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Southwater Municipal Utility Authority

# St. Clair County-Algonac WWTP Improvements Preliminary Design Report

Project No. 241369
August 21, 2026

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# St. Clair County-Algonac WWTP Improvements
# Preliminary Design Report

**Prepared For:**
**Southwater Municipal Utility Authority**
**St. Clair County, Michigan**

**August 21, 2026**
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## List of Abbreviations/Acronyms

| | |
|---|---|
| ASME | American Society of Mechanical Engineers |
| $CBOD_5$ | 5-day carbonaceous biochemical oxygen demand |
| DP | distribution panel |
| EGLE | Michigan Department of Environment, Great Lakes, and Energy |
| ESA | Environmental Site Assessment |
| gpd | gallons per day |
| gpm | gallons per minute |
| lbs | pounds |
| lbs/d | pounds per day |
| MBTU/hr | thousand British thermal units per hour |
| MCC | motor control center |
| MGD | million gallons per day |
| mg/L | milligrams per liter |
| NFPA | National Fire Protection Association |
| $NH_3$-N | ammonia |
| NPEDS | National Pollutant Discharge Elimination System |
| P&ID | process and instrumentation diagram |
| SMUA | Southwater Municipal Utility Authority |
| TP | total phosphorus |
| TSS | total suspended solids |
| µg/kg | micrograms per kilogram |
| WWTP | Wastewater Treatment Plant |

# 1.0 Introduction

## 1.1 Overview

The Southwater Municipal Utility Authority (SMUA) serves the City of Algonac, Clay Township, and Ira Township, and owns and operates the St. Clair County-Algonac Wastewater Treatment Plant (WWTP). Based on Fishbeck's 2026 condition assessment report, SMUA is planning a significant improvements project for the WWTP, including:

1. Addition of a new wet weather retention system.
2. Replacement of two customer flow meters, the raw sewage flow meter, and the effluent flow meter.
3. Replacement of the four primary clarifier tank internal mechanisms and the system controls.
4. Replacement of the two secondary clarifier tank internal mechanisms, drive units, sludge flow meter, and system controls.
5. Replacement of three ferric chloride transfer pumps and tank level instruments.
6. Replacement of the polymer activation and feed system.
7. Replacement of select digester gas handling equipment, one of the digester boiler and heat exchanger units, two digester tank mixing systems, one digester transfer pump, and system controls.
8. Replacement of the power distribution system's main transformer and the main motor control center.
9. Replacement of various process control panels.

An overall site map identifying locations of the proposed improvements is provided in Appendix 1 (see Sheet C201).

SMUA is budgeting $16,000,000 for completion of the improvements. SMUA is soliciting a federal Community Project Funding grant, requesting $2,850,000 for the proposed retention system, including a diversion chamber, pump station, two retention tanks, return valve vault, and controls. This federal funding is awaiting approval and may be approved for an amount less than requested. The customer communities plan to self-fund the remaining amount.

## 1.2 Purpose

The purpose of this Preliminary Design Report is to establish the design criteria for the project improvements. This effort includes developing a conceptual layout for the proposed retention system, process and instrumentation diagrams (P&IDs) for the various unit processes, an electrical one-line diagram, and replacement equipment options for some of the existing equipment.

# 2.0 Background

## 2.1 Sanitary Sources

The WWTP provides treatment for approximately 12,300 people in the City of Algonac, Clay Township, and Ira Township. The WWTP has a permitted design flow of 2.7 million gallons per day (MGD). This hydraulic capacity is contractually allocated by SMUA to the contributing municipalities. The City of Algonac is allocated 30% (0.81 MGD) and has an observed average flow of approximately 0.81 MGD. Clay Township is allocated 35% (0.945 MGD) and has an observed average flow of approximately 0.55 MGD. Ira Township is allocated 35% (0.945 MGD) and has an observed average flow of approximately 0.45 MGD.

The facility currently receives trucked waste from a restaurant on Harsens Island. The restaurant has recently received a permit to install a septic system, so trucking waste to the WWTP will no longer be necessary once the septic system is installed.

## 2.2 Collection System

SMUA owns and operates the three largest pump stations that collectively serve two or more of the customer communities. Aside from these three stations, each community owns and maintains its respective collection system, including its individual pump stations. Clay and Ira Townships have a shared interceptor and are completing sewer lining projects to help reduce the increased flow response during wet weather events. Algonac is pursuing funding for similar projects.

## 2.3 WWTP Overview

An overall layout of the existing site is included in Appendix 1 (see Sheet C101).

### *2.3.1 Process Flow*

The WWTP includes the following unit processes:

- Liquid Treatment:
  - Influent screening.
  - Raw sewage pumping.
  - Grit removal.
  - Primary clarification.
  - Intermediate pumping to the trickling filters.
  - Trickling filters for secondary treatment.
  - Secondary clarification.
  - Chlorination and de-chlorination.
  - Ferric chloride feed system for phosphorus removal.
  - Polymer feed system for improved primary settleability.
- Biosolids Treatment:
  - Anaerobic digestion.
  - Biosolids storage.

An overall flow schematic is provided in Appendix 2 (see Sheet P102).

The influent sewers from the contributing communities converge at the WWTP in a 30-inch influent pipe that enters the headworks facility. Influent flow first passes through a mechanical bar screen, which discharges screened materials into a washer compactor. There is a manual coarse bar screen in an adjacent channel to provide screening and protect the influent pumps if the mechanical bar screen is out of service.

Screened flow passes into the raw sewage wet well below. Ferric chloride is fed to this influent wet well. There are four raw sewage pumps in the adjacent dry well, which is located in the Main Control Building. The WWTP influent flow meter is located on the discharge header of the raw sewage pumps.

The raw sewage pumps discharge to the aerated grit tank to remove inorganics. The grit tank is outfitted with a bucket mechanism to scoop and lift out grit, where it is passed through a grit classifier.

De-gritted flow enters the primary influent channel where polymer is added for chemically enhanced primary treatment. The flow then moves to one of four rectangular primary clarifiers. The clarifiers have chain and flight mechanisms, and fiberglass covers for odor control. Secondary sludge is also directed to the primary clarifiers for co-settling.

Primary effluent flows by gravity to the two trickling filter pump station wet wells. Four trickling filter pumps feed the two trickling filters. The bolted steel trickling filter tanks are covered with aluminum domes. Flow is pumped up to a center feed mechanism and trickles down through biological growth on crossflow media. Each trickling filter is equipped with two blowers to provide an updraft through the filter media to aerate the treatment process.

Trickling filter effluent splits between two circular secondary clarifiers. Secondary effluent flows by gravity to the chlorination chamber. Effluent samples are collected at the front of the chamber. Then sodium hypochlorite solution is fed to the chamber, which is mixed by submersible jet pumps for disinfection.

Disinfected effluent passes through the final effluent meter chamber, and flows by gravity through a 30-inch effluent pipe to the permitted outfall location at the St. Clair River. Calcium thiosulfate is fed to the outfall pipe for de-chlorination to meet discharge limits.

#### *2.3.2 Solids Flow*

A solids flow schematic is provided in Appendix 2 (see Sheet P103).

Settled sludge from the secondary clarifiers is pumped by the secondary sludge pumps to the primary clarifiers for co-settling. Co-settled sludge is then pumped by the primary sludge pump to one of the two anaerobic digester tanks. The digesters are fitted with floating covers and gas mixing systems. The tanks are heated by two boilers with heat exchangers. Three recirculation pumps circulate digester contents through the heat exchangers and back to the tanks. Digested solids are removed by the digester transfer pump to one of the two biosolids storage tanks, and later hauled for land application as final disposal.

# 3.0 WWTP Flows and Loads

## 3.1 NPDES Permit

The WWTP is regulated by National Pollutant Discharge Elimination System (NPDES) Permit No. M0020389. The WWTP is authorized to discharge from Monitoring Point 001A through Outfall 001, which discharges to the St. Clair River. The permit is based on a design flow of 2.7 MGD. The effluent discharge limits and other permit requirements are outlined in the NPDES permit.

The WWTP is designated by the Michigan Department of Environment, Great Lakes, and Energy (EGLE) as a Class B treatment facility based on its design capacity to serve a population between 10,000 and 50,000 people.

## 3.2 Flow Rates

The WWTP has a permitted design flow of 2.7 MGD based on the current NPDES permit. Record drawings indicate the design peak flow for the plant was previously 6.7 MGD; however, the secondary clarifiers present a bottleneck with a design peak flow of 5.7 MGD based on the current Recommended Standards for Wastewater Facilities known as Ten States Standards, and operators report a hydraulic bottleneck occurs with the effluent piping at approximately 5 to 5.5 MGD.

The WWTP reports effluent flow from the effluent meter chamber to EGLE in its monthly discharge monitoring reports. Influent flow is measured on weekdays at the raw sewage pump discharge header but is not reported.

Table 1 summarizes the daily effluent flow from January 2022 through April 2026.

Table 1 – Effluent Flow Rates – 2022–2026

| Year | Annual Average (MGD) | Maximum Day (MGD) |
|---|---|---|
| 2022 | 1.71 | 3.51 |
| 2023 | 1.89 | 5.90 |
| 2024 | 1.96 | 5.62 |
| 2025 | 1.66 | 4.75 |
| 2022–2026 | 1.81 | 5.90 |

The 4-year maximum flow in Table 1 may reflect the effective capacity or operation of the raw sewage pumps possibly being limited to 4,000 gallons per minute (gpm), or approximately 5.8 MGD.

## 3.3 Influent Conditions

Influent samples are collected using a composite sampler prior to screening and grit removal.

Table 2 summarizes data from monthly operating reports covering January 2022 through April 2026. Ammonia ($NH_3$-N) data was reviewed for January 2024 through April 2026. Treatment loads are calculated in pounds per day (lbs/d) based on daily influent concentrations and corresponding effluent flows.

Table 2 – Influent Data – 2022–2026

| Parameter | Average Day | | 4-Year Maximum | |
|---|---|---|---|---|
| $CBOD_5$ | 157 mg/L | 2,290 lbs/d | 360 mg/L | 6,990 lbs/d |
| TSS | 173 mg/L | 2540 lbs/d | 415 mg/L | 9,990 lbs/d |
| $NH_3$-N* | 19.7 mg/L | 282 lbs/d | 33.6 mg/L | 567 lbs/d |
| TP* | 3.99 mg/L | 55.3 lbs/d | 10.4 mg/L | 198 lbs/d |

*Daily ammonia and weekly phosphorus data was provided starting from 2024.

$CBOD_5$ 5-day carbonaceous biochemical oxygen demand
mg/L milligrams per liter
TP total phosphorus
TSS total suspended solids

In this case, the maximum load appears to correlate with maximum concentrations. This may be a result of extra decanting from the digesters or similar recycle streams being returned to the head of the plant.

Tables 3 and 4 summarize the influent annual average and maximum day concentrations and loads by year, showing the variability from year to year.

Table 3 – Influent Concentrations by Year – 2022–2025

| Parameter | 2022 | 2023 | 2024 | 2025 |
|---|---|---|---|---|
| $CBOD_5$ – Annual Average | 169 mg/L | 148 mg/L | 148 mg/L | 168 mg/L |
| $CBOD_5$ – Maximum Day | 300 mg/L | 360 mg/L | 253 mg/L | 310 mg/L |
| TSS – Annual Average | 183 mg/L | 165 mg/L | 168 mg/L | 181 mg/L |
| TSS – Maximum Day | 415 mg/L | 320 mg/L | 325 mg/L | 343 mg/L |
| $NH_3$-N – Annual Average | N/A | N/A | 17.9 mg/L | 21.9 mg/L |
| $NH_3$-N – Maximum Day | N/A | N/A | 31.2 mg/L | 33.6 mg/L |
| TP – Annual Average | N/A | N/A | 3.8 mg/L | 7.8 mg/L |
| TP – Maximum Day | N/A | N/A | 4.2 mg/L | 10.4 mg/L |

Table 4 – Influent Loads by Year – 2022–2025

| Parameter | 2022 | 2023 | 2024 | 2025 |
|---|---|---|---|---|
| $CBOD_5$ – Annual Average | 2,360 lbs/d | 2,250 lbs/d | 2,290 lbs/d | 2,270 lbs/d |
| $CBOD_5$ – Maximum Day | 4,090 lbs/d | 5,080 lbs/d | 4,900 lbs/d | 6,990 lbs/d |
| TSS – Annual Average | 2,570 lbs/d | 2,520 lbs/d | 2,670 lbs/d | 2,490 lbs/d |
| TSS – Maximum Day | 9,750 lbs/d | 9,360 lbs/d | 7,380 lbs/d | 9,990 lbs/d |
| $NH_3$-N – Annual Average | N/A | N/A | 17.9 lbs/d | 21.9 lbs/d |
| $NH_3$-N – Maximum Day | N/A | N/A | 31.2 lbs/d | 33.6 lbs/d |
| TP – Annual Average | N/A | N/A | 3.8 lbs/d | 7.8 lbs/d |
| TP – Maximum Day | N/A | N/A | 4.2 lbs/d | 10.4 lbs/d |

The peaking factor for the $CBOD_5$ load ranges from 1.7 to over 3, and for TSS load from 2.8 to over 4. This also may be a result of extra decanting from the digesters or similar intermittent recycle stream loading.

## 3.4 Effluent Quality and Treatment Performance

Table 5 summarizes performance data from the same monthly operating reports of January 2022 through April 2026. Effluent samples are collected ahead of the chlorination chamber prior to disinfection at the permit-required frequencies. Percent removal rates are calculated based on the difference between the influent and effluent concentrations on a given day. These removal rates represent the treatment performance of the WWTP.

Table 5 – Effluent Data and Removal Rates – 2022–2026

| Parameter | Average Effluent Concentration | Average Removal Rate |
|---|---|---|
| $CBOD_5$ | 7.3 mg/L | 95% |
| TSS | 11.8 mg/L | 93% |
| $NH_3$-N* | 0.77 mg/L | 96% |
| TP | 0.66 mg/L | 83% |

*Daily ammonia data was provided starting from 2024.

The WWTP consistently achieves the NPDES permit required 85% removal efficiencies for $CBOD_5$ and TSS.

While the NPDES permit does not specify an ammonia limit, effluent water quality indicates the WWTP is able to consistently remove ammonia by maintaining nitrification in the trickling filters throughout the year.

Ferric chloride is added to help precipitate phosphorus to achieve the NPDES permit limit of 1 mg/L on a monthly average basis. The WWTP has consistently met the phosphorus effluent requirements during the years reviewed.

The effluent quality data indicates the WWTP is operating well.

Both ferric chloride and polymer are added upstream of the primary clarifiers for chemically enhanced primary treatment. Table 6 illustrates the effectiveness of this enhanced performance compared to typical removal rates in chemically enhanced and conventional primary treatment.

Table 6 – Primary Treatment Removal Rates – 2022–2026

| Parameter | WWTP's Primary Removal Rate | Typical Chemically Enhanced Primary Removal Rate* | Typical Conventional Primary Removal Rate* |
|---|---|---|---|
| $CBOD_5$ | 56% | 40%–70% | 25%–40% |
| TSS | 43% | 60%–90% | 50%–70% |
| TP | 67% | 70%–90% | 5%–10% |

*Source: Water Environment Federation's *Design of Water Resource Recovery Facilities* (Manual of Practice 8)

$CBOD_5$ and total phosphorus removal rates are within the typical ranges for chemically enhanced primary treatment. The TSS removal rate is relatively low even for conventional primary treatment, but this may be attributed to the higher solids loading rates resulting from co-settling secondary sludge.

## 3.5 Biosolids Handling

### *3.5.1 Digester Loading*

Co-settled primary and secondary solids are pumped by the primary sludge pump to the two digester tanks. There is no digester feed flow meter; the volume of sludge fed to the digesters is estimated from a primary sludge pump volume displacement counter. The co-settled material from the primary clarifiers is typically about 4% total solids.

Table 7 summarizes the annual average day and maximum day flow by year for 2023 through 2025. It is unclear what source may account for the wide fluctuation in daily flow.

Table 7 – Digester Feed Rate – 2023–2025

| Year | Annual Average Day (gpd) | Maximum Day (gpd) |
|---|---|---|
| 2023 | 8,200 | 23,000 |
| 2024 | 7,900 | 19,900 |
| 2025 | 8,700 | 18,000 |
| gpd gallons per day | | |

#### *3.5.2 Digester Treatment Capacity*

Assuming a 70% volatile solids content of the co-settled sludge and a design loading rate of 100 lbs of volatile suspended solids per day per 1,000 cubic feet, the two digesters have a total design loading capacity of 8,840 lbs per day of total solids, or 26,500 gallons per day at an assumed solids concentration of 4%.

# 4.0 Proposed Retention System

## 4.1 Overview

Influent flows can increase significantly during wet weather events, with a peaking factor up to 4 observed between dry weather months and maximum day flow. A wet weather retention system is planned to allow the diversion and storage of peak flow during wet weather. This will continue to allow proper operation of the contributing collection systems and maintain influent flows to the WWTP below adequate treatment capacities.

## 4.2 Basis of Design

To adequately size the proposed retention system, a flow monitoring study is currently ongoing. Temporary flow meters have been installed in 10 locations throughout the collection system, to characterize the distribution of flows in the service area, along with two rain gauges to measure rain events. This will allow for a sewer hydraulic model to be calibrated to both dry and wet weather flows as they actually occur in the collection system. The calibrated model will be used to assess the current capacity of the WWTP and determine the retention tank volume and pumping capacity required for the 4.1-inch 25-year, 24-hour design storm event as defined by EGLE under the sanitary sewer overflow standard. The model will also be used to verify that flows under this design storm condition can be properly conveyed through the collection system to the WWTP without causing backups.

## 4.3 Proposed Location

#### *4.3.1 Property Acquisition*

Given the limited space available on the existing WWTP site, it was recognized early on that additional property would be necessary to build a new wet weather retention system. Throughout 2026, SMUA has been pursuing the purchase of a publicly owned parcel that consists of a portion of the Algonac Department of Public Works property at 453 State Street and is located directly adjacent to the east of the WWTP. Fishbeck provided a boundary survey for the proposed parcel split.

#### *4.3.2 Environmental Assessment*

Fishbeck completed a Phase I Environmental Site Assessment (ESA) in anticipation of the property purchase. Based on the Phase I assessment findings, a Phase II ESA was recommended and completed.

For the Phase II ESA, soil and groundwater samples were collected from the property. One of seven soil samples exceeded the non-residential limits for a particular type of volatile organic compound: the limit for Isopropylbenzene (Cumene) is 210 µg/kg (microgram per kilogram), where the soil sample was 1,200 µg/kg. Cumene is a constituent of crude oil and refined fuels. Two ground water samples were collected and had various amounts of arsenic, chromium, copper, and lead that exceeded the non-residential cleanup criteria limits.

Based on the sample results and exceedances, a Baseline Environmental Assessment has been completed and will be filed with the State of Michigan to document that SMUA is not liable for the contamination conditions prior to purchase. Filing the Baseline Environmental Assessment will not commit SMUA to any required cleanup efforts; it will only serve to protect SMUA from future liability, should any arise.

The level of contamination found is not severe enough to prohibit the intended use of the property. However, a Documentation of Due Care Compliance Report will be completed to outline measures necessary for given use and construction on the property. For example, any soil excavated and removed from this area during construction will need to go to a Type II landfill.

## 4.4 System Concept

### *4.4.1 Site Layout*

A conceptual site layout is provided in Appendix 1 (see Sheet C201). Downstream of the manhole where the Clay-Ira and Algonac interceptors converge, a diversion chamber will be constructed on the 30-inch influent sewer with an overflow weir directing excess flow into a new retention pump station. This pump station will consist of a wet well with submersible pumps to lift flow into the retention tanks. Pumping up into the tanks allows the tanks to be constructed above ground and reduces excavation costs when compared to below grade tanks. Being above ground will allow the tanks to empty by gravity to return flow to the WWTP influent sewer and headworks.

The conceptual layout shows two 50-foot diameter circular tanks, to fit with the 80-foot width of the property being purchased allowing for adequate property setbacks and isolation from a water main along the original property line. The final tank volumes and dimensions will be confirmed based on the ongoing flow monitoring study described in Section 4.2.

The tanks will be bolted steel with aluminum covers. A return valve vault with a manual isolation valve for each tank and a common control valve will allow the tanks to drain by gravity at a controlled rate.

### *4.4.2 Design Considerations*

The existing trickling filter system also has above ground bolted steel tanks. Records indicate these tanks were constructed on pile foundations. It is assumed similar foundations will be required for the retention tanks.

A geotechnical assessment will be completed with soil borings on the proposed property. There are currently large piles of asphalt millings that must be moved off the property to allow the borings to be drilled.

The Documentation of Due Care Compliance Report will include considerations for both design and construction of the below grade structures, including the retention pump station and two valve vaults.

Depending on the tank volume required and the allowable tank diameter on the site, the tanks could be up to 50 to 55 feet high at the dome cover apex. This is comparable in height to the abandoned lime silo portion of the Main Control Building. Based on preliminary discussions with the City of Algonac, there are no initial concerns of height restrictions for the tanks.

