities under Part II.C.11. of this permit.

f. Definitions

1) Bypass means the intentional diversion of waste streams from any portion of a treatment facility.

2) Severe property damage means substantial physical damage to property, damage to the treatment facilities which causes them to become inoperable, or substantial and permanent loss of natural resources which can reasonably be expected to occur in the absence of a bypass. Severe property damage does not mean economic loss caused by delays in production.

## 10. Bioaccumulative Chemicals of Concern (BCC)

Consistent with the requirements of R 323.1098 and R 323.1215 of the Michigan Administrative Code, the permittee is prohibited from undertaking any action that would result in a lowering of water quality from an increased loading of a BCC unless an increased use request and antidegradation demonstration have been submitted and approved by the Department.

## 11. Notification of Changes in Discharge

The permittee shall notify the Department, in writing, as soon as possible but no later than 10 days of knowing, or having reason to believe, that any activity or change has occurred or will occur which would result in the discharge of: 1) detectable levels of chemicals on the current Michigan Critical Materials Register, priority pollutants or hazardous substances set forth in 40 CFR 122.21, Appendix D, or the Pollutants of Initial Focus in the Great Lakes Water Quality Initiative specified in 40 CFR 132.6, Table 6, which were not acknowledged in the application or listed in the application at less than detectable levels; 2) detectable levels of any other chemical not listed in the application or listed at less than detection, for which the application specifically requested information; or 3) any chemical at levels greater than five times the average level reported in the complete application (see the first page of this permit, for the date(s) the complete application was submitted). Any other monitoring results obtained as a requirement of this permit shall be reported in accordance with the compliance schedules.

**PART II**

## Section C. Reporting Requirements

### 12. Changes in Facility Operations

Any anticipated action or activity, including but not limited to facility expansion, production increases, or process modification, which will result in new or increased loadings of pollutants to the receiving waters must be reported to the Department by a) submission of an increased use request (application) and all information required under R 323.1098 (Antidegradation) of the Water Quality Standards or b) by notice if the following conditions are met: 1) the action or activity will not result in a change in the types of wastewater discharged or result in a greater quantity of wastewater than currently authorized by this permit; 2) the action or activity will not result in violations of the effluent limitations specified in this permit; 3) the action or activity is not prohibited by the requirements of Part II.C.10.; and 4) the action or activity will not require notification pursuant to Part II.C.11. Following such notice, the permit or, if applicable, the facility's COC may be modified according to applicable laws and rules to specify and limit any pollutant not previously limited.

### 13. Transfer of Ownership or Control

In the event of any change in control or ownership of facilities from which the authorized discharge emanates, the permittee shall submit to the Department 30 days prior to the actual transfer of ownership or control a written agreement between the current permittee and the new permittee containing: 1) the legal name and address of the new owner; 2) a specific date for the effective transfer of permit responsibility, coverage and liability; and 3) a certification of the continuity of or any changes in operations, wastewater discharge, or wastewater treatment.

If the new permittee is proposing changes in operations, wastewater discharge, or wastewater treatment, the Department may propose modification of this permit in accordance with applicable laws and rules.

### 14. Operations and Maintenance Manual

For wastewater treatment facilities that serve the public (and are thus subject to Part 41 of the NREPA), Section 4104 of Part 41 and associated Rule 2957 of the Michigan Administrative Code allow the Department to require an Operations and Maintenance (O&M) Manual from the facility. An up-to-date copy of the O&M Manual shall be kept at the facility and shall be provided to the Department upon request. The Department may review the O&M Manual in whole or in part at its discretion and require modifications to it if portions are determined to be inadequate.

At a minimum, the O&M Manual shall include the following information: permit standards; descriptions and operation information for all equipment; staffing information; laboratory requirements; record keeping requirements; a maintenance plan for equipment; an emergency operating plan; safety program information; and copies of all pertinent forms, as-built plans, and manufacturer's manuals.

Certification of the existence and accuracy of the O&M Manual shall be submitted to the Department at least sixty days prior to start-up of a new wastewater treatment facility. Recertification shall be submitted sixty days prior to start-up of any substantial improvements or modifications made to an existing wastewater treatment facility.

PART II

## Section C. Reporting Requirements

## 15. Signatory Requirements

All applications, reports, or information submitted to the Department in accordance with the conditions of this permit and that require a signature shall be signed and certified as described in the Federal Act and the NREPA.

The Federal Act provides that any person who knowingly makes any false statement, representation, or certification in any record or other document submitted or required to be maintained under this permit, including monitoring reports or reports of compliance or noncompliance, shall, upon conviction, be punished by a fine of not more than $10,000 per violation, or by imprisonment for not more than 6 months per violation, or by both.

The NREPA (Section 3115(2)) provides that a person who at the time of the violation knew or should have known that he or she discharged a substance contrary to this part, or contrary to a permit, COC, or order issued or rule promulgated under this part, or who intentionally makes a false statement, representation, or certification in an application for or form pertaining to a permit or COC or in a notice or report required by the terms and conditions of an issued permit or COC, or who intentionally renders inaccurate a monitoring device or record required to be maintained by the Department, is guilty of a felony and shall be fined not less than $2,500.00 or more than $25,000.00 for each violation. The court may impose an additional fine of not more than $25,000.00 for each day during which the unlawful discharge occurred. If the conviction is for a violation committed after a first conviction of the person under this subsection, the court shall impose a fine of not less than $25,000.00 per day and not more than $50,000.00 per day of violation. Upon conviction, in addition to a fine, the court in its discretion may sentence the defendant to imprisonment for not more than 2 years or impose probation upon a person for a violation of this part. With the exception of the issuance of criminal complaints, issuance of warrants, and the holding of an arraignment, the circuit court for the county in which the violation occurred has exclusive jurisdiction. However, the person shall not be subject to the penalties of this subsection if the discharge of the effluent is in conformance with and obedient to a rule, order, permit, or COC of the Department. In addition to a fine, the attorney general may file a civil suit in a court of competent jurisdiction to recover the full value of the injuries done to the natural resources of the state and the costs of surveillance and enforcement by the state resulting from the violation.

## 16. Electronic Reporting

Upon notice by the Department that electronic reporting tools are available for specific reports or notifications, the permittee shall submit electronically all such reports or notifications as required by this permit, on forms provided by the Department.

PART II

# Section D. Management Responsibilities

## 1. Duty to Comply

All discharges authorized herein shall be consistent with the terms and conditions of this permit. The discharge of any pollutant identified in this permit, more frequently than, or at a level in excess of, that authorized, shall constitute a violation of the permit.

It is the duty of the permittee to comply with all the terms and conditions of this permit. Any noncompliance with the Effluent Limitations, Special Conditions, or terms of this permit constitutes a violation of the NREPA and/or the Federal Act and constitutes grounds for enforcement action; for permit or Certificate of Coverage (COC) termination, revocation and reissuance, or modification; or denial of an application for permit or COC renewal.

It shall not be a defense for a permittee in an enforcement action that it would have been necessary to halt or reduce the permitted activity in order to maintain compliance with the conditions of this permit.

## 2. Operator Certification

The permittee shall have the waste treatment facilities under direct supervision of an operator certified at the appropriate level for the facility certification by the Department, as required by Sections 3110 and 4104 of the NREPA. Permittees authorized to discharge storm water shall have the storm water treatment and/or control measures under direct supervision of a storm water operator certified by the Department, as required by Section 3110 of the NREPA.

## 3. Facilities Operation

The permittee shall, at all times, properly operate and maintain all treatment or control facilities or systems installed or used by the permittee to achieve compliance with the terms and conditions of this permit. Proper operation and maintenance includes adequate laboratory controls and appropriate quality assurance procedures.

## 4. Power Failures

In order to maintain compliance with the effluent limitations of this permit and prevent unauthorized discharges, the permittee shall either:

a. provide an alternative power source sufficient to operate facilities utilized by the permittee to maintain compliance with the effluent limitations and conditions of this permit; or

b. upon the reduction, loss, or failure of one or more of the primary sources of power to facilities utilized by the permittee to maintain compliance with the effluent limitations and conditions of this permit, the permittee shall halt, reduce or otherwise control production and/or all discharge in order to maintain compliance with the effluent limitations and conditions of this permit.

## 5. Adverse Impact

The permittee shall take all reasonable steps to minimize or prevent any adverse impact to the surface waters or groundwaters of the state resulting from noncompliance with any effluent limitation specified in this permit including, but not limited to, such accelerated or additional monitoring as necessary to determine the nature and impact of the discharge in noncompliance.

PART II

## Section D. Management Responsibilities

### 6. Containment Facilities

The permittee shall provide facilities for containment of any accidental losses of polluting materials in accordance with the requirements of the Part 5 Rules (R 324.2001 through R 324.2009 of the Michigan Administrative Code). For a Publicly Owned Treatment Work (POTW), these facilities shall be approved under Part 41 of the NREPA.

### 7. Waste Treatment Residues

Residuals (i.e. solids, sludges, biosolids, filter backwash, scrubber water, ash, grit, or other pollutants or wastes) removed from or resulting from treatment or control of wastewaters, including those that are generated during treatment or left over after treatment or control has ceased, shall be disposed of in an environmentally compatible manner and according to applicable laws and rules. These laws may include, but are not limited to, the NREPA, Part 31 for protection of water resources, Part 55 for air pollution control, Part 111 for hazardous waste management, Part 115 for solid waste management, Part 121 for liquid industrial wastes, Part 301 for protection of inland lakes and streams, and Part 303 for wetlands protection. Such disposal shall not result in any unlawful pollution of the air, surface waters or groundwaters of the state.

### 8. Right of Entry

The permittee shall allow the Department, any agent appointed by the Department, or the Regional Administrator, upon the presentation of credentials and, for animal feeding operation facilities, following appropriate biosecurity protocols:

a. to enter upon the permittee's premises where an effluent source is located or any place in which records are required to be kept under the terms and conditions of this permit; and

b. at reasonable times to have access to and copy any records required to be kept under the terms and conditions of this permit; to inspect process facilities, treatment works, monitoring methods and equipment regulated or required under this permit; and to sample any discharge of pollutants.

### 9. Availability of Reports

Except for data determined to be confidential under Section 308 of the Federal Act and Rule 2128 (R 323.2128 of the Michigan Administrative Code), all reports prepared in accordance with the terms of this permit, shall be available for public inspection at the offices of the Department and the Regional Administrator. As required by the Federal Act, effluent data shall not be considered confidential. Knowingly making any false statement on any such report may result in the imposition of criminal penalties as provided for in Section 309 of the Federal Act and Sections 3112, 3115, 4106 and 4110 of the NREPA.

### 10. Duty to Provide Information

The permittee shall furnish to the Department, within a reasonable time, any information which the Department may request to determine whether cause exists for modifying, revoking and reissuing, or terminating this permit or the facility's COC, or to determine compliance with this permit. The permittee shall also furnish to the Department, upon request, copies of records required to be kept by this permit.

Where the permittee becomes aware that it failed to submit any relevant facts in a permit application, or submitted incorrect information in a permit application or in any report to the Department, it shall promptly submit such facts or information.

PART II

## Section E. Activities Not Authorized by This Permit

### 1. Discharge to the Groundwaters

This permit does not authorize any discharge to the groundwaters. Such discharge may be authorized by a groundwater discharge permit issued pursuant to the NREPA.

### 2. POTW Construction

This permit does not authorize or approve the construction or modification of any physical structures or facilities at a POTW. Approval for the construction or modification of any physical structures or facilities at a POTW shall be by permit issued under Part 41 of the NREPA.

### 3. Civil and Criminal Liability

Except as provided in permit conditions on "Bypass" (Part II.C.9. pursuant to 40 CFR 122.41(m)), nothing in this permit shall be construed to relieve the permittee from civil or criminal penalties for noncompliance, whether or not such noncompliance is due to factors beyond the permittee's control, such as accidents, equipment breakdowns, or labor disputes.

### 4. Oil and Hazardous Substance Liability

Nothing in this permit shall be construed to preclude the institution of any legal action or relieve the permittee from any responsibilities, liabilities, or penalties to which the permittee may be subject under Section 311 of the Federal Act except as are exempted by federal regulations.

### 5. State Laws

Nothing in this permit shall be construed to preclude the institution of any legal action or relieve the permittee from any responsibilities, liabilities, or penalties established pursuant to any applicable state law or regulation under authority preserved by Section 510 of the Federal Act.

### 6. Property Rights

The issuance of this permit does not convey any property rights in either real or personal property, or any exclusive privileges, nor does it authorize violation of any federal, state or local laws or regulations, nor does it obviate the necessity of obtaining such permits, including any other Department of Environmental Quality permits, or approvals from other units of government as may be required by law.

# APPENDIX D

2018 WWTP Feasibility Study

# Allendale Charter Township
# Wastewater Treatment Plant

## FEASIBILITY STUDY

## DRAFT

## PREPARED FOR:

Allendale
Charter Township est. 1849

## OTTAWA COUNTY, MICHIGAN

Date: February 2019
Project No.: 836130

FLEIS&VANDENBRINK
DESIGN. BUILD. OPERATE.

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# EXECUTIVE SUMMARY

This Feasibility Study was completed to address current issues and provide a long-term plan for sanitary sewer service in Allendale Charter Township (Township). The Project includes recommended upgrades to the Wastewater Treatment Plant (WWTP) and reflects the short-term and long-term needs of the community. The 20-year planning period for this report is from 2019 through 2039.

This report presents the results of the engineering and scientific evaluations performed to determine the need for the project, develop alternatives to remedy identified challenges, and to define the scope of the recommended alternatives. Background information on the existing system is also provided along with the rationale used to define alternatives capable of meeting the wastewater treatment needs of the community. The viable alternatives are compared and evaluated based on their financial and technical feasibility with regard to implementation.

The Allendale WWTP, which was upgraded in 1999 to a 1,600,000 gallon per day (GPD) Rotating Biological Contactor (RBC) plant, is quickly reaching its design capacity due to continued growth within the sewer district. The WWTP will need to increase capacity in order to ensure reliable service to its customers and meet demand for future growth within the sewer district. Nine alternatives were developed for expanding the capacity of the WWTP. Four principal alternatives were determined to meet the project objectives and serve the long-term needs (20-year planning period) of the Township.

Each principal alternative is designed to optimize the existing WWTP with continued use of the existing Headworks, primary clarifiers, secondary clarifiers, and anaerobic digestion system. Each alternative includes the construction of Headworks improvements, two additional primary clarifiers, a biological treatment system, two additional secondary clarifiers, a UV Disinfection System, an odor control system, Control Building improvements, a dewatering system for biosolids disposal and abandoning the existing sludge storage lagoons.

The major difference between each principal alternative is the method used for biological treatment. Alternative 1 utilizes an MBBR system and a Nitrification Tower for biological treatment. Alternative 2 utilizes an extended aeration process in a vertical loop reactor (VLR) configuration for biological treatment. Alternative 3 utilizes an extended aeration process in a race-track style oxidation ditch configuration for biological treatment. Alternative 4 utilizes an activated sludge process for biological treatment.

A detailed cost analysis has been performed for all four principal alternatives. Estimated project costs are presented in Table 1 below along with the net present worth for each alternative. The net present worth analysis includes Operation, Maintenance and Replacement (OM&R) costs for each alternative.

**Table 1. Cost Summary**

| Alternative | Project Cost | Net Present Worth |
|---|---|---|
| Alternative 1 - WWTP Expansion with MBBR and Nitrification Tower | $27,500,000 | **$63,680,000** |
| Alternative 2 - WWTP Expansion with Extended Aeration (VLR) | $27,300,000 | **$60,020,000** |
| Alternative 3 - WWTP Expansion with Extended Aeration (Oxidation Ditch) | $30,800,000 | **$63,120,000** |
| Alternative 4 - WWTP Expansion with Activated Sludge | $26,700,000 | **$61,560,000** |

Note: This table represents budgetary estimates for planning purposes. Further definition of the scope of the projects through preliminary and final design will provide details necessary to improve the accuracy of the costs.

The monetary evaluation revealed that Alternative 1, 2 and 4 have similar capital costs and net present worth values. Additional factors should be considered while selecting the preferred alternative, including the potential environmental impacts, the long-term reliability of the system, the ease of implementation, the overall public perception and the potential restrictions on future connected growth. Recommended next steps have been identified and should be completed prior to determining the selected alternative. Information acquired by completing the next steps should be used to project potential rate impacts to customers. Results of this analysis can be used to help select the desired course of action for improvements to the Allendale Township WWTP.

# I. INTRODUCTION

## A. Objectives

The purpose of the Feasibility Study is to evaluate alternative expansion options for the Allendale Charter Township (Township) Wastewater Treatment Plant (WWTP) to meet the long-term wastewater treatment needs of the service area. In order to accomplish this objective, historical influent data, effluent permit limits and Township population growth were reviewed to determine the magnitude of the expansion. An evaluation of the existing facility, projected flows and loadings, and future economic and environmental considerations have been used to identify the prioritized needs and improvements necessary at the WWTP. These results have been used to identify and analyze principal alternatives for the best long-term use of the WWTP.

The scope of this Feasibility Study includes a summary of the current condition of the WWTP, projections of population growth within the service area and the wastewater needs of the Township for the 20-year planning period. The Feasibility Study identifies four principal alternatives to meet the current and future wastewater needs and evaluates the financial and environmental impacts of these alternatives. Alternative 1, 2 and Alternative 4 are described in detail and further evaluated. A phased approach for the implementation of the alternatives is also presented.

## B. Project Background

The Allendale Charter Township WWTP is located at the eastern boundary of the Township, off of 40$^{th}$ Avenue. The WWTP operates under the jurisdiction of the Michigan Department of Environmental Quality (MDEQ) NPDES permit system. The WWTP is authorized to discharge under its NPDES Permit No. MI0057679 (see Appendix B). The permit expires on October 1, 2020.

The Township's WWTP accepts sanitary waste from the Township's sewer district, an area in the Township to the west of the sewer district and a small area of Georgetown Township south of Pierce Ave. The WWTP and collection system are operated by Township staff who work for the Public Utilities Department. The WWTP service area, WWTP location and lift station locations are shown in Figure A-1A and A-1B, in Appendix A.

The average flow to the plant from January 2013 through January 2018 was 1.08 MGD, with a maximum daily flow of 2.9 MGD. Seasonal flows fluctuate due to the Grand Valley State University (GVSU) contribution to the influent flow. In the 2017 Fall semester, flows averaged 1.27 MGD, almost 200,000 gallons per day higher than the five-year average. The WWTP discharges treated effluent to the Grand River in accordance with the NPDES Permit.

Refer to the SAW Asset Management Plan for additional plant details and history.

# II. DESIGN CRITERIA

## A. Development of Design Criteria

Design criteria were developed for the WWTP in order to evaluate the WWTP and understand the extent of the improvements required at the facility. The design criteria take into account possible increases in service area population through population projections. These projections are used to estimate future flows and loadings to the WWTP.

The design criteria were determined based on a 20-year planning period. For this study, the planning period is 2019 to 2039.

## B. Population Projections

The WWTP provides treatment and disposal for wastewater collected from the Township's sewer district as well as one area outside the Township. The sewer district currently has 2,113 residential, 143 school, 8 industrial, 798 commercial, 20 government, and 17 church connections according to Township records. This represents approximately 7,700 Resident Equivalent Units (REUs) as reported in the Wastewater Asset Management Plan. Based on the number of connections in the Township service area and the average household size from the United States Census Bureau's 2010 Census, the population served by the Township's sanitary sewer system was calculated to be approximately 15,000.

Projecting the Township's 20-Year Service Area population is difficult. The Township has averaged a growth rate of 3.89% since 1940. According to the 2013 Master Plan, the growth in the Township from 2000 to 2010 was largely due to the continued increase in student enrollment at Grand Valley State University and growth in student enrollment at GVSU is expected to increase at a lower rate between 0.5% and 1.5% in the future. According to GVSU Enrollment Reports, student enrollment increased at a rate of 0.29% from Fall 2010 to Fall 2017 and there was a decrease in enrollment between 2017 and 2018. Despite the limited growth at GVSU, the Township's population increased at an estimated annual rate of 3.34% from 2010 (20,708) to 2017 (26,059 est.) according to US Census Bureau data. Additionally, the Township has received inquiries about expanding the existing sewer district both inside and outside of the Township.

With continued growth in the Township, it is anticipated that the population within the sewer district will expand over the next 20 years. The projected population in the sewer district at the end of the 20-Year planning period would exceed 30,000 people at a 3.5% growth rate. The population at the end of the planning period represents approximately 60% of the sewer district's population projected at full buildout.

Figure 1 and Table 2 below illustrate the historic and projected Township population data. It is important to note that the entire Township population is not served by public utilities. Recently, the Township has required all new developments to connect to the water system. However, new developments outside of the existing Sewer District are not required to connect to the sanitary sewer system at this time.

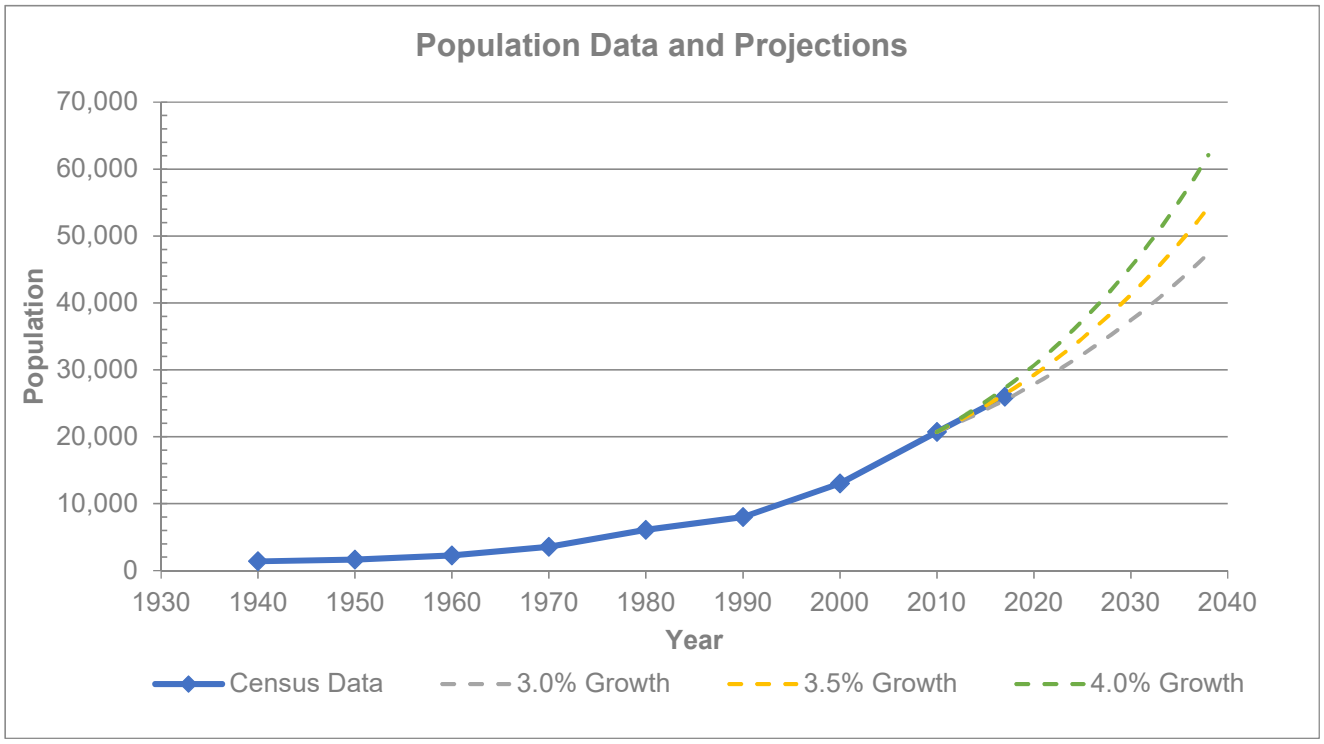



*Figure 1. Population Data and Projections*

**Table 2. Township Population and Projections**

| Date | Total Population | Sewer District Population | Service Area REUs |
|---|---|---|---|
| 2017 | 26,059[2] | 14,900[3] | 7,700[3] |
| Estimated 2039[1] | 55,545 | 31,800 | 16,400 |

1: Estimated using a 3.5% growth for the 20-year planning period.
2: Source: US Census Bureau
3: Source: Wastewater Asset Management Plan

# C. Wastewater Characteristics

### 1. Wastewater Volume

An analysis of wastewater flows from January 2013 through January 2018 indicated that the treatment plant received an annual average wastewater flow of 1.1 MGD and average 1.27 MGD while GVSU is in session. Daily flows ranged from 0.4 MGD to 2.9 MGD during the period of review.

The Township has recorded totalized annual flows since 1987. Over the 30-year period of tracking flow, the flow has increased by 4.29% per year. Historic annual flow amounts are shown in Figure 2.

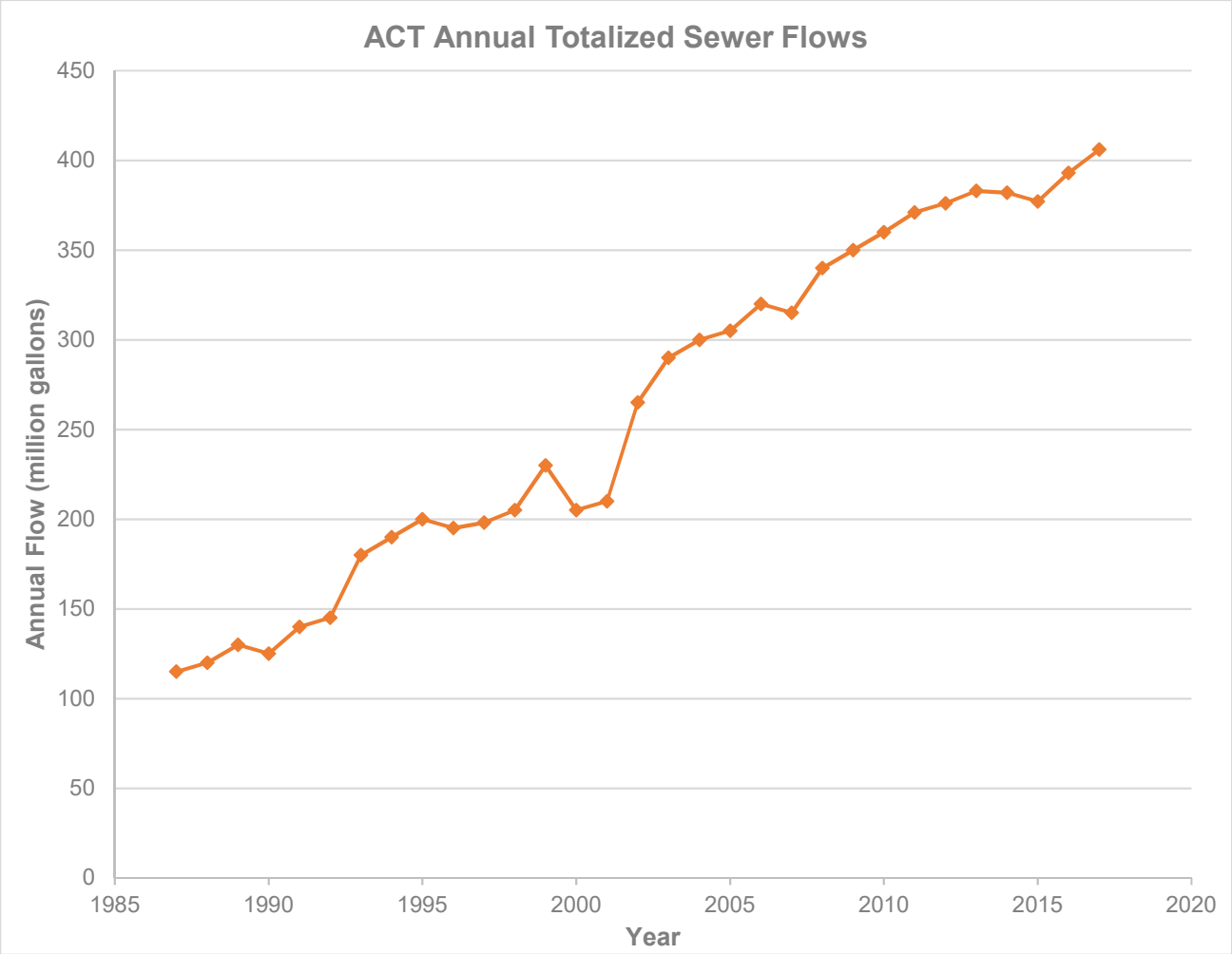



*Figure 2. Annual Totalized Sewer Flows*

Flow projections are based on available historical flow data and the equivalent population served by the WWTP. Wastewater in the Township is generated at a rate of approximately 165 gallons per day per REU (gpd/REU). This rate falls between the USEPA estimates for average daily wastewater flows of approximately 50 – 70 gallons per person per day or 150 – 210 gpd/REU (assuming three people per REU). Assuming wastewater is generated at the current rate during the planning period, the projected average daily influent flow is approximately 2.7 MGD at the end of the planning period as shown below in Table 3.

| Table 3. Township Wastewater Flow Rate and Projections | | | | |
|---|---|---|---|---|
| Date | Service Area REUs | Flow Rate Per REU, gpd/REU | Average Daily Flow, MGD | Design Average Daily Flow, MGD |
| 2017 | 7,700[3] | 165 | 1.27 | 1.6 |
| Projected 2039[1] | 16,400 | 165 | 2.7 | 3.2 |

1: Estimated using a 3.5% growth for the 20-year planning period.
2: Source: US Census Bureau
3: Source: Wastewater Asset Management Plan

## 2. Wastewater Quality

Influent sampling and population projections were used to project the flow rate and loading data used to evaluate WWTP alternatives. A summary of influent sampling results along with the Township Sewer Use Ordinance limits and design information (Appendix E) are presented in Table 4 below.

| Table 4. Influent Flow, Load and Concentrations | | | | | | | |
|---|---|---|---|---|---|---|---|
| Parameter | | Influent Sampling (Jan. 2013 – Jan. 2018) | | | | Sewer Use Ordinance Limits | 1999 Basis of Design |
| | | Average | % of Design | Maximum | 85th Percentile | | |
| Flow | (MGD) | 1.08 | 67% | 2.9 | 1.291 | - | 1.6 |
| BOD | Conc. (mg/L) | 272 | 109% | 735 | 321 | 780 | 250 |
| | Loading (lbs.) | 2477 | 74% | 6984 | 3282 | - | 3714 |
| TSS | Conc. (mg/L) | 261 | 130% | 1030 | 330 | 680 | 200 |
| | Loading (lbs.) | 2388 | 89% | 9909 | 3307 | - | 2972 |
| Phosphorus | Conc. (mg/L) | 6.6 | 110% | 15.6 | 8.0 | 10 | 6 |
| | Loading (lbs.) | 60.6 | 68% | 165 | 83 | - | 89 |
| VSS | Conc. (mg/L) | 241 | - | 540 | 310 | - | - |
| pH | (S.U.) | 7.5 | - | 8.5 | 7.6 | - | - |
| Temperature | (deg F) | 60.5 | - | 73 | 67 | - | - |

The anticipated growth in the Township is expected to be consistent with the current zoning, land use and future land use maps (Figure A3, Figure A4 in Appendix A). The projected growth is expected to significantly increase the total influent loading to the WWTP over the planning period. Table 5 outlines the projected loading estimates.

| Table 5. 2039 Design Criteria | | |
|---|---|---|
| | Concentration | Loading |
| | mg/L | lbs/day |
| $BOD_5$ | 300 | 8,012 |
| TSS | 300 | 8,012 |
| Phosphorus | 8.0 | 214 |
| $NH_3$-N | 41 | 1,095 |

*3.2 MGD used to calculate loading

Typical sanitary sewer systems experience a dilution of the influent concentration in wastewater during times of high flow. This trend has not been observed with monitoring that has been performed to date. Sampling should be performed during wet weather events to confirm wet weather loading requirements.

# III. Evaluation of Existing Treatment Systems

## A. General

The original WWTP was constructed in 1963. A Rotating Biological Contractor (RBC) process was added as part of the 1980 expansion. The 1999 expansion doubled the plant's capacity from 0.8 MGD to 1.6 MGD. The aerobic sludge storage tanks were converted into anaerobic digesters in 2012 to help reduce odors generated on site. Additional improvements and modifications have been made since the expansions including replacement of pumps, blowers, samplers, and other miscellaneous improvements.

The WWTP is designed to treat an annual average flow of 1.60 MGD. The daily average flow received by the plant ranged from 0.37 to 2.9 MGD between January 2013 and January 2018, with a total average influent for this time period of 1.08 MGD. The current hydraulic profile can be found in Figure A7 and a process schematic can be found in Figure A8, both in Appendix A.

After biological treatment and disinfection, final effluent is discharged to the Grand River. Currently the WWTP is effectively meeting permit limits. The MDEQ developed an Effluent Limits Only (ELO) report which provided potential limits for the WWTP expansion. This report can be found in Appendix C.

Refer to the SAW Asset Management Plan for additional detail on the condition assessment of the WWTP and Lift Stations.

## B. Existing (1999) RBC Basis of Design

The 1999 Basis of Design Summary and 2012 Basis of Design (Appendix D) provides information regarding the existing treatment plant capacity. Table 6 outlines the influent loading data used for the 1999 RBC project which was designed to treat an average day flow of 1.6 MGD and a peak hourly flow of 4.2 MGD.

**Table 6. 1999 Basis of Design**

| Parameter | Influent | | Effluent | |
|---|---|---|---|---|
| | mg/L | lbs/day | mg/L | lbs/day |
| $BOD_5$ | 250 | 3,338 | 15 | 200 |
| TSS | 200 | 2,670 | 15 | 200 |
| Ammonia (NH3-N) | 30 | 80 | | |
| Phosphorus | 6.0 | 400 | 0.8 | 10.3 |

## C. Influent Pressure Sewer, Preliminary Treatment and Flow Measurement

Wastewater flows by series of gravity sewer and lift stations in the collection system to the influent pressure sewers to the WWTP. The collection system consists of gravity sewer ranging in size from 6-inch to 24-inch as well as force mains ranging in size from 2-inch to 12-inch in diameter. The influent pressure sewers enter the Headworks Building on the north side. After entering the Headworks, flow is directed through a mechanical fine screen to remove non-organic material from the wastewater. After passing through the fine screen, flow enters the vortex grit chamber to removed heavy solids. Flow measurement and sampling is conducted downstream of the vortex grit chamber by a Parshall flume and an automatic sampler. Preliminary treatment acts to reduce inorganic material that may adversely affect downstream equipment.

### 1. Influent Pressure Sewer

The influent pressure sewer conveys all flow from the collection system to the treatment plant through a 14-inch and/or 20-inch ductile iron pipe. Since the WWTP is at a lower elevation than the majority of the Township, a pump station is not required to provide flow the treatment plant at this time. The combined capacity of the influent pressure sewers is approximately 6.0 mgd.

### 2. Screening and Conveying

Influent flow is typically routed through the existing mechanical screen to remove trash and debris from the wastewater. Originally, a macerating unit was located upstream of the mechanical screen separate organic material from the screenings for treatment downstream. The macerating unit has been taken out of service due to operational issues. The mechanical screen protects equipment downstream from damage and eliminates the material from being able to recombine in the primary clarifiers, RBC tanks, secondary clarifiers, anaerobic digesters and sludge storage lagoons. The screenings are conveyed from the screen through a horizontal conveyor to the dumpster.

Without influent equalization, the preliminary treatment equipment needs to be rated for peak hourly flow rate. The existing screen is rated at a peak hour flow of 5.2 MGD and will need to be replaced in order to handle the design peak hourly flow rate.

### 3. Grit Removal

Influent flow is routed through the vortex grit removal system following the screen. The grit removal system consists of a 10-foot diameter, 16.5-foot deep tank with an airlift pump to remove the grit slurry from the bottom of the sump. A paddle mixer is used to keep organics suspended while the grit and heavy particles are able to settle out. The airlift pump, powered by a 5-horsepower blower, is used to remove grit from the system. The slurry is pumped to the grit classifier where the grit is dewatered using an inclined auger system. The wastewater is drained off back into the system and the grit is conveyed into the dumpster.

Similar to the screening equipment, the grit removal system needs to be rated for the design peak hour flow rate. Grit removal should be upgraded to improve treatment, protect downstream equipment and handle increased flows.

### 4. Influent Flow Measurement & Sampling

A 12-inch Parshall flume nested in an 18-inch Parshall flume is used to measure plant influent flow. The flume was installed in 1999 and is located downstream of the grit tank, before the water flows into the effluent well. Since the Parshall flume is nested with an 18-inch flume, a minor modification is required to remove the 12-inch flume in order to use the 18-inch Parshall flume.

Influent flow is sampled for various wastewater parameters with a sampler located in the headworks building. This sampler is in good working condition, allows for an influent flow proportional sample to be collected and does not require improvements at this time.

## D. Primary Treatment

After the headworks building, wastewater is split between four primary clarifiers. The clarifiers are 12-feet wide, 58-feet long and vary between 13-feet deep at the influent end and 6-feet deep at the effluent end of the clarifier. Each clarifier has an approximate working volume of 45,000 gallons. Heavy organics are settled out and scum and grease float to the top. A chain and flight scraper mechanism conveys the sludge to the hopper and scum and grease to the scum skimmer. Sludge and scum are pumped directly to the digesters after collecting in the sludge hoppers and scum wells. The mechanism drive motors have been rebuilt over the years and the skimmer shoes have been adjusted due to wearing of the bottom plate.

Primary Clarifier No. 1 and No. 2 drives should be replaced in the near future. The other equipment and drives will need to be monitored and replaced as necessary. Additional Primary Clarifiers will be required to handle increased flows.

## E. Secondary Treatment

The secondary treatment process consists of four trains of two air driven Rotating Biological Contactors. The secondary treatment system acts to reduce BOD, ammonia, and phosphorus by means of microbial metabolism. A regulated supply of air promotes an aerobic environment and rotates the RBCs. RBCs do not require an air supply because of the submerged/unsubmerged nature of the technology. Allendale provides air to the system to allow the RBCs to rotate by capturing the air in the media and making one side more buoyant than the other eliminating the need of a drive motor for each media unit. The microorganisms utilize the organic matter from the wastewater and atmospheric oxygen provided by rotation of the media above the water surface for metabolism, growth and reproduction.

### 1. Rotating Biological Contactors (RBC)

The WWTP secondary treatment process is comprised of two 62-foot long by 28-foot wide rectangular RBC tanks. The tanks are sectioned into four different reactors to house 12-foot diameter high density or low-density RBC media. Each low density/high density system works together to provide treatment and can be isolated separately from the other RBC systems. The RBC system includes aeration diffusers to rotate the media and FRP covers to reduce algae growth.

The RBC utilizes fixed film media growth to remove nutrients in the water. Microbes living on the media are submerged into the water and uptake organics and nutrients, then they are exposed to air to allow the bacteria to oxidize the organics and degrade the nutrients. With the abundant organics and nutrients in the wastewater, the microbes flourish and reproduce rapidly. This creates an excess of bugs which can help remove additional material from the water.

The RBCs are staged with low density media first and then high-density media to reduce loading on the upstream shafts. Uneven or excessive microbial loading on the RBC media can cause the rotational shaft to become unbalanced and bend or break.

The media appears to be in good condition, but the condition of the shafts is largely unknown. Fatigue on the shafts can lead to failure but this has not been a major issue to date. The Township has two high density and two low-density shafts with media on site. The bearings and shafts have shown wear from consistent use. The Township has repaired the shafts and repaired or replaced the bearing as necessary in the past.

### 2. Aeration Blowers

There are three multi-stage centrifugal blowers at the WWTP which are used to provide aeration to the RBC system for rotation of the media. Blower No. 1 was replaced in 2013 and is operating well. Blower No. 2 and No. 3 are original blowers from the 1999 improvements project. Blower No. 2 and No. 3 should be replaced to reliably maintain adequate air supply to the RBC systems.

### 3. Secondary Clarifiers

There are two circular secondary clarifier tanks. Each tank is 55-feet in diameter with an approximate volume of 233,000 gallons with a 12-foot side water depth with the bottom sloping to a sump. The detention time at design flow (1.6 mgd) is approximately seven hours. Flow from the RBCs enters the secondary clarifiers through the center of the bottom of the tank and discharges through the center column into the flocculation area. The clarifier bottom scraper mechanism conveys secondary sludge to the center of the tank for removal by the sludge pumps in the basement of the clarifier building. The same mechanism is used to move scum on the surface of the tank to the scum trough for removal by the scum pumps. The scum can be pumped to the digester or sludge storage lagoons. Each clarifier has two mixers in the center well for incorporating chemical addition into the tanks for additional settling. The clarifiers have been operating well but the mechanisms should be sandblasted and painted, and the drives and the mixers should be replaced.

## F. Discharge Facilities

Following the secondary clarification process, effluent is routed through the chlorine contact manhole where the Township adds chlorine tablets to disinfect the final effluent. Water is then routed through the chlorine contact chamber and then to the dechlorination pond. The pond can be bypassed, and sodium bisulfite can be added to chemically remove the chlorine residual. The Township's normal operating procedure is to bypass the dechlorination pond.

### 1. Chlorine Feed System

Flow from the secondary clarifiers is routed through the chlorine feed manhole where the Township adds chlorine tablets. The tablet feed system uses a 2' x 2' x 2' steel mesh basket with 1-inch openings. The effluent passes through the basket slowly dissolving the tablets over the course of the day. The chlorine tablets are added on a daily basis and are stored in the nearby fiberglass storage building.

The Township has an alternate chlorine feed system which uses sodium hypochlorite totes and diaphragm metering pumps. The sodium hypochlorite is pumped to an injection quill located on the 24-inch pipe inside the sample manhole downstream of the sample tap.

### 2. Chlorine Contact Chamber

The chlorine contact chamber consists of the two former rectangular secondary clarifier tanks and the original baffled concrete contact tank. At the design flow of 1.6 mgd, the combined chamber provides approximately 1.7 hours of contact time. Each rectangular tank and baffled concrete section can be isolated for maintenance purposes. With increasing plant flows, the chlorine contact time will need to be increased by adding additional tanks. UV disinfection could be provided as an alternative to chlorine disinfection.

### 3. Dechlorination Pond

The dechlorination pond normally provides adequate detention time to allow the dissipation of chlorine residual from the final effluent prior to discharge. The pond has a volume of two million gallons at a surface area of 1.35 acres. The water depth across the pond is 7.5-feet. The detention time at average design flow of 1.6 mgd is 30

hours. The berm in the pond mitigates short-circuiting and the scum baffle at the outfall helps to minimize the amount of algae leaving the pond.

The Township has experienced nutrient resolubilization in the effluent and this is why the pond is no longer in service. This area could be repurposed, or the pond could remain to be available in the future for dechlorination.

#### 4. Effluent Control Structure

The effluent control structure discharges the treated effluent from the WWTP along with the effluent from the Leprino treatment system. At this point, the effluent is sampled and flows through the 21-inch outfall pipe to the Grand River.

## G. Solids Handling and Disposal

The sludge that is collected from the primary clarifiers is pumped directly to the anaerobic digesters. Sludge from the secondary clarifiers is pumped to the Headworks Building and co-settled with the primary sludge. Scum from the primary and secondary clarifiers is pumped directly to the sludge storage lagoons. Digested sludge is pumped to the sludge storage lagoons as well. Decant from the sludge storage lagoons flows through the supernatant pump station and is pumped back to the head of the plant.

#### 1. Anaerobic Digesters

Two 33-foot diameter digesters are used for high-rate anaerobic digestion. Each tank is 26.5-feet deep, with 3-feet of foam headspace allocation, corresponding to 23.5-feet of working depth providing 150,000 gallons of capacity in each tank. The digesters are used to produce biogas (65% methane; 35% $CO_2$) which can then be burned to provide heat back to the digesting sludge. Sludge is stabilized in the digestion process. The digesters are designed for an average incoming flow rate of 15,000 gpd which totals a solids retention time of 20 days. One digester has a fixed cover while the other digester has a gas holding cover that is able to move up and down depending on gas storage volume and pressure. The digesters are in good condition but there have been issues with the dual fuel boiler used to heat the digesters.

#### 2. Sludge Storage Lagoons

Two sludge storage lagoons are utilized to thicken and store biosolids. The township contracts with a biosolids management company to remove biosolids and land apply on local farmer's fields. The west sludge storage lagoon has a surface area of 3.0 acres and a depth of 6-feet. The total sludge storage volume in west lagoon is 5.2 million gallons. The east sludge storage lagoon has a surface area of 4.0 acres and a depth of 7-feet. The total sludge storage volume in east lagoon is 8.3 million gallons. The sludge storage lagoons are clay lined with no known issues, but valves and gates should be replaced. The Township has expressed interest in alternative sludge dewatering, storage and disposal methods.

#### 3. Supernatant Pump Station

The supernatant pump station is utilized to receive decant from the sludge storage lagoons and pump it back to the head of the plant. The pump station is also used to drain the primary clarifiers, RBC tanks, chlorine contact chamber, and digesters. All flows are pumped to the headworks effluent well. The pumps are 2-horsepower with a capacity of 150 gpm at 24-feet TDH.

## H. Chemical Feed System

### 1. Alum Feed System

The alum feed system consists of two 6,000-gallon storage tanks and two metering pumps. The alum tanks are located within the Control Building to prevent freezing. Alum is fed to the system at the effluent of the RBCs. This facilitates phosphorus removal and increased settling. The Township is currently using a poly-alum chloride solution which results in a cost of approximately $18,000 per month. The use of Ferric Chloride or another chemical should be considered to reduce operating costs and to allow outdoor storage, freeing up building space for other uses.

### 2. Polymer Feed System

The polymer feed system is currently not used by the WWTP operators but remains in place if it is needed. Polymer can be added to the secondary clarifiers and can improve the settleability of the floc and aids in phosphorus removal. The polymer feed system consists of a barrel lift and scale, and two injection and mixing stations. This system is located in the clarifier building. Two single-head, motor-driven diaphragm metering pumps are used to feed polymer to the clarifiers.

## I. Ancillary Equipment

### 1. Emergency Standby Generator

The Allendale WWTP currently has a pad mounted 250-kilowatt natural gas standby generator which was installed in 2014 to provide backup power to the facility. The generator appears to be in good working order and is scheduled to automatically exercise weekly. The capacity of the generator will need to be evaluated with the new equipment being installed.

### 2. Portable Generators

The WWTP has two trailer mounted portable generators. One generator is rated for 20 kilowatts and one is rated for 80 kilowatts. These are normally used for lift stations during power outages.

## J. Building Conditions

The treatment plant contains seven buildings, the Control Building, Headworks Building, Secondary Clarifier Building, Digester Pump Building, Boiler Building, Storage Building and the Garage.

### 1. Control Building

The Control Building was built in 1980 and contains office spaces, laboratory, chemical feed tanks and metering pumps, aeration blowers, electrical controls, primary sludge pumping system and storage for Township equipment and vehicles. Current issues include leaking roof, unbalanced HVAC, minimal training areas, and space constraints. The Township has expressed interest expanding this building and relocating the chemical feed system. The Township would like to have increased area for training opportunities and additional office space as well.

### 2. Headworks Building

The Headworks Building was constructed in 1999. Due to the hazardous and corrosive atmosphere the wastewater creates in this building, it is experiencing accelerated deterioration. The HVAC system should be replaced to maintain a safe atmosphere and the roof should be reconstructed to address leaks into the building.

### 3. Secondary Clarifier Building

The Secondary Clarifier Building was constructed in 1999. The basement of the Secondary Clarifier Building houses the secondary sludge and scum pumps which draw from of the secondary clarifiers. On the main floor, there is a polymer feed system which is currently not in use by the Township. This building does not contain a harsh atmosphere and is in good condition. The HVAC system is aging and should be replaced in the near future.

### 4. Digester Pump Building

The Digester Pump Building was originally constructed in 1980 and expanded in 2012 when the aerobic sludge storage tanks were converted to anaerobic digesters. This building houses the two sludge mixing pumps and the two sludge recirculation pumps. The heat exchangers and some hydronic pumps and piping are also located within this building. The roof was replaced during the building expansion in 2012.

### 5. Boiler Building

The Boiler Building was constructed in 2012 with the anerobic digester project. This building is utilized to house the duel-fuel boiler and additional hydronic pumps and piping. Since the building is only 6-years old, it is still in good condition and no modifications are necessary to the existing structure.

### 6. Storage Building

The Storage Building is the large garage located north of the main building. The metal roof on the building currently leaks during rain events. The Storage Building is used to store maintenance equipment and tools. The roof should be replaced in the near future.

### 7. Garage

The Garage is located to the east of the main building and stores additional equipment for the Township. This building was constructed in 1995 and the roof currently leaks. The roof should be replaced to address the leaks.

## K. Overall Plant Performance

Overall, the plant has performed well over the past 20 years since the expansion of the WWTP in 1999. Continued investment in the form of maintaining and replacing existing equipment and installing new, necessary equipment has helped to preserve the successful operation of the facility.

This system is approaching capacity both from a loading and a flow standpoint while GVSU is in session. An expansion of treatment capacity and improvements to the existing treatment processes are recommended in order to maintain operation of the existing facilities and to continue to reliably meet permit requirements.

# IV. ANALYSIS OF ALTERNATIVES

## A. Identification of Potential Alternatives

Alternatives to accomplish needed improvements to the Allendale Charter Township Wastewater Treatment Plant were developed and evaluated based on their ability to meet the scope of the project while remaining within financial, regulatory, and technical constraints.

Project objectives include:

1. Provide facilities capable of delivering consistent reliable service and continued compliance with regulatory and permit requirements.
2. Plan for future growth within the Township and corresponding treatment capacity.
3. Minimize operating costs through improved treatment methods.
4. Rehabilitate/repair high priority areas of existing wastewater infrastructure.
5. Minimize financial burden to the sewer system users.
6. Minimize environmental impact during construction of the improvements project.
7. Minimize environmental impact of WWTP operations and discharge.

The following four principal alternatives were developed to meet the project objectives for biological treatment:

1. Expansion with MBBR and Nitrification Tower
2. Expansion with Extended Aeration Vertical Loop Reactor (VLR)
3. Expansion with Extended Aeration (Oxidation Ditch)
4. Expansion with Activated Sludge

Five additional alternatives were analyzed. These alternatives were determined to not meet the project objectives:

5. No Action
6. Expansion with Rotating Biological Contactors (RBC)
7. Expansion with Sequencing Batch Reactors (SBR)
8. Expansion with Aqua Nereda
9. Expansion with Biotowers

The alternatives are described in detail in the following subsections. Each alternative was initially screened based on effectiveness, implementability, and financial requirements. Feasible alternatives were then subjected to a comprehensive evaluation with attention to detailed economic, technical, environmental, and public concerns. A proposed site plan for each principal alternative is included in Appendix H.

Financial analysis of the alternatives followed a net present worth methodology. Capital, operation, maintenance and replacement costs were analyzed over the design period. Salvage values were determined separately and discounted back to present value. Consideration of all of these costs for the principal alternatives provides a basis for determining the net present worth of the project.

## B. Wastewater Treatment Plant Expansion

Each principal alternative is designed to optimize the existing WWTP with continued use of the existing Headworks, primary clarifiers, secondary clarifiers, and anaerobic digestion system. Each alternative includes the construction of Headworks improvements, two additional primary clarifiers, a biological treatment system, two additional secondary clarifiers, a UV Disinfection System, an odor control system, Control Building improvements, a dewatering system for biosolids disposal and abandoning the existing sludge storage lagoons. A Preliminary Basis of Design for these improvements is included in Appendix E. In order to provide for the new WWTP capacity, the following improvements are necessary for each alternative:

### 1. Headworks

The existing mechanical fine screen and grit equipment is not capable of handling the future peak flow rate. The existing mechanical fine screen will be relocated to the bypass channel and a new mechanical fine screen will be installed to handle the peak flow rates. A washer compactor will be installed to collect, wash, compact and dewater the screenings. The washer compactor will reduce the volume and odor by washing organic matter off the screenings. The organic material will be returned to the wastewater, providing energy for the anaerobic digestion process. The existing 10-foot diameter vortex grit tank will be retrofitted with a new mechanism and grit removal pump to handle the additional grit load. The grit slurry will be sent to a new dewatering classifier to remove organics and dewater the slurry.

The influent flow is currently measured by a 12-inch Parshall flume nested in an 18-inch Parshall flume. Influent wastewater passes through a contraction in both walls in the flume and flow is determined by measuring the depth of the water upstream of the flume. At future flow rates, the 12-inch Parshall flume will increase the depth of the water upstream to a level higher than recommended. The nested 12-inch Parshall flume will be removed and the 18-inch Parshall flume will be used to measure influent flow.

In addition, improvements to the Headworks Building will include replacing the existing roof, doors, electrical and control panels.

### 2. Primary Clarifiers

There are four existing primary clarifiers. To meet future flow rates, a minimum of two additional primary clarifiers will be constructed. The new clarifiers will be the same size and use the same type of sludge collector as the existing clarifiers. The drives on the existing clarifiers will also be replaced.

### 3. Secondary Clarifiers

There are two existing Secondary Clarifiers. Two additional secondary clarifiers will be constructed matching the existing clarifiers. The existing clarifier mechanisms will be sandblasted and painted. The launders will be covered with fiberglass covers. The fiberglass covers prevent algae growth on the clarifier weirs and launders. Removing algae growth from the clarifiers requires an operator to manually scrub and wash the weirs. This is a difficult, time consuming and potentially dangerous task. The resulting solids loading to the chlorine contact chambers causes additional operational challenges.

### 4. Disinfection System

Disinfection is currently performed using chlorine tablets. While the chlorine tablet system has performed well, when additional chlorine is required, the tablets do not dissolve fast enough to meet the additional chlorine demand.

A UV Disinfection System will be constructed to replace the chlorine tablet system. The existing Chlorine Contact Tank will be modified to create channels for the UV Disinfection System and a building will be

constructed over the channels to protect the system from the elements and improve the ability to monitor and maintain the disinfection system.

**5. Chemical Feed System**

The WWTP currently feeds polyaluminum chloride to precipitate phosphorus ahead of the Secondary Clarifiers. The cost of polyaluminum chloride has increased greatly over the years and it is no longer cost effective to utilize for phosphorus removal.

A ferric chloride feed system is proposed to replace the polyaluminum chloride feed system. Off-gas from ferric chloride is corrosive and should be isolated from non-corrosion resistant electrical and plumbing. The existing polyaluminum chloride storage tanks and metering pumps are located in the Control Building in an open area that is not suitable for ferric chloride long term. A new containment structure and building for the ferric chloride storage tank and metering pump equipment will be constructed.

**6. Secondary Sludge Thickening**

Sludge from the secondary clarifiers is currently pumped to the Headworks Building and co-settled with the primary sludge. The co-settled sludge is pumped to the anaerobic digesters for stabilization. Co-settling the secondary sludge with heavier primary sludge increases the density and reduces the total amount of liquid pumped to the anaerobic digesters. Reducing the volume of cooler sludge entering the digester saves energy by reducing the heat load.

One issue with continuing the practice of co-settling is that all of the secondary sludge may not be removed in the primary clarifiers. This does not create issues with the current treatment process as the biomass required for treatment is fixed on the RBCs. However, one of the most important controls available for an operator with activated sludge processes is secondary sludge wasting to control the biomass population. If wasted secondary sludge is not removed in the primary clarifiers, the sludge age will increase and cause operational problems in the biological treatment process. More efficient operation is achieved if the secondary sludge is thickened to reduce liquid volume and pumped directly to the anaerobic digesters.

A mechanical thickener is proposed to be installed in an addition to the existing Digester Pump Building. The mechanical thickener system will include a thickener, polymer feed system and thickened sludge pumps to discharge sludge directly to the digesters.

Different types of sludge thickeners are available including gravity belt thickener, rotating drum thickener, and volute thickener. Pilot testing should be performed to determine thickening performance, operating costs, and polymer requirements prior to selecting the type of thickener to install. The cost estimate prepared for this report is based on a volute thickener. A brief description of each type of thickener and advantages/disadvantages are listed below.

<u>Gravity Belt Thickener</u>

A gravity belt thickener uses gravity drainage through a filter belt to thicken sludge. Dilute sludge is fed down a sloping inlet ramp with guide vanes and baffles to disperse the solids across the belt. As the sludge makes its way down the moving belt, liquid drains through the porous belt. Solids remaining on the belt are scrapped off and deposited in a hopper to be pumped to the digesters. After solids are removed, the belt is cleaned by high-pressure water.

Advantages of a gravity belt thickener include:

- Proven, simple, well know technology

Disadvantages of a gravity belt thickener include:

- Higher polymer costs
- Open system which can lead to odors and wet operating environment
- High wash water requirement
- Large footprint

Rotating Drum Thickener

A rotating drum thickener uses gravity drainage similar to a gravity belt thickener. Instead of a belt, a rotating horizontal cylinder screen is used to thicken sludge. Sludge is fed internally and distributed across the drum. As the drum rotates, the sludge cascades across the cylinder screen and water drains through the screen. A spiral flight within the drum moves the sludge along the length of the drum. Solids discharge at the end of the drum into a hopper. The drum is cleaned by spray wash system located near the top of the drum.

Advantages of a rotating drum thickener include:

- Closed system, reducing potential for odors
- Smaller footprint than gravity belt filter
- Lower overall capital cost

Disadvantages of a rotating drum thickener include:

- High wash water requirement

Volute Thickener

A volute thickener utilizes a series of fixed rings that are held together on tie rods and separated by spacers to form a cylinder around an Archimedean screw. Between each fixed ring is a moving ring which is slightly narrower than the spacers to create a fine gap between the moving and fixed rings. Liquid from the sludge drains through the fine gap between the rings. As the screw rotates, it pushes the moving rings which prevents solids from plugging the fine gaps between the rings. Solids are conveyed along the length of the drum by the screw and discharged at the opposite end.

Advantages of a volute thickener include:

- Closed system, reducing potential for odors
- Smaller footprint than gravity belt filter
- Low maintenance requirements
- No wash water required during normal operation
- Multiple cylinders can be provided in one unit, allowing for redundancy or future expansion

Disadvantages of a volute thickener include:

- Higher capital cost

### 7. Biosolids Dewatering System

The WWTP currently pumps biosolids from the anaerobic digesters to two biosolids storage lagoons. The Township contracts with a biosolids hauler to remove biosolids from the lagoons every three to four years on average. The cost for disposal has increased in recent years and land available to apply biosolids in the area has reduced over time. In addition, WWTP Superintendents from across Ottawa County have recently begun discussions of a county-wide biosolids disposal facility, which may include drying or incinerating biosolids to

reduce disposal costs. If a regional facility is constructed, dewatered biosolids would need to be hauled to the facility location in roll off dumpsters or a dump truck.

A dewatering system is proposed, along with abandoning the use of the biosolids storage lagoons and liquid handling. The dewatering system is proposed to include a new Dewatering Building, biosolids feed tank, feed pumps, two dewatering presses, and conveyors to discharge biosolids into dumpsters or a dump truck. Biosolids from the anaerobic digesters will be pumped to the biosolids feed tank for temporary storage. The dewatering equipment will be sized to dewater the biosolids while operating for six hours a day, five days per week. The biosolids feed tank will be sized to hold approximately four days of biosolids to allow for the dewatering press to remain idle over the weekend.

