



Water and Waste Department • Service des eaux et des déchets

**West End Sewage Treatment Plant (WEWPCC)
Effluent Monitoring Station
Process Controls Narrative
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1.0 PROCESS MONITORING

The WEWPCC Effluent Monitoring Station is designed to measure and record the volume of effluent discharged from the polishing ponds through a 750mm diameter effluent outfall pipeline. A 750mm diameter electromagnetic flow meter will be inserted into the outfall pipeline. It will record the volume of effluent discharged through the outfall pipeline and will transmit a signal to a control panel. The outfall will then pass over a concrete weir (which floods the electromagnetic flow meter) before leaving the Effluent Monitoring Station. The emitted effluent will then continue to gravity flow down the 750mm diameter outfall pipeline before flowing into a 1500mm diameter effluent outfall pipeline. The 1500mm diameter pipeline carries and discharges the effluent into the Assiniboine River north of the WEWPCC.

The new Effluent Monitoring Station building will also be used to City of Winnipeg laboratory personnel to collect daily samples (including a daily composite sample) of the effluent discharge. A gasketed floor hatch will be used to lower laboratory bottles on a roped tether into the effluent outfall to collect daily grab samples. A pumped effluent circulation loop will cycle the effluent from the flooded upstream section of the wet well past an ISOLOK pneumatic grab sampler located on the ground floor. This ISOLOK sampler will capture a volume of the effluent (25 cc's) every time the electromagnetic flow meter records a discharged volume that is user configurable from HMI (initially set at 200,000 liters). The ISOLOK sampler then gravity drains the captured sample into a container located within a small refrigerator beneath the ISOLOK sampler. The remaining effluent in the pumped circulation loop is discharged into the downstream section of the wet well. The system provides flow proportional sampling.

To keep the equipment from freezing in the winter season, the new Effluent Monitoring Station building will be equipped with a heated air handling unit to provide fresh tempered air to the building (ground floor and dry well) when occupied. A minimum heating temperature set point will be maintained during all un-manned conditions utilizing redundant electric unit heaters.

2.0 PROCESS UNIT COMPONENTS

The process control components are comprised of the following pieces of equipment:

- 1) Electromagnet Flow Meter Sensor and Transmitter:

Siemens Sitrans F M MAG 5100 W Flow Sensor with MAG6000 Transmitter.
Model: 7ME6580-7DL14-2JF2-ZY41
Sensor is fitted with Ebonite Hard Rubber liner for use in all water applications.
- 2) Effluent Circulation Loop Sample Pump:

Franklin Electric Self-Priming FBSE Centrifugal Pump
Model FBSE-50-S
0.37 kW (½ HP), 120V, 1 phase, 60 Hz
- 3) Effluent Circulation Loop Vacuum Priming Valve:

Valmatic Vacuum Priming Valve
Model: 38P
- 4) Effluent Circulation Loop Vacuum Pump:

Gast Vacuum Pump
Model: DOA-P703-FB
0.25 kW (1/3 HP), 120V, 1 phase, 60 Hz
- 5) Effluent Circulation Loop Automatic Sampler:

Sentry ISOLOK Series SAB Automatic Sampler
Model: SAB-25
120V, 1 phase, 60 Hz
Minimum compressed air requirements: 60 psig
- 6) Effluent Circulation Loop Automatic Sampler Control Panel:

Sentry SBC Automatic Sampler Controller
120V, 1 phase, 60 Hz
- 7) Effluent Circulation Loop Air Compressor:

Ingersoll Rand Oil-lubricated Twin-Stack Air Compressor
Model: P1IU-A9
1.5 kW (2 HP), 120V, 1 phase, 60 Hz
- 8) PLC:
Schneider Electric M340 PLC Platform c/w Profibus Network

- 9) HMI:
Schneider Electric Magelis Terminal
Model: XBTGT6330

- 10) Supply Fan:

Greenheck Belt Drive Centrifugal Inline Fan
Model: BSQ-90-4

- 11) Electric Duct Heater:

Price
Model: DF CI00H
16kW
208V, 3 phase, 60 Hz

- 12) Unit Heaters:

Ouellet Commercial Industrial Suspended Unit Heater
4 kW Model: OAS04038
208V, 3 phase, 60 Hz

500 W Model: OPX2A0502
120V, 1 phase, 60 Hz

- 13) Refrigerator:

Danby 4.4 cu. ft. capacity compact all fridge
Model: DAR482BLS
120V, 1 phase, 60 Hz

3.0 PARAMETERS MEASURED

The electromagnetic flow meter assesses real-time flow data to record the volume of effluent passed through the meter and transmits this information to the PLC. When the volume of effluent reaches a HMI selectable value, the PLC outputs a signal to the sampler control panel.

The flow switch within the effluent circulation loop monitors the flow of effluent through the circulation loop to provide confirmation of the operation of the circulation loop pump.

The ISOLOK automatic sampler compressed air system is monitored to provide confirmation of the operation of the ISOLOK sampler.

The building temperature and humidity levels are monitored to regulate the environment and control the operation of the air handling unit and unit heaters.

4.0 CONTROL STRATEGY

4.1 EFFLUENT CIRCULATION PUMP (P-Z004)

The effluent circulation pump is a self-priming pump that operates continuously in order to provide effluent to the ISOLOK sampler at all times. The flow in the circulation loop is monitored by flow switch FSL-Z0042 which has an adjustable deadband and delay setting. In the event of a low flow condition the effluent circulation pump will trip off and the pump will go through its normal startup procedure.

In the event that three successive low flow conditions occur in the span of 30 minutes the effluent circulation pump shall be locked out and a Priority 1 alarm generated in order for maintenance to investigate.

In order to start the effluent circulation pump, the effluent circulation pump must have a prime which is monitored by level switch LSL-Z0041.

4.2 VACUUM PUMP (P-Z005)

The vacuum pump operates to maintain a vacuum in order to prime the effluent circulation pump. When the vacuum is insufficient a vacuum pressure switch, PSH-Z0050, is activated which is used as the start for the vacuum pump. When the vacuum pressure switch is deactivated the vacuum pump is shut down.

In the event that the vacuum pressure switch is activated for a period greater than 15 minutes the vacuum pump shall be locked out and a Priority 2 alarm generated in order for maintenance to investigate.

4.3 SAMPLER (SA-Z006)

The sampler is used to take a 25 cc sample of the effluent once for every volume equal to a HMI configurable setpoint of effluent as measured by the magnetic flow meter FIT-Z0002. The totalized flow volume is a direct fieldbus variable from the magnetic flow meter. An established

effluent flow on the circulation line needs to be established, therefore a permissive for established flow for a minimum of 30 seconds is required to initiate the sample. The compressed air pressure to the sample control panel is monitored by a low pressure switch, PSL-Z5030 which is required to initiate a sample. The sample activation shall be delayed until these permissive conditions are met. Any delay in the sample shall not affect the overall proportionality of the sample to the flow.

In the event the permissives are not met for an extended period such that the next sample should be taken, the sample that has not yet been taken shall be skipped and a Priority 2 alarm (not a callout) event shall be generated. The alarm shall require a manual reset. Once the permissives are established only the current sample may be taken. Additional samples should not be taken as it will no longer be a representative sample.

4.4 HVAC CONTROLS

The effluent monitoring building light switch position shall be monitored by the PLC in order to determine if the building is in an occupied or un-occupied state.

4.4.1 Electric Unit Heaters (UH-Z606, UH-Z607 and HTR-Z608)

Two (2) electric unit heaters on the main floor and one (1) electric unit heater within the dry well maintain a minimum temperature set point within the effluent monitoring building. The unit heaters are controlled by independent adjustable thermostats for each unit heater which shall be set at 10°C.

4.4.2 Air Handling Unit (SF-Z604 and HCE-Z603)

A heating / cooling controller with an auto / manual mode shall control the air handling unit. In auto mode the controller shall transition to heating when the ambient room temperature is less than the occupied setpoint minus 3°C for 10 seconds. The controller shall transition to cooling when the ambient temperature is greater than 35°C for seconds. In manual mode the operator may select heating or cooling.