Based on the future geotechnical evaluation and recommended tank foundations, constructability considerations will need to be reviewed with various site constraints to confirm the largest feasible tank diameters. This may include setbacks from the property lines and the existing water main and hydrant. Relocation of the water main and hydrant may also need to be considered.

Tank material options, including stainless steel, fusion-bonded, and glass-lined, will be considered based on cost and longevity.

#### *4.4.3 Control Functional Intent*

The diversion chamber will have an overflow weir set to divert excess flow to the pump station. If hydraulic conditions are not suitable for a passive overflow, a control slide gate may be used. Normal operation must maximize forward flow through the plant.

The pump station will have level-based control for pump on/off.

The return control valve will have modulating control to provide a variable return rate to maintain pumped raw sewage flow at approximately 3,500 gpm (5.0 MGD).

A flow schematic and P&ID are provided in Appendix 2 (see Sheet P104).

## 5.0 Treatment Process Improvements

### 5.1 Flow Metering

#### *5.1.1 Clay-Ira Meter*

The Clay-Ira Meter Building consists of a below grade dry meter pit. At this building, the influent 30-inch interceptor from Clay and Ira Townships drops through reduced sized closed pipes and passes through 16-inch and 8-inch flow meters in parallel. These are used to meter flows from Clay and Ira Townships. The 16-inch meter needs to be replaced. The 8-inch meter was replaced recently.

Downstream of the meter piping is a weir prior to transitioning back to a 30-inch gravity sewer. Depending on the arrangement of the weir, the meters could potentially be replaced by an H-flume with a level sensor for calculated flow (similar to the more common Parshall flume).

Replacement options will be investigated further during the final design phase.

Various drain and supernatant piping from different WWTP tanks tie into the 30-inch sewer upstream of the meters. Whenever tank draining or supernatant draw-offs occur, the volume should be noted and subtracted from the customers' metered flow.

#### *5.1.2 Algonac Meter*

The separate 18-inch influent sewer from Algonac passes through a below-grade chamber with a closed pipe 16-inch partial flow meter prior to combining with the 30-inch interceptor at the WWTP. This meter is currently abandoned and has been stripped for parts. A portable flow meter is currently installed in the 18-inch Algonac sewer at the downstream manhole. The 16-inch meter needs to be replaced.

#### *5.1.3 WWTP Influent Flow Meter*

The WWTP influent 16-inch magnetic flow meter is installed on the raw sewage pump discharge header pipe and needs to be replaced.

This flow signal will be used for control of the retention tank return rate and flow pacing of the ferric chloride and polymer dosing.

#### *5.1.4 WWTP Effluent Flow Meter*

The WWTP effluent gravity closed pipe 16-inch partial flow meter is located in the effluent meter chamber downstream from the chlorine contact tank and needs to be replaced. The piping is reduced from the main 24-inch effluent sewer.

## 5.2 Primary Clarification System

### 5.2.1 Existing Conditions

From the grit tank, flow enters the small primary influent channel where polymer is fed. Two primary influent pipes direct flow from the influent channel, one to Primary Clarifiers 1 through 3, and the other pipe to Primary Clarifier 4 which was installed later. Each clarifier has two influent isolation gate valves, located in the basement pipe gallery of the Main Control Building.

The tanks are rectangular cast-in-place concrete structures with chain and flight internal mechanisms. Each is 14 feet wide and 60 feet long, with an 8.2-foot side wall depth. Each tank has two fiberglass covers for odor control.

Secondary sludge from the secondary clarifiers is also directed to the primary influent channel for co-settling in the primary clarifiers. Co-settled sludge collects in the sludge hopper where it is drawn off by the primary sludge pump via a 6-inch pneumatically actuated plug valve at each tank. The pump and sludge valves are located in the basement pipe gallery of the Main Control Building.

### 5.2.2 Proposed Improvements

The four primary clarifier tank chain and flight mechanisms will be replaced, including the gears, sprockets, and shafts. The mechanism drives were recently replaced and will be reused. The upper and lower guide rails for the internal mechanisms are in good condition and will be reused if possible. The influent baffles are concrete and assumed to be in good condition. The galvanized effluent weirs and 10-inch galvanized scum troughs will be replaced with non-corrosive material in each tank. The fiberglass tank covers are expected to be reused. The influent gate valves and pneumatically actuated sludge valves will be reused.

The cast-in-place concrete tanks require some minimal repairs. Fishbeck engineers conducted a structural inspection of Primary Clarifier 1 (assumed to be representative of Primary Clarifiers 2 and 3, being the same age) and Primary Clarifier 4 to determine the extent of recommended concrete repairs. The inspection was mostly visual. Areas of concern were identified during the visual inspection and, where accessible, were sounded with a hammer or similar device to determine if any delamination is present below the surface. Similar repair quantities will be assumed for Primary Clarifiers 2 and 3, and their conditions will be confirmed during construction.

Primary system controls will be replaced. The new control panel will incorporate control signals, feedback and alarms related to the tank drives, pneumatic sludge valves, and the primary sludge pump, all of which are existing and will be reused.

A flow schematic and P&ID are provided in Appendix 2 (see Sheet P105).

### 5.2.3 Design Considerations

If the ferric chloride will continue to be fed to the raw sewage wet well, the primary clarifier component materials should be replaced with non-corrosive metals or plastics where possible. This includes changing the effluent weirs and scum trough from galvanized steel to stainless steel or fiberglass.

### 5.2.4 Basis of Design

Based on Ten States Standards (Recommended Standards for Wastewater Facilities) design guidelines for co-settling of secondary sludge, the rated treatment capacity of the two primary clarifiers would be a total design average flow of 2.4 MGD and a design peak hourly flow of 4.0 MGD. This would be considered undersized for the hydraulic design flows of the WWTP but is compensated for with polymer addition to provide chemically enhanced primary treatment. This is reflected in the current removal rates achieved by the WWTP primary treatment, which are significantly higher than typical rates achieved by primary clarification alone, as shown previously in Table 6.

## 5.3 Secondary Clarification System

### *5.3.1 Existing Conditions*

Trickling filter effluent flows by gravity to the secondary splitter box to one of the two secondary clarifiers with influent isolation slide gates. The box includes a slide gate and piping for a future third tank.

The clarifiers are 55-foot diameter circular tanks that have a 15-foot side wall depth and inboard launder troughs that are offset from the outer wall. The launder troughs are galvanized steel with double v-notch fiberglass weirs. The clarifier internal mechanisms include a plow-type sludge arm and single scum skimmer arm.

Settled sludge is pumped from the secondary clarifiers by the two secondary sludge pumps. Each pump is dedicated to one tank but can pump from either with valve adjustments if the other pump is out of service.

The secondary sludge pump discharge flows through a 4-inch magnetic meter and then through a 6-inch force main. The sludge pumps are controlled by a relay and timer-based control panel.

All sludge is wasted; it is typically directed to the primary clarifiers for co-settling. Existing valving allows for secondary sludge to be pumped directly to the anaerobic digesters, but this is not ideal given the typically thin secondary sludge being only 0.5% solids.

### *5.3.2 Proposed Improvements*

Both secondary clarifier internal mechanisms will be replaced, including the associated drives. The inboard launder troughs and associated double v-notch effluent weirs will be replaced. WWTP staff report the trough supports may be in good enough condition to be reused.

The cast-in-place concrete tanks require some minimal repairs. Fishbeck structural engineers conducted a structural inspection of Secondary Clarifier 2. The inspection was mostly visual. Areas of concern are identified during the visual inspection and, where accessible, were sounded with a hammer or similar device to determine if any delamination is present below the surface. Similar repair quantities will be assumed for Secondary Clarifier 1, and its condition will be confirmed during construction.

While the tank is empty, the center support column and steel access bridge will be visually inspected for section loss. It is expected the column and bridge will be reused and repainted. Launder trough supports can be visually inspected at this time as well.

For the secondary sludge system, the 4-inch magnetic flow meter will be replaced along with the sludge pump controls.

A flow schematic and P&ID are provided in Appendix 2 (see Sheet P106).

### *5.3.3 Design Considerations*

If the ferric chloride feed location will be changed to the secondary clarifier splitter box, non-corrosive materials, such as painted steel or stainless steel, must be selected for the secondary clarifier internals. Material selection will be determined during final design.

Electrical conduits extend along the bridge and will need to be replaced or reconnected when the bridge is reinstalled.

The secondary sludge flow meter should be sized for both pumps running simultaneously.

#### 5.3.4 Basis of Design

Based on Ten States Standards design guidelines for facilities with trickling filters upstream, the rated capacity of the secondary clarifiers is a design peak hourly flow of 5.7 MGD. This is lower than the peak design flow of the rest of the plant, indicating a need for a third tank. However, the east-west biosolids storage tanks are installed in the location originally intended for a third clarifier, and now there is not readily available space for a third tank outside the 100-year floodplain.

The existing secondary sludge pumps have a design capacity of 150 gpm.

#### 5.3.5 Control Functional Intent

The pumps currently are not alternated, they are run together for a set amount of time. New controls will allow the pump run times to be programmed for a set number of times per day and length of run time.

### 5.4 Ferric Chloride System

#### 5.4.1 Existing Conditions

Ferric chloride solution is currently fed to the raw sewage wet well to chemically precipitate phosphorus and assist in the chemically enhanced primary treatment. Record drawings and site observations indicate there may be an alternative feed location at the primary effluent chamber. WWTP staff have recently extended feed piping to the secondary splitter box as another alternative feed location but have not changed operations at this time.

The WWTP currently feeds 38% ferric chloride solution. There are two 9,000-gallon fiberglass bulk storage tanks located in the Chemical Building. There are three pneumatic single-diaphragm transfer pumps; only two are currently working. The transfer pumps are used to fill one of the two day tanks located in the Main Control Building chemical room. Each day tank has two feed pumps.

Only one day tank and its associated feed pumps are currently used. WWTP staff plan to consolidate the feed system independently, to eliminate one day tank and its two feed pumps.

#### 5.4.2 Proposed Improvements

The three ferric transfer pumps will be replaced with double-diaphragm style pumps. The bulk storage tanks' level instruments will be replaced with radar sensors.

A flow schematic and P&ID are provided in Appendix 2 (see Sheet P109).

#### 5.4.3 Design Considerations

Ferric chloride is corrosive to most metals, including galvanized steel. If ferric chloride will continue to be fed to the raw sewage wet well, equipment materials, including any up to the primary clarifiers, should be replaced with non-corrosive metals or plastics where possible.

Changing the feed location to the secondary treatment may affect the efficacy of the primary treatment as it is currently enhanced chemically by the upstream dosing of ferric chloride and polymer. However, moving from the raw sewage wet well to the primary clarifiers may protect the raw sewage pumps and grit system from corrosion.

#### 5.4.4 Basis of Design

The existing transfer pump capacity has not been confirmed. WWTP staff report that approximately 60 gpd is fed and thus transferred on average, and can range up to 90 gpd. (The dosing rate was recently decreased from 240 gpd.) Based on the WWTP's current phosphorus removal rates and a 38% ferric chloride solution, this range of 60 to 90 gpd equates an iron to phosphorus molar ratio of 1.3 to 2.0, which is relatively close to the ideal 1:1 ratio for dosing near the primary clarification process.

The operators are accustomed to the transfer pump operation taking about 10 minutes and no more than 15 minutes daily. For the typical range of transfer volumes, this equates to a 10 to 15 gpm pump capacity.

## 5.5 Polymer System

### *5.5.1 Existing Conditions*

Dry polymer is activated with water in small batches throughout the day in a make-down system. Each batch of polymer is transferred using one of two pumps to a 500-gallon feed tank equipped with a mechanical mixer. Polymer is then fed from the feed tank by one of two peristaltic feed pumps to the primary influent channel.

WWTP staff report a typical usage rate of approximately 4 lbs/day of dry polymer. The system is set to make a new batch of polymer solution every 40 to 45 minutes, with about 35 batches per day. Each batch is made with 51.2 grams of polymer and 45 gallons of water, for a concentration of 300 parts per million. There is currently no flow-based adjustment of the feed rate.

### *5.5.2 Proposed Improvements*

The make-down equipment and transfer pumps will be replaced with a skid system. Instead of transfer pumps, the skid will include dosing pumps to feed the polymer solution directly to the primary influent channel.

The 500-gallon feed tank and existing dosing pumps will be kept for backup service.

A flow schematic and P&ID are provided in Appendix 2 (see Sheet P109).

### *5.5.3 Design Considerations*

Based on the enhanced removal rates achieved in the primary clarifiers, the current feed rate on a dry basis appears to be an appropriate starting point for system capacity.

Making a more concentrated polymer solution with less water per batch would allow for greater efficiency

Controls will be included to allow for flow-paced dosing.

# 6.0 Digester System Improvements

## 6.1 System Overview

There are two digester tanks to treat the co-settled sludge and reduce volatile solids and overall volume prior to land application. The digester tanks are currently operated in series as one primary digester (being heated and mixed) and one secondary digester (with decanting and solids draw-off). Both tanks are equipped for heating and mixing, and can be alternated as the primary digester. Biogas is produced through the biological anaerobic digestion process. The biogas consists primarily of methane and is a beneficial fuel source that is collected and burned in the boilers used to heat the digesters and the digester building.

Each digester is a 45-foot diameter, above ground, cast-in-place concrete tank. The tanks are insulated on the side and fitted with a floating cover. Located on each floating cover is a gas mixing system housed in a small enclosure.

The Digester Building is also cast-in-place concrete at grade, constructed with shared walls between the two tanks. The lower level houses the pump room with the digester transfer pump and three recirculation pumps. The upper level is the boiler room, with two boilers and heat exchangers to heat the digester contents.

## 6.2 Digester Mixing

### *6.2.1 Existing Conditions*

Each digester tank has a floating cover with a recirculated compressed gas mixing system. The gas mixing system is a relatively simple technology that draws off the biogas from under the cover and compresses it to discharge the gas at six discharge wells around the bottom of each tank, providing coarse bubbles to mix the tank contents. A gas compressor and six gas valves are located in a compressor house atop each floating cover, with controls and motor starters mounted on the side of the housing. The compressor and two of the six valves for Digester 1 were replaced in 2011. The compressor for Digester 2 and all the remaining valves are original to 1978, along with the controls for both digesters.

### *6.2.2 Equipment Options for Proposed Improvements*

#### 6.2.2.1 Recirculated Compressed Gas Mixing

Recirculated compressed gas mixing technology is no longer commonly used. Only one supplier has been confirmed to still provide the equipment, and the equipment price may be cost-prohibitive.

The flow schematic and P&ID in Appendix 2 (Sheet P108) reflects replacement of the system in kind.

#### 6.2.2.2 Liquid Mixing

More common mixing technology now uses liquid mixing of the digester contents. Typical options include draft tube technology and pumped jet-mixing technology.

Draft tube mixing uses a mechanical mixer, either in a center tube or external tube arrangement. In this case, a center tube is not recommended with the existing floating covers. An external tube arrangement may be feasible but would require large piping penetrations through the tank wall to the flow tube.

Jet mixing uses large-volume mixing pumps to circulate the liquid contents to mix the tank via jet nozzles. While the equipment may be the most cost-effective, there would be retrofitting costs. This arrangement requires large piping penetrations through the tank wall. New jet mixing pumps would likely need to be located outside with heated enclosures as there is not room in the Digester Building for additional pumps and piping.

Though jet mixing may entail more complex retrofitting to the tank, it may be less cost-prohibitive than the gas mixing or draft tube system.

### *6.2.3 Design Considerations*

Costs for the various mixing options will be compared for selection during the final design phase.

Any enclosure with gas mixing equipment, i.e., with piped conveyance and compression of digester biogas, is classified as a Class I, Division 1, Group D, hazardous location. Likewise, any mixing motors, disconnects, and control panel located within the digester tank envelope would need to be properly rated for the classified area.

It may be preferrable to replace select older equipment pieces at this time and then replace the mixing systems later with the digester covers. A new gas mixing system may impose limitations or complicate replacement of the floating cover later. Likewise, keeping the existing cover may limit technology options without significant retrofitting to the cover.

## 6.3 Gas Handling System

### *6.3.1 Existing Conditions*

When not being recirculated through the gas mixing system, digester biogas is collected from under each cover and conditioned through the gas handling system for use in the digester heating system. Excess biogas is flared at the waste gas burners. The system consists of two trains, each capable of serving either digester.

Each gas handling train consists of a sediment trap, low pressure check valve, and positive displacement rotary gas meter. The combined gas from both digesters then passes through a common flame-trap assembly ahead of the boilers and waste gas burners.

Many components of the gas handling system are original from 1978 and beyond their expected useful life. The waste gas burners were replaced in 2012 and 2020.

### *6.3.2 Proposed Improvements*

The two sediment traps, one flame-trap assembly, and drip traps throughout will be replaced, along with the small diameter piping that is showing signs of corrosion and deterioration.

A flow schematic and P&ID are provided in Appendix 2 (see Sheet P108).

### *6.3.3 Design Considerations*

Due to the digester gas piping in the lower level pump room, the space is classified as a Class I, Division 1, Group D, hazardous location.

If the gas flow meters are a positive displacement type, they should be replaced with a different type that complies with Ten States Standards.

## 6.4 Digester Heating

### *6.4.1 Existing Conditions*

The digester heating system includes two boilers, one per tank. Boiler 1 is original and has an integral heat exchanger; Boiler 2 was replaced in 2016 and has a separate external heat exchanger. There are also three recirculation pumps used to draw off digestate, pump it through the heat exchangers, and return it to the digesters.

The boilers are a dual fuel type that can run off either digester biogas or natural gas. The boiler exhaust stacks are located on the building roof. Boiler 1 is older and has an integral heat exchanger; Boiler 2 was recently replaced with an exterior heat exchanger that is mounted on the wall. The boilers heat water that circulates through the heat exchangers to transfer heat to the digester sludge. The recirculation pumps draw sludge from the digesters and through the heat exchangers for warming. The sludge then returns to the digesters as a form of partial mixing.

The three recirculation pumps are controlled by two separate boiler control panels: Pumps 1 and 3 are controlled by the control panel associated with Boiler 1.

The digester tanks are insulated to prevent heat loss.

### *6.4.2 Proposed Improvements*

Boiler 1 will be replaced, either in kind with an integral heat exchanger or with an external heat exchanger. A new control panel will be provided for the boiler and the existing recirculation pumps.

A flow schematic and P&ID are provided in Appendix 2 (see Sheet P107).

### *6.4.3 Design Considerations*

It is recommended that Boiler 1 be replaced to match its companion unit, which was replaced in 2016 with a stand-alone boiler and a separate heat exchanger. Besides having a consistent equipment arrangement for the operators, an external heat exchanger would allow for easier cleaning of fouling and greater flexibility to use either heat exchanger with either boiler. Units with integral heat exchangers are not common and such equipment may require sole-sourcing. However, space limitations and budget may necessitate an integral unit. Exact dimensions and layout options will be considered during final design.

Sludge pipe penetrations pass through the floor between the recirculation pumps, tanks, and the heat exchanger piping. This poses a limitation on placement and layout of the equipment. Existing Heat Exchanger 2 may need to be temporarily or permanently relocated to get new equipment in.

The existing boiler flue stacks are relatively short, extending approximately 5 to 6 feet above the roof. While they may meet basic clearance requirements, the low height limits dispersion, thereby increasing the potential for flue gas recirculation. Evaluation is recommended, with potential extension of the stacks.

Based on the estimated boiler capacity, the new boiler needs to comply with American Society of Mechanical Engineers (ASME) Controls and Safety Devices for Automatically Fired Boilers (Standard Number CSD-1), including requirements for flame safeguard controls, low-water cutoff protection, and automatic shutdown and safety interlocks.

Combustion air openings will be verified in accordance with applicable codes. Evaluation will confirm adequacy of room volume and combustion air openings or the need for dedicated outside combustion air.

### *6.4.4 Basis of Design*

The existing Boiler 1 has an input capacity of 750 million British thermal units per hour (MBTU/hr). The Digester System O&M Manual indicates this accounted for 375 MBTU/hr output heating capacity for the digester heat, plus additional for building heat.

Boiler 2 has a higher input capacity of 837 MBTU/hr and an output capacity of 670 MBTU/hr. While this is larger than Boiler 1, it is possible that Boiler 2 was upsized when replaced in 2016, based on standard boiler sizes available, to more than adequately cover the peak heating demand.

Current design standards require digester heating to account for a 1.3 factor of safety in case of fouling in the heat exchangers. The resulting calculated output heating demand is approximately 400 MBTU/hr of sludge heating capacity.

## 6.5 Transferring Solids

### *6.5.1 Existing Conditions*

There is one primary sludge pump used to feed co-settled sludge to the digester tanks. Pumping is currently controlled on a timed basis, not flow basis. There is a passive overflow pipe on each digester, but there is no instrumentation for monitoring overflow.