Many different types of dewatering presses are available to dewater biosolids including belt filter presses, centrifuges, screw presses, volute dewatering press, and rotary fan presses. While each type of press claims similar dewatering performance (16%-25% solids), actual performance and operating costs can vary depending on the specific type of biosolids fed to the press. Solids capture in the press and the resulting impact of the side stream flows on the WWTP is a key consideration in selecting the best technology. Pilot testing should be performed to determine dewatering performance, operating costs, and polymer requirements prior to selecting the type of dewatering press to install. The cost estimate prepared for this report is includes the cost to provide on volute dewatering press. A brief description of each type of press and advantages/disadvantages are listed below.

Belt Filter Press:

A belt filter press includes three primary zones. The first zone is a gravity zone where free draining water is drained by gravity through a porous belt. The second zone is the wedge zone where the biosolids are sandwiched between two tensioned belts and low pressure is applied. The third zone is the pressure zone where high pressure and shear are applied to the biosolids by the belts passing through a serpentine path of decreasing diameter rolls.

Advantages of a belt filter press include:

- Capable of dewatering dilute sludge where suspended solids are less than 1.5%
- Lower capital cost
- Low operating speed
- Low power use
- Low polymer use
- High solids capture efficiency

Disadvantages of a belt filter press include:

- High wash water use
- Open frame increases the potential of odors
- High operator oversite required

Centrifuge:

A centrifuge uses the force from high speed rotation of a cylindrical bowl to separate solids from liquid. Sludge enters the bowl through a stationary inlet tube and is accelerated by an inlet distributor. The centrifugal force that results from the rotation causes the solids to settle on the wall of the bowl, separating the liquid from the solids. A conveyor rotates in the same direction as the bowl at a slightly slower speed, moving the solids to the end of the conical bowl. Liquid is discharged at the opposite end of the conical bowl.

Advantages of a centrifuge include:

- High percentage of cake solids
- Low operator oversight
- Low wash water consumption
- Low sensitivity to different sludges
- Minimal space requirements

Disadvantages of a centrifuge include:

- Highest power consumption
- High polymer consumption
- High operating speed
- High noise levels when operating
- High potential for odor
- Difficult maintenance due to high speed operation

Screw Press:

A screw press consists of a conical shaft screw surrounded by a cylindrical screen. At the beginning of the screw press, the shaft of the screw is narrow. As the biosolids progress through the press, the shaft increases in size, reducing the volume between the shaft and the screen. This presses the sludge against the inner cylindrical screen surface, forcing liquid from the biosolids. A pneumatic cone at the press discharge increases pressure on the biosolids.

Advantages of a screw press include:

- Low operating speed
- Low power consumption
- Low noise levels during operation
- Low operator oversight
- Low wash water consumption

Disadvantages of a screw press include:

- Sensitive to different sludges, does not perform as well on dilute sludges
- High capital cost

Volute Dewatering Press:

A volute dewatering press operates similar to the volute thickener. The volute dewatering press utilizes a series of fixed rings that are held together on tie rods and separated by spacers to form a cylinder around an Archimedean screw. Between each fixed ring is a moving ring which is slightly narrower than the spacers to create a fine gap between the moving and fixed rings. Liquid from the biosolids drains through the fine gap between the rings. As the screw rotates, it pushes the moving rings which prevents solids from plugging the fine gaps. Solids are conveyed along the length of the drum by the screw and discharged at the opposite end. Unlike the volute thickener, wash water is required to spray the outside of the fixed rings to prevent plugging.

Advantages of a volute dewatering press include the following:

- Capable of dewatering dilute sludge where suspended solids are less than 1.5%
- Low operating speed
- Low power consumption
- Low noise levels during operation
- Low operator oversight

- Low wash water consumption
- Multiple cylinders can be provided in one unit, allowing for redundancy or future expansion

Disadvantages of a volute dewatering press include the following:

- High capital cost

Rotary Fan Press:

A rotary fan press uses two rotating filter screens to dewater biosolids. Biosolids enter a channel in the annular space between the two screens at a low pressure. A pressure differential is developed within the press as the biosolids move slowly through a tapered channel. An adjustable restrictor gate arm is used to increase pressure and form a cake plug. As the pressure increases, liquid drains through the two filter screens.

Advantages of a rotary fan press include the following:

- Low power use
- Low space requirements
- Low operator oversight

Disadvantages of a rotary fan press include the following:

- Sensitive to different types of biosolids
- High polymer consumption
- Limited throughput capacity

**8. Odor Control System**

The WWTP does not currently have an odor control system to treat odors generated from the Headworks Building and Primary Clarifier Tanks.

A biofilter is proposed to be constructed in the existing RBC tanks. Retractable covers would be added over the primary clarifiers to contain odors emitting from the clarifiers. Ductwork and a blower would be used to draw foul air from the Headworks Building and the primary clarifiers. The biofilter consists of wood chip media and a drip irrigation system to maintain the moisture and nutrient level in the biofilter. The foul air is delivered to the bottom of the biofilter and flows up through the organic media containing the treatment organisms.

**9. Control Building Expansion**

The existing Control Building is limited in space for Operation and Maintenance personnel. An addition will be added onto the existing building to provide a new lab and additional office space. The existing locker room will be expanded, and the existing lab will be renovated into office space. Additional improvements will include replacement of the existing roof, boiler, electrical equipment, lighting, conversion of the existing chemical feed area to a training room and other miscellaneous improvements.

## C. Alternatives for Biological Treatment

Nine alternatives were developed for biological treatment. The alternatives are described in the following sections.

**Alternative 1 – Expansion with MBBR and Nitrification Tower**

Alternative 1 is designed to replace the secondary treatment process (the existing RBCs) with a Moving Bed Biological Reactors (MBBR) system and a Nitrification Tower.

An MBBR system operates similar to the existing RBCs where the biomass that treats the wastewater is attached to surfaces of media with no returned sludge and little suspended biomass. Unlike the RBCs, where the media consists of a larger disc attached to a shaft rotating in and out of the water, the media is smaller high surface area media shapes designed to provide a home for the biomass to live on. Aeration and mixing are provided by medium bubble aeration diffusers and blowers.

A nitrification tower consists of blocks of media stacked inside of a bolted steel tank. The Nitrification Tower operates similar to the RBCs and MBBR where biomass required for nitrification grows on the surfaces of media. Effluent from the MBBR would be pumped to the top of the tower and distributed evenly across the top of the media using a rotating distribution mechanism. The wastewater trickles down through the media to the bottom of the tank. Treated effluent can be recirculated to increase treatment efficiency and maintain a minimum hydraulic loading rate during low flow periods. Additional oxygen to support higher biomass growth on the media may be added using ventilation fans.

This alternative is designed to replace the secondary treatment process with an MBBR to treat CBOD5 and a nitrification tower to treat ammonia (NH3-N) by converting ammonia to nitrate (NO3-) in the effluent. Phosphorus would require chemical precipitation to meet permit limits for this alternative.

**Alternative 2 – Expansion with Extended Aeration (VLR)**

Alternative 2 is designed to replace the secondary treatment process (the existing RBCs) with an Oxidation Ditch in a vertical loop configuration. An Oxidation Ditch is a modified activated sludge biological treatment process that utilizes brush, disk or vertical aerators and long solids retention times (SRT) to treat wastewater. The Vertical Loop Reactor (VLR) system consists of an anaerobic tank followed by three reactors operating in series. Each reactor has a horizontal baffle in the middle of the reactor to direct flow in a vertical loop in the tank (under and over the baffle). Two horizontal disc aerators would be provided in each reactor to add oxygen required for treatment, create a uniform flow pattern and maintain a velocity in the channel to prevent solids from settling in the tank.

The VLR system is designed to provide biological nutrient removal (BNR). The BNR process is designed to remove $CBOD_5$, ammonia (NH3-N), total nitrogen, and phosphorus below permit limits without the addition of chemicals.

**Alternative 3 – Expansion with Extended Aeration (Oxidation Ditch)**

Alternative 3 is designed to replace the secondary treatment process (existing RBCs) with an Oxidation Ditch in a horizontal or race-track configuration. The Oxidation Ditch system includes two process trains with each train consisting of two anaerobic zones, one anoxic zone and one aerobic zone. Each anaerobic zone and the anoxic zone are equipped with mixers to mix the contents of the tank and keep solids in suspension. The aerobic zone consists of an oval shaped channel equipped with a vertical aerator at each end to add oxygen required for treatment, create a uniform flow pattern and maintain velocity in the channel to keep solids in suspension.

Due to the limited hydraulic grade distance required by the influent gravity sewer and 100-year floodplain, a low lift pump station will be required to pump the flow from the discharge of the primary clarifiers to the influent of the Oxidation Ditch system.

The Oxidation Ditch system is designed to provide biological nutrient removal (BNR). The BNR process is designed to remove CBOD5, ammonia (NH3-N), total nitrogen, and phosphorus below permit limits without the addition of chemicals.

**Alternative 4 – Expansion with Activated Sludge**

Alternative 4 is designed to replace the secondary treatment process (existing RBCs) with a plug flow activated sludge process. This alternative is designed to be able to use a conventional activated sludge process or an anaerobic / anoxic / oxic (A2/O) process. In a conventional activated sludge process, primary effluent is mixed with return activated sludge (RAS) before entering the front end of an aeration tank (aerobic zone). Diffused air is added to the tank to mix the contents of the tank and provide the oxygen required for treatment. In the A2/O process, primary effluent is mixed with RAS without the addition of oxygen to create an anaerobic zone. Following the anaerobic zone, a nitrate ($NO_2$) rich mixed liquor recycle is introduced from the end of the aerobic zone to facilitate uptake of the "canned" oxygen on the nitrate molecule. This process is called denitrification and causes the nitrogen to be released to the atmosphere as nitrogen gas. Mixers would be provided in the anaerobic and denitrification (anoxic) zones to prevent solids from settling. After the anoxic zone, the mixed liquor would enter an aerobic zone where diffused air is added to mix the contents of the tank and provide oxygen required for complete treatment. The denitrification process saves energy since some of the oxygen required for treatment is recovered from the nitrate molecule.

The conventional activated sludge process is designed to remove $CBOD_5$ to meet the current permit limits and ammonia (NH3-N). The A2/O process is designed to provide BNR and remove phosphorus below permit limits without the addition of chemicals.

**Alternative 5 – No Action**

Alternative 5 includes continuing to use and maintain the existing WWTP at the current rated capacity. The existing WWTP is currently approaching its design flow and loading capacities and will not be able to continue to meet permit limits over time. New construction within the sewer district would need to be limited in order to maintain long term compliance with permit limits. This alternative does not address the project objectives. No further analysis is presented on Alternative 5.

**Alternative 6 – Expansion with Rotating Biological Contactors**

Alternative 6 is designed to reuse the existing air driven RBCs and add new mechanically driven, air assist RBCs to meet the design flow and loading. Due to the increase in loading received at the WWTP, three new trains consisting of four RBCs would need to be constructed to bring the total number of shafts in operation at twenty. If an ammonia limit is added to the NPDES permit in the future, a total of 48 shafts would need to be put into operation.

After an initial review of tank sizing, equipment cost and operational requirements, it was determined that this alternative does not meet the project objectives as well as Alternatives 1 – 4. This is due to the high capital cost and large footprint required for the treatment system. No further analysis is presented on Alternative 6.

**Alternative 7 – Expansion with Sequencing Batch Reactor (SBR)**

Alternative 7 is designed to replace the secondary treatment process with an SBR system. An SBR system is a batch process consisting of five steps in a single tank or reactor that operates based on a time-managed sequence. The first step is "mix-fill" in which influent flow enters the reactor and is mixed without the addition of air. The second step is "react-fill" in which the influent flow continues to enter the reactor under mixed and aerated conditions. The third step is "react" in which the influent flow is terminated and mixing/aeration continue. The fourth step is "settle" in which mixing and aeration are terminated and solids settle to the bottom of the reactor. The fifth step is "decant/sludge waste" in which a decanter removes the liquid from on

top of the settled sludge blanket and is sent to the disinfection system. At the end of the fifth step, sludge would be wasted to the biosolids handling system.

After an initial review of tank sizing, equipment cost and operational requirements, it was determined that this alternative does not meet the project objectives as well as Alternatives 1 – 4. This is due to the higher capital costs, large footprint and increased operational requirements. No further analysis is presented on Alternative 8.

**Alternative 8 – Expansion with Aqua Nereda**

Alternative 8 is designed to replace the secondary treatment process with an Aqua Nereda system. The Aqua Nereda system is a patented system that is similar to an SBR. The process is a time-managed batch process that, unlike an SBR, only includes three steps and has no moving parts in the tank. The first step is "fill/draw" in which influent flow enters the bottom of the reactor and treated water is displaced over effluent weirs located on top of the reactor. The second step is "react" in which influent flow is terminated and the biomass is subjected to aerobic and anoxic conditions for treatment. The third step is "settle" in which the biomass is separated from the treated water and excess sludge is wasted. The Aqua Nereda process requires smaller footprint and energy savings compared to the SBR system.

After an initial review of tank sizing, equipment cost and operational requirements, it was determined that this alternative does not meet the project objectives as well as Alternatives 1 – 4. The Aqua Nereda system has a higher capital cost, limited installations in the US and has not been permitted in the state. No further analysis is presented on Alternative 8.

**Alternative 9 – Expansion with Biotowers**

Alternative 9 is designed to replace the secondary treatment process with a Biotower treatment system. The Biotower system operates similar to the Nitrification Tower described in Alternative 1. However, instead of using an MBBR system to remove $CBOD_5$, two biotowers would be used to treat $CBOD_5$ and a Nitrification Tower would be used to treat ammonia.

After an initial review tank sizing, equipment cost and operational requirements, it was determined that this alternative does not meet the project objectives as well as Alternatives 1 – 4. This is due to the high capital cost of the equipment required for $CBOD_5$ removal and required footprint. No further analysis is presented on Alternative 9.

## D. Analysis of Principal Alternatives

All four of the principal alternatives meet the project objectives. These alternatives were analyzed further as summarized in the following sections.

### 1. Monetary Evaluation

The monetary evaluation includes a present worth analysis for the four principal alternatives. The analysis does not identify the source of funds but compares cost uniformly for each alternative over the 20-year planning period. The present worth is the sum which, if invested now at a given interest rate, would provide the funds required to pay projected costs over the 20-year planning period. The total present worth, used to compare the alternatives, is the sum of the initial capital cost, plus the present worth of Operation, Maintenance, and Replacement (OM&R) costs, minus the present worth of the salvage value at the end of the 20-year planning period. The discount rate used in computing the present worth cost is the rate established by the MDEQ and is currently set at 0.2%.

The salvage value is calculated at the end of 20 years where portions of the project structures or equipment may have a salvage value, which is determined by using straight-line depreciation. The present worth of the 20-year salvage value is then computed using the discount rate of 0.2%. The MDEQ guidance document establishes the estimated life for the project structures and equipment to assess salvage values at 20-year planning period. In general, concrete structures, earthwork basins, and piping has a useful life of 30-50 years and equipment has a useful life of 10-20 years.

The cost of labor, equipment and materials is not escalated over the 20-year life since it assumes any increase in these costs will apply equally to all alternatives. The interest charge during construction (capitalized interest) would not significantly influence the comparison of alternatives and was not included in the cost-effective analysis.

To ensure uniformity of the cost comparisons, the following cost comparison details were specifically addressed and were applied in the present worth analysis as per the MDEQ guidance.

- Capital costs were included for all identified improvements.
- Sunk costs were excluded from the present worth cost. Sunk costs for the project include existing land, existing waterworks facilities, and outstanding bond indebtedness.
- Operation, Maintenance, and Replacement, (OM&R) costs were included in the present worth cost. The Operation costs were compared at treating the design flow and loading over the 20-year planning period.
- The economic comparison is based on a 20-year planning period and a discount rate of 0.2%, per MDEQ/EPA guidance for FY2019.
- Salvage values were included in the present worth cost.
- Energy costs escalation was assumed equal between the alternatives and therefore are not adjusted over the 20-year period.

A detailed breakdown of all identified project costs is included in Appendix C for each alternative. Table 7 compares the costs for the principal alternatives.

**Table 7. Summary of Present Worth Cost Analysis**

| Alternative | Project Cost | Annual OM&R Cost (1) | Net Present Worth of OM&R Cost (2) | Salvage Value | Net Present Worth |
|---|---|---|---|---|---|
| **Alternative 1 - WWTP Expansion with MBBR and Nitrification Tower** | $27,500,000 | $1,970,000 | $38,600,000 | $2,420,000 | **$63,680,000** |
| **Alternative 2 - WWTP Expansion Extended Aeration (VLR)** | $27,300,000 | $1,810,000 | $35,500,000 | $2,780,000 | **$60,020,000** |
| **Alternative 3 - WWTP Expansion Extended Aeration (Oxidation Ditch)** | $30,800,000 | $1,850,000 | $36,200,000 | $3,880,000 | **$63,120,000** |
| **Alternative 4 - WWTP Expansion with Activated Sludge** | $26,700,000 | $1,890,000 | $37,000,000 | $2,140,000 | **$61,560,000** |

Note: This table represents budgetary estimates for planning purposes. Further definition of the scope of the projects through preliminary and final design will provide details necessary to improve the accuracy of the costs.

(1) Annual OM&R Cost based on the existing 2019 Sewer Fund Budget (including collection system) with adjustments for the upgraded system, assuming treatment at design flow rate and loading. 2019 Sewer Fund Budget = $1,405,051.
(2) Net Present Worth calculated using the real discount rate for a 20-year period (i = 0.2%) based on MDEQ guidance for fiscal year 2019.

### 2. Environmental Evaluation

Environmental impacts are similar for construction of all four principal alternatives, which include construction at the existing WWTP site.

Construction Impacts

Each alternative will require construction in the 100-year flood plain and removal of trees near the south end of the site. A compensating cut will be required to offset the volume of fill added within the 100-year flood plain. Alternative 1 will have less of an impact than Alternatives 2, 3 and 4.

Lakes and Streams

The WWTP is currently authorized to discharge to the Grand River under NPDES Permit No. MI0057679. A revised NPDES permit will be required to account for the increased design flow of the WWTP for any of the principal alternatives. Preliminary effluent limit recommendations were requested from the MDEQ for the revised permit. Based on the model previously used to develop effluent limits in the vicinity of Grand Rapids, no specific recommendations were made to protect against chronic toxicity in the receiving water based on federal secondary treatment standards. However, federal secondary treatment standards assume a daily maximum ammonia (NH3-N) concentration of 30 mg/L. Based on recent sampling data, higher concentrations of ammonia are anticipated with the expanded system. A copy of the Effluent Limits Only Report is included in Appendix C.

Social Impacts

Each Alternative will require an increase in user rates. In order to reduce the impact to users, a phased construction approach could be used to allow the impact on rates to be spread out over time.

## E. Additional Considerations

In addition to the monetary, reliability, and environmental considerations used to analyze the alternatives, a number of additional factors should be considered for each of the principal alternatives. Primary advantages and disadvantages for each principal alternative have been identified.

### 1. Alternative 1 – WWTP Expansion with MBBR and Nitrification Tower

Advantages

The primary advantage to Alternative 1 is that the construction could be phased to install the MBBR system initially and then the Nitrification Tower if an ammonia limit is added to the NPDES permit in the future. This would reduce the initial capital cost of the project and provide treatment necessary to meet the current NPDES permit limits.

Another advantage is that the mode of operation for the MBBR system is consistent with current operations. While the method of treatment would change, the improvements would expand plant capacity while maintaining similar treatment techniques.

Additionally, the MBBR process utilizes media in each reactor for treatment and the treatment capacity may be modified by adjusting the amount of media contained in each reactor. This flexibility may allow the treatment process to be designed to treat closer to the current flow and loading received at the WWTP initially and allow for expansion as flows increase by simply adding media to the reactors.

Disadvantages

The primary disadvantage is that removing phosphorus will require the use of chemical precipitation rather than taking advantage of treatment using a BNR process. Future chemical prices will have a large impact on operational costs of the system over the next twenty years.

**2. Alternative 2 – WWTP Expansion with Extended Aeration (VLR)**

Advantages

The primary advantage of Alternative 2 is that the VLR system is relatively easy to maintain and operate and is resilient to shock loading. With longer hydraulic retention times and greater sludge age, the VLR System handles changes in flow rates and loading better than a conventional activated sludge system.

Alternative 2 has the lowest annual OM&R cost of the four alternatives.

Additionally, Alternative 2 utilizes a BNR process to provide removal of phosphorus without the use of chemicals.

Disadvantages

The Net Present Worth is higher than Alternative 1. The treatment system has a larger footprint than the other alternatives, potentially limiting future expansion opportunities.

**3. Alternative 3 - WWTP Expansion with Extended Aeration (Oxidation Ditch)**

Advantages

The primary advantage of Alternative 3 is similar to Alternative 2. An Oxidation Ditch is relatively easy to maintain and operate and is resilient to shock loading.

Alternative 3 uses vertically mounted aerators, which are easier to maintain than the horizontal aerators used in Alternative 2.

Additionally, Alternative 3 utilizes a BNR process to provide removal of phosphorus without the use of chemicals.

Disadvantages

The area required for construction of an oxidation ditch is much greater than the other available technologies. With the limited available hydraulic grade between the influent and effluent of the WWTP, a low lift pump station will be required to pump primary effluent into the oxidation ditch.

The large footprint required for the treatment system creates challenges for future expansion.

Additionally, the Net Present Worth is the highest of the alternatives.

**4. Alternative 4 - WWTP Expansion with Activated Sludge**

Advantages

The primary advantage of Alternative 4 is the flexibility to operate the treatment system as a conventional activated sludge process or A2/O process.

Disadvantages

Operation of a conventional activated sludge plant requires a higher level of process control and is more labor intensive than an extended aeration process. Variations in flow rates and loadings may cause upsets in the treatment process.

The existing primary clarifier effluent weir, mechanisms and walls will need to be raised 1-foot to handle the future peak capacity.

### 5. Analysis of Alternate Population and Flow Projections

In order to evaluate the potential impact of a longer planning period or potential service area population growth higher than projected in this report, the principal alternatives were analyzed based on two additional scenarios.

The first scenario includes full development within the existing service area. The current projection for the design flow rate from a full buildout of the Service Area is 4.5 mgd with a peak flow of 9.8 mgd. The second scenario includes doubling the existing design capacity to 6.4 mgd to allow for future expansion outside of the existing sewer district. Based on a 10 States Standards peaking factor, the peak flow in this scenario would be approximately 12.5 mgd.

There is limited available area for expansion on the south side of the WWTP. Future expansion including new Headworks Building, primary clarifiers and secondary treatment could be constructed in the green space to the west of the WWTP and south of the entrance driveway. New secondary clarifiers could be constructed to the east of the existing secondary clarifiers. New Anaerobic Digesters could be constructed to the north of the existing entrance driveway.

Alternatives 1, 2 and 4 have similar requirements for expansion. Due to the large surface area required for secondary treatment, Alternative 3 does not allow for expansion as well as the other alternatives due to the large footprint required for the biological treatment system. A site plan showing the locations for future expansion is included in Appendix H.

# V. RECOMMENDED ALTERNATIVES

## A. Description of the Recommended Alternatives

The objectives of the wastewater treatment system improvements project are identified as:

3. Provide facilities capable of delivering consistent reliable service and continued compliance with regulatory and permit requirements.
4. Plan for future growth within the Township and corresponding treatment capacity.
5. Minimize operating costs through improved treatment methods.
6. Rehabilitate/repair high priority areas of existing wastewater infrastructure.
7. Minimize financial burden to the sewer system users.
8. Minimize environmental impact during construction of the improvements project.
9. Minimize environmental impact of WWTP operations and discharge.

All of the alternatives were reviewed for effectiveness, reliability, implementability, environmental impacts, and cost effectiveness.

The analysis determined that Alternative 1 – WWTP Expansion with MBBR and Nitrification Tower, Alternative 2 – WWTP Expansion with Extended Aeration (VLR), and Alternative 4 – WWTP Expansion with Activated Sludge have similar project costs and net present worth values and are therefore viable alternatives.

Additional discussion of Alternative 1, Alternative 2, and Alternative 4 is presented below.

## B. Description of Alternative 1 Improvements

### 1. WWTP Expansion with MBBR and Nitrification Tower

Alternative 1 includes constructing an MBBR and Nitrification Tower system for biological treatment to meet the 20-year design flow and loading. Alternative 1 also includes improvements to the Headworks, primary clarifiers, secondary clarifiers, disinfection system, chemical feed system, biosolids handling, odor control and Control Building as described in Section IV. A site plan showing the proposed improvements can be found in Figure H-1 in Appendix H.

The proposed MBBR system design includes two process trains including one reactor per train. The proposed reactors would be located to the south of the existing RBC tanks. A channel connecting to the primary clarifier effluent channel would be constructed to convey primary effluent to the MBBR system. Gates would be provided on the influent end of each reactor to split flow evenly between each reactor. The influent gates would also provide a means to take each reactor out of service for maintenance. Three blowers, two duty and one standby, would be provided to meet biological and mixing air requirements. The blowers will be installed in the Control Building where the existing multistage centrifugal blowers are located. Process air will be conveyed to the MBBR reactors using the existing air pipe located underneath the existing RBC tanks. Within each reactor, a medium bubble diffuser system would be provided to distribute air within the reactor. Treated effluent from the MBBR reactors would overflow a full-length weir at the end of each reactor into an effluent channel.

Effluent from the MBBR system would then enter a submersible pump station to pump to the Nitrification Tower. The pump station would also be designed to recirculate a portion of treated effluent from the tower. Recirculating treated effluent is recommended to increase treatment efficiency and maintain a minimum hydraulic loading rate during low flow periods. Flow entering the Nitrification Tower from the pump station would be distributed evenly across the top of the media using a rotating distribution mechanism. Following the Nitrification Tower, treated effluent would be distributed to the secondary clarifiers using a splitter box.

### 2. Cost Summary for Alternative 1

Table 8 summarizes the estimated costs for Alternative 1.

**Table 8. Cost Summary for Alternative 1**

| Alternative | Capital Cost | Annual OM&R Cost | Net Present Value of OM&R Cost | Present Worth of Salvage Value | Net Present Worth |
|---|---|---|---|---|---|
| 1 | $27,500,000 | $1,970,000 | $38,600,000 | $2,420,000 | **$63,680,000** |

## C. Description of Alternative 2 Improvements

### 1. WWTP Expansion with Extended Aeration (VLR)

Alternative 2 includes constructing an oxidation ditch in a vertical loop configuration (VLR) for biological treatment to meet the 20-year design flows and loadings. Alternative 2 also includes improvements to the Headworks, primary clarifiers, secondary clarifiers, disinfection system, chemical feed system, biosolids handling, odor control and Control Building as described in Section IV. A site plan showing the proposed improvements can be found in Figure H-2 in Appendix H.

The VLR treatment system consists of an anaerobic tank followed by three reactors operating in series. A channel connecting to the primary clarifier effluent channel would be constructed to convey primary effluent to the anaerobic tank. The anaerobic tank would be equipped with a mixer to prevent solids from settling in the tank. Following the anaerobic tank, flow will enter the first vertical loop reactor. Each vertical loop reactor has a horizontal baffle in the middle of the reactor to direct flow in a vertical loop in the tank (under and over the baffle). Two horizontal disc aerators are proposed in each reactor to add oxygen required for treatment, create a uniform flow pattern and maintain a velocity in the channel to prevent solids from settling in the tank. Bypass piping and gates would be provided to allow for the anaerobic tank or one of the three reactors to be taken offline for maintenance. Effluent from VLR system would be distributed to the secondary clarifiers using a splitter box.

### 2. Cost Summary for Alternative 2

Table 9 summarizes the estimated costs for Alternative 2:

**Table 9. Cost Summary for Alternative 2**

| Alternative | Capital Cost | Annual OM&R Cost | Net Present Value of OM&R Cost | Present Worth of Salvage Value | Net Present Worth |
|---|---|---|---|---|---|
| 2 | $27,300,000 | $1,810,000 | $35,500,000 | $2,780,000 | **$60,020,000** |

## D. Description of Alternative 4 Improvements

### 1. WWTP Expansion with Activated Sludge

Alternative 4 includes constructing an activated sludge system for biological treatment to meet the 20-year design flows and loadings. Alternative 4 also includes improvements to the Headworks, primary clarifiers, secondary clarifiers, disinfection system, chemical feed system, biosolids handling system, odor control and

Control Building as described in Section IV. A site plan showing the proposed improvements can be found in Figure H-4 in Appendix H.

The activated sludge process design includes three process trains operating in parallel. Each train would be designed to operate as a conventional activated sludge process or A2/O process. To accommodate both methods of operation, each tank would be separated into three separate zones with baffles. Fine bubble diffusers would be installed in each zone. When operating as a conventional activated sludge process, diffused air would be added to each zone. When operating as a A2/O process, the diffused air would be turned off in the first two zones and mixers would be turned on to prevent solids from settling. Primary effluent entering the first zone would be mixed with RAS to create an anaerobic zone. Following the anaerobic zone, a nitrate (NO2) rich mixed liquor recycle would be pumped from the end of the aerobic zone to create a denitrification (anoxic) zone. Following the denitrification zone, the mixed liquor would enter aerobic zone where diffused air is added to mix the contents of the tank and provide the oxygen required for treatment.

A channel connecting to the primary clarifier effluent channel would be constructed to convey primary effluent to the activated sludge system. In order to provide an even split of flow between each process train, gates would be provided on the influent end of each train. Due to the limited hydraulic profile, the effluent weirs on the primary clarifiers would need to be raised a minimum of six inches to prevent the weirs from becoming submerged during normal operation. Raising the effluent weirs would require modifications to the clarifier mechanisms and raising the existing clarifier walls.

Four blowers, three duty and one standby, are proposed to meet biological and mixing air requirements. The blowers will be installed in the Control Building in the location of the existing multistage centrifugal blowers. Process air will be conveyed to the activated sludge system using the existing air pipe located underneath the existing RBC tanks. Effluent from activated sludge system would be distributed to the secondary clarifiers using a splitter box.

### 2. Cost Summary for Alternative 4

Table 10 summarizes the estimated costs for Alternative 4:

**Table 10. Cost Summary for Alternative 4**

| Alternative | Capital Cost | Annual OM&R Cost | Net Present Value of OM&R Cost | Present Worth of Salvage Value | Net Present Worth |
|---|---|---|---|---|---|
| 4 | $26,700,000 | $1,890,000 | $37,000,000 | $2,140,000 | **$61,560,000** |

## E. Phased Approach for Implementing the Project

A phased approach could be used to successfully implement each alternative in order to decrease the initial capital investment. The following discussion outlines how the Alternatives might be implemented with a phased approach while meeting the current needs of the WWTP.

While phasing the implementation of Alternatives will help reduce the initial capital costs, the total construction cost for all phases would be greater than constructing the project in a single construction project. Table 11 outlines the estimated project cost for each phase.

| Table 11. Phased Construction Approach | | | | |
|---|---|---|---|---|
| **Asset Description** | **Anticipated Year of Implementation** | **Alternative 1 Project Cost (Inflated 3%/yr)** | **Alternative 2 Project Cost (Inflated 3%/yr)** | **Alternative 4 Project Cost (Inflated 3%/yr)** |
| **Phase I – Control Building and Miscellaneous Improvements** | 2020 | $ 2,500,000 | $ 2,500,000 | $ 2,500,000 |
| **Phase II – Capacity Expansion and Biosolids Dewatering** | 2022 | $ 23,800,000 | $ 23,500,000 | $ 22,900,000 |
| **Phase III – Headworks and Solids Handling Improvements** | 2025 | $ 4,000,000 | $ 4,000,000 | $ 4,000,000 |

**Phase I - Control Building and Miscellaneous Improvements**

Phase I of the project addresses the immediate need of additional office space, reducing operating costs with improvements to the chemical feed system and other improvements necessary to increase reliability and operator safety. Phase I includes the following items:

- Control Building Improvements: Lab Expansion, Locker Room, Office Space, Training Room, HVAC Improvements and Boiler Replacement
- Chemical Feed Improvements
- Secondary Clarifier: Launder Covers, Flocculator Replacement, Clarifier Mechanism Coating
- Relocate/Extend Watermain, add Hydrant south of Control Building
- Add Parking Spaces
- Miscellaneous Concrete Repairs

**Phase II – Capacity Expansion and Biosolids Dewatering**
Phase II of the project addresses the need of adding additional treatment capacity and biosolids dewatering. Phase II includes the addition of two primary clarifiers, construction of the biological treatment system, addition of two secondary clarifiers, UV disinfection system and odor control system. Phase II also includes the installation of a biosolids dewatering system.

**Phase III – Headworks and Secondary Solids Handling Improvements**
Phase III of the project addresses the need of expanding peak flow capacity in the Headworks and improving the solids handling system. Phase III includes improvements to the Headworks screening and grit removal systems, and secondary sludge thickening.

## F. Project Funding

Available options for funding this project include municipal bonds and the Clean Water State Revolving Fund (SRF). A municipal financial advisor should be consulted to determine the best source of funding for the project.

Issuing municipal bonds is one option to finance wastewater system projects. The municipal bond rate is dependent on the loan term and the Township's credit rating. Financing the project with municipal bonds does not put restrictions on project schedule, project delivery methods, or bidding requirements. However, the interest rate would be higher than funding with the SRF program.

Financing through the SRF program is another option. The SRF program is a federal-state partnership that provides communities a permanent, independent source of low-cost financing for a wide range of water quality infrastructure projects. The current interest rate for SRF loans is 2.0% for 20-year loans in fiscal year 2020. Financing the project through the SRF program requires a project plan to be completed to qualify for funding. The feasibility study can be used as a basis for the project plan. The SRF program requires following a quarterly schedule for design and bidding of projects and limits project delivery methods. The SRF program also requires compliance with Davis-Bacon prevailing wage rates for labor and compliance with American Iron and Steel requirements which may increase construction costs.

# VI. RECOMMENDED NEXT STEPS

The results of the alternatives analysis identify Alternative 1, Alternative 2 and Alternative 4 as viable alternatives, as they meet the project objectives:

- Provide facilities capable of delivering consistent reliable service and continued compliance with regulatory and permit requirements.
- Plan for future growth within the Township and corresponding treatment capacity.
- Minimize operating costs through improved treatment methods.
- Rehabilitate/repair high priority areas of existing wastewater infrastructure.
- Minimize financial burden to the sewer system users.
- Minimize environmental impact during construction of the improvements project.
- Minimize environmental impact of WWTP operations and discharge.

The following next steps are recommended to help the community make an informed decision on the final selected alternative.

1. Consult with a Municipal Financial Advisor to conduct a rate study considering the Alternatives and funding options.
2. Evaluate rate impacts, funding options, and project phasing.
3. Complete MDEQ SRF Project Plan (if SRF financing is selected).
4. Continue visiting other wastewater treatment plants to further review equipment and treatment technologies.
5. Continue discussions regarding long-term biosolids disposal options.
6. Begin design of the improvements.

This Feasibility Study has been completed in order to evaluate alternative improvement options to meet the long-term wastewater treatment needs of the community. A comprehensive analysis of the principal alternatives revealed Alternative 1, Alternative 2 and Alternative 4 as viable solutions. The results of the financial analysis can be used to help select the desired course of action for proposed improvements.

# APPENDIX A
# MAPS AND FIGURES

# Allendale Charter Township Sanitary Sewer Network

- Lift Station
- Manhole
- Force Main
- Gravity Main

Buchanan
Pingree
Bent Tree
Almari
Comfort
Baicom
Dales
Essex
Bridgeton
Rich
LS_60TH-NORTH
Frostline
Pebble
Village
Crystal
Washington
Cherell
Avery Sheridan
Scott
Valley View
Brown
Cardinal
LS_BROWN
Blue Jay
Red Hawk
Lake Michigan
LS_HIDDEN_SHORES
Waterway
Waterline
Island
Watermark
Timber Creek
Pinevalley
Pine Grove
Aspen
Joal
Sunset
LS_TIMBERLINE
Black Cherry White Birch
North
Timberline
Learning
LS_COUNTY_PARK
Henry
Mista
Marthie
Winans
Constant
Timber
Burg Gemmen
Countryview
Red Oak
Maple Bend
LS_60TH-SOUTH
Maplebrook
Mapleview
Stepping Stone
Pierce
64th
68th
74th
76th
72nd
60th

Sanitary Collection System (WEST)

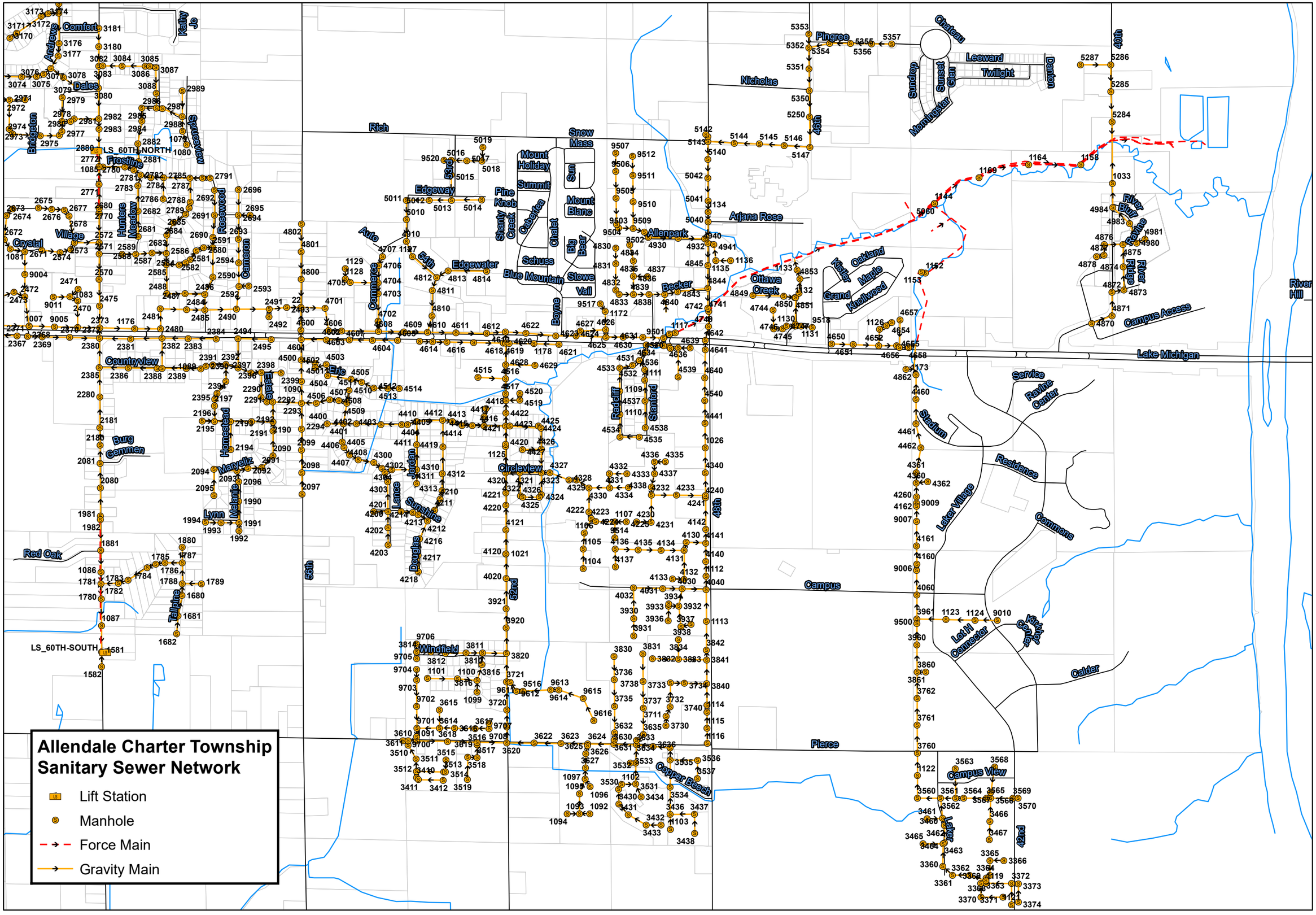
Allendale Charter Township, Michigan

FLEIS&VANDENBRINK
DESIGN. BUILD. OPERATE.

| DRAWN BY | DATE |
|---|---|
| BSR | 9/5/2018 |
| PROJECT NO. | SCALE |
| 814975 | 1:13,500 |
| FILE LOCATION | |
| SOURCES | |

NORTH
0 560 1,120
SCALE IN FEET

FIGURE
A-1A




# Sanitary Collection System (EAST)

Allendale Charter Township, Michigan

FLEIS&VANDENBRINK
DESIGN. BUILD. OPERATE.

| DRAWN BY | DATE |
|---|---|
| BSR | 9/5/2018 |
| PROJECT NO. | SCALE |
| 814975 | 1:13,500 |
| FILE LOCATION | |
| SOURCES | |

NORTH

0 560 1,120

SCALE IN FEET

FIGURE

A-1B

Warner St.

60th Ave.

48th Ave.

Township Borders

Allendale Charter Township Sewer District Border

Lake Michigan Drive (M-45)

40th Ave.

78th Ave.

68th Ave.

64th Ave.

60th Ave.

56th Ave.

52nd Ave.

Pierce St.

Filmore St.

Allendale Charter Township

Georgetown Township

Blendon Township

GRAND RIVER

NORTH

SCALE IN FEET

TOTAL SEWER DISTRICT AREA

9500 ACRES (14.8 SQ. MI.)
(3200 ACRES N. OF M-45 AND 6300 ACRES S. OF M-45)

LEGEND

= SEWER DISTRICT BOUNDRY
= SUB-DISTRICT BOUNDRY
= FUTURE GRAVITY SEWER
= FUTURE FORCEMAIN
= PROPOSED LIFT STATION
= EXISTING LIFT STATION
= SUB-DISTRICT DESIGNATION
= APPROXIMATE GROUND AND PIPE INVERT ELEVATIONS
= POTENTIAL TEMPORARY LIFT STATION
= POTENTIAL TEMPORARY FORCEMAIN

FLEIS & VANDENBRINK ENGINEERING, INC.

4711 - 50th Street SE, Grand Rapids, MI 49512
Phone: (616) 541-6000 Fax: (616) 541-1010

REVISIONS: REVISED AND UPDATED

REVISED IN ACCORDANCE WITH CONSTRUCTION CERTIFICATE

ALLENDALE CHARTER TOWNSHIP

SEWER DISTRICT MAP

| | |
|---|---|
| PROJECT MGR | S.R.V.B. |
| DRAWN BY | B.S.R. |
| ENGINEER | S.M.B. |
| CAD FILE | SANAP_C2003 |
| DATE | JAN '03 |
| DATE | MAY '02 |
| DATE | MAY '02 |
| EDIT | JDB100803 |
| SCALE | 1" = 1000' |
| DRAWING SCALE | 1:1 |
| PLOT SCALE | |

PROJECT A-2

SHEET NO.

# Allendale Charter Township
## Ottawa County, Michigan
# OFFICIAL ZONING MAP
### Latest Revision January, 2013

## ZONING DISTRICT LEGEND

| | | | |
|---|---|---|---|
| AG | AGRICULTURAL AND RURAL | PUD | PLANNED UNIT DEVELOPMENT |
| RE | RURAL ESTATE | O | OFFICE DISTRICT REGULATIONS |
| R-1 | LOW DENSITY ONE-FAMILY RESIDENTIAL | C-1 | LIMITED BUSINESS |
| R-2 | MEDIUM DENSITY ONE- AND TWO-FAMILY RESIDENTIAL | C-2 | GENERAL COMMERCIAL |
| R-3 | LOW DENSITY MULTIPLE FAMILY RESIDENTIAL | C-3 | SERVICE COMMERCIAL |
| R-4 | MEDIUM DENSITY MULTIPLE FAMILY RESIDENTIAL/OFFICE | I-1 | LIGHT INDUSTRIAL |
| R-5 | MOBILE HOME PARK | PID | PLANNED INDUSTRIAL DEVELOPMENT |
| ⊏ ⊐ | GROUP HOUSING OVERLAY ZONE (SEE SECTION 3.15) | | |

FLOOD PLAIN SHOWN IS APPROXIMATE BASED ON GIS DATA FROM OTTAWA COUNTY AND IS FOR REFERENCE ONLY

* DEERFIELD MANOR DEVELOPMENT WAS ALLOWED UNDER COURT ORDER DATED MAY 11, 1999

NORTH

SCALE IN FEET 0 2000 4000

FLEIS & VANDENBRINK ENGINEERING, INC.

THIS MAP IS INTENDED FOR REFERENCE ONLY. ALLENDALE TOWNSHIP AND FLEIS & VANDENBRINK ARE NOT LIABLE FOR ERRORS OR OMISSIONS.

APPROX. LIMITS OF 100 YEAR FLOOD PLAIN

POLKTON TOWNSHIP

ROBINSON TOWNSHIP

TALLMADGE TOWNSHIP

BLENDON TOWNSHIP

GEORGETOWN TOWNSHIP

GRAND RIVER

LAKE MICHIGAN DRIVE

LINCOLN STREET

WARNER STREET

BUCHANAN STREET

PIERCE STREET

FILLMORE STREET

(M-45)

96TH AVENUE

92ND AVENUE

88TH AVENUE

84TH AVENUE

80TH AVENUE

76TH AVENUE

72ND AVENUE

68TH AVENUE

64TH AVENUE

60TH AVENUE

56TH AVENUE

52ND AVENUE

48TH AVENUE

40TH AVENUE

GRAND VALLEY STATE UNIVERSITY

(NOT SUBJECT TO TOWNSHIP ZONING)

OTTAWA AREA CENTER

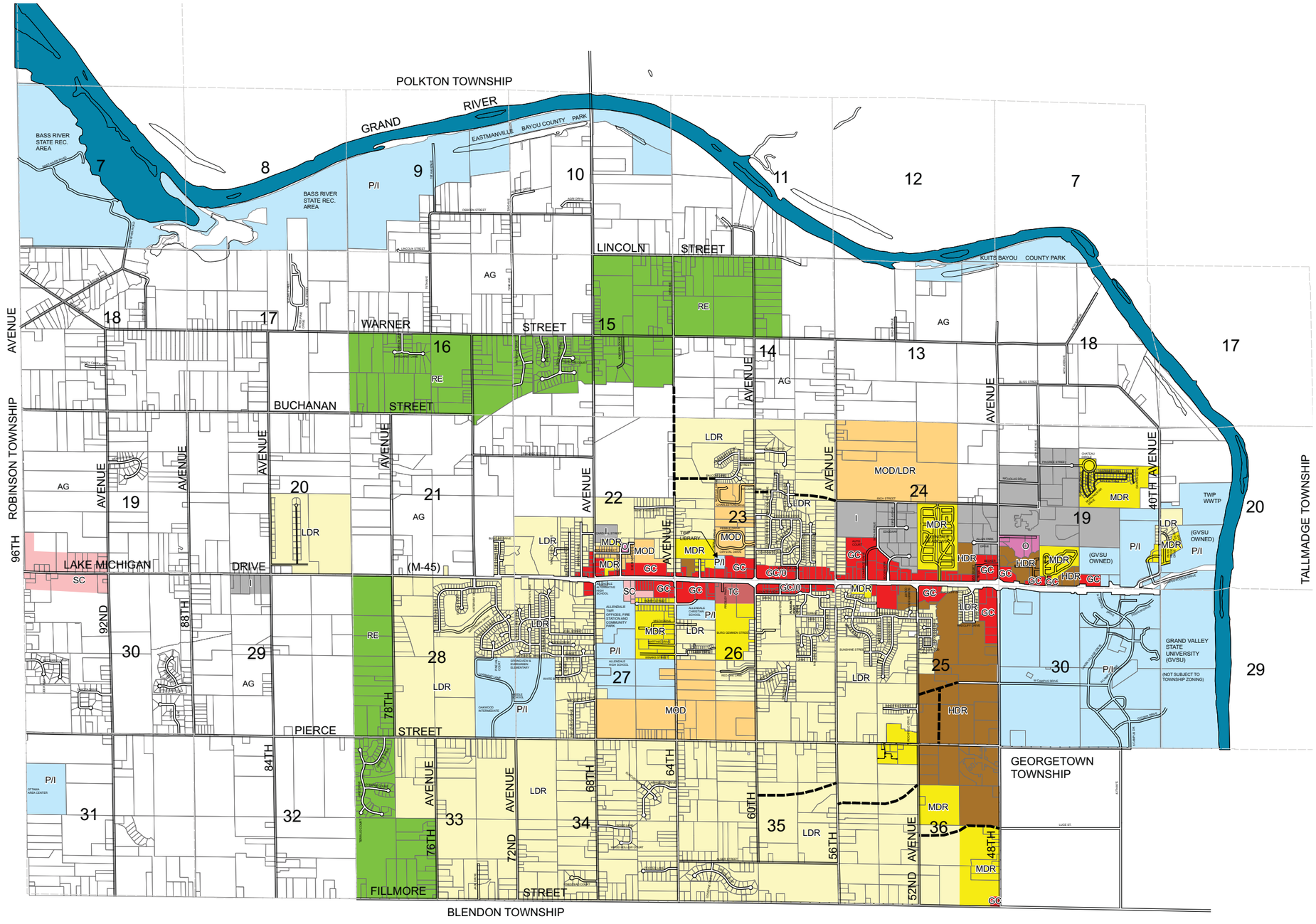
### PUD LEGEND

| | | | |
|---|---|---|---|
| 1 | PLACID WATERS | 23 | EDGEWATER BUSINESS PARK |
| 2 | DANENBERG ESTATES | 24 | WESTSHORE COMMUNICATIONS |
| 3 | HIDDEN FOREST | 25 | - |
| 4 | HIDDEN SHORES | 26 | MEADOW LAKE |
| 5 | BITTERSWEET ESTATES | 27 | SPRINGFIELDS OF ALLENDALE |
| 6 | BRUMMEL PUD | 28 | MYSTIC WOODS |
| 7 | WALGREENS PUD | 29 | SUMMER BROOK PUD |
| 8 | COMPLIMENTS | 30 | ALLENDALE CROSSINGS |
| 9 | FUNERAL HOME | 31 | WINDING CREEK CROSSINGS |
| 10 | DEWPOINT WEST | 32 | SUTTERS MILL PUD |
| 11 | THE DALES | 33 | WINDING CREEK CIRCLE |
| 12 | VILLAGE CONDOS | 34 | COPPER BEECH TOWNHOMES |
| 13 | STONEBRIDGE PUD | 35 | MEADOWS CROSSING |
| 14 | HERITAGE TOWNE SQUARE | 36 | 48 WEST |
| 15 | ALLENDALE LANDINGS | 37 | MAJOR BRAND OIL PUD |
| 16 | FAMILY FARE PUD | 38 | ALLENDALE MEADOWS PUD |
| 17 | TRADERS CREEK LANDING | 39 | UNIVERSITY PARK PUD |
| 18 | CHRISTIANSON ESTATES | 40 | CAMPUS TOWNE CENTER PUD |
| 19 | LONE PINE ESTATES | 41 | ALLENDALE BUSINESS PARK |
| 20 | RANDALL ESTATES | 42 | MACKADE PUD |
| 21 | BROOKLAND ESTATES II | 43 | CADENCE PLACE |
| 22 | ALLENDALE PROFESSIONAL PARK | | |

Zoning Map \karim 022813

# FUTURE LAND USE MAP

## ADOPTED BY THE ALLENDALE CHARTER TOWNSHIP BOARD ON JULY 22, 2013




### AG - AGRICULTURE

This future land use category is analogous to the Agricultural and Rural Zoning District and recognizes those lands which are best suited for farming based on location, current utility served areas, soil type, parcel size and active farm operations. Farming would be a principal permitted use along with single family dwellings but AG areas would not be served by public water and sanitary sewer. The Plan recommends a continuation of the current Zoning Ordinance requirement of a one acre minimum lot size for a single family dwelling with 150 feet of lot width.

### RE - RURAL ESTATE

This Master Plan category is the same as the Rural Estate zoning district and is intended to serve as a transition from residential subdivision type development in the R-1 and R-2 zoning districts to the rural farmed areas in the AG zone. The RE category provides opportunities for very low density residential developments and creative design to preserve natural features and provide open space buffers between such areas and active farms thereby helping to preserve rural character. Public water and sanitary sewer not envisioned for RE zones which are located outside the boundaries of the planned sanitary sewer service area. The minimum lot size is proposed to remain as it has been for many years at one acre with 150 feet of lot width. The Master Plan recommends that farming no longer would be a permitted use in RE zoned areas. The Plan recommends that RE areas be developed under the Residential Open Space provisions of the Township Zoning Ordinance which allows lot sizes to be reduced below the minimum one acre requirement provided a certain percentage of the site is set aside as preserved open space. The density of one unit per acre would remain the same.

### LDR - LOW DENSITY RESIDENTIAL

Low Density Residential land use comprises most of the residential land use component in the Township and is the equivalent of the R-1 zoning district. Single family detached dwellings constitute the principal use along with supporting uses typically located in residential areas such as school, churches, parks which would be allowed as special land uses. Minimum lot sizes would be 15,000 sq. ft. with 100 feet of lot width which is a density of 2.9 du/ac. LDR areas are located within the boundaries of the Townships public water and sanitary sewer served areas. Large portions of Sections 23, 28, 33, 34, 35 and 36 are planned for LDR density due to the availability of public utilities and roadways and proximity to R-1 zoned neighborhoods, schools, shopping and services. LDR neighborhoods should include sidewalks along all streets and adjoining subdivisions should be connected by both streets and walkways to provide for safe pedestrian movement and allow for dispersion of vehicle traffic on local streets.

### MOD - MODERATE DENSITY RESIDENTIAL

The Moderate Density Residential classification is essentially the same as the R2 Zone and is intended to provide another choice for those desiring to own a house in Allendale Township. Single family dwellings would be the principal land use along with supporting uses such as schools, churches and parks as special land use similar to the LDR areas. The MOD category would have a density of 4.35 du/ac. which is slightly higher than that of the LDR category. A minimum lot size of 10,000 sq. ft. with 80 feet of lot width is recommended. MOD planned areas would be served by public water and sanitary sewer.

### MDR - MEDIUM DENSITY RESIDENTIAL

The Medium Density Residential category corresponds to the R3 Zone but the Plan proposes a significant changes to the current R-3 regulations to permit single family detached dwellings, (currently not allowed) while continuing to allow two family and multifamily dwellings to create a true mixed use residential use zone. The maximum density in MDR areas would continue to be 6.7 dwelling units per acre. This proposed change satisfies a major objective of the Plan which is to "Create attractive, safe and convenient residential communities with a variety of housing types for all income levels..." The MDR category provides opportunities for residential developments to be built with a variety of lot sizes and dwelling unit types without having to create a new Planned Unit Development zone. Single family dwellings would require a minimum lot size of 6500 sq. ft. with 65 feet of lot width. Two family dwellings would continue to need 12,000 sq. ft. with 100 feet of lot width. Public water and sanitary sewer would be required

### HDR - HIGH DENSITY RESIDENTIAL

The High Density Residential category is essentially the same as the R4 Zoning District in which multifamily dwellings are the principal use. Office uses would also be allowed by Special Use Permit. HDR land uses are recommended to have a maximum density of 12 units per acre and to be served by public water and sanitary sewer. HDR land use is also proposed for the parcels north of Pierce Street and east of 52nd Avenue as these parcels abut large multi-family buildings on the east and can be connected to the University via Campus West Drive which extends from 48th Avenue west to these HDR planned parcels. HDR land use on these parcels also meets one of the objectives of the Plan which states: Locate student rental housing close to the University for easier and safer pedestrian access or close to bus lines and require that on-site security be provided. Ideally, multi-family housing which is intended specifically for college students should not be located west of 52nd.

### O - OFFICE

This Master Plan category corresponds to the existing Office Zoning District with current Zoning Ordinance requirements calling for a minimum lot size of 15,000 sq. ft. with 100 ft. of lot width. The Future land Use Map recognizes existing office zoning districts. The Office Future Land Use classification is intended to provide opportunities for small scale office uses to serve the needs of the larger community. Free standing retail uses would not be allowed.

### GC - GENERAL COMMERCIAL

This category includes both the C-1 (Limited Business Zone) and the C-2 (General Commercial Zone). Principal land uses are generally recognized retail and service uses which serve surrounding residential areas and also passing traffic. GC uses will mostly front on M-45 which is the major commercial corridor in Allendale Township. The Plan recognizes the existing commercial land uses which are zoned C-1, C-2 and PUD. The Plan recommends additional commercial land use for the northwest corner of Fillmore Street and 48th Avenue at such time that public utilities become available. The Master Plan also recommends that those parcels with frontage on M-45 between 56th Avenue and 60th Avenue be planned for Commercial and Office use to the depth of these parcels. This area is composed of single family houses and a few vacant lots. Land on M-45 to the east and west of this portion of M-45 has developed over the years with commercial uses and the area between 56th and 60th is seen as being a logical extension of this commercial land use pattern.

### SC - SERVICE COMMERCIAL

This category is analogous to the C-3 Zoning District. It is intended to accommodate those uses which have both retail, service and industrial characteristics and which involve outdoor sales or display storage of products, delivery of products by semi-trucks, some outdoor activity, low traffic volumes and large lot size. Such uses do not need the all season roads or infrastructure normally required for industrial uses but do need visibility and good access afforded by higher volume roadways. Such uses would not always fit in with traditional retail uses such as grocery stores and restaurants. Examples of such uses include contractor yards, open air businesses, lumber yards, auto body repair shops, mini-warehouse storage facilities and veterinarian establishments. Not all such uses need public water and sanitary sewer.

### TC - TOWN CENTER

The Town Center concept and its location on the south side of M-45 between 60th and 64th Avenues was the centerpiece of the 2015 Community Strategic Plan adopted in 2003. The 2011 community survey showed strong support for the continuation of this form of land use in the Master Plan update. The 2012 Master Plan still supports the development of a Town Center which can provide an identity for Allendale Township in a central location which is walkable and can serve as a gathering place for residents. The focus of the 2012 Plan is therefore more on the layout and design of the future commercial portion of the site along the M-45 frontage and less on the residential portion to the south. The Plan recommends commercial development to a depth of 500 to 800 feet from M-45. Buildings and support facilities should be located and designed to provide a village or traditional town atmosphere and to function in a manner consistent with a village or traditional town by providing strong pedestrian amenities and traditional circulation patterns, providing open space in the form of a village square or similar amenity, and similar fundamental village components including the arrangement of commercial buildings along both sides of a main street in a traditional town center fashion. It is important that any design of the commercial portion incorporate safe and easy access both motorized and non-motorized to and from the residential area designated to the south.

### I - INDUSTRIAL

This Future land Use category includes both the Light Industrial Zone and the Planned Industrial zoning districts. This future land use classification is intended primarily for light industrial uses with limited nuisance characteristics. Manufacturing, production, processing, assembling and packaging from previously prepared materials within an enclosed building are generally acceptable. Industrial land uses should be located so they are served by public water and sanitary sewer and paved roads. Based on the analysis of industrial land in Chapter 4 the amount of vacant industrial zoned land would appear to be sufficient for the next five year planning period when this matter can reviewed again.

