

Exhibit E1 Instrumentation and Controls Detailed Field Notes

Instrumentation and Controls Evaluation

Black & Veatch visually inspected NEWRF instrumentation and controls during a site visit on Thursday, April 6, 2023. The information provided in this discussion includes a summary of field observations and input from operations staff regarding the presence and condition of the field instruments and control devices.

1. Plant Influent

The plant influent has measurements for flow, conductivity, and pH. The flow is measured by a flume flowmeter and the conductivity and pH by a Hach analyzer. The flume flowmeter is Siemens HydroRanger 200, which uses a level transducer Siemens EchoMax XPS to measure and transmit the plant influent flow to the SCADA.

The Siemens HydroRanger 200 transmitter is installed inside a stainless steel enclosure; the wiring is spliced and is not terminated at the device terminals. A power breaker, to interrupt service for safely performing maintenance tasks, is not available inside the enclosure. It is recommended to terminate the wiring at the device terminals and consider a power breaker addition. The Siemens HydroRanger 200 transmitter is shown in Figure 1.

The Siemens EchoMax XPS is installed correctly but the transmitter cable conduit is bent, and it does not end at the box where the controller is located. Half of the transmitter cable is tied to a handrail. The cable conduit should be repaired and should cover the length of the cable. The cable should not be exposed or tied to the handrail. The City staff commented that the transducers are calibrated yearly, and they have no issues to report. In addition, they have spares available in the Plant's stock. The Siemens EchoMax XPS is shown in Figure 2.



Figure 1 Plant Influent Flow Transmitter

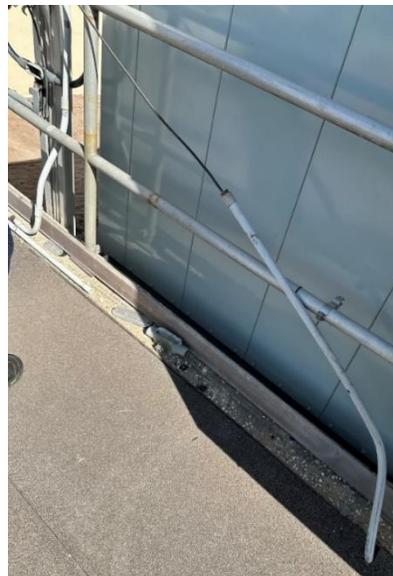


Figure 2 Level Transducer Cable and Conduit

The conductivity/pH analyzer is a Hach SC200 shown in Figure 3. The power was off during the visit on April 6, 2023. The sensor's cables are tangled around pipes and the cable from the digital gateway to the controller is damaged near the quick-connect fitting connection to the gateway. A visual of the cables is provided in Figure 4. The digital gateway is hanging outside the panel. The power issue must be solved as soon as possible because it affects the reliability of the device. The sensor's cables should be routed through conduits fixed to the wall. The cable with the quick-connect fitting should be replaced. The gateway should be tied inside the panel. The manufacturer recommends replacing the pH sensor probe every 12 to 18 months. In addition, the SCADA display is showing negative pH and conductivity values. Operators should be alarmed if values are negative.



Figure 3 Plant Influent Conductivity and pH



Figure 4 Quick-Fitting Connection Damaged

2. Plant and System Pressures

The plant pressure is measured by a Rosemount 3051 pressure transmitter. The Rosemount 3051 is shown in Figure 5. The device is in working condition and no issues were reported.



Figure 5 Plant Pressure Transmitter

The system pressure is measured by a Rosemount 1151 pressure transmitter; shown in Figure 6. The device is in working condition and no issues were reported. However, the model is discontinued, and replacement may be considered.



Figure 6 System Pressure Transmitter

3. Headworks Bar Screens Level

The headworks area has two ultrasonic level transducers and one level controller-transmitter per bar screen.

The controller-transmitters are Siemens HydroRanger 200 (Figure 7). The controllers are correctly installed and wired. However, the City staff commented that the analog signal with the measurement is not transmitted to the SCADA system. The 4-20 milliampere (mA) signals should be wired and added to the analog inputs of the bar screen programmable logic controller (PLC), and the measurements should be visible in the pretreatment display in SCADA.