There is one piston-style plunger pump used to transfer digested biosolids from either digester. The suction and discharge piping for the pump is concealed under the building floor, including the bypass piping around the pump. The pump can discharge to either of the buried biosolids storage tanks.

A position indicator connected to each floating cover provides level indication of each digester. Digester levels are manually monitored when transferring digested sludge to determine the volume of sludge transferred.

#### *6.5.2 Proposed Improvements*

The digester transfer pump and control panel will be replaced.

A flow schematic and P&ID are provided in Appendix 2 (see Sheet P107).

#### *6.5.3 Design Considerations*

A double-disc diaphragm style pump may be more desirable from a cost and maintenance perspective. Pump dimensions and piping layout will need to be considered during the final design phase.

### 6.6 Digester Building

#### *6.6.1 Existing Conditions*

Per National Fire Protection Association (NFPA) 820, the Digester Building's lower-level pump room is classified as a Class I, Division 1, Group D, hazardous location.

#### *6.6.2 Proposed Improvements*

A gas detection system will be added to the pump room with one sensor for the lower explosive limit (that includes methane) and one sensor for hydrogen sulfide gas. RKI Instrument sensors will be considered, to match existing wet well sensors for plant consistency.

#### *6.6.3 Design Considerations*

Although the upper-level boiler room is considered unclassified, it is located within the Digester Building, which shares common walls with anaerobic digesters.

Per NFPA 820, evaluation should include:

- The potential for digester biogas migration into the space, e.g., at pipe penetrations and cracks.
- The adequacy of ventilation.
- Consideration of combustible gas detection.

These items address whether digester biogas can enter the space, whether it can accumulate, and whether it can be detected before reaching unsafe levels.

## 7.0 Electrical, Instrumentation, and Control Systems

### 7.1 Power Distribution

#### *7.1.1 Overview*

The WWTP receives a 13,200-volt, 3-phase, 3-wire underground electrical service from the local utility company, DTE. Power is delivered to outdoor metering equipment that supplies a SMUA-owned 1,000-kilovolt-amp pad-mounted transformer. The transformer steps down the primary power to 480Y/277-volt, 3-phase, 4-wire utilization voltage.

Secondary power is routed underground to a main switchboard. The main switchboard has an integral automatic transfer switch to the 300 kilowatt diesel standby generator. The switchboard and generator are located in the Generator Building.

From the main switchboard, power is distributed to two motor control centers, MCC BD and MCC C1. MCC BD is in the storage garage and MCC C1 is in the Main Control Building.

From MCC BD, power is distributed to MCC FC and Distribution Panel (DP) 4. MCC FC is in the Secondary Sludge Pump House, and DP 4 is in the Digester Building.

From MCC C1, power is distributed to MCC F1, MCC F2, and DP 1, located in the Main Control Building. From DP 1, power is distributed to DP 2 and DP 3. DP 2 is in the Main Control Building, and DP 3 is in the Chemical Building.

One-line diagrams for the WWTP are provided in Appendix 3.

### *7.1.2 Existing Conditions*

The pad-mounted transformer and all the MCCs and DPs are from the original WWTP construction (in 1968) or the 1976 expansion. The switchboard and generator were installed in 2023.

### *7.1.3 Proposed Improvements*

The pad-mounted transformer and main MCC C1 will be replaced. Connectors between the transformer and main switchboard, and between the main switchboard and MCC C1, will be replaced.

One-line diagrams showing the proposed electrical equipment are provided in Appendix 3 (see Sheets E401 and E402). The connected loads reflect existing equipment at this time and will be updated during the final design phase to reflect proposed equipment replacements.

### *7.1.4 Design Considerations*

Sizing for the pad-mounted transformer, MCC C1, and conductors will be confirmed during the final design phase, based on proposed loads to be connected.

MCC C1 includes a 100-amp breaker and 200-amp breaker to feed MCC F1 and MCC F2, respectively. A majority of the loads fed by MCC F1 and MCC F2 are no longer in use. What loads are remaining may be consolidated to one of these two MCCs, or possibly refed directly from the new MCC C1, to free up some of this 300-amp capacity on MCC C1.

## 7.2 Controls System

### *7.2.1 Existing Conditions*

Control of the wastewater process equipment is generally accomplished with distributed local control panels for each unit process. These control panels vary in age and were generally installed with the corresponding unit process they control. Most control panels use relays, timers, pushbuttons, and pilot lights with only local control at the panel. A couple control panels have programmable logic controllers that are obsolete and no longer supported. Some panels have been replaced either when pump variable frequency drives were replaced or as the panels became inoperable or obsolete.

A new RACO brand monitoring system was installed in 2020 to improve the system’s reliability. The RACO system provides remote alarms for critical fault conditions.

### *7.2.2 Proposed Improvements*

Local control panels with programmable logic controllers will be provided by a systems integrator to support the following equipment or processes:

- Main Control Panel (Main-CP): For retention system, raw sewage pumps, influent flow meter, and primary clarifiers and pump.
- Grit Control Panel (Grit-CP): For grit system, including bucket system, classifier, and blowers.

- Secondary Sludge Control Panel (SS-CP): For secondary sludge pumps, secondary sludge flow meter, and effluent flow meter.
- Digester Control Panel (Digester-CP): For digester tank instruments, digester transfer pump, building alarms, and sludge heating equipment including recirculation pumps.

Local control panels will be provided by corresponding equipment suppliers for the following equipment systems:

- Digester Mixing Equipment.
- Polymer System.

# 8.0 Discipline-Specific Design Criteria

## 8.1 Process

The process design shall conform to the applicable design recommendations and standards, including:

- Recommended Standards for Wastewater Facilities, 2026 edition; commonly known as Ten States Standards.
- NFPA 820 – Standard for Fire Protection in Wastewater Treatment and Collection Facilities, 2024 edition.

## 8.2 Electrical

### *8.2.1 Codes*

The electrical design shall conform to the applicable electrical codes, which include:

- NFPA 70 – National Electric Code, 2023 edition.
- NFPA 70E – National Electrical Safety Code, 2023 edition.
- NFPA 820 – Standard for Fire Protection in Wastewater Treatment and Collection Facilities, 2024 edition.
- Michigan Electrical Code.
- Locally adopted codes and amendments.

Where applicable, electrical equipment will be UL listed and approved.

### *8.2.2 Hazardous Locations*

In general, electrical equipment installed in hazardous locations will be approved for use in the respective location. Conduit seal off fittings will be installed in all conduit runs that enter/leave hazardous locations. Instruments and control devices installed in hazardous locations will utilize intrinsically safe circuitry.

If the Main Control Building were constructed today, the current version of NFPA 820 would require the electrical room be rated as a classified (hazardous) location as it has a direct connection through the stairwell to the raw sewage dry well. Since the space was constructed prior to 1990, when the first edition of NFPA 820 was published, NFPA 820 has an exception that permits the space to remain unclassified. Following the exception permitted by NFPA 820, and with a track record of safe operation of the equipment within the electrical room, equipment will be replaced in kind. Installations will not be rated for a classified (hazardous) location, and the space will not be brought up to current NFPA 820 standards, which would require extensive electrical, heating and ventilation, and potentially architectural changes.

## 8.3 Mechanical and Plumbing

Replacement of the existing dual fuel (natural gas and biogas) boiler in the Digester Building will comply with the following codes:

- Michigan Mechanical Code – 2021 (based on the 2021 International Mechanical Code).
- Michigan Fuel Gas Code – 2015 (based on the 2015 International Fuel Gas Code).

- ASME Boiler and Pressure Vessel Code, Section IV – 2019 (latest adopted edition).
- ASME CSD-1 – 2018 (Controls and Safety Devices for Automatically Fired Boilers).
- NFPA 70 – National Electric Code, 2023 edition.
- NFPA 820, as adopted and enforced by the Authority Having Jurisdiction (i.e., Fire Protection in Wastewater Treatment and Collection Facilities).

### 8.4 Structural

The structural design shall conform to applicable structural and building codes, which include:

- American Concrete Institute 350 – Code Requirements for Environmental Engineering Concrete Structures, 2020 edition.
- American Concrete Institute 318 – Building Code Requirements for Structural Concrete, 2019 edition.
- Michigan Building Code, 2021 edition.
- American Institute of Steel Construction 360 – Specification for Structural Steel Buildings, 2016 edition.

## 9.0 Opinion of Probable Cost

The opinion of probable project cost was updated from the 2026 condition assessment report, based on revised project scope and considerations discussed in this report. The improvements included in the proposed project and the associated costs are included in Table 8. Budgets reflect costs for starting construction in 2027. These costs currently include a 30% design contingency. The retention system and digester system costs currently account for higher cost equipment options; lower cost options will be explored during the final design phase.

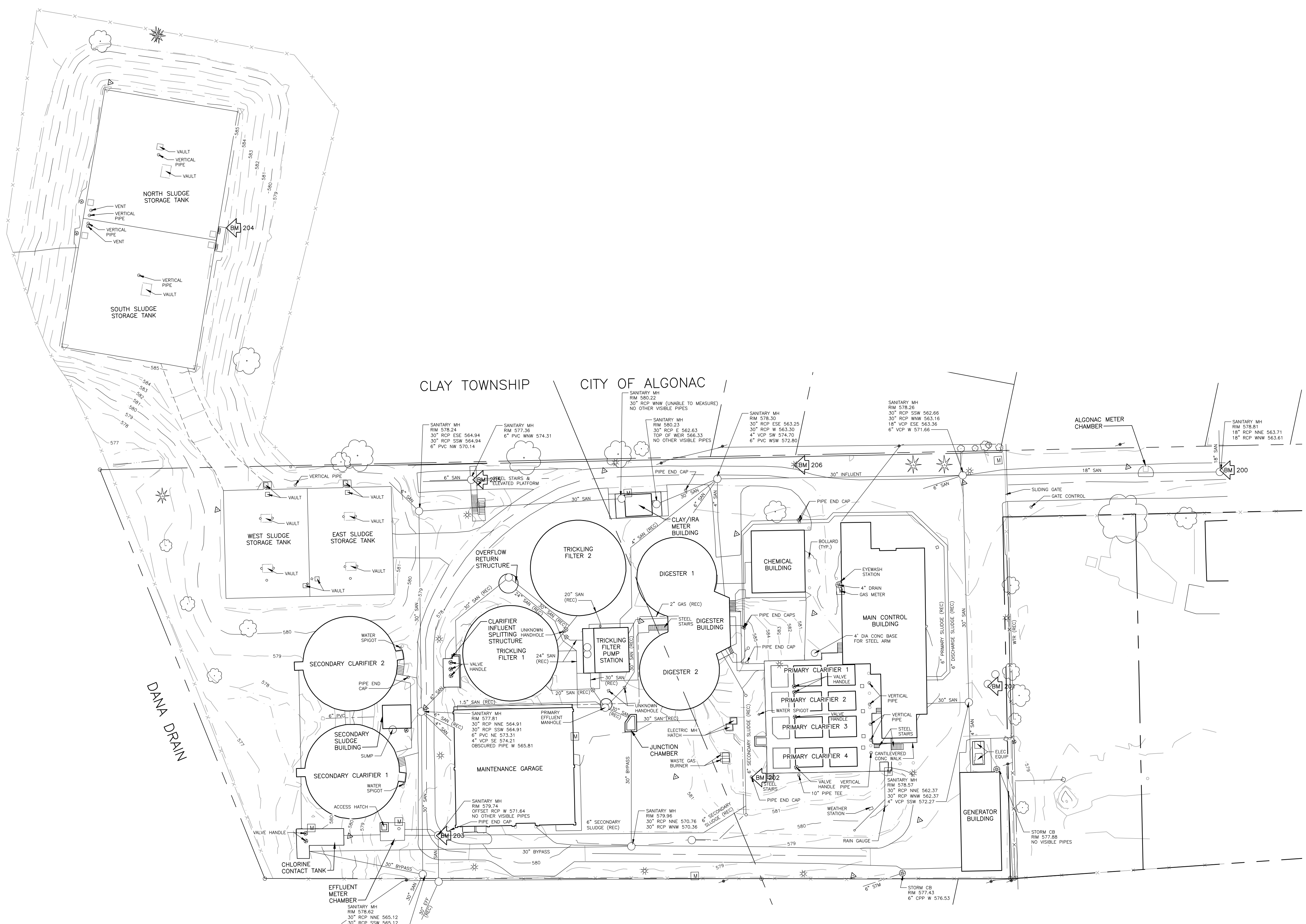
Table 8 – Opinion of Probable Cost

| Item | Budget |
|---|---|
| New Retention System | $5,700,000 |
| Flow Metering Improvements | $410,000 |
| Primary Clarification Improvements | $1,100,000 |
| Secondary Clarification Improvements | $1,400,000 |
| Ferric Chloride System Improvements | $40,000 |
| Polymer System Improvements | $260,000 |
| Anaerobic Digestion Improvements | $2,500,000 |
| Electrical Power Distribution Improvements | $560,000 |
| Process Control Panel Improvements | $690,000 |
| **Construction Subtotal** | **$12,660,000** |
| General Conditions, Overhead and Profit | $2,150,000 |
| **Total Construction Cost** | **$14,810,000** |
| Design Engineering | $1,545,000 |
| Construction Engineering and Observation (10%) | $1,500,000 |
| **Total Project Cost** | **$17,855,000** |

Any federal funding received will impose certain construction requirements including domestic material procurement and wage rates. It may be preferable to separate the federally funded portion of the project under a separate contract, possibly a pre-procurement package for the retention tank structures.

# Appendix

# 1




## EXISTING CONDITIONS PLAN

SCALE: 1" = 30'

0 15 30 60

NORTH

## BENCH MARKS

BENCH MARK 200 ELEVATION: 578.82
CHISELED X ON NORTH SIDE OF RIM OF SANITARY MANHOLE IN DRIVE TO SURVEYED SITE, 300' WEST OF STATE STREET

BENCH MARK 201 ELEVATION: 579.23
CHISELED X ON SOUTH SIDE OF RIM OF ELECTRIC MANHOLE, 36' EAST OF CONTROL BUILDING AND 53' NORTH OF GENERATOR ROOM

BENCH MARK 202 ELEVATION: 583.19
CHISELED X ON SOUTH BOLT OF VERTICAL PIPE NEAR SOUTHWEST CORNER OF PRIMARY SETTLING TANKS AND 54' SOUTH OF SLUDGI DIGESTER #2

BENCH MARK 203 ELEVATION: 579.75
CHISELED X ON WEST SIDE OF RIM OF SANITARY MANHOLE NEAR SOUTHWEST CORNER OF MAINTENANCE GARAGE

BENCH MARK 204 ELEVATION: 585.27
MAG NAIL IN NORTHEAST CORNER OF CONCRETE FOUNDATION FOR TANK ON NORTHWEST SIDE OF SURVEYED SITE

BENCH MARK 205 ELEVATION: 577.36
CHISELED X ON EAST SIDE OF RIM OF SANITARY MANHOLE NEAR STAIRS & ELEVATED PLATFORM NORTH OF TRICKLING FILTERS & 92' WEST OF METER PIT BUILDING

BENCH MARK 206 ELEVATION: 579.52
CHISELED X ON SOUTH BOLT IN BASE OF LIGHT POLE, 40' NORTH OF CHEMICAL BUILDING

## SYMBOL LEGEND

BM BENCH MARK
PROPERTY LINE
SOIL BORING
CONIFEROUS TREE
DECIDUOUS TREE
725 CONTOUR MAJOR
724 CONTOUR MINOR
LIGHT
UTILITY POLE
SIGN
FENCE LINE
GRAVEL SURFACE
PAVED SURFACE
8" SAN SANITARY SEWER & MANHOLE
12" STM STORM SEWER & MANHOLE
CATCH BASIN CURB AND LAWN TYPE
VALVE
HYDRANT
6" WTR WATER MAIN
2" GAS GAS MAIN
M METER

## SURVEY NOTES

1. TOPOGRAPHIC SURVEY WAS COMPLETED BY FISHBECK IN MARCH 2026 AND REFLECTS CONDITIONS AT THAT TIME. THE SURVEY HAS BEEN SUPPLEMENTED WITH RECORD INFORMATION FOR THE CONTRACTOR'S CONVENIENCE. THE CONTRACTOR IS RESPONSIBLE FOR VISITING THE SITE PRIOR TO BIDDING TO CONFIRM EXISTING CONDITIONS AS SHOWN ON THE PLANS. REPORT ALL DISCREPANCIES TO THE ENGINEER.
2. THE HORIZONTAL AND VERTICAL INFORMATION PROVIDED IS BASED ON THE MICHIGAN STATE PLANE COORDINATE SYSTEM (SOUTH ZONE, INTERNATIONAL FEET) WITH NAD83 HORIZONTAL AND NAVD88 VERTICAL DATUM, RESPECTIVELY.
3. UNDERGROUND UTILITIES ARE SHOWN BASED ON SURFACE MANHOLE AND VALVE LOCATIONS, RECORD DRAWINGS, AND OWNER PROVIDED UTILITY MAPS AND MAY NOT BE ACCURATE. CONTRACTOR SHALL CONTACT MISS DIG PRIOR TO ANY EXCAVATION. CONTACT ENGINEER IF UTILITIES ARE FOUND IN DIFFERENT CONDITIONS THAN SHOWN ON THESE PLANS.
4. PIPE ROUTING IS DIAGRAMMATIC. ALL EQUIPMENT & PIPES ARE TO BE FIELD VERIFIED PRIOR TO CONSTRUCTION.

## GEOTECHNICAL NOTES

1. GEOTECHNICAL FIELD INVESTIGATION AND REPORT PREPARED BY [GEOTECHNICAL ENGINEER] IN [DATE MM/YYYY] AND REFLECT CONDITIONS AT THAT TIME.
2. USCS SOIL CLASSIFICATION: [INSERT TYPICAL SOIL DATA]

fishbeck
Engineers | Architects | Scientists | Constructors

# Southwater MUA
St. Clair County, Michigan

St. Clair County-Algonac WWTP Improvements

REVISIONS

NOT FOR CONSTRUCTION

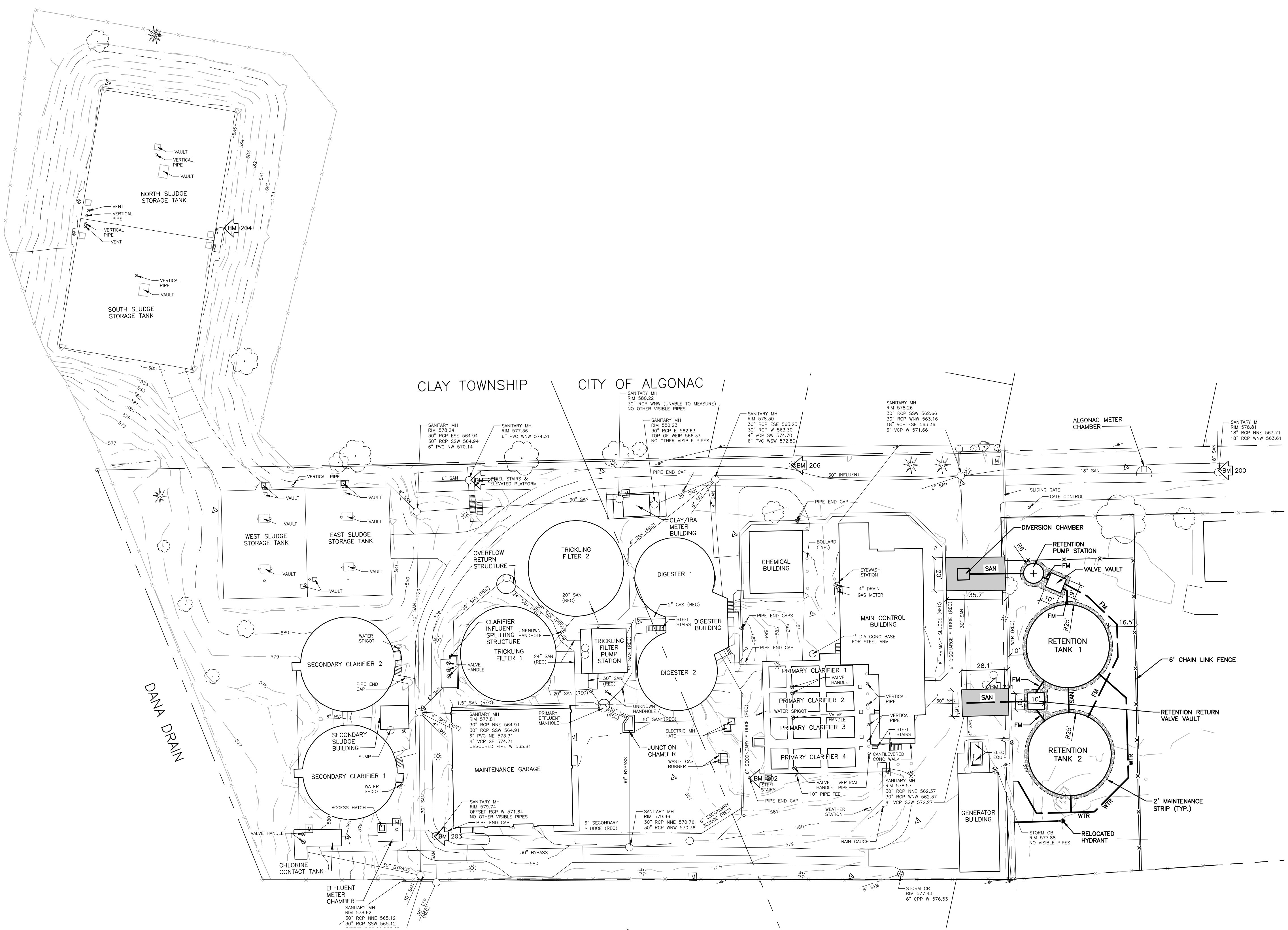
| | |
|---|---|
| 6/9/2026 | 30% PRELIMINARY DESIGN |
| 5/29/2026 | 30% PEER REVIEW |

| | |
|---|---|
| Drawn By | DRHOTON |
| Designer | DRHOTON |
| Reviewer | ERANDOLPH |
| Manager | ERINS |

Hard copy is intended to be 24"x36" when plotted. Scale(s) indicated and graphic quality may not be accurate for any other size.