### P/I - PUBLIC/INSTITUTIONAL

This future land use category recognizes those lands and facilities that are owned or operated by a government agency or are supported by public funds and include government buildings, libraries, parks, recreational lands, cemeteries and public schools. Churches and other religious facilities are not included in this category as such buildings can and do change over time.

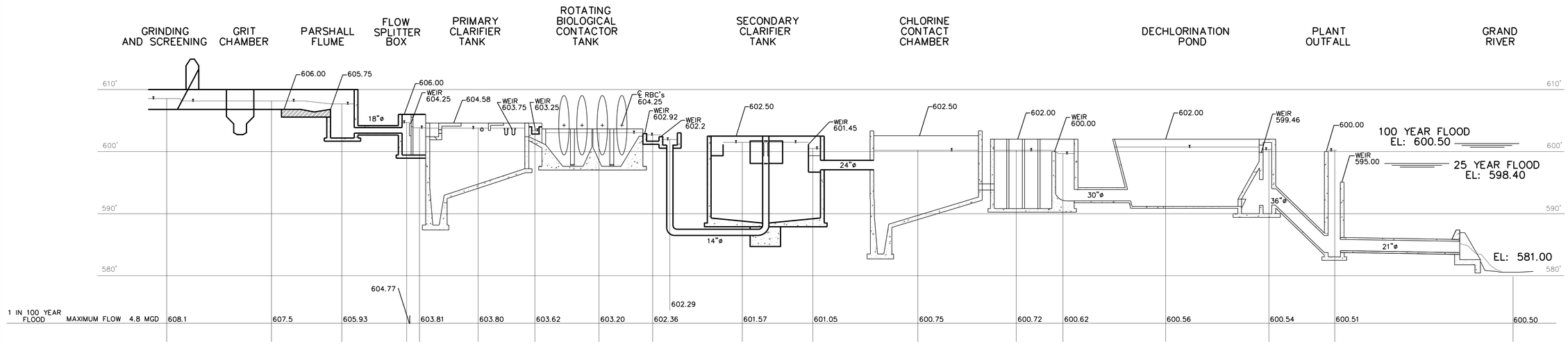
### FUTURE STREETS

The Plan recommends the extension of Campus West Drive from its present terminus to either 52nd Avenue as shown on the Future Land Use Map or possibly Pierce Street. This extension would continue to be public and will provide good access to Grand Valley State University from an area planned for High Density Residential which likely be student housing thereby lessening future traffic on 52nd Avenue and Pierce Street. Construction of the road should take place in conjunction with the development of the property. Typically, payment for the road is borne by the property developers. The Future Land Use Map illustrates locations of other future streets which connect to existing major north south roads and provide alternative route to disperse traffic. The locations are general and are illustrated so that measures can be taken to ensure that road connections can be made during review of development plans.


progressive ae
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www.progressiveae.com


N

NO SCALE




## VALVE SCHEDULE

| NO. | SIZE (in.) | TYPE | ACTUATOR | COMMENTS | LOCATION |
|---|---|---|---|---|---|
| 1 | 20 | GATE | NUT | W/VALVE BOX | HEADWORKS EFFLUENT |
| 2 | 20 | GATE | NUT | W/VALVE BOX | HEADWORKS EFFLUENT |
| 3 | 4 | GATE | CHAINWHEEL | | GRIT SLURRY HEADWORKS |
| 4 | 3 | SWING CHECK | NA | | SCUM HEADWORKS |
| 5 | 3 | GATE | HANDWHEEL | | SCUM HEADWORKS |
| 6 | | | | | NOT USED |
| 7 | 2 | BUTTERFLY | LEVER | | SLUDGE AIR |
| 8 | 2 | BUTTERFLY | LEVER | | SLUDGE AIR |
| 9 | 2 | BUTTERFLY | LEVER | | SLUDGE AIR |
| 10 | 6 | TELESCOPING | HANDWHEEL | | SUPERNATE |
| 11 | 6 | TELESCOPING | HANDWHEEL | | SUPERNATE |
| 12 | 8 | PLUG | NUT | STEM EXTENSION | SUPERNATE |
| 13 | 2 | BUTTERFLY | LEVER | | SLUDGE AIR |
| 14 | 2 | BUTTERFLY | LEVER | | SLUDGE AIR |
| 15 | 2 | BUTTERFLY | LEVER | | SLUDGE AIR |
| 16 | 6 | PLUG | HANDWHEEL | | BLOWER BUILDING |
| 17 | 6 | PLUG | HANDWHEEL | | BLOWER BUILDING |
| 18 | 6 | PLUG | HANDWHEEL | | BLOWER BUILDING |
| 19 | 4 | BUTTERFLY | LEVER | | BLOWER BUILDING |
| 20 | 4 | BUTTERFLY | LEVER | | BLOWER BUILDING |
| 21 | 4 | BUTTERFLY | LEVER | | BLOWER BUILDING |
| 22 | 4 | BUTTERFLY | LEVER | | BLOWER BUILDING |
| 23 | 4 | BUTTERFLY | LEVER | | BLOWER BUILDING |
| 24 | 4 | BUTTERFLY | LEVER | | BLOWER BUILDING |
| 25 | 4 | BUTTERFLY | LEVER | | BLOWER BUILDING |
| 26 | | | | | NOT USED |
| 27 | | | | | NOT USED |
| 28 | | | | | NOT USED |
| 29 | | | | | NOT USED |
| 30 | | | | | NOT USED |
| 31 | | | | | NOT USED |
| 32 | | | | | NOT USED |
| 33 | 6 | GATE | CHAINWHEEL | | SEC. CLARIFIER BUILDING |
| 34 | 6 | BUTTERFLY | LEVER | SUPPLIED BY EQPT. MFG. | NO. 3 CENTRIFUGAL BLOWER |
| 35 | 6 | DBL. DOOR CH. | NA | SUPPLIED BY EQPT. MFG. | NO. 3 CENTRIFUGAL BLOWER |
| 36 | 6 | BUTTERFLY | AIR ACTUATOR | SUPPLIED BY EQPT. MFG. | NO. 3 CENTRIFUGAL BLOWER |
| 37 | 6 | PLUG | HANDWHEEL | | SLUDGE DRAWOFF |
| 38 | 6 | GATE | NUT | STEM EXTENTION | PRIMARY SLUDGE SUMP DRAIN |
| 39 | 6 | PLUG | NUT | STEM EXTENTION | PRIMARY SLUDGE WELL |
| 40 | 6 | TELESCOPING | HANDWHEEL | | PRIMARY SLUDGE WELL |
| 41 | 6 | PLUG | NUT | STEM EXTENTION | PRIMARY SLUDGE WELL |
| 42 | 6 | PLUG | NUT | STEM EXTENTION | PRIMARY SLUDGE WELL |
| 43 | 6 | TELESCOPING | HANDWHEEL | | PRIMARY SLUDGE WELL |
| 44 | 6 | PLUG | NUT | STEM EXTENTION | PRIMARY SLUDGE WELL |
| 45 | 6 | PLUG | NUT | STEM EXTENTION | PRIMARY SLUDGE WELL |
| 46 | 6 | TELESCOPING | HANDWHEEL | | PRIMARY SLUDGE WELL |
| 47 | 6 | PLUG | NUT | STEM EXTENTION | PRIMARY SLUDGE WELL |
| 48 | 6 | PLUG | NUT | STEM EXTENTION | PRIMARY SLUDGE WELL |
| 49 | 6 | TELESCOPING | HANDWHEEL | | PRIMARY SLUDGE WELL |
| 50 | 6 | PLUG | NUT | STEM EXTENTION | PRIMARY SLUDGE WELL |
| 51 | 6 | GATE | NUT | FLOOR BOX & STEM EXT. | RBC |
| 52 | 6 | GATE | NUT | FLOOR BOX & STEM EXT. | RBC |
| 53 | 4 | BUTTERFLY | LEVER | SUPPLIED BY EQMT. MFG. | RBC |
| 54 | 4 | BUTTERFLY | LEVER | SUPPLIED BY EQMT. MFG. | RBC |
| 55 | 4 | BUTTERFLY | LEVER | SUPPLIED BY EQMT. MFG. | RBC |
| 56 | 4 | BUTTERFLY | LEVER | SUPPLIED BY EQMT. MFG. | RBC |
| 57 | 16 | GATE | NUT | STEM EXTENTION | CHLORINE CONTACT CHAMBER |
| 58 | 16 | GATE | NUT | STEM EXTENTION | CHLORINE CONTACT CHAMBER |
| 59 | 6 | GATE | HANDWHEEL | RISING STEM | CLARIFIER BUILDING – SCUM SUCTION |
| 60 | 6 | GATE | HANDWHEEL | RISING STEM | CLARIFIER BUILDING – SCUM SUCTION |
| 61 | 6 | GATE | HANDWHEEL | RISING STEM | CLARIFIER BUILDING – SCUM SUCTION |
| 62 | 6 | SWING CHECK | NA | | SECONDARY CLARIFIER BUILDING |
| 63 | 6 | GATE | CHAINWHEEL | RISING STEM | SECONDARY CLARIFIER BUILDING |
| 64 | 6 | SWING CHECK | NA | | SECONDARY CLARIFIER BUILDING |
| 65 | 6 | GATE | CHAINWHEEL | RISING STEM | SECONDARY CLARIFIER BUILDING |
| 66 | 6 | GATE | CHAINWHEEL | NRS | SECONDARY CLARIFIER BUILDING |
| 67 | 6 | GATE | CHAINWHEEL | RISING STEM | SECONDARY CLARIFIER BUILDING |
| 68 | 6 | SWING CHECK | NA | | SECONDARY CLARIFIER BUILDING |
| 69 | 6 | GATE | CHAINWHEEL | RISING STEM | SECONDARY CLARIFIER BUILDING |
| 70 | 6 | SWING CHECK | NA | | SECONDARY CLARIFIER BUILDING |
| 71 | 6 | GATE | CHAINWHEEL | RISING STEM | SECONDARY CLARIFIER BUILDING |
| 72 | 6 | SWING CHECK | NA | | SECONDARY CLARIFIER BUILDING |
| 73 | 6 | GATE | CHAINWHEEL | RISING STEM | SECONDARY CLARIFIER BUILDING |
| 74 | 6 | GATE | HANDWHEEL | RISING STEM | SECONDARY CLARIFIER BUILDING |
| 75 | 6 | GATE | HANDWHEEL | RISING STEM | SECONDARY CLARIFIER BUILDING |
| 76 | 6 | GATE | HANDWHEEL | RISING STEM | SECONDARY CLARIFIER BUILDING |
| 77 | 6 | GATE | HANDWHEEL | RISING STEM | SECONDARY CLARIFIER BUILDING |
| 78 | 6 | GATE | HANDWHEEL | RISING STEM | SECONDARY CLARIFIER BUILDING |
| 79 | 6 | GATE | HANDWHEEL | RISING STEM | SECONDARY CLARIFIER BUILDING |
| 80 | 6 | GATE | HANDWHEEL | RISING STEM | SECONDARY CLARIFIER BUILDING |
| 81 | 6 | GATE | HANDWHEEL | RISING STEM | SECONDARY CLARIFIER BUILDING |
| 82 | 6 | GATE | HANDWHEEL | RISING STEM | SECONDARY CLARIFIER BUILDING |
| 83 | 6 | GATE | HANDWHEEL | RISING STEM | SECONDARY CLARIFIER BUILDING |
| 84 | 6 | GATE | HANDWHEEL | RISING STEM | SECONDARY CLARIFIER BUILDING |
| 85 | 6 | GATE | HANDWHEEL | RISING STEM | SECONDARY CLARIFIER BUILDING |
| 86 | 6 | GATE | HANDWHEEL | RISING STEM | SECONDARY CLARIFIER BUILDING |
| 87 | 6 | GATE | CHAINWHEEL | RISING STEM | SECONDARY CLARIFIER BUILDING |
| 88 | 18 | GATE | NUT | | CHLORINE CONTACT BYPASS |

## LEGEND

### PIPE

- FLANGED CONNECTION
- MECHANICAL JOINT
- GROVED CONNECTION
- FLEXIBLE CONNECTION
- UNION CONNECTION
- REDUCER
- GROOVED FLANGED ADAPTOR (GFA)
- (X) VALVE NUMBER
- (SPX) STOP PLATE NUMBER
- (SGX) SLIDE GATE NUMBER
- (WX) WEIR NUMBER

### VALVES

- GATE
- PLUG (N.O.)
- PLUG (N.C.)
- BUTTERFLY
- CHECK
- BALL
- PRESSURE RELIEF
- TELESCOPING
- ELECTRIC (SOLENOID) ACTUATOR
- AIR (CYLINDER) ACTUATOR
- SLIDE, SLUICE OR STOP
- PRESSURE REGULATOR
- AIR RELEASE, AIR/VACCUM OR COMBINATION
- BACK PRESSURE
- PRESSURE RELIEF
- PULSATION

### EQUIPMENT

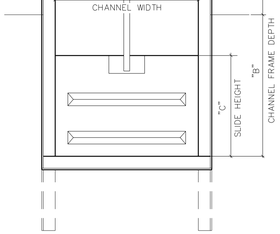
- PUMP
- CENTRIFUGAL BLOWER
- POSITIVE DISPLACEMENT BLOWER
- PRESSURE GAGE WITH ISOLATION VALVE
- MIXER
- (M) IN-LINE FLOWMETER
- GRINDER
- ELECTRIC MOTOR
- CLARIFIER DRIVE
- FLUME FLOWMETER

**WALL/FLOOR PIPES**

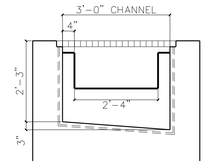
**WALL/FLOOR SLEEVES**

SLEEVES

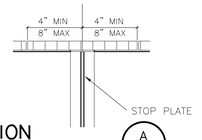
**WALL/FLOOR PENETRATIONS**



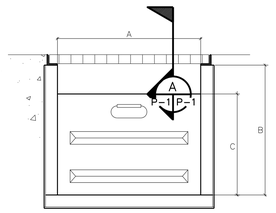

SLIDE GATE DETAIL
SCALE: NTS




WEIR TYPE STOP PLATE DETAIL
SCALE: NTS




SECTION
REMOVABLE GRATE
SCALE: NTS
A
P-1 P-1




STOP PLATE DETAIL
SCALE: NTS

## WEIR SCHEDULE

| NO. | WEIR LENGTH | WEIR ELEVATION | PLATE HEIGHT | LOCATION |
|---|---|---|---|---|
| W1 | 3'-6" | 604.25' | 13" | FLOW SPLITTER BOX |
| W2 | 3'-6" | 604.25' | 13" | FLOW SPLITTER BOX |
| W3 | 4'-6" | 602.92' | 13" | RBC #3 EFFLUENT |
| W4 | 4'-6" | 602.92' | 13" | RBC #4 EFFLUENT |

## STOP PLATE SCHEDULE

| NO. | "A" CHANNEL WIDTH | "B" FRAME HEIGHT | "C" PLATE HEIGHT | LOCATION | COMMENT | MATERIAL |
|---|---|---|---|---|---|---|
| SP1 | 24 | 46 | 44 | GRIT CHAMBER INFLUENT CHANNEL | | FRP |
| SP2 | 48 | 46 | 44 | GRIT CHAMBER SCREENING CHANNEL | | FRP |
| SP3 | 48 | 46 | 44 | GRIT CHAMBER EFFLUENT CHANNEL | | FRP |
| SP4 | 24 | 23 | 21 | 1° CLARIFIER INLET | | FRP |
| SP5 | 24 | 23 | 21 | 1° CLARIFIER INLET | | FRP |
| SP6 | 24 | 23 | 21 | 1° CLARIFIER INLET | | FRP |
| SP7 | 24 | 23 | 21 | 1° CLARIFIER INLET | | FRP |
| SP8 | 36 | 27 & 30 | 24 & 28 | RBC #4 INFLUENT | SLOPING BOTTOM | FRP |
| SP9 | 48 | 25 | 23 | RBC #3 EFFLUENT | | FRP |
| SP10 | 48 | 30 | 28 | RBC #3 INFLUENT | | FRP |
| SP11 | 48 | 14 | 12 | RBC #4 EFFLUENT | | FRP |
| SP12 | 36 | 27 & 30 | 24 & 28 | RBC FLOW SPLIT | WEIR TYPE, SLOPING BOTTOM | FRP |
| SP13 | 36 | 27 & 30 | 24 & 28 | RBC FLOW SPLIT | WEIR TYPE, SLOPING BOTTOM | FRP |
| SP14 | 36 | 22 | 20 | FLOW SPLITTER BOX | | FRP |
| SP15 | 36 | 22 | 20 | FLOW SPLITTER BOX | | FRP |
| SP16 | 36 | 22 | 20 | FLOW SPLITTER BOX | FRAME ONLY | FRP |
| SP17 | 36 | 22 | 20 | FLOW SPLITTER BOX | FRAME ONLY | FRP |
| SP18 | 36 | 26 | 24 | RBC BYPASS | | FRP |
| SP19 | 36 | 28 | 26 | RBC EFFLUENT CHANNEL | | FRP |

## SLIDE GATE SCHEDULE

| NO. | "A" CHANNEL WIDTH | "B" FRAME HEIGHT/DEPTH | "C" SLIDE HEIGHT | COMMENTS (SEE KEY) | LOCATION | MATERIAL |
|---|---|---|---|---|---|---|
| SG1 | 48 | 72 | 30 | | INFLUENT RISING WELL | FRP |
| SG2 | 48 | 72 | 30 | | INFLUENT RISING WELL | FRP |
| SG3 | 18 | 102 | 36 | D, F1, RS | SCUM WELL– EFFLUENT WELL | ALUMINUM |
| SG4 | 36 | 60 | 28 | D, F1, RS | RBC EFFLUENT | ALUMINUM |
| SG5 | 36 | 60 | 28 | D, F1, RS | RBC EFFLUENT | ALUMINUM |

KEY: D= Downward Opening
F1= Face Mounted Frame
F2= Existing Channel Frame
F3= Embedded Frame
RS= Rising Stem
NRS= Non Rising Stem


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ENVIRONMENTAL ENGINEERS & SCIENTISTS
3310 Eagle Park Drive, NE • Suite 101 • Grand Rapids, Michigan 49525
SILVER SPRING DETROIT DENVER GRAND RAPIDS


| NO. | REVISIONS | BY | DATE |
|---|---|---|---|
| | REVISED IN ACCORDANCE WITH CONSTRUCTION RECORDS | K.A.S. | 6/00 |

ALLENDALE CHARTER TOWNSHIP
OTTAWA COUNTY, MICHIGAN
WWTP IMPROVEMENTS

HYDRAULIC PROFILE & LEGENDS

| | | | |
|---|---|---|---|
| PROJECT MGR. | RPG | DATE | 6/98 |
| DRAWN BY | IOC | DATE | 6/98 |
| ENGINEER | BRS | DATE | 6/98 |
| CAD FILE | FILE | EDIT | |
| SCALE | NOT TO SCALE | | |
| DRAWING | 1:1 | | |
| PLOT SCALE | | | |

PROJECT 3102

P–1

SHEET NO.

M:\Proj\M3102\A\D0000\387971.1427 Jerome (Ada Council)\Images\Scan1999 Construction\Record Drawings\3102P01.dwg, 9/14/2011 3:38:29 PM, DWG To PDF.pc3, 1:1

E:: 14" RAW WATER
E:: 20" RAW WATER
TO E::STING BAR SCREEN AND GRIT CHANNEL
20"
14"
HEADWORKS BUILDING
RAW WATER RISING WELL
INFLUENT WELL
AIR DIFFUSER
NPW
6"
6"
GRIT CLASSIFIER
6" GRIT RECYCLE
SCREENINGS AUGER
SCREENINGS CONVEYOR
BYPASS CHANNEL
SCREENING CHANNEL
4" GRIT SLURRY
2" AIR
2" MOTOR OPERATED VALVE CLASS I, DIV.1
GRIT CHAMBER INFLUENT CHANNEL
GRIT MI ER
GRIT CHAMBER EFFLUENT CHANNEL
1" NPW
MOTOR OPERATED VALVES CLASS I, DIV.1
AIR LIFT PUMP
GRIT CHAMBER
INFLUENT FLOWMETER
DISCHARGE SILENCERS
AIR DIFFUSER
EFFLUENT WELL
SCUM WELL
2" MOTOR OPERATED VALVE CLASS I, DIV.1
BLOWER NO.1
BLOWER NO.2
2"
INTAKE SILENCER
20"
20"
18"
12"
6"
SEE SHEET OM2, FOR DETAILS
3" SCUM
NORTH DIGESTER
T-1
PUMP BUILDING
SOUTH DIGESTER
T-2
PLANT DRAIN MANHOLE
6" DRAIN
6" SUPERNATANT TO SLUDGE PUMP NO. 1
6" SLUDGE TO SLUDGE PUMP NO. 1
6" CHLORINE CONTACT TANK SCUM
6" PRIMARY □ SECONDARY SLUDGE
CONTROL BUILDING
CHLORINE FEED ROOM
MACHINE ROOM
12" AIR INTAKE
INTAKE FILTER
NO.3
NO.2
NO.1
POSITIVE DISPLACEMENT BLOWERS
CENTRIFUGAL BLOWERS
SLUDGE TREATMENT ROOM
SLUDGE PUMP ROOM
6" WASTE SLUDGE TO SLUDGE LAGOON
SLUDGE PUMPS
NO.1
NO.2
NO.3
6" SLUDGE RECYCLE
SUMP PUMP
6" TO SLUDGE HOLDING TANK
4" LOW PRESSURE AIR
10" LOW PRESSURE AIR
6" SLUDGE DRAWOFF
6" SLUDGE DRAWOFF
6" PRIMARY SLUDGE
6" PRIMARY SCUM
6" CHLORINE CONTACT TANK :SECONDARY SCUM::
6" CHLORINE CONTACT TANK :SECONDARY SLUDGE::
6" PRIMARY SLUDGE
6" PRIMARY SLUDGE
6"
4"
4" SUPERNATE PUMP STATION DISCHARGE
8" LAGOON SUPERNATE
VALVE CHAMBER
DRAIN AND SUPERNATE PUMP STATION
NO.1
NO.2
MANHOLE
8" DRAIN
10" PRI. SCUM
CO
10" LPA
8" DRAIN
SLUDGE SUMP
SCUM SUMP
NO.1
NO.2
FLOC. HOPPER
FLASH MIX TANK
E::ISTING PRIMARY CLARIFIERS
E::ISTING ROTATING BIOLOGICAL CONTACTORS
NO.1
NO.2
NO.3
NO.4
NO.5
NO.6
NO.7
NO.8
CHLORINE CONTACT :FORMER SECONDARY CLARIFIER::
CHLORINE CONTACT
DECHLORINATION POND
GRAND RIVER OUTFALL
24"
24"
24"
30" BYPASS
30"
30"
21" BYPASS
6" DRAIN
6" PRI. SLUDGE
10" LPA
6"
6" SEC.SLUDGE TO HEADWORKS
CLARIFIER BUILDING
6" SCUM TO HOLDING TANK
SLUDGE PUMPS
NO.2
NO.1
NO.3
SCUM PUMPS
NO.1
NO.2
6" DRAIN
10" PRI. SCUM
CO
6" DRAIN
14"
16"
16"
6"
6"
24"
18"
FLOCCULATOR NO.2A
SLUDGE DRIVE
FLOCCULATOR NO.2B
NO.2
FLOCCULATOR NO.1A
SLUDGE DRIVE
FLOCCULATOR NO.1B
NO.1
SCUM SUMP
SCUM SUMP
6"
6"
PRIMARY SPLITTER BO::
PRIMARY CLARIFIERS
ROTATING BIOLOGICAL CONTACTORS
SECONDARY CLARIFIERS
12"
18"
TO FUTURE PRIMARY TANKS NO. 7 □ 8
TO FUTURE PRIMARY TANKS NO. 5 □ 6


FLEIS&VANDENBRINK engineering
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REVISION :

ALLENDALE CHARTER TOWNSHIP
OTTAWA COUNTY, MICHIGAN
OPERATIONS AND MAINTENANCE MANUAL
OVERALL PLANT PROCESS DIAGRAM

DESIGN TEAM
RWW, EMG, DCT
CHEC□□TY

DRAWING INFORMATION
8□39□□OM1
r□□□9□515

F&V PROJECT NO. 8□39□□

OM1

NORTH DIGESTER
T-1

10" MIXING PUMP SUCTION
4" SCUM MIXING
4" FOAM SPRAY
8" MIXED SLUDGE
8"
4"
6" DIGESTING SLUDGE
6" RAW SLUDGE

PUMP BUILDING

P-1 SLUDGE MIXING PUMP
P-3 SLUDGE RECIRCULATION PUMP
P-2 SLUDGE MIXING PUMP
P-4 SLUDGE RECIRCULATION PUMP
PI 3, PI 5, PI 7, PI 6, PI 8, PI 4, PI 2, PI 1
TI
F.C.
HEAT EXCHANGERS
HX-1
HX-2
30 GPM
100 GPM
M
N.C.
FE-1
FE-2
SAMPLE TAP
10'
6" OVERFLOW
6" TRANSFER
6" RAW SLUDGE
6" DIGESTER UNDERFLOW
6" OVERFLOW ABANDONED
CONNECTION TO CONTROL BUILDING HYDRONIC SYSTEM

BOILER BUILDING

FE-5
CV-1
BV-1
MAU-1
11 GPM
4" HWR
4" HWS
6" RAW SLUDGE
6" CCT SCUM
6" PRIMARY & SECONDARY SLUDGE
6" CHLORINE CONTACT TANK SCUM
FUTURE CHP CONNECTION
B.F.
N.O.
EXPANSION TANK ET-1
SET @ 15 PSIG
1" NPW
1" P.W.
N.C.
3/4"
AIR VENT AV-1
4" AIR SEPARATOR AS-1
2 1/2"
FUTURE BOILER CONNECTION
1"
3/4" HOSE THREADS w/CAP
SHOT FEEDER
P-5
P-6
P-7
PI
BOILER INNER LOOP PRESSURE RELIEF VALVE
PS
MAIN LOOP PRESSURE RELIEF VALVE
TO DRAIN
HOT WATER BOILER
EQUIPMENT INCLUDED IN BOILER SPECIFICATIONS

PLANT DRAIN MANHOLE

SOUTH DIGESTER
T-2

6" DIGESTER UNDERFLOW
6" SUPERNATANT TO SLUDGE PUMP NO. 1
8" PLANT DRAIN
8" PLANT DRAIN TO SUPERNATANT P.S.
6" DIGESTER UNDERFLOW
6" SLUDGE TO SLUDGE PUMP NO. 1
6" DRAIN
6" DRAIN FROM BOILER BUILDING
6" OVERFLOW
6" OVERFLOW TO PRIMARY FLOW SPLITTER

FLEIS & VANDENBRINK engineering
2960 Lucerne Drive SE
Grand Rapids, MI 49546
P: 616.977.1000
F: 616.977.1005

REVISION :

ALLENDALE CHARTER TOWNSHIP
OTTAWA COUNTY, MICHIGAN
OPERATIONS AND MAINTENANCE MANUAL
SLUDGE AND HYDRONIC FLOW DIAGRAM

DESIGN TEAM
RWW, EMG, DCT
CHECKED BY:

DRAWING INFORMATION
8139OM
F:\8139\515

F&V PROJECT NO. 8139

OM

# APPENDIX B
# NPDES PERMIT

# PERMIT NO. MI0057679

# *STATE OF MICHIGAN*
# *DEPARTMENT OF ENVIRONMENTAL QUALITY*

## AUTHORIZATION TO DISCHARGE UNDER THE NATIONAL POLLUTANT DISCHARGE ELIMINATION SYSTEM

In compliance with the provisions of the Federal Water Pollution Control Act, 33 U.S.C., Section 1251 *et seq*., as amended; Part 31, Water Resources Protection, of the Natural Resources and Environmental Protection Act, 1994 PA 451, as amended (NREPA); Part 41, Sewerage Systems, of the NREPA; and Michigan Executive Order 2011-1,

**Allendale Charter Township**
11624 40th Avenue
Allendale, MI 49401

is authorized to discharge from the **Allendale Township Wastewater Treatment Plant** located at

11624 40th Avenue
Allendale, MI 49401

designated as **Allendale Twp WWTP**

to the receiving water named the Grand River in accordance with effluent limitations, monitoring requirements, and other conditions set forth in this permit.

This permit is based on a complete application submitted on March 26, 2015, as amended through April 25, 2015.

**This permit takes effect on October 1, 2018**. The provisions of this permit are severable. After notice and opportunity for a hearing, this permit may be modified, suspended, or revoked in whole or in part during its term in accordance with applicable laws and rules. On its effective date, this permit shall supersede National Pollutant Discharge Elimination System (NPDES) Permit No. MI0057679 (expiring October 1, 2015).

This permit and the authorization to discharge shall expire at midnight on **October 1, 2020**. In order to receive authorization to discharge beyond the date of expiration, the permittee shall submit an application that contains such information, forms, and fees as are required by the Michigan Department of Environmental Quality (Department) by **April 4, 2020**.

**Issued:** September 26, 2018

Original signed by Christine Alexander
Christine Alexander, Manager
Permits Section
Water Resources Division

## PERMIT FEE REQUIREMENTS

In accordance with Section 324.3120 of the NREPA, the permittee shall make payment of an annual permit fee to the Department for each October 1 the permit is in effect regardless of occurrence of discharge. The permittee shall submit the fee in response to the Department's annual notice. The fee shall be postmarked by January 15 for notices mailed by December 1. The fee is due no later than 45 days after receiving the notice for notices mailed after December 1.

**Annual Permit Fee Classification:** Municipal Major, less than 10 MGD (Individual Permit)

In accordance with Section 324.3132 of the NREPA, the permittee shall make payment of an annual biosolids land application fee to the Department if the permittee land applies biosolids. In response to the Department's annual notice, the permittee shall submit the fee, which shall be postmarked no later than January 31 of each year.

## CONTACT INFORMATION

Unless specified otherwise, all contact with the Department required by this permit shall be made to the Grand Rapids District Office of the Water Resources Division. The Grand Rapids District Office is located at State Office Building, Fifth Floor, 350 Ottawa Ave NW, Unit 10, Grand Rapids, MI 49503-2341, Telephone: 616-356-0500, Fax: 616-356-0202.

## CONTESTED CASE INFORMATION

Any person who is aggrieved by this permit may file a sworn petition with the Michigan Administrative Hearing System within the Michigan Department of Licensing and Regulatory Affairs, c/o the Michigan Department of Environmental Quality, setting forth the conditions of the permit which are being challenged and specifying the grounds for the challenge. The Department of Licensing and Regulatory Affairs may reject any petition filed more than 60 days after issuance as being untimely.

## PART I

# Section A. Limitations and Monitoring Requirements

## 1. Final Effluent Limitations, Monitoring Point 001A

During the period beginning on the effective date of this permit and lasting until the expiration date of this permit, the permittee is authorized to discharge treated municipal wastewater from Monitoring Point 001A through Outfall 001. Outfall 001 discharges to the Grand River at Latitude 42.98056, Longitude -85.87500. Such discharge shall be limited and monitored by the permittee as specified below.

| | Maximum Limits for Quantity or Loading | | | | Maximum Limits for Quality or Concentration | | | | Monitoring | Sample |
|---|---|---|---|---|---|---|---|---|---|---|
| **Parameter** | **Monthly** | **7-Day** | **Daily** | **Units** | **Monthly** | **7-Day** | **Daily** | **Units** | **Frequency** | **Type** |
| Flow | (report) | --- | (report) | MGD | --- | | --- | --- | Daily | Report Total Daily Flow |
| Carbonaceous Biochemical Oxygen Demand ($CBOD_5$) | 500 | 800 | (report) | lbs/day | 25 | 40 | (report) | mg/l | 5x Weekly | 24-Hr Composite |
| Total Suspended Solids (TSS) | 600 | 900 | (report) | lbs/day | 30 | 45 | (report) | mg/l | 5x Weekly | 24-Hr Composite |
| Ammonia Nitrogen (as N) | | | | | | | | | | |
| May - September | --- | --- | --- | --- | (report) | --- | (report) | mg/l | Monthly | 24-Hr Composite |
| Total Phosphorus (as P) | 20 | --- | (report) | lbs/day | 1.0 | --- | (report) | mg/l | 5x Weekly | 24-Hr Composite |
| Fecal Coliform Bacteria | --- | --- | --- | --- | 200 | 400 | (report) | cts/100 ml | 5x Weekly | Grab |
| Total Residual Chlorine | --- | --- | --- | --- | --- | --- | 38 | µg/L | 5x Weekly | Grab |
| Total Mercury | | | | | | | | | | |
| Corrected | (report) | --- | (report) | lbs/day | (report) | --- | (report) | ng/l | Quarterly | Calculation |
| Uncorrected | --- | --- | --- | --- | --- | --- | (report) | ng/l | Quarterly | Grab |
| Field Duplicate | --- | --- | --- | --- | --- | --- | (report) | ng/l | Quarterly | Grab |
| Field Blank | --- | --- | --- | --- | --- | --- | (report) | ng/l | Quarterly | Preparation |
| Laboratory Method Blank | --- | --- | --- | --- | --- | --- | (report) | ng/l | Quarterly | Preparation |
| | | | | | **Minimum % Monthly** | | **Minimum % Daily** | | | |
| $CBOD_5$ Minimum % Removal | --- | --- | --- | --- | 85 | --- | (report) | % | Monthly | Calculation |
| TSS Minimum % Removal | --- | --- | --- | --- | 85 | --- | (report) | % | Monthly | Calculation |
| | | | | | **Minimum Daily** | | **Maximum Daily** | | | |
| pH | --- | --- | --- | --- | 6.5 | --- | 9.0 | S.U. | 5xWeekly | Grab |
| Dissolved Oxygen | --- | --- | --- | --- | 4.0 | --- | --- | mg/l | 5xWeekly | Grab |

The following design flow was used in determining the above limitations, but is not to be considered a limitation or actual capacity: 2.4 MGD.

a. Narrative Standard
The receiving water shall contain no turbidity, color, oil films, floating solids, foams, settleable solids, or deposits as a result of this discharge in unnatural quantities which are or may become injurious to any designated use.

**PART I**

## Section A. Limitations and Monitoring Requirements

b. Sampling Locations
Samples for $CBOD_5$, TSS, Ammonia Nitrogen, and Total Phosphorus shall be taken prior to disinfection. Samples for Fecal Coliform Bacteria, Total Residual Chlorine, Total Mercury, pH, and Dissolved Oxygen shall be taken after disinfection. The Department may approve alternate sampling locations that are demonstrated by the permittee to be representative of the effluent.

c. Quarterly Monitoring
Quarterly samples shall be taken during the months of January, April, July, and October. If the facility does not discharge during these months, the permittee shall sample the next discharge occurring during the period in question. If the facility does not discharge during the period in question, a sample is not required for that period. For any month in which a sample is not taken, the permittee shall enter "*G" on the Discharge Monitoring Report (DMR). (For purposes of reporting on the Daily tab of the DMR, the permittee shall enter “*G” on the first day of the month only).

d. Total Residual Chlorine (TRC)
Compliance with the TRC limit shall be determined on the basis of one or more grab samples. If more than one (1) sample per day is taken, the additional samples shall be collected in near equal intervals over at least eight (8) hours. The samples shall be analyzed immediately upon collection and the average reported as the daily concentration. Samples shall be analyzed in accordance with Part II.B.2. of this permit.

e. Percent Removal Requirements
These requirements shall be calculated based on the monthly (30-day) effluent $CBOD_5$ and TSS concentrations and the monthly influent concentrations for approximately the same period.

f. Total Mercury Testing and Additional Reporting Requirements
The analytical protocol for total mercury shall be in accordance with EPA Method 1631, Revision E, "Mercury in Water by Oxidation, Purge and Trap, and Cold Vapor Atomic Fluorescence Spectrometry." The quantification level for total mercury shall be 0.5 ng/l, unless a higher level is appropriate because of sample matrix interference. Justification for higher quantification levels shall be submitted to the Department within 30 days of such determination.

The use of clean technique sampling procedures is required unless the permittee can demonstrate to the Department that an alternate sampling procedure is representative of the discharge. Guidance for clean technique sampling is contained in EPA Method 1669, Sampling Ambient Water for Trace Metals at EPA Water Quality Criteria Levels (Sampling Guidance), EPA-821-R96-001, July 1996. Information and data documenting the permittee's sampling and analytical protocols and data acceptability shall be submitted to the Department upon request.

In order to demonstrate compliance with EPA Method 1631E and EPA Method 1669, the permittee shall report, on the daily sheet, the analytical results of all field blanks and field duplicates collected in conjunction with each sampling event, as well as laboratory method blanks when used for blank correction. The permittee shall collect at least one (1) field blank and at least one (1) field duplicate per sampling event. If more than ten (10) samples are collected during a sampling event, the permittee shall collect at least one (1) additional field blank AND field duplicate for every ten (10) samples collected. Only field blanks or laboratory method blanks may be used to calculate a concentration lower than the actual sample analytical results (i.e., a blank correction). Only one (1) blank (field OR laboratory method) may be used for blank correction of a given sample result, and only if the blank meets the quality control acceptance criteria. If blank correction is not performed on a given sample analytical result, the permittee shall report under "Total Mercury – Corrected" the same value reported under "Total Mercury – Uncorrected." The field duplicate is for quality control purposes only; its analytical result shall not be averaged with the sample result.

PART I

# Section A. Limitations and Monitoring Requirements

The Department will review the mercury monitoring data using the reasonable potential process described in R 323.1211 of the Michigan Administrative Code to determine if there is a reasonable potential for the Water Quality Standard of 1.3 ng/l of total mercury to be exceeded in the effluent. If it is determined that the effluent has a reasonable potential to exceed 1.3 ng/l of total mercury, upon written notification by the Department, the permittee shall resume the Pollutant Minimization Program for Total Mercury in accordance with the provisions of Part I.A.4. of this permit. If, at any time during the life of the permit, the final effluent concentration exceeds 5 ng/l, the permittee shall notify the Department at the time of its next regular monthly monitoring report and shall resume the Pollutant Minimization Program for Total Mercury contained in Part I.A.4. of this permit.

## 2. Quantification Levels and Analytical Methods for Selected Parameters

Quantification levels (QLs) are specified for selected parameters in the table below. These QLs shall be considered the maximum acceptable unless a higher QL is appropriate because of sample matrix interference. Justification for higher QLs shall be submitted to the Department within 30 days of such determination. Where necessary to help ensure that the QLs specified can be achieved, analytical methods may also be specified in the table below. The sampling procedures, preservation and handling, and analytical protocol for all monitoring conducted in compliance with this permit, including monitoring conducted to meet the requirements of the application for permit reissuance, shall be in accordance with the methods specified in the table below, or in accordance with Part II.B.2. of this permit if no method is specified in the table below, unless an alternate method is approved by the Department. With the exception of total mercury, all units are in ug/l. The table is continued on the following page:

| Parameter | QL | Units | Analytical Method |
|---|---|---|---|
| 1,2-Diphenylhydrazine (as Azobenzene) | 3.0 | ug/l | |
| 2,4,6-Trichlorophenol | 5.0 | ug/l | |
| 2,4-Dinitrophenol | 19 | ug/l | |
| 3,3'-Dichlorobenzidine | 1.5 | ug/l | EPA Method 605 |
| 4,4'-DDD | 0.05 | ug/l | EPA Method 608 |
| 4,4'-DDE | 0.01 | ug/l | EPA Method 608 |
| 4,4'-DDT | 0.01 | ug/l | EPA Method 608 |
| Acrylonitrile | 1.0 | ug/l | |
| Aldrin | 0.01 | ug/l | EPA Method 608 |
| Alpha-Hexachlorocyclohexane | 0.01 | ug/l | EPA Method 608 |
| Antimony, Total | 1 | ug/l | |
| Arsenic, Total | 1 | ug/l | |
| Barium, Total | 5 | ug/l | |
| Benzidine | 0.1 | ug/l | EPA Method 605 |
| Beryllium, Total | 1 | ug/l | |
| Beta-Hexachlorocyclohexane | 0.01 | ug/l | EPA Method 608 |
| Bis (2-Chloroethyl) Ether | 1.0 | ug/l | |
| Boron, Total | 20 | ug/l | |
| Cadmium, Total | 0.2 | ug/l | |
| Chlordane | 0.01 | ug/l | EPA Method 608 |
| Chromium, Hexavalent | 5 | ug/l | |
| Chromium, Total | 10 | ug/l | |
| Copper, Total | 1 | ug/l | |
| Cyanide, Available | 2 | ug/l | EPA Method OIA 1677 |
| Cyanide, Total | 5 | ug/l | |
| Delta-Hexachlorocyclohexane | 0.01 | ug/l | EPA Method 608 |
| Dieldrin | 0.01 | ug/l | EPA Method 608 |

## PART I

# Section A. Limitations and Monitoring Requirements

| Parameter | QL | Units | Analytical Method |
|---|---|---|---|
| Di-N-Butyl Phthalate | 9.0 | ug/l | |
| Endosulfan I | 0.01 | ug/l | EPA Method 608 |
| Endosulfan II | 0.01 | ug/l | EPA Method 608 |
| Endosulfan Sulfate | 0.01 | ug/l | EPA Method 608 |
| Endrin | 0.01 | ug/l | EPA Method 608 |
| Endrin Aldehyde | 0.01 | ug/l | EPA Method 608 |
| Fluoranthene | 1.0 | ug/l | |
| Heptachlor | 0.01 | ug/l | EPA Method 608 |
| Heptachlor Epoxide | 0.01 | ug/l | EPA Method 608 |
| Hexachlorobenzene | 0.01 | ug/l | EPA Method 612 |
| Hexachlorobutadiene | 0.01 | ug/l | EPA Method 612 |
| Hexachlorocyclopentadiene | 0.01 | ug/l | EPA Method 612 |
| Hexachloroethane | 5.0 | ug/l | |
| Lead, Total | 1 | ug/l | |
| Lindane | 0.01 | ug/l | EPA Method 608 |
| Lithium, Total | 10 | ug/l | |
| Mercury, Total | 0.5 | **ng/l** | EPA Method 1631E |
| Nickel, Total | 5 | ug/l | |
| PCB-1016 | 0.1 | ug/l | EPA Method 608 |
| PCB-1221 | 0.1 | ug/l | EPA Method 608 |
| PCB-1232 | 0.1 | ug/l | EPA Method 608 |
| PCB-1242 | 0.1 | ug/l | EPA Method 608 |
| PCB-1248 | 0.1 | ug/l | EPA Method 608 |
| PCB-1254 | 0.1 | ug/l | EPA Method 608 |
| PCB-1260 | 0.1 | ug/l | EPA Method 608 |
| Pentachlorophenol | 1.8 | ug/l | |
| Phenanthrene | 1.0 | ug/l | |
| Selenium, Total | 1.0 | ug/l | |
| Silver, Total | 0.5 | ug/l | |
| Strontium, Total | 1000 | ug/l | |
| Sulfides, Dissolved | 20 | ug/l | |
| Thallium, Total | 1 | ug/l | |
| Toxaphene | 0.1 | ug/l | EPA Method 608 |
| Vinyl Chloride | 0.25 | ug/l | |
| Zinc, Total | 10 | ug/l | |

**PART I**

# Section A. Limitations and Monitoring Requirements

## 3. Additional Monitoring Requirements

As a condition of this permit, the permittee shall monitor the discharge from monitoring point 001A for the constituents listed below. This monitoring is an application requirement of 40 CFR 122.21(j), effective December 2, 1999. Testing shall be conducted in December 2018, April 2019, August 2019, and January 2020. Grab samples shall be collected for total mercury, available cyanide, total phenols, and the Volatile Organic Compounds identified below. For all other parameters, 24-hour composite samples shall be collected.

Test species for whole effluent toxicity monitoring shall include fathead minnow **and** either *Daphnia magna, Daphnia pulex* or *Ceriodaphnia dubia*, for a total of four (4) tests on each species. Testing and reporting procedures shall follow procedures contained in EPA-821-R-02-012, "Methods for Measuring the Acute Toxicity of Effluents and Receiving Waters to Freshwater and Marine Organisms" (Fifth Edition). When the effluent ammonia nitrogen (as N) concentration is greater than 5 mg/l, the pH of the toxicity test shall be maintained at the pH of the effluent at the time of sample collection. Toxicity test data acceptability is contingent upon the validation of the test method by the testing laboratory. Such validation shall be submitted to the Department upon request.

The results of such additional monitoring shall be submitted with the application for reissuance (see the cover page of this permit for the application due date). The permittee shall notify the Department within 14 days of completing the monitoring for each month specified above in accordance with Part II.C.5. Additional reporting requirements are specified in Part II.C.11. The permittee shall report to the Department any whole effluent toxicity test results greater than 1.0 $TU_A$ or 1.0 $TU_C$ within five (5) days of becoming aware of the result. If, upon review of the analysis, it is determined that additional requirements are needed to protect the receiving waters in accordance with applicable water quality standards, the permit may then be modified by the Department in accordance with applicable laws and rules.

Whole Effluent Toxicity

| | |
|---|---|
| acute toxicity | chronic toxicity |

Hardness

calcium carbonate

Metals (Total Recoverable), Cyanide and Total Phenols

| | | | |
|---|---|---|---|
| antimony | arsenic | available cyanide | barium |
| beryllium | boron | cadmium | chromium |
| copper | lead | nickel | selenium |
| silver | thallium | zinc | |
| total phenolic compounds | | | |

Volatile Organic Compounds

| | | | |
|---|---|---|---|
| acrolein | acrylonitrile | benzene | bromoform |
| carbon tetrachloride | chlorobenzene | chlorodibromomethane | chloroethane |
| 2-chloroethylvinyl ether | chloroform | dichlorobromomethane | 1,1-dichloroethane |
| 1,2-dichloroethane | trans-1,2-dichloroethylene | 1,1-dichloroethylene | 1,2-dichloropropane |
| 1,3-dichloropropylene | ethylbenzene | methyl bromide | methyl chloride |
| methylene chloride | 1,1,2,2-tetrachloroethane | tetrachloroethylene | toluene |
| 1,1,1-trichloroethane | 1,1,2-trichloroethane | trichloroethylene | vinyl chloride |

Acid-Extractable Compounds

| | | | |
|---|---|---|---|
| 4-chloro-3-methylphenol | 2-chlorophenol | 2,4-dichlorophenol | 2,4-dimethylphenol |
| 4,6-dinitro-o-cresol | 2,4-dinitrophenol | 2-nitrophenol | 4-nitrophenol |
| Pentachlorophenol | phenol | 2,4,6-trichlorophenol | |

**PART I**

## Section A. Limitations and Monitoring Requirements

Base/Neutral Compounds

| | | | |
|---|---|---|---|
| acenaphthene | acenaphthylene | anthracene | benzidine |
| benzo(a)anthracene | benzo(a)pyrene | 3,4-benzofluoranthene | benzo(ghi)perylene |
| benzo(k)fluoranthene | bis(2-chloroethoxy)methane | bis(2-chloroethyl)ether | bis(2-chloroisopropyl)ether |
| bis(2-ethylhexyl)phthalate | 4-bromophenyl phenyl ether | butyl benzyl phthalate | 2-chloronaphthalene |
| 4-chlorophenyl phenyl ether | chrysene | di-n-butyl phthalate | di-n-octyl phthalate |
| dibenzo(a,h)anthracene | 1,2-dichlorobenzene | 1,3-dichlorobenzene | 1,4-dichlorobenzene |
| 3,3'-dichlorobenzidine | diethyl phthalate | dimethyl phthalate | 2,4-dinitrotoluene |
| 2,6-dinitrotoluene | 1,2-diphenylhydrazine | fluoranthene | fluorene |
| Hexachlorobenzene | hexachlorobutadiene | hexachlorocyclo-pentadiene | hexachloroethane |
| indeno(1,2,3-cd)pyrene | isophorone | naphthalene | nitrobenzene |
| n-nitrosodi-n-propylamine | n-nitrosodimethylamine | n-nitrosodiphenylamine | phenanthrene |
| pyrene | 1,2,4-trichlorobenzene | | |

## 4. Pollutant Minimization Program for Total Mercury

This condition is required, upon written notification by the Department or if the permittee notifies the Department that the final effluent concentration of total mercury has exceeded 5 ng/l, as specified in Part I.A.1. The goal of the Pollutant Minimization Program is to maintain the effluent concentration of total mercury at or below 1.3 ng/l. The permittee upon notification shall resume implementation of the Pollutant Minimization Program approved on April 1, 2006, and modifications thereto, to proceed towards the goal. The Pollutant Minimization Program shall include the following:

a. an annual review and semi-annual monitoring of potential sources of mercury entering the wastewater collection system;

b. a program for quarterly monitoring of influent and periodic monitoring of sludge for mercury; and

c. implementation of reasonable cost-effective control measures when sources of mercury are discovered. Factors to be considered include significance of sources, economic considerations, and technical and treatability considerations.

The Pollutant Minimization Program shall be implemented upon approval by the Department.

On or before March 31 of each year following approval of the Pollutant Minimization Program, the permittee shall submit a status report for the previous calendar year to the Department that includes 1) the monitoring results for the previous year, 2) an updated list of potential mercury sources, and 3) a summary of all actions taken to reduce or eliminate identified sources of mercury.

Any information generated as a result of the Pollutant Minimization Program set forth in this permit may be used to support a request to modify the approved program or to demonstrate that the Pollutant Minimization Program requirement has been completed satisfactorily.

A request for modification of the approved program and supporting documentation shall be submitted in writing to the Department for review and approval. The Department may approve modifications to the approved program (approval of a program modification does not require a permit modification), including a reduction in the frequency of the requirements under items a. and b.

This permit may be modified in accordance with applicable laws and rules to include additional mercury conditions and/or limitations as necessary.

**PART I**

# Section A. Limitations and Monitoring Requirements

## 5. Untreated or Partially Treated Sewage Discharge Reporting and Testing Requirements

In accordance with Section 324.3112a of the NREPA, if untreated sewage, including sanitary sewer overflows (SSO) and combined sewer overflows (CSO), or partially treated sewage is directly or indirectly discharged from a sewer system onto land or into the waters of the state, the entity responsible for the sewer system shall immediately, but not more than 24 hours after the discharge begins, notify, by telephone, the Department, local health departments, a daily newspaper of general circulation in the county in which the permittee is located, and a daily newspaper of general circulation in the county or counties in which the municipalities whose waters may be affected by the discharge are located that the discharge is occurring.

The permittee shall also annually contact municipalities, including the superintendent of a public drinking water supply with potentially affected intakes, whose waters may be affected by the permittee's discharge of combined sewage, and if those municipalities wish to be notified in the same manner as specified above, the permittee shall provide such notification. Such notification shall also include a daily newspaper in the county of the affected municipality.

At the conclusion of the discharge, written notification shall be submitted in accordance with and on the "Report of Discharge Form" available via the internet at: http://www.deq.state.mi.us/csosso/ , or, alternatively for combined sewer overflow discharges, in accordance with notification procedures approved by the Department.

In addition, in accordance with Section 324.3112a of the NREPA, each time a discharge of untreated sewage or partially treated sewage occurs, the permittee shall test the affected waters for *Escherichia coli* to assess the risk to the public health as a result of the discharge and shall provide the test results to the affected local county health departments and to the Department. The testing shall be done at locations specified by each affected local county health department but shall not exceed 10 tests for each separate discharge event. The affected local county health department may waive this testing requirement, if it determines that such testing is not needed to assess the risk to the public health as a result of the discharge event. The results of this testing shall be submitted with the written notification required above, or, if the results are not yet available, submit them as soon as they become available. This testing is not required, if the testing has been waived by the local health department, or if the discharge(s) did not affect surface waters.

Permittees accepting sanitary or municipal sewage from other sewage collection systems are encouraged to notify the owners of those systems of the above reporting and testing requirements.

## 6. Facility Contact

The "Facility Contact" was specified in the application. The permittee may replace the facility contact at any time, and shall notify the Department in writing within 10 days after replacement (including the name, address and telephone number of the new facility contact).

a. The facility contact shall be (or a duly authorized representative of this person):
   - for a corporation, a principal executive officer of at least the level of vice president; or a designated representative if the representative is responsible for the overall operation of the facility from which the discharge originates, as described in the permit application or other NPDES form,
   - for a partnership, a general partner,
   - for a sole proprietorship, the proprietor, or
   - for a municipal, state, or other public facility, either a principal executive officer, the mayor, village president, city or village manager or other duly authorized employee.

b. A person is a duly authorized representative only if:
- the authorization is made in writing to the Department by a person described in paragraph a. of this section; and
- the authorization specifies either an individual or a position having responsibility for the overall operation of the regulated facility or activity such as the position of plant manager, operator of a well or a well field, superintendent, position of equivalent responsibility, or an individual or position having overall responsibility for environmental matters for the facility (a duly authorized representative may thus be either a named individual or any individual occupying a named position).

Nothing in this section releases the permittee from properly submitting reports and forms as required by law.

## 7. Monthly Operating Reports

Part 41 of Act 451 of 1994 as amended, specifically Section 324.4106 and associated R 299.2953, requires that the permittee file with the Department, on forms prescribed by the Department, operating reports showing the effectiveness of the treatment facility operation and the quantity and quality of liquid wastes discharged into waters of the state.

Within 30 days of the effective date of this permit, the permittee shall submit to the Department a revised treatment facility monitoring program to address monitoring requirement changes reflected in this permit, or submit justification explaining why monitoring requirement changes reflected in this permit do not necessitate revisions to the treatment facility monitoring program. The permittee shall implement the revised treatment facility monitoring program upon approval from the Department. Applicable forms and guidance are available on the Department's web site at http://www.michigan.gov/deq/0,1607,7-135-3313_44117---,00.html. The permittee may use alternate forms if they are consistent with the approved treatment facility monitoring program. Unless the Department provides written notification to the permittee that monthly submittal of operating reports is required, operating reports that result from implementation of the approved treatment facility monitoring program shall be maintained on site for a minimum of three (3) years and shall be made available to the Department for review upon request.

## 8. Asset Management

The permittee shall at all times properly operate and maintain all facilities (i.e., the sewer system and treatment works as defined in Part 41 of the NREPA), and control systems installed or used by the permittee to operate the sewer system and treatment works and achieve and maintain compliance with the conditions of this permit (also see Part II.D.3 of this permit). The requirements of an Asset Management Program function to achieve the goals of effective performance, adequate funding, and adequate operator staffing and training. Asset management is a planning process for ensuring that optimum value is gained for each asset and that financial resources are available to rehabilitate and replace those assets when necessary. Asset management is centered on a framework of five (5) core elements: the current state of the assets; the required sustainable level of service; the assets critical to sustained performance; the minimum life-cycle costs; and the best long-term funding strategy.

a. Asset Management Program Requirements
On or before July 1, 2019, the permittee shall submit to the Department an Asset Management Plan for review and approval. An approvable Asset Management Plan shall contain a schedule for the development and implementation of an Asset Management Program that meets the requirements outlined below in 1) – 4). A copy of any Asset Management Program requirements already completed by the permittee should be submitted as part of the Asset Management Plan. Upon approval by the Department the permittee shall implement the Asset Management Plan. (The permittee may choose to include the Operation and Maintenance Manual required under Part II.C.14. of this permit as part of their Asset Management Program).

**PART I**

## Section A. Limitations and Monitoring Requirements

1) *Maintenance Staff.* The permittee shall provide an adequate staff to carry out the operation, maintenance, repair, and testing functions required to ensure compliance with the terms and conditions of this permit. The level of staffing needed shall be determined by taking into account the work involved in operating the sewer system and treatment works, planning for and conducting maintenance, and complying with this permit.

2) *Collection System Map.* The permittee shall complete a map of the sewer collection system it owns and operates. The map shall be of sufficient detail and at a scale to allow easy interpretation. The collection system information shown on the map shall be based on current conditions and shall be kept up-to-date and available for review by the Department. **Note: Items below referencing combined sewer systems are not applicable to separate sewer systems.** Such map(s) shall include but not be limited to the following:

a) all sanitary sewer lines and related manholes;

b) all combined sewer lines, related manholes, catch basins and CSO regulators;

c) all known or suspected connections between the sanitary sewer or combined sewer and storm drain systems;

d) all outfalls, including the treatment plant outfall(s), combined sewer treatment facility outfalls, untreated CSOs, and any known SSOs;

e) all pump stations and force mains;

f) the wastewater treatment facility(ies), including all treatment processes;

g) all surface waters (labeled);

h) other major appurtenances such as inverted siphons and air release valves;

i) a numbering system which uniquely identifies manholes, catch basins, overflow points, regulators and outfalls;

j) the scale and a north arrow;

k) the pipe diameter, date of installation, type of material, distance between manholes, and the direction of flow; and

l) the manhole interior material, rim elevation (optional), and invert elevations.

3) *Inventory and assessment of fixed assets.* The permittee shall complete an inventory and assessment of operations-related fixed assets. Fixed assets are assets that are normally stationary (e.g., pumps, blowers, and buildings). The inventory and assessment shall be based on current conditions and shall be kept up-to-date and available for review by the Department.

a) The fixed asset inventory shall include the following:

(1) a brief description of the fixed asset, its design capacity (e.g., pump: 120 gallons per minute), its level of redundancy, and its tag number if applicable;

(2) the location of the fixed asset;

(3) the year the fixed asset was installed;

(4) the present condition of the fixed asset (e.g., excellent, good, fair, poor); and

**PART I**

## Section A. Limitations and Monitoring Requirements

(5) the current fixed asset (replacement) cost in dollars for year specified in accordance with approved schedules;

b) The fixed asset assessment shall include a "Business Risk Evaluation" that combines the probability of failure of the fixed asset and the criticality of the fixed asset, as follows:

(1) Rate the probability of failure of the fixed asset on a scale of 1-5 (low to high) using criteria such as maintenance history, failure history, and remaining percentage of useful life (or years remaining);

(2) Rate the criticality of the fixed asset on a scale of 1-5 (low to high) based on the consequence of failure versus the desired level of service for the facility; and

(3) Compute the Business Risk Factor of the fixed asset by multiplying the failure rating from (1) by the criticality rating from (2).