The ultrasonic level transducers are Siemens model EchoMax XPS (Figure 8). The transducers are installed correctly but the transmitter cable should be routed through a conduit for protection. City staff commented that the transducers are calibrated yearly, and they have no issues to report. In addition, they have spares available in the Plant's stock.



Figure 7 Bar Screens Level Controller-Transmitter

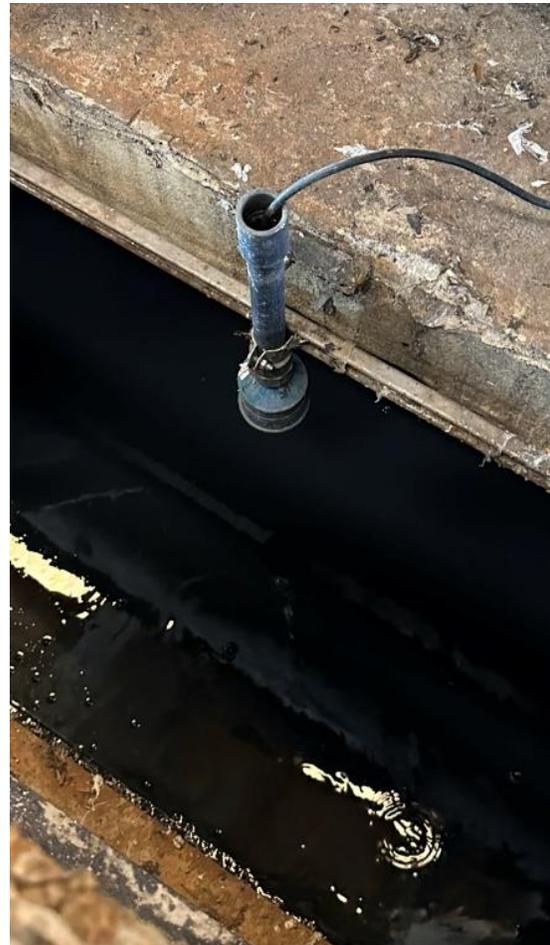


Figure 8 Bar Screen 1 Influent Level Transducer

4. Oxidation Reactors

The oxidation reactors area covers the oxidation reactor channels, screw pump channel, internal recycle pump station, first anoxic tanks, and fermentation tanks.

The oxidation reactor channels are divided into east and west. Each side has an internal recycle channel flume flow indicator: 1) a transmitter with an ultrasonic level transducer and a dissolved oxygen analyzer, and 2) a transmitter with two measuring probes.

The signals from the two flow transmitters are tagged in the supervisory control and data acquisition (SCADA) display as FM-227 (east) and FM-228 (west). The signals from the dissolved oxygen (DO) analyzers are tagged as DO-202 (west), DO-203 (west), DO-204 (east), and DO-205 (east). However, the instruments have not been tagged on-site.

The flume flow transmitters are Siemens Milltronics HydroRanger. The transmitters are in working condition. However, the model is discontinued, and the devices look like they have been in service for more than 10 years, increasing the probability of failure. The east flow transmitter (Figure 9) is installed inside a fiberglass enclosure that is deteriorated because of direct sunlight and the exposed fibers. The enclosure door has no clear window and needs to be opened to observe the measurement. The enclosure has no power breaker to interrupt service to perform maintenance and no transient surge protector for power or field signal. The west flow transmitter (Figure 10) is installed inside a stainless steel enclosure. Although it is dirty inside and the conduit opens should be sealed, the enclosure is still in good condition. The enclosure door has no clear window and needs to be opened to observe the measurement. The field signal and the power are protected by transient surge protectors and the wiring is correctly terminated. However, the enclosure has no power breaker, and both transient surge protectors are discontinued, obsolete, and in need of replacement. It is recommended to replace both transmitters with a newer model like Siemens SITRANS LUT400 as well as both panels. The replacement installation shall consider the addition of transient surge protectors and power breakers.