PROJECT NO.
241369

SHEET NO.
# C101




## SITE AND UTILITY PLAN

SCALE: 1" = 30'

0 15 30 60

NORTH

## BENCH MARKS

BENCH MARK 200 ELEVATION: 578.82
CHISELED X ON NORTH SIDE OF RIM OF SANITARY MANHOLE IN DRIVE TO SURVEYED SITE, 300' WEST OF STATE STREET

BENCH MARK 201 ELEVATION: 579.23
CHISELED X ON SOUTH SIDE OF RIM OF ELECTRIC MANHOLE, 36' EAST OF CONTROL BUILDING AND 53' NORTH OF GENERATOR ROOM

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BENCH MARK 206 ELEVATION: 579.52
CHISELED X ON SOUTH BOLT IN BASE OF LIGHT POLE, 40' NORTH OF CHEMICAL BUILDING

## SYMBOL LEGEND

BENCH MARK
PROPERTY LINE
CONTOUR MAJOR
CONTOUR MINOR
ASPHALT PAVEMENT, SEE DETAIL
MAINTENANCE STRIP
4" THICK CONCRETE SIDEWALK
EXPANSION JOINT
FENCE
SANITARY SEWER & MANHOLE
FORCE MAIN
METER
GAS MAIN
ELECTRIC

## NOTES

1. DIMENSIONS ARE TO BACK OF CURB, OUTSIDE FACE OF BUILDING, AND EDGE OF PAVEMENT UNLESS NOTED OTHERWISE.
2. KEEP THE APPROVED AND/OR MOST CURRENT SET OF PROJECT DRAWINGS ON SITE AT ALL TIMES. CONTRACTOR TO CONFIRM THEY ARE IN POSSESSION OF THE MOST CURRENT DRAWING FILES.
3. RESTORE ALL DISTURBED AREA WITH SUITABLE TOPSOIL AND SEED.

## UTILITY NOTES

1. EXISTING UTILITIES LOCATIONS SHOWN ARE APPROXIMATE.
2. VERIFY THE HORIZONTAL AND VERTICAL LOCATION OF EXISTING UTILITIES PRIOR TO EXCAVATION WHERE NECESSARY.
3. PROTECT AND MAINTAIN SERVICE OF OTHER UTILITIES AT CROSSINGS.
4. DO NOT CONNECT ROOF DRAINS, FOUNDATION DRAINS, AND OTHER CLEAN WATER SERVICES TO THE SITE RECYCLE DRAINS.
5. PROVIDE AND MAINTAIN INLET FILTERS AT ALL CATCH BASIN INLETS, DURING CONSTRUCTION.
6. WATER MAIN AND FORCE MAIN TO HAVE A MINIMUM OF FIVE (5) FEET OF COVER.
7. PROVIDE A MINIMUM OF EIGHTEEN (18) INCHES OF VERTICAL SEPARATION AND TEN (10) FEET OF HORIZONTAL SEPARATION BETWEEN THE WATER MAIN AND ALL SANITARY AND STORM SEWERS.
8. ADJUST ALL CASTINGS TO FINISH GRADES.
9. PIPE LENGTHS ARE TO CENTER OF STRUCTURES UNLESS NOTED OTHERWISE. ALL PIPE LENGTHS ARE FOR THE CONVENIENCE OF THE CONTRACTOR.
10. UTILITY ELEVATIONS INDICATED REPRESENT INVERT ELEVATIONS UNLESS OTHERWISE NOTED.

fishbeck
Engineers | Architects | Scientists | Constructors

# Southwater MUA

St. Clair County, Michigan

St. Clair County-Algonac WWTP Improvements

REVISIONS

NOT FOR CONSTRUCTION

| | |
|---|---|
| 6/9/2026 | 30% PRELIMINARY DESIGN |
| 5/29/2026 | 30% PEER REVIEW |

| | |
|---|---|
| Drawn By | DRHOTON |
| Designer | DRHOTON |
| Reviewer | ERANDOLPH |
| Manager | ERINS |

Hard copy is intended to be 24"x36" when plotted. Scale(s) indicated and graphic quality may not be accurate for any other size.

PROJECT NO.
241369

SHEET NO.
C201



PLOT INFO: Z:\2024\241369\CAD\CDC\C201241369.DWG LAYOUT: C201 DATE: 6/11/2026 TIME: 7:30:38 PM USER: DRHOTON

# Appendix

# 2

## GENERAL ABBREVIATIONS

| | |
|---|---|
| A | AIR |
| AB | ANCHOR BOLT |
| ABAN | ABANDON, ABANDONED |
| ADJ | ADJACENT |
| AFF | ABOVE FINISHED FLOOR |
| AG | ABOVE GRADE |
| AL | ALUMINUM |
| ALT | ALTERNATE, ALTERNATIVE |
| AMT | AMOUNT |
| APPROX | APPROXIMATE |
| ASSY | ASSEMBLY |
| AVG | AVERAGE |
| B/B | BACK TO BACK |
| BF | BLIND FLANGE |
| BFG | BELOW FINISHED GRADE |
| BFP | BACKFLOW PREVENTER |
| BG | BIOGAS |
| BLDG | BUILDING |
| BLKHD | BULKHEAD |
| BLWDN | BLOWDOWN |
| BM | BENCHMARK |
| BMC | BOLTED MECHANICAL COUPLING |
| BTM | BOTTOM |
| BRG | BEARING |
| BSMT | BASEMENT |
| BTU | BRITISH THERMAL UNITS |
| BTWN | BETWEEN |
| C/C | CENTER TO CENTER |
| CF | CUBIC FEET |
| CFM | CUBIC FEET PER MINUTE |
| CFS | CUBIC FEET PER SECOND |
| CHAM | CHAMFER |
| CHEM | CHEMICAL |
| CHKPL | CHECKERPLATE |
| CL | CENTERLINE |
| CLR | CLEARANCE |
| CO | CLEANOUT |
| COMP | COMPANION |
| CONC | CONCRETE |
| CONC | CONCENTRATED |
| CONC | CONCENTRIC |
| CONST | CONSTRUCTION |
| COORD | COORDINATE |
| CPLG | COUPLING |
| CTL | CONTROL |
| CW | COLD WATER |
| CY | CUBIC YARD |
| DEG | DEGREE |
| DEMO | DEMOLITION |
| DET | DETAIL |
| DIA | DIAMETER |
| DIF | DIFFUSER |
| DIM | DIMENSION |
| DIR | DIRECTION |
| DISCH | DISCHARGE |
| DIST | DISTANCE |
| DMS | DIAPHRAGM SEAL |
| DN | DOWN |
| DP | DEEP, DEPTH |
| DWG | DRAWING |
| DWV | DRAIN WASTE VENT |
| E/E | END TO END |
| EA | EACH |
| ECC | ECCENTRIC |
| EHT | ELECTRICALLY HEAT-TRACED |
| EJ | EXPANSION JOINT |
| EL,ELEV | ELEVATION |
| EL | ELBOW |
| EMBED | EMBEDMENT |
| ENGR | ENGINEER |
| EQ | EQUAL |
| EQUIP | EQUIPMENT |
| ES | EACH SIDE |
| ESEW | EMERGENCY SHOWER AND EYE WASH |
| EW | EACH WAY |
| EX, EXIST | EXISTING |
| EXC | EXCAVATE, EXCAVATION |
| EXP | EXPOSED |
| EXT | EXTERIOR |
| F/F | FACE TO FACE |
| FAB | FABRICATED |
| FD | FLOOR DRAIN |
| FF | FINISHED FLOOR |
| FIG | FIGURE |
| FIN | FINISHED |
| FLR | FLOOR |
| FM | FORCE MAIN |
| FRP | FIBERGLASS REINFORCED PLASTIC |
| FSP | FABRICATED STEEL PIPE |
| FTG | FITTING |
| FV | FIELD VERIFY |
| GA | GAUGE/GAGE |
| GAC | GRANULATED ACTIVATED CARBON |
| GFA | GROOVED FLANGE ADAPTER |
| GPC | GROOVED PIPE COUPLING |
| GPD | GALLONS PER DAY |
| GPM | GALLONS PER MINUTE |
| GR | GRADE |
| HB | HOSE BIBB |
| HDPE | HIGH DENSITY POLYETHYLENE EXTRUSION |
| HDWL | HEADWALL |
| HGL | HYDRAULIC GRADE LINE |
| HGR | HANGER |
| HHWL | HIGH HIGH WATER LEVEL |
| HORIZ | HORIZONTAL |
| HP | HIGH POINT |
| HP | HORSEPOWER |
| HT | HEIGHT |
| HVAC | HEATING, VENTILATING AND AIR CONDITIONING |
| HW | HOT WATER |
| HWL | HIGH WATER LEVEL |
| HYD | HYDRAULIC |
| HZ | HERTZ |
| ID | INSIDE DIAMETER |
| IE | INVERT ELEVATION |
| IN | INCH |
| INCL | INCLUDE |
| INSUL | INSULATE, INSULATION |
| INSTR | INSTRUMENT, INSTRUMENTATION |
| INT | INTERIOR |
| INV | INVERT |
| IPS | IRON PIPE SIZE |
| IR | ISOLATION RING |
| JT | JOINT |
| LAB | LABORATORY |
| LAT | LATERAL |
| LB | POUND |
| LF | LINEAL FOOT |
| LGTH | LENGTH |
| LH | LEFT HAND |
| LIQ | LIQUID |
| LLWL | LOW LOW WATER LEVEL |
| LONG | LONGITUDINAL |
| LP | LOW POINT |
| LR | LONG RADIUS |
| LWL | LOW WATER LEVEL |
| M | MOTOR |
| MAINT | MAINTENANCE |
| MATL | MATERIAL |
| MAX | MAXIMUM |
| MEZZ | MEZZANINE |
| MFR | MANUFACTURER |
| MGD | MILLION GALLONS PER DAY |
| MH | MANHOLE |
| MIN | MINIMUM |
| MISC | MISCELLANEOUS |
| MJ | MECHANICAL JOINT |
| MTD | MOUNTED |
| MTL | METAL |
| N/A | NOT APPLICABLE |
| NIC | NOT IN CONTRACT |
| NO | NUMBER |
| NPT | AMERICAN NATIONAL TAPER PIPE THREAD |
| NTS | NOT TO SCALE |
| OC | ON CENTER |
| OD | OUTSIDE DIAMETER |
| OPNG | OPENING |
| OPP | OPPOSITE |
| ORIG | ORIGINAL |
| OH | OVERHEAD |
| P&ID | PROCESS AND INSTRUMENTATION DIAGRAM |
| PE | PLAIN END |
| PERF | PERFORATED |
| PHA | PHOSPHORIC ACID |
| PL | PLATE |
| PNL | PANEL |
| PPM | PARTS PER MILLION |
| PROP | PROPOSED |
| PS | PUMP STATION |
| PSF | POUNDS PER SQUARE FOOT |
| PSI | POUNDS PER SQUARE INCH |
| Q | FLOW |
| QD | QUICK DISCONNECT |
| QTY | QUANTITY |
| R | RADIUS |
| RD | ROOF DRAIN |
| RECIRC | RECIRCULATE, RECIRCULATING, RECIRCULATION |
| RED | REDUCER, REDUCING |
| REF | REFERENCE |
| REHAB | REHABILITATION |
| REINF | REINFORCE, REINFORCING |
| REQD | REQUIRED |
| REV | REVISION |
| RFA | RESTRAINED FLANGE ADAPTER |
| RH | RIGHT HAND |
| RJ | RESTRAINED JOINT |
| RM | ROOM |
| RO | ROUGH OPENING |
| RPM | REVOLUTIONS PER MINUTE |
| RSR | RISER |
| RUB | RUBBER |
| SAN | SANITARY |
| SCH | SCHEDULE |
| SCRN | SCREEN |
| SED | SEDIMENTATION |
| SHT | SHEET, SHEETING |
| SIM | SIMILAR |
| SL | SLOPE |
| SP | SAMPLE POINT |
| SP | STATIC PRESSURE |
| SPEC | SPECIFICATION/SPECIFIED |
| SPR | SPARE |
| SF | SQUARE FOOT |
| SY | SQUARE YARD |
| SR | SHORT RADIUS |
| SS | STAINLESS STEEL |
| STA | STATION |
| STD | STANDARD |
| STG | STORAGE |
| STL | STEEL |
| SUBM | SUBMERGED |
| SUCT | SUCTION |
| SURF | SURFACE |
| SUSP | SUSPENDED |
| SW | SOCKET WELDED |
| SYS | SYSTEM |
| TDH | TOTAL DYNAMIC HEAD |
| TEMP | TEMPERATURE |
| THK | THICK |
| TYP | TYPICAL |
| UG | UNDERGROUND |
| UL | UNDERWRITERS LABORATORY |
| UNO | UNLESS NOTED OTHERWISE |
| UTIL | UTILITY |
| UV | ULTRAVIOLET LIGHT |
| V | VOLTS |
| VAC | VACUUM |
| VB | VALVE BOX |
| VERT | VERTICAL |
| VOL | VOLUME |
| VTR | VENT THROUGH ROOF |
| VTW | VENT THROUGH WALL |
| W/ | WITH |
| W/O | WITHOUT |
| WT | WEIGHT |
| WH | WALL HYDRANT |
| WL | WATER LEVEL |
| WP | WEATHERPROOF |
| WS | WATERSTOP |
| WSE | WATER SURFACE ELEVATION |
| WT | WATERTIGHT |
| XP | EXPLOSION PROOF |

## PIPE/TUBING MATERIAL ABBREVIATIONS

| | |
|---|---|
| CI | CAST IRON |
| CPVC | CHLORINATED POLYVINYL CHLORIDE |
| CS | CARBON STEEL |
| CU | COPPER |
| DI | DUCTILE IRON |
| FRP | FIBERGLASS REINFORCED PLASTIC |
| GALV | GALVANIZED STEEL |
| HDPE | HIGH-DENSITY POLYETHYLENE |
| LCS | LINED CARBON STEEL |
| LDI | LINED DUCTILE IRON |
| PCCP | PRESTRESSED CONCRETE CYLINDER PIPE |
| PE | POLYETHYLENE |
| PP | POLYPROPYLENE |
| PTFE | TEFLON PIPE |
| PVC | POLYVINYL CHLORIDE |
| PVDF | POLYVINYLIDENE FLUORIDE (KYNAR) |
| RCP | REINFORCED CONCRETE PIPE |
| ###SS | STAINLESS STEEL (### INDICATES GRADE) |
| TT | TITANIUM |

## EQUIPMENT TYPE ABBREVIATIONS

| | |
|---|---|
| A | AIR SYSTEM |
| AIC | AIR COMPRESSOR |
| BFP | BELT FILTER PRESS |
| BP | BOOSTER PUMP |
| BPS | BOOSTER PUMP SKID |
| BTK | BULK STORAGE CHEMICAL TANK |
| B | BLOWER |
| CENT | CENTRIFUGE |
| CF | CARTRIDGE FILTER |
| CIP | CLEAN-IN-PLACE |
| CL | CLARIFIER |
| CN | CONVEYOR |
| DIF | DIFFUSER |
| DIG | DIGESTER |
| DTK | DAY TANK (CHEMICAL) |
| ESEW | EMERGENCY SHOWER AND EYE WASH |
| FLT | FILTER |
| FM | FLOCCULATOR MIXER |
| GT | GRAVITY THICKENER |
| HP | HIGH-PRESSURE PUMP |
| HSP | HIGH SERVICE PUMP |
| HTR | HEATER |
| HX | HEAT EXCHANGER |
| LSP | LOW SERVICE PUMP |
| MH | MANHOLE |
| MX | MIXER |
| P | PUMP |
| PFP | PLATE AND FRAME FILTER PRESS |
| PM | POLYMER FEED SYSTEM |
| R | REACTOR |
| RD | RUPTURE DISC |
| RPZ | REDUCED PRESSURE ZONE VALVE |
| S | SAMPLER |
| SCP | SCREW PRESS |
| SCR | SCREEN |
| SMP | SUMP PUMP |
| SP | SAMPLE PUMP |
| STR | STRAINER |
| T | TANK |
| TP | TRANSFER PUMP |
| U | MISCELLANEOUS EQUIPMENT |
| UV | ULTRAVIOLET DISINFECTION |
| WC | WASHER COMPACTOR |

## VALVE ABBREVIATIONS

| | |
|---|---|
| ANV | ANGLE VALVE |
| ARV | AIR RELEASE VALVE |
| AVV | AIR/VACUUM VALVE |
| BAV | BALL VALVE |
| BFV | BUTTERFLY VALVE |
| BPV | BACKPRESSURE VALVE |
| CAV | COMBINATION AIR/VACUUM RELEASE VALVE |
| CKV | CHECK VALVE |
| CNV | ROTARY CONE VALVE |
| CV | CONTROL VALVE |
| DV | DIAPHRAGM VALVE |
| ECV | ELECTRONIC CONTROL VALVE |
| EPV | ECCENTRIC PLUG VALVE |
| GBV | GLOBE VALVE |
| GV | GATE VALVE |
| HG | HAND GATE |
| MDV | MUD VALVE |
| NV | NEEDLE VALVE |
| PFV | PRESSURE RELIEF VALVE |
| PNV | PINCH VALVE |
| PRV | PRESSURE REDUCING VALVE |
| PSV | PRESSURE SUSTAINING/RELIEF VALVE |
| PV | PLUG VALVE |
| SAV | SURGE ANTICIPATOR VALVE |
| SG | SLIDE OR SLUICE GATE |
| SL | STOP LOG |
| SV | SOLENOID VALVE |
| TSV | THERMAL OPERATED SHUT-OFF VALVE |
| V | VALVE |
| VBV | VACUUM BREAKER VALVE |
| WG | WEIR GATE |
| XV | SPECIALTY VALVE |

## PIPE SYSTEM ABBREVIATIONS

| | |
|---|---|
| ALUM | ALUMINUM SULFATE |
| AR | AIR RELEASE (RELIEF) |
| AS | AIR SCOUR |
| BG | BIOGAS |
| BWR | BACKWASH RETURN |
| BWS | BACKWASH SUPPLY |
| BWW | BACKWASH WASTE |
| CA | COMPRESSED AIR |
| CIT | CITRIC ACID |
| CLP | CHLORINE GAS (PRESSURIZED) |
| CLS | CHLORINE SOLUTION |
| CN | CENTRATE |
| DC | DECANT |
| DG | DIGESTER GAS |
| DR | DRAIN |
| DSL | DIGESTED SLUDGE |
| DW | DILUTION WATER |
| EQ | EQUALIZED WASTEWATER |
| FE | FINAL EFFLUENT |
| FECL | FERRIC CHLORIDE / FERROUS CHLORIDE |
| FLT | FILTRATE |
| FTW | FILTER TO WASTE |
| FW | FILTERED WATER |
| GRIT | GRIT SLURRY |
| HFS | HYDROFLUOROSILICIC ACID |
| HYPO | SODIUM HYPOCHLORITE |
| IA | INSTRUMENT AIR |
| LIME | LIME |
| LO | LUBRICATION OIL |
| LPA | LOW PRESSURE AIR |
| LPG | LIQUEFIED PETROLEUM GAS |
| ME | METHANOL |
| ML | MIXED LIQUOR |
| NAOH | SODIUM HYDROXIDE (CAUSTIC) |
| NG | NATURAL GAS |
| NH | AMMONIA |
| O2 | OXYGEN |
| O3 | OZONE |
| OF | OVERFLOW |
| PA | PLANT AIR |
| PAC | POWDERED ACTIVATED CARBON |
| PAL | POLYALUMINUM CHLORIDE |
| PE | PRIMARY EFFLUENT |
| PEW | PLANT EFFLUENT WATER |
| PH | PHOSPHATE |
| PI | PRIMARY INFLUENT |
| PIPR | PRIMARY INFLUENT W/ PLANT RECYCLE |
| POLY | POLYMER |
| PP | POTASSIUM PERMANGANATE |
| PR | PLANT RECYCLE |
| PSW | PLANT SERVICE WATER |
| PW | POTABLE/FINISHED WATER |
| RAS | RETURN ACTIVATED SLUDGE |
| RW | RAW WATER |
| SA | SULFURIC ACID |
| SAN | SANITARY |
| SBS | SODIUM BISULFITE |
| SCUM | SCUM |
| SCE | SECONDARY CLARIFIER EFFLUENT |
| SE | SECONDARY EFFLUENT |
| SL | SLUDGE |
| SLR | SLUDGE RECIRCULATION |
| SN | SUPERNATANT |
| SODA | SODA ASH |
| SPD | SUMP PUMP DISCHARGE |
| SPL | SAMPLE LINE |
| SSL | SECONDARY SLUDGE |
| STR | SLUDGE TRANSFER |
| STW | SETTLED/CLARIFIED WATER |
| TE | TERTIARY EFFLUENT |
| TSL | THICKENED SLUDGE |
| V | VENT |
| VC | VACUUM |
| WAS | WASTE ACTIVATED SLUDGE |
| WF | WARM FLARE |
| WW | INFLUENT WASTEWATER (RAW) |

## ANALYTICAL ABBREVIATIONS

| | |
|---|---|
| ALK | ALKALINITY |
| CH4 | METHANE |
| CL2 | CHLORINE |
| COMB | COMBUSTIBLE GAS |
| CON | CONDUCTIVITY |
| DO | DISSOLVED OXYGEN |
| F | FLUORIDE |
| IR | INFRARED |
| H2S | HYDROGEN SULFIDE |
| METH | METHANOL |
| NH3 | AMMONIA |
| NO3 | NITRATE |
| O2 | OXYGEN |
| O3 | OZONE |
| ORP | OXIDATION/REDUCTION POTENTIAL |
| PC | PARTICLE COUNTER |
| PH | HYDROGEN ION CONCENTRATION |
| PO4 | PHOSPHATE |
| SC | STREAMING CURRENT |
| SO2 | SULFUR DIOXIDE |
| TH | TOTAL HARDNESS |
| TSS | TOTAL SUSPENDED SOLIDS |
| TURB | TURBIDITY |
| UV | ULTRAVIOLET |

## GENERAL SHEET NOTES

1. THIS IS A STANDARD LEGEND SHEET. THEREFORE, NOT ALL OF THE INFORMATION SHOWN MAY BE USED ON THIS PROJECT.
2. CONTACT ENGINEER FOR ABBREVIATIONS USED BUT NOT SHOWN ON THIS DRAWING.