4) *Operation, Maintenance & Replacement (OM&R) Budget and Rate Sufficiency for the Sewer System and Treatment Works.* The permittee shall complete an assessment of its user rates and replacement fund, including the following:

a) beginning and end dates of fiscal year;

b) name of the department, committee, board, or other organization that sets rates for the operation of the sewer system and treatment works;

c) amount in the permittee's replacement fund in dollars for year specified in accordance with approved schedules;

d) replacement fund strategy of all assets with a useful life of 20 years or less;

e) expenditures for maintenance, corrective action and capital improvement taken during the fiscal year;

f) OM&R budget for the fiscal year; and

g) rate calculation demonstrating sufficient revenues to cover OM&R expenses. If the rate calculation shows there are insufficient revenues to cover OM&R expenses, the permittee shall document, within three (3) fiscal years after submittal of the Asset Management Plan, that there is at least one rate adjustment that reduces the revenue gap by at least 10 percent. The permittee may prepare and submit an alternate plan, subject to Department approval, for addressing the revenue gap. The ultimate goal of the Asset Management Program is to ensure sufficient revenues to cover OM&R expenses.

b. Annual Reporting

The permittee shall develop a written report that summarizes asset management activities completed during the previous year and planned for the upcoming year. The written report shall be submitted to the Department on or before July 1 of each year. The written report shall include:

1) a description of the staffing levels maintained during the year;

2) a description of inspections and maintenance activities conducted and corrective actions taken during the previous year;

3) expenditures for collection system maintenance activities, treatment works maintenance activities, corrective actions, and capital improvement during the previous year;

**PART I**

## Section A. Limitations and Monitoring Requirements

4) a summary of assets/areas identified for inspection/action (including capital improvement) in the upcoming year based on the five (5) core elements and the Business Risk Factors;

5) a maintenance budget and capital improvement budget for the upcoming year that take into account implementation of an effective Asset Management Program that meets the five (5) core elements;

6) an updated asset inventory based on the original submission; and

7) an updated OM&R budget with an updated rate schedule that includes the amount of insufficient revenues, if any

## 9. Discharge Monitoring Report – Quality Assurance Study Program

The permittee shall participate in the Discharge Monitoring Report – Quality Assurance (DMR-QA) Study Program. The purpose of the DMR-QA Study Program is to annually evaluate the proficiency of all in-house and/or contract laboratory(ies) that perform, on behalf of the facility authorized to discharge under this permit, the analytical testing required under this permit. In accordance with Section 308 of the Clean Water Act (33 U.S.C. § 1318); and R 323.2138 and R 323.2154 of Part 21, Wastewater Discharge Permits, promulgated under Part 31 of the NREPA, participation in the DMR-QA Study Program is required for all major facilities, and for minor facilities selected for participation by the Department.

Annually and in accordance with DMR-QA Study Program requirements and submittal due dates, the permittee shall submit to the Michigan DMR-QA Study Program state coordinator all documentation required by the DMR-QA Study. DMR-QA Study Program participation is required only for the analytes required under this permit and only when those analytes are also identified in the DMR-QA Study.

If the permitted facility's status as a major facility should change, participation in the DMR-QA Study Program may be reevaluated. Questions concerning participation in the DMR-QA Study Program should be directed to the Michigan DMR-QA Study Program state coordinator.

All forms and instructions required for participation in the DMR-QA Study Program, including submittal due dates and state coordinator contact information, can be found at http://www.epa.gov/compliance/discharge-monitoring-report-quality-assurance-study-program.

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## Section B. Storm Water Pollution Prevention

Section B. Storm Water Pollution Prevention is not required for this permit.

**PART I**

## Section C. Industrial Waste Pretreatment Program

### 1. Michigan Industrial Pretreatment Program

a. The permittee shall implement the Michigan Industrial Pretreatment Program (MIPP) approved on September 19, 1994, and any subsequent modifications approved up to the issuance of this permit.

b. The permittee shall comply with R 323.2301 through R 323.2317 of the Michigan Administrative Code (Part 23 Rules) and the approved MIPP.

c. The permittee shall have the legal authority and necessary interjurisdictional agreements that provide the basis for the implementation and enforcement of the approved MIPP throughout the service area. The legal authority and necessary interjurisdictional agreements shall include, at a minimum, the authority to carry out the activities specified in R 323.2306(a).

d. The permittee shall develop procedures which describe, in sufficient detail, program commitments which enable implementation of the approved MIPP and the Part 23 Rules in accordance with R 323.2306(c).

e. The permittee shall establish an interjurisdictional agreement (or comparable document) with all tributary governmental jurisdictions. Each interjurisdictional agreement shall contain, at a minimum, the following:

1) identification of the agency responsible for the implementation and enforcement of the approved MIPP within the tributary governmental jurisdiction's boundaries; and

2) the provision of the legal authority which provides the basis for the implementation and enforcement of the approved MIPP within the tributary governmental jurisdiction's boundaries.

f. The permittee shall prohibit discharges that:

1) cause, in whole or in part, the permittee's failure to comply with any condition of this permit or the NREPA;

2) restrict, in whole or in part, the permittee's management of biosolids;

3) cause, in whole or in part, operational problems at the treatment facility or in its collection system;

4) violate any of the general or specific prohibitions identified in R 323.2303(1) and (2);

5) violate categorical standards identified in R 323.2311; and

6) violate local limits established in accordance with R 323.2303(4).

g. The permittee shall maintain a list of its nondomestic users that meet the criteria of a significant industrial user as identified in R 323.2302(cc).

h. The permittee shall develop an enforcement response plan which describes, in sufficient detail, program commitments which will enable the enforcement of the approved MIPP and the Part 23 Rules in accordance with R 323.2306(g).

i. The Department may require modifications to the approved MIPP which are necessary to ensure compliance with the Part 23 Rules in accordance with R 323.2309.

j. The permittee shall not implement changes or modifications to the approved MIPP without notification to the Department.

**PART I**

## Section C. Industrial Waste Pretreatment Program

k. The permittee shall maintain an adequate revenue structure and staffing level for effective implementation of the approved MIPP.

l. The permittee shall develop and maintain, for a minimum of three (3) years, all records and information necessary to determine nondomestic user compliance with the Part 23 Rules and the approved MIPP. This period of retention shall be extended during the course of any unresolved enforcement action or litigation regarding a nondomestic user or when requested by the Department or the United States Environmental Protection Agency. All of the aforementioned records and information shall be made available upon request for inspection and copying by the Department and the United States Environmental Protection Agency.

m. The permittee shall evaluate the approved MIPP for compliance with the Part 23 Rules and the prohibitions set forth in item f. above. Based upon this evaluation, the permittee shall propose to the Department all necessary changes or modifications to the approved MIPP no later than the next Industrial Pretreatment Program Annual Report due date (see item o. below).

n. The permittee shall develop and enforce local limits to implement the prohibitions set forth in item f. above. Local limits shall be based upon data representative of actual conditions demonstrated in a maximum allowable headworks loading analysis.

o. On or before April 1st of each year, the permittee shall submit to the Department, as required by R 323.2310(8), an Industrial Pretreatment Program Annual Report on the status of program implementation and enforcement activities. The reporting period shall begin on January 1st and end on December 31st. At a minimum, the Industrial Pretreatment Program Annual Report shall include:

1) the Pretreatment Program Reports data identified in Appendix A to 40 CFR Part 127 – NPDES Electronic Reporting;

2) a summary of changes to the approved MIPP that have not been previously reported to the Department;

3) a summary of results of all the sampling and analyses performed of the wastewater treatment plant's influent, effluent, and biosolids conducted in accordance with approved methods during the reporting period. The summary shall include the monthly average, daily maximum, quantification level, and number of samples analyzed for each pollutant. At a minimum, the results of analyses for all locally limited parameters for at least one monitoring event that tests influent, effluent and biosolids during the reporting period shall be submitted with each report, unless otherwise required by the Department. Sample collection shall be at intervals sufficient to provide pollutant removal rates, unless the pollutant is not measurable; and

4) any other relevant information requested by the Department.

**PART I**

# Section D. Residuals Management Program

## 1. Residuals Management Program for Land Application of Biosolids

The permittee is authorized to land-apply bulk biosolids or prepare bulk biosolids for land application in accordance with the permittee's approved Residuals Management Program (RMP) approved on October 20, 2006, and approved modifications thereto, in accordance with the requirements established in R 323.2401 through R 323.2418 of the Michigan Administrative Code (Part 24 Rules). The approved RMP, and any approved modifications thereto, are enforceable requirements of this permit. Incineration, landfilling and other residual disposal activities shall be conducted in accordance with Part II.D.7. of this permit. The Part 24 Rules can be obtained via the internet (http://www.michigan.gov/deq/ and on the left side of the screen click on Water, Biosolids & Industrial Pretreatment, Biosolids then click on Biosolids Laws and Rules Information which is under the Laws & Rules banner in the center of the screen).

a. Annual Report
On or before October 30 of each year, the permittee shall submit an annual report to the Department for the previous fiscal year of October 1 through September 30. The report shall be submitted electronically via the Department's MiWaters system at https://miwaters.deq.state.mi.us. At a minimum, the report shall contain:

1) a certification that current residuals management practices are in accordance with the approved RMP, or a proposal for modification to the approved RMP; and

2) a completed Biosolids Annual Report Form, available at https://miwaters.deq.state.mi.us.

b. Modifications to the Approved RMP
Prior to implementation of modifications to the RMP, the permittee shall submit proposed modifications to the Department for approval. The approved modification shall become effective upon the date of approval. Upon written notification, the Department may impose additional requirements and/or limitations to the approved RMP as necessary to protect public health and the environment from any adverse effect of a pollutant in the biosolids.

c. Record Keeping
Records required by the Part 24 Rules shall be kept for a minimum of five years. However, the records documenting cumulative loading for sites subject to cumulative pollutant loading rates shall be kept as long as the site receives biosolids.

d. Contact Information
RMP-related submittals shall be made to the Department.

## PART II

Part II may include terms and /or conditions not applicable to discharges covered under this permit.

# Section A. Definitions

**Acute toxic unit ($TU_A$)** means $100/LC_{50}$ where the $LC_{50}$ is determined from a whole effluent toxicity (WET) test which produces a result that is statistically or graphically estimated to be lethal to 50% of the test organisms.

**Annual monitoring frequency** refers to a calendar year beginning on January 1 and ending on December 31. When required by this permit, an analytical result, reading, value or observation shall be reported for that period if a discharge occurs during that period.

**Authorized public agency** means a state, local, or county agency that is designated pursuant to the provisions of section 9110 of Part 91 of the NREPA to implement soil erosion and sedimentation control requirements with regard to construction activities undertaken by that agency.

**Best management practices (BMPs)** means structural devices or nonstructural practices that are designed to prevent pollutants from entering into storm water, to direct the flow of storm water, or to treat polluted storm water.

**Bioaccumulative chemical of concern (BCC)** means a chemical which, upon entering the surface waters, by itself or as its toxic transformation product, accumulates in aquatic organisms by a human health bioaccumulation factor of more than 1000 after considering metabolism and other physiochemical properties that might enhance or inhibit bioaccumulation. The human health bioaccumulation factor shall be derived according to R 323.1057(5). Chemicals with half-lives of less than 8 weeks in the water column, sediment, and biota are not BCCs. The minimum bioaccumulation concentration factor (BAF) information needed to define an organic chemical as a BCC is either a field-measured BAF or a BAF derived using the biota-sediment accumulation factor (BSAF) methodology. The minimum BAF information needed to define an inorganic chemical as a BCC, including an organometal, is either a field-measured BAF or a laboratory-measured bioconcentration factor (BCF). The BCCs to which these rules apply are identified in Table 5 of R 323.1057 of the Water Quality Standards.

**Biosolids** are the solid, semisolid, or liquid residues generated during the treatment of sanitary sewage or domestic sewage in a treatment works. This includes, but is not limited to, scum or solids removed in primary, secondary, or advanced wastewater treatment processes and a derivative of the removed scum or solids.

**Bulk biosolids** means biosolids that are not sold or given away in a bag or other container for application to a lawn or home garden.

**Certificate of Coverage (COC)** is a document, issued by the Department, which authorizes a discharge under a general permit.

**Chronic toxic unit ($TU_C$ )** means $100/MATC$ or $100/IC_{25}$, where the maximum acceptable toxicant concentration (MATC) and $IC_{25}$ are expressed as a percent effluent in the test medium.

**Class B biosolids** refers to material that has met the Class B pathogen reduction requirements or equivalent treatment by a Process to Significantly Reduce Pathogens (PSRP) in accordance with the Part 24 Rules. Processes include aerobic digestion, composting, anaerobic digestion, lime stabilization and air drying.

**Combined sewer system** is a sewer system in which storm water runoff is combined with sanitary wastes.

**PART II**

# Section A. Definitions

**Daily concentration** is the sum of the concentrations of the individual samples of a parameter divided by the number of samples taken during any calendar day. The daily concentration will be used to determine compliance with any maximum and minimum daily concentration limitations (except for pH and dissolved oxygen). When required by the permit, report the maximum calculated daily concentration for the month in the "MAXIMUM" column under "QUALITY OR CONCENTRATION" on the Discharge Monitoring Reports (DMRs).

For pH, report the maximum value of any *individual* sample taken during the month in the "MAXIMUM" column under "QUALITY OR CONCENTRATION" on the DMRs and the minimum value of any *individual* sample taken during the month in the "MINIMUM" column under "QUALITY OR CONCENTRATION" on the DMRs. For dissolved oxygen, report the minimum concentration of any *individual* sample in the "MINIMUM" column under "QUALITY OR CONCENTRATION" on the DMRs.

**Daily loading** is the total discharge by weight of a parameter discharged during any calendar day. This value is calculated by multiplying the daily concentration by the total daily flow and by the appropriate conversion factor. The daily loading will be used to determine compliance with any maximum daily loading limitations. When required by the permit, report the maximum calculated daily loading for the month in the "MAXIMUM" column under "QUANTITY OR LOADING" on the DMRs.

**Daily monitoring frequency** refers to a 24-hour day. When required by this permit, an analytical result, reading, value or observation shall be reported for that period if a discharge occurs during that period.

**Department** means the Michigan Department of Environmental Quality.

**Detection level** means the lowest concentration or amount of the target analyte that can be determined to be different from zero by a single measurement at a stated level of probability.

**Discharge** means the addition of any waste, waste effluent, wastewater, pollutant, or any combination thereof to any surface water of the state.

**$EC_{50}$** means a statistically or graphically estimated concentration that is expected to cause 1 or more specified effects in 50% of a group of organisms under specified conditions.

**Fecal coliform bacteria monthly**
FOR WWSLs THAT COLLECT AND STORE WASTEWATER AND ARE AUTHORIZED TO DISCHARGE ONLY IN THE SPRING AND/OR FALL ON AN INTERMITTENT BASIS – Fecal coliform bacteria monthly is the geometric mean of all daily concentrations determined during a discharge event. Days on which no daily concentration is determined shall not be used to determine the calculated monthly value. The calculated monthly value will be used to determine compliance with the maximum monthly fecal coliform bacteria limitations. When required by the permit, report the calculated monthly value in the "AVERAGE" column under "QUALITY OR CONCENTRATION" on the DMR. If the period in which the discharge event occurred was partially in each of two months, the calculated monthly value shall be reported on the DMR of the month in which the last day of discharge occurred.

FOR ALL OTHER DISCHARGES – Fecal coliform bacteria monthly is the geometric mean of all daily concentrations determined during a reporting month. Days on which no daily concentration is determined shall not be used to determine the calculated monthly value. The calculated monthly value will be used to determine compliance with the maximum monthly fecal coliform bacteria limitations. When required by the permit, report the calculated monthly value in the "AVERAGE" column under "QUALITY OR CONCENTRATION" on the DMR.

**PART II**

# Section A. Definitions

**Fecal coliform bacteria 7-day**
FOR WWSLs THAT COLLECT AND STORE WASTEWATER AND ARE AUTHORIZED TO DISCHARGE ONLY IN THE SPRING AND/OR FALL ON AN INTERMITTENT BASIS – Fecal coliform bacteria 7-day is the geometric mean of the daily concentrations determined during any 7 consecutive days of discharge during a discharge event. If the number of daily concentrations determined during the discharge event is less than 7 days, the number of actual daily concentrations determined shall be used for the calculation. Days on which no daily concentration is determined shall not be used to determine the value. The calculated 7-day value will be used to determine compliance with the maximum 7-day fecal coliform bacteria limitations. When required by the permit, report the maximum calculated 7-day geometric mean value for the month in the "MAXIMUM" column under "QUALITY OR CONCENTRATION" on the DMRs. If the 7-day period was partially in each of two months, the value shall be reported on the DMR of the month in which the last day of discharge occurred.

FOR ALL OTHER DISCHARGES – Fecal coliform bacteria 7-day is the geometric mean of the daily concentrations determined during any 7 consecutive days in a reporting month. If the number of daily concentrations determined is less than 7, the actual number of daily concentrations determined shall be used for the calculation. Days on which no daily concentration is determined shall not be used to determine the value. The calculated 7-day value will be used to determine compliance with the maximum 7-day fecal coliform bacteria limitations. When required by the permit, report the maximum calculated 7-day geometric mean for the month in the "MAXIMUM" column under "QUALITY OR CONCENTRATION" on the DMRs. The first calculation shall be made on day 7 of the reporting month, and the last calculation shall be made on the last day of the reporting month.

**Flow-proportioned sample** is a composite sample with the sample volume proportional to the effluent flow.

**General permit** means a National Pollutant Discharge Elimination System permit issued authorizing a category of similar discharges.

**Geometric mean** is the average of the logarithmic values of a base 10 data set, converted back to a base 10 number.

**Grab sample** is a single sample taken at neither a set time nor flow.

**$IC_{25}$** means the toxicant concentration that would cause a 25% reduction in a nonquantal biological measurement for the test population.

**Illicit connection** means a physical connection to a municipal separate storm sewer system that primarily conveys non-storm water discharges other than uncontaminated groundwater into the storm sewer; or a physical connection not authorized or permitted by the local authority, where a local authority requires authorization or a permit for physical connections.

**Illicit discharge** means any discharge to, or seepage into, a municipal separate storm sewer system that is not composed entirely of storm water or uncontaminated groundwater. Illicit discharges include non-storm water discharges through pipes or other physical connections; dumping of motor vehicle fluids, household hazardous wastes, domestic animal wastes, or litter; collection and intentional dumping of grass clippings or leaf litter; or unauthorized discharges of sewage, industrial waste, restaurant wastes, or any other non-storm water waste directly into a separate storm sewer.

**Individual permit** means a site-specific NPDES permit.

**Inlet** means a catch basin, roof drain, conduit, drain tile, retention pond riser pipe, sump pump, or other point where storm water or wastewater enters into a closed conveyance system prior to discharge off site or into waters of the state.

**PART II**

## Section A. Definitions

**Interference** is a discharge which, alone or in conjunction with a discharge or discharges from other sources, both: 1) inhibits or disrupts the POTW, its treatment processes or operations, or its sludge processes, use or disposal; and 2) therefore, is a cause of a violation of any requirement of the POTW's NPDES permit (including an increase in the magnitude or duration of a violation) or, of the prevention of sewage sludge use or disposal in compliance with the following statutory provisions and regulations or permits issued thereunder (or more stringent state or local regulations): Section 405 of the Clean Water Act, the Solid Waste Disposal Act (SWDA) (including Title II, more commonly referred to as the Resource Conservation and Recovery Act (RCRA), and including state regulations contained in any state sludge management plan prepared pursuant to Subtitle D of the SWDA), the Clean Air Act, the Toxic Substances Control Act, and the Marine Protection, Research and Sanctuaries Act. [This definition does not apply to sample matrix interference].

**Land application** means spraying or spreading biosolids or a biosolids derivative onto the land surface, injecting below the land surface, or incorporating into the soil so that the biosolids or biosolids derivative can either condition the soil or fertilize crops or vegetation grown in the soil.

**$LC_{50}$** means a statistically or graphically estimated concentration that is expected to be lethal to 50% of a group of organisms under specified conditions.

**Maximum acceptable toxicant concentration (MATC)** means the concentration obtained by calculating the geometric mean of the lower and upper chronic limits from a chronic test. A lower chronic limit is the highest tested concentration that did not cause the occurrence of a specific adverse effect. An upper chronic limit is the lowest tested concentration which did cause the occurrence of a specific adverse effect and above which all tested concentrations caused such an occurrence.

**Maximum extent practicable** means implementation of best management practices by a public body to comply with an approved storm water management program as required by a national permit for a municipal separate storm sewer system, in a manner that is environmentally beneficial, technically feasible, and within the public body's legal authority.

**MGD** means million gallons per day.

**Monthly concentration** is the sum of the daily concentrations determined during a reporting period divided by the number of daily concentrations determined. The calculated monthly concentration will be used to determine compliance with any maximum monthly concentration limitations. Days with no discharge shall not be used to determine the value. When required by the permit, report the calculated monthly concentration in the "AVERAGE" column under "QUALITY OR CONCENTRATION" on the DMR.

For minimum percent removal requirements, the monthly influent concentration and the monthly effluent concentration shall be determined. The calculated monthly percent removal, which is equal to 100 times the quantity [1 minus the quantity (monthly effluent concentration divided by the monthly influent concentration)], shall be reported in the "MINIMUM" column under "QUALITY OR CONCENTRATION" on the DMRs.

**Monthly loading** is the sum of the daily loadings of a parameter divided by the number of daily loadings determined during a reporting period. The calculated monthly loading will be used to determine compliance with any maximum monthly loading limitations. Days with no discharge shall not be used to determine the value. When required by the permit, report the calculated monthly loading in the "AVERAGE" column under "QUANTITY OR LOADING" on the DMR.

**Monthly monitoring frequency** refers to a calendar month. When required by this permit, an analytical result, reading, value or observation shall be reported for that period if a discharge occurs during that period.

**Municipal separate storm sewer** means a conveyance or system of conveyances designed or used for collecting or conveying storm water which is not a combined sewer and which is not part of a publicly-owned treatment works as defined in the Code of Federal Regulations at 40 CFR 122.2.

PART II

## Section A. Definitions

**Municipal separate storm sewer system (MS4)** means all separate storm sewers that are owned or operated by the United States, a state, city, village, township, county, district, association, or other public body created by or pursuant to state law, having jurisdiction over disposal of sewage, industrial wastes, storm water, or other wastes, including special districts under state law, such as a sewer district, flood control district, or drainage district, or similar entity, or a designated or approved management agency under Section 208 of the Federal Act that discharges to the waters of the state. This term includes systems similar to separate storm sewer systems in municipalities, such as systems at military bases, large hospital or prison complexes, and highways and other thoroughfares. The term does not include separate storm sewers in very discrete areas, such as individual buildings.

**National Pretreatment Standards** are the regulations promulgated by or to be promulgated by the Federal Environmental Protection Agency pursuant to Section 307(b) and (c) of the Federal Act. The standards establish nationwide limits for specific industrial categories for discharge to a POTW.

**No observed adverse effect level (NOAEL)** means the highest tested dose or concentration of a substance which results in no observed adverse effect in exposed test organisms where higher doses or concentrations result in an adverse effect.

**Noncontact cooling water** is water used for cooling which does not come into direct contact with any raw material, intermediate product, by-product, waste product or finished product.

**Nondomestic user** is any discharger to a POTW that discharges wastes other than or in addition to water-carried wastes from toilet, kitchen, laundry, bathing or other facilities used for household purposes.

**Outfall** is the location at which a point source discharge enters the surface waters of the state.

**Part 91 agency** means an agency that is designated by a county board of commissioners pursuant to the provisions of section 9105 of Part 91 of the NREPA; an agency that is designated by a city, village, or township in accordance with the provisions of section 9106 of Part 91 of the NREPA; or the Department for soil erosion and sedimentation activities under Part 615, Part 631, or Part 632 pursuant to the provisions of section 9115 of Part 91 of the NREPA.

**Part 91 permit** means a soil erosion and sedimentation control permit issued by a Part 91 agency pursuant to the provisions of Part 91 of the NREPA.

**Partially treated sewage** is any sewage, sewage and storm water, or sewage and wastewater, from domestic or industrial sources that is treated to a level less than that required by the permittee's National Pollutant Discharge Elimination System permit, or that is not treated to national secondary treatment standards for wastewater, including discharges to surface waters from retention treatment facilities.

**Point of discharge** is the location of a point source discharge where storm water is discharged directly into a separate storm sewer system.

**Point source discharge** means a discharge from any discernible, confined, discrete conveyance, including but not limited to any pipe, ditch, channel, tunnel, conduit, well, discrete fissure, container, or rolling stock. Changing the surface of land or establishing grading patterns on land will result in a point source discharge where the runoff from the site is ultimately discharged to waters of the state.

**Polluting material** means any material, in solid or liquid form, identified as a polluting material under the Part 5 Rules (R 324.2001 through R 324.2009 of the Michigan Administrative Code).

**POTW** is a publicly owned treatment work.

**Pretreatment** is reducing the amount of pollutants, eliminating pollutants, or altering the nature of pollutant properties to a less harmful state prior to discharge into a public sewer. The reduction or alteration can be by physical, chemical, or biological processes, process changes, or by other means. Dilution is not considered pretreatment unless expressly authorized by an applicable National Pretreatment Standard for a particular industrial category.

## PART II

# Section A. Definitions

**Public** (as used in the MS4 individual permit) means all persons who potentially could affect the authorized storm water discharges, including, but not limited to, residents, visitors to the area, public employees, businesses, industries, and construction contractors and developers.

**Public body** means the United States; the state of Michigan; a city, village, township, county, school district, public college or university, or single-purpose governmental agency; or any other body which is created by federal or state statute or law.

**Qualified Personnel** means an individual who meets qualifications acceptable to the Department and who is authorized by an Industrial Storm Water Certified Operator to collect the storm water sample.

**Qualifying storm event** means a storm event causing greater than 0.1 inch of rainfall and occurring at least 72 hours after the previous measurable storm event that also caused greater than 0.1 inch of rainfall. Upon request, the Department may approve an alternate definition meeting the condition of a qualifying storm event.

**Quantification level** means the measurement of the concentration of a contaminant obtained by using a specified laboratory procedure calculated at a specified concentration above the detection level. It is considered the lowest concentration at which a particular contaminant can be quantitatively measured using a specified laboratory procedure for monitoring of the contaminant.

**Quarterly monitoring frequency** refers to a three month period, defined as January through March, April through June, July through September, and October through December. When required by this permit, an analytical result, reading, value or observation shall be reported for that period if a discharge occurs during that period.

**Regional Administrator** is the Region 5 Administrator, U.S. EPA, located at R-19J, 77 W. Jackson Blvd., Chicago, Illinois 60604.

**Regulated area** means the permittee's urbanized area, where urbanized area is defined as a place and its adjacent densely-populated territory that together have a minimum population of 50,000 people as defined by the United States Bureau of the Census and as determined by the latest available decennial census.

**Secondary containment structure** means a unit, other than the primary container, in which significant materials are packaged or held, which is required by State or Federal law to prevent the escape of significant materials by gravity into sewers, drains, or otherwise directly or indirectly into any sewer system or to the surface or ground waters of this state.

**Separate storm sewer system** means a system of drainage, including, but not limited to, roads, catch basins, curbs, gutters, parking lots, ditches, conduits, pumping devices, or man-made channels, which is not a combined sewer where storm water mixes with sanitary wastes, and is not part of a POTW.

**Significant industrial user** is a nondomestic user that: 1) is subject to Categorical Pretreatment Standards under 40 CFR 403.6 and 40 CFR Chapter I, Subchapter N; or 2) discharges an average of 25,000 gallons per day or more of process wastewater to a POTW (excluding sanitary, noncontact cooling and boiler blowdown wastewater); contributes a process waste stream which makes up five (5) percent or more of the average dry weather hydraulic or organic capacity of the POTW treatment plant; or is designated as such by the permittee as defined in 40 CFR 403.12(a) on the basis that the industrial user has a reasonable potential for adversely affecting the POTW's treatment plant operation or violating any pretreatment standard or requirement (in accordance with 40 CFR 403.8(f)(6)).

**PART II**

## Section A. Definitions

**Significant materials** Significant Materials means any material which could degrade or impair water quality, including but not limited to: raw materials; fuels; solvents, detergents, and plastic pellets; finished materials such as metallic products; hazardous substances designated under Section 101(14) of Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) (see 40 CFR 372.65); any chemical the facility is required to report pursuant to Section 313 of Emergency Planning and Community Right-to-Know Act (EPCRA); polluting materials as identified under the Part 5 Rules (R 324.2001 through R 324.2009 of the Michigan Administrative Code); Hazardous Wastes as defined in Part 111 of the NREPA; fertilizers; pesticides; and waste products such as ashes, slag, and sludge that have the potential to be released with storm water discharges.

**Significant spills and significant leaks** means any release of a polluting material reportable under the Part 5 Rules (R 324.2001 through R 324.2009 of the Michigan Administrative Code).

**Special-use area** means secondary containment structures required by state or federal law; lands on Michigan's List of Sites of Environmental Contamination pursuant to Part 201, Environmental Remediation, of the NREPA; and/or areas with other activities that may contribute pollutants to the storm water for which the Department determines monitoring is needed.

**Stoichiometric** means the quantity of a reagent calculated to be necessary and sufficient for a given chemical reaction.

**Storm water** means storm water runoff, snow melt runoff, surface runoff and drainage, and non-storm water included under the conditions of this permit.

**Storm water discharge point** is the location where the point source discharge of storm water is directed to surface waters of the state or to a separate storm sewer. It includes the location of all point source discharges where storm water exits the facility, including *outfalls* which discharge directly to surface waters of the state, and *points of discharge* which discharge directly into separate storm sewer systems.

**SWPPP** means the Storm Water Pollution Prevention Plan prepared in accordance with this permit.

**Tier I value** means a value for aquatic life, human health or wildlife calculated under R 323.1057 of the Water Quality Standards using a tier I toxicity database.

**Tier II value** means a value for aquatic life, human health or wildlife calculated under R 323.1057 of the Water Quality Standards using a tier II toxicity database.

**Total maximum daily loads (TMDLs)** are required by the Federal Act for waterbodies that do not meet water quality standards. TMDLs represent the maximum daily load of a pollutant that a waterbody can assimilate and meet water quality standards, and an allocation of that load among point sources, nonpoint sources, and a margin of safety.

**Toxicity reduction evaluation (TRE)** means a site-specific study conducted in a stepwise process designed to identify the causative agents of effluent toxicity, isolate the sources of toxicity, evaluate the effectiveness of toxicity control options, and then confirm the reduction in effluent toxicity.

**Water Quality Standards** means the Part 4 Water Quality Standards promulgated pursuant to Part 31 of the NREPA, being R 323.1041 through R 323.1117 of the Michigan Administrative Code.

**Weekly monitoring frequency** refers to a calendar week which begins on Sunday and ends on Saturday. When required by this permit, an analytical result, reading, value or observation shall be reported for that period if a discharge occurs during that period.

**WWSL** is a wastewater stabilization lagoon.

**WWSL discharge event** is a discrete occurrence during which effluent is discharged to the surface water up to 10 days of a consecutive 14 day period.

## PART II

# Section A. Definitions

**3-portion composite sample** is a sample consisting of three equal-volume grab samples collected at equal intervals over an 8-hour period.

**7-day concentration**
FOR WWSLs THAT COLLECT AND STORE WASTEWATER AND ARE AUTHORIZED TO DISCHARGE ONLY IN THE SPRING AND/OR FALL ON AN INTERMITTENT BASIS – The 7-day concentration is the sum of the daily concentrations determined during any 7 consecutive days of discharge during a WWSL discharge event divided by the number of daily concentrations determined. If the number of daily concentrations determined during the WWSL discharge event is less than 7 days, the number of actual daily concentrations determined shall be used for the calculation. The calculated 7-day concentration will be used to determine compliance with any maximum 7-day concentration limitations. When required by the permit, report the maximum calculated 7-day concentration for the WWSL discharge event in the "MAXIMUM" column under "QUALITY OR CONCENTRATION" on the DMR. If the WWSL discharge event was partially in each of two months, the value shall be reported on the DMR of the month in which the last day of discharge occurred.

FOR ALL OTHER DISCHARGES – The 7-day concentration is the sum of the daily concentrations determined during any 7 consecutive days in a reporting month divided by the number of daily concentrations determined. If the number of daily concentrations determined is less than 7, the actual number of daily concentrations determined shall be used for the calculation. The calculated 7-day concentration will be used to determine compliance with any maximum 7-day concentration limitations in the reporting month. When required by the permit, report the maximum calculated 7-day concentration for the month in the "MAXIMUM" column under "QUALITY OR CONCENTRATION" on the DMR. The first 7-day calculation shall be made on day 7 of the reporting month, and the last calculation shall be made on the last day of the reporting month.

**7-day loading**
FOR WWSLs THAT COLLECT AND STORE WASTEWATER AND ARE AUTHORIZED TO DISCHARGE ONLY IN THE SPRING AND/OR FALL ON AN INTERMITTENT BASIS – The 7-day loading is the sum of the daily loadings determined during any 7 consecutive days of discharge during a WWSL discharge event divided by the number of daily loadings determined. If the number of daily loadings determined during the WWSL discharge event is less than 7 days, the number of actual daily loadings determined shall be used for the calculation. The calculated 7-day loading will be used to determine compliance with any maximum 7-day loading limitations. When required by the permit, report the maximum calculated 7-day loading for the WWSL discharge event in the "MAXIMUM" column under "QUANTITY OR LOADING" on the DMR. If the WWSL discharge event was partially in each of two months, the value shall be reported on the DMR of the month in which the last day of discharge occurred.

FOR ALL OTHER DISCHARGES – The 7-day loading is the sum of the daily loadings determined during any 7 consecutive days in a reporting month divided by the number of daily loadings determined. If the number of daily loadings determined is less than 7, the actual number of daily loadings determined shall be used for the calculation. The calculated 7-day loading will be used to determine compliance with any maximum 7-day loading limitations in the reporting month. When required by the permit, report the maximum calculated 7-day loading for the month in the "MAXIMUM" column under "QUANTITY OR LOADING" on the DMR. The first 7-day calculation shall be made on day 7 of the reporting month, and the last calculation shall be made on the last day of the reporting month.

**24-hour composite sample** is a flow-proportioned composite sample consisting of hourly or more frequent portions that are taken over a 24-hour period. A time-proportioned composite sample may be used upon approval of the Department if the permittee demonstrates it is representative of the discharge.

PART II

# Section B. Monitoring Procedures

## 1. Representative Samples

Samples and measurements taken as required herein shall be representative of the volume and nature of the monitored discharge.

## 2. Test Procedures

Test procedures for the analysis of pollutants shall conform to regulations promulgated pursuant to Section 304(h) of the Federal Act (40 CFR Part 136 – Guidelines Establishing Test Procedures for the Analysis of Pollutants), unless specified otherwise in this permit. **Test procedures used shall be sufficiently sensitive to determine compliance with applicable effluent limitations**. Requests to use test procedures not promulgated under 40 CFR Part 136 for pollutant monitoring required by this permit shall be made in accordance with the Alternate Test Procedures regulations specified in 40 CFR 136.4. These requests shall be submitted to the Manager of the Permits Section, Water Resources Division, Michigan Department of Environmental Quality, P.O. Box 30458, Lansing, Michigan, 48909-7958. The permittee may use such procedures upon approval.

The permittee shall periodically calibrate and perform maintenance procedures on all analytical instrumentation at intervals to ensure accuracy of measurements. The calibration and maintenance shall be performed as part of the permittee's laboratory Quality Control/Quality Assurance program.

## 3. Instrumentation

The permittee shall periodically calibrate and perform maintenance procedures on all monitoring instrumentation at intervals to ensure accuracy of measurements.

## 4. Recording Results

For each measurement or sample taken pursuant to the requirements of this permit, the permittee shall record the following information: 1) the exact place, date, and time of measurement or sampling; 2) the person(s) who performed the measurement or sample collection; 3) the dates the analyses were performed; 4) the person(s) who performed the analyses; 5) the analytical techniques or methods used; 6) the date of and person responsible for equipment calibration; and 7) the results of all required analyses.

## 5. Records Retention

All records and information resulting from the monitoring activities required by this permit including all records of analyses performed and calibration and maintenance of instrumentation and recordings from continuous monitoring instrumentation shall be retained for a minimum of three (3) years, or longer if requested by the Regional Administrator or the Department.

**PART II**

# Section C. Reporting Requirements

## 1. Start-up Notification

If the permittee will not discharge during the first 60 days following the effective date of this permit, the permittee shall notify the Department within 14 days following the effective date of this permit, and then 60 days prior to the commencement of the discharge.

## 2. Submittal Requirements for Self-Monitoring Data

Part 31 of the NREPA (specifically Section 324.3110(7)); and R 323.2155(2) of Part 21, Wastewater Discharge Permits, promulgated under Part 31 of the NREPA, allow the Department to specify the forms to be utilized for reporting the required self-monitoring data. Unless instructed on the effluent limitations page to conduct "Retained Self-Monitoring," the permittee shall submit self-monitoring data via the Department's MiWaters system.

The permittee shall utilize the information provided on the MiWaters website, located at https://miwaters.deq.state.mi.us, to access and submit the electronic forms. Both monthly summary and daily data shall be submitted to the Department no later than the 20th day of the month following each month of the authorized discharge period(s). The permittee may be allowed to submit the electronic forms after this date if the Department has granted an extension to the submittal date.

## 3. Retained Self-Monitoring Requirements

If instructed on the effluent limits page (or otherwise authorized by the Department in accordance with the provisions of this permit) to conduct retained self-monitoring, the permittee shall maintain a year-to-date log of retained self-monitoring results and, upon request, provide such log for inspection to the staff of the Department. Retained self-monitoring results are public information and shall be promptly provided to the public upon request.

The permittee shall certify, in writing, to the Department, on or before January 10th (April 1st for animal feeding operation facilities) of each year, that: 1) all retained self-monitoring requirements have been complied with and a year-to-date log has been maintained; and 2) the application on which this permit is based still accurately describes the discharge. With this annual certification, the permittee shall submit a summary of the previous year's monitoring data. The summary shall include maximum values for samples to be reported as daily maximums and/or monthly maximums and minimum values for any daily minimum samples.

Retained self-monitoring may be denied to a permittee by notification in writing from the Department. In such cases, the permittee shall submit self-monitoring data in accordance with Part II.C.2., above. Such a denial may be rescinded by the Department upon written notification to the permittee. Reissuance or modification of this permit or reissuance or modification of an individual permittee's authorization to discharge shall not affect previous approval or denial for retained self-monitoring unless the Department provides notification in writing to the permittee.

## 4. Additional Monitoring by Permittee

If the permittee monitors any pollutant at the location(s) designated herein more frequently than required by this permit, using approved analytical methods as specified above, the results of such monitoring shall be included in the calculation and reporting of the values required in the Discharge Monitoring Report. Such increased frequency shall also be indicated.

Monitoring required pursuant to Part 41 of the NREPA or Rule 35 of the Mobile Home Park Commission Act (Act 96 of the Public Acts of 1987) for assurance of proper facility operation shall be submitted as required by the Departmen

**PART II**

# Section C. Reporting Requirements

## 5. Compliance Dates Notification

Within 14 days of every compliance date specified in this permit, the permittee shall submit a *written* notification to the Department indicating whether or not the particular requirement was accomplished. If the requirement was not accomplished, the notification shall include an explanation of the failure to accomplish the requirement, actions taken or planned by the permittee to correct the situation, and an estimate of when the requirement will be accomplished. If a written report is required to be submitted by a specified date and the permittee accomplishes this, a separate written notification is not required.

## 6. Noncompliance Notification

Compliance with all applicable requirements set forth in the Federal Act, Parts 31 and 41 of the NREPA, and related regulations and rules is required. All instances of noncompliance shall be reported as follows:

a. 24-Hour Reporting
Any noncompliance which may endanger health or the environment (including maximum and/or minimum daily concentration discharge limitation exceedances) shall be reported, verbally, within 24 hours from the time the permittee becomes aware of the noncompliance. A written submission shall also be provided within five (5) days.

b. Other Reporting
The permittee shall report, in writing, all other instances of noncompliance not described in a. above at the time monitoring reports are submitted; or, in the case of retained self-monitoring, within five (5) days from the time the permittee becomes aware of the noncompliance.

Written reporting shall include: 1) a description of the discharge and cause of noncompliance; and 2) the period of noncompliance, including exact dates and times, or, if not yet corrected, the anticipated time the noncompliance is expected to continue, and the steps taken to reduce, eliminate and prevent recurrence of the noncomplying discharge.

## 7. Spill Notification

The permittee shall immediately report any release of any polluting material which occurs to the surface waters or groundwaters of the state, unless the permittee has determined that the release is not in excess of the threshold reporting quantities specified in the Part 5 Rules (R 324.2001 through R 324.2009 of the Michigan Administrative Code), by calling the Department at the number indicated on the second page of this permit (or, if this is a general permit, on the COC); or, if the notice is provided after regular working hours, call the Department's 24-hour Pollution Emergency Alerting System telephone number, 1-800-292-4706 (calls from **out-of-state** dial 1-517-373-7660).

Within ten (10) days of the release, the permittee shall submit to the Department a full written explanation as to the cause of the release, the discovery of the release, response (clean-up and/or recovery) measures taken, and preventive measures taken or a schedule for completion of measures to be taken to prevent reoccurrence of similar releases.

**PART II**

## Section C. Reporting Requirements

## 8. Upset Noncompliance Notification

If a process "upset" (defined as an exceptional incident in which there is unintentional and temporary noncompliance with technology based permit effluent limitations because of factors beyond the reasonable control of the permittee) has occurred, the permittee who wishes to establish the affirmative defense of upset, shall notify the Department by telephone within 24 hours of becoming aware of such conditions; and within five (5) days, provide in writing, the following information:

a. that an upset occurred and that the permittee can identify the specific cause(s) of the upset;

b. that the permitted wastewater treatment facility was, at the time, being properly operated and maintained (note that an upset does not include noncompliance to the extent caused by operational error, improperly designed treatment facilities, inadequate treatment facilities, lack of preventive maintenance, or careless or improper operation); and

c. that the permittee has specified and taken action on all responsible steps to minimize or correct any adverse impact in the environment resulting from noncompliance with this permit.

No determination made during administrative review of claims that noncompliance was caused by upset, and before an action for noncompliance, is final administrative action subject to judicial review.

In any enforcement proceedings, the permittee, seeking to establish the occurrence of an upset, has the burden of proof.

## 9. Bypass Prohibition and Notification

a. Bypass Prohibition
Bypass is prohibited, and the Department may take an enforcement action, unless:

1) bypass was unavoidable to prevent loss of life, personal injury, or severe property damage;

2) there were no feasible alternatives to the bypass, such as the use of auxiliary treatment facilities, retention of untreated wastes, or maintenance during normal periods of equipment downtime. This condition is not satisfied if adequate backup equipment should have been installed in the exercise of reasonable engineering judgment to prevent a bypass; and

3) the permittee submitted notices as required under 9.b. or 9.c. below.

b. Notice of Anticipated Bypass
If the permittee knows in advance of the need for a bypass, it shall submit prior notice to the Department, if possible at least ten (10) days before the date of the bypass, and provide information about the anticipated bypass as required by the Department. The Department may approve an anticipated bypass, after considering its adverse effects, if it will meet the three (3) conditions listed in 9.a. above.

c. Notice of Unanticipated Bypass
The permittee shall submit notice to the Department of an unanticipated bypass by calling the Department at the number indicated on the second page of this permit (if the notice is provided after regular working hours, use the following number: 1-800-292-4706) as soon as possible, but no later than 24 hours from the time the permittee becomes aware of the circumstances.

**PART II**

## Section C. Reporting Requirements

d. Written Report of Bypass
A written submission shall be provided within five (5) working days of commencing any bypass to the Department, and at additional times as directed by the Department. The written submission shall contain a description of the bypass and its cause; the period of bypass, including exact dates and times, and if the bypass has not been corrected, the anticipated time it is expected to continue; steps taken or planned to reduce, eliminate, and prevent reoccurrence of the bypass; and other information as required by the Department.

e. Bypass Not Exceeding Limitations
The permittee may allow any bypass to occur which does not cause effluent limitations to be exceeded, but only if it also is for essential maintenance to ensure efficient operation. These bypasses are not subject to the provisions of 9.a., 9.b., 9.c., and 9.d., above. This provision does not relieve the permittee of any notification responsibilities under Part II.C.11. of this permit.

f. Definitions

1) Bypass means the intentional diversion of waste streams from any portion of a treatment facility.

2) Severe property damage means substantial physical damage to property, damage to the treatment facilities which causes them to become inoperable, or substantial and permanent loss of natural resources which can reasonably be expected to occur in the absence of a bypass. Severe property damage does not mean economic loss caused by delays in production.

## 10. Bioaccumulative Chemicals of Concern (BCC)

Consistent with the requirements of R 323.1098 and R 323.1215 of the Michigan Administrative Code, the permittee is prohibited from undertaking any action that would result in a lowering of water quality from an increased loading of a BCC unless an increased use request and antidegradation demonstration have been submitted and approved by the Department.

## 11. Notification of Changes in Discharge

The permittee shall notify the Department, in writing, as soon as possible but no later than 10 days of knowing, or having reason to believe, that any activity or change has occurred or will occur which would result in the discharge of: 1) detectable levels of chemicals on the current Michigan Critical Materials Register, priority pollutants or hazardous substances set forth in 40 CFR 122.21, Appendix D, or the Pollutants of Initial Focus in the Great Lakes Water Quality Initiative specified in 40 CFR 132.6, Table 6, which were not acknowledged in the application or listed in the application at less than detectable levels; 2) detectable levels of any other chemical not listed in the application or listed at less than detection, for which the application specifically requested information; or 3) any chemical at levels greater than five times the average level reported in the complete application (see the first page of this permit, for the date(s) the complete application was submitted). Any other monitoring results obtained as a requirement of this permit shall be reported in accordance with the compliance schedules.

**PART II**

## Section C. Reporting Requirements

### 12. Changes in Facility Operations

Any anticipated action or activity, including but not limited to facility expansion, production increases, or process modification, which will result in new or increased loadings of pollutants to the receiving waters must be reported to the Department by a) submission of an increased use request (application) and all information required under R 323.1098 (Antidegradation) of the Water Quality Standards or b) by notice if the following conditions are met: 1) the action or activity will not result in a change in the types of wastewater discharged or result in a greater quantity of wastewater than currently authorized by this permit; 2) the action or activity will not result in violations of the effluent limitations specified in this permit; 3) the action or activity is not prohibited by the requirements of Part II.C.10.; and 4) the action or activity will not require notification pursuant to Part II.C.11. Following such notice, the permit or, if applicable, the facility's COC may be modified according to applicable laws and rules to specify and limit any pollutant not previously limited.

### 13. Transfer of Ownership or Control

In the event of any change in control or ownership of facilities from which the authorized discharge emanates, the permittee shall submit to the Department 30 days prior to the actual transfer of ownership or control a written agreement between the current permittee and the new permittee containing: 1) the legal name and address of the new owner; 2) a specific date for the effective transfer of permit responsibility, coverage and liability; and 3) a certification of the continuity of or any changes in operations, wastewater discharge, or wastewater treatment.

If the new permittee is proposing changes in operations, wastewater discharge, or wastewater treatment, the Department may propose modification of this permit in accordance with applicable laws and rules.

### 14. Operations and Maintenance Manual

For wastewater treatment facilities that serve the public (and are thus subject to Part 41 of the NREPA), Section 4104 of Part 41 and associated Rule 2957 of the Michigan Administrative Code allow the Department to require an Operations and Maintenance (O&M) Manual from the facility. An up-to-date copy of the O&M Manual shall be kept at the facility and shall be provided to the Department upon request. The Department may review the O&M Manual in whole or in part at its discretion and require modifications to it if portions are determined to be inadequate.

At a minimum, the O&M Manual shall include the following information: permit standards; descriptions and operation information for all equipment; staffing information; laboratory requirements; record keeping requirements; a maintenance plan for equipment; an emergency operating plan; safety program information; and copies of all pertinent forms, as-built plans, and manufacturer's manuals.

Certification of the existence and accuracy of the O&M Manual shall be submitted to the Department at least sixty days prior to start-up of a new wastewater treatment facility. Recertification shall be submitted sixty days prior to start-up of any substantial improvements or modifications made to an existing wastewater treatment facility.

PART II

## Section C. Reporting Requirements

## 15. Signatory Requirements

All applications, reports, or information submitted to the Department in accordance with the conditions of this permit and that require a signature shall be signed and certified as described in the Federal Act and the NREPA.

The Federal Act provides that any person who knowingly makes any false statement, representation, or certification in any record or other document submitted or required to be maintained under this permit, including monitoring reports or reports of compliance or noncompliance, shall, upon conviction, be punished by a fine of not more than $10,000 per violation, or by imprisonment for not more than 6 months per violation, or by both.

The NREPA (Section 3115(2)) provides that a person who at the time of the violation knew or should have known that he or she discharged a substance contrary to this part, or contrary to a permit, COC, or order issued or rule promulgated under this part, or who intentionally makes a false statement, representation, or certification in an application for or form pertaining to a permit or COC or in a notice or report required by the terms and conditions of an issued permit or COC, or who intentionally renders inaccurate a monitoring device or record required to be maintained by the Department, is guilty of a felony and shall be fined not less than $2,500.00 or more than $25,000.00 for each violation. The court may impose an additional fine of not more than $25,000.00 for each day during which the unlawful discharge occurred. If the conviction is for a violation committed after a first conviction of the person under this subsection, the court shall impose a fine of not less than $25,000.00 per day and not more than $50,000.00 per day of violation. Upon conviction, in addition to a fine, the court in its discretion may sentence the defendant to imprisonment for not more than 2 years or impose probation upon a person for a violation of this part. With the exception of the issuance of criminal complaints, issuance of warrants, and the holding of an arraignment, the circuit court for the county in which the violation occurred has exclusive jurisdiction. However, the person shall not be subject to the penalties of this subsection if the discharge of the effluent is in conformance with and obedient to a rule, order, permit, or COC of the Department. In addition to a fine, the attorney general may file a civil suit in a court of competent jurisdiction to recover the full value of the injuries done to the natural resources of the state and the costs of surveillance and enforcement by the state resulting from the violation.

## 16. Electronic Reporting

Upon notice by the Department that electronic reporting tools are available for specific reports or notifications, the permittee shall submit electronically all such reports or notifications as required by this permit, on forms provided by the Department.

PART II

# Section D. Management Responsibilities

## 1. Duty to Comply

All discharges authorized herein shall be consistent with the terms and conditions of this permit. The discharge of any pollutant identified in this permit, more frequently than, or at a level in excess of, that authorized, shall constitute a violation of the permit.

It is the duty of the permittee to comply with all the terms and conditions of this permit. Any noncompliance with the Effluent Limitations, Special Conditions, or terms of this permit constitutes a violation of the NREPA and/or the Federal Act and constitutes grounds for enforcement action; for permit or Certificate of Coverage (COC) termination, revocation and reissuance, or modification; or denial of an application for permit or COC renewal.

It shall not be a defense for a permittee in an enforcement action that it would have been necessary to halt or reduce the permitted activity in order to maintain compliance with the conditions of this permit.

## 2. Operator Certification

The permittee shall have the waste treatment facilities under direct supervision of an operator certified at the appropriate level for the facility certification by the Department, as required by Sections 3110 and 4104 of the NREPA. Permittees authorized to discharge storm water shall have the storm water treatment and/or control measures under direct supervision of a storm water operator certified by the Department, as required by Section 3110 of the NREPA.

## 3. Facilities Operation

The permittee shall, at all times, properly operate and maintain all treatment or control facilities or systems installed or used by the permittee to achieve compliance with the terms and conditions of this permit. Proper operation and maintenance includes adequate laboratory controls and appropriate quality assurance procedures.

## 4. Power Failures

In order to maintain compliance with the effluent limitations of this permit and prevent unauthorized discharges, the permittee shall either:

a. provide an alternative power source sufficient to operate facilities utilized by the permittee to maintain compliance with the effluent limitations and conditions of this permit; or

b. upon the reduction, loss, or failure of one or more of the primary sources of power to facilities utilized by the permittee to maintain compliance with the effluent limitations and conditions of this permit, the permittee shall halt, reduce or otherwise control production and/or all discharge in order to maintain compliance with the effluent limitations and conditions of this permit.

## 5. Adverse Impact

The permittee shall take all reasonable steps to minimize or prevent any adverse impact to the surface waters or groundwaters of the state resulting from noncompliance with any effluent limitation specified in this permit including, but not limited to, such accelerated or additional monitoring as necessary to determine the nature and impact of the discharge in noncompliance.

PART II

## Section D. Management Responsibilities

### 6. Containment Facilities

The permittee shall provide facilities for containment of any accidental losses of polluting materials in accordance with the requirements of the Part 5 Rules (R 324.2001 through R 324.2009 of the Michigan Administrative Code). For a Publicly Owned Treatment Work (POTW), these facilities shall be approved under Part 41 of the NREPA.

### 7. Waste Treatment Residues

Residuals (i.e. solids, sludges, biosolids, filter backwash, scrubber water, ash, grit, or other pollutants or wastes) removed from or resulting from treatment or control of wastewaters, including those that are generated during treatment or left over after treatment or control has ceased, shall be disposed of in an environmentally compatible manner and according to applicable laws and rules. These laws may include, but are not limited to, the NREPA, Part 31 for protection of water resources, Part 55 for air pollution control, Part 111 for hazardous waste management, Part 115 for solid waste management, Part 121 for liquid industrial wastes, Part 301 for protection of inland lakes and streams, and Part 303 for wetlands protection. Such disposal shall not result in any unlawful pollution of the air, surface waters or groundwaters of the state.

### 8. Right of Entry

The permittee shall allow the Department, any agent appointed by the Department, or the Regional Administrator, upon the presentation of credentials and, for animal feeding operation facilities, following appropriate biosecurity protocols:

a. to enter upon the permittee's premises where an effluent source is located or any place in which records are required to be kept under the terms and conditions of this permit; and

b. at reasonable times to have access to and copy any records required to be kept under the terms and conditions of this permit; to inspect process facilities, treatment works, monitoring methods and equipment regulated or required under this permit; and to sample any discharge of pollutants.

### 9. Availability of Reports

Except for data determined to be confidential under Section 308 of the Federal Act and Rule 2128 (R 323.2128 of the Michigan Administrative Code), all reports prepared in accordance with the terms of this permit, shall be available for public inspection at the offices of the Department and the Regional Administrator. As required by the Federal Act, effluent data shall not be considered confidential. Knowingly making any false statement on any such report may result in the imposition of criminal penalties as provided for in Section 309 of the Federal Act and Sections 3112, 3115, 4106 and 4110 of the NREPA.

### 10. Duty to Provide Information

The permittee shall furnish to the Department, within a reasonable time, any information which the Department may request to determine whether cause exists for modifying, revoking and reissuing, or terminating this permit or the facility's COC, or to determine compliance with this permit. The permittee shall also furnish to the Department, upon request, copies of records required to be kept by this permit.

Where the permittee becomes aware that it failed to submit any relevant facts in a permit application, or submitted incorrect information in a permit application or in any report to the Department, it shall promptly submit such facts or information.

PART II

## Section E. Activities Not Authorized by This Permit

### 1. Discharge to the Groundwaters

This permit does not authorize any discharge to the groundwaters. Such discharge may be authorized by a groundwater discharge permit issued pursuant to the NREPA.

### 2. POTW Construction

This permit does not authorize or approve the construction or modification of any physical structures or facilities at a POTW. Approval for the construction or modification of any physical structures or facilities at a POTW shall be by permit issued under Part 41 of the NREPA.

### 3. Civil and Criminal Liability

Except as provided in permit conditions on "Bypass" (Part II.C.9. pursuant to 40 CFR 122.41(m)), nothing in this permit shall be construed to relieve the permittee from civil or criminal penalties for noncompliance, whether or not such noncompliance is due to factors beyond the permittee's control, such as accidents, equipment breakdowns, or labor disputes.

### 4. Oil and Hazardous Substance Liability

Nothing in this permit shall be construed to preclude the institution of any legal action or relieve the permittee from any responsibilities, liabilities, or penalties to which the permittee may be subject under Section 311 of the Federal Act except as are exempted by federal regulations.

### 5. State Laws

Nothing in this permit shall be construed to preclude the institution of any legal action or relieve the permittee from any responsibilities, liabilities, or penalties established pursuant to any applicable state law or regulation under authority preserved by Section 510 of the Federal Act.

### 6. Property Rights

The issuance of this permit does not convey any property rights in either real or personal property, or any exclusive privileges, nor does it authorize violation of any federal, state or local laws or regulations, nor does it obviate the necessity of obtaining such permits, including any other Department of Environmental Quality permits, or approvals from other units of government as may be required by law.

# APPENDIX C
# MDEQ EFFLUENT LIMITS ONLY REPORT

**MICHIGAN DEPARTMENT OF ENVIRONMENTAL QUALITY**

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**INTEROFFICE COMMUNICATION**

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TO: Byron Lane, Permits Section, Water Resources Division

FROM: Phillip DePetro, Permits Section, Water Resources Division

DATE: September 10, 2018

SUBJECT: Allendale Twp WWTP
National Pollutant Discharge Elimination System (NPDES) Permit No. MI0057679
Effluent Limits Only (ELO)

Permits Section has calculated preliminary effluent limit recommendations for a proposed modification of NPDES Permit No MI0057679, which authorizes the Allendale Twp WWTP to discharge treated municipal wastewater to the Grand River at the existing outfall 001 at 42.9806°N, -85.8750°E. The current facility annual average design flow is 2.4 million gallons per day (MGD). The expected design flow in the expanded facility is 4.2 MGD.

The Grand River is protected for warmwater fish species, other indigenous aquatic life and wildlife, agriculture, navigation, industrial water supply, public water supply at the point of intake, partial body contact recreation, total body contact recreation from May 1 to October 31, and fish consumption.

The monthly exceedance flows (in cfs) for the Grand River at the Allendale Twp WWTP discharge, are as follows based on Low Flow Discharge Request 8689:

| | JAN. | FEB. | MAR. | APR. | MAY | JUNE |
|---|---|---|---|---|---|---|
| 50% | 3170 | 3440 | 6640 | 6220 | 4310 | 2910 |
| 95% | 1270 | 1440 | 2220 | 2600 | 1880 | 910 |

| | JULY | AUG. | SEP. | OCT. | NOV. | DEC. |
|---|---|---|---|---|---|---|
| 50% | 1910 | 1620 | 1570 | 1910 | 2570 | 2940 |
| 95% | 910 | 890 | 960 | 1020 | 1260 | 1300 |

The 95% exceedance flows are consistent with past WQBEL development. The lowest monthly 95% exceedance flow in each of up to four seasons are used as the background flow of the receiving stream for the purpose of developing water quality-based effluent limits.

A calibrated O'Connor-DiTorro model was previously used to develop effluent limits for a five-facility waste-load allocation (WLA) for the Grand River in the vicinity of Grand Rapids. Recommendations are made for effluent five-day carbonaceous biochemical oxygen demand ($CBOD_5$), ammonia (NH3-N), and minimum effluent dissolved oxygen (DO) from each facility to protect the DO standard of 5.0 mg/l at all times in the Grand River. The information used to develop the existing model is summarized in the permit file and in a report summarizing field work in 2005 (MI/DEQ/WRD-12/009). No changes were made to the model assumptions. A map showing the location of the five outfalls and the major tributaries to the Grand River model is presented in Figure 1.