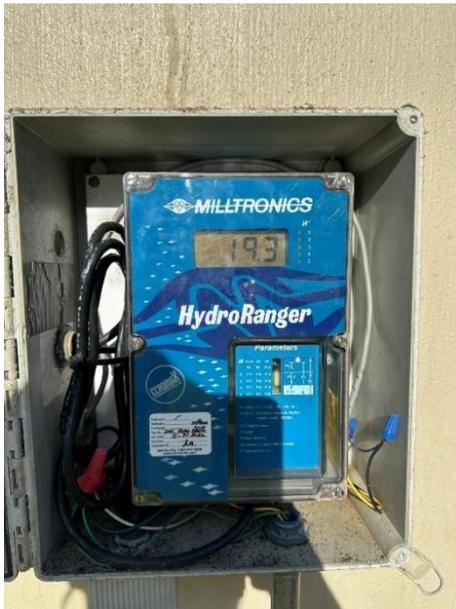


Figure 9 East Flow Transmitter



Figure 10 West Flow Transmitter

The ultrasonic level transducers are Siemens Model EchoMax® XPS. The transducers are installed in the mechanical structure of a gate, which is a not-fixed structure. City staff commented that the gate is

never operated, the transducers are calibrated yearly, and they have no issues to report. In addition, they have spares available in the Plant's stock.

The DO analyzers are Hach SC200 with two DO probes Hach LDO SC Model 2 (Figure 11, Figure 12). The City staff commented that these instruments are reliable, and they have no issues to report. Staff should follow the manufacturer's recommendation of replacing the DO probe cap every 2 years. Spares should be available in the Plant's stock.



Figure 11 West DO Analyzer

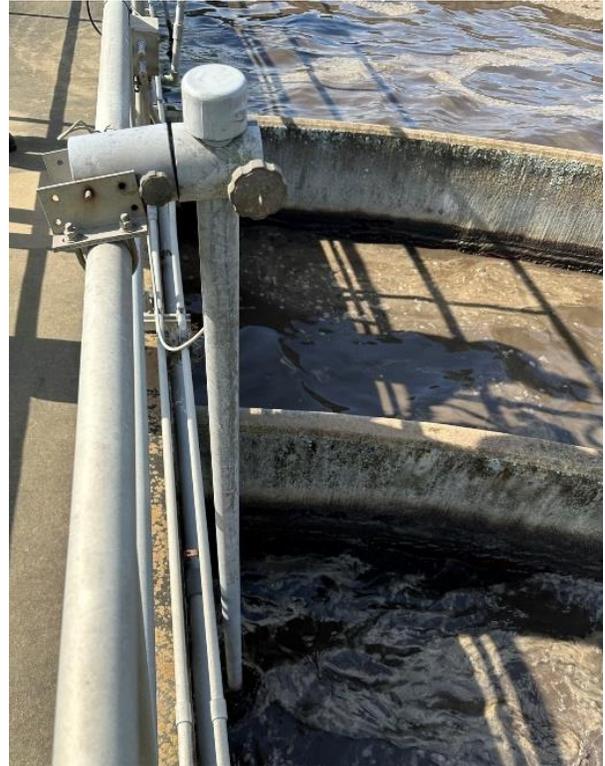


Figure 12 West DO Probe Installation

The screw pump channel has a submersible pressure transducer Contegra SLX to measure the water column and a precision digital display to indicate and transmit the channel level (Figure 13, Figure 14). The precision digital is protected by a transient surge protector. The surge protector enclosure color has faded because of sunlight exposure. No local power breaker was found on-site. City staff commented that these instruments are reliable, and they have no issues to report.



Figure 13 LIT 100 Installation



Figure 14 LIT 100 Transmitter

The Internal Recycle Pump Station Tank 1 level is measured by a Siemens Milltronics HydroRanger level controller-transmitter (Figure 15, Figure 16) with a Siemens EchoMax XPS ultrasonic level transducer. The devices are in working condition. The controller-transmitters model is discontinued and is installed inside a fiberglass enclosure that is deteriorated because of direct sunlight and the exposed fibers. Replacement for a newer stainless-steel enclosure with a clear window and a newer controller-transmitter model like Siemens SITRANS LUT400 should be considered. The Siemens EchoMax XPS is installed inside a box that has a rusty interior and needs replacement.