## PROCESS GENERAL NOTES

1. THE FOLLOWING NOTES APPLY TO ALL PROCESS SHEETS.
2. NOTES, SYMBOLS, LEGENDS, AND ABBREVIATIONS SHOWN ON PROCESS DRAWINGS MAY NOT BE ALL INCLUSIVE, ONLY APPLY TO PROCESS DRAWINGS (P### SHEETS) AND, WHEN PRESENT, PROCESS DEMOLITION (D4## SHEETS).
3. GRAPHICAL REPRESENTATION OF EXISTING SYSTEMS IS BASED ON PREVIOUS CONSTRUCTION AND/OR RECORD DRAWINGS AND MAY NOT FULLY REPRESENT EXISTING CONDITIONS, AND IS FOR REFERENCE ONLY. FIELD VERIFY EXISTING CONDITIONS TO DETERMINE EXTENT OF WORK.
4. FIELD VERIFY ALL DIMENSIONS SHOWN.
5. REFER TO PIPING PLAN VIEWS FOR CORRECT PIPE ORIENTATION TO BUILDINGS AND STRUCTURES.
6. SEE STRUCTURAL FOR TYPICAL EQUIPMENT PAD DETAIL FOR NEW EQUIPMENT INSTALLATION.
7. WALL SLEEVES AND WALL PIPE TO BE PAINTED PRIOR TO EMBEDMENT/PIPE INSTALLATION.
8. PAINT PIPE SURFACES THAT WILL BE CONCEALED BY PIPE SUPPORTS PRIOR TO INSTALLING PIPE.
9. COORDINATE NEW WORK WITH DEMOLITION.
10. ALL BURIED/EXPOSED PIPE JOINTS NEW AND EXISTING FOR NEW PIPING INSTALLATIONS TO BE RESTRAINED, UNLESS NOTED OTHERWISE.
11. ENCASE BURIED PIPING UNDER STRUCTURES WITH 1'-0" MINIMUM CONCRETE ENCASEMENT AROUND PIPE AND FROM FURTHEST EXTENSIONS OF FITTING JOINTS, AFTER PIPE HAS BEEN PRESSURE TESTED.
12. FIELD VERIFY THAT ALL EXISTING PIPE PENETRATIONS, WALL SLEEVES AND WALL PIPES ARE AS SHOWN ON PLANS.
13. FOR PURPOSE OF CLARITY, NOT ALL PIPING AND VALVES MAY BE SHOWN IN PLAN VIEWS. SEE PROCESS SCHEMATICS FOR COMPLETE DETAILS.

## PROCESS SITE PIPING NOTES

1. VERIFY DEPTH, SIZE, MATERIAL AND LOCATION OF ALL EXISTING BELOW GRADE PIPING FOR NEW BURIED PIPE INSTALLATION, PRIOR TO COMMENCING WORK.
2. COORDINATE CONSTRUCTION WITH ENGINEER/OWNER TO MAINTAIN PLANT/FACILITY NORMAL MODE OF OPERATION.
3. FIELD VERIFY ALL EXISTING UTILITIES AND BURIED PIPING PRIOR TO ABANDONMENT AND INSTALLATION OF PIPING.
4. INSTALL VALVE BOXES ON ALL BELOW GRADE VALVES.
5. USE APPROPRIATE FITTINGS AND/OR PIPE JOINT DEFLECTION AS NECESSARY TO INSTALL PIPE AT INVERTS AND ELEVATIONS INDICATED.
6. RESTRAIN ALL NEW BURIED MECHANICAL JOINT PIPE AND NEW TIE-IN CONNECTIONS TO EXISTING PIPE.

## PROCESS CHEMICAL FEED NOTES

1. CHEMICAL FEED PIPING SHOWN FOR GENERAL ROUTING AND CHEMICAL FEED POINT LOCATIONS ONLY. ROUTE PIPING AS NECESSARY TO AVOID CONFLICTS AND INSTALL PIPING AND VALVES IN ACCORDANCE WITH THE CHEMICAL FEED SYSTEM SCHEMATIC DIAGRAMS.
2. DO NOT MOUNT VALVES HIGHER THAN 6 FEET ABOVE FINISHED FLOOR.
3. PUMP SHELVES TO BE COMPATIBLE WITH CHEMICAL SERVICE. MOUNT PUMP SHELVES 3 FEET ABOVE FINISHED FLOOR UNLESS NOTED OTHERWISE.

PLOT INFO: 6/9/2026 12:22:15 PM Autodesk Docs://241369 - Southwater MUA - Algonac/2026_General_PR_241369.rvt

fishbeck
Engineers | Architects | Scientists | Constructors

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St. Clair County, Michigan
St. Clair County-Algonac WWTP Improvements

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| Drawn By | JKING |
| Designer | JKING |
| Reviewer | JREDNER |
| Manager | ERINS |

Hard copy is intended to be 24"x36" when plotted. Scale(s) indicated and graphic quality may not be accurate for any other size.

PROJECT NO.
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SHEET NO.
**P001**

## PIPE/FITTINGS SYMBOLS

DOUBLE LINE PIPING | SINGLE LINE/SCHEMATIC

- CROSS
- TEE SIDE
- TEE DOWN
- TEE UP
- LATERAL SIDE
- LATERAL DOWN
- LATERAL UP
- ELBOW, 90 DEGREE
- ELBOW, 90 DEGREE LONG RADIUS (LR)
- ELBOW DOWN
- ELBOW UP
- ELBOW, 45 SIDE (45)
- ELBOW, 22.5 AND 11.25 SIDE (22.5, 11.25)
- CONCENTRIC REDUCER
- ECCENTRIC REDUCER
- FLARED END SECTION
- FLANGED JOINT
- MECHANICAL JOINT
- GROOVED FLANGE ADAPTER (GFA)
- GROOVED PIPE COUPLING (GPC)
- BOLTED MECHANICAL COUPLING (BMC)
- FLANGE ADAPTER (RFA) (RESTRAINED)
- DISMANTLING JOINT (DMJ)
- FLANGED EXPANSION JOINT (FXJ)
- UNION
- QUICK DISCONNECT COUPLING (FEMALE, MALE)
- BLIND FLANGE (BF) (FLAT, DISHED)
- PIPE CAP OR PLUG (CAP)

## VALVE SYMBOLS

- GATE VALVE
- BUTTERFLY VALVE
- BALL VALVE
- GLOBE VALVE
- PLUG VALVE
- 3-WAY PLUG VALVE
- ROTARY CONE VALVE
- PINCH VALVE
- NEEDLE VALVE
- CHECK VALVE
- BALL CHECK VALVE
- ANGLE VALVE
- DIAPHRAGM VALVE
- KNIFE GATE VALVE
- SOLENOID VALVE
- 3-WAY VALVE
- 4-WAY/MULTI-FUNCTION VALVE
- BACKPRESSURE VALVE
- ANTI-SIPHON VALVE (CHEMICAL)
- MUD VALVE
- TELESCOPING VALVE
- ROTARY VALVE
- CORPORATION STOP
- PSV — PRESSURE SUSTAINING/RELIEF VALVE (PILOT OPERATED)
- PRV — PRESSURE REDUCING VALVE (PILOT OPERATED)
- ECV — ELECTRONIC CONTROL VALVE (PILOT OPERATED)
- SAV — SURGE ANTICIPATOR VALVE (PILOT OPERATED)
- PRESSURE REDUCING VALVE
- PRESSURE RELIEF VALVE
- AUTOMATIC AIR RELEASE VALVE
- MANUAL AIR RELEASE VALVE
- COMBINATION AIR/VACUUM RELEASE VALVE
- VACUUM BREAKER
- ANTI-SIPHON VALVE (PIPING)
- SPECIAL VALVE (X)
  - CV - CONTROL VALVE
  - F - FLAP GATE
  - S - STOP COCK
  - X - USER DEFINED
- BACKFLOW PREVENTER

## ACTUATOR SYMBOLS

- CONTROL VALVE
- VALVE W/ ELECTRIC ACTUATOR
- VALVE W/ ELECTRIC ACTUATOR (MODULATING)
- VALVE W/ ELECTRO-HYDRAULIC ACTUATOR
- VALVE W/ PNEUMATIC ACTUATOR
- VALVE W/ HYDRAULIC ACTUATOR
- VALVE W/ SOLENOID ACTUATOR
- VALVE W/ MANUAL ACTUATOR

THE FOLLOWING ADDITIONAL DESIGNATIONS MAY BE UTILIZED ADJACENT TO SOME VALVE OR GATE SYMBOLS.

- NC NORMALLY CLOSED
- NO NORMALLY OPEN
- FC FAILS CLOSED
- FO FAILS OPEN
- FIP FAILS IN LAST KNOWN POSITION

## GATE SYMBOLS

- SLUICE GATE
- SLIDE GATE
- WEIR GATE
- STOP LOG / HAND GATE

## BLOWER/COMPRESSOR SYMBOLS

- CENTRIFUGAL BLOWER
- ROTARY LOBE BLOWER
- ROTARY SCREW BLOWER
- COMPRESSOR

## PUMP SYMBOLS

- CENTRIFUGAL PUMP (GENERAL)
- VERTICAL INLINE PUMP
- HAND (MANUAL) PUMP
- SUBMERSIBLE PUMP
- CHEMICAL METERING PUMP
- DOUBLE DISC PUMP
- GEAR PUMP
- SUMP PUMP
- VACUUM PUMP
- PERISTALTIC PUMP
- ROTARY LOBE PUMP
- PROGRESSIVE CAVITY PUMP
- AIR-OPERATED DOUBLE DIAPHRAGM (AODD) PUMP
- VERTICAL TURBINE PUMP
- VERTICAL TURBINE PUMP (CANNED)
- GENERIC/UNKNOWN PUMP

## EQUIPMENT SYMBOLS

- Y-STRAINER
- REGULATOR
- LUBRICATOR
- IN-LINE MIXER
- CALIBRATION COLUMN
- SIGHT GLASS
- AIR PUMP CONNECTION FITTING
- HOSE CONNECTION
- AIR GAP
- TIE-IN POINT/CONNECTION
- SP — SAMPLE POINT
- CHEM — CHEMICAL FEED INJECTION POINT
- PROBE — PROBE LOCATION
- EJ — EJECTOR
- BASKET STRAINER
- FILTER
- COALESCING FILTER
- FLEXIBLE CONNECTION
- FLUSHING CONNECTION
- FLUSHING CONNECTION W/BALL VALVE
- PULSATION DAMPER
- MOTOR
- MIXER
- EMERGENCY SHOWER AND EYE WASH (ESEW)
- D — DRAIN
- V — VENT
- BELT CONVEYOR
- SCREW CONVEYOR

## PRIMARY ELEMENT SYMBOLS

- PRESSURE GAUGE
- PRESSURE GAUGE W/SHUTOFF
- PRESSURE GAUGE W/DIAPHRAGM SEAL
- PRESSURE GAUGE W/DIAPHRAGM SEAL & SHUTOFF VALVE
- PRESSURE GAUGE W/ISOLATION RING
- PRESSURE GAUGE W/BALL VALVE
- PRESSURE GAUGE W/DIAPHRAGM SEAL & BALL VALVE
- PS — PRESSURE SWITCH
- PIT — PRESSURE TRANSMITTER
- TEMPERATURE GAUGE
- TEMPERATURE GAUGE W/SHUTOFF
- TEMPERATURE PROBE W/THERMOWELL
- ULTRASONIC LEVEL INDICATOR
- FLOAT LEVEL SWITCH
- SUBMERSIBLE LEVEL TRANSMITTER
- RADAR LEVEL INDICATOR (GUIDED WAVE)
- RADAR LEVEL INDICATOR (NON-CONTACT)
- BUBBLER
- FS — FLOW SWITCH
- M — MAGNETIC FLOW METER
- VENTURI FLOW METER
- V-CONE FLOW METER
- PROPELLER/TURBINE FLOW METER
- ΔT — THERMAL MASS FLOW METER
- VORTEX FLOW METER
- ORIFICE FLOW METER
- AFM — MAGNETIC AIR FLOW METER
- ROTAMETER
- FLUME
- WEIR

## EQUIPMENT TAG NUMBERS

- X-YZZ — MAJOR EQUIPMENT TAG NUMBER:
  - X - EQUIPMENT TYPE
  - Y - PROCESS AREA DESIGNATION
  - Z - UNIT NUMBER
- X — VALVE TAG
- X-X — SPECIAL VALVE TAG

## PIPELINE IDENTIFICATION NUMBERS

ZZ"-SSSS-MMMM

- PIPE SIZE IN INCHES
- PIPE SYSTEM ABBREVIATION (SEE ABBREVIATIONS SHEET)
- MATERIAL ABBREVIATION (SEE ABBREVIATIONS SHEET)

## LINE SYMBOLS

- MAJOR PROCESS PIPING OR FLOW CHANNEL
- SECONDARY PROCESS PIPING
- MISCELLANEOUS PIPING
- SCREENED LINE DENOTES EXISTING PIPING OR EQUIPMENT
- SCREENED DASHED LINE DENOTES FUTURE PIPING OR EQUIPMENT OR EXISTING BELOW PIPING
- BOLD THICK CENTERLINE DENOTES OWNER PROVIDED EQUIPMENT PACKAGE
- BOLD THICK PHANTOM DENOTES MANUFACTURER PROVIDED EQUIPMENT PACKAGE
- DEMOLISHED PIPING OR EQUIPMENT
- FLOW ARROW FOR MAJOR PROCESS PIPING
- FLOW ARROW FOR SECONDARY / MISCELLANEOUS PROCESS PIPING
- FLOW ARROW FOR BI-DIRECTIONAL PROCESS PIPING
- PROCESS PIPE BREAK (NOT CONNECTED)
- 1 | P101 — PROCESS PIPING GOING TO ANOTHER SHEET
  - MATCH LINE SHEET NO.
  - MATCH LINE IDENTIFIER
- 1 | P101 — PROCESS PIPING COMING FROM ANOTHER SHEET
- WSE = — WATER SURFACE ELEVATION
- SPOT / LEVEL ELEVATION TARGET

## GENERAL SHEET NOTES

1. THIS IS A STANDARD LEGEND SHEET. THEREFORE, NOT ALL OF THE INFORMATION SHOWN MAY BE USED ON THIS PROJECT.
2. CONTACT ENGINEER FOR SYMBOLS USED BUT NOT SHOWN ON THIS DRAWING.

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# Southwater MUA
St. Clair County, Michigan

St. Clair County-Algonac WWTP Improvements

REVISIONS

NOT FOR CONSTRUCTION

| | |
|---|---|
| 6/9/2026 | 30% PRELIMINARY DESIGN |
| 5/29/2026 | 30% PEER REVIEW |

| | |
|---|---|
| Drawn By | JKING |
| Designer | JKING |
| Reviewer | JREDNER |
| Manager | ERINS |

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PROJECT NO.
241369

SHEET NO.
**P002**

| DEVICE TYPE DEFINITIONS | | | | | |
|---|---|---|---|---|---|
| | FIRST LETTER | | SUCCEEDING LETTERS | | |
| LETTER | PROCESS OR INITIATING VARIABLE | MODIFIER | READOUT OR PASSIVE FUNCTION | OUTPUT FUNCTION | MODIFIER |
| A | ANALYSIS | | ALARM | | |
| B | BURNER FLAME, COMBUSTION | | USER'S CHOICE | USER'S CHOICE | USER'S CHOICE |
| C | CONDUCTIVITY | | | CONTROL (WITH FEEDBACK) | CLOSE OR CLOSED |
| D | DENSITY OR SPECIFIC GRAVITY | DIFFERENTIAL | | | DEVIATION |
| E | VOLTAGE | | SENSOR, PRIMARY ELEMENT | | |
| F | FLOW, FLOW RATE | RATIO | | | |
| G | GAUGE | | GLASS, GAUGE, VIEW | | |
| H | HAND/MANUAL | | | | HIGH |
| I | CURRENT | | INDICATE | | |
| J | POWER | | SCAN | | |
| K | TIME, SCHEDULE | RATE OF CHANGE | | CONTROL STATION (NO FEEDBACK) | |
| L | LEVEL | | LIGHT (PILOT) | | LOW |
| M | MOTION OR MOTOR | MOMENTARY | | | MIDDLE, INTERMEDIATE |
| N | TORQUE | | USER'S CHOICE | USER'S CHOICE | USER'S CHOICE |
| O | USER'S CHOICE | | ORIFICE, RESTRICTION | | OPEN OR OPENED |
| P | PRESSURE OR VACUUM | | POINT (TEST CONNECTION) | | |
| Q | QUANTITY | INTEGRATE, TOTALIZE | INTEGRATE, TOTALIZE | | |
| R | RADIOACTIVITY | | RECORD OR PRINT | | RUN |
| S | SPEED OR FREQUENCY | SAFETY | | SWITCH | STOP |
| T | TEMPERATURE | | | TRANSMIT | |
| U | MULTIVARIABLE | | MULTIFUNCTION | MULTIFUNCTION | |
| V | VISCOSITY OR VIBRATION | | | VALVE | |
| W | WEIGHT OR FORCE | | WELL PROBE | | |
| X | UNCLASSIFIED | X-AXIS | UNCLASSIFIED | UNCLASSIFIED | UNCLASSIFIED |
| Y | EVENT, STATE | Y-AXIS | | RELAY OR COMPUTE | |
| Z | POSITION | Z-AXIS | | DRIVER, ACTUATOR, CONTROL | |

## GENERAL SYMBOLS

- FIELD/LOCAL DEVICE
- CONTROL PANEL DEVICE FACE-MOUNTED
- CONTROL PANEL DEVICE INTERIOR-MOUNTED
- MCC DEVICE FACE-MOUNTED
- MCC DEVICE INTERIOR-MOUNTED
- LOGICAL INTERLOCK

## LINE SYMBOLS

- PROCESS CONTROL LINE
- DISCRETE SIGNAL
- ANALOG SIGNAL
- FIBER OPTIC CABLE
- UNSHIELDED TWISTED PAIR CABLE
- WIRELESS ETHERNET
- PNEUMATIC PIPING/SIGNAL
- HYDRAULIC PIPING/SIGNAL

## I/O SYMBOLS

- DISCRETE PLC INPUT
- ANALOG PLC INPUT
- DISCRETE PLC OUTPUT
- ANALOG PLC OUTPUT
- CONTROL PANEL INPUT/OUTPUT INTERIOR-MOUNTED