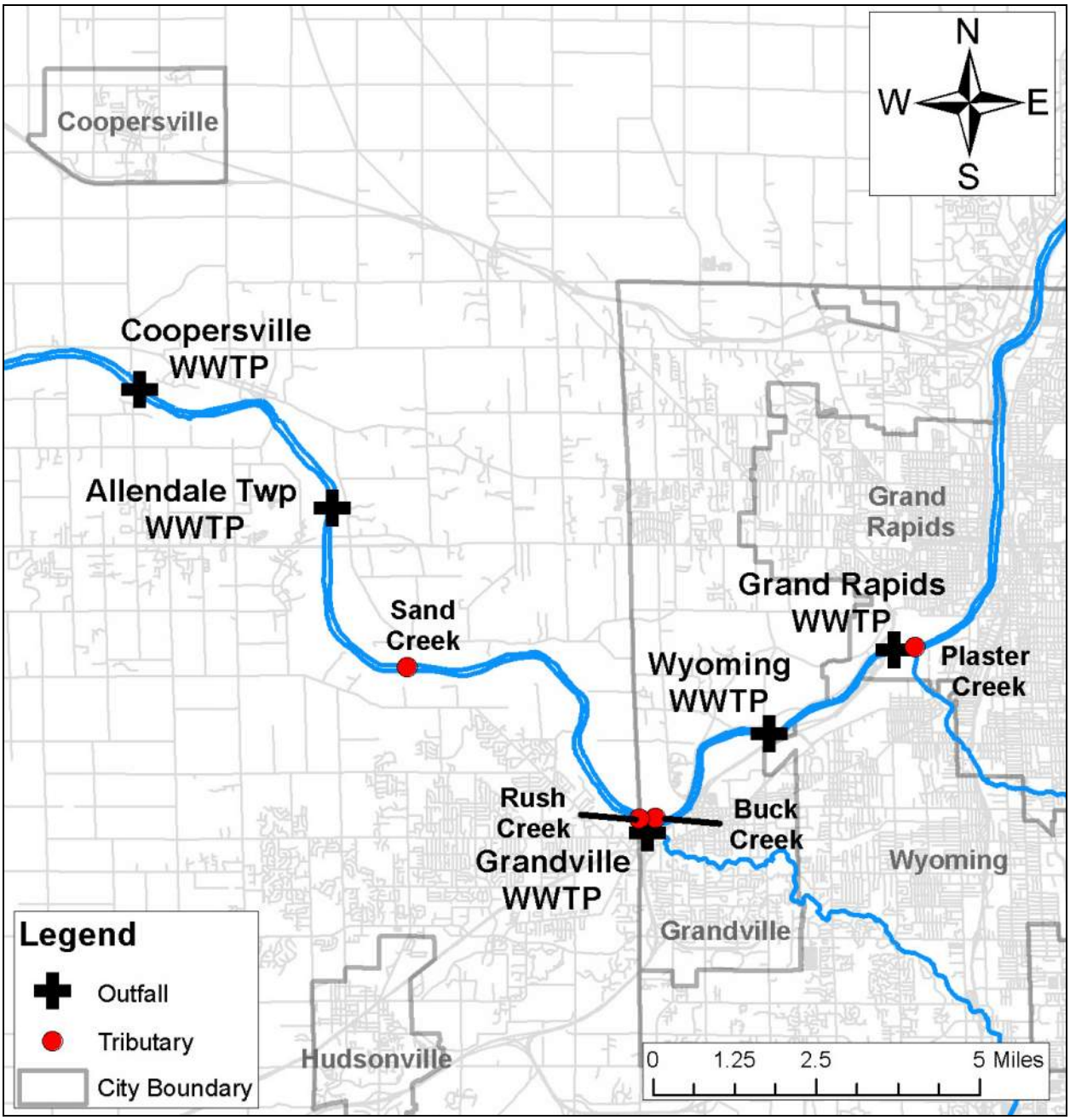


Figure 1: Grand River Waste-Load Allocation Point Source Facilities and Tributaries

Current permit effluent limits for the Allendale Twp WWTP are based on federal secondary treatment standards (STS). Conservatively, STS is assumed to be limited by a daily maximum $CBOD_5$ concentration of 60 mg/l and a daily maximum NH3-N concentration of 30 mg/l. A minimum effluent DO effluent limit of 3.0 mg/l is included with STS-based effluent limits to prevent acute toxicity in the effluent-receiving water mixing zone.

The Allendale Twp WWTP represents less than 1% of the total flow in the Grand River in all seasons, even at the expanded design flow of 4.2 MGD. Effluent limits reflective of STS are still protective of the Grand River downstream of the Allendale Twp WWTP at the expanded flow, with the assumption that the design flows and permit limits of the upstream facilities remains

unchanged. The lowest predicted DO concentrations in the WLA reach are upstream of the Allendale Twp WWTP, and therefore the facility does not impact the lowest DO sag of the model. Both the Allendale Twp WWTP and Coopersville WWTPs discharge to the reach of the Grand River where oxygen concentrations are increasing after the impact of the Grand Rapids area inputs. The input from the increased flow at the Allendale Twp WWTP does result in lower DO concentrations downstream of the facility, but minimum DO concentrations remain above the warmwater DO standard.

The proposed facility expansion was considered to determine monthly average effluent limits of NH3-N that would be protective of the chronic warmwater un-ionized NH3-N toxicity criterion of 0.053 mg/l. In all seasons the recommended effluent limit would be much greater than the expected effluent quality for a municipal wastewater treatment facility producing effluent based on STS. No specific recommendations are made to protect against chronic toxicity in the receiving water.

The effluent limits presented are based only on water quality standards and the assimilation capacity currently available in the receiving water at the point of discharge based on default modeling assumptions. We have not addressed treatment practicality or cost effectiveness. Our recommendations do not imply that other considerations should not be taken into account when deciding on permit limits. Effluent limits may also be recalculated for an amended permit based on additional information, such as data collected during field study.

# APPENDIX D
# EXISTING BASIS OF DESIGN

# DATA FOR BASIS OF DESIGN
# WASTEWATER TREATMENT PLANT

**Date:** September 9, 1997
**Community:** Allendale Charter Township, Michigan
**Type of Sewer System:** Separate sanitary and storm sewer
**Type of Treatment:** Rotating Biological Contactor

## WASTE LOADING:

**Population:** **Present:** 9,400 population equivalent (PE)
**Design (for year 2014):** 15,600 PE

**Service Area:** Designated approximately as Sections 27, 26, and 25, the northeast corner of Section 36, and the south half of Sections 22, 23, and 24 of Allendale Township, R14W, T7N, Ottawa County. Also, the south ¾ of the west ½ of Section 19, that part lying south of Ottawa Creek in Sections 19 and 20, Section 30 and that part lying west of the Grand River in Section 29 of Allendale Township, R13W, T7N, Ottawa County. Also, Section 31 of Georgetown Township, R13W, T7N, Ottawa County.

**Sewage Flows (MGD):**

| | | | |
|---|---|---|---|
| **Present:** | Minimum 0.25; | Average 0.65; | Maximum 2.0 |
| **Design:** | Minimum 0.14; | Average 1.60; | Maximum 4.8 |

**Influent Sewage Characteristics:**

| | @ Average Flow | | @ Peak Flow | |
|---|---|---|---|---|
| | mg/L | lbs/day | mg/L | lbs/day* |
| BOD5: | 250 | 3,338 | 220 | 8,807 |
| Suspended Solids: | 200 | 2,670 | 150 | 6,005 |
| Phosphorus: | 6 | 80 | 5 | 200 |
| Ammonia: | 30 | 400 | 25 | 1,000 |

* peak hourly rate; not maximum daily value

## PUMPING STATION: (NONE)

**Influent**: Two surcharged gravity sewers to plant influent structure
**Capacity:** 6.0 mgd (combined); 4.0 mgd in 20″ sewer; 2.0 mgd in 14″ sewer
**Bypass:** None

## SCREENS:

**Location**: Ahead of grit chamber
**Mechanical Screen:** **Type:** Mechanically cleaned bar screen **Opening Size:** ⅜-inch
**Screen Velocity:** ≥1.25 fps @ Q avg; <3.0 fps @ Q peak
**Bypass:** Manual bar rack **To what point?** Grit chamber

## GRIT CHAMBER:

**Type:** Vortex style grit chamber
**Capacity:** 4.8 mgd
**Holding Capacity:** For grit 28 $ft^3$
**Method for removal and disposal of grit:** Air lift pump
**Grit washer description:** Dewatering screw; **Disposal location:** Landfill
**Bypass:** Yes; **To what point:** Primary clarifiers

## MEASUREMENT OF PLANT INFLUENT:

**Type of primary measuring device:** 12" Parshall Flume
**Location:** Downstream of grit chamber
**Measuring unit:** Ultrasonic Level Sensor; **Recorder:** Yes

## PRIMARY CLARIFICATION:

**Type:** four rectangular tanks @ 672 $ft^2$ each, with 9' SWD x 56' L x 12' W
**Capacity:** 4.8 mgd
**Detention Time:** 163 min @ avg flow; 54 min @ max flow
**Surface settling rates:** 595 gal/$ft^2$/day @ Avg flow; 1,786 gal/$ft^2$/day @ Max flow
**Type of sludge removal:** scraper to hopper with 6" suction line.
**Sludge discharge point:** Sludge digestion tanks
**Bypass?** No; **To what point?**
**Tank effluent quality:** (@ average design flow)

BOD = 175 mg/l, 2,337 lbs; 30% removal
Suspended Solids = 100 mg/l, 1,335 lbs; 50% removal
Phosphorus = 4 mg/l, 53 lbs, 33% removal
Ammonia = N/A

## ROTATING BIOLOGICAL CONTACTORS:

**Design Flow:** Avg 1.6 mgd; Max 4.8 mgd
**Applied Sewage:** BOD 175 mg/l @ 1.6 mgd; 154 mg/l @ 4.8 mgd
**Number and area of shaft/disc assemblies:** Each train consists of two shafts @ 102,700 $ft^2$ media each shaft and two shafts @ 150,400 $ft^2$ media each shaft; total of two trains
**Media Material:** HDPE; **Diameter:** 11'-10"; **Submergence:** 4'-8" @ Avg. flow
**Hydraulic Loading: Avg:** 1.6 gpd/$ft^2$; **Max:** 4.8 gpd/$ft^2$
**Organic Loading: Avg:** 1.5 lbs sBOD/1000 $ft^2$ day; **Max:** 4.0 lbs sBOD/1000 $ft^2$ day*
**Bypass?** Yes; **To what point?** Flash Mixing Chamber

***Assume soluble $BOD_5$ ($sBOD_5$) = 0.65 x $BOD_5$)**

## CHEMICAL TREATMENT:

**1st Chemical:** Alum (liquid); **Dosage:** 70 mg/l avg;; 150 mg/l max
**Storage Capacity:** Two @ 7,400 gal/each; **Method:** Tank; **30 day usage:** 5212 gallons

**Capacity Range Required:** 0.3 to 23 gph;
**Number of Feeders:** 4; **Type:** Positive displacement diaphragm; motor driven
**Points of Application:** Flash Mixing Chamber, downstream of grit chamber
**Method of Mixing:** Air

**2nd Chemical:** Polymer; **Dosage:** 0.5 mg/l avg; 1.0 mg/l max
**Storage Capacity:** 10, 50 lb. bags; **Delivery time:** 2 weeks
**Preparation System:** automatic make-up
**Feed Capacity Range:** 0.01 gph to 1 gph
**Number of Feeders:** 3; **Type:** Solenoid driven diaphragm
**Points of Application:** Influent to flocculation tank
**Interval after 1st chemical:** 92 sec. @ Avg flow, 23 sec. @ max. flow
**Method of Flocculation:** Mechanical; **Paddle Speed:** Variable
**Flocculation Tanks Number and Capacity:** 2 @ 1,688 $ft^3$
**Detention:** @ Avg flow 23 min.; @ Max flow 7.6 min.

## SECONDARY CLARIFICATION:

**Type:** two 55' diameter circular tanks @ 2,375 $ft^2$ each, with 14' SWD
**Detention Time:** 7.5 hrs @ avg. flow; 2.5 hrs @ max. flow
**Surface overflow rates:** 337 gal/$ft^2$/day @ Avg flow; 1,010 gal/$ft^2$/day @ Max flow
**Type of sludge removal:** scraper to hopper with 6" suction line.
**Sludge discharge point:** Primary Clarifier Tanks or Sludge Digester Tanks
**Bypass?** None; **To what point?**
**Tank effluent quality:** (Design flow 1.6 mgd)

BOD = 15 mg/l, 200 lbs.; 91% removal
Suspended Solids = 15 mg/l, 200 lbs.; 85% removal
Phosphorus = 0.8 mg/l, 10.3 lbs.; 90% removal

## CHLORINATION:

**Chemical:** Sodium hydroxide 12% **Dosage:** 13.3 gals/day x 30 days = 400 gals; 5 mg/l max
**Storage:** 55 gallon drums
**Feed Capacity:** 0.02 to 6.67 gph
**Dosage Control:** Flow paced
**Number of Feeders:** 2 pumps + one standby **Type:** Solenoid-driven diaphragm
**Points of Application:** Headworks and chlorine contact tank
**Contact time:** @ Avg flow: 109 min.; @ Max flow: 36 min.
**Bypass?** none; **To what point?**
**Storage:** Nine 55-gal drums

## DECHLORINATION POND:

**Capacity:** 2.4 mgd
**Type:** Earthen, clay lined; **Number and Size:** One; 226' x 260' x 10' with center divider berm
**Volume:** 2.0 million gallons
**Detention:** @ Avg flow: 30 hours; @ Max flow 10 hours
**Bypass:** Yes; **To what point:** Plant Outlet Structure

## SAMPLERS:

**Types and location:**

**Plant Influent:** direct dipper, flow paced, 24 hr composite (after bar screen)

**Leprino Influent:** direct dipper, flow paced, 24 hr composite (at metering structure)

**Final Effluent:** peristaltic pump, flow paced, 24 hr composite (at combined effluent sampling/metering structure)

# SLUDGE HANDLING FACILITIES

## QUANTITY & CHARACTER:

| | | | Solids | Receiving |
|---|---|---|---|---|
| **Source** | **lbs. solids/day** | **% Volatile** | **Concentrations,%** | **Unit** |
| Secondary Settling | 2,280 | 70 | 1.2 | Pri. Settling Tanks |
| Cosettled Primary | 4,714 | 70 | 2.0 | Aerobic Digester |
| Digested | 2,704 | 54 | 3.5 | Sludge Lagoons |

## SLUDGE DIGESTION:

| | | Capacity | | | Heating | |
|---|---|---|---|---|---|---|
| | | **Volume** | **Detention** | | | |
| **Digester** | **No.** | **(cu. ft.)** | **(days)** | **lbs VSS/ 1000 cu ft/day** | **capacity** | **type** |
| Aerobic | 1 | 16,940 | 18 | 104 | (none) | |
| Aerobic | 2 | 16,940 | 18 | 104 | (none) | |

| | Mixing | | Aeration | | |
|---|---|---|---|---|---|
| **Digester** | **Type** | **Capacity** | **Type** | **Capacity** | **cfm/lb vol solids** |
| Aerobic No. 1 | Diffused Air | 20 cfm/1000 $ft^3$ | Diffused Air | 339 acfm | 0.19 |
| Aerobic No. 2 | Diffused Air | 20 cfm/1000 $ft^3$ | Diffused Air | 339 acfm | 0.19 |

**SLUDGE PUMPS:**

| Location | Type | No. | Standby | Suction from | Discharge To |
|---|---|---|---|---|---|
| Pump Room | progessive cavity | 1 | | digester or primary settling | primary settling or lagoons |
| Pump Room | progessive cavity | 1 | | chlorine contact, digester or primary settling | digester, primary settling or lagoons |
| Pump Room | progressive cavity | 1 | | chlorine contact or primary settling | digester, primary settling or lagoons |
| Clarifier Building | progressive cavity | 1 | | secondary clarifier No. 1 | digester, primary clarifier |
| Clarifier Building | progressive cavity | 2 | | secondary clarifier No. 1 and No.2 | digester, primary clarifier |
| Clarifier Building | progressive cavity | 3 | | secondary clarifier No. 2 | digester, primary clarifier |
| Clarifier Building | progessive cavity | 1 | 1 | primary and secondary clarifier scum well | digester, primary clarifier |

## SLUDGE DISPOSAL LOCATIONS & METHOD:

In accordance with approved PERM

## SLUDGE STORAGE LAGOONS:

**Type & Size:** Earthen, clay lined; one @ 300' x 500' x 10'; one @ 300' x 600' x 10'
**Surface Area:** West lagoon 3.29 acres @ mid-depth; East lagoon 3.84 acres at mid depth
**Capacity:** West lagoon 1.54 M $ft^3$; East lagoon 1.80 M $ft^3$
**Overflow/Decant:** 8" to supernatant pump station, discharge to head of primary settling tanks

FLEIS & VANDENBRINK ENGINEERING, INC.

# Basis of Design
# Allendale Charter Township 2012 WWTF Improvements

January 7, 2019

| **WWTP Flows and Loading** | 2012 | 2032 | |
|---|---|---|---|
| Population Served: | 25,358 | 39,492 | |
| Average Daily Flow (ADF): | 1.1 | 1.8 | mgd |
| Peak Hourly Flow: | 2.8 | 4.2 | mgd |

***2012 Influent Sewage Characteristics:***

| | Concentration | Current | Design |
|---|---|---|---|
| | mg/L | lbs/day | lbs/day |
| Biochemical Oxygen Demand | 250 | 2284 | 3714 |
| Total Suspended Solids | 200 | 1828 | 2972 |
| Ammonia Nitrogen | 30 | 274 | 446 |
| Total Kjeldahl Nitrogen | 55 | 503 | 817 |
| Total Phosphorus | 6 | 55 | 89 |

**Anaerobic Digester:**

| | | |
|---|---|---|
| Biological Solids Yield: | 4,135 | lbs/day |
| Biosolids Volume: | 25,400 | gallons/day |
| Digester Loading: | 77 | lbs VSS per 1000 $ft^3$ per day |
| Number of tanks | 2 | |
| Diameter | 33 | ft |
| Tank wall height | 26.5 | ft |
| Foam headspace allocation | 3 | ft |
| SWD | 23.5 | ft |
| Volume, each tank | 20,100 | $ft^3$ |
| Total Digester Volume: | 40,199 | $ft^3$ |
| HRT: | 20.1 | days |

| *Loading References:* | *Values in lbs/day/1,000cf* |
|---|---|
| *WEF MOP-8* | *120-160* |
| *Plainwell "high-rate" Loading* | *110* |
| *10 States Std Loading* | *80* |
| *Sturgis "high-rate" loading* | *73* |

**Digester Mixing:**

| | | |
|---|---|---|
| Mixing Energy Supplied: | 4.5 | hp |
| Mixing Energy : | 0.023 | hp/1kcf |
| Exit Velocity: | 27.28 | fps |
| Velocity Gradient: | 80.1 | 1/sec |

| *Design Criteria:* | | |
|---|---|---|
| *Mixing Energy* | | |
| *WEF MOP 8 :* | *0.020-0.026* | *hp/1kcf* |
| *M & E Typical:* | *0.025-0.04* | *hp/1kcf* |
| *Velocity Gradient:* | *50-80* | *1/sec* |

**Digester Heatloss:**

Heating Requirements

| *Winter* | Lead | Lag | Total | |
|---|---|---|---|---|
| Sludge Heating Requirements | 402,000 | 0* | 402,000 | BTU/hr |
| Digester Skin Losses | 48,000 | 48,000 | 96,000 | BTU/hr |
| Total | 450,000 | 48,000 | 498,000 | BTU/hr |

**Sludge fed into the lag digester is at the operating temperature and does not increase the heatload*

**Biogas Generation:**

Method: Theoretical VSS Destroyed

Vd = 13.7 ln*(t)* + 18.94

*Where t = HRT*

| | Low | High | |
|---|---|---|---|
| Typical Gas Production: | 12 | 18 | cf biogas/lb VSS destroyed |
| Theoretical Production: | 15.5 | 23.3 | cfm biogas |
| | | | |
| Heating Value | 650 | | BTU/cf |
| Heat Available | 605,754 | 908,631 | BTU/hr |

**Heat Exchangers**

Design Conditions

| Cold Side (sludge) | Lead | Lag | |
|---|---|---|---|
| Heat exchanged Q | 466,000 | 90,000 | BTU/hr |
| Flow | 120 | 80 | gpm |
| Temp In (T2B) | 97 | 97 | °F |
| Hot Side (hydronic loop) | | | |
| Temp In (T1A) | 150 | 150 | °F |
| Temp Out (T1B) | 140 | 140 | °F |
| | | | |
| Heat Transfer Coefficient: | 135 | 55 | |
| Log Mean Temperature: | 44 | 47 | °F |
| | | | |
| Surface Area Required[(1)] : | 86 | 39 | $ft^2$ |

*(1) - Based on additional 10% Safety Factor*

**Boiler Sizing:**

| | | |
|---|---|---|
| Boiler Heat Output: | 584,000 | BTU/hr |
| Efficiency: | 80% | |
| Required Heat Input: | 730,000 | BTU/hr |
| | | |
| Req'd Biogas Flow Rate: | 18.7 | cfm |

**Redundancy**

The anaerobic digesters are normally run in series but have been designed to have the capability to operate in parallel. This will allow a single digester to be taken out of service while maintaining anaerobic digestion. The existing sludge holding lagoons will be used as backup in case of upsets or mechanical failures.

# APPENDIX E
# PRELIMINARY BASIS OF DESIGN

# ALLENDALE CHARTER TOWNSHIP
## Wastewater Treatment Plant
## Preliminary Design Basis - Flow, Loading and Effluent Limits

**Population Projection**

| Year | Total Township Population | Service Area REUs | Flow Rate Per REU, gpd/REU | Average Daily Flow, MGD |
|---|---|---|---|---|
| 2017 | 26,059 | 7,700 | 165 | 1.27 |
| 2039 (1) | 55,500 | 16,400 | 165 | 2.7 |

(1) Estimated based on 3.5% growth rate during the planning period.

(2) Average Daily Flow Rate while GVSU is in session

**Influent**

| Parameter | Current Flow mgd | Proposed Flow mgd |
|---|---|---|
| Peak Hour Flow | 4.2 | 7.5 |
| Average Daily Flow | 1.6 | 3.2 |
| Minimum Flow | 0.07 | 0.4 |

| Parameter | Current Concentration mg/L | Current Loading lb/day | Proposed Concentration mg/L | Proposed Loading lb/day |
|---|---|---|---|---|
| $CBOD_5$ | 250 | 3,338 | 300 | 8,012 |
| TSS | 200 | 2,671 | 300 | 8,012 |
| Ammonia Nitrogen | | | 41 | 1,095 |
| Total Phosphorus | 6 | 80 | 8 | 214 |

**Effluent Limits**

| Parameter | 2018 NPDES Permit Concentration mg/L | 2018 NPDES Permit Loading lb/day | Proposed Concentration mg/L | Proposed Loading lb/day |
|---|---|---|---|---|
| $CBOD_5$ | 25 Daily<br>40 7-Day | 500 Daily<br>700 7-Day | 25 Daily<br>40 7-Day | 500 Daily<br>700 7-Day |
| TSS | 30 Daily<br>45 7-Day | 900 Daily<br>700 7-Day | 30 Daily<br>45 7-Day | 900 Daily<br>700 7-Day |
| Ammonia Nitrogen: May - September | | Report | | Report |
| Total Phosphorus | 1.0 Monthly | 20 Monthly | 1.0 Monthly | 20 Monthly |

# ALLENDALE CHARTER TOWNSHIP
## Wastewater Treatment Plant
## Preliminary Design Basis - Headworks

**Influent Fine Screen**

| | |
|---|---|
| Type | Perforated Plate |
| Number | 1 |
| Opening Size | 1/4" |
| Capacity | 7.5 MGD |
| Disposal of screening | Washer / Compactor |

**Bypass Screen**

| | |
|---|---|
| Type | Perforated Plate |
| Number | 1 |
| Peak Hour Flow | 1/4" |
| Capcity | 5.7 MGD |
| Disposal of screening | Manual |

**Grit Removal**

| | |
|---|---|
| Type of Grit removal | Vortex |
| Number of units | 1 |
| Size of units | 10' diameter |
| Method for Removal of Grit | Air Lift Pump |
| Grit washer description | Dewater Screw Classifier |
| Capacity | 7.5 MGD |

**Flow Meters**

| | |
|---|---|
| Type | 18" Parshall Flume |
| Location | Downstream of Grit Removal |
| Measuring Unit | Ultrasonic Level Sensor, 4-20 mA to SCADA |

**ALLENDALE CHARTER TOWNSHIP**
**Wastewater Treatment Plant**
**Preliminary Design Basis - Primary Clarifiers**

**Influent Loading**

| | | |
|---|---|---|
| Design Peak Flow | 7,500,000 | gallons per day |
| Design Flow | 3,200,000 | gallons per day |

**Primary Clarifiers**

| | | |
|---|---|---|
| Quantity: | 6 | Rectangular |
| Dimensions: | 56 ft x 12 ft | |
| Average Depth: | 8 | ft |
| Surface Area, per clarifier | 672 | SF |
| Peak Hour Flow | 4,032 | SF |
| Total Volume: | 241,275 | gallons |
| Weir length, per clarifier | 44 | ft |
| Total weir length | 264 | ft |

**Surface Loading Rates**

| | | | | |
|---|---|---|---|---|
| Design Loading : | 794 | gpd/SF at | 3,200,000 | gpd |
| Design Standard (Avg, co-settle): | 700 | gpd/SF | | |
| Design Standard (Avg, primary only): | 1,000 | gpd/SF | | |
| | | | | |
| Peak Design Loading: | 1,860 | gpd/SF, using all clarifiers at | 7,500,000 | gpd |
| Design Standard (Peak Hr, co-settle): | 1,200 | gpd/SF | | |
| Design Standard (Peak Hr, primary only): | 2,000 | gpd/SF (10SS Range 1,500 - 2,000) | | |
| | | | | |
| Maximum Capacity (co-settle) | 4.8 | MGD | | |
| Maximum Capacity (primary only) | 8.1 | MGD | | |

**Weir Loading Rates**

| | | |
|---|---|---|
| Peak Loading | 28,409 | gpd/ft weir |
| Design Standard (Peak): | 30,000 | gpd/ft weir |
| | | |
| Maximum capacity | 7.9 | MGD |

# ALLENDALE CHARTER TOWNSHIP
## Wastewater Treatment Plant
## Preliminary Design Basis - Secondary Clarifiers

**Influent Loading**

| | | |
|---|---|---|
| Design Peak Flow | 7,500,000 | gallons per day |
| Design Flow | 3,200,000 | gallons per day |

**Secondary Clarifiers**

| | | |
|---|---|---|
| Quantity: | 4 | |
| Size: | 55 | ft diameter |
| Depth: | 12 | ft SWD |
| Total Surface Area: | 9,503 | SF |
| Peak Hour Flow | 213,254 | gallons |
| Total Volume: | 426,509 | gallons |
| Weir Length: | 637 | ft |

**Surface Overflow**

| | | | | |
|---|---|---|---|---|
| Peak Hour Surface Overflow: | 789 | gpd/SF at | 7,500,000 | gpd |
| Design Standard: | 900 | gpd/SF | | |
| Maximum Capacity: | 8.6 | MGD | | |

**Detention Time**

| | | | | |
|---|---|---|---|---|
| Design Flow | 3.2 | hours at | 3,200,000 | gpd |
| Peak Flow | 1.4 | hours at | 7,500,000 | gpd |

**Weir Overflow Rates**

| | | | | |
|---|---|---|---|---|
| Design Flow | 5,026 | gpd/ft at | 3,200,000 | gpd |
| Peak Flow | 11,779 | gpd/ft at | 7,500,000 | gpd |
| Design Standard (Peak): | 30,000 | gpd/ft weir | | |

# ALLENDALE CHARTER TOWNSHIP
## Wastewater Treatment Plant
## Preliminary Design Basis - Disinfection

### UV Disinfection

| | | |
|---|---|---|
| Lamp Type: | Low Pressure | |
| Ballast Type: | Electronic, variable | |
| Number of Banks: | 2 | |
| Number of Modules per Bank: | 4 | |
| Number of Bulbs per Module: | 6 | |
| Total Number of Bulbs: | 48 | |
| Average Power Draw: | 6.6 | kW |
| Maximum Power Draw: | 8.7 | kW |
| Peak Hour Flow | Horizontal | |
| Level Control Device: | Weir | |
| Electronic Power Input: | 480 V, Three Phase | |
| Channel Length: | 22 | ft |
| Channel Width: | 16 | in |
| Channel Depth: | 54 | in |
| Design UV Transmittance: | 60 | % UVT |
| UV Module Lifting Device: | Yes, inlcudes Davit crane and lift sling | |
| Automatic Cleaning System: | Yes, uses mechanical and chemical methods | |

**ALLENDALE CHARTER TOWNSHIP**
**Wastewater Treatment Plant**
**Preliminary Design Basis - Solids Handling System**

**Waste Activated Sludge Thickener**

| | | |
|---|---|---|
| WAS to Thickener | 21,176 | gpd |
| RAS/WAS Concentration | 1.0% | |
| RAS/WAS S.G. | 1.02 | |
| Wasting Interval | 8 | hrs/day |
| Thickener Influent Flow Rate | 44 | gpm |
| Thickened WAS | 6,918 | gpd |
| Effluent WAS Concentration | 4% - 6% | |

**Digester Loading**

| | | |
|---|---|---|
| Peak Hour Flow | 8,288 | dry lb/day |
| Avg. Sludge Wasting % solids | 5.0% | |
| Avg. Sludge Wasting % VSS | 75.0% | |
| VSS into Digestion | 6,216 | dry lb/day |
| Sludge Wasting Volume to digester | 18,213 | gpd |

**Digester Capacity**

| | | |
|---|---|---|
| Number of tanks | 2 | |
| Diameter | 33 | ft |
| Tank wall height | 26.5 | ft |
| Foam headspace allocation | 3.0 | ft |
| SWD | 23.5 | ft |
| Volume, each tank | 20,100 | cf |
| | 150,344 | gallons |
| Volume, total | 40,199 | cf |
| | 300,689 | gallons |

**Loading and Detention Time**

| | | |
|---|---|---|
| Detention Time | 16.5 | days |
| VSS Loading to digester | 155 | lb VSS/1000 CF |

*See loading references below*

**Dewatering System**

| | | |
|---|---|---|
| Digester Biosolids Produced | 4,807 | dry lb/day |
| | 33,649 | dry lb/week |
| Assume Specific Gravity | 1.25 | |
| Percent solids of incoming sludge | 2% | |
| Final Solids | 20% | |
| Cake Volume per Week | 2,157 | cubic feet |
| | 80 | cubic yards |
| Cake Volume per Day | 11.4 | cubic yards |
| Digested Biosolids Flow Rate | 161,289 | gallons per week |

| | | |
|---|---|---|
| Operating Time | 5 | days per week |
| | 6 | hours per day |
| Dewatering System Flow Rate | 90 | gpm |
| Storage Required | 4 | days |
| Biosolids Feed Tank Size | 93,000 | gallons |
| Tank Diameter | 25 | ft |
| Tank Height | 27 | ft |

# APPENDIX F
# OPINION OF PROBABLE COST

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| Summary Table: Engineer's Opinion of Probable Project Costs | | | | | | |
|---|---|---|---|---|---|---|
| **Alternative** | **Project Cost** | **Annual OM&R Cost (1)** | **Net Present Worth of OM&R Cost (2)** | **Total Present Worth** | **Salvage Value** | **Net Present Worth** |
| **Alternatives** | | | | | | |
| **Alternative 1 - WWTP Expansion with MBBR and Nitrification Tower** | $27,500,000 | $1,970,000 | $38,600,000 | **$ 66,100,000** | $2,420,000 | **$63,680,000** |
| **Alternative 2 - WWTP Expansion Extended Aeration (VLR)** | $27,300,000 | $1,810,000 | $35,500,000 | **$ 62,800,000** | $2,780,000 | **$60,020,000** |
| **Alternative 3 - WWTP Expansion Extended Aeration (Oxidation Ditch)** | $30,800,000 | $1,850,000 | $36,200,000 | **$ 67,000,000** | $3,880,000 | **$63,120,000** |
| **Alternative 4 - WWTP Expansion with Activated Sludge** | $26,700,000 | $1,890,000 | $37,000,000 | **$ 63,700,000** | $2,140,000 | **$61,560,000** |

Note: This table represents budgetary estimates for planning purposes. Further definition of the scope of the projects through preliminary and final design will provide details

(1) Annual OM&R Cost based on the existing 2019 Sewer Fund Budget (including collection system) with adjustments for the upgraded system, assuming treatment at design flow rate and loading. 2019 Sewer Fund Budget = $1,405,051.

(2) Net Present Worth calculated using the real discount rate for a 20-year period (i = 0.2%) based on MDEQ guidance for FY2019.

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# Engineer's Opinion of Probable Project Cost [1]

| | | | |
|---|---|---|---|
| *Project:* | Allendale Charter Township - Feasibility Study | *Project No.* | 836130 |
| *Basis for Estimate:* | [ X ] Conceptual [ ] Basis of Design [ ] Final | *Estimator:* | MJV |
| *Work:* | **Alternative 1 - WWTP Expansion with MBBR and Nitrification Tower** | *Current ENR-CCI:* | 11185 |

| Item | Description | Unit | Qty. | Unit Price | Amount |
|---|---|---|---|---|---|
| **1** | **Phase I - Control Building and Miscellaneous Improvements** | **1** | **LS** | **$ 2,500,000** | **$ 2,500,000** |
| **2** | **Phase II - Capacity Expansion and Biosolids Dewatering** | **1** | **LS** | **$ 21,700,000** | **$ 21,700,000** |
| **3** | Primary Clarifiers | | | $ 1,260,000 | |
| **4** | Biological Treatment with MBBR and Nitrification Tower | | | $ 9,240,000 | |
| **5** | Secondary Clarifier | | | $ 2,900,000 | |
| **6** | Disinfection | | | $ 1,500,000 | |
| **7** | Biosolids Dewatering System | | | $ 5,700,000 | |
| **8** | Odor Control | | | $ 1,040,000 | |
| **9** | **Phase III-Headworks and Secondary Solids Handling Improvements** | **1** | **LS** | **$ 3,300,000** | **$ 3,300,000** |
| **10** | Headworks Improvements | | | $ 1,600,000 | |
| **11** | Waste Secondary Sludge Thickening | | | $ 1,700,000 | |
| | | | | **Total Project Cost:** | **$27,500,000** |

Notes:

(1) This estimate represents a budgetary cost estimate to be used for planning purposes. Further definition of the scope of the project through preliminary and final design will provide details necessary to improve the accuracy of conceptual estimates.

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# Engineer's Opinion of Probable Project Cost [1]

| | | | |
|---|---|---|---|
| *Project:* | Allendale Charter Township - Feasibility Study | *Project No.* | 836130 |
| *Basis for Estimate:* | [ X ] Conceptual [ ] Basis of Design [ ] Final | *Estimator:* | MJV |
| *Work:* | **Alternative 2 - WWTP Expansion Extended Aeration (VLR)** | *Current ENR-CCI:* | 11185 |

| Item | Description | Unit | Qty. | Unit Price | Amount |
|---|---|---|---|---|---|
| **1** | **Phase I - Control Building and Miscellaneous Improvements** | **1** | **LS** | **$ 2,500,000** | **$ 2,500,000** |
| **2** | **Phase II - Capacity Expansion and Biosolids Dewatering** | **1** | **LS** | **$ 21,500,000** | **$ 21,500,000** |
| **3** | Primary Clarifiers | | | $ 1,260,000 | |
| **4** | Biological Treatment with Vertical Loop Reactor | | | $ 9,050,000 | |
| **5** | Secondary Clarifier | | | $ 2,900,000 | |
| **6** | Disinfection | | | $ 1,500,000 | |
| **7** | Biosolids Dewatering System | | | $ 5,700,000 | |
| **8** | Odor Control | | | $ 1,040,000 | |
| **9** | **Phase III-Headworks and Secondary Solids Handling Improvements** | **1** | **LS** | **$ 3,300,000** | **$ 3,300,000** |
| **10** | Headworks Improvements | | | $ 1,600,000 | |
| **11** | Waste Secondary Sludge Thickening | | | $ 1,700,000 | |
| | | | | **Total Project Cost:** | **$27,300,000** |

Notes:

(1) This estimate represents a budgetary cost estimate to be used for planning purposes. Further definition of the scope of the project through preliminary and final design will provide details necessary to improve the accuracy of conceptual estimates.

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# Engineer's Opinion of Probable Project Cost [1]

| | | | |
|---|---|---|---|
| *Project:* | Allendale Charter Township - Feasibility Study | *Project No.* | 836130 |
| *Basis for Estimate:* | [ X ] Conceptual [ ] Basis of Design [ ] Final | *Estimator:* | MJV |
| *Work:* | **Alternative 3 - WWTP Expansion Extended Aeration (Oxidation Ditch)** | *Current ENR-CCI:* | 11185 |

| Item | Description | Unit | Qty. | Unit Price | Amount |
|---|---|---|---|---|---|
| **1** | **Phase I - Control Building and Miscellaneous Improvements** | **1** | **LS** | **$ 2,500,000** | **$ 2,500,000** |
| **2** | **Phase II - Capacity Expansion and Biosolids Dewatering** | **1** | **LS** | **$ 25,000,000** | **$ 25,000,000** |
| **3** | Primary Clarifiers | | | $ 1,260,000 | |
| **4** | Biological Treatment with Oxidation Ditch | | | $ 12,600,000 | |
| **5** | Secondary Clarifier | | | $ 2,900,000 | |
| **6** | Disinfection | | | $ 1,500,000 | |
| **7** | Biosolids Dewatering System | | | $ 5,700,000 | |
| **8** | Odor Control | | | $ 1,040,000 | |
| **9** | **Phase III-Headworks and Secondary Solids Handling Improvements** | **1** | **LS** | **$ 3,300,000** | **$ 3,300,000** |
| **10** | Headworks Improvements | | | $ 1,600,000 | |
| **11** | Waste Secondary Sludge Thickening | | | $ 1,700,000 | |
| | | | | **Total Project Cost:** | **$30,800,000** |

Notes:

(1) This estimate represents a budgetary cost estimate to be used for planning purposes. Further definition of the scope of the project through preliminary and final design will provide details necessary to improve the accuracy of conceptual estimates.

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# Engineer's Opinion of Probable Project Cost [1]

| | | | |
|---|---|---|---|
| *Project:* | Allendale Charter Township - Feasibility Study | *Project No.* | 836130 |
| *Basis for Estimate:* | [ X ] Conceptual [ ] Basis of Design [ ] Final | *Estimator:* | MJV |
| *Work:* | **Alternative 4 - WWTP Expansion with Activated Sludge** | *Current ENR-CCI:* | 11185 |

| Item | Description | Unit | Qty. | Unit Price | Amount |
|---|---|---|---|---|---|
| **1** | **Phase I - Control Building and Miscellaneous Improvements** | **1** | **LS** | **$ 2,500,000** | **$ 2,500,000** |
| **2** | **Phase II - Capacity Expansion and Biosolids Dewatering** | **1** | **LS** | **$ 20,900,000** | **$ 20,900,000** |
| **3** | Primary Clarifiers | | | $ 1,260,000 | |
| **4** | Biological Treatment with Conventional Activated Sludge | | | $ 8,480,000 | |
| **5** | Secondary Clarifier | | | $ 2,900,000 | |
| **6** | Disinfection | | | $ 1,500,000 | |
| **7** | Biosolids Dewatering System | | | $ 5,700,000 | |
| **8** | Odor Control | | | $ 1,040,000 | |
| **9** | **Phase III-Headworks and Secondary Solids Handling Improvements** | **1** | **LS** | **$ 3,300,000** | **$ 3,300,000** |
| **10** | Headworks Improvements | | | $ 1,600,000 | |
| **11** | Waste Secondary Sludge Thickening | | | $ 1,700,000 | |
| | | | | **Total Project Cost:** | **$26,700,000** |

Notes:

(1) This estimate represents a budgetary cost estimate to be used for planning purposes. Further definition of the scope of the project through preliminary and final design will provide details necessary to improve the accuracy of conceptual estimates.

# APPENDIX G
# WWTP SAMPLE RESULTS

# WASTEWATER TREATMENT PLANT FLOWS, LOADS AND CONCENTRATIONS

Influent sampling is conducted five times weekly. The results of this sampling are presented in Table 11.

**Table 1. Influent Flows, Loads and Concentration**

| Parameter | | Influent Sampling (Jan. 2013 – Jan. 2018) | | | | Sewer Use Ordinance Limits | Basis of Design |
|---|---|---|---|---|---|---|---|
| | | Average | % of Design | Maximum | 85th Percentile | | |
| **Flow** | (MGD) | 1.075 | 67% | 2.907 | 1.291 | - | 1.6 |
| **BOD** | Conc. (mg/L) | 272 | 109% | 735 | 321 | 780 | 250 |
| | Loading (lbs) | 2477 | 74% | 6984 | 3282 | - | 3714 |
| **TSS** | Conc. (mg/L) | 261 | 130% | 1030 | 330 | 680 | 200 |
| | Loading (lbs) | 2388 | 89% | 9909 | 3307 | - | 2972 |
| **Phosphorus** | Conc. (mg/L) | 6.6 | 110% | 15.6 | 8.0 | 10 | 6 |
| | Loading (lbs) | 60.6 | 68% | 165 | 83 | - | 89 |
| **VSS** | Conc. (mg/L) | 241 | - | 540 | 310 | - | - |
| **pH** | (S.U.) | 7.5 | - | 8.5 | 7.6 | - | - |
| **Temperature** | (deg F) | 60.5 | - | 73 | 67 | - | - |

Table 2 displays the average monthly influent wastewater characteristics.

**Table 2. Influent Monthly Averages**

| Date | BOD (mg/L) | BOD (lbs) | TSS (mg/L) | TSS (lbs) | Phos. (mg/L) | Phos. (lbs) | VSS (mg/L) | pH | Temperature (deg F) | Flow |
|---|---|---|---|---|---|---|---|---|---|---|
| **Jan-13** | 245.9 | 2290.3 | 200.0 | 1833.9 | 3.8 | 35.2 | 183.5 | 7.9 | 58.3 | 1.129 |
| **Feb-13** | 270.0 | 2815.7 | 249.0 | 2596.2 | 3.3 | 34.6 | 240.0 | 7.6 | 56.5 | 1.249 |
| **Mar-13** | 253.6 | 2399.7 | 216.7 | 2082.2 | 3.5 | 33.3 | 204.8 | 7.7 | 54.4 | 1.122 |
| **Apr-13** | 248.2 | 3042.9 | 226.8 | 2765.8 | 3.7 | 45.5 | 210.9 | 7.6 | 54.0 | 1.470 |
| **May-13** | 215.6 | 1581.3 | 193.6 | 1425.8 | 3.2 | 23.0 | 185.0 | 7.6 | 56.9 | 0.880 |
| **Jun-13** | 250.4 | 1725.6 | 214.8 | 1476.3 | 3.5 | 24.3 | 198.6 | 7.5 | 60.2 | 0.828 |
| **Jul-13** | 242.9 | 1538.7 | 193.0 | 1226.2 | 3.2 | 20.4 | 183.0 | 7.5 | 64.1 | 0.763 |
| **Aug-13** | 256.7 | 1965.7 | 256.7 | 1974.2 | 3.8 | 29.0 | 240.5 | 7.5 | 66.3 | 0.891 |
| **Sep-13** | 321.1 | 3034.5 | 286.8 | 2759.3 | 7.3 | 70.9 | 261.4 | 7.6 | 68.4 | 1.154 |
| **Oct-13** | 284.3 | 2880.8 | 277.4 | 2813.3 | 7.3 | 77.9 | 261.7 | 7.6 | 67.4 | 1.217 |
| **Nov-13** | 287.0 | 2774.6 | 262.5 | 2575.2 | 7.1 | 68.9 | 242.5 | 7.5 | 63.3 | 1.163 |
| **Dec-13** | 303.2 | 2340.5 | 245.9 | 1999.2 | 6.7 | 52.4 | 229.1 | 7.6 | 58.1 | 0.904 |
| **Jan-14** | 314.5 | 3037.7 | 268.6 | 2605.3 | 7.2 | 69.4 | 255.0 | 7.6 | 55.5 | 1.154 |
| **Feb-14** | 309.5 | 3050.1 | 307.0 | 3028.7 | 7.6 | 74.8 | 286.5 | 7.6 | 54.5 | 1.183 |
| **Mar-14** | 250.5 | 2424.8 | 234.1 | 2290.3 | 6.6 | 64.4 | 210.9 | 7.6 | 53.0 | 1.165 |
| **Apr-14** | 247.3 | 2572.3 | 246.5 | 2584.3 | 6.5 | 67.5 | 227.0 | 7.6 | 53.8 | 1.242 |
| **May-14** | 215.0 | 1639.5 | 223.0 | 1707.7 | 5.6 | 42.8 | 203.5 | 7.5 | 55.7 | 0.923 |

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| **Jun-14** | 212.0 | 1507.6 | 231.4 | 1670.0 | 6.0 | 42.7 | 211.4 | 7.5 | 60.0 | 0.859 |
| **Jul-14** | 214.3 | 1459.4 | 213.9 | 1450.0 | 5.6 | 37.9 | 193.5 | 7.6 | 63.4 | 0.817 |
| **Aug-14** | 262.9 | 2143.8 | 271.0 | 2202.2 | 6.6 | 53.4 | 256.7 | 7.5 | 65.9 | 0.956 |
| **Sep-14** | 312.3 | 3068.8 | 313.2 | 3075.0 | 7.7 | 75.5 | 294.5 | 7.5 | 68.4 | 1.178 |
| **Oct-14** | 284.1 | 2725.6 | 338.8 | 3243.4 | 8.0 | 77.0 | 302.8 | 7.5 | 67.1 | 1.149 |
| **Nov-14** | 296.2 | 2828.0 | 295.7 | 2818.5 | 7.4 | 70.0 | 275.2 | 7.6 | 62.1 | 1.134 |
| **Dec-14** | 267.8 | 2071.9 | 313.5 | 2441.8 | 6.5 | 50.6 | 271.3 | 7.6 | 58.0 | 0.904 |
| **Jan-15** | 296.0 | 2790.2 | 341.9 | 3256.5 | 7.7 | 72.9 | 319.5 | 7.6 | 56.0 | 1.135 |
| **Feb-15** | 334.5 | 3207.8 | 348.5 | 3346.5 | 7.7 | 73.5 | 331.0 | 7.6 | 55.4 | 1.152 |
| **Mar-15** | 300.0 | 2830.3 | 308.3 | 2903.9 | 6.9 | 65.3 | 284.8 | 7.6 | 53.3 | 1.122 |
| **Apr-15** | 315.0 | 3069.8 | 320.9 | 3192.0 | 6.9 | 67.2 | 300.9 | 7.5 | 54.6 | 1.168 |
| **May-15** | 256.7 | 1890.8 | 257.4 | 1924.7 | 5.9 | 43.1 | 247.2 | 7.5 | 56.5 | 0.887 |
| **Jun-15** | 220.7 | 1538.6 | 232.3 | 1628.6 | 6.2 | 43.5 | 206.4 | 7.5 | 60.1 | 0.840 |
| **Jul-15** | 247.9 | 1644.0 | 225.5 | 1501.7 | 6.3 | 41.8 | 201.8 | 7.5 | 63.0 | 0.795 |
| **Aug-15** | 274.6 | 2074.7 | 248.6 | 1860.1 | 6.7 | 49.9 | 213.6 | 7.5 | 66.0 | 0.877 |
| **Sep-15** | 272.7 | 2811.1 | 235.5 | 2432.7 | 7.4 | 76.7 | 213.2 | 7.5 | 69.0 | 1.251 |
| **Oct-15** | 321.9 | 3117.9 | 312.9 | 3033.3 | 8.3 | 80.2 | 292.4 | 7.5 | 67.4 | 1.162 |
| **Nov-15** | 313.6 | 2907.3 | 277.7 | 2602.7 | 7.9 | 74.0 | 261.8 | 7.4 | 65.0 | 1.109 |
| **Dec-15** | 286.6 | 2491.7 | 260.0 | 2274.1 | 7.0 | 60.5 | 245.7 | 7.5 | 60.4 | 1.004 |
| **Jan-16** | 280.5 | 2645.3 | 267.6 | 2528.8 | 7.2 | 67.5 | 249.5 | 7.5 | 56.7 | 1.118 |
| **Feb-16** | 278.6 | 2891.9 | 291.0 | 3018.2 | 7.2 | 74.6 | 270.0 | 7.5 | 57.6 | 1.248 |
| **Mar-16** | 272.6 | 2653.9 | 275.7 | 2685.8 | 7.2 | 71.0 | 254.8 | 7.5 | 57.7 | 1.153 |
| **Apr-16** | 253.5 | 2727.2 | 259.5 | 2790.1 | 7.1 | 76.4 | 250.0 | 7.5 | 56.9 | 1.293 |
| **May-16** | 225.8 | 1685.3 | 228.3 | 1710.8 | 6.1 | 46.0 | 217.8 | 7.5 | 57.0 | 0.899 |
| **Jun-16** | 246.3 | 1689.6 | 226.8 | 1562.3 | 6.5 | 44.3 | 206.8 | 7.4 | 60.5 | 0.826 |
| **Jul-16** | 231.7 | 1577.2 | 242.9 | 1663.8 | 6.6 | 45.0 | 226.0 | 7.4 | 64.0 | 0.818 |
| **Aug-16** | 242.9 | 2029.6 | 236.1 | 1977.5 | 6.8 | 57.2 | 223.0 | 7.5 | 66.9 | 0.990 |
| **Sep-16** | 300.3 | 3136.7 | 275.0 | 2850.2 | 8.0 | 82.5 | 267.1 | 7.4 | 70.3 | 1.242 |
| **Oct-16** | 301.5 | 3083.1 | 283.2 | 2892.1 | 8.2 | 83.7 | 267.7 | 7.4 | 68.6 | 1.226 |
| **Nov-16** | 284.5 | 2797.8 | 258.1 | 2537.4 | 8.1 | 79.9 | 245.7 | 7.4 | 63.9 | 1.178 |
| **Dec-16** | 260.0 | 2256.2 | 234.8 | 2083.9 | 7.0 | 61.6 | 228.5 | 7.5 | 55.9 | 1.021 |
| **Jan-17** | 271.7 | 2735.2 | 250.5 | 2538.6 | 7.1 | 71.9 | 238.9 | 7.5 | 52.6 | 1.192 |
| **Feb-17** | 300.9 | 3120.4 | 274.5 | 2855.1 | 7.9 | 82.0 | 260.6 | 7.5 | 52.6 | 1.244 |
| **Mar-17** | 280.9 | 2742.8 | 256.8 | 2502.0 | 7.3 | 71.4 | 241.8 | 7.5 | 54.0 | 1.154 |
| **Apr-17** | 265.1 | 2905.5 | 251.9 | 2772.8 | 7.2 | 79.6 | 239.5 | 7.5 | 57.0 | 1.317 |
| **May-17** | 238.6 | 1851.0 | 219.1 | 1705.5 | 6.6 | 51.3 | 206.2 | 7.5 | 57.2 | 0.938 |
| **Jun-17** | 238.5 | 1777.1 | 242.0 | 1803.3 | 7.0 | 51.8 | 228.5 | 7.5 | 62.2 | 0.893 |
| **Jul-17** | 272.5 | 1964.7 | 230.0 | 1652.9 | 6.5 | 46.5 | 195.5 | 7.5 | 65.1 | 0.863 |
| **Aug-17** | 276.4 | 2324.3 | 257.4 | 2155.3 | 7.1 | 59.6 | 230.0 | 7.5 | 67.1 | 0.988 |
| **Sep-17** | 311.5 | 3243.5 | 278.0 | 2888.8 | 8.3 | 86.0 | 254.5 | 7.6 | 69.4 | 1.247 |
| **Oct-17** | 304.4 | 3364.1 | 278.3 | 3101.2 | 7.9 | 87.4 | 227.0 | 7.6 | 68.1 | 1.336 |

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| **Nov-17** | 309.7 | 3276.3 | 300.5 | 3176.0 | 7.8 | 82.7 | 263.5 | 7.5 | 64.0 | 1.237 |
| **Dec-17** | 289.8 | 2529.3 | 274.3 | 2386.3 | 7.3 | 62.9 | 234.5 | 7.5 | 59.0 | 1.013 |
| **Jan-18** | 285.5 | 3024.4 | 314.8 | 3379.6 | 7.7 | 82.1 | 272.4 | 7.5 | 56.7 | 1.269 |
| **Maximum** | 334.5 | 3364.1 | 348.5 | 3379.6 | 8.3 | 87.4 | 331.0 | 7.9 | 70.3 | 1.470 |
| **Minimum** | 212.0 | 1459.4 | 193.0 | 1226.2 | 3.2 | 20.4 | 183.0 | 7.4 | 52.6 | 0.763 |
| **Average** | 272.6 | 2480.8 | 261.6 | 2390.5 | 6.6 | 60.6 | 241.8 | 7.5 | 60.5 | 1.076 |
| **In School Ave** | 287.5 | 2822.4 | 275.9 | 2720.5 | 7.0 | 69.3 | 255.4 | 7.5 | 59.9 | 1.173 |
| **Summer Ave** | 242.1 | 1780.4 | 232.2 | 1713.9 | 5.8 | 42.7 | 213.8 | 7.5 | 61.9 | 0.877 |
| **Design Value** | 250 | 3336 | 200 | 2670 | 6 | 80 | | | | 1.600 |

Table 3 provides a summary of the facility effluent flows and concentrations on a monthly average. The facility discharges treated wastewater directly to the Grand River on a continuous basis.