Figure 15 Internal Recycle Pump Station Tank 1 Level Transmitter



Figure 16 Internal Recycle Pump Station Tank 1 Level Transmitter Enclosure

The Internal Recycle Pump Station Tank 2 level is measured by a Siemens Milltronics HydroRanger level controller-transmitter with a Siemens EchoMax XPS ultrasonic level transducer. The controller-transmitter is transmitting the measurement to SCADA, but the display does not work, and the device has lost its cover (Figure 17). The controller-transmitters model is discontinued and is installed inside a fiberglass enclosure that is deteriorated because of direct sunlight and the exposed fibers. Replacement for a newer stainless-steel enclosure with a clear window and a newer controller-transmitter model like Siemens SITRANS LUT400 should be considered. The Siemens EchoMax XPS is installed inside a box that has a rusty interior and needs replacement (Figure 18).



Figure 17 Internal Recycle PS Tank 2 Level Transmitter



Figure 18 Internal Recycle PS Tank 2 Level Transducer

5. Secondary Clarifiers

The TSS and the DO are measured at the south and north clarifiers by a Cerlic BB2 analyzer. The devices are in working condition and no issues were reported.

The sludge blanket level is measured at each one of the eight secondary clarifiers by an interface level analyzer from Analytical Technology, Inc., called EchoSmart Sludge Blanket Monitoring (Figure 19, Figure 20). The devices are in working condition and no issues were reported.



Figure 19 Clarifiers Sludge Blanket Level Analyzer



Figure 20 Clarifiers Sludge Blanket Level Transducer

6. Sand Filters Level

The level of each sand filter is measured by a Siemens Milltronics HydroRanger level controller-transmitter with a Siemens EchoMax XPS ultrasonic level transducer (Figure 21, Figure 22). The devices are in working condition and no issues were reported. However, the controller-transmitters model is discontinued. Replacement for a newer model such as Siemens SITRANS LUT400 may be considered.



Figure 21 Sand Filter 1 Level Transmitter



Figure 22 Sand Filter 2 Level Transmitter

7. Disinfection Tanks Level

The Hypochlorite Tank 1 level is measured by a Siemens Milltronics HydroRanger level controller-transmitter with a Siemens EchoMax XPS ultrasonic level transducer (Figure 23). The devices are in working condition and no issues were reported. However, the controller-transmitter model is discontinued. Replacement for a newer model like Siemens SITRANS LUT400 may be considered.

The Hypochlorite Tank 2 level is measured by a previous version of the Siemens HydroRanger 200 level controller-transmitter with a Siemens EchoMax XPS ultrasonic level transducer (Figure 24). The devices are in working condition and no issues were reported. However, the controller-transmitter model is discontinued. Replacement for a newer model like Siemens SITRANS LUT400 may be considered.



Figure 23 Hypochlorite Tank 1 Level Controller-Transmitter



Figure 24 Hypochlorite Tank 2 Level Controller-Transmitter

The sodium bisulfate tank level is measured by a Siemens Milltronics HydroRanger level controller-transmitter with a Siemens EchoMax XPS ultrasonic level transducer (Figure 25). The devices are in working condition and no issues were reported. However, the controller-transmitter model is discontinued. Replacement for a newer model like Siemens SITRANS LUT400 may be considered.



Figure 25 Sodium Bisulfate Tank Level Controller-Transmitter

8. Contact Chambers

Each contact chamber effluent flow is measured by flume flowmeters, which are a previous version of the Siemens HydroRanger 200 level controller-transmitter with a Siemens EchoMax XPS ultrasonic level transducer (Figure 26, Figure 27). The devices are in working condition and no issues were reported. However, the controller-transmitters model is discontinued, and they are installed inside a fiberglass enclosure that is deteriorated because of direct sunlight and the exposed fibers. Replacement for a newer stainless steel enclosure with a clear window and a newer controller-transmitter model such as Siemens SITRANS LUT400 should be considered.



Figure 26 South Chamber Effluent Flowmeter



Figure 27 South Chamber Effluent Level Transducer

Each wetwell level is measured by a Siemens SITRANS LUT400 level controller-transmitter with a Siemens EchoMax XPS ultrasonic level transducer (Figure 28, Figure 29). The devices are in working condition and no issues were reported; however, they are installed inside a fiberglass enclosure that is deteriorated because of direct sunlight to the exposed fibers. Replacement for a newer stainless-steel enclosure with a clear window should be considered.