## INSTRUMENTATION TAG NUMBERS

- LOCAL DEVICE
  X = DEVICE TYPE
  Y = LOOP NUMBER
- PANEL MOUNTED DEVICE
  X = DEVICE TYPE
  Y = LOOP NUMBER

## ABBREVIATIONS

| | |
|---|---|
| AIT | ANALYZER INDICATING TRANSMITTER |
| AE | ANALYZER SENSOR |
| AV/SV | VALVE CONTROL |
| CP | CONTROL PANEL |
| CS | CONTROL SWITCH |
| ESPB | EMERGENCY STOP PUSH BUTTON |
| FE | FLOW ELEMENT |
| FI | FLOW INDICATOR |
| FIT | FLOW INDICATING TRANSMITTER |
| FIQ | FLOW INDICATING TOTALIZER |
| FR | FLOW RECORDER |
| FS | FLOW SWITCH |
| FT | FLOW TRANSMITTER |
| HOA | HAND/OFF/AUTO |
| HS | HAND SWITCH |
| JA | POWER ALARM |
| JIT | POWER TRANSMITTER |
| JY | POWER EVENT (FAIL) |
| KS | TIME DELAY |
| LAH | LEVEL ALARM HIGH |
| LAHH | LEVEL ALARM HIGH HIGH |
| LAL | LEVEL ALARM LOW |
| LALL | LEVEL ALARM LOW LOW |
| LE | LEVEL ELEMENT |
| LI | LEVEL INDICATOR |
| LS | LEVEL SWITCH |
| LSL | LEVEL SWITCH LOW |
| LSLL | LEVEL SWITCH LOW LOW |
| LSH | LEVEL SWITCH HIGH |
| LSHH | LEVEL SWITCH HIGH HIGH |
| LT | LEVEL TRANSMITTER |
| LIC | LEVEL INDICATING CONTROLLER |
| LIT | LEVEL INDICATING TRANSMITTER |
| MCC | MOTOR CONTROL CENTER |
| MCP | MAIN CONTROL PANEL |
| ML | MOTION LIGHT |
| PAH | PRESSURE ALARM HIGH |
| PAL | PRESSURE ALARM LOW |
| PE | PRESSURE ELEMENT |
| PI | PRESSURE INDICATOR |
| PIT | PRESSURE INDICATING TRANSMITTER |
| PS | PRESSURE SWITCH |
| PSH | PRESSURE SWITCH HIGH |
| PSL | PRESSURE SWITCH LOW |
| PT | PRESSURE TRANSMITTER |
| SC | SPEED CONTROL OR CONTROLLER |
| ST | SPEED TRANSMITTER |
| SV | SOLENOID VALVE |
| TS (H/L) | TEMPERATURE SWITCH (HIGH/LOW) (HH=HIGH HIGH) (LL=LOW LOW) |
| TT | TEMPERATURE TRANSMITTER |
| VFD | VARIABLE FREQUENCY DRIVE |
| WE | WEIGHT ELEMENT |
| WIT | WEIGHT INDICATING TRANSMITTER |
| WT | WEIGHT TRANSMISSION SIGNAL |
| XL/ML | EVENT OR STATUS (I.E. RUNNING) |
| YA/QA | EVENT ALARM (I.E. FAULT) |
| YS | EVENT SWITCH |
| ZC | POSITION CONTROL |
| ZCC | CLOSE POSITION CONTROL |
| ZCO | OPEN POSITION CONTROL |
| ZS | POSITION SWITCH |
| ZSA | EMERGENCY CLOSE CONTROL (ALARM) |
| ZSC | CLOSED POSITION (LIMIT) SWITCH |
| ZSM | INTERMEDIATE POSITION (LIMIT) SWITCH (I.E. 95% CLOSED) |
| ZSO | OPENED POSITION (LIMIT) SWITCH |
| ZT | POSITION TRANSMITTER (STATUS) |

## GENERAL SHEET NOTES

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2. CONTACT ENGINEER FOR DEFINITIONS, SYMBOLS, AND ABBREVIATIONS USED BUT NOT SHOWN ON THIS DRAWING.

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**Southwater MUA**
St. Clair County, Michigan

St. Clair County-Algonac WWTP Improvements

REVISIONS

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| | |
|---|---|
| 6/9/2026 | 30% PRELIMINARY DESIGN |
| 5/29/2026 | 30% PEER REVIEW |

| | |
|---|---|
| Drawn By | JKING |
| Designer | JKING |
| Reviewer | JREDNER |
| Manager | ERINS |

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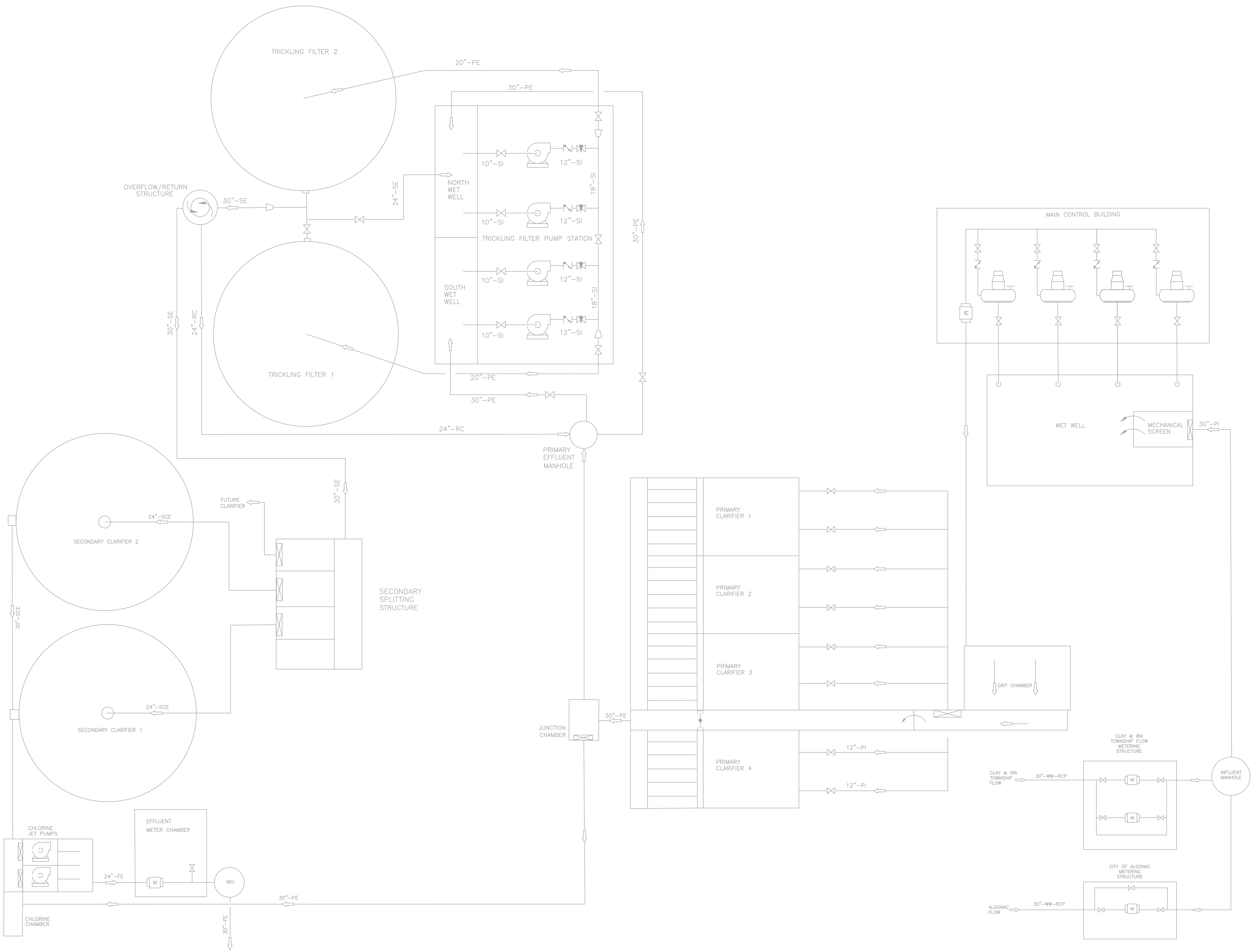
PROJECT NO.
241369

SHEET NO.
**P003**




## OVERALL FLOW SCHEMATIC

NO SCALE

### SYMBOL LEGEND

### NOTES

1. NOTE TEXT HERE...

### KEY NOTES

1. KEY NOTE TEXT HERE...

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St. Clair County, Michigan

St. Clair County-Algonac WWTP Improvements

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| | |
|---|---|
| Drawn By | AKRAUSS |
| Designer | ZKIRSCHMAN |
| Reviewer | JREDNER |
| Manager | ERINS |

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PROJECT NO.
241369

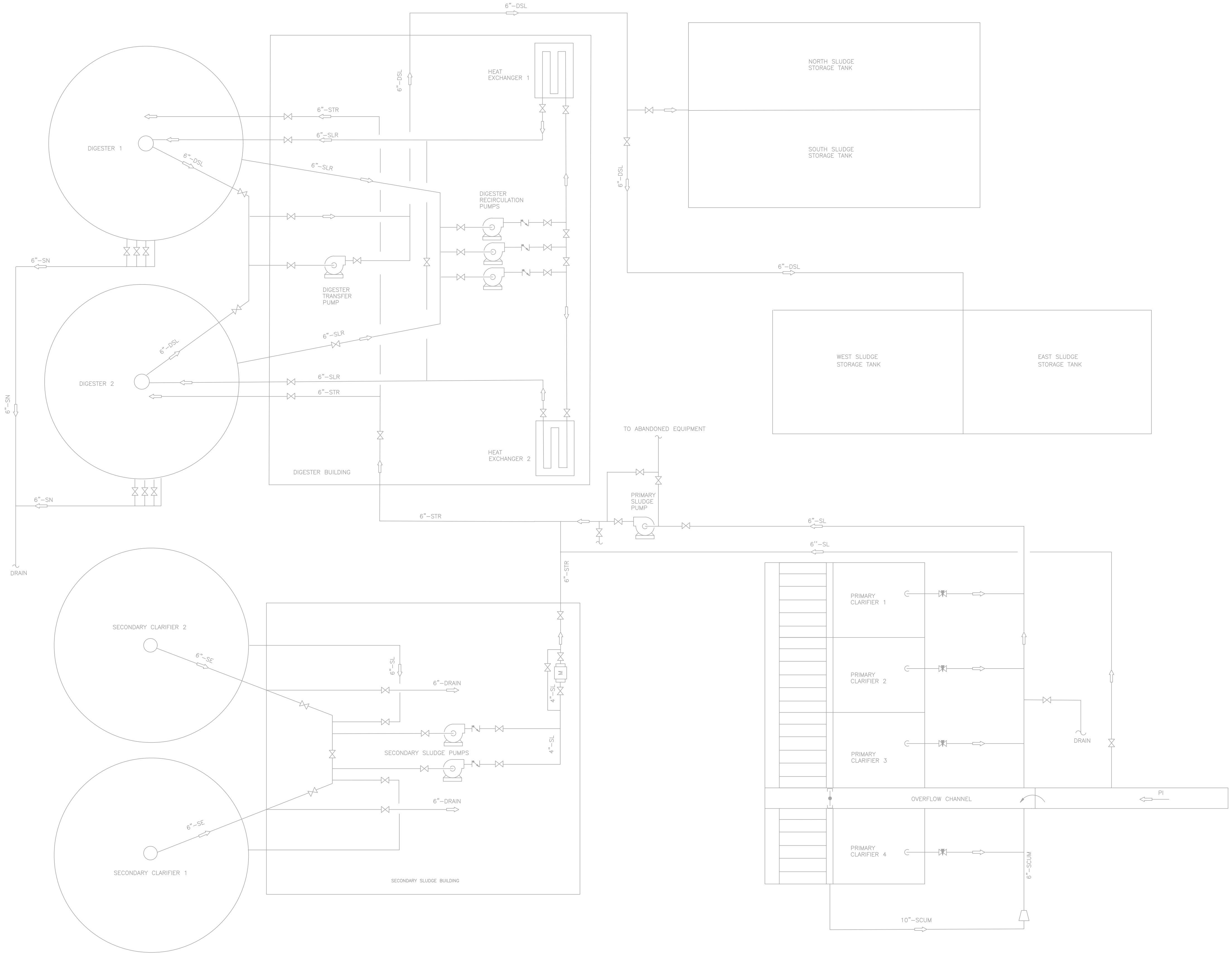
SHEET NO.
P102



PLOT INFO: Z:\2024\241369\CAD\CD\P102241369.DWG LAYOUT: P102 DATE: 6/12/2026 TIME: 10:11:14 AM USER: JKING

## NOTES

1. NOTE TEXT HERE...




# SOLIDS FLOW SCHEMATIC

NO SCALE



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|---|---|
| 8/12/2026 | PROGRESS SET |
| 6/9/2026 | 30% PRELIMINARY DESIGN |
| 5/29/2026 | 30% PEER REVIEW |

| | |
|---|---|
| Drawn By | AKRAUSS |
| Designer | EEDWARDS |
| Reviewer | JREDNER |
| Manager | ERINS |

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PROJECT NO.

241369

SHEET NO.

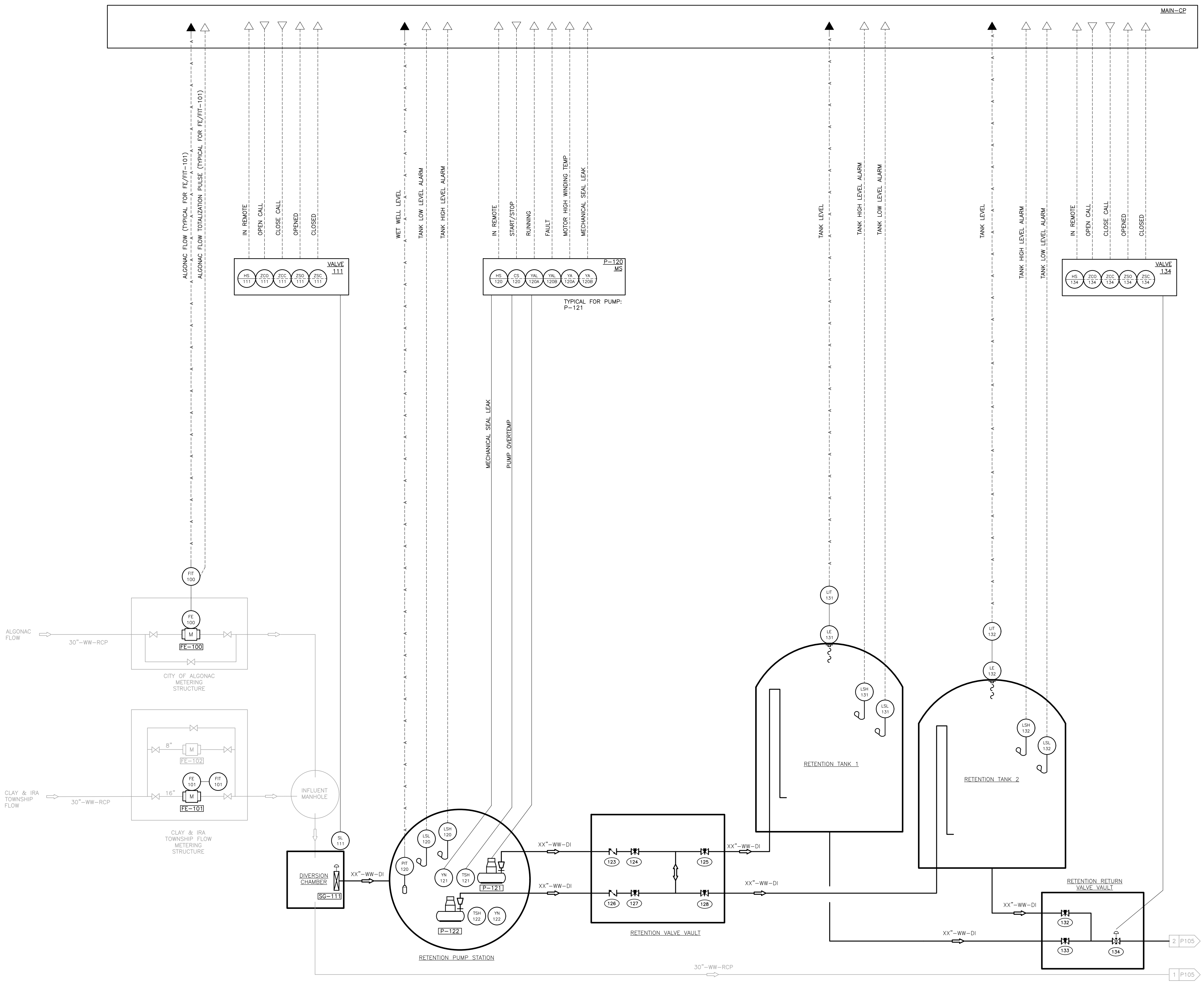
**P103**

## NOTES

1. NOTE TEXT HERE...

## KEY NOTES

1. KEY NOTE TEXT HERE...




INFLUENT FLOW AND RETENTION TANK

# FLOW SCHEMATIC AND P&ID

NO SCALE

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| 5/29/2026 | 30% PEER REVIEW |

| | |
|---|---|
| Drawn By | ZKIRSCHMAN |
| Designer | ZKIRSCHMAN |
| Reviewer | JREDNER |
| Manager | ERINS |

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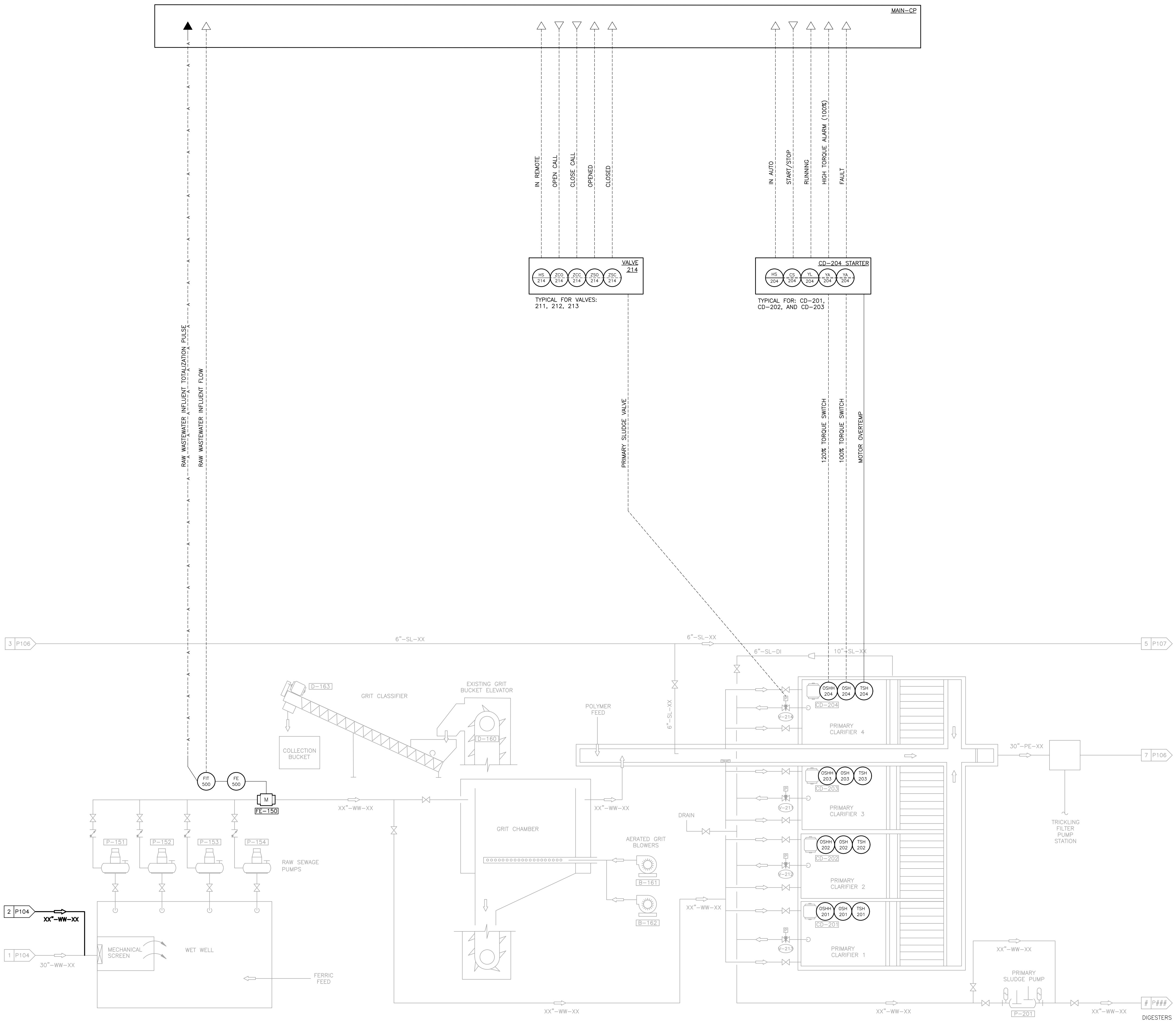
PROJECT NO.
241369