**Table 3. Effluent Monthly Averages**

| Data | BOD (mg/L) | BOD (lbs) | TSS (mg/L) | TSS (lbs) | Phos. (mg/L) | Phos. (lbs) | VSS (mg/L) | BOD %Rem | TSS %Rem | Phos. %Rem | pH | D.O. MG/L | F.Coli. #/100m | Flow (mgd) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Jan-13** | 5.8 | 93.3 | 5.1 | 83.7 | 0.6 | 10.2 | 3.9 | 97.5 | 96.5 | 82.4 | 7.5 | 9.5 | 22 | 1.851 |
| **Feb-13** | 6.2 | 104.8 | 6.2 | 105.6 | 0.6 | 9.6 | 4.6 | 97.8 | 97.5 | 83.1 | 7.5 | 9.7 | 31 | 2.032 |
| **Mar-13** | 6.7 | 105.1 | 8.8 | 135.1 | 0.6 | 9.4 | 6.8 | 97.5 | 96.0 | 82.8 | 7.7 | 10.5 | 31 | 1.856 |
| **Apr-13** | 7.6 | 148.1 | 8.1 | 171.5 | 0.6 | 11.9 | 5.5 | 97.0 | 96.3 | 83.3 | 7.6 | 9.6 | 29 | 2.347 |
| **May-13** | 4.2 | 47.5 | 6.5 | 74.3 | 0.6 | 6.6 | 4.9 | 98.0 | 97.3 | 80.6 | 7.6 | 8.2 | 21 | 1.348 |
| **Jun-13** | 3.8 | 40.1 | 7.2 | 79.7 | 0.6 | 6.0 | 4.3 | 98.5 | 96.2 | 83.3 | 7.5 | 7.1 | 30 | 1.280 |
| **Jul-13** | 3.6 | 36.3 | 3.9 | 39.6 | 0.7 | 6.8 | 3.1 | 98.6 | 98.2 | 79.3 | 7.5 | 6.3 | 52 | 1.226 |
| **Aug-13** | 4.1 | 47.1 | 4.1 | 48.6 | 0.8 | 8.9 | 2.8 | 98.5 | 98.7 | 77.9 | 7.4 | 6.1 | 58 | 1.313 |
| **Sep-13** | 4.0 | 53.4 | 3.7 | 49.9 | 0.6 | 7.5 | 2.5 | 98.8 | 98.7 | 92.2 | 7.4 | 6.6 | 44 | 1.601 |
| **Oct-13** | 3.2 | 44.6 | 2.3 | 31.4 | 0.5 | 7.0 | 1.7 | 98.9 | 99.3 | 93.3 | 7.4 | 7.1 | 72 | 1.644 |
| **Nov-13** | 4.3 | 59.7 | 3.4 | 47.6 | 0.5 | 7.1 | 2.4 | 98.7 | 98.6 | 92.8 | 7.5 | 8.4 | 68 | 1.669 |
| **Dec-13** | 3.9 | 51.0 | 3.0 | 38.9 | 0.5 | 6.1 | 2.2 | 98.9 | 98.6 | 92.8 | 7.5 | 9.7 | 25 | 1.516 |
| **Jan-14** | 5.8 | 90.1 | 6.1 | 95.6 | 0.7 | 10.7 | 4.2 | 98.2 | 97.8 | 90.1 | 7.5 | 10.0 | 66 | 1.837 |
| **Feb-14** | 6.4 | 97.4 | 9.3 | 140.3 | 0.7 | 10.7 | 5.9 | 98.1 | 96.9 | 90.6 | 7.6 | 9.7 | 42 | 1.826 |
| **Mar-14** | 5.8 | 85.1 | 3.7 | 51.0 | 0.4 | 5.7 | 2.2 | 97.8 | 98.8 | 93.9 | 7.6 | 10.5 | 19 | 1.693 |
| **Apr-14** | 9.8 | 144.4 | 6.8 | 99.5 | 0.4 | 5.7 | 4.8 | 96.3 | 96.8 | 94.2 | 7.5 | 9.8 | 16 | 1.771 |
| **May-14** | 6.0 | 71.5 | 6.5 | 77.4 | 0.4 | 4.5 | 5.0 | 97.5 | 97.6 | 93.3 | 7.5 | 8.5 | 12 | 1.420 |
| **Jun-14** | 4.5 | 48.8 | 3.9 | 43.2 | 0.5 | 5.7 | 3.1 | 97.9 | 98.6 | 91.5 | 7.5 | 7.1 | 28 | 1.318 |
| **Jul-14** | 4.7 | 50.6 | 5.9 | 64.1 | 0.5 | 5.6 | 4.8 | 97.9 | 97.1 | 90.7 | 7.4 | 6.8 | 24 | 1.307 |
| **Aug-14** | 6.2 | 72.5 | 10.1 | 121.2 | 0.9 | 10.5 | 7.4 | 98.0 | 96.3 | 86.7 | 7.4 | 6.2 | 46 | 1.355 |
| **Sep-14** | 5.9 | 79.4 | 3.9 | 52.7 | 0.7 | 9.1 | 3.0 | 98.3 | 99.1 | 91.6 | 7.5 | 6.9 | 46 | 1.622 |
| **Oct-14** | 4.7 | 63.0 | 3.4 | 45.2 | 0.6 | 8.1 | 2.4 | 98.4 | 99.0 | 92.5 | 7.6 | 7.7 | 57 | 1.585 |

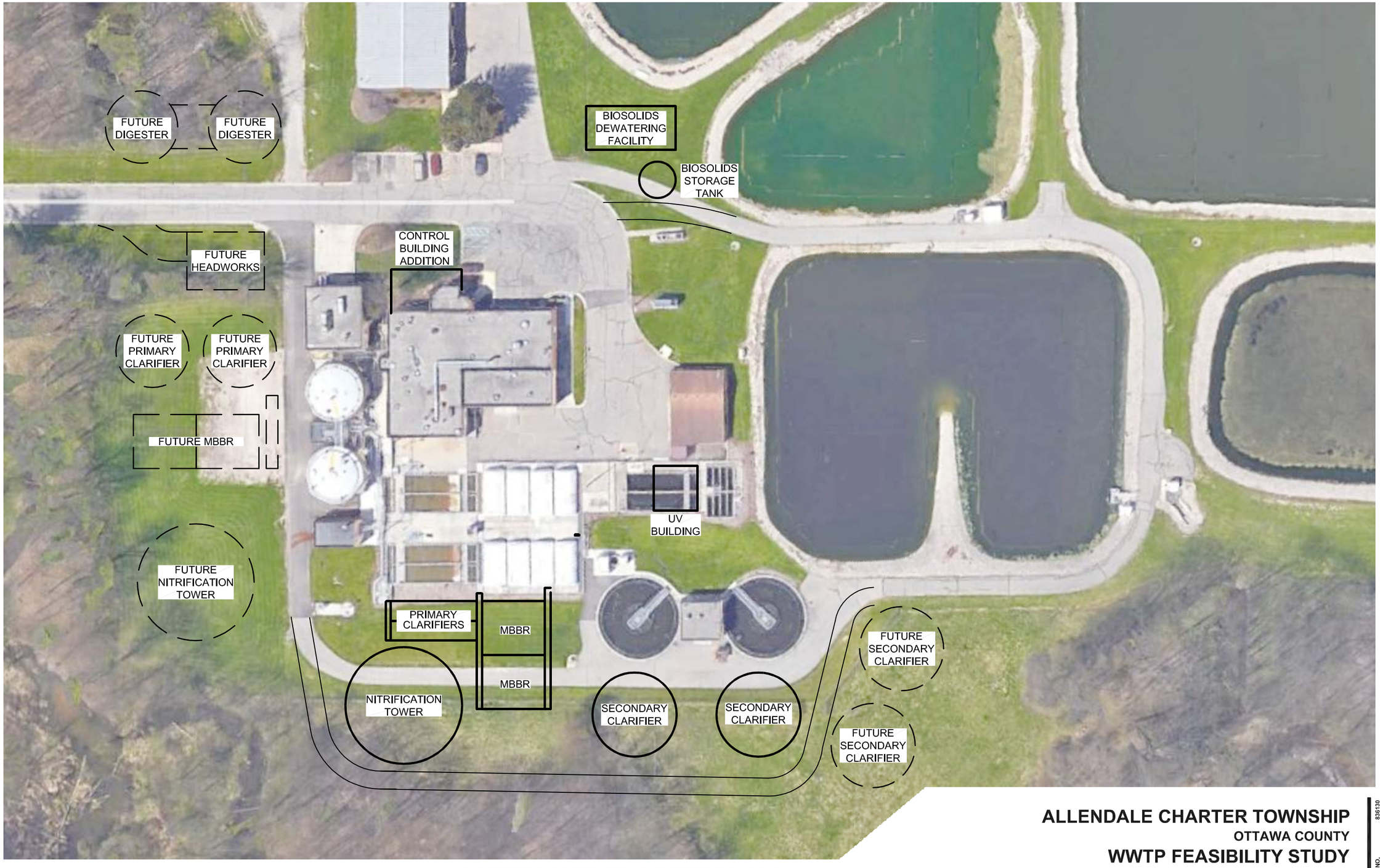
| | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Nov-14** | 4.8 | 65.6 | 2.9 | 38.8 | 0.6 | 8.3 | 2.4 | 98.5 | 99.1 | 91.8 | 7.5 | 8.6 | 82 | 1.632 |
| **Dec-14** | 4.0 | 49.5 | 2.4 | 29.2 | 0.5 | 6.4 | 1.8 | 98.9 | 99.4 | 91.8 | 7.6 | 9.4 | 21 | 1.458 |
| **Jan-15** | 6.2 | 89.7 | 5.8 | 84.2 | 0.7 | 10.0 | 4.5 | 97.9 | 98.4 | 91.4 | 7.6 | 9.9 | 88 | 1.719 |
| **Feb-15** | 6.5 | 87.2 | 6.2 | 83.8 | 0.6 | 8.7 | 4.7 | 98.1 | 98.3 | 91.6 | 7.7 | 10.7 | 441 | 1.611 |
| **Mar-15** | 6.4 | 88.7 | 6.9 | 95.3 | 0.5 | 6.7 | 5.5 | 97.9 | 97.8 | 92.8 | 7.7 | 10.9 | 18 | 1.629 |
| **Apr-15** | 7.2 | 108.0 | 6.7 | 98.8 | 0.5 | 7.2 | 5.6 | 97.8 | 98.2 | 93.0 | 7.6 | 9.1 | 7 | 1.774 |
| **May-15** | 5.0 | 58.9 | 4.4 | 52.3 | 0.5 | 6.0 | 3.3 | 98.1 | 98.0 | 90.0 | 7.5 | 6.9 | 37 | 1.390 |
| **Jun-15** | 4.1 | 43.8 | 4.0 | 43.1 | 0.8 | 8.6 | 3.0 | 98.3 | 98.6 | 85.8 | 7.5 | 6.5 | 32 | 1.301 |
| **Jul-15** | 4.4 | 45.1 | 4.2 | 42.7 | 0.5 | 5.5 | 3.3 | 98.6 | 98.1 | 91.5 | 7.5 | 6.6 | 50 | 1.238 |
| **Aug-15** | 4.2 | 47.0 | 4.9 | 54.8 | 0.6 | 6.5 | 3.5 | 98.8 | 98.0 | 91.3 | 7.4 | 6.4 | 88 | 1.320 |
| **Sep-15** | 5.6 | 76.1 | 9.3 | 146.0 | 0.7 | 9.5 | 6.5 | 97.8 | 96.2 | 90.1 | 7.5 | 6.7 | 141 | 1.591 |
| **Oct-15** | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| **Nov-15** | 4.3 | 59.7 | 3.9 | 56.7 | 0.7 | 10.1 | 2.7 | 98.7 | 98.5 | 91.2 | 7.5 | 8.2 | 23 | 1.661 |
| **Dec-15** | 3.7 | 48.3 | 3.3 | 44.3 | 0.6 | 7.9 | 2.3 | 98.8 | 98.7 | 91.9 | 7.6 | 8.9 | 18 | 1.609 |
| **Jan-16** | 4.2 | 73.2 | 4.8 | 84.1 | 0.6 | 10.1 | 3.2 | 98.4 | 98.2 | 91.7 | 7.5 | 9.4 | 55 | 2.086 |
| **Feb-16** | 4.6 | 84.9 | 4.3 | 79.8 | 0.5 | 9.6 | 3.1 | 98.3 | 98.3 | 92.9 | 7.6 | 9.3 | 34 | 2.185 |
| **Mar-16** | 5.3 | 92.7 | 4.9 | 86.1 | 0.5 | 8.5 | 3.7 | 98.1 | 98.2 | 93.4 | 7.7 | 9.3 | 4 | 2.090 |
| **Apr-16** | 6.2 | 124.3 | 5.9 | 118.6 | 0.6 | 13.1 | 4.4 | 97.6 | 97.7 | 90.6 | 7.7 | 8.6 | 27 | 2.433 |
| **May-16** | 6.2 | 98.8 | 6.2 | 98.4 | 0.4 | 6.9 | 5.3 | 97.1 | 97.5 | 93.1 | 7.6 | 8.5 | 58 | 1.912 |
| **Jun-16** | 5.2 | 81.8 | 7.2 | 114.5 | 0.5 | 7.6 | 5.7 | 97.9 | 96.8 | 92.7 | 7.6 | 8.2 | 49 | 1.869 |
| **Jul-16** | 3.8 | 54.4 | 5.9 | 83.8 | 0.5 | 7.1 | 4.6 | 98.5 | 97.6 | 92.6 | 7.4 | 7.5 | 209 | 1.711 |
| **Aug-16** | 4.6 | 67.6 | 4.5 | 66.0 | 0.5 | 7.8 | 3.5 | 98.1 | 98.2 | 92.4 | 7.4 | 7.3 | 86 | 1.782 |
| **Sep-16** | 7.4 | 103.1 | 6.0 | 82.9 | 0.7 | 9.7 | 4.7 | 97.8 | 97.8 | 92.3 | 7.4 | 7.1 | 101 | 1.674 |
| **Oct-16** | 6.2 | 83.6 | 4.9 | 66.8 | 0.6 | 7.9 | 3.4 | 97.9 | 98.4 | 92.8 | 7.4 | 6.9 | 74 | 1.615 |
| **Nov-16** | 6.2 | 72.8 | 4.5 | 53.8 | 0.5 | 5.8 | 3.3 | 97.5 | 98.1 | 94.0 | 7.5 | 7.5 | 22 | 1.398 |
| **Dec-16** | 4.4 | 50.9 | 3.4 | 40.5 | 0.4 | 4.7 | 2.7 | 98.2 | 98.7 | 94.0 | 7.4 | 8.2 | 24 | 1.318 |
| **Jan-17** | 7.3 | 95.8 | 5.4 | 70.5 | 0.6 | 7.1 | 3.9 | 97.9 | 98.0 | 92.4 | 7.4 | 7.9 | 140 | 1.497 |
| **Feb-17** | 8.0 | 100.2 | 6.6 | 82.8 | 0.7 | 8.8 | 4.6 | 97.2 | 97.7 | 91.0 | 7.4 | 8.0 | 73 | 1.500 |
| **Mar-17** | 6.9 | 88.2 | 6.5 | 83.1 | 0.5 | 6.6 | 4.7 | 97.7 | 97.5 | 92.6 | 7.4 | 8.5 | 8 | 1.477 |
| **Apr-17** | 8.2 | 110.1 | 6.7 | 91.2 | 0.7 | 8.8 | 5.4 | 96.9 | 97.3 | 90.7 | 7.4 | 7.8 | 54 | 1.594 |

| | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **May-17** | 4.7 | 46.3 | 5.2 | 50.8 | 0.5 | 5.1 | 3.6 | 98.0 | 97.8 | 92.1 | 7.4 | 8.0 | 24 | 1.181 |
| **Jun-17** | 4.3 | 41.6 | 6.6 | 63.4 | 0.6 | 6.0 | 4.8 | 98.3 | 97.3 | 91.1 | 7.4 | 7.8 | 53 | 1.161 |
| **Jul-17** | 3.7 | 35.5 | 6.4 | 61.3 | 0.6 | 6.2 | 4.3 | 98.6 | 97.1 | 90.0 | 7.5 | 7.5 | 64 | 1.150 |
| **Aug-17** | 4.1 | 43.8 | 5.7 | 58.2 | 0.6 | 5.7 | 4.2 | 98.6 | 97.8 | 92.1 | 7.4 | 7.3 | 75 | 1.223 |
| **Sep-17** | 6.2 | 75.2 | 6.1 | 74.3 | 0.6 | 7.2 | 4.4 | 98.1 | 97.6 | 93.3 | 7.4 | 6.8 | 104 | 1.460 |
| **Oct-17** | 6.7 | 88.1 | 6.3 | 83.1 | 0.6 | 8.3 | 3.9 | 97.8 | 97.7 | 91.9 | 7.4 | 7.1 | 27 | 1.583 |
| **Nov-17** | 6.5 | 83.3 | 6.2 | 80.6 | 0.7 | 8.7 | 4.1 | 97.8 | 97.9 | 46.3 | 7.5 | 7.6 | 23 | 1.523 |
| **Dec-17** | 5.5 | 62.6 | 5.2 | 59.1 | 0.6 | 6.3 | 3.0 | 98.2 | 98.1 | 92.0 | 7.5 | 8.2 | 10 | 1.256 |
| **Jan-18** | 6.4 | 83.2 | 5.9 | 75.2 | 0.7 | 8.2 | 3.3 | 98.0 | 98.1 | 91.8 | 7.5 | 8.5 | 18 | 1.518 |
| **Maximum** | 9.8 | 148.1 | 10.1 | 171.5 | 0.9 | 13.1 | 7.4 | 98.9 | 99.4 | 94.2 | 7.7 | 10.9 | 441 | 2.433 |
| **Minimum** | 3.2 | 35.5 | 2.3 | 29.2 | 0.4 | 4.5 | 1.7 | 96.3 | 96.0 | 46.3 | 7.4 | 6.1 | 4 | 1.150 |

Table 4 includes the recent sample results for Ammonia (NH3-N) in the influent and effluent.

| Table 4. Ammonia Sample Results | | |
|---|---|---|
| | Raw Influent | Effluent |
| Date | mg/L | mg/L |
| 7/19/2018 | 38.5 | 17 |
| 7/31/2018 | 34 | 14 |
| 8/2/2018 | 35.5 | 8.37 |
| 8/6/2018 | 36.4 | 5.71 |
| 8/13/2018 | 35.2 | 9.64 |
| 8/15/2018 | 33.9 | 8.75 |
| 8/27/2018 | 40.3 | 20.4 |
| 8/29/2018 | 41.9 | 24.9 |
| 9/3/2018 | 34.7 | 16.3 |
| 9/5/2018 | 36.3 | 20.4 |
| 9/10/2018 | 37.8 | 19.2 |
| 9/12/2018 | 42.6 | 21.4 |
| 9/17/2018 | 48 | 25.2 |
| 9/19/2018 | 49.3 | 27.3 |
| 9/24/2018 | 71.8 | 53.6 |
| 9/26/2018 | 41 | 25.6 |
| Average | 41 | 20 |
| Maximum | 71.8 | 53.6 |
| Minimum | 33.9 | 5.71 |

# APPENDIX H
# ALTERNATIVE LAYOUTS




NORTH

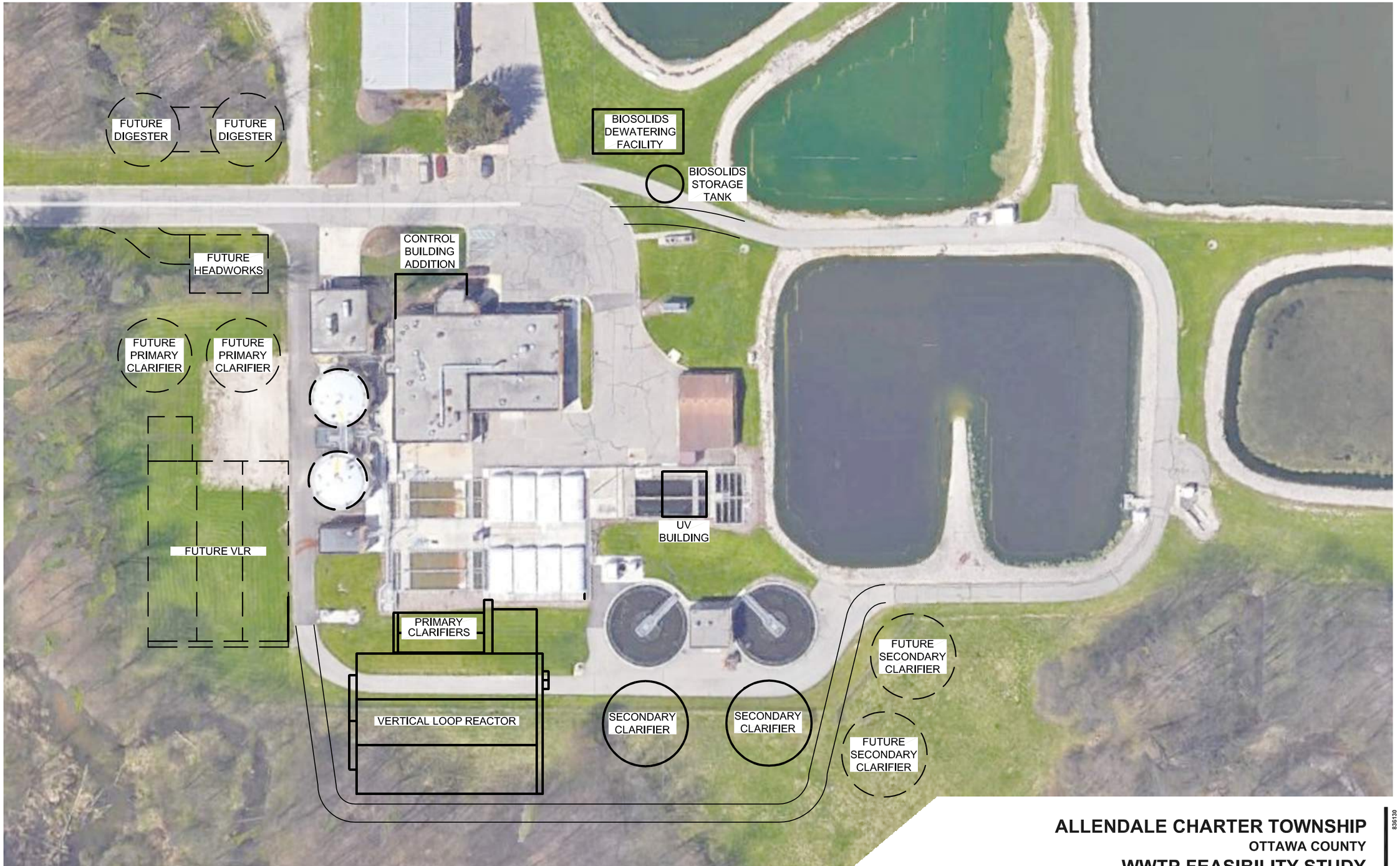
# ALTERNATIVE 1 SITE PLAN

SCALE: 3/16"=1'-0"

**ALLENDALE CHARTER TOWNSHIP**
**OTTAWA COUNTY**
**WWTP FEASIBILITY STUDY**

**FIGURE H-1**

F&V PROJECT NO. 836130




NORTH

# ALTERNATIVE 2 SITE PLAN

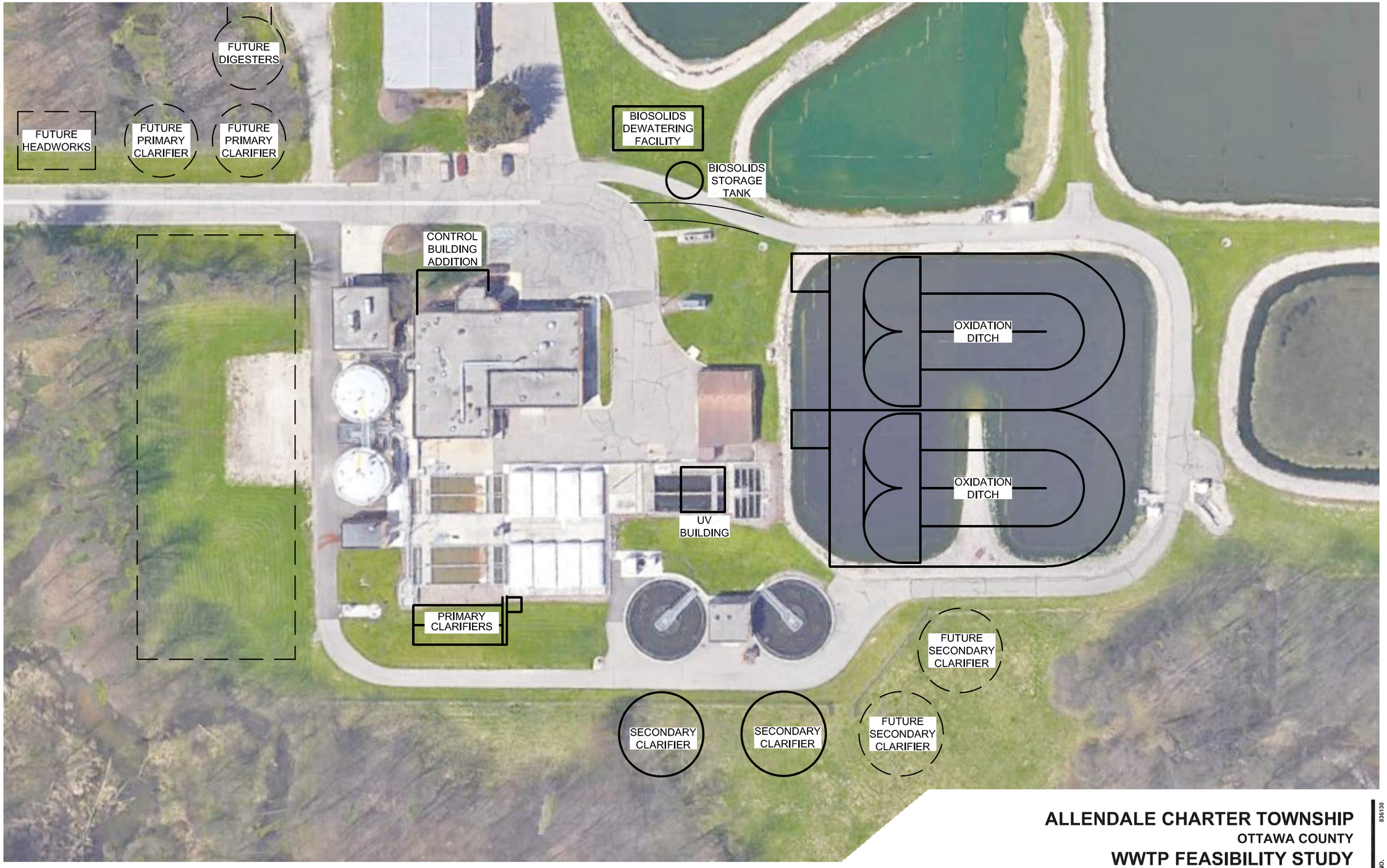
SCALE: 3/16"=1'-0"

**ALLENDALE CHARTER TOWNSHIP**
**OTTAWA COUNTY**
**WWTP FEASIBILITY STUDY**

**FIGURE H-2**

F&V PROJECT NO. 836130

F&V




NORTH

# ALTERNATIVE 3 SITE PLAN

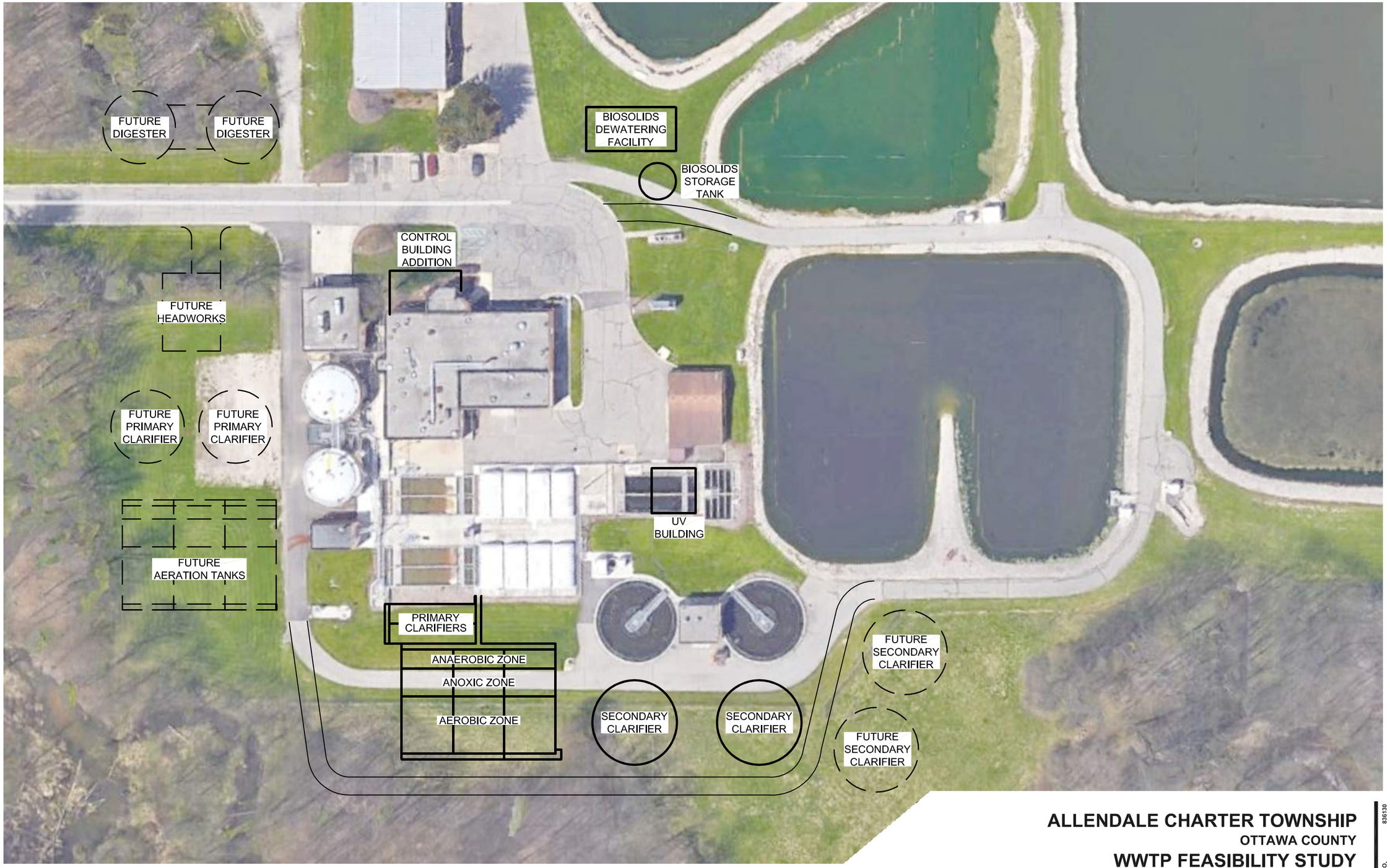
SCALE: 3/16"=1'-0"

**ALLENDALE CHARTER TOWNSHIP**
**OTTAWA COUNTY**
**WWTP FEASIBILITY STUDY**

**FIGURE H-3**

F&V PROJECT NO. 836130

F&V




NORTH

# ALTERNATIVE 4 SITE PLAN

SCALE: 3/16"=1'-0"

**ALLENDALE CHARTER TOWNSHIP**
**OTTAWA COUNTY**
**WWTP FEASIBILITY STUDY**

**FIGURE H-4**

F&V PROJECT NO. 836130

F&V

# APPENDIX E

AquaNereda® Conceptual Evaluation Report

Allendale Charter Township est. 1849

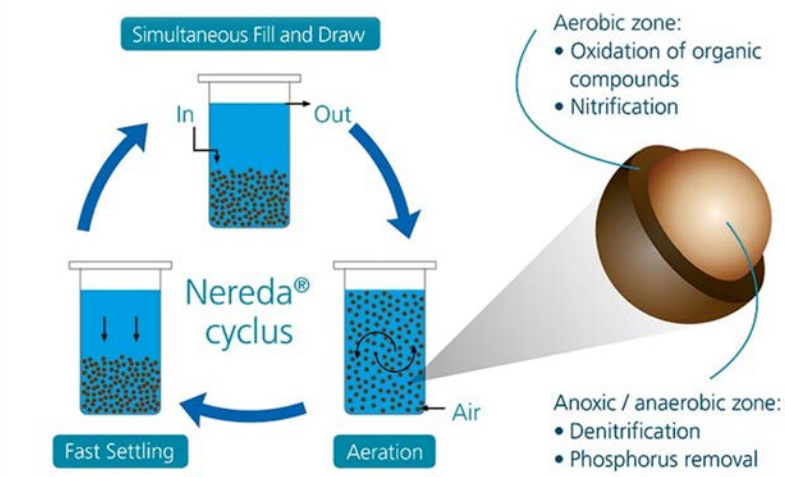
# Allendale Wastewater Treatment Plant

## Conceptual AquaNereda® Evaluation Report

**January 31, 2020**








Moore+Bruggink
Consulting Engineers
Engineering Clean Water

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**Appendix A** – Conceptual Site Layout

**Appendix B** – Conceptual Process Flow Diagram

**Appendix C** – Conceptual AquaNereda® Daily Operation Sequence

**Appendix D** – Detailed Conceptual Cost Estimate

# LIST OF ABBREVIATIONS

GBT – Gravity Belt Thickener

GPD – Gallons Per Day

GPM – Gallons Per Minute

HRT – Hydraulic Residence Time

MBBR – Moving Bed Bio-Reactor

OLR – Organic Loading Rate

RBC – Rotating Biological Contactor

SBR – Sequencing Batch Reactor

VS – Volatile Solids

WWTP – Wastewater Treatment Plant

# 1.0 CONCEPTUAL DESIGN SUMMARY

## 1.1 Project Background

The Allendale Township Waste Water Treatment Plant (WWTP) utilizes rotating biological contactors (RBCs) to accomplish the biological treatment stage. Although this technology achieves proper treatment, it is out of date and the equipment at the plant is reaching the end of its useful life.

This conceptual design document evaluates the option of installing an AquaNereda® sequencing batch reactor (SBR) with granular activated solids clusters. This technology is highly efficient in both footprint and treatment capabilities.

The items described in this conceptual basis of design document are part of a “Phase II” project, where Phase I is a current project to improve the laboratory and administrative facilities on site. Phase III is a potential solids disposal improvements project that this basis of design will briefly outline.

## 1.2 Project Goals

The goals of this evaluation are as follows:

- Calculate hydraulic and solids treatment parameters to confirm the feasibility of the proposed technologies at a design flow of 3.2 MGD and a peak of 7.5 MGD.
- Determine a conceptual site layout that will accomplish the intended design.
- Formulate a conceptual capital cost estimate and 20-year life cycle cost evaluation.
- Create a conceptual process flow diagram of the proposed design.

## 1.3 Summary

The evaluation concluded that an AquaNereda® system accompanied by miscellaneous modifications to existing equipment will accomplish the proposed treatment goals. This conceptual design will provide a simple, highly efficient treatment process that will drastically improve the longevity and reliability of the WWTP. This technology will also push Allendale to the leading edge of wastewater treatment in West Michigan.

# 2.0 CONCEPTUAL BASIS OF DESIGN

For the proposed components described within this basis of design document, refer to **Appendix A** and **Appendix B** for the conceptual site layout and conceptual process flow diagram, respectively.

## 2.1 Headworks

### 2.1.1 Screening

The plant currently has two motorized drum screens. One is relatively new and properly sized. The other is undersized and due for replacement. This smaller drum screen also has a manually raked bypass channel. This smaller drum screen will be replaced to match the newer larger screen. This project will also include upgrades to the disposal system for these screens to provide more compaction and reduce waste. These upgrades will alleviate operator maintenance labor, reduce waste, and allow for an increased flow capacity through the system.

### 2.1.2 Grit Removal

The existing vortex grit system will remain, but the mechanism and the grit pump will be replaced in this project. A Gorman Rupp suction lift pump is the suggested option to replace the existing air lift grit pump.

### 2.1.3 Headworks Effluent Chamber

The proposed AquaNereda® system will be directly after the headworks process. The conceptual design shows the installation of a 30” pipe from the raw sewage chamber to the south of the headworks building.

## 2.2 AquaNereda® System

The conceptual design for this system includes (3) reactor tanks, a new building, (4) positive displacement (PD) blowers, air piping in, process water piping in/out, solids piping out, and buffer water piping out. Refer to the conceptual site layout in **Appendix A.** The individual components are described in the following sections.

### 2.2.1 Reactor Tanks

Three concrete tanks are proposed to function as the batch reactors for the system. Their physical parameters are described in **Table 1.**

**Table 1 – Aqua-Nereda® Reactor Tanks**

| | |
|---|---|
| **Quantity** | 3 |
| **Material** | Concrete |
| **Capacity (each tank)** | 620,000 gallons |
| **Size** | 49’ x 80’ x 21’ deep |
| **Total HRT** | 0.56 days |

These tanks will each operate in batch cycles. Each cycle takes 4 hours to complete. The daily sequence of operations for this process can be found in **Appendix C. Table 2** describes each influent/effluent pipe pertaining to the reactor tanks.

**Table 2 – Reactor Tanks Piping List**

| Process Description | From Location | To Location | Reference |
|---|---|---|---|
| **Air** | PD Blowers in Bldg. | Reactors | Subsection 2.2.3 |
| **Process Influent** | Headworks Chamber | Reactors | Subsection 2.2.4 |
| **Process Effluent** | Reactors | UV system | Subsection 2.2.4 |
| **Solids Effluent** | Reactors | Solids Holding Tank | Subsection 2.2.5 |
| **Water Buffer Effluent** | Reactors | Supernatant Lift Station | Subsection 2.2.6 |

### 2.2.2 Reactor Building

The proposed conceptual design includes a building next to the reactors to house the blowers, UV system, necessary control equipment, and any automatic valves on various process piping. The estimated size of this building is approximately 2,400 square feet.

### 2.2.3 Positive Displacement Blowers

Four positive displacement blowers will provide the proper aeration capabilities and redundancy for the three reactors. These blowers will turn on during the "react" phase of each cycle. Estimated blower data can be seen in **Table 3.**

| Table 3 – Reactor Blowers | |
|---|---|
| **Quantity** | 4 |
| **Type** | Positive Displacement |
| **Size** | 125 hp |

### 2.2.4 Process Water

The conceptual design shows each reactor being fed via a 30" line that will extend up into the proposed building and through the east wall of each tank. Each tank will have an automatic valve to control which tank is to be fed with raw sewage influent. This will occur during the "fill/draw" cycle.

The reactors will also have automatic valves on the 30" process effluent lines that release effluent water collected from each reactor's weirs at the surface during the "fill/draw" cycle. This water will be fed to the UV disinfection stage (**Section 2.3**) via gravity.

### 2.2.5 Waste Solids

During the "waste solids" cycle, suspended solids will be drawn out of the reactor(s) from the middle of each tank, allowing the heavier granules to remain in the bottom of the tank(s). The waste solids will be routed via gravity to the proposed Solids Holding/Thickening Tank (modified final clarifier). Refer to **Subsection 2.5.1** for details on the solids handling process.

### 2.2.6 Buffer Water

After the reactor completes the fill/draw cycle, the water level is lowered before the "react" cycle begins. This prevents the process water from overtopping the effluent launders while the tank is being aerated. This buffer water will be routed via gravity

to the proposed Supernatant Lift Station (modified Primary Tank). Refer to **Section 2.6** for details on the Supernatant Lift Station.

## 2.3 Ultraviolet (UV) Disinfection

Currently, the WWTP utilizes chlorine tablets to achieve proper disinfection within the final effluent water. This system is labor intensive, cumbersome, and requires a large footprint for de-chlorination downstream. In order to address these issues, an ultraviolet disinfection system is proposed in this conceptual basis of design.

There are two proposed conceptual UV options presented for this project: an in-pipe installation or a channel installation. Both options will function properly and adequate space is available for each.

### 2.3.1 Option 1 – UV in Pipe

The proposed conceptual Reactor Building was sized to include three in-pipe UV units at the south end on the reactor effluent piping. Refer to *Figure 1* for an example installation of this type of in-pipe UV.



***Figure 1 – Example in-pipe UV installation (Credit: Aquionics)***

This option provides a compact, accessible UV system that can be inspected and maintained within a building. These systems often require more attention due to the possibility of clogging within the closed vessels. It is recommended to further evaluate the expected effluent water quality from the reactors during the design phase of this project to determine the effectiveness of an in-pipe system.

### 2.3.2 Option 2 – UV in Channel

There is ample existing tankage available to retrofit an in-channel UV system within. An in-channel system can provide simple visuals of functionality, but would require an additional structure to be installed over the channels if the plant staff desires a controlled climate to access and maintain the system. An example of a UV channel installation can be seen in *Figure 2.*




***Figure 2 – Example UV Installation in a Channel***

This is the recommended system at this point in the design. This system will require higher capital costs, but will provide the plant staff with a simple system that is easily maintainable.

## 2.4 Final Effluent Water

A proposed 30" pipe would connect the UV effluent to the existing final effluent chamber at the existing de-chlorination pond.

## 2.5 Solids Handling Process

### 2.5.1 Solids Holding/Thickening Tank

The existing Final Clarifier no. 2 will be modified to accommodate waste solids holding/settling from the reactor tanks. Waste solids will be released to this tank every 80 minutes from the reactors. This tank will gravity thicken and equalize waste solids before being mechanically thickened before digestion.

The existing solids collector mechanism and pumps will be re-used for this process. A decant system will be installed to allow decant water to flow into the suction side of the existing scum pumps. These pumps will transfer decant water to the existing Digester Building where the line will be extended to the headworks effluent chamber. Details of the proposed Solids Holding/Thickening Tank are shown in **Table 4**.

| Table 4 – Solids Holding/Thickening Tank | |
|---|---|
| **Quantity** | 1 |
| **Capacity** | 220,000 gallons |
| **Total Waste Solids In** | 475,000 gpd @ 0.2% |
| **Total Supernatant Out** | 427,500 gpd |
| **Total Solids Out** | 47,500 gpd @ 2.0% |

The existing pumps in the clarifier building will be re-used to pump solids from the holding tank to the proposed solids thickening equipment. The existing force main will be re-used up to the proposed tie-in point as shown in the conceptual layout (**Appendix A**).

### 2.5.2 Solids Thickening Equipment

This conceptual evaluation proposes modifying the existing Primary Clarifier Tanks 1-2 for new mechanical thickening equipment. There will also be a proposed structure around this equipment above the tanks. The two solids thickening technologies evaluated were gravity belt thickening and volute thickening. Both options provide adequate thickening performance. The volute thickeners come at a higher capital cost, but are cleaner and require less footprint. Refer to **Table 5** for the design parameters pertaining to this proposed equipment.

| Table 5 – Solids Thickening Equipment | |
|---|---|
| **Quantity** | 2 |
| **Throughput** | 1,500 dry lb/hour |
| **Daily Solids In** | 47,500 gpd @ 2.0% |
| **Daily Supernatant Out** | 28,500 gpd |
| **Daily Solids Out** | 19,000 gpd @ 5.0% |
| **Equipment Operation** | 8 hrs/day |
| **Equipment Flow Rate** | 99 gpm |

A conservative solids content of 5% was used for calculation purposes. The volute thickener can likely thicken solids up to 8% and the GBT can likely thicken up to 7%. Existing Primary Tanks 1-2 will be modified to accommodate the thickened solids discharge and the existing primary solids hoppers and pumps will be re-used for thickened solids transfer to the digester.

### 2.5.3 Existing Anaerobic Digester

The operation of the digester shall be similar to current operations. Solids will be fed from the existing Primary Solids pumps. Because the solids will be thickened to 5%, further evaluation of the digester performance with a higher organic loading will be performed during the design phase. Refer to **Table 6** for the design parameters pertaining to the digester tanks.

| Table 6 – Existing Anaerobic Digesters | |
|---|---|
| **Quantity** | 2 |
| **Capacity (each tank)** | 150,000 gallons |
| **Daily Solids In** | 19,000 gpd @ 5.0% = 7,923 lb |
| **HRT*** | 15.8 days |
| **Expected VS content** | 70% |
| **Organic Loading Rate**** | 137.9 lb VS / 1000 $ft^3$ |
| **Expected TS Reduction** | 40.0% |
| **Daily Solids Out** | 19,000 gpd @ 3.0% = 4,754 lb |
| **Avg. Flow Rate** | 13.2 gpm |

*If solids were fed to the digesters at 2% (only gravity thickened), the HRT of the digesters would only be 12 days.
**Ten States Standards recommends a maximum of 80 lb VS / 1000 $ft^3$, but there are many proven instances of operating at higher OLRs, up to 4 times higher than the recommended value.

The existing solids draw-off lines from the digesters will be re-used, and one of the existing three solids pumps in the Control Building will be dedicated for digested solids transfer, utilizing the swing pump for redundancy. The existing pumping/mixing system for the two digester tanks will be further evaluated during the design phase of the project.

### 2.5.4 Biosolids Dewatering

These dewatering improvements are proposed to take place in Phase III. This will include the construction of a dewatering system in the solids handling process to dispose of biosolids in a landfill. This will be a proposed building to the east end of the entrance drive. This area provides adequate space and a convenient location for biosolids dewatering and dumpster load-out. This conceptual evaluation and the cost estimate associated with it is based constructing a building to accommodate dewatering equipment, a conveying system, and two dumpsters for hauling solids.

There are many different types of equipment that could satisfy the dewatering needs of a treatment plant. To be conservative in this conceptual layout with the size requirements of certain equipment, two screw presses are shown in the design and cost estimate. These are usually the largest pieces of equipment of the different options, but provide effective dewatering at a low energy cost. Refer to **Table 7** for details on the evaluated dewatering equipment.

**Table 7 – Solids Dewatering Equipment**

| | |
|---|---|
| **Quantity** | 2 |
| **Total power (per unit)** | 7.5 HP |
| **Avg. Daily Throughput** | 4,754 dry lb/day |
| **Avg. Daily Solids In** | 19,000 gpd @ 3.0% |
| **Avg. Daily Supernatant Out** | 16,720 gpd |
| **Avg. Daily Solids Out** | 9.5 wet tons @ 25.0% |
| **Equipment Operation** | 8 hrs/day |
| **Avg. Equipment Flow Rate** | 40 gpm |
| **Avg. Equipment Throughput** | 595 dry lb/hour |
| **Max. Daily Throughput** | 7,923 dry lb/day |
| **Max. Equipment Throughput** | 990 dry lb/hour |
| **Max. Equipment Flow Rate** | 100 gpm |
| **Max. Daily Solids Out** | 15.8 wet tons/day |

The dewatering equipment shall be sized to handle the average solids flows, assuming 40% reduction of solids in the digestion process. The equipment shall also be able to handle the maximum flows shown, assuming no reduction in solids and a higher flow rate.

## 2.6 Supernatant Lift Station

This evaluation proposes renovating Primary Tanks 3 and 4 to create a supernatant recycle lift station that will collect supernatant/decant from multiple processes throughout the plant. It is proposed to remove the floor of the primary tank and make a deep pit to allow all water to flow here by gravity. The data for this proposed lift station can be seen in **Table 8**.

| Table 8 – Supernatant Lift Station | |
|---|---|
| **Required Size of Wet Well** | 25,000 gallons |
| **Quantity of Pumps** | 2 |
| **Type of Pump** | Submersible |
| **Capacity (per pump)** | 700 gpm @ 40 ft. TDH |
| **Maximum Flows into Station** | |
| **Reactor Buffer Water** | 460 gpm |
| **Thickening Equipment Filtrate** | 100 gpm |
| **Dewatering Equipment Pressate** | 80 gpm |

This lift station would be designed to handle the slugs of the different recycle streams in order to gradually pump back to the headworks chamber at a constant rate.

# 3.0 COST EVALUATION

The Allendale WWTP is in need of an expansion/renovation project in the near future. Because of this, it was deemed necessary to evaluate a completely different technology for the plant to utilize. Overall, the capital cost of the AquaNereda® system is competitive with traditional treatment plant technologies. On top of this, the ongoing operation and maintenance expenses for the system are lower than the traditional treatment systems, due to the efficient treatment methods and the compact footprint of the reactors.

## 3.1 Conceptual Project Cost Evaluation

During this conceptual design, a cost estimate was developed to provide the Allendale WWTP with a budgetary number to use when analyzing the expansion project alternatives. This conceptual estimate was formed using current construction unit prices, manufacturer quotes, and contractor/engineering judgment. The summarized estimate is shown in **Table 9.** The detailed conceptual cost estimate can be found in **Appendix D.**

**Table 9 – Conceptual Cost Estimate Summary**

| | | |
|---|---|---|
| *General Contracting* | $ | 1,759,000.00 |
| *Demolition* | $ | 390,000.00 |
| *Site Improvements / Structures* | $ | 3,465,000.00 |
| *AquaNereda® Components* | $ | 3,100,000.00 |
| *Mechanical* | $ | 3,317,000.00 |
| *Electrical* | $ | 1,252,000.00 |
| *Controls* | $ | 1,177,000.00 |
| *Contingency* | $ | 3,615,000.00 |
| *Engineering / Survey / Inspection* | $ | 2,892,000.00 |
| *Phase III – Dewatering* | $ | 5,151,000.00 |
| ***Conceptual Total Project Cost*** | **$** | **26,118,000.00** |

## 3.2 Conceptual 20-Year Life Cycle Cost Evaluation

Allendale has previously ruled out the option of expanding their current RBC operation due to the large footprint and capital cost anticipated if the plant were required to abide by an ammonia limit on their NPDES permit. Because of this, the alternative used to compare to the AquaNereda System was an MBBR system. This type of system was previously evaluated by a different engineering firm and the capital cost from that study is referenced in this section.

**Table 10** summarizes the capital costs and associated annual costs with both the AquaNereda system and an MBBR system. Both of these options include similar headworks, UV disinfection, and biosolids dewatering upgrades.

**Table 10 – MBBR vs. AquaNereda Capital and O&M**

| **MBBR Option** | | | **AquaNereda Option** | | |
|---|---|---|---|---|---|
| *Capital Cost* | $ | 27,500,000.00 | *Capital Cost* | $ | 26,118,000.00 |
| *Annual Electrical Costs* | $ | 91,104.00 | *Annual Electrical Costs* | $ | 104,208.96 |
| *Annual Maintenance Costs* | $ | 16,500.00 | *Annual Maintenance Costs* | $ | 16,656.20 |
| *Annual Chemical Costs* | $ | 45,000.00 | *Annual Chemical Costs* | $ | 25,000.00 |
| *Annual Solids Disposal* | $ | 148,556.55 | *Annual Solids Disposal* | $ | 148,556.55 |

It should be noted that a detailed O&M cost estimate for the MBBR system was not developed, but it was estimated to be comparable to the AquaNereda system. These values were used to develop a 20-year life cycle cost using a present worth analysis method. The following assumptions were used to evaluate this:

- Inflation Rate: 3.0%
- Present Worth Rate: 3.0%
- 20-year Flow Increase Rate: 5.08% (from 1.3 MGD to 3.5 MGD over 20 years)

*Figure 3* illustrates the conceptual 20-year life cycle cost in total accumulated spending using 2020 dollars.

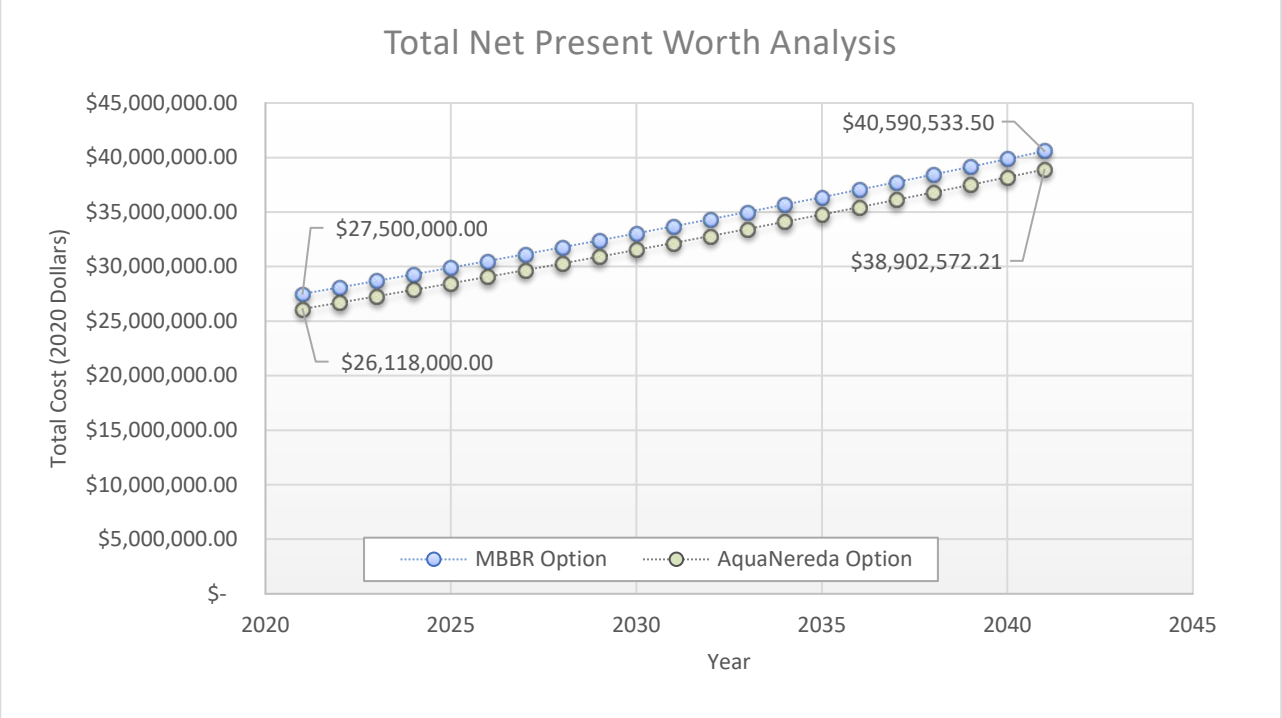



***Figure 3 – 20-year Life Cycle Cost Analysis***

As shown in the chart, 2021 begins with the capital cost associated with each option. From here, each year's maintenance, electrical, chemical, and solids disposal costs are added together with the appropriate rate of increase. It should be noted that neither option assumed a salvage value at the end of 20 years.

According to this conceptual model, the AquaNereda option has a lower capital cost and 20-year cost.

# 4.0 SUMMARY AND CONCLUSION

After evaluating the parameters outlined within this document, it was determined that the AquaNereda® system is a viable option for the Allendale Wastewater Treatment Plant. There is available space within the site, and the existing infrastructure can be modified to handle the liquid and solids processes with minimal capital improvement costs. A more detailed evaluation could be conducted during the design phase to calculate a more accurate cost estimate and long term life cycle effect on the process.

In conclusion, the AquaNereda® system, along with the implementation of UV disinfection, would provide exemplary wastewater treatment capabilities, reduce overall footprint of the plant, and push the Allendale WWTP to the leading edge of treatment technology within the region.




SCALE: 1" = 20'

| # | DATE | PLAN REVISIONS |
|---|---|---|
| 1 | | |
| 2 | | |
| 3 | | |
| 4 | | |
| 5 | | |
| 6 | | |
| 7 | | |
| 8 | | |

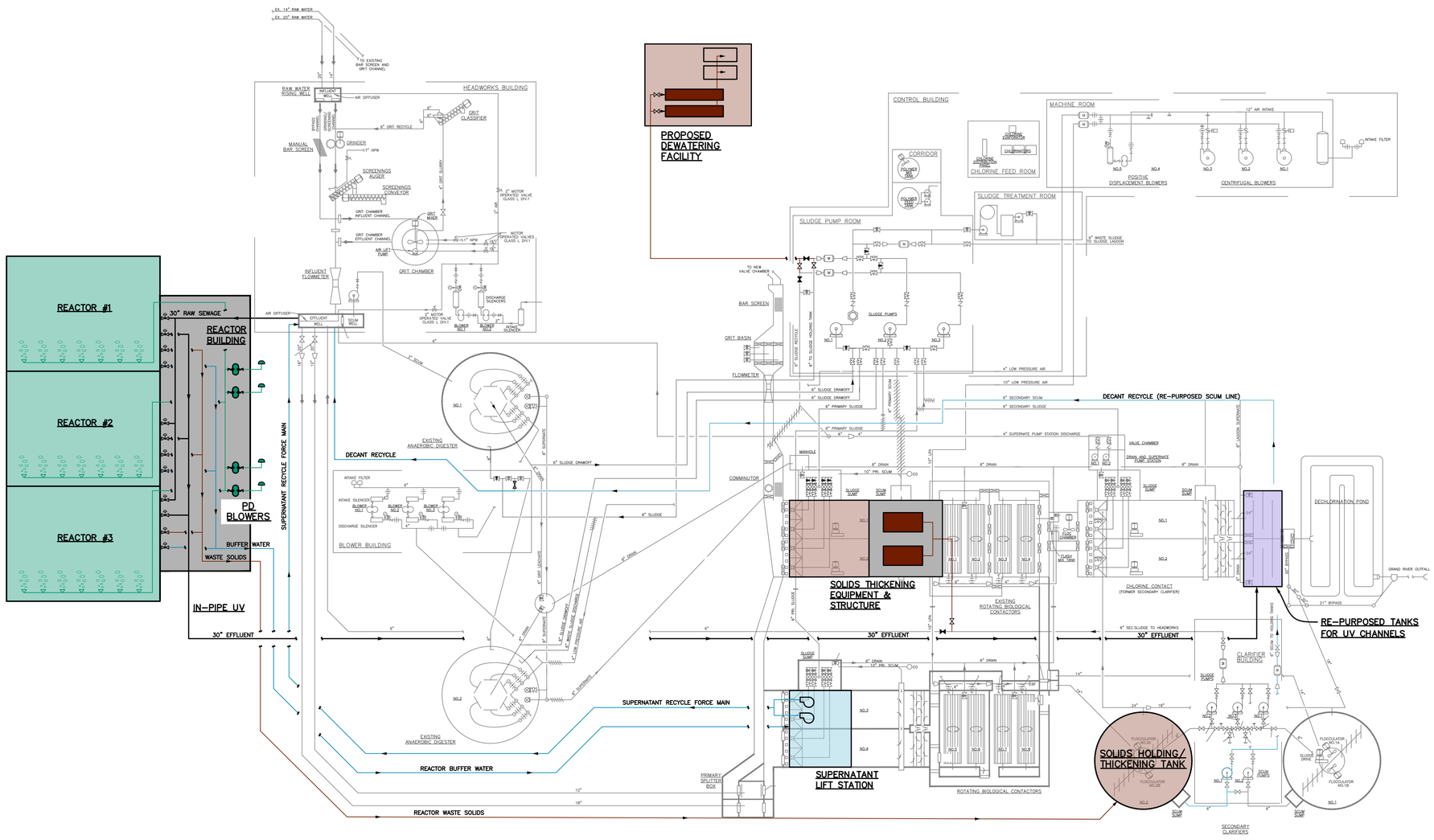
Moore+Bruggink
Consulting Engineers
2020 Monroe Ave.
Grand Rapids, MI 49505
(616) 363-9801
mailbox@mbce.com

**AQUA NEREDA CONCEPTUAL EVALUATION**
FOR THE
ALLENDALE CHARTER TOWNSHIP WWTP
OTTAWA COUNTY, MICHIGAN

**CONCEPTUAL SITE LAYOUT**

| | |
|---|---|
| FIELD SURVEY / DATE | N/A |
| PROJECT NO.: | 190146.2 |
| DESIGN DRAWN BY: | JSS |
| DESIGNED BY: | BJH / JSS |
| CHECKED BY: | BJH |
| PLAN DATE: | 12/27/19 |
| SHEET DESCRIPTION: | C-1 |
| SHEET NUMBER: | 1 OF 2 |

Know what's below. Call before you dig.