When the effluent monitoring building is in an occupied state the inlet air damper XV-Z6010 opens and after the open limit switch, ZSO-Z6010, proves the damper open the supply fan, SF-Z604, starts to supply fresh air to the building. If the open limit switch does not prove the damper open then a general alarm shall be generated.

In heating mode the discharge air temperature from the supply fan is heated via SCR control output, TY-Z6030, to maintain a minimum of 18°C as measured by the duct temperature transmitter TT-Z6030. In the event that the supply air is already above 18°C then the SCR output is zero. In cooling mode the SCR control output is zero.

On a call for ventilation the building relief damper, XV-Z6060 shall open to provide building relief. If the relief damper fails to prove open a general alarm shall be generated.

If the ambient building temperature measure by TT-Z6101 is in excess of 35°C then the air handling system is activated just like it was in an occupied state. Additionally, if the building high humidity switch is activated, and the humidity control is enabled from the HMI/PLC, then again the air handling system is active as if it were in an occupied state.

4.5 WET WELL SUMP (P-Z501)

Sump pump P-Z501 has a local float switch, LC-Z5010, used for starting and stopping the pump which discharges into the wet well.

5.0 SIGNIFICANT ALARMS

5.1 CONTROL STRATEGY ALARMS

These are alarms previously discussed within Section 4.0 - CONTROL STRATEGY and are summarized the table below.

Section	Alarm Description
4.1	P-Z004 Effluent Circulation Pump Low Flow Trip
4.2	P-Z005 Vacuum Pump Failure to Provide Vacuum
4.3	SA-Z006 Failure to Sample
4.4.2	XV-Z6010 Inlet Air Damper Fail to Open
4.4.2	XV-Z6060 Outlet Air Damper Fail to Open

5.2 HAND-OFF-REMOTE SWITCHES

The Hand-Off-Remote switch status for a piece of equipment shall be indicated on the HMI.

5.3 MOTOR CONTROLS

A general failed to start alarm shall be generated for any motor when the motor has been requested to start and a run status feedback is not received within 0.5 seconds.

A Priority 2 overload alarm shall be generated for any overload conditions as directly monitored from the discrete inputs.

5.4 WET WELL LEVEL (LAH-Z0007)

A Priority 1 alarm shall be initiated on high effluent level within the wet well.

5.5 DOOR STATUS ALARM (ZA-Z9801)

The door status contacts shall operate a Priority 1 alarm when either of the doors are opened for 5 minutes during normal working hours or either door opened during non-working hours.

5.6 BUILDING TEMPERATURE ALARMS (TALL-Z6101, TAL-Z6101 AND TAHH-Z6101)

A Priority 1 alarm (TALL-Z6101) shall be initiated if the building ambient temperature measured by TT-Z6101 is below 2°C. A Priority 1 alarm (TAHH-Z6101) shall be initiated if the building ambient temperature is above 40°C. A Priority 2 alarm (TAL-Z6101) shall be initiate if the building ambient temperature is below 6°C.

5.7 FILTER PLUGGED ALARM (PDAH-Z6020)

A Priority 3 alarm shall be initiated if the inlet air supply filter, FIL-Z602, has a high differential pressure as indicated by PDSH-Z6020.

5.8 DRY WELL HIGH LEVEL ALARM (LAH-Z0003)

A Priority 1 alarm shall be initiated if the dry well high level alarm contact is initiated.

5.9 MOTORIZED DAMPERS (XV-Z6010 & XV-Z6060)

In addition to the damper open limit switches for dampers XV-Z6010 and XV-Z6060, both dampers are equipped with close limit switches which shall operate a Priority 3 alarm if either damper fails to close after the air handling system is deactivated for 60 seconds.

5.10 MISCELLANEOUS ALARMS

Provide all other alarming as indicated within the functional requirements specifications (Document A-0103-AFRS-Z001).