SHEET NO.
**P104**



PLOT INFO: Z:\2024\241369\CAD\CDP104241369.DWG LAYOUT: P104 DATE: 6/12/2026 TIME: 10:42:59 AM USER: JKING




PRELIMINARY AND PRIMARY TREATMENT
# FLOW SCHEMATIC AND P&ID
NO SCALE

## SYMBOL LEGEND

## NOTES

1. NOTE TEXT HERE...

## KEY NOTES

1. KEY NOTE TEXT HERE...

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| 5/29/2026 | 30% PEER REVIEW |

| | |
|---|---|
| Drawn By | ZKIRSCHMAN |
| Designer | ZKIRSCHMAN |
| Reviewer | JREDNER |
| Manager | ERINS |

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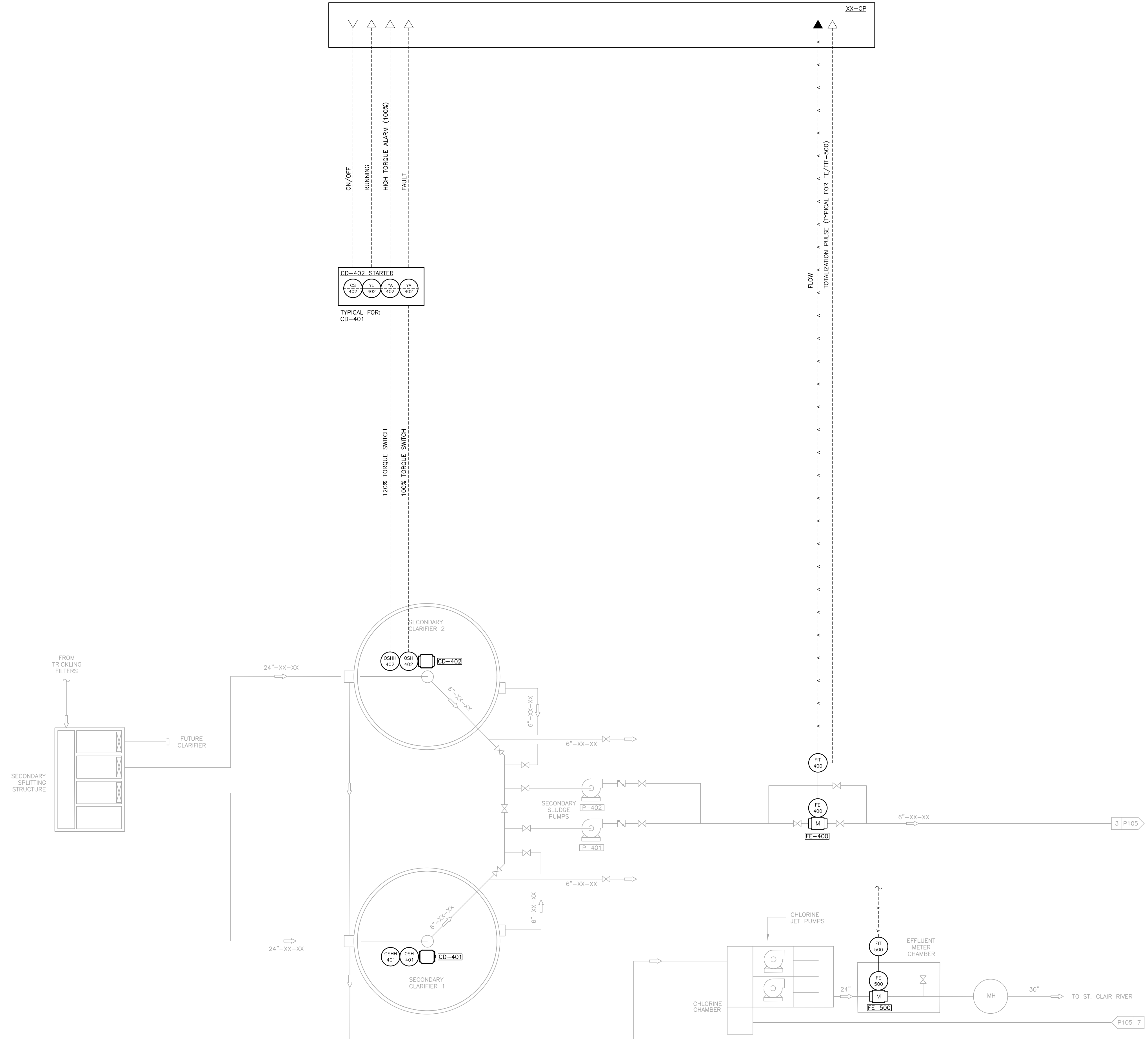
PROJECT NO.
241369

SHEET NO.
**P105**



PLOT INFO: Z:\2024\241369\CAD\CD\P105241369.DWG LAYOUT: P105 DATE: 6/12/2026 TIME: 10:11:16 AM USER: JKING




SECONDARY CLARIFIER
## FLOW SCHEMATIC AND P&ID
NO SCALE

### NOTES
1. NOTE TEXT HERE...

### KEY NOTES
1. KEY NOTE TEXT HERE...

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REVISIONS

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|---|---|
| 6/9/2026 | 30% PRELIMINARY DESIGN |
| 5/29/2026 | 30% PEER REVIEW |

Drawn By
Designer
Reviewer
Manager ERINS

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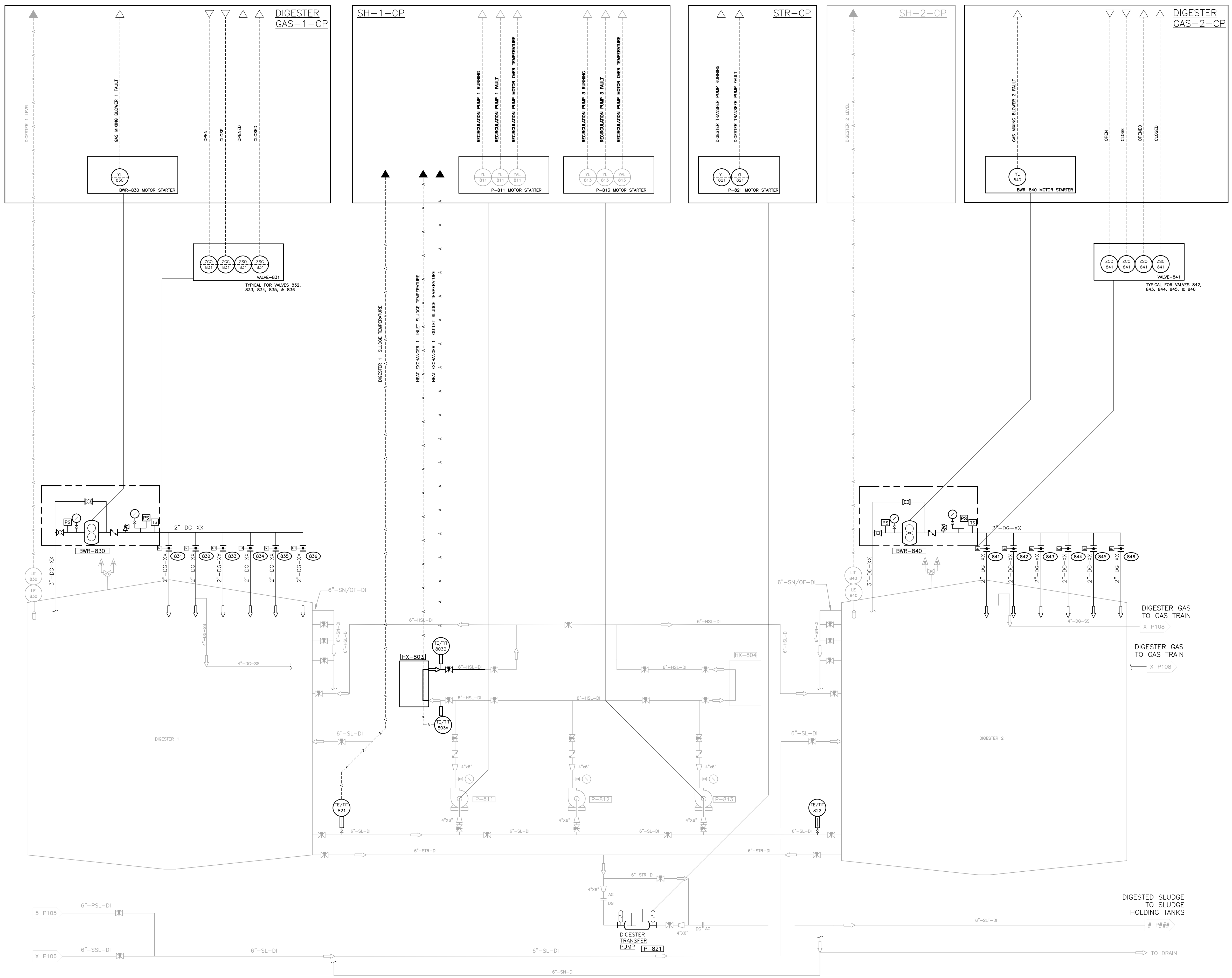
PROJECT NO.
241369

SHEET NO.
**P106**



PLOT INFO: Z:\2024\241369\CAD\CD\P105241369.DWG LAYOUT: P106 DATE: 6/12/2026 TIME: 10:11:16 AM USER: JKING




DIGESTERS
# FLOW SCHEMATIC AND P&ID
NO SCALE

SYMBOL LEGEND

NOTES

1. NOTE TEXT HERE...

KEY NOTES

1. KEY NOTE TEXT HERE...

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St. Clair County, Michigan
St. Clair County-Algonac WWTP Improvements

REVISIONS

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|---|---|
| 6/9/2026 | 30% PRELIMINARY DESIGN |
| 5/29/2026 | 30% PEER REVIEW |

| | |
|---|---|
| Drawn By | EEDWARDS |
| Designer | EEDWARDS |
| Reviewer | JREDNER |
| Manager | ERINS |

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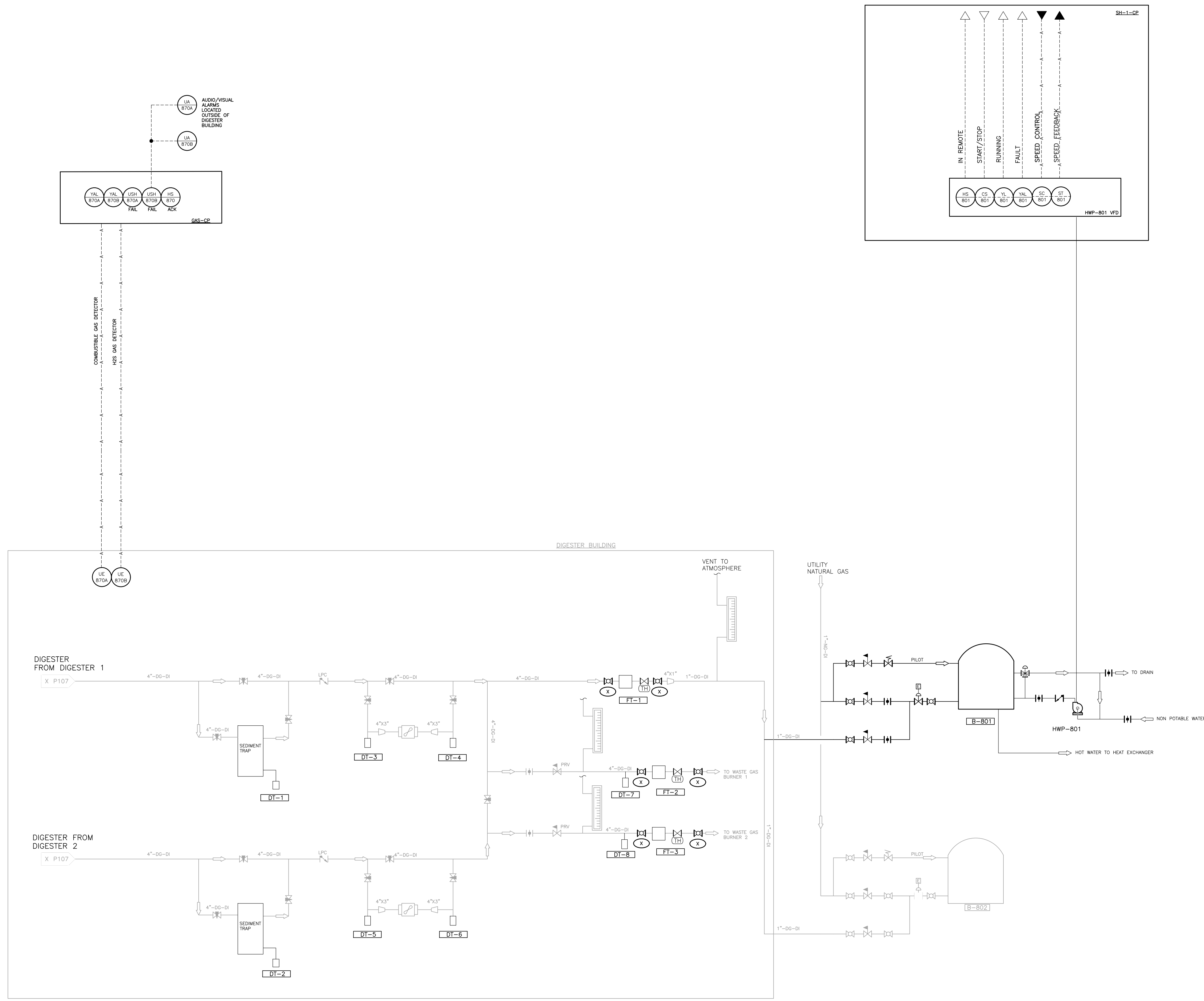
PROJECT NO.
241369

SHEET NO.
**P107**



PLOT INFO: Z:\2024\241369\CAD\CD\P107241369.DWG LAYOUT: P107 DATE: 6/12/2026 TIME: 10:11:17 AM USER: JKING




DIGESTER GAS
## FLOW SCHEMATIC AND P&ID
NO SCALE

SYMBOL LEGEND

NOTES

1. NOTE TEXT HERE...

KEY NOTES

1. KEY NOTE TEXT HERE...

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St. Clair County, Michigan
St. Clair County-Algonac WWTP Improvements

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|---|---|
| Drawn By | EEDWARDS |
| Designer | EEDWARDS |
| Reviewer | JREDNER |
| Manager | ERINS |

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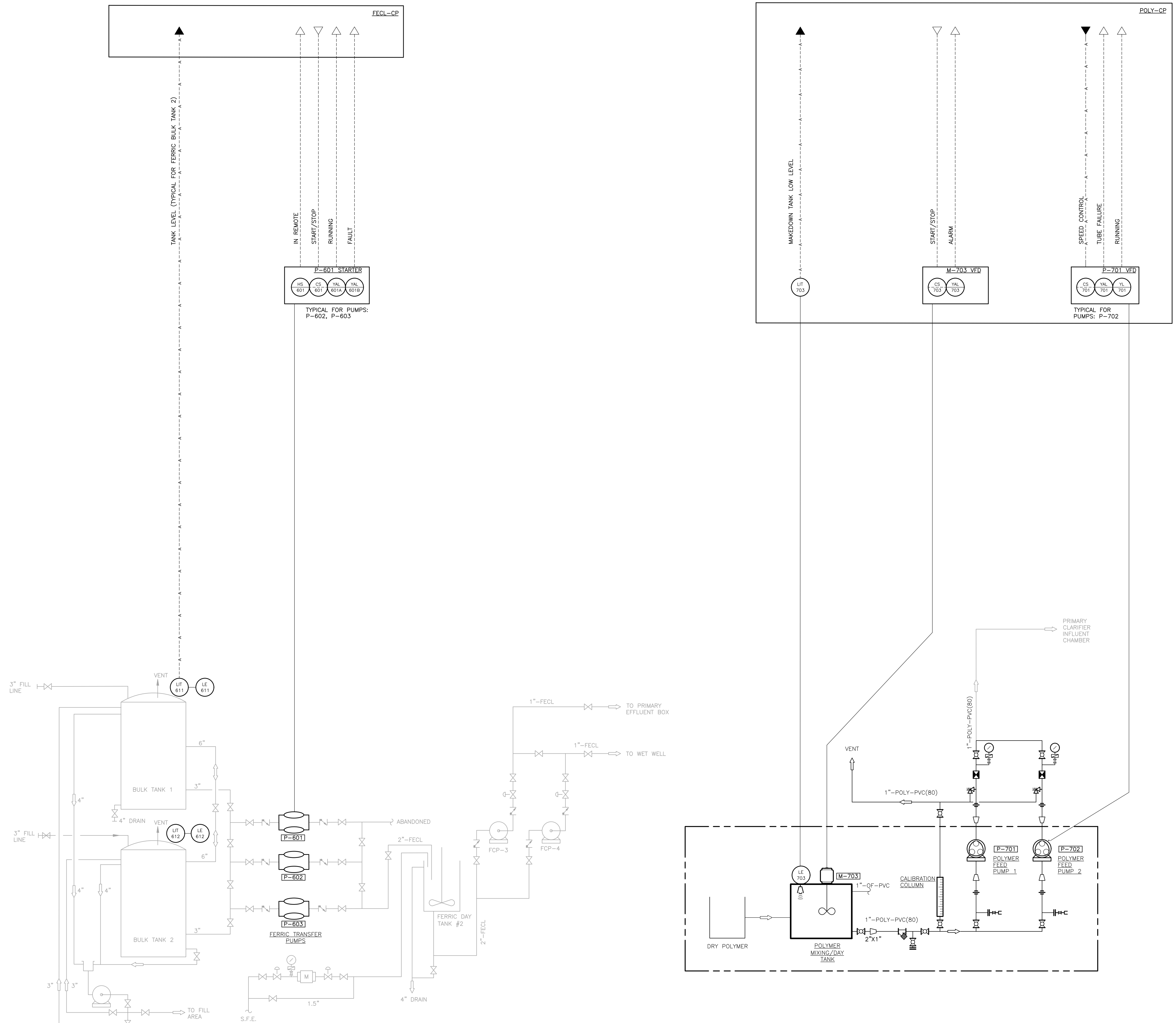
PROJECT NO.
241369

SHEET NO.
**P108**



PLOT INFO: Z:\2024\241369\CAD\CD\P107241369.DWG LAYOUT: P108 DATE: 6/12/2026 TIME: 10:11:18 AM USER: JKING




CHEMICAL SYSTEMS
## FLOW SCHEMATIC AND P&ID
NO SCALE

SYMBOL LEGEND

NOTES

1. NOTE TEXT HERE...

KEY NOTES

1. KEY NOTE TEXT HERE...

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St. Clair County, Michigan

St. Clair County-Algonac WWTP Improvements

REVISIONS

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| 5/29/2026 | 30% PEER REVIEW |

| | |
|---|---|
| Drawn By | ZKIRSCHMAN |
| Designer | ZKIRSCHMAN |
| Reviewer | JREDNER |
| Manager | ERINS |