## PFD SYMBOL LEGEND

- EXISTING EQUIPMENT
- EXISTING EQUIPMENT TO BE RE-USED
- PROPOSED VALVE NORMALLY OPEN
- PROPOSED VALVE NORMALLY CLOSED
- PROPOSED CENTRIFUGAL PUMP
- PROPOSED CENTRIFUGAL PUMP
- PROPOSED PD BLOWER
- PROPOSED PROCESS LINE
- PROPOSED SOLIDS LINE
- EXISTING SOLIDS LINE TO BE RE-USED
- PROPOSED SUPERNATANT RECYCLE LINE
- SCUM LINE TO BE RE-USED FOR DECANT
- PROPOSED AIR LINE
- EXISTING MISCELLANEOUS PIPING
- FLOW DIRECTION

Know what's below. Call before you dig.

| BY | DATE | PLAN REVISIONS |
|---|---|---|

Moore+Bruggink
Consulting Engineers
2020 Monroe Ave.
Grand Rapids, MI 49505
(616) 363-9801 mailbox@mbce.com

**AQUA NEREDA CONCEPTUAL EVALUATION**
FOR THE
ALLENDALE CHARTER TOWNSHIP WWTP
OTTAWA COUNTY, MICHIGAN

**CONCEPTUAL PROCESS FLOW DIAGRAM**

| | |
|---|---|
| FIELD SURVEY / DATE | N/A |
| PROJECT NO.: | 190146.2 |
| DESIGN DRAWN BY: | JSS |
| DESIGNED BY: | BJH / JSS |
| CHECKED BY: | BJH |
| PLAN DATE: | 12/27/19 |
| SHEET DESCRIPTION: | C-2 |
| SHEET NUMBER: | 2 OF 2 |

P:\190146.2 Allendale WWTP - Nereda Conceptual Evaluation\CAD\DWG\190146.2_Conceptual PFD.dwg, 1/28/2020 4:54:47 PM, JAROD STUYVESANT

# Appendix C - Reactor Daily Operation Sequence

| *Time of Day* | *Reactor #1* | *Reactor #2* | *Reactor #3* |
|---|---|---|---|
| 0:00 | FILL/DRAW | REACT | REACT |
| 0:20 | FILL/DRAW | REACT | REACT |
| 0:40 | FILL/DRAW | REACT | REACT |
| 1:00 | FILL/DRAW | WASTE SOLIDS | REACT |
| 1:20 | REACT | FILL/DRAW | REACT |
| 1:40 | REACT | FILL/DRAW | REACT |
| 2:00 | REACT | FILL/DRAW | REACT |
| 2:20 | REACT | FILL/DRAW | WASTE SOLIDS |
| 2:40 | REACT | REACT | FILL/DRAW |
| 3:00 | REACT | REACT | FILL/DRAW |
| 3:20 | REACT | REACT | FILL/DRAW |
| 3:40 | WASTE SOLIDS | REACT | FILL/DRAW |
| 4:00 | FILL/DRAW | REACT | REACT |
| 4:20 | FILL/DRAW | REACT | REACT |
| 4:40 | FILL/DRAW | REACT | REACT |
| 5:00 | FILL/DRAW | WASTE SOLIDS | REACT |
| 5:20 | REACT | FILL/DRAW | REACT |
| 5:40 | REACT | FILL/DRAW | REACT |
| 6:00 | REACT | FILL/DRAW | REACT |
| 6:20 | REACT | FILL/DRAW | WASTE SOLIDS |
| 6:40 | REACT | REACT | FILL/DRAW |
| 7:00 | REACT | REACT | FILL/DRAW |
| 7:20 | REACT | REACT | FILL/DRAW |
| 7:40 | WASTE SOLIDS | REACT | FILL/DRAW |
| 8:00 | FILL/DRAW | REACT | REACT |
| 8:20 | FILL/DRAW | REACT | REACT |
| 8:40 | FILL/DRAW | REACT | REACT |
| 9:00 | FILL/DRAW | WASTE SOLIDS | REACT |
| 9:20 | REACT | FILL/DRAW | REACT |
| 9:40 | REACT | FILL/DRAW | REACT |
| 10:00 | REACT | FILL/DRAW | REACT |
| 10:20 | REACT | FILL/DRAW | WASTE SOLIDS |
| 10:40 | REACT | REACT | FILL/DRAW |
| 11:00 | REACT | REACT | FILL/DRAW |
| 11:20 | REACT | REACT | FILL/DRAW |
| 11:40 | WASTE SOLIDS | REACT | FILL/DRAW |
| 12:00 | FILL/DRAW | REACT | REACT |
| 12:20 | FILL/DRAW | REACT | REACT |
| 12:40 | FILL/DRAW | REACT | REACT |
| 13:00 | FILL/DRAW | WASTE SOLIDS | REACT |
| 13:20 | REACT | FILL/DRAW | REACT |
| 13:40 | REACT | FILL/DRAW | REACT |
| 14:00 | REACT | FILL/DRAW | REACT |
| 14:20 | REACT | FILL/DRAW | WASTE SOLIDS |
| 14:40 | REACT | REACT | FILL/DRAW |
| 15:00 | REACT | REACT | FILL/DRAW |
| 15:20 | REACT | REACT | FILL/DRAW |
| 15:40 | WASTE SOLIDS | REACT | FILL/DRAW |
| 16:00 | FILL/DRAW | REACT | REACT |
| 16:20 | FILL/DRAW | REACT | REACT |
| 16:40 | FILL/DRAW | REACT | REACT |
| 17:00 | FILL/DRAW | WASTE SOLIDS | REACT |
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| 19:20 | REACT | REACT | FILL/DRAW |
| 19:40 | WASTE SOLIDS | REACT | FILL/DRAW |
| 20:00 | FILL/DRAW | REACT | REACT |
| 20:20 | FILL/DRAW | REACT | REACT |
| 20:40 | FILL/DRAW | REACT | REACT |
| 21:00 | FILL/DRAW | WASTE SOLIDS | REACT |
| 21:20 | REACT | FILL/DRAW | REACT |
| 21:40 | REACT | FILL/DRAW | REACT |
| 22:00 | REACT | FILL/DRAW | REACT |
| 22:20 | REACT | FILL/DRAW | WASTE SOLIDS |
| 22:40 | REACT | REACT | FILL/DRAW |
| 23:00 | REACT | REACT | FILL/DRAW |
| 23:20 | REACT | REACT | FILL/DRAW |
| 23:40 | WASTE SOLIDS | REACT | FILL/DRAW |
| 0:00 | FILL/DRAW | REACT | REACT |

# Appendix D - Conceptual Capital Cost Estimate

## Allendale WWTP Improvements Conceptual Cost Estimate

Project No. 190146.02
Date 1/23/2020
Engineer JSS
Checked By BJH

### Phase II - AquaNereda and Process Upgrades

| Category | Description | Unit | Quantity | Unit Price | Amount |
|---|---|---|---|---|---|
| Demolition | Primary Tank Modifications | lsum | 1 | $ 75,000.00 | $ 75,000.00 |
| Demolition | Final Tank Modifications | lsum | 1 | $ 150,000.00 | $ 150,000.00 |
| Demolition | Yard piping demo | lsum | 1 | $ 100,000.00 | $ 100,000.00 |
| Demolition | Electrical Demo | lsum | 1 | $ 65,000.00 | $ 65,000.00 |
| Site Improvements / Structures | Aqua Nereda Concrete | Cyd | 2200 | $ 750.00 | $ 1,650,000.00 |
| AquaNereda Components | Aqua Nereda Components | lsum | 1 | $ 3,100,000.00 | $ 3,100,000.00 |
| Site Improvements / Structures | Reactor Tank Walkways and Handrails | lft | 350 | $ 200.00 | $ 70,000.00 |
| Site Improvements / Structures | Groundwater Dewatering Efforts during construction | days | 60 | $ 5,000.00 | $ 300,000.00 |
| Mechanical | Screening Equipment | lsum | 1 | $ 175,000.00 | $ 175,000.00 |
| Mechanical | Screen Conveying Equipment & Compactor | lsum | 1 | $ 175,000.00 | $ 175,000.00 |
| Mechanical | Grit mechanism and pump | lsum | 1 | $ 120,000.00 | $ 120,000.00 |
| Mechanical | Solids Thickening Equipment (Volute Thickener) | ea | 2 | $ 320,000.00 | $ 640,000.00 |
| Mechanical | In-channel UV option with Building | lsum | 1 | $ 650,000.00 | $ 650,000.00 |
| Mechanical | Process Piping | lsum | 1 | $ 380,000.00 | $ 380,000.00 |
| Mechanical | Process Piping Valves | ea | 40 | $ 5,000.00 | $ 200,000.00 |
| Site Improvements / Structures | Primary Tank Modification Concrete | cyd | 100 | $ 700.00 | $ 70,000.00 |
| Site Improvements / Structures | Supernatant Lift Station | lsum | 1 | $ 50,000.00 | $ 50,000.00 |
| Site Improvements / Structures | Aqua Nereda Equipment Building | sft | 2400 | $ 300.00 | $ 720,000.00 |
| Site Improvements / Structures | Solids Thickening Building | sft | 1300 | $ 350.00 | $ 455,000.00 |
| Electrical | Existing MCC Modifications | lsum | 1 | $ 75,000.00 | $ 75,000.00 |
| Electrical | Electrical Equipment (Control panels, VFDs, SCADA cabinets) | lsum | 1 | $ 200,000.00 | $ 200,000.00 |
| Controls | SCADA Programming | lsum | 1 | $ 200,000.00 | $ 200,000.00 |
| Site Improvements / Structures | Site paving and grading | lsum | 1 | $ 150,000.00 | $ 150,000.00 |
| | | | | | |
| | Materials and Equipment Subtotal | | | | $ 9,770,000.00 |
| | | | | | |
| Mechanical | Mechanical Labor and Misc. equipment | % | | 10% | $ 977,000.00 |
| Electrical | Electrical Labor and Misc. equipment | % | | 10% | $ 977,000.00 |
| Controls | Instrumentation and Controls Labor and Misc. equipment | % | | 10% | $ 977,000.00 |
| General Contracting | General Contracting (OH&P, Bonding, Insurance, etc.) | % | | 18% | $ 1,759,000.00 |
| | | | | | |
| | Construction Subtotal | | | | $ 14,460,000.00 |
| | | | | | |
| Contingency | Contingency | % | | 25% | $ 3,615,000.00 |
| Engineering / Survey / Inspection | Project Costs (engineering, survey, inspection) | % | | 20% | $ 2,892,000.00 |
| | | | | | |
| | **Total Cost Phase II** | | | | **$ 20,967,000.00** |

### Phase III - Dewatering

| Category | Description | Unit | Quantity | Unit Price | Amount |
|---|---|---|---|---|---|
| Phase III | New Solids Dewatering Building | sft | 3500 | $ 300.00 | $ 1,050,000.00 |
| Phase III | Solids Dewatering Equipment (Screw Press) | ea | 2 | $ 500,000.00 | $ 1,000,000.00 |
| Phase III | Cake Conveying Equipment | lsum | 1 | $ 350,000.00 | $ 350,000.00 |
| | | | | | |
| | Materials and Equipment Subtotal | | | | $ 2,400,000.00 |
| | | | | | |
| Mechanical | Mechanical Labor and Misc. equipment | % | | 10% | $ 240,000.00 |
| Electrical | Electrical Labor and Misc. equipment | % | | 10% | $ 240,000.00 |
| Controls | Instrumentation and Controls Labor and Misc. equipment | % | | 10% | $ 240,000.00 |
| General Contracting | General Contracting (OH&P, Bonding, Insurance, etc.) | % | | 18% | $ 432,000.00 |
| | | | | | |
| | Construction Subtotal | | | | $ 3,552,000.00 |
| | | | | | |
| Contingency | Contingency | % | | 25% | $ 888,000.00 |
| Engineering / Survey / Inspection | Project Costs (engineering, survey, inspection) | % | | 20% | $ 711,000.00 |
| | | | | | |
| | **Total Cost Phase III** | | | | **$ 5,151,000.00** |

| | |
|---|---|
| **Grand Total Phases II & III** | **$ 26,118,000.00** |

# APPENDIX F

AquaNereda® Preliminary Engineering Design Report

AQUA-AEROBIC SYSTEMS, INC.
A Metawater Company

# Process Design Report

## ALLENDALE WWTP MI

Design# 159701
Option: Revised Nereda Design (4 basins)



## AquaNereda®

Aerobic Granular Sludge System

March 20, 2020
Designed By: Thea Davis

6306 N. Alpine Rd Loves Park, IL 61111
(815) 654-2501 www.aqua-aerobic.com

Nereda® is a registered U.S. trademark of Royal HaskoningDHV
© 2020 Aqua-Aerobic Systems, Inc

# Design Notes

## Pre-AGS

- Screening (by others) is required ahead of the AquaNereda system, with an opening of 6mm depending upon the characteristics of the screen. Punched hole or wire mesh up to 6 mm is preferred.

- It is assumed that there will be reduction in FOG prior to the AGS system as required to maintain a low concentration of FOG in the system. Acceptable levels are approximately 60 mg/l on a daily average basis (based on a 24-hour composite sample.)

- Neutralization is required ahead of the AquaNereda system if the pH is expected to fall outside of 6.5-8.5 for significant durations.

- Coarse solids removal is recommended prior to the AquaNereda System.

- Elevated concentration of Hydrogen Sulfide can be detrimental to both civil and mechanical structures. If anaerobic conditions exist in the collection system, steps should be taken to eliminate Hydrogen Sulfide prior to the treatment system.

## Flow

- The maximum flow, as shown on the design, has been assumed as a hydraulic maximum and does not represent an additional organic load.

- The four basin AGS has been designed to receive flow such that each basin's fill period comprises the first 25% of the cycle.

## Aeration

- The aeration system has been designed to provide 1.5 lbs. O2/lb. BOD5 applied and 4.6 lbs. O2/lb. TKN applied at the design average loading conditions.

## Process/Site

- The anticipated effluent NH3-N requirement is predicated upon an influent waste temperature of 10° C or greater. While lower temperatures may be acceptable for a short-term duration, nitrification below 10° C can be unpredictable, requiring special operator attention.

- Sufficient alkalinity is required for nitrification, as approximately 7.1 mg alkalinity (as CaCO3) is required for every mg of NH3-N nitrified. If the raw water alkalinity cannot support this consumption, while maintaining a residual concentration of 50 mg/l, supplemental alkalinity shall be provided (by others).

- To achieve the effluent monthly average total phosphorus limit, the biological process and chemical feed systems need to be designed to facilitate optimum performance.

- A minimum of twelve (12) daily composite samples per month (both influent and effluent) shall be obtained for total phosphorus analysis.

- Influent to the biological system is a typical municipal wastewater application with a TP range of 6–8 mg/l. Influent TP shall be either in a particle associated form or in a reactive soluble phosphate form or in a soluble form that can be converted to reactive phosphorus in the biological system. Soluble hydrolyzable and organic phosphates are not removable by chemical precipitation with metal salts. A water quality analysis is required to determine the phosphorus speciation with respect to soluble and insoluble reactive, acid hydrolyzable and total phosphorus at the system influent, point(s) of chemical addition, and final effluent.

- Chemical feed lines (i.e. metal salts) shall be furnished to each reactor, aerobic digester and dewatering supernatant streams as necessary. Metal salts shall be added to each reactor during the React phase of the cycle.

- pH monitoring of the biological reactor is required when adding metal salts.

## Equipment

- The basins are not included and shall be provided by others.

- A minimum freeboard of 2 ft is recommended for diffused aeration.

- Scope of supply includes freight, installation supervision and start-up services.

- Aqua-Aerobic Systems, Inc. is familiar with various “Buy American” Acts (i.e. AIS, ARRA, Federal FAR 52.225, EXIM Bank, USAid, PA Steel Products Act, etc.). As the project develops Aqua-Aerobic Systems can work with you to ensure full compliance of our goods with various Buy American provisions if they are applicable/required for the project. When applicable, please provide us with the specifics of the project’s “Buy American” provisions.

- VFDs for all motors are to be provided by others. MCC to be provided by others.

- AquaNereda is a proprietary technology; in order to protect this technology some additional safeguards are typical. At time of plans and specification development typically a Non Disclosure Agreement is required between Aqua-Aerobic and the Consulting Engineer. At time of project execution the End User is required to sign an End User Agreement which includes non disclosure obligations and limits distribution of the granules.

- The basin dimensions reported on the design have been assumed based upon the required volumes and assumed basin geometry. Actual basin geometry may be circular, square, and rectangular with construction materials including concrete, or steel.

- Water level correction and sludge buffer tanks are to be retrofitted into existing basins. Equipment will be supplied when more information is available.

# AquaNereda - Aerobic Granular Sludge Reactor - Design Summary

## DESIGN INFLUENT CONDITIONS

**Avg. Design Flow** = 3.20 MGD = 12,113 m3/day

**Max Design Flow** = 7.50 MGD = 28,391 m3/day

## DESIGN PARAMETERS

| | Influent | mg/l | Effluent Required | <= mg/l | Effluent Anticipated | <= mg/l |
|---|---|---|---|---|---|---|
| **Bio/Chem Oxygen Demand:** | BOD5 | 300 | BOD5 | 15 | BOD5 | 15 |
| **Total Suspended Solids:** | TSS | 300 | TSS | 15 | TSS | 15 |
| **Total Kjeldahl Nitrogen:** | TKN | 55 | TKN | -- | TKN | -- |
| **NH3-N:** | -- | -- | NH3-N | 1.0 | NH3-N | 1.0 |
| **Phosphorus:** | Total P | 8 | Total P | 0.8 | Total P | 0.8 |

## SITE CONDITIONS

| | Maximum | | Minimum | | Design | | Elevation (MSL) |
|---|---|---|---|---|---|---|---|
| **Ambient Air Temperatures:** | 80 F | 27.0 C | 28 F | -2.0 C | 80 F | 27.0 C | 627 ft |
| **Influent Waste Temperatures:** | 68 F | 20.0 C | 50 F | 10.0 C | 50 F | 10.0 C | 191.0 m |

## AGS BASIN DESIGN VALUES

| | | | Water Depth | | | Basin Vol./Basin | |
|---|---|---|---|---|---|---|---|
| **No./Basin Geometry:** | 4 Rectangular Basin(s) | | **Process Level (PWL):** | 21.0 ft | (6.40 m) | 0.50 MG | (1,900 m³) |
| **Freeboard (from PWL):** | 2.0 ft | (0.6 m) | **Discharge Level (DWL):** | 21.5 ft | (6.60 m) | | |
| **Length of Basin:** | 71.0 ft | (21.6 m) | | | | | |
| **Width of Basin:** | 45.0 ft | (13.7 m) | | | | | |

| | | |
|---|---|---|
| **Cycle Duration:** | = 4.0 Hours/Cycle | |
| **Food/Mass (F/M) ratio:** | = 0.060 lbs. BOD5/lb. MLSS-Day | |
| **MLSS Concentration:** | = 8000 mg/l | |
| **Hydraulic Retention Time:** | = 0.61 Days | |
| **Solids Retention Time:** | = 17.52 Days | |
| **Est. Net Sludge Yield:** | = 0.99 lbs. WAS/lb. BOD5 | |
| **Est. Dry Solids Produced:** | = 7615.0 lbs. WAS/Day | = (3454.1 kg/Day) |
| **Lbs. O2/lb. BOD5** | = 1.50 | |
| **Lbs. O2/lb. TKN** | = 4.60 | |
| **Actual Oxygen Required:** | = 18762 lbs./Day | = (8510.4 kg/Day) |
| **Air Flowrate/Basin:** | = 2029 SCFM | = (57.5 Sm3/min) |
| **Max. Discharge Pressure:** | = 10.88 PSIG | = (75 KPA) |
| **Avg. Power Required:** | = 2274 KW-Hrs/Day | |

# *Water Level Correction Tank - Design Summary*

## *WATER LEVEL CORRECTION TANK DESIGN VALUES*

| | | |
|---|---|---|
| **No./Basin Geometry** | = 1.0 Rectangular Basin(s) | |
| **Max. Water Depth** | = 14.4 ft | = (4.4 m) |
| **Max. Basin Volume (Total):** | = 13,209 gallons | = (50 m³) |

## *WATER LEVEL CORRECTION VOLUME DETERMINATION*

The water correction tank volume has been determined based on the required level drop in the AquaNereda reactors. The water from this tank will be pumped back to the head of the plant.

## *WATER LEVEL CORRECTION EQUIPMENT CRITERIA*

| | | |
|---|---|---|
| **Max. Capacity per Pump:** | = 260.9 gpm | = 60.0 m3/hr |
| **Number of Pumps:** | = 1 | |

# Sludge Buffer - Design Summary

## SLUDGE BUFFER DESIGN VALUES

| | | |
|---|---|---|
| **No./Basins Geometry:** | = 2 Rectangular Basin(s) | |
| **Max Water Depth:** | = 13.9 ft | = (4.2 m) |
| **Max Basin Vol. Basin:** | = 30,017 gallons | = (114 m³) |

## SLUDGE BUFFER VOLUME DETERMINATION

The sludge buffer volume has been determined based on the sludge production and the concentration of sludge from the AquaNereda reactors. The Sludge from this basin will be pumped to the sludge handling system, and the supernatant back to the head of the plant.

## SLUDGE BUFFER EQUIPMENT CRITERIA

| | | |
|---|---|---|
| **Max. Sludge Flow Rate Required:** | = 96 gpm | = (22 m³/hr) |
| **Max. Supernatant Flow Rate Required:** | = 383 gpm | = (88 m³/hr) |

## AquaNereda

### Influent Valves

**4 Influent Valve(s) will be provided as follows:**

- 24 inch electrically operated plug valve(s).

### Influent Distribution System

**4 Influent Distribution Assembly(ies) consisting of:**

- Influent distribution system consisting of HDPE and PVC pipe with supports.

### Effluent Weir Assembly

**4 Effluent Weir Assembly(ies) consisting of:**

- Concrete main effluent channel(s) provided by others.
- Stainless steel weir assembliy(ies) with supports.

### Sludge Removal System

**4 Solids Waste System(s) consisting of:**

- Stainless steel solids waste system(s).
- 4 inch electrically operated butterfly valve(s) with actuator.
- 16 inch electrically operated butterfly valve(s) with actuator.
- 16 inch diameter manual plug valve(s).

### Fixed Fine Bubble Diffusers

**4 Fixed Fine Bubble Diffuser Assembly(ies) consisting of:**

- 304 SS, 12 Ga. drop pipe(s).
- PVC, Sch 40 Manifold(s) with connection to drop pipe.
- PVC, Air distributor(s) with connection to the manifold and required PVC pipe joint connections.
- 304 Stainless steel piping supports with vertical supports, clamps, adjusting mechanism and anchor bolts.
- Fine bubble diffuser assemblies.
- 8" manual butterfly valve(s).

### Positive Displacement Blowers

**4 Positive Displacement Blower Package(s), with each package consisting of:**

- Aerzen 100HP Rotary Positive Displacement Blower(s).
- 8" manual butterfly valve(s).

### Air Valves

**4 Air Control Valve(s) will be provided as follows:**

- 10 inch electrically operated butterfly valve(s).
- Auma actuator will be upgraded from open/close service to modulating service.
- Air flow meter(s).

### Level Sensor Assemblies

**4 Pressure Transducer Assembly(ies) each consisting of:**

- Submersible pressure transducer(s).
- Mounting bracket weldment(s).
- Transducer mounting pipe weldment(s).

**4 Level Sensor Assembly(ies) will be provided as follows:**

- Float switch(es).
- Float switch mounting bracket(s).

- Stainless steel anchors.

**Instrumentation**

**1 Process Control System will be provided as follows:**

Instrumentation including sensors and/or analyzers along with mounting assemblies shall be provided to measure the following for the AquaNereda basin(s):
- Dissolved Oxygen
- pH
- ORP
- TSS
- Ammonium
- Phosphorus

Instrumentation including sensors and/or analyzers along with mounting assemblies shall be provided to measure the following for the Sludge Buffer basin(s):
- TSS
- Controller(s).

## AquaNereda: PLC Controls

**Controls wo/Starters**

**1 Controls Package(s) will be provided as follows:**

- NEMA 12 panel enclosure suitable for indoor installation and constructed of painted steel.
- Fuse(s) and fuse block(s).
- Compactlogix Processor.
- Operator interface(s).
- Remote Access Ethernet Modem.

# APPENDIX G

Green Project Reserve Business Case

# Allendale Charter Township WWTP Expansion

## Green Project Reserve Business Case

**May 20, 2020**





*Prepared for the*

**State of Michigan Clean Water**
**State Revolving Fund (SRF) Program**

*Prepared by*

Moore+Bruggink
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# 1.0 SUMMARY

There are several components of the Allendale Township Wastewater Treatment Plant (WWTP) expansion project that would qualify for the Green Project Reserve (GPR) program.

1. AquaNereda® Activated Granular Sludge (AGS) Reactors – Chemical reduction, footprint reduction, energy savings, environmentally innovative technology.

2. UV Disifinfection – Elimination of chlorine at the WWTP, efficient reliable disinfection.

3. Solids Dewatering – Reduction of volume for solids disposal.

This proposed expansion project will improve the treatment of nutrients within the wastewater, greatly reduce the amount of chemicals needed for treatment, and provide efficient treatment within a smaller footprint than the previously used technologies at the WWTP. Sequencing batch reactors are one of the most energy efficient technologies available to attain the desired treatment.

**Cost Estimate Summary**

| | | |
|---|---|---|
| Portion 1 – WWTP Expansion | | |
| Total Estimated Costs | | $30,872,000 |
| *Estimated eligible (Green) costs* | = ***$28,888,000*** | |
| *Estimated non-eligible costs* | = *$1,984,000* | |
| Portion 2 – Influent Sewer and Lift Station | | |
| Total Estimated Costs (all non-eligible) | | $11,000,000 |
| **Grand Total Estimated SRF Project Costs** | | **$41,872,000** |

Please refer to the attached *Green Project Reserve Cost Estimate* spreadsheet for more information.

# 2.0 BACKGROUND AND PROJECT SCOPE

## 2.1 Project Background

The Allendale Township Waste Water Treatment Plant (WWTP) utilizes rotating biological contactors (RBCs) to accomplish the biological treatment stage. Although this technology achieves proper treatment, it is out of date and the equipment at the plant is reaching the end of its useful life. This technology is also very inefficient at removing Ammonia from the wastewater. Currently, the WWTP has no Ammonia limit in their NPDES permit. If they were to receive an ammonia limit in their reissued permit, the RBC's would not meet the limits. Based on other treatment facilities in the area, it is anticipated that Allendale WWTP will have a stringent ammonia limit at some point within the 20-year planning period. The plant would need to double the amount of RBCs to meet the potential ammonia limits under current flow conditions and quadruple the number of RBCs under design flow conditions.

The proposed project will implement an AquaNereda® sequencing batch reactor (SBR) system with granular activated solids clusters. This technology is highly efficient in both footprint and treatment capabilities.

## 2.2 Need for Project

Allendale Township has seen consistent growth over the past 20 years. This growth is expected to continue at an average annual rate of 3.5% over the next 20 years. Because of this, the WWTP is expected to exceed its current design flow (1.60 MGD) in 2027. The proposed expansion will be able to handle a design flow of 3.2 MGD and a peak of 7.5 MGD. As mentioned above, in order to achieve these values utilizing the RBC technology, the plant would need to install four times the current amount of RBCs. There is not available footprint for this at the WWTP, and the cost impacts would be undesirable. On top of this, the air-driven RBC technology is obsolete. The WWTP struggles to find spare parts and schedule maintenance on this equipment.

## 2.3 Summary of Selected Alternative

For the reasons given above, it is necessary to pursue other treatment alternatives. After conducting a feasibility study in 2018, and a conceptual engineering report in 2019, the chosen treatment alternative is an AquaNereda Sequencing Batch Reactor system. The new treatment system will be a highly efficient treatment process that will drastically improve the longevity and reliability of the WWTP. This technology, coupled with other WWTP improvements, will drastically reduce chemical consumption, decrease footprint, and greatly improve the quality of the treated effluent discharged to the Grand River.

# 3.0 ELIGIBLE PROJECT COMPONENTS

An analysis of the treatment components for the proposed expansion was conducted to determine which were eligible for Green Project Reserve funds.

## 3.1 AquaNereda® Aerobic Granular Sludge (AGS) Reactors

This portion of the expansion is eligible for Green Project Reserve monies under the Environmentally Innovative category because of its reduction in chemical usage, decreased footprint, and energy reduction. These reactors will offer efficient treatment in a minimal footprint utilizing activated sludge granules. The system is designed in such a way to allow for large sludge granules to form. These granules can support aerobic microbiology on the outside of them and anaerobic microbiology on the inside. These granules are also efficient in the removal of phosphorus via biological phosphorus removal. The reactors will be designed to decrease phosphorus levels below permit limits without any chemical addition. The plant currently uses ferric chloride and poly-aluminum chloride in order to treat the phosphorus within the wastewater. They also utilize the residual ferric chloride from this dosage to prevent $H_2S$ build-up within the digester bio-gas. By implementing the proposed reactors, the WWTP will reduce their chemical consumption by approximately 53% in regards to biological treatment. Please reference the attached *Environmentally Innovative Criteria* spreadsheet.

These reactors will utilize positive displacement blowers to supply dissolved oxygen (DO) through fine bubble diffusers. These blowers will be controlled by DO / ORP probes inside the tanks. This will minimize unnecessary energy usage and encourage the most efficient use of resources. Compared to a conventional aeration system sized to treat these design flows, the AquaNereda® system will use approximately 43% less energy overall. Please reference the attached *Environmentally Innovative Criteria* spreadsheet.

## 3.2 Ultraviolet (UV) Disinfection

This portion of the expansion is eligible for Green Project Reserve monies under the Environmentally Innovative category because of its reduction in chemical usage. Currently, the WWTP uses chlorine tablets at a dosing chamber to fulfill the disinfection requirements of the effluent water. They use approximately 15 pounds of chlorine tablets each day to treat their current flow (~1.27 MGD). This would require approximately 35 pounds of tablets per day to disinfect 3.0 MGD. The plant also doses sodium-bisulfite in order to provide de-chlorination to the effluent water. This system is difficult to operate efficiently. These chemicals take time to break down, and dosing needs to be adjusted ahead of time to attempt to match up with flow rates anticipated within the next 24 hours. Implementing a UV system will ensure a safe, reliable, chemical-free disinfection solution for the WWTP. They will also be able to adjust intensity in real-time depending on flow and/or transmissivity of the water. Please refer to the *Environmentally Innovative Criteria* spreadsheet for more details.

## 3.3 Solids Disposal Methods

This portion of the expansion is eligible for Green Project Reserve monies under the Environmentally Innovative category because of its reduction in total solids disposal volume. Currently, the WWTP disposes of residual solids post-digestion at about 3% solids. These are stored in the existing sludge lagoon which is emptied every 3-5 years. If a dewatering facility is constructed, solids can be dewatered to approximately 22% solids and disposed of in a landfill. This will decrease the total volume of solids disposed by 76%.

Ottawa County is currently conducting a study to determine the feasibility of constructing a regional biosolids disposal facility. One of the anticipated criteria for participation in this facility is to provide dewatered solids above a certain percentage. In order to be eligible to participate in this regional facility, Allendale WWTP will need to install a dewatering system. This improvement will also allow the WWTP to utilize the large sludge storage lagoon for other purposes in the future. Please refer to the *Environmentally Innovative Criteria* spreadsheet for more details on these calculations.

# 4.0 CONCLUSION

In conclusion, the AquaNereda® system, UV disinfection and solids dewatering upgrades would qualify as Environmentally Innovative based on the criteria set forth by the Green Project Reserve eligibility guidelines and the data provided in this business case. The proposed expansion will reduce chemical usage, decrease footprint needed, decrease biosolids disposal volume, and provide energy-efficient and reliable treatment methods to continually provide a quality effluent to the receiving waters.

---

Attached Documents:

- *Eligible Components Cost Estimate* spreadsheet
- *Environmentally Innovative Criteria* spreadsheet

Reference Material:

- *2018 Allendale Charter Township WWTP Feasibility Study*
- *2019 Allendale Charter Township WWTP AquaNereda® Conceptual Evaluation*
- *2019 AquaNereda® Production Engineering Report*

# Allendale Charter Township FY2021 Q4 SRF Project Cost Estimate

| | |
|---|---|
| Project No. | 200148.01 |
| Date | 5/12/2020 |
| Engineer | JSS |
| Checked By | BJH |

**Green Project Reserve - Qualifying WWTP Project Items**

| Item # | Description | Unit | Quantity | Unit Price | Amount |
|---|---|---|---|---|---|
| 1 | Primary Tank Modifications for AquaNereda Decant Water | lsum | 1 | $ 75,000.00 | $ 75,000.00 |
| 2 | Final Tank Modifications for AquaNereda waste solids storage | lsum | 1 | $ 150,000.00 | $ 150,000.00 |
| 3 | Yard piping demolition | lsum | 1 | $ 100,000.00 | $ 100,000.00 |
| 4 | Electrical Demolition | lsum | 1 | $ 65,000.00 | $ 65,000.00 |
| 5 | Aqua Nereda Reactors - Concrete | Cyd | 2400 | $ 750.00 | $ 1,800,000.00 |
| 6 | Aqua Nereda Reactors - Internal Components | lsum | 1 | $ 3,500,000.00 | $ 3,500,000.00 |
| 7 | Reactor Tank Walkways and Handrails | lft | 350 | $ 200.00 | $ 70,000.00 |
| 8 | Groundwater Dewatering Efforts for Reactor construction | days | 60 | $ 5,000.00 | $ 300,000.00 |
| 9 | New Solids Dewatering Building | sft | 3500 | $ 300.00 | $ 1,050,000.00 |
| 10 | Solids Dewatering Equipment (Screw Press) | ea | 2 | $ 500,000.00 | $ 1,000,000.00 |
| 11 | Cake Conveying Equipment | lsum | 1 | $ 350,000.00 | $ 350,000.00 |
| 12 | Solids Thickening Equipment (Volute Thickener) | ea | 2 | $ 320,000.00 | $ 640,000.00 |
| 13 | In-channel UV with Building | lsum | 1 | $ 650,000.00 | $ 650,000.00 |
| 14 | Process Piping | lsum | 1 | $ 380,000.00 | $ 380,000.00 |
| 15 | Process Piping Valves | ea | 40 | $ 5,000.00 | $ 200,000.00 |
| 16 | Primary Tank Modification Concrete | cyd | 100 | $ 700.00 | $ 70,000.00 |
| 17 | Supernatant Lift Station (for AquaNereda decant water) | lsum | 1 | $ 50,000.00 | $ 50,000.00 |
| 18 | Aqua Nereda Equipment Building | sft | 2400 | $ 300.00 | $ 720,000.00 |
| 19 | Solids Thickening Building | sft | 1300 | $ 350.00 | $ 455,000.00 |
| 20 | Electrical Equipment (Control panels, VFDs, SCADA cabinets) | lsum | 1 | $ 200,000.00 | $ 200,000.00 |
| 21 | SCADA Programming | lsum | 1 | $ 200,000.00 | $ 200,000.00 |
| | | | | *Materials and Equipment Subtotal* | *$ 12,025,000.00* |
| | Mechanical Labor and Misc. equipment | % | | 15% | $ 1,804,000.00 |
| | Electrical Labor and Misc. equipment | % | | 15% | $ 1,804,000.00 |
| | Instrumentation and Controls Labor and Misc. equipment | % | | 15% | $ 1,804,000.00 |
| | General Contracting (OH&P, Bonding, Insurance, etc.) | % | | 20% | $ 2,405,000.00 |
| | | | | *Construction Subtotal* | *$ 19,842,000.00* |
| | Contingency | % | | 25% | $ 4,961,000.00 |
| | Project Costs (design/construction engineering, survey, inspection) | % | | 10% | $ 1,985,000.00 |
| | Design Engineering Costs | lsum | 1 | $ 2,100,000.00 | $ 2,100,000.00 |
| | | | | ***Total GPR Eligible Items*** | ***$ 28,888,000.00*** |

| WWTP Items not Pertaining to Green Project Reserve | | | | | |
|---|---|---|---|---|---|
| Item # | ***Description*** | ***Unit*** | ***Quantity*** | ***Unit Price*** | ***Amount*** |
| 22 | Odor Control Unit for Headworks | ea | 1 | $ 150,000.00 | *$ 150,000.00* |
| 23 | Screening Equipment | lsum | 1 | $ 175,000.00 | *$ 175,000.00* |
| 24 | Screen Conveying Equipment & Compactor | lsum | 1 | $ 175,000.00 | *$ 175,000.00* |
| 25 | Grit mechanism and pump | lsum | 1 | $ 120,000.00 | *$ 120,000.00* |
| 26 | Existing MCC Modifications | lsum | 1 | $ 75,000.00 | *$ 75,000.00* |
| 27 | Site paving and grading | lsum | 1 | $ 150,000.00 | *$ 150,000.00* |
| | | | | *Materials and Equipment Subtotal* | *$ 845,000.00* |
| | Mechanical Labor and Misc. equipment | % | | 15% | *$ 127,000.00* |
| | Electrical Labor and Misc. equipment | % | | 15% | *$ 127,000.00* |
| | Instrumentation and Controls Labor and Misc. equipment | % | | 15% | *$ 127,000.00* |
| | General Contracting (OH&P, Bonding, Insurance, etc.) | % | | 20% | *$ 169,000.00* |
| | | | | *Construction Subtotal* | *$ 1,395,000.00* |
| | Contingency | % | | 25% | *$ 349,000.00* |
| | Project Costs (design/construction engineering, survey, inspection) | % | | 10% | *$ 140,000.00* |
| | Design Engineering costs | lsum | 1 | $ 100,000.00 | *$ 100,000.00* |
| | | | | ***Total Other WWTP Items*** | ***$ 1,984,000.00*** |
| | | | | **Total WWTP Cost** | **$ 30,872,000.00** |

| Influent Sewer and Lift Station Items | | | | | |
|---|---|---|---|---|---|
| ***Item #*** | ***Description*** | ***Unit*** | ***Quantity*** | ***Unit Price*** | ***Amount*** |
| 28 | Influent Sewer | lsum | 1 | $ 6,000,000.00 | $ 6,000,000.00 |
| 29 | Lift Station | lsum | 1 | $ 5,000,000.00 | $ 5,000,000.00 |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | **Total Influent Sewer Project** | **$ 11,000,000.00** |

| | |
|---|---|
| **SRF Grand Total** | **$ 41,872,000.00** |
| Breakdown: | |
| *GPR Grand Total* | *$ 28,888,000.00* |
| *Non-GPR Grand Total* | *$ 12,984,000.00* |

Attachment 2

## Environmentally Innovative Technologies Business Case Calculations

Allendale WWTP Expansion

### Footprint Impacts

| | Conventional Upgrades* | | Proposed Upgrades | |
|---|---|---|---|---|
| | *Quantity* | *Units* | *Quantity* | *Units* |
| *Primary Treatment Footprint required* | 4000 | sft | 0 | sft |
| *Biological Treatment Footprint required* | 11200 | sft | 12780 | sft |
| *Sludge and Water Buffer Footprint required* | 0 | sft | 2900 | sft |
| *Secondary Treatment Footprint required* | 9800 | sft | 0 | sft |
| *Sludge Storage Lagoon footprint required* | 195000 | sft | 0 | sft |
| *Pre-Digestion thickening footprint required* | 0 | sft | 1500 | sft |
| *Dewatering Footprint required* | 0 | sft | 3000 | sft |
| ***Total*** | ***220000*** | ***sft*** | ***20180*** | ***sft*** |

*Conventional aeration with chlorine & sludge hauling

Footprint reduction **91%**

### Chemical Impacts

| | Conventional Upgrades* | | Proposed Upgrades | |
|---|---|---|---|---|
| | *Quantity* | *Units* | *Quantity* | *Units* |
| *Ferric Chloride for Phosphorus Removal* | 18800 | gal/year | 0 | gal/year |
| *Ferric Chloride for Digester Dosing* | 0 | gal/year | 18250 | gal/year |
| *Poly-Aluminum Chloride for P. Removal* | 19800 | gal/year | 0 | gal/year |
| ***Total*** | ***38600*** | gal/year | ***18250*** | gal/year |

*Conventional aeration with chlorine & sludge hauling

Phosphorus removal chemical reduction **53%**

| | Chlorine Disinfection | | Ultraviolet Disinfection | |
|---|---|---|---|---|
| | *Quantity* | *Units* | *Quantity* | *Units* |
| *Chlorine Tablets needed for disinfection* | 10979 | lb / year | 0 | lb / year |
| *Sodium-Bisulfite needed for de-chlorination* | 7210 | lb/year | 0 | lb/year |
| ***Total*** | ***10979*** | lb / year | ***0*** | lb / year |

Disinfection chemical reduction **100%**

### Solids Disposal Volume Impacts

| | **Sludge Land Application** | | **Biosolids Dewatering** | |
|---|---|---|---|---|
| | *Quantity* | *Units* | *Quantity* | *Units* |
| *Solids Disposal Volume* | 3035000 | gal / year | 832200 | gal / year |
| ***Total*** | ***3035000*** | gal / year* | ***832200*** | gal / year |

*assumes a 25% reduction while stored in lagoon

Biosolids volume reduction **73%**

### Energy Consumption Impacts

| | **Conventional Aeration** | | **AquaNereda AGS Reactors** | |
|---|---|---|---|---|
| | *Quantity* | *Units* | *Quantity* | *Units* |
| *Energy Required for Biological Treatment* | 1453000 | kWh / year | 830010 | kWh / year |
| ***Total*** | ***1453000*** | kWh / year | ***830010*** | kWh / year |

Energy Reduction for Treatment Processes **43%**

# APPENDIX H

Cost Estimate Breakdown and Useful Life Calculations

# Allendale Charter Township FY2021 Q4 SRF Project Cost Estimate

| | |
|---|---|
| Project No. | 200148.01 |
| Date | 5/12/2020 |
| Engineer | JSS |
| Checked By | BJH |

## Green Project Reserve - Qualifying WWTP Project Items

| Item # | Description | Unit | Quantity | Unit Price | Amount |
|---|---|---|---|---|---|
| 1 | Primary Tank Modifications for AquaNereda Decant Water | lsum | 1 | $ 75,000.00 | $ 75,000.00 |
| 2 | Final Tank Modifications for AquaNereda waste solids storage | lsum | 1 | $ 150,000.00 | $ 150,000.00 |
| 3 | Yard piping demolition | lsum | 1 | $ 100,000.00 | $ 100,000.00 |
| 4 | Electrical Demolition | lsum | 1 | $ 65,000.00 | $ 65,000.00 |
| 5 | Aqua Nereda Reactors - Concrete | Cyd | 2400 | $ 750.00 | $ 1,800,000.00 |
| 6 | Aqua Nereda Reactors - Internal Components | lsum | 1 | $ 3,500,000.00 | $ 3,500,000.00 |
| 7 | Reactor Tank Walkways and Handrails | lft | 350 | $ 200.00 | $ 70,000.00 |
| 8 | Groundwater Dewatering Efforts for Reactor construction | days | 60 | $ 5,000.00 | $ 300,000.00 |
| 9 | New Solids Dewatering Building | sft | 3500 | $ 300.00 | $ 1,050,000.00 |
| 10 | Solids Dewatering Equipment (Screw Press) | ea | 2 | $ 500,000.00 | $ 1,000,000.00 |
| 11 | Cake Conveying Equipment | lsum | 1 | $ 350,000.00 | $ 350,000.00 |
| 12 | Solids Thickening Equipment (Volute Thickener) | ea | 2 | $ 320,000.00 | $ 640,000.00 |
| 13 | In-channel UV with Building | lsum | 1 | $ 650,000.00 | $ 650,000.00 |
| 14 | Process Piping | lsum | 1 | $ 380,000.00 | $ 380,000.00 |
| 15 | Process Piping Valves | ea | 40 | $ 5,000.00 | $ 200,000.00 |
| 16 | Primary Tank Modification Concrete | cyd | 100 | $ 700.00 | $ 70,000.00 |
| 17 | Supernatant Lift Station (for AquaNereda decant water) | lsum | 1 | $ 50,000.00 | $ 50,000.00 |
| 18 | Aqua Nereda Equipment Building | sft | 2400 | $ 300.00 | $ 720,000.00 |
| 19 | Solids Thickening Building | sft | 1300 | $ 350.00 | $ 455,000.00 |
| 20 | Electrical Equipment (Control panels, VFDs, SCADA cabinets) | lsum | 1 | $ 200,000.00 | $ 200,000.00 |
| 21 | SCADA Programming | lsum | 1 | $ 200,000.00 | $ 200,000.00 |
| | | | | *Materials and Equipment Subtotal* | *$ 12,025,000.00* |
| | Mechanical Labor and Misc. equipment | % | | 15% | $ 1,804,000.00 |
| | Electrical Labor and Misc. equipment | % | | 15% | $ 1,804,000.00 |
| | Instrumentation and Controls Labor and Misc. equipment | % | | 15% | $ 1,804,000.00 |
| | General Contracting (OH&P, Bonding, Insurance, etc.) | % | | 20% | $ 2,405,000.00 |
| | | | | *Construction Subtotal* | *$ 19,842,000.00* |
| | Contingency | % | | 25% | $ 4,961,000.00 |
| | Project Costs (design/construction engineering, survey, inspection) | % | | 10% | $ 1,985,000.00 |
| | Design Engineering Costs | lsum | 1 | $ 2,100,000.00 | $ 2,100,000.00 |
| | | | | ***Total GPR Eligible Items*** | ***$ 28,888,000.00*** |

| WWTP Items not Pertaining to Green Project Reserve | | | | | |
|---|---|---|---|---|---|
| Item # | ***Description*** | ***Unit*** | ***Quantity*** | ***Unit Price*** | ***Amount*** |
| 22 | Odor Control Unit for Headworks | ea | 1 | $ 150,000.00 | *$ 150,000.00* |
| 23 | Screening Equipment | lsum | 1 | $ 175,000.00 | *$ 175,000.00* |
| 24 | Screen Conveying Equipment & Compactor | lsum | 1 | $ 175,000.00 | *$ 175,000.00* |
| 25 | Grit mechanism and pump | lsum | 1 | $ 120,000.00 | *$ 120,000.00* |
| 26 | Existing MCC Modifications | lsum | 1 | $ 75,000.00 | *$ 75,000.00* |
| 27 | Site paving and grading | lsum | 1 | $ 150,000.00 | *$ 150,000.00* |
| | | | | *Materials and Equipment Subtotal* | *$ 845,000.00* |
| | Mechanical Labor and Misc. equipment | % | | 15% | *$ 127,000.00* |
| | Electrical Labor and Misc. equipment | % | | 15% | *$ 127,000.00* |
| | Instrumentation and Controls Labor and Misc. equipment | % | | 15% | *$ 127,000.00* |
| | General Contracting (OH&P, Bonding, Insurance, etc.) | % | | 20% | *$ 169,000.00* |
| | | | | *Construction Subtotal* | *$ 1,395,000.00* |
| | Contingency | % | | 25% | *$ 349,000.00* |
| | Project Costs (design/construction engineering, survey, inspection) | % | | 10% | *$ 140,000.00* |
| | Design Engineering costs | lsum | 1 | $ 100,000.00 | *$ 100,000.00* |
| | | | | ***Total Other WWTP Items*** | ***$ 1,984,000.00*** |
| | | | | **Total WWTP Cost** | **$ 30,872,000.00** |

| Influent Sewer and Lift Station Items | | | | | |
|---|---|---|---|---|---|
| ***Item #*** | ***Description*** | ***Unit*** | ***Quantity*** | ***Unit Price*** | ***Amount*** |
| 28 | Influent Sewer | lsum | 1 | $ 6,000,000.00 | $ 6,000,000.00 |
| 29 | Lift Station | lsum | 1 | $ 5,000,000.00 | $ 5,000,000.00 |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | **Total Influent Sewer Project** | **$ 11,000,000.00** |

| | |
|---|---|
| **SRF Grand Total** | **$ 41,872,000.00** |
| Breakdown: | |
| *GPR Grand Total* | *$ 28,888,000.00* |
| *Non-GPR Grand Total* | *$ 12,984,000.00* |

| Average Useful Life Estimate | | | |
|---|---|---|---|
| ***Asset*** | ***Cost*** | ***Useful Life*** | ***Product*** |
| *Primary Tank Modifications for AquaNereda Decant Water* | *$ 75,000.00* | 40 | 3000000.00 |
| *Final Tank Modifications for AquaNereda waste solids storage* | *$ 150,000.00* | 40 | 6000000.00 |
| *Yard piping demolition* | *$ 100,000.00* | 40 | 4000000.00 |
| *Electrical Demolition* | *$ 65,000.00* | 20 | 1300000.00 |
| *Aqua Nereda Reactors - Concrete* | *$ 1,800,000.00* | 50 | 90000000.00 |
| *Aqua Nereda Reactors - Internal Components* | *$ 3,500,000.00* | 20 | 70000000.00 |
| *Reactor Tank Walkways and Handrails* | *$ 70,000.00* | 50 | 3500000.00 |
| *Groundwater Dewatering Efforts for Reactor construction* | *$ 300,000.00* | 50 | 15000000.00 |
| *New Solids Dewatering Building* | *$ 1,050,000.00* | 50 | 52500000.00 |
| *Solids Dewatering Equipment (Screw Press)* | *$ 1,000,000.00* | 20 | 20000000.00 |
| *Cake Conveying Equipment* | *$ 350,000.00* | 20 | 7000000.00 |
| *Solids Thickening Equipment (Volute Thickener)* | *$ 640,000.00* | 20 | 12800000.00 |
| *In-channel UV with Building* | *$ 650,000.00* | 20 | 13000000.00 |
| *Process Piping* | *$ 380,000.00* | 40 | 15200000.00 |
| *Process Piping Valves* | *$ 200,000.00* | 40 | 8000000.00 |
| *Primary Tank Modification Concrete* | *$ 70,000.00* | 50 | 3500000.00 |
| *Supernatant Lift Station (for AquaNereda decant water)* | *$ 50,000.00* | 20 | 1000000.00 |
| *Aqua Nereda Equipment Building* | *$ 720,000.00* | 50 | 36000000.00 |
| *Solids Thickening Building* | *$ 455,000.00* | 40 | 18200000.00 |
| *Electrical Equipment (Control panels, VFDs, SCADA cabinets)* | *$ 200,000.00* | 15 | 3000000.00 |
| *SCADA Programming* | *$ 200,000.00* | 10 | 2000000.00 |
| *Odor Control Unit for Headworks* | *$ 150,000.00* | 20 | 3000000.00 |
| *Screening Equipment* | *$ 175,000.00* | 20 | 3500000.00 |
| *Screen Conveying Equipment & Compactor* | *$ 175,000.00* | 20 | 3500000.00 |
| *Grit mechanism and pump* | *$ 120,000.00* | 20 | 2400000.00 |
| *Existing MCC Modifications* | *$ 75,000.00* | 15 | 1125000.00 |
| *Site paving and grading* | *$ 150,000.00* | 40 | 6000000.00 |
| *Influent Sewer* | *$ 6,000,000.00* | 30 | 180000000.00 |
| *Lift Station* | *$ 5,000,000.00* | 20 | 100000000.00 |
| *Totals* | *$ 23,870,000.00* | *890* | *684525000.00* |
| | Sum of Products / Sum of Useful life | | 769129.21 |
| | Total Asset Costs / previous value | | 31.04 years |

# APPENDIX I

State Historic Preservation Office Documents

Moore+Bruggink
Consulting Engineers

June 1, 2020

Re: Allendale WRRF & Collection System Improvements

Environmental Review Coordinator
State Historic Preservation Officer
735 East Michigan Avenue
Lansing, Michigan 48909

Dear Review Coordinator:

In order to comply with the Archeological and Historic Preservation Act and the National Historic Preservation Act, we are hereby requesting your review to determine if there are any potential prehistoric, historical, and/or archaeological concerns in the vicinity of our proposed project. Enclosed is the Application for Section 106 Review, and following is information supplemental to the application.

The project is located in Sections 19, & 20, Town 7 North, Range 13 West, in Ottawa County, Michigan. The proposed project at the WWTP includes constructing a 3.20 MGD biological treatment process with three batch reactor tanks; abandoning/re-purposing primary tanks, rotating biological contactor tanks, and final clarifier tanks; Installing a new building for the reactors to house blowers and piping; constructing a new biosolids processing building and equipment to dewater treated biosolids for disposal. Project activities for the transmission main portion include: Renovating/repairing an existing pressure sewer leading to the WWTP; re-routing the Grand Valley State University trunk sewer line; and removing/re-locating some other smaller sections of trunk sewer in order to increase the life span and minmize risk of failure of these critical utilities..

A State Revolving Fund loan is being applied for in order to help fund these projects. The project plan for this application is being compiled.

Based on our research and the Michigan State Historic Preservation Office's records, we do not believe any historic or architecturally significant properties will be impacted by the project. The Michigan State Historic Preservation Office's records did not find any records of any archaeological or architecturally significant buildings directly in the project area. There are a few commercial, industrial, and residential structures adjacent to the project areas, but none of these structures are over 50 years old. These structures are not unique, nor can they be associated with historical events, significant people, or characteristics of a type, period, or method of construction.

Upon review of the enclosed, please proceed with the Environmental Review. If you have any questions, please contact me at (616) 363-9801.

Sincerely,

Brian Hannon, P.E.

Enclosures
jss
cc: Chad Doornbos, Superintendent of Public Utilities, Allendale Charter Township

**STATE HISTORIC PRESERVATION OFFICE**
# Application for Section 106 Review

SHPO Use Only

☐ IN Received Date ____ / ____ / ____ Log In Date ____ / ____ / ____

☐ OUT Response Date ____ / ____ / ____ Log Out Date ____ / ____ / ____

Sent Date ____ / ____ / ____

*Submit one copy for each project for which review is requested. This application is required. Please type. Applications must be complete for review to begin. Incomplete applications will be sent back to the applicant without comment. Send only the information and attachments requested on this application. Materials submitted for review cannot be returned. Due to limited resources we are unable to accept this application electronically.*

## I. GENERAL INFORMATION

☒ THIS IS A NEW SUBMITTAL ☐ THIS IS MORE INFORMATION RELATING TO ER#

a. Project Name: Allendale WRRF & Collection System Improvements
b. Project Address (if available): 11624 40th Ave, Allendale, MI 49401
c. Municipal Unit: Allendale Charter Township County: Ottawa
d. Federal Agency, Contact Name and Mailing Address (*If you do not know the federal agency involved in your project please contact the party requiring you to apply for Section 106 review, not the SHPO, for this information*.):
e. State Agency (if applicable), Contact Name and Mailing Address: Michigan EGLE, Clarence Jones, P.O. Box 30457, Lansing, MI 48909-7957, jonesc13@michigan.gov
f. Consultant or Applicant Contact Information (if applicable) *including mailing address*: Jarod Stuyvesant, Moore & Bruggink, Inc., 2020 Monroe Ave NW Grand Rapids, MI 49505, jstuyv@mbce.com

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## II. GROUND DISTURBING ACTIVITY (INCLUDING EXCAVATION, GRADING, TREE REMOVALS, UTILITY INSTALLATION, ETC.)

DOES THIS PROJECT INVOLVE GROUND-DISTURBING ACTIVITY? ☒ YES ☐ NO (If no, proceed to section III.)

Exact project location must be submitted on a USGS Quad map (portions, photocopies of portions, and electronic USGS maps are acceptable as long as the location is clearly marked).

a. USGS Quad Map Name: Allendale Quadrangle, Michigan - Ottawa County
b. Township: T7N Range: R13W Section: 19,20
c. Description of width, length and depth of proposed ground disturbing activity: At the WWTP: 150 ft. long by 80 ft. wide by 18 ft. deep for new biological treatment tanks. For the transmission sewer and force main: 5,000 ft. long, 15 ft.. wide, 5-15 ft. depths
d. Previous land use and disturbances: WWTP excavation: green space designated for future treatment plant capacities. Transmission Main: Currently used for wastewater and other utilities and public right of way
e. Current land use and conditions: WWTP: Green space with grass adjacent to treatment tanks and buildings. Transmission Main: utility corridor with minimal vegitation over top.
f. Does the landowner know of any archaeological resources found on the property? ☐ YES ☒ NO
Please describe: A survey was conducted in 1975 for construction at the WWTP and no evidence of archaeological resources was found on site.

---

## III. PROJECT WORK DESCRIPTION AND AREA OF POTENTIAL EFFECTS (APE)
## Note: Every project has an APE.

a. Provide a detailed written description of the project (plans, specifications, Environmental Impact Statements (EIS), Environmental Assessments (EA), etc. **cannot** be substituted for the written description): At the WWTP, the project activities include: Constructing a 3.20 MGD biological treatment process with three batch reactor tanks to utilize Aerobic Granular Sludge biological treatment; abandoning/re-purposing primary tanks, rotating biological contactor tanks, and final clarifier tanks; Installing a new building for the reactors to house

blowers and piping; constructing a new biosolids processing building and equipment to dewater treated biosolids for disposal. Project activities for the transmission main portion include: Renovating/repairing an existing pressure sewer leading to the WWTP; re-routing the Grand Valley State University trunk sewer line; and removing/re-locating some other smaller sections of trunk sewer in order to increase the life span and minmize risk of failure of these critical utilities.

b. Provide a localized map indicating the location of the project; road names must be included and legible.
c. On the above-mentioned map, identify the APE.
d. Provide a written description of the APE (physical, visual, auditory, and sociocultural), the steps taken to identify the APE, and the justification for the boundaries chosen. For the WWTP portion (will be renamed to WRRF in the future), the site is located off a gravel road (40th Ave) between 40th ave and the Grand River. The site has a long driveway that leads to the plant. The plant has standard wastewater treatment tanks, structures, and equipment to treat 1.60 million gallons per day. There are also four large lagoons on site used for different purposes. The Township owns all of thise property. The APE for the transmission main portion of the project consists of three different areas that each serve as a unique option for repairing and/or relocating the transmission line that brings wastewater to the treatment facility. The current location (option 1) follows along the Ottawa Creek bed. This area is heavily wooded and difficult to access. Option 2 follows along Lake Michigan Drive from west to east. This is a major transportation corridor with a four lane divided highway. The utilities would be located in the green space along the north edge of this highway. Option 3 would follows rural streets to the north and east of the western edge of the APE. These include following 48th Ave north from M-45 and continuing along Rich St to the east, until the curve. Then the transmission pipe would traverse cross country to the east toward the WWTP.

## IV. IDENTIFICATION OF HISTORIC PROPERTIES

a. List and date **all** properties 50 years of age or older located in the APE. If the property is located within a National Register eligible, listed or local district it is only necessary to identify the district: There are no structures within the APE over 50 years in age.

b. Describe the steps taken to identify whether or not any **historic** properties exist in the APE and include the level of effort made to carry out such steps: All properties adjacent to the proposed APE's (all options for the transmission main portion as well) were researched using Ottawa County's property descriptions available through the GIS mapping online.The oldest structure within the APE limits was found to be constructed in 1982. A map of the propose project APE was sent to the SHPO office via email. This map was evaluated by the survey coordinator and archaeologist on staff with SHPO. It was found that there were previously conducted archaeological surveys within portions of the APE. These surveys found that there are no known significant archaeological impacts within these areas. There are other areas with a history of archaeological signifance within the Township limits. These areas are significantly distant from any areas of impact within the APE. See the attached map with these areas highlighted. Also attached are the reports for these identified areas.
As for architectural sites, there were no historical buildings or structures located within the APE. The oldest structure determined adjacent to the APE was built in 1982. SHPO was only aware of a previously demolished bridge on the west side of the Township being the only registered historical structure. After researching the APE, it was determined there are no known historically significant structures within the APE.

c. Based on the information contained in "b", please choose one:

- ☐ Historic Properties Present in the APE
- ☒ No Historic Properties Present in the APE

d. Describe the condition, previous disturbance to, and history of any historic properties located in the APE:

---

## V. PHOTOGRAPHS

**Note: All photographs must be keyed to a localized map.**

a. Provide photographs of the site itself.

b. Provide photographs of all properties 50 years of age or older located in the APE (faxed or photocopied photographs are not acceptable).

---

## VI. DETERMINATION OF EFFECT

☒ No historic properties affected based on [36 CFR § 800.4(d)(1)], please provide the basis for this determination.

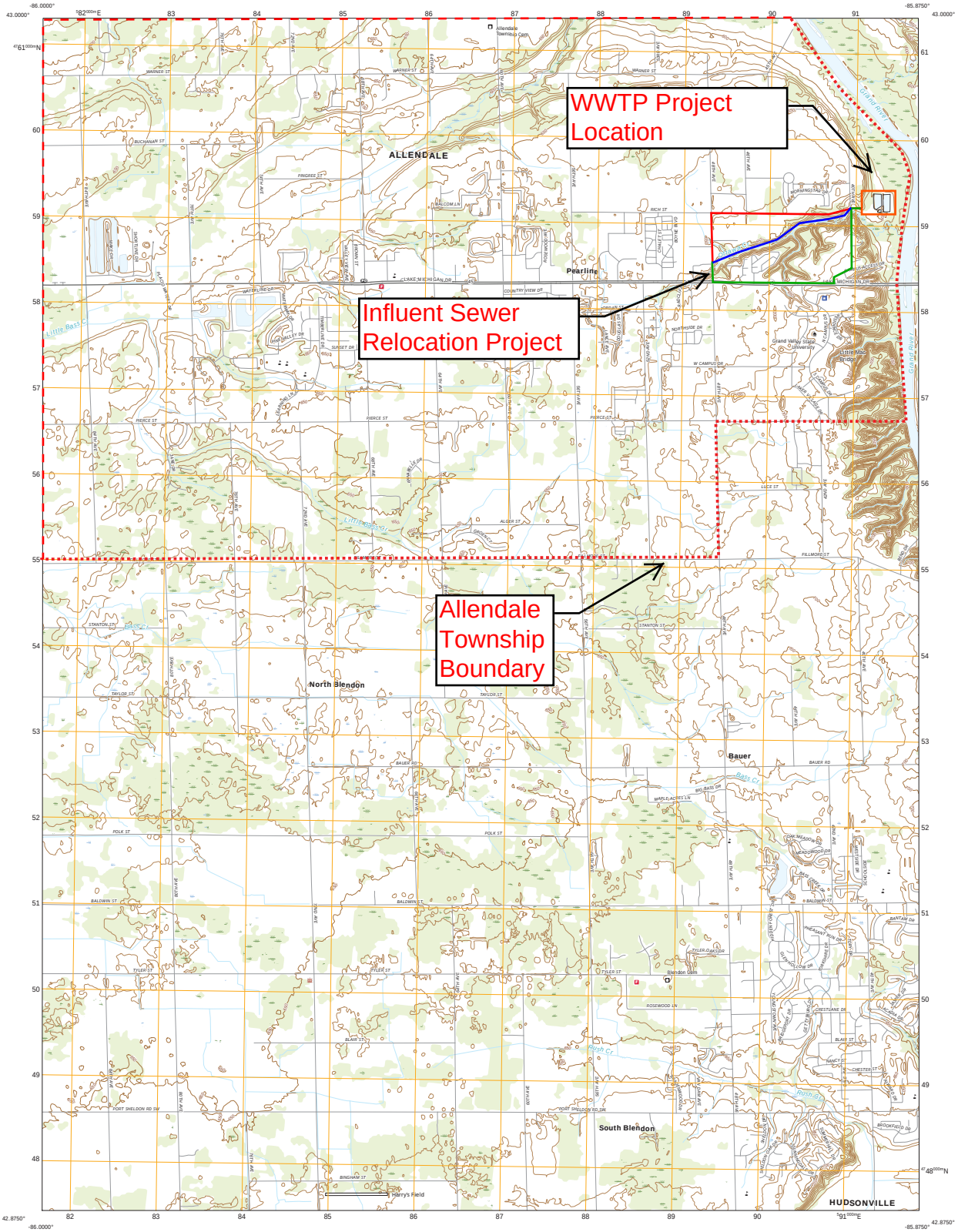
☐ No Adverse Effect [36 CFR § 800.5(b)] on historic properties, explain why the criteria of adverse effect, 36 CFR Part 800.5(a)(1), were found not applicable.