Figure 28 North Wetwell Level Controller-Transmitter Enclosure



Figure 29 North Wetwell Level Controller-Transmitter

Chlorine residual, pH, and sodium bisulfate are measured at the effluent.

The pH in the south chamber is measured by a Hach SC200 (Figure 30). The device is in working condition and no issues were reported. According to manufacturer recommendations, the pH sensor probe should be replaced every 12 to 18 months.

The chlorine residual in the south chamber is measured by a ProMinent® Dulcometer D1Cb (Figure 31). The device is in working condition and no issues were reported. The manufacturer recommends replacing the pH sensor probe every 12 to 18 months.

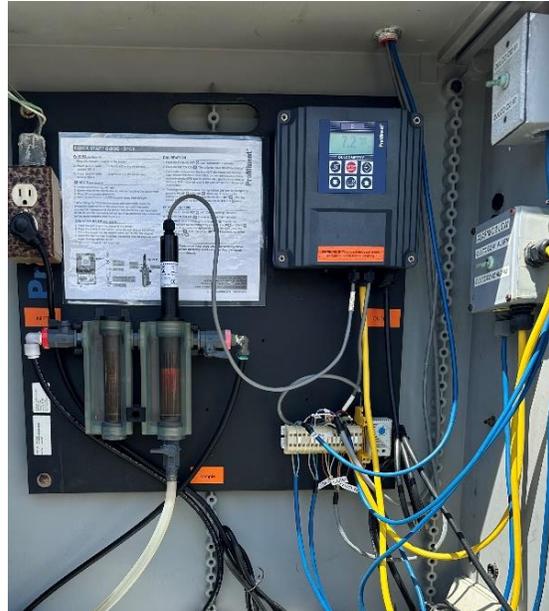


Figure 30 South Contact Chamber pH Analyzer **Figure 31** South Contact Chamber Cl₂ Analyzer

The pH and the chlorine residual in the north chamber are measured by a ProMinent diaLog DACb (Figure 32). The device is in working condition and no issues were reported. The manufacturer recommends replacing the pH sensor probe every 12 to 18 months.



Figure 32 North Contact Chamber pH and Cl₂ Analyzer

The sodium bisulfate is measured by a ProMinent Dulcometer D1Cb (Figure 33). The device is in working condition and no issues were reported.



Figure 33 Effluent Sodium Bisulfate Analyzer

9. Final Pump House

The wetwell level at the South and the North Final Pump House are measured each by a previous version of the Siemens HydroRanger 200 level controller-transmitter with a Siemens EchoMax XPS ultrasonic level transducer (Figure 34). The devices are in working condition and no issues were reported. However, the controller-transmitters model is discontinued, and they are installed inside a fiberglass enclosure that is deteriorated because of direct sunlight and the exposed fibers. Replacement for a newer stainless steel enclosure with a clear window and a newer controller-transmitter model like Siemens SITRANS LUT400 should be considered.



Figure 34 South Wetwell Final Pump House Level Transmitter

The total suspended solids (TSS) are measured at each pump house by a Cerlic BB2 analyzer (Figure 35). The devices are in working condition and no issues were reported.



Figure 35 South Final Pump House TSS Transmitter

10. Thioguard Tank

The Thioguard tank level is measured by a Milltronics HydroRanger level controller-transmitter with a Siemens EchoMax XPS ultrasonic level transducer (Figure 36). The transmitter's power was off during the site visit, but City staff reported that it is in working condition. The model is discontinued, and the device looks like it has been in service for more than 10 years, increasing the probability of failure. It is recommended to replace the transmitter with a newer model such as Siemens SITRANS LUT400. The Siemens EchoMax XPS installation is correct (Figure 37), and it is reported as in working condition, without any issues. In addition, spares are available in the Plant's stock.



Figure 36 Thioguard Tank Level Transmitter



Figure 37 Thioguard Tank Level Transducer

11. Waste Activated Sludge Flow

The waste activated sludge (WAS) flow is measured outside the Digesters Building by two flowmeters tagged as FIT-100 and two other flowmeters tagged as FIT-500 (Figure 38, Figure 39).