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PROJECT NO.
241369

SHEET NO.
**P109**



PLOT INFO: Z:\2024\241369\CAD\CD\P109241369.DWG LAYOUT: P109 DATE: 6/12/2026 TIME: 10:11:19 AM USER: JKING

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# Appendix

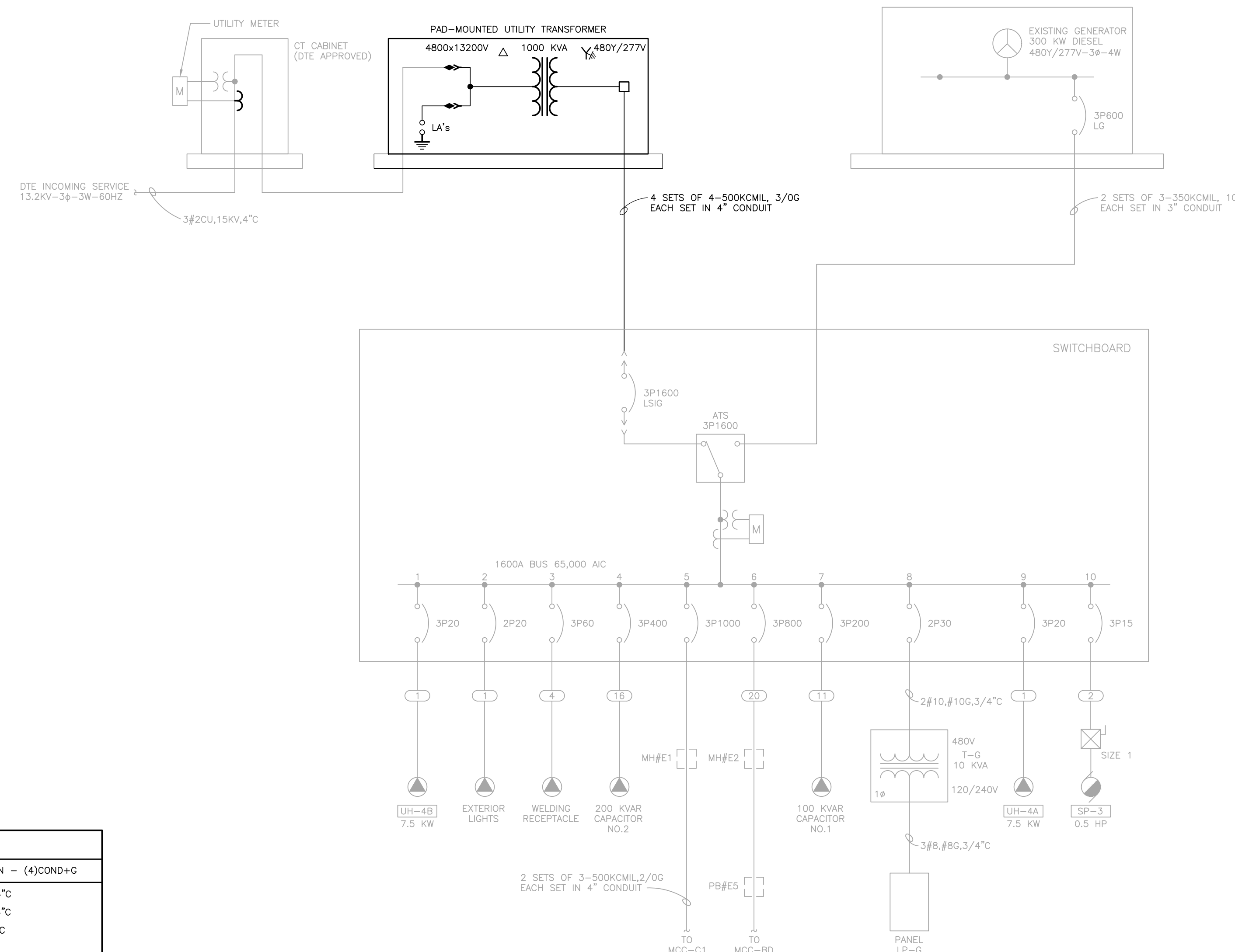
# 3

## NOTES

1. EQUIPMENT, CONDUIT, AND LOADS IN LIGHTER LINE WEIGHTS ARE EXISTING, UNLESS NOTED OTHERWISE.

## KEY NOTES

1. KEY NOTE TEXT HERE...




## ONE LINE DIAGRAM

4800V; 480Y/277V-3ø-4W

### ONE LINE FEEDER LEGEND

| TAG | DESCRIPTION – (3)COND+G | TAG | DESCRIPTION – (4)COND+G |
|---|---|---|---|
| 1 | 3#12,#12G,3/4"C | 1N | 4#12,#12G,3/4"C |
| 2 | 3#10,#10G,3/4"C | 2N | 4#10,#10G,3/4"C |
| 3 | 3#8,#10G,3/4"C | 3N | 4#8,#10G,3/4"C |
| 4 | 3#6,#10G,1"C | 4N | 4#6,#10G,1"C |
| 5 | 3#4,#8G,1 1/4"C | 5N | 4#4,#8G,1 1/4"C |
| 6 | 3#3,#8G,1 1/4"C | 6N | 4#3,#8G,1 1/2"C |
| 7 | 3#2,#6G,1 1/2"C | 7N | 4#2,#8G,1 1/2"C |
| 8 | 3#1,#6G,2"C | 8N | 4#1,#6G,2"C |
| 9 | 3-1/0,#6G,2"C | 9N | 4-1/0,#6G,2"C |
| 10 | 3-2/0,#6G,2"C | 10N | 4-2/0,#6G,2"C |
| 11 | 3-3/0,#6G,2 1/2"C | 11N | 4-3/0,#6G,2 1/2"C |
| 12 | 3-4/0,#4G,2 1/2"C | 12N | 4-4/0,#6G,2 1/2"C |
| 13 | 3-250kcmil,#4G,3"C | 13N | 4-250kcmil,#4G,3"C |
| 14 | 3-300kcmil,#4G,3"C | 14N | 4-300kcmil,#4G,3"C |
| 15 | 3-350kcmil,#4G,3"C | 15N | 4-350kcmil,#4G,4"C |
| 16 | 3-500kcmil,#3G,4"C | 16N | 4-400kcmil,#4G,4"C |
| 17 | (2)3-250kcmil,#2G,3"C | 17N | 4-500kcmil,#3G,4"C |
| 18 | (2)3-350kcmil,#1G,3"C | 18N | 4-600kcmil,#3G,4"C |
| 19 | (2)3-400kcmil,1/0G,4"C | 19N | (2)4-300kcmil,#2G,3"C |
| 20 | (2)3-500kcmil,1/0G,4"C | 20N | (2)4-400kcmil,#1G,4"C |
| 21 | (3)3-400kcmil,2/0G,4"C | 21N | (2)4-500kcmil,1/0G,4"C |
| 22 | (4)3-350kcmil,3/0G,4"C | 22N | (2)4-600kcmil,1/0G,4"C |
| 23 | (4)3-500kcmil,4/0G,4"C | 23N | (3)4-500kcmil,2/0G,4"C |
| 24 | (5)3-400kcmil,4/0G,4"C | 24N | (4)4-400kcmil,3/0G,4"C |
| 25 | (6)3-400kcmil,250kcmil G,4"C | 25N | (4)4-600kcmil,4/0G,4"C |
| 26 | (7)3-500kcmil,350kcmil G,4"C | 26N | (6)4-350kcmil,4/0G,4"C |
| 27 | (8)3-500kcmil,400kcmil G,4"C | 27N | (6)4-500kcmil,250kcmil G,4"C |
| | | 28N | (7)4-600kcmil,350kcmil G,4"C |
| | | 29N | (8)4-600kcmil,400kcmil G,4"C |

PLOT INFO: Z:\2024\241369\CAD\CD\E401241369.DWG LAYOUT: E401 DATE: 6/9/2026 TIME: 3:27:39 PM USER: TDWYER

fishbeck
Engineers | Architects | Scientists | Constructors

# Southwater MUA
St. Clair County, Michigan

St. Clair County-Algonac WWTP Improvements

REVISIONS

NOT FOR CONSTRUCTION

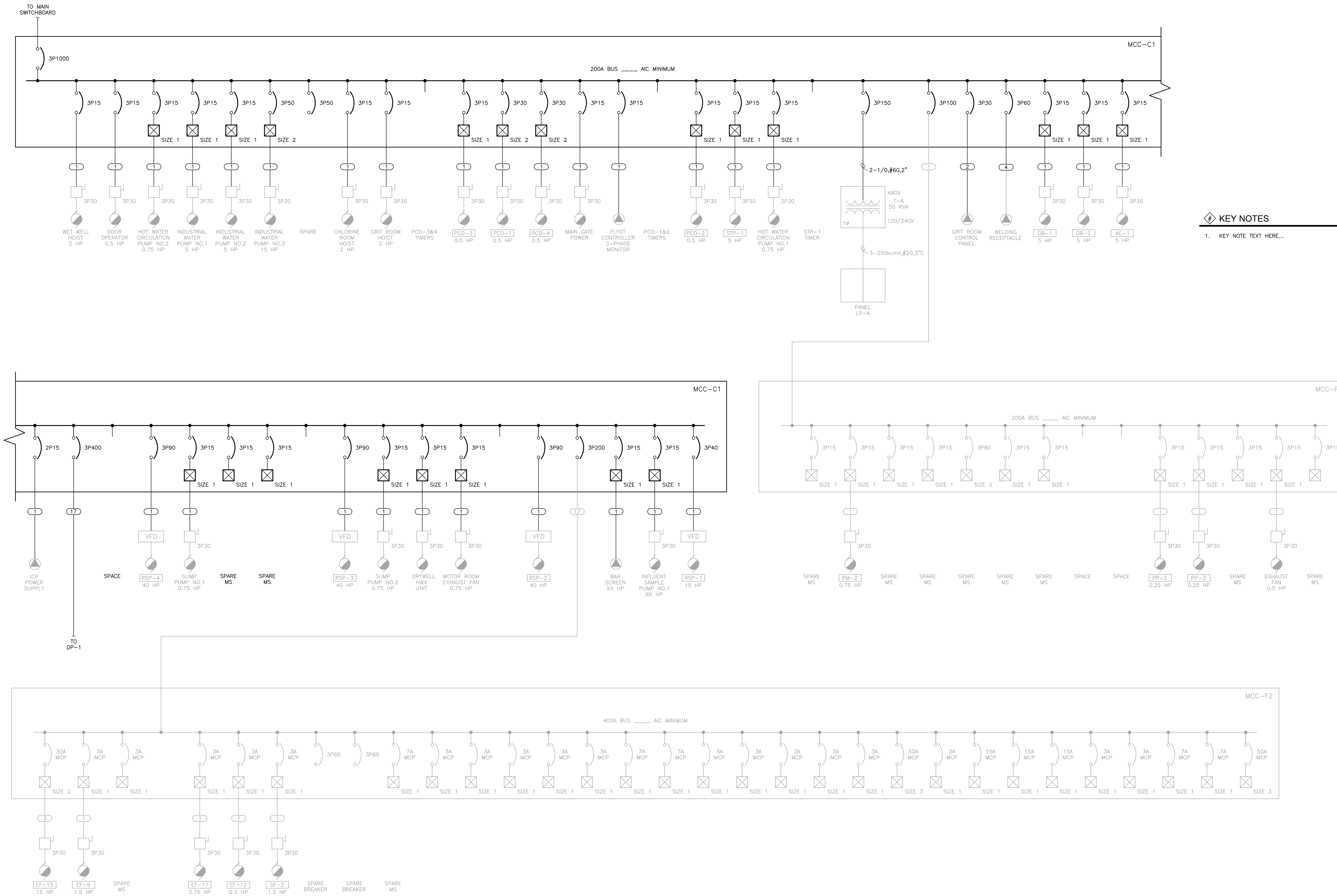
| | |
|---|---|
| 6/9/2026 | 30% PRELIMINARY DESIGN |
| 5/29/2026 | 30% PEER REVIEW |

| | |
|---|---|
| Drawn By | TDWYER |
| Designer | TDWYER |
| Reviewer | |
| Manager | ERINS |

Hard copy is intended to be 24"x36" when plotted. Scale(s) indicated and graphic quality may not be accurate for any other size.

PROJECT NO.
241369

SHEET NO.
# E401




## ONE LINE DIAGRAM

480V-3ø-3W; 120/240V-3ø-3W

## NOTES

1. EQUIPMENT, CONDUIT, AND LOADS IN LIGHTER LINE WEIGHTS ARE EXISTING, UNLESS NOTED OTHERWISE.

## KEY NOTES

1. KEY NOTE TEXT HERE...

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# Southwater MUA

St. Clair County, Michigan

St. Clair County-Algonac WWTP Improvements

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| | |
|---|---|
| Drawn By | TDWYER |
| Designer | TDWYER |
| Reviewer | |
| Manager | ERINS |

Hard copy is intended to be 24"x36" when plotted. Scale(s) indicated and graphic quality may not be accurate for any other size.

PROJECT NO.

241369

SHEET NO.

# E402



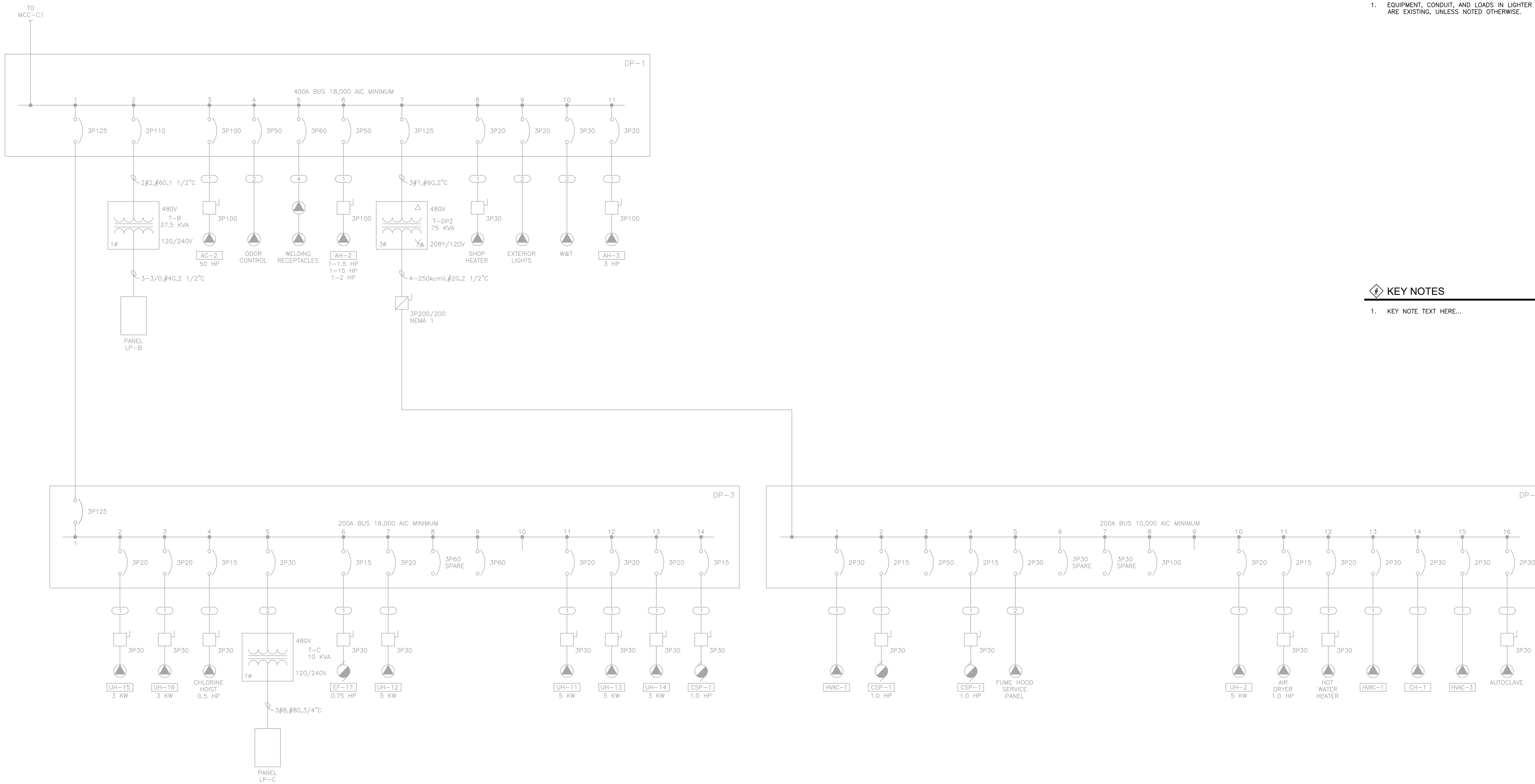
PLOT INFO: Z:\2024\241369\CAD\CD\E\241369.DWG LAYOUT: E402 DATE: 6/9/2026 TIME: 3:27:27 PM USER: TDWYER

## NOTES

1. EQUIPMENT, CONDUIT, AND LOADS IN LIGHTER LINE WEIGHTS ARE EXISTING, UNLESS NOTED OTHERWISE.

## KEY NOTES

1. KEY NOTE TEXT HERE...




# ONE LINE DIAGRAM

480V-3Ø-3W; 120/240V-3Ø-3W

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Engineers | Architects | Scientists | Constructors

# Southwater MUA

St. Clair County, Michigan

St. Clair County-Algonac WWTP Improvements

REVISIONS

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| | |
|---|---|
| 6/9/2026 | 30% PRELIMINARY DESIGN |
| 5/29/2026 | 30% PEER REVIEW |

| | |
|---|---|
| Drawn By | TDWYER |
| Designer | TDWYER |
| Reviewer | |
| Manager | ERINS |

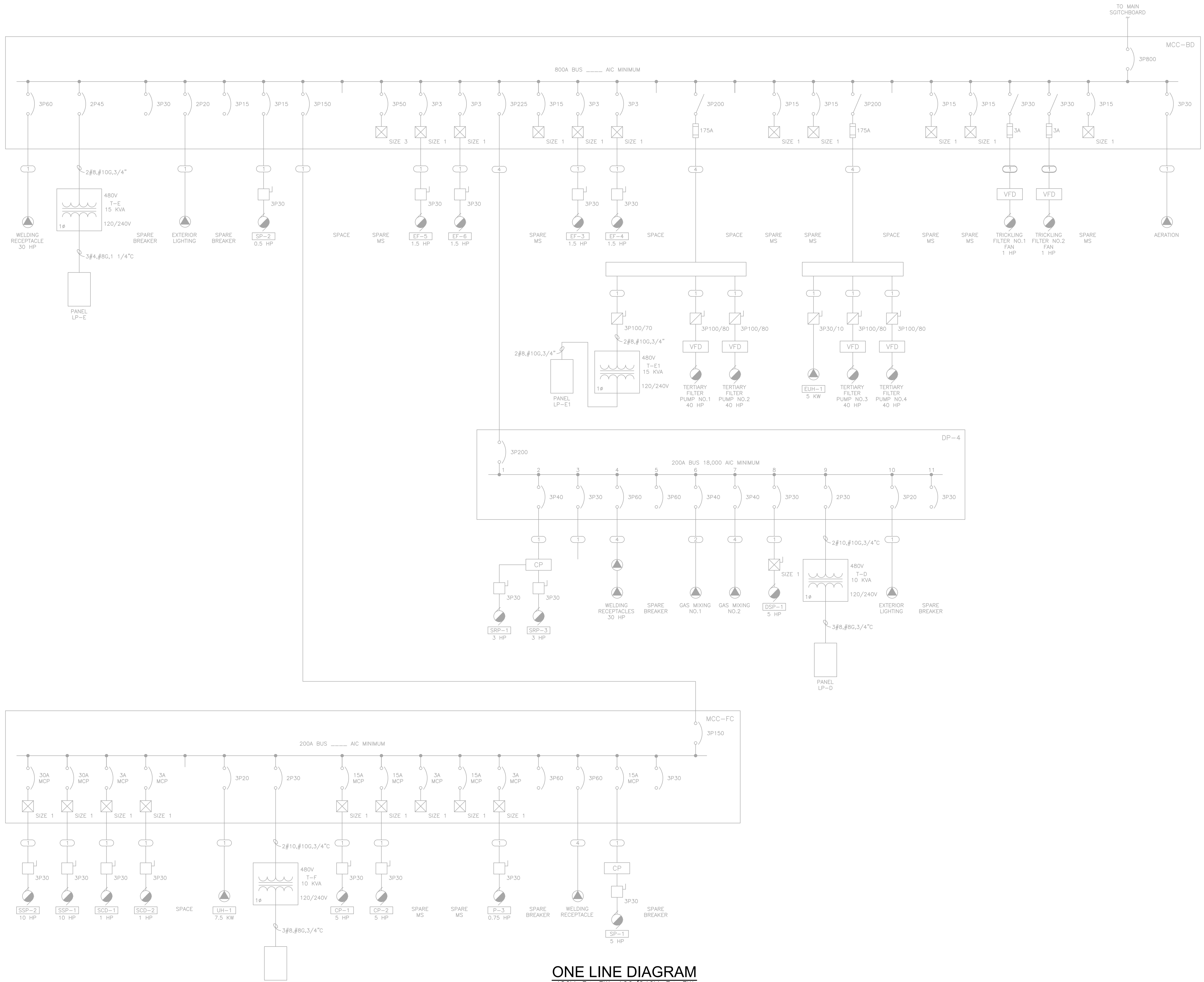
Hard copy is intended to be 24"x36" when plotted. Scale(s) indicated and graphic quality may not be accurate for any other size.

PROJECT NO.
241369

SHEET NO.
E403



PLOT INFO: Z:\2024\241369\CAD\CD\E401241369.DWG LAYOUT: E403 DATE: 6/9/2026 TIME: 3:27:14 PM USER: TDWYER




## ONE LINE DIAGRAM

480V–3ø–3W; 120/240V–3ø–3W

## NOTES

1. EQUIPMENT, CONDUIT, AND LOADS IN LIGHTER LINE WEIGHTS ARE EXISTING, UNLESS NOTED OTHERWISE.

## KEY NOTES

1. KEY NOTE TEXT HERE...

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# Southwater MUA

St. Clair County, Michigan

St. Clair County-Algonac WWTP Improvements

REVISIONS

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| | |
|---|---|
| 6/9/2026 | 30% PRELIMINARY DESIGN |
| 5/29/2026 | 30% PEER REVIEW |

| | |
|---|---|
| Drawn By | TDWYER |
| Designer | TDWYER |
| Reviewer | |
| Manager | ERINS |

Hard copy is intended to be 24"x36" when plotted. Scale(s) indicated and graphic quality may not be accurate for any other size.

PROJECT NO.
241369

SHEET NO.
E404



PLOT INFO: Z:\2024\241369\CAD\CD\E401241369.DWG LAYOUT: E404 DATE: 6/9/2026 TIME: 3:27:03 PM USER: TDWYER