☐ Adverse Effect [36 CFR § 800.5(d)(2)] on historic properties, explain why the criteria of adverse effect, [36 CFR Part 800.5(a)(1)], were found applicable.

***Please print and mail completed form and required information to:***

*State Historic Preservation Office, Environmental Review Office, Michigan Historical Center, 702 W. Kalamazoo Street, P.O. Box 30740, Lansing, MI 48909-8240*

# Exhibit 1 - Allendale Township Quadrangle Topo Map




U.S. DEPARTMENT OF THE INTERIOR
U.S. GEOLOGICAL SURVEY

The National Map US Topo

ALLENDALE QUADRANGLE
MICHIGAN - OTTAWA COUNTY
7.5-MINUTE SERIES

**Produced by the United States Geological Survey**

North American Datum of 1983 (NAD83)
World Geodetic System of 1984 (WGS84). Projection and
1 000-meter grid:Universal Transverse Mercator, Zone 16T
This map is not a legal document. Boundaries may be
generalized for this map scale. Private lands within government
reservations may not be shown. Obtain permission before
entering private lands.

Imagery..... NAIP, July 2016 - October 2016
Roads..... U.S. Census Bureau, 2016
Names..... GNIS, 1980 - 2019
Hydrography..... National Hydrography Dataset, 2006 - 2019
Contours..... National Elevation Dataset, 2019
Boundaries..... Multiple sources; see metadata file 2017 - 2018
Public Land Survey System..... BLM, 2018
Wetlands..... FWS National Wetlands Inventory 2005 - 2012

UTM GRID AND 2019 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET

SCALE 1:24 000

CONTOUR INTERVAL 10 FEET
NORTH AMERICAN VERTICAL DATUM OF 1988

This map was produced to conform with the
National Geospatial Program US Topo Product Standard, 2011.
A metadata file associated with this product is draft version 0.6.18

ADJOINING QUADRANGLES
1 Nunica
2 Coopersville
3 Marne
4 Borculo
5 Grandville
6 Holland East
7 Hudsonville West
8 Hudsonville East

ROAD CLASSIFICATION
Expressway
Secondary Hwy
Ramp
Local Connector
Local Road
4WD
Interstate Route
US Route
State Route

ALLENDALE, MI
2019

NSN 7643-01-932-4007
MAP REF NO. 13015274007


Allendale WRRF and Collection System Improvements APE map
WWTP portion APE
Transmission Portion Option 3 APE
8
11
10
7
Oldest known Structure in APE - 1982
Tranmssion Portion Option 1 APE
9
Transmission Portion Option 1 APE
Transmission Portion Option 2 APE
6
1
2
3
4
5
Photo reference #'s

# MICHIGAN ARCHAEOLOGICAL SITE FILE
# CONFIDENTIAL-NOT FOR PUBLIC DISTRIBUTION

**Name:** Riverside Terrace **Site Number:** 20OT346

**Other Names:**

**County:** Ottawa

**Township:**

**Region:** Grand **River Basin:** Grand

**Map:** Allendale Quadrangle, 7.5' USGS

| Township | Range | Section | Quarter |
|---|---|---|---|
| 07N | 13W | 20 | Center-SW |
| 07N | 13W | 20 | Center-SW |

**Longitude:**

**Latitude:**

**Narrative Description:** This site consists of a low density concentration of chert flakes found on the south end of a clearing and a concentration of burnt faunal bones and pottery found on the north end of the clearing along the flood plain of the Grand River. The site shows no evidence of plow disturbance.

**Information Sources:** Field Verified

**Field Evidence:** Positive shovel-test(s)

| Period | Date | Culture | Function |
|---|---|---|---|
| A - Prehistoric Period | | Native American | camp |

**Field Work Summary:** 2010: Phase I survey, GVSU (J. Brashler and C. Caroll-Howard)

**Collections:**

**Publications:**

| Author | Year | Title | Publisher |
|---|---|---|---|
| | | Allendale Quadrangle, 7.5' USGS | |

**Other Documentation:** Caroll-Howard, Christopher, 2010, GVSU Site form and maps for lithic scatter on Grand River (20OT346). On file at the Office of the State Archaeologist.

**NRHP Status:** More Information Needed/Unevaluated

| Evaluation | Date of Evaluation | Evaluation Comment |
|---|---|---|
| More Information Needed / No Determination Made | 7/27/2010 | |

**Ownership:**

**Projects:** B10-311

**Record Created:** 4/3/2015 **Record Last Modified:** 12/9/2019

# MICHIGAN ARCHAEOLOGICAL SITE FILE
# CONFIDENTIAL-NOT FOR PUBLIC DISTRIBUTION

**By:** # SA_MiSHPO_CRM

# MICHIGAN ARCHAEOLOGICAL SITE FILE
# CONFIDENTIAL-NOT FOR PUBLIC DISTRIBUTION

**Name:** GVSU North **Site Number:** 20OT350

**Other Names:**

**County:** Ottawa

**Township:** Allendale

**Region:** Grand **River Basin:** Grand

**Map:** Allendale Quadrangle, 7.5' USGS

| Township | Range | Section | Quarter |
|---|---|---|---|
| | | | |
| 07N | 13W | 20 | NE-SW-SW & NW-SE-SW |
| 07N | 13W | 20 | NE-SW-SW & NW-SE-SW |

**Longitude:**

**Latitude:**

**Narrative Description:** Survey by GVSU in the field west of the Grand River located a low density of historic items, including bone, glass, metal and plastic. Some prehistoric flakes were also located.

**Information Sources:** Recon. Level Survey (Meets Fed. S&G)

**Field Evidence:** Positive shovel-test(s), Surface scatter

| Period | Date | Culture | Function |
|---|---|---|---|
| N - Historic Period | | | undetermined |
| A - Prehistoric Period | | Native American | undetermined |

**Field Work Summary:** 2010: Ph I Survey by GVSU (J. Brashler)

**Collections:**

**Publications:**

| Author | Year | Title | Publisher |
|---|---|---|---|
| | | Allendale Quadrangle, 7.5' USGS | |

**Other Documentation:** Wieghmink, 2011, GVSU Archaeological Site Report Form. On file.

**NRHP Status:** More Information Needed/Unevaluated

| Evaluation | Date of Evaluation | Evaluation Comment |
|---|---|---|
| More Information Needed / No Determination Made | 10/5/2011 | |

**Ownership:** owner, Recorder

**Projects:**

**Record Created:** 4/3/2015 **Record Last Modified:** 11/26/2019

# MICHIGAN ARCHAEOLOGICAL SITE FILE
# CONFIDENTIAL-NOT FOR PUBLIC DISTRIBUTION

**By:** # SA_MiSHPO_CRM

# MICHIGAN ARCHAEOLOGICAL SITE FILE
# CONFIDENTIAL-NOT FOR PUBLIC DISTRIBUTION

**Name:** 20OT367 **Site Number:** 20OT367

**Other Names:** GROS

**County:** Ottawa

**Township:** Tallmadge

**Region:** Grand **River Basin:** Grand

**Map:** Allendale Quadrangle, 7.5' USGS

| Township | Range | Section | Quarter |
|---|---|---|---|
| 07N | 13W | 29 | E1/2-NW |

**Longitude:** -85.87538

**Latitude:** 42.96746

**Narrative Description:** Site excavated by GVSU in 2014. Three superimposed hearths were located within one feature. Excavations found mostly ceramics, but a local collector may have some lithics from the site.

**Information Sources:** Tested

**Field Evidence:** Feature(s)

| Period | Date | Culture | Function |
|---|---|---|---|
| K - Late Woodland Period | | Native American | camp |

**Field Work Summary:** 2014: Survey and Excavation by GVSU

**Collections:**

**Publications:**

| Author | Year | Title | Publisher |
|---|---|---|---|
| | | Allendale Quadrangle, 7.5' USGS | |

**Other Documentation:** Jackson, 2018, EMail to S. Tchorzynski, FW: Site Number. On file.

**NRHP Status:** More Information Needed/Unevaluated

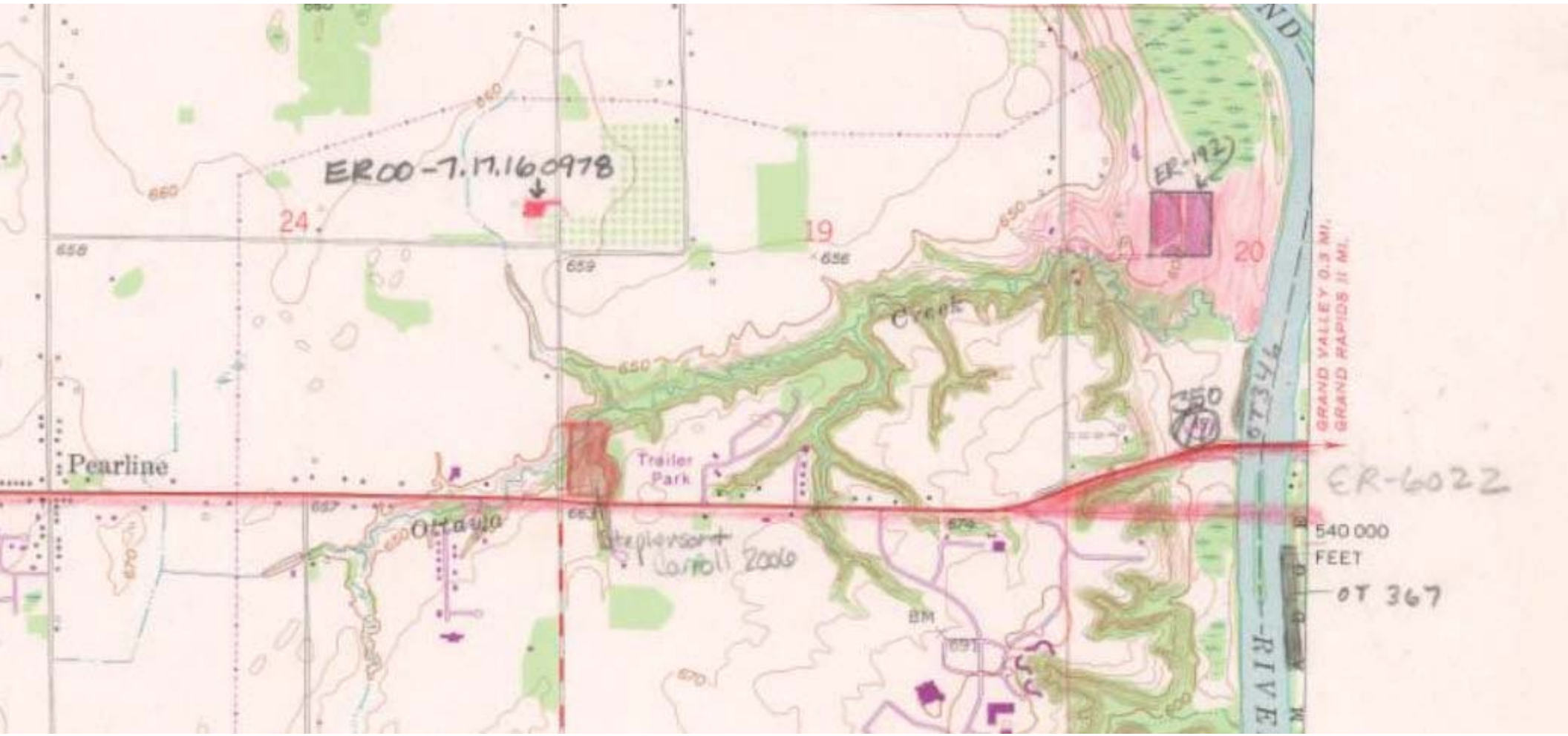
| Evaluation | Date of Evaluation | Evaluation Comment |
|---|---|---|
| More Information Needed / No Determination Made | 2/14/2018 | |

**Ownership:** Recorder

**Projects:**

**Record Created:** 2/14/2018 **Record Last Modified:** 11/26/2019

**By:** # SA_MiSHPO_CRM


ER00-7.17.160978
ER-192
24
19
20
Pearline
Trailer Park
Ottawa
Stephenson
Carroll 2006
Creek
BM
RIVER
GRAND VALLEY 0.3 MI.
GRAND RAPIDS 11 MI.
ER-6022
540 000
FEET
OT 367

# PROJECT BIBLIOGRAPHY REPORT

**PROJECT DETAILS**

| | |
|---|---|
| **Project ID** | ER00-7.17.160978 |
| **Project Name** | G2 Cellular Tower Site Review #160978 |

**PROJECT BIBLIOGRAPHY RECORDS**

| | **Bibkey** |
|---|---|
| **Citation**:<br>Robertson, Charlie and Larry N. Stillwell. 2016. An Archaeological Field Reconnaissance of a Proposed Telecommunications Facility (Project #160978) in Allendale, Ottawa County, Michigan. 14FR218Mi. Archaeological Consultants of Ossian<br>**Notes**:<br>No new archaeological sites were identified in a survey of less than an acre at T07N, R14W, Section 24. | 14784 |

# PROJECT BIBLIOGRAPHY REPORT

**PROJECT DETAILS**

| | |
|---|---|
| **Project ID** | ER-192 |
| **Project Name** | Allendale Waste Water Treatment Plant |

**PROJECT BIBLIOGRAPHY RECORDS**

| | **Bibkey** |
|---|---|
| **Citation**:<br>Flanders, Richard E. 1975. Allendale Waste Water Treatment Plant Proposal Archaeological Survey: P-82684.<br>**Notes**:<br>About 9 acres were surveyed in Section 20, T7N, R13W, Ottawa County. No archaeological sites were located. | 08121 |

# PROJECT BIBLIOGRAPHY REPORT

**PROJECT DETAILS**

| | |
|---|---|
| **Project ID** | ER-6022 |
| **Project Name** | M-45 Improvements, 24th Street to 68th Street |

**PROJECT BIBLIOGRAPHY RECORDS**

| | **Bibkey** |
|---|---|
| **Citation**:<br>Holman, Margaret B. and Michael J. Hambacher. 1986. Phase II Investigations of the Bolthouse Site (20OT11/52) Ottawa County, Michigan. 88. Michigan State University Museum<br>**Notes**:<br>Phase II investigations at the Bolthouse site (20OT52) in Tallmadge Twp., Sec. 29, T7N R13W, confirm that the major locus of prehistoric activity at the site is within the proposed M-95 right of way. Analysis of 3 Features plus artifacts, and plant remains indicate that the site was not intensively occupied, that it was used for generalized purposes, and that it was probably contemporary with 3 nearby sites. These include the Middle Woodland/Early Late Woodland Zemaitis village site and 2 special function sites ancillary to Zemaitis. Phase III Excavation is recommended. | 03508 |
| **Citation**:<br>Roper, Donna C., J. Schuldenrein, D.R. Hayes, and D.J. Weir. 1984. Phase I Archaeological Investigation and Deep Site Testing along M-45, Ottawa County, Michigan. R-2588. Commonwealth Associates, Inc.<br>**Notes**:<br>Survey of a 150 foot wide corridor along about 3250 feet of highway corridor, covering about 11 acres. Deep testing indicated little chance of buried sites. Two light lithic scatters were found. (20OT115 and 116). Previously known site 20OT11/52 ws investigated. The George Davis collection from this site was studied, and a controlled surface collection of the site made. Phase II Investigation is recommended for 20OT11/52. These sites were located in Secs. 27,28,21,20,29,19,and 30, T7N R13W. | 03063 |

Photo #1

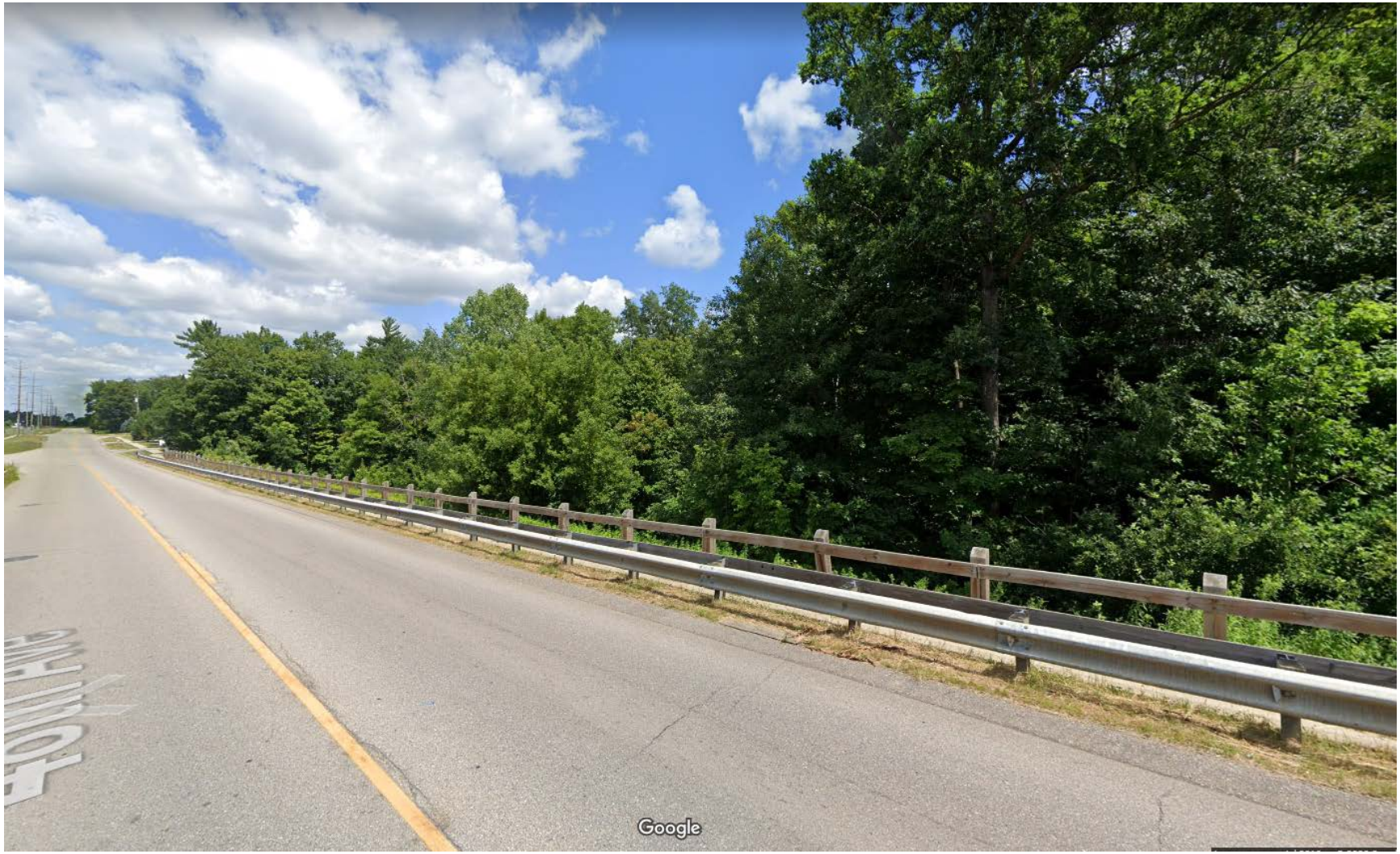


Photo #2



Photo #3



Photo #4



Photo #5



Photo #6



Photo #7



Photo #8



Photo #9


11395 48th Ave
Allendale Charter Twp, Michigan
Google
Street View
Laser Dynamics
Laker Insurance
8th Ave
Google

Photo #10


11472 48th Ave
Allendale Charter Twp, Michigan
Google
Street View
U-HAUL
U-HAUL
48th Ave
Laser Dynamics
Google

Photo #11


4798 Rich St
Allendale Charter Twp, Michigan
Google
Street View
Rich St
Leprino Foods company
Google

WWTP Aerial



# APPENDIX J

Tribal Historic Preservation Office Letters

Moore+Bruggink
Consulting Engineers

June 1, 2020

Earl Meshigaud
Hannahville Potawatomi Indian Community
N-14911 Hannahville B-1 Road
Wilson, MI 49896

SUBJECT: **Notice and Opportunity to Comment**
Water Reclamation and Recovery Facility & Collection System Improvements
Allendale Charter Township

Dear Earl Meshigaud,

Moore & Bruggink, working on behalf of Allendale Charter Township, is preparing an application to fund improvements to the Allendale Wastewater Treatment Plant and sewage collection system. This work is proposed for funding through the Michigan Department of Environment, Great Lakes, and Energy, State Revolving Fund, starting in fiscal year 2021.

The proposed work consists of an expansion at the treatment facility to allow for the treatment of 3.2 million gallons per day of wastewater, in addition to the removal and replacement of the main transmission line of wastewater to the treatment facility. At the WWTP, the project activities include: Constructing a 3.20 MGD biological treatment process with three batch reactor tanks to utilize Aerobic Granular Sludge biological treatment; abandoning/re-purposing primary tanks, rotating biological contactor tanks, and final clarifier tanks; Installing a new building for the reactors to house blowers and piping; constructing a new biosolids processing building and equipment to dewater treated biosolids for disposal. Project activities for the transmission main portion include: Renovating/repairing an existing pressure sewer leading to the WWTP; re-routing the Grand Valley State University trunk sewer line; and removing/re-locating some other smaller sections of trunk sewer in order to increase the life span and minmize risk of failure of these critical utilities.

The project will be located in Ottawa County, township 7N, range 13W, sections 19, 20, 29, 30. Refer to the attached map of the proposed project areas.

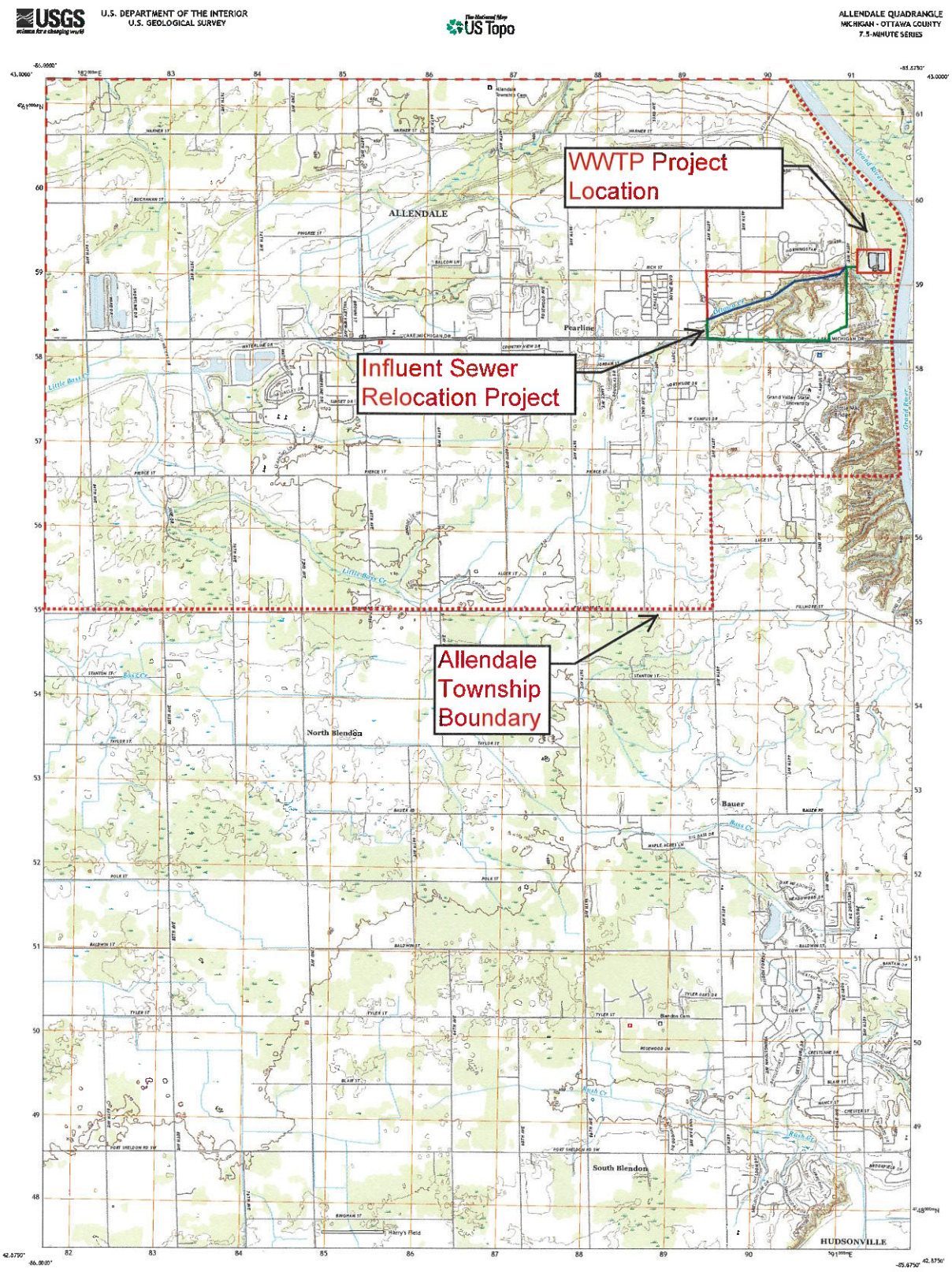
This notice and opportunity to comment is being sent to you to fulfill Section 106 of the National Historic Preservation Act review process, which requires a federal agency or applicant to consult with THPOs and federally recognized Indian tribes. The purpose of this notice is to give you an opportunity to have your interests and concerns considered. Should you have any comments on potential impacts to known religious and/or culturally significant properties in the area of the proposed project, please provide them to us within 30 days of this notice.

2020 Monroe Avenue NW | Grand Rapids, MI 49505-6298
T [616] 363 9801 | F [616] 363 2480 | W mbce.com

Sincerely,

Brian Hannon, P.E.
Project Manager
Moore & Bruggink, Inc.
2020 Monroe Ave NW
Grand Rapids, MI 49505
bhannon@mbce.com
616-363-9801

# Exhibit 1 - Allendale Township Quadrangle Topo Map




USGS U.S. DEPARTMENT OF THE INTERIOR U.S. GEOLOGICAL SURVEY

The National Map US Topo

ALLENDALE QUADRANGLE
MICHIGAN - OTTAWA COUNTY
7.5-MINUTE SERIES

Produced by the United States Geological Survey

SCALE 1:24 000

ROAD CLASSIFICATION

ALLENDALE, MI
2019

Moore+Bruggink
Consulting Engineers

June 1, 2020

Jay Sam
Little River Band of Ottawa Indians
2608 Governmental Center Drive
Manistee, MI 49660

SUBJECT: **Notice and Opportunity to Comment**
Water Reclamation and Recovery Facility & Collection System Improvements
Allendale Charter Township

Dear Jay Sam,

Moore & Bruggink, working on behalf of Allendale Charter Township, is preparing an application to fund improvements to the Allendale Wastewater Treatment Plant and sewage collection system. This work is proposed for funding through the Michigan Department of Environment, Great Lakes, and Energy, State Revolving Fund, starting in fiscal year 2021.

The proposed work consists of an expansion at the treatment facility to allow for the treatment of 3.2 million gallons per day of wastewater, in addition to the removal and replacement of the main transmission line of wastewater to the treatment facility. . At the WWTP, the project activities include: Constructing a 3.20 MGD biological treatment process with three batch reactor tanks to utilize Aerobic Granular Sludge biological treatment; abandoning/re-purposing primary tanks, rotating biological contactor tanks, and final clarifier tanks; Installing a new building for the reactors to house blowers and piping; constructing a new biosolids processing building and equipment to dewater treated biosolids for disposal. Project activities for the transmission main portion include: Renovating/repairing an existing pressure sewer leading to the WWTP; re-routing the Grand Valley State University trunk sewer line; and removing/re-locating some other smaller sections of trunk sewer in order to increase the life span and minmize risk of failure of these critical utilities.

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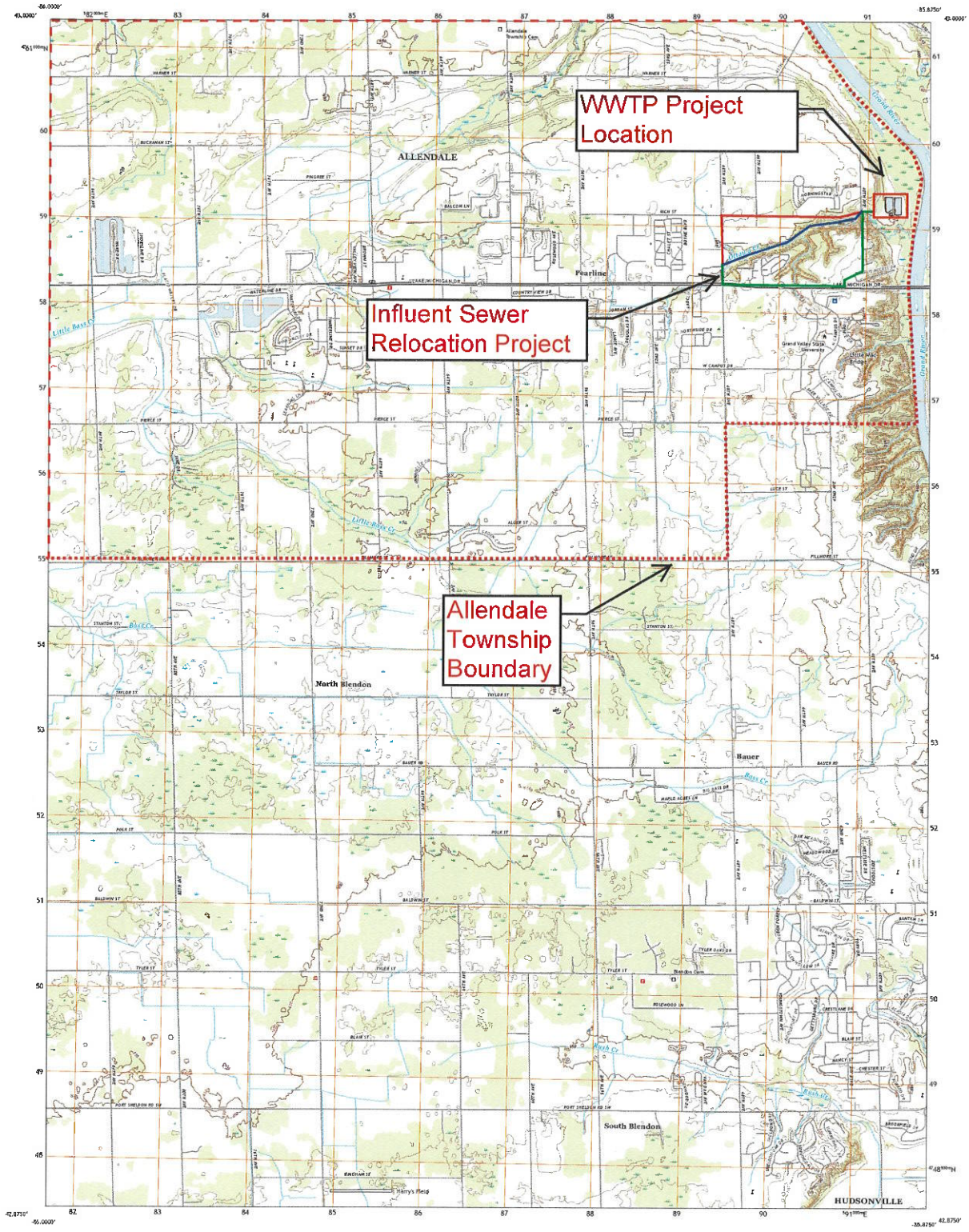
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Project Manager
Moore & Bruggink, Inc.
2020 Monroe Ave NW
Grand Rapids, MI 49505
bhannon@mbce.com
616-363-9801

# Exhibit 1 - Allendale Township Quadrangle Topo Map



Moore+Bruggink
Consulting Engineers

June 1, 2020

Heather Bush
Match-e-be-nash-shee-wish Gun Lake Band of Potawatomi Indians
2872 Mission Drive
Shelbyville, MI 49344

SUBJECT: **Notice and Opportunity to Comment**
Water Reclamation and Recovery Facility & Collection System Improvements
Allendale Charter Township

Dear Heather Bush,

Moore & Bruggink, working on behalf of Allendale Charter Township, is preparing an application to fund improvements to the Allendale Wastewater Treatment Plant and sewage collection system. This work is proposed for funding through the Michigan Department of Environment, Great Lakes, and Energy, State Revolving Fund, starting in fiscal year 2021.

The proposed work consists of an expansion at the treatment facility to allow for the treatment of 3.2 million gallons per day of wastewater, in addition to the removal and replacement of the main transmission line of wastewater to the treatment facility. . At the WWTP, the project activities include: Constructing a 3.20 MGD biological treatment process with three batch reactor tanks to utilize Aerobic Granular Sludge biological treatment; abandoning/re-purposing primary tanks, rotating biological contactor tanks, and final clarifier tanks; Installing a new building for the reactors to house blowers and piping; constructing a new biosolids processing building and equipment to dewater treated biosolids for disposal. Project activities for the transmission main portion include: Renovating/repairing an existing pressure sewer leading to the WWTP; re-routing the Grand Valley State University trunk sewer line; and removing/re-locating some other smaller sections of trunk sewer in order to increase the life span and minmize risk of failure of these critical utilities.

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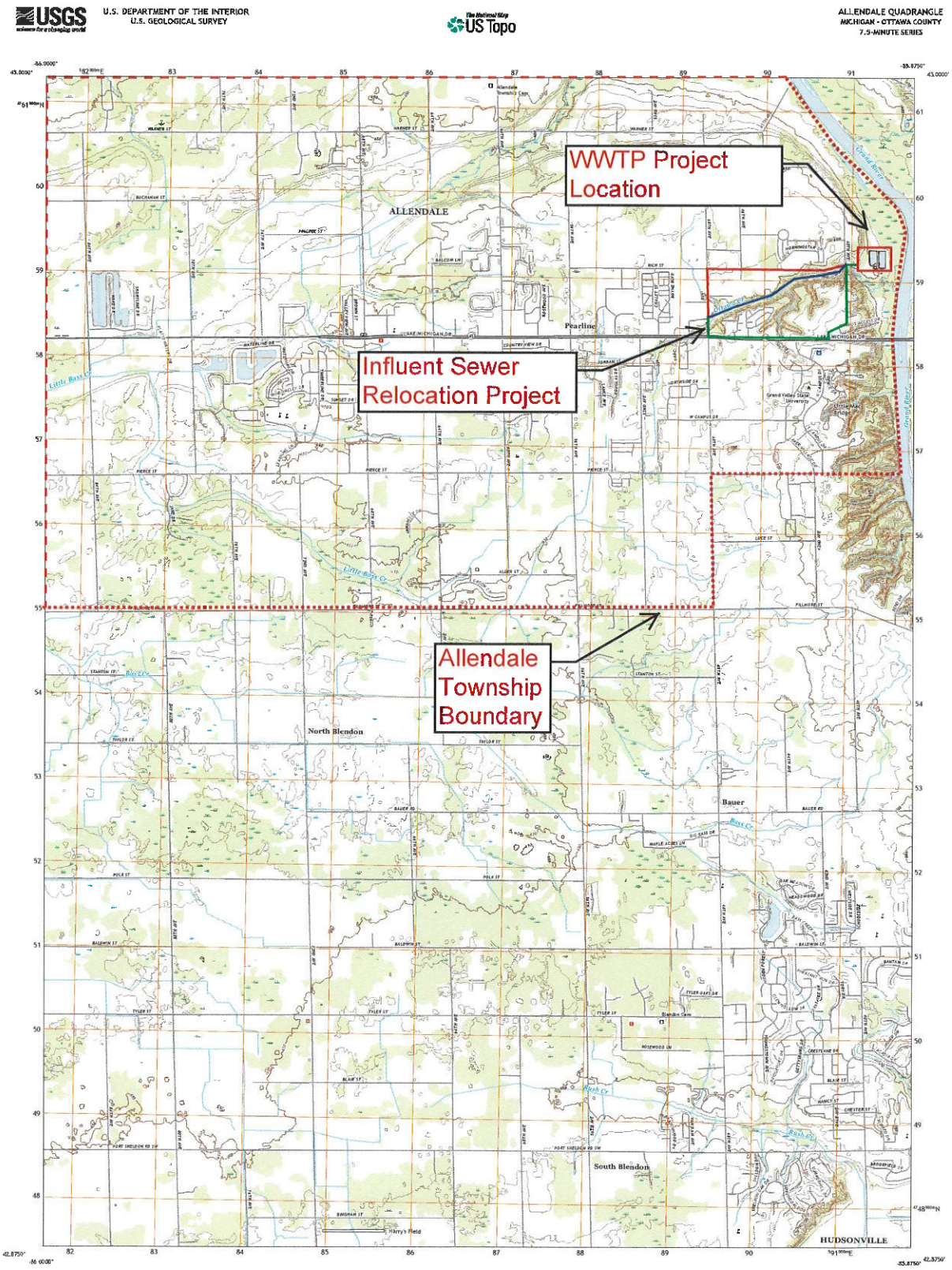
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Sincerely,

Brian Hannon, P.E.
Project Manager
Moore & Bruggink, Inc.
2020 Monroe Ave NW
Grand Rapids, MI 49505
bhannon@mbce.com
616-363-9801

# Exhibit 1 - Allendale Township Quadrangle Topo Map



Moore+Bruggink
Consulting Engineers

June 1, 2020

Mon-ee Zapata
Nottawaseppi Band of Huron Potawatomi
1485 Mno-Bmadzewen Way
Fulton, MI 49052

SUBJECT: **Notice and Opportunity to Comment**
Water Reclamation and Recovery Facility & Collection System Improvements
Allendale Charter Township

Dear Mon-ee Zapata,

Moore & Bruggink, working on behalf of Allendale Charter Township, is preparing an application to fund improvements to the Allendale Wastewater Treatment Plant and sewage collection system. This work is proposed for funding through the Michigan Department of Environment, Great Lakes, and Energy, State Revolving Fund, starting in fiscal year 2021.

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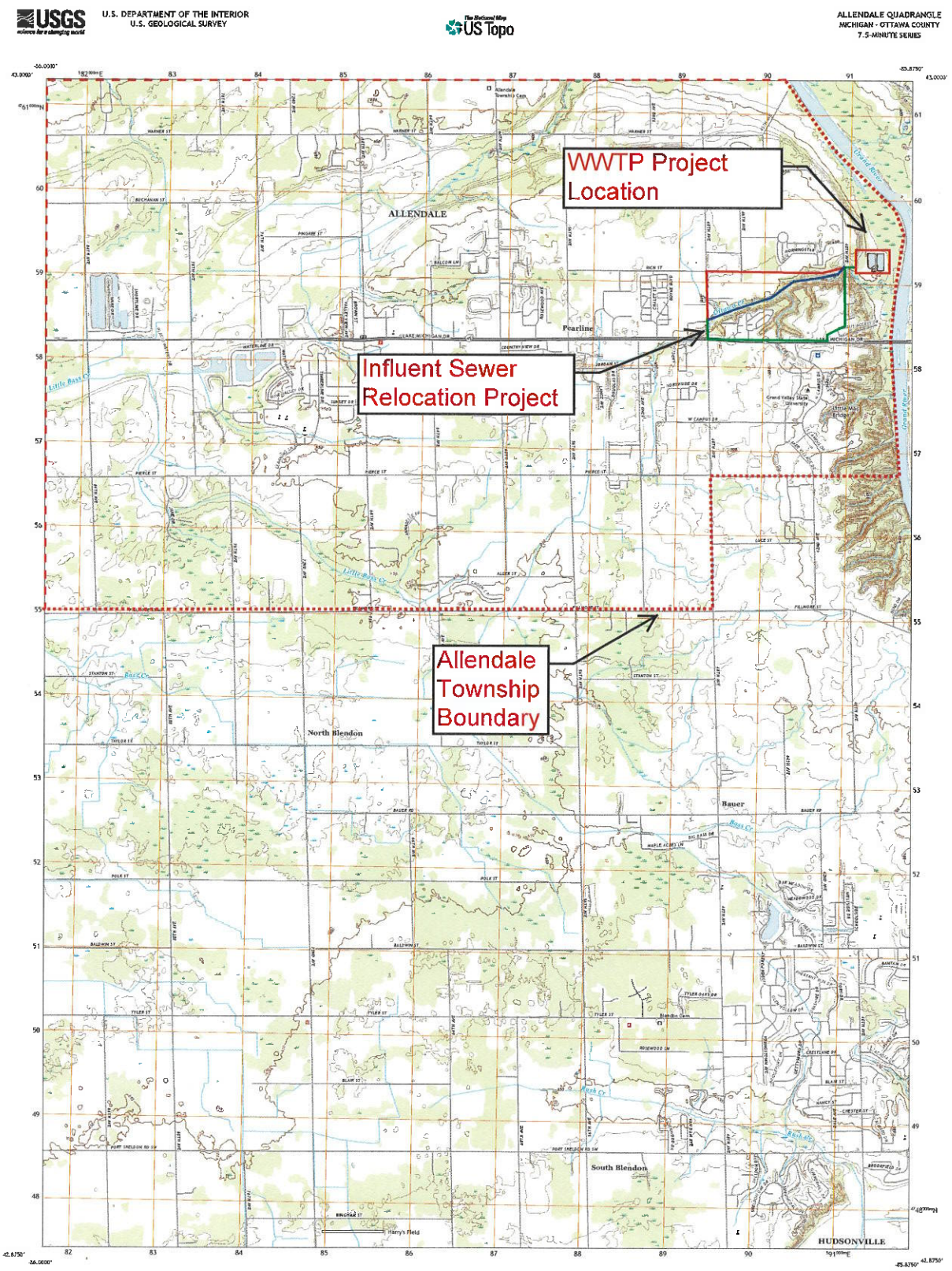
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Moore & Bruggink, Inc.
2020 Monroe Ave NW
Grand Rapids, MI 49505
bhannon@mbce.com
616-363-9801

# Exhibit 1 - Allendale Township Quadrangle Topo Map



Moore+Bruggink
Consulting Engineers

June 1, 2020

Marcus Winchester
Pokagon Band of Potawatomi
58620 Sink Road
Dowagiac, MI 49047

SUBJECT: **Notice and Opportunity to Comment**
Water Reclamation and Recovery Facility & Collection System Improvements
Allendale Charter Township

Dear Marcus Winchester,

Moore & Bruggink, working on behalf of Allendale Charter Township, is preparing an application to fund improvements to the Allendale Wastewater Treatment Plant and sewage collection system. This work is proposed for funding through the Michigan Department of Environment, Great Lakes, and Energy, State Revolving Fund, starting in fiscal year 2021.

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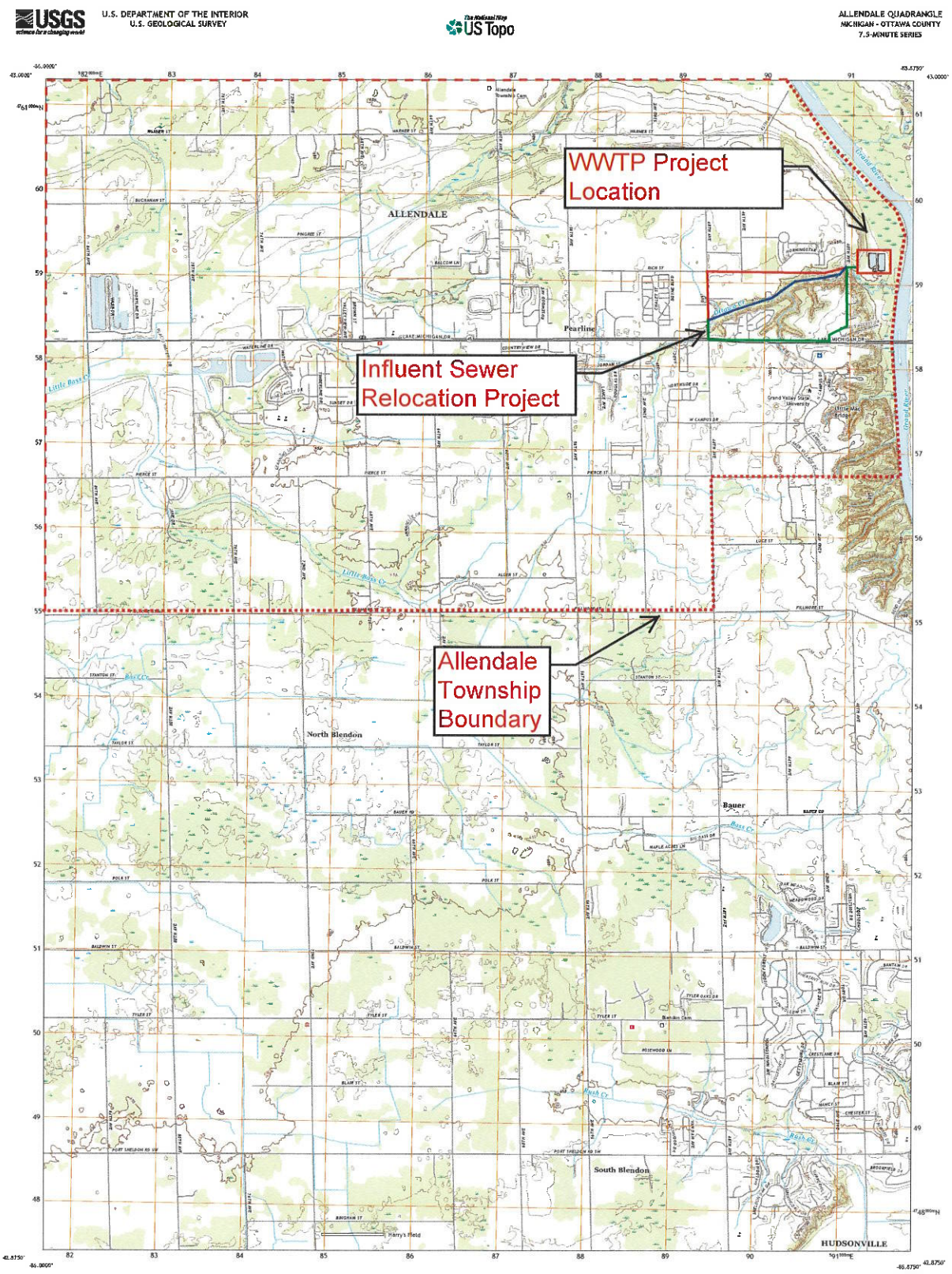
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Sincerely,

Brian Hannon, P.E.
Project Manager
Moore & Bruggink, Inc.
2020 Monroe Ave NW
Grand Rapids, MI 49505
bhannon@mbce.com
616-363-9801

# Exhibit 1 - Allendale Township Quadrangle Topo Map



# APPENDIX K

Michigan Natural Features Inventory Data Package

# APPENDIX L

Allendale 20-Year Capital Improvement Plan

Revised: 5/18/2020

| Sanitary Sewer CIP | Water System CIP | Total Water & Sewer | Inflated Costs (3% per year) |
|---|---|---|---|
| $ 53,612,000 | $ 5,287,000 | $ 58,899,000 | $ 70,480,000 |

| Year | Project Identification | Sanitary Sewer CIP | Water System CIP | Total Water & Sewer | Inflated Costs (3% per year) |
|---|---|---|---|---|---|
| 2019 | Winans St water and sewer services | $ 84,000 | | | $ 85,000 |
| | Collection System Maintenance (Annual Cost) | $ 72,917 | | | $ 75,000 |
| | Collection System Rehabilitation (Annual Cost) | $ 215,015 | | | $ 220,000 |
| | Water main and services from Lincoln St and 60th to Traders View | | $ 197,000 | | $ 205,000 |
| | | $ 371,932 | $ 197,000 | $ 568,932 | $ 585,000 |
| 2020 | WWTP expansion phase I | $ 2,500,000 | | | $ 2,650,000 |
| | Lift Station improvements | $ 416,000 | | | $ 440,000 |
| | Leprino influent structure rehabilitation and monitoring improvements | BY OTHERS | | | |
| | Collection System Maintenance (Annual Cost) | $ 72,917 | | | $ 75,000 |
| | Collection System Rehabilitation (Annual Cost) | $ 215,015 | | | $ 230,000 |
| | 6,750 feet of 12" WM on 60th Ave from Comfort St to Lincoln St | | $ 1,100,000 | | $ 1,165,000 |
| | Upgrade 2 centrifugal pump at GVSU metering station | | $ 70,000 | | $ 75,000 |
| | | $ 3,203,932 | $ 1,170,000 | $ 4,373,932 | $ 4,635,000 |
| 2021 | Pierce St trunk line lift station construction (phase 1: 56th LS to 64th) | $ 3,200,000 | | | $ 3,495,000 |
| | Collection System Maintenance (Annual Cost) | $ 72,917 | | | $ 80,000 |
| | Collection System Rehabilitation (Annual Cost) | $ 215,015 | | | $ 235,000 |
| | | $ 3,487,932 | | | $ 3,810,000 |
| 2022 | WWTP expansion phase II | $ 25,000,000 | | | $ 28,140,000 |
| | Collection System Maintenance (Annual Cost) | $ 72,917 | | | $ 80,000 |
| | Collection System Rehabilitation (Annual Cost) | $ 215,015 | | | $ 240,000 |
| | Henry St WM improvements from 64th Ave to west | | $ 240,000 | | $ 270,000 |
| | 5,280 feet of 12" WM west on Lincoln from 60th Ave to 68th connnection | | $ 740,000 | | $ 835,000 |
| | | $ 25,287,932 | $ 980,000 | $ 26,267,932 | $ 29,565,000 |
| 2023 | Lift Station Equipment Replacement (Annual Cost) | $ 81,240 | | | $ 95,000 |
| | Pierce St trunk line lift station construction (phase 2: 64th to 78th) | $ 3,300,000 | | | $ 3,825,000 |
| | Collection System Maintenance (Annual Cost) | $ 72,917 | | | $ 85,000 |
| | Collection System Rehabilitation (Annual Cost) | $ 215,015 | | | $ 250,000 |
| | | $ 3,669,172 | $ - | $ 3,669,172 | $ 4,255,000 |
| 2024 | WWTP Equipment Replacement (Annual Cost) | $ 66,250 | | | $ 80,000 |
| | Collection System Maintenance (Annual Cost) | $ 72,917 | | | $ 85,000 |
| | Collection System Rehabilitation (Annual Cost) | $ 215,015 | | | $ 255,000 |
| | 2,650 feet of 12" WM on 68th Ave from Lincoln St to Warner St | | $ 430,000 | | $ 515,000 |
| | | $ 354,182 | $ 430,000 | $ 784,182 | $ 935,000 |
| 2025 | WWTP expansion phase III | $ 3,300,000 | | | $ 4,060,000 |
| | Collection System Maintenance (Annual Cost) | $ 72,917 | | | $ 90,000 |
| | Collection System Rehabilitation (Annual Cost) | $ 215,015 | | | $ 265,000 |
| | 9,255 feet of 16" WM from 68th Ave to west of 52nd Ave along Pierce St | | $ 1,388,000 | | $ 1,705,000 |
| | | $ 3,587,932 | $ 1,388,000 | $ 4,975,932 | $ 6,120,000 |

SHEET TOTALS

| | | | |
|---|---|---|---|
| $ 39,963,014 | $ 4,165,000 | $ 44,128,014 | $ 49,905,000 |

Revised: 5/18/2020

| Sanitary Sewer CIP | Water System CIP | Total Water & Sewer | Inflated Costs (3% per year) |
|---|---|---|---|
| $ 53,612,000 | $ 5,287,000 | $ 58,899,000 | $ 70,480,000 |

| Year | Project Identification | Sanitary Sewer CIP | Water System CIP | Total Water & Sewer | Inflated Costs (3% per year) |
|---|---|---|---|---|---|
| 2026 | GVSU Lift Station improvements | $ 500,000 | | | $ 635,000 |
| | LMD sewer Trunkline | $ 6,000,000 | | | $ 7,600,000 |
| | Collection System Maintenance (Annual Cost) | $ 72,917 | | | $ 90,000 |
| | Collection System Rehabilitation (Annual Cost) | $ 215,015 | | | $ 270,000 |
| | | $ 6,787,932 | $ - | $ 6,787,932 | $ 8,595,000 |
| 2027 | Lift Station Equipment Replacement (Annual Cost) | $ 81,240 | | | $ 105,000 |
| | Collection System Maintenance (Annual Cost) | $ 72,917 | | | $ 95,000 |
| | Collection System Rehabilitation (Annual Cost) | $ 215,015 | | | $ 280,000 |
| | | $ 369,172 | $ - | $ 369,172 | $ 480,000 |
| 2028 | LMD & 52nd Ave. Sewer Upsizing | $ 2,700,000 | | | $ 3,630,000 |
| | Collection System Maintenance (Annual Cost) | $ 72,917 | | | $ 100,000 |
| | Collection System Rehabilitation (Annual Cost) | $ 215,015 | | | $ 290,000 |
| | | $ 2,987,932 | $ - | $ 2,987,932 | $ 4,020,000 |
| 2029 | WWTP Equipment Replacement (Annual Cost) | $ 66,250 | | | $ 90,000 |
| | Collection System Maintenance (Annual Cost) | $ 72,917 | | | $ 100,000 |
| | Collection System Rehabilitation (Annual Cost) | $ 215,015 | | | $ 300,000 |
| | | $ 354,182 | | $ 354,182 | $ 490,000 |
| 2030 | Collection System Rehabilitation (Annual Cost) | $ 215,015 | | | $ 305,000 |
| | | $ 215,015 | | $ 215,015 | $ 305,000 |
| 2031 | Lift Station Equipment Replacement (Annual Cost) | $ 81,240 | | | $ 120,000 |
| | Collection System Rehabilitation (Annual Cost) | $ 215,015 | | | $ 315,000 |
| | | $ 296,255 | $ - | $ 296,255 | $ 435,000 |

| SHEET TOTALS | | | |
|---|---|---|---|
| $ 11,010,488 | $ - | $ 11,010,488 | $ 14,325,000 |

Revised: 5/18/2020

| Sanitary Sewer CIP | Water System CIP | Total Water & Sewer | Inflated Costs (3% per year) |
|---|---|---|---|
| $ 53,612,000 | $ 5,287,000 | $ 58,899,000 | $ 70,480,000 |

| Year | Project Identification | Sanitary Sewer CIP | Water System CIP | Total Water & Sewer | Inflated Costs (3% per year) |
|---|---|---|---|---|---|
| 2032 | WWTP equipment replacement - Primary clarifiers, hydronic system and biogas collection system improvements | $ 530,000 | | | $ 800,000 |
| | Collection System Rehabilitation (Annual Cost) | $ 215,015 | | | $ 325,000 |
| | 2,252 feet of 12" WM on 64th Ave running north from Pierce St to connection | | $ 293,000 | | $ 445,000 |
| | | $ 745,015 | $ 293,000 | $ 1,038,015 | $ 1,570,000 |
| 2033 | Collection System Rehabilitation (Annual Cost) | $ 215,015 | | | $ 335,000 |
| | | $ 215,015 | | $ 215,015 | $ 335,000 |
| 2034 | WWTP Equipment Replacement (Annual Cost) | $ 66,250 | | | $ 105,000 |
| | Collection System Rehabilitation (Annual Cost) | $ 215,015 | | | $ 345,000 |
| | | $ 281,265 | | $ 281,265 | $ 450,000 |
| 2035 | WWTP equipment replacement - Secondary clarifier improvements, pump replacements, water circulator replacement | $ 430,000 | | | $ 710,000 |
| | Collection System Rehabilitation (Annual Cost) | $ 215,015 | | | $ 355,000 |
| | 850 feet of 12" WM on 60th Ave running north from Pierce St to connection | | $ 111,000 | | $ 185,000 |
| | | $ 645,015 | $ 111,000 | $ 756,015 | $ 1,250,000 |
| 2036 | Collection System Rehabilitation (Annual Cost) | $ 215,015 | | | $ 365,000 |
| | | $ 215,015 | | $ 215,015 | $ 365,000 |
| 2037 | Collection System Rehabilitation (Annual Cost) | $ 215,015 | | | $ 375,000 |
| | | $ 215,015 | | $ 215,015 | $ 375,000 |
| 2038 | WWTP roof replacement | $ 41,000 | | | $ 75,000 |
| | Collection System Rehabilitation (Annual Cost) | $ 215,015 | | | $ 390,000 |
| | 3,315 feet of 8" WM on 56th Ave running north from Pierce St to connection | | $ 414,000 | | $ 750,000 |
| | | $ 256,015 | $ 414,000 | $ 670,015 | $ 1,215,000 |
| 2039 | WWTP Equipment Replacement (Annual Cost) | $ 66,250 | | | $ 125,000 |
| | Replace 2,536 ft of 6" WM on Radcliff Dr with 8" from M-45 to 48th Ave | | $ 304,000 | | $ 565,000 |
| | | $ 66,250 | $ 304,000 | $ 370,250 | $ 690,000 |
| | SHEET TOTALS | | | | |
| | | $ 2,638,605 | $ 1,122,000 | $ 3,760,605 | $ 6,250,000 |

# APPENDIX M

Formal Public Hearing Notice

# NOTICE OF PROJECT PLAN PUBLIC HEARING
*(Model)*

The Allendale Charter Township Board of Trustees will hold a public hearing on the proposed Allendale Wastewater Treatment and Collection System Improvement project for the purpose of receiving comments from interested persons.

The hearing will be held at 7:00 p.m. on _____ at the following location: Allendale Charter Township, 6676 Lake Michigan Dr. Allendale, MI 49401.

The purpose of the proposed project is to expand the current Wastewater Treatment Plant (WWTP) in Allendale Charter Township to allow for the treatment of more wastewater and improve conveyance to the facility. This project will allow for an increase in capacity to the WWTP which creates opportunities for more residents and businesses to develop within the Township service area and protects the environment by relocating the trunk sewer lines to a more accessible location.

Project construction will involve general construction vehicle traffic and construction equipment activities

Impacts of the proposed project include minor dusting and major earth excavations. Proper soil erosion control measures will be implemented to minimize sedimentation runoff and soil erosion.

The estimated cost to users for the proposed project will be $15.10 per Residential Equivalent Unit (REU) per month. Allendale Charter Township Completed a rate study in 2019 that will increase revenue by 17.9% for the next 5 years. Allendale Charter Township will be working with a financial advisor to ensure we stay on an economically viable path.

Copies of the plan detailing the proposed project are available for inspection at the following location(s): Allendale Charter Township
6676 Lake Michigan Dr
Allendale, MI 49401

Written comments received before the hearing record is closed on _____ will receive responses in the final project plan. Written comments should be sent to:

_____

# APPENDIX N

Formal Public Hearing Agenda

# APPENDIX O

Formal Public Hearing Transcript

# APPENDIX P

Adoption of Project Plan Resolution

# APPENDIX Q

Trunk Sewer Evaluation Report