A new Rosemount 8750 electromagnetic flowmeter and Rosemount 8712 flow indicator-transmitter for the WAS diversion were in the installation process at the time of the site visit.



Figure 38 Flow Indicator-Transmitter
WAS Diversion Flow



Figure 39 Electromagnetic Flowmeter WAS
Diversion Flow

In the WAS flow line are in service an UniMag DT electromagnetic flowmeter and an Advanced Flow Technology 441e flow indicator-transmitter (Figure 40, Figure 41). The devices are in working condition, but they have been in service for more than 10 years and look deteriorated. Their replacement should be considered.



Figure 40 WAS Flow Indicator-Transmitter



Figure 41 WAS Flow Electromagnetic Flowmeter

The truck unloading station has two WAS flowmeters. In one of the lines, an UniMag DT electromagnetic flowmeter and an Advanced Flow Technology 4411e flow indicator-transmitter is in service (Figure 42,

Error! No bookmark name given.). The devices are in working condition, but they have been in service for more than 10 years and look deteriorated. Their replacement should be considered.



Figure 42 Truck Unloading WAS Flow Indicator-Transmitter



Figure 43 Truck Unloading WAS Flowmeter

On the other line, an Endress+Hauser Promag W400 electromagnetic flowmeter and an Endress+Hauser Proline 400 flow transmitter are in service (Figure 44, Figure 45). The devices are in working condition and no issues were reported.



Figure 44 Truck Unloading WAS Flow E+H Indicator-Transmitter



Figure 45 Truck Unloading WAS Flow E+H Flowmeter

12. Digesters Building

The WAS and primary sludge line (PSL) flow transfer from the digesters is measured by an electromagnetic flowmeter UniMag DT and an Advanced Flow Technology 4411e flow indicator - transmitter tagged as FIT-400 (Figure 46, Figure 47). The flowmeter is in working condition, but has been in service for more than 10 years and replacement should be considered. The display of the flow indicator transmitter does not work; the model has been discontinued by the manufacturer and should be replaced.



Figure 46 WAS and PSL Transfer Flow Indicator-Transmitter



Figure 47 WAS and PSL Transfer Flowmeter

The digester's floating roof level is measured in each tank by a Varec Tank Gauge 2500 and a Varec 8200 liquid level indicator – transmitter (Figure 48). The devices are in working condition and no issues were reported.



Figure 48 Primary Digester Tank Floating Roof Level Indicator - Transmitter

The sludge level inside the digester tanks is measured by a Rosemount 3051 pressure transmitter set up as a water column meter (Figure 49). In the primary tank, the transmitter has been temporarily moved from the wall of the tank to a flange in the sludge influent pipe. When the isolation valve is closed, the transmitter does not read the level inside the tank. The transmitter should be reinstalled in the wall of the tank. In the secondary tanks, the transmitter was off-line at the time of the site visit.



Figure 49 Primary Digester Tank Sludge Level Indicator - Transmitter

The sludge temperature in each digester tank is measured by a Rosemount 144H temperature transmitter installed in the sludge recirculation line (Figure 50). The devices are in working condition and no issues were reported. However, the devices were manufactured in 2006 and it is probable they have been in service more than 10 years, increasing their probability of failure. Spares should be available in the Plant's stock.



Figure 50 Sludge Temperature Transmitter

The scum level is measured by a Siemens Milltronics HydroRanger level controller-transmitter with a Siemens EchoMax XPS ultrasonic level transducer (Figure 51). The devices are in working condition and no issues were reported. However, the controller-transmitter model is discontinued. Replacement for a newer model such as Siemens SITRANS LUT400 may be considered.



Figure 51 Scum Level Transmitter

13. Boiler Room

An MSA Ultimata® XE gas detector is in service in the boiler room for the continuous measurement and monitoring of combustible gases (Figure 52, Figure 53). The device is in working condition and no issues were reported; however, the model has been discontinued by the manufacturer and replacement should be considered.



Figure 52 Boiler Room Combustible Gases Detector



Figure 53 Boiler Room Combustible Gases Sensor Installation