TRUSENSE S330 BETA SITE

WET-WELL EVALUATION

Version *1.5*

Author: John Budden

9/10/2020

Table of Contents

Overview

This report will focus on a beta test site of a Wet-Well location and the data provided by a Supervisory Control and Data Acquisition (SCADA) system of a major city in Colorado. The install date was 10/29/2019.

The current level technology at the Wet-Well was an aging bubbler system with known erratic issues. The purpose of the Wet-Well is to store water after running through the filter beds located above the Wet-Well. The level monitoring system is to provide feedback to maintain a continuous level. As city water demands change, it will directly affect the water level in the Wet-Well. This level information will indicate how many filter beds need to be active to maintain a constant level in the Wet-Well.

The data provided by the city for this evaluation included their bubbler level sensor, a TruSense S330 laser level sensor, and when filter pumps 5 and 6 are on or off. The S330 is installed between the two filter discharge outlets (see photo 1 on the next page). When the pumps are on, it will cause surface conditions to be turbulent and when they are off it will cause surface conditions to be calm.

The S330 was mounted in an access manway (see Photo 3) using a simple bracket to span across the opening. Unlike the bubbler system, the S330 laser sensor is a non-contact sensor, meaning it can be placed at a point easily accessed for installation, inspection, and maintenance.

Site Setup

Photo 1 shows the manway access point where the sensor is mounted. It is approximately halfway between filter bed 5 and 6 discharge pipes.

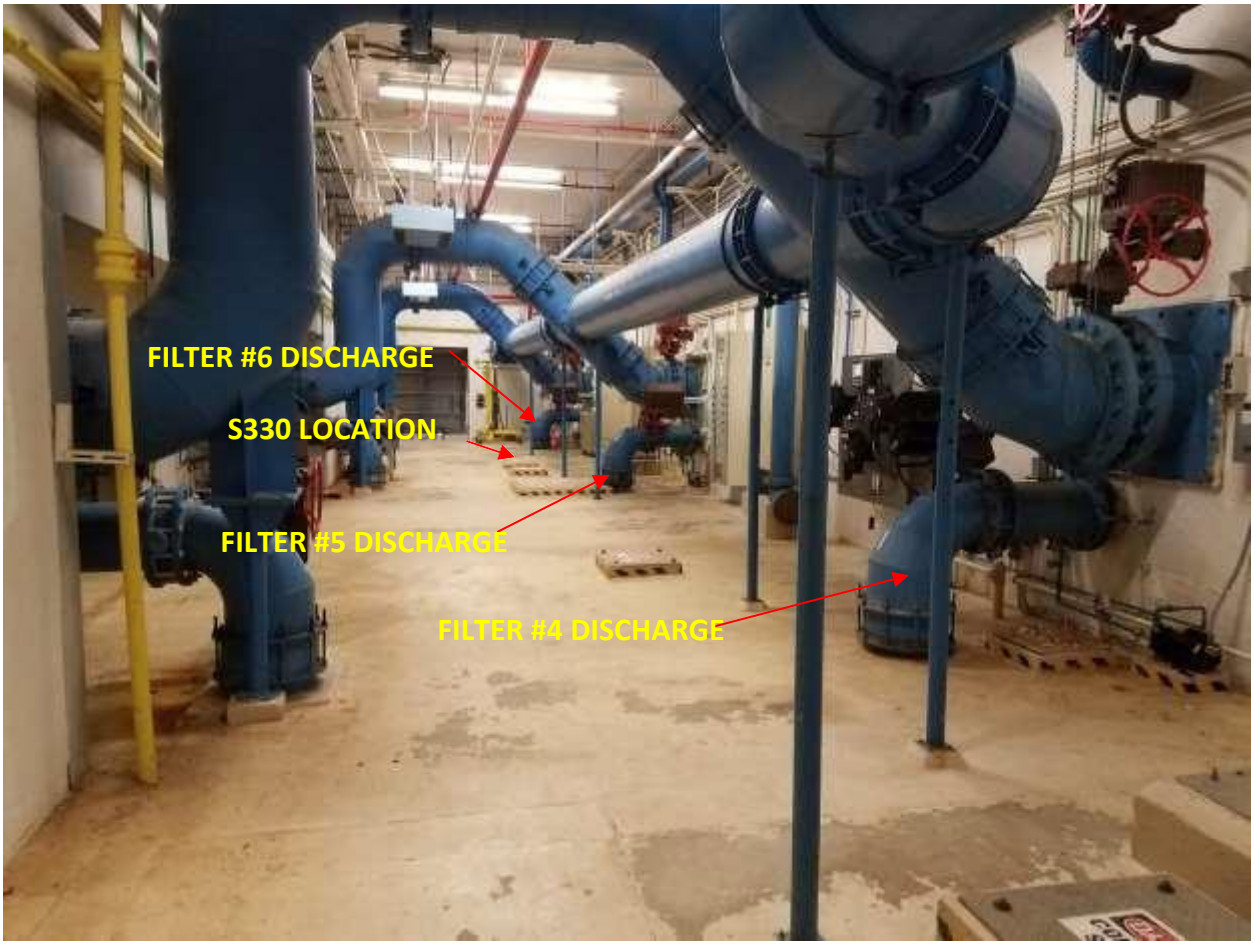


Photo 1

Measurements were made to fabricate a bracket to suspend the S330 in the center of a manway access point (Illustration 1). Additionally, an interface box was used to enclose the terminal strip for wiring power to the sensor, power to a data logger, a data logger and connection point for the city's 4-20 loop wiring (Photo 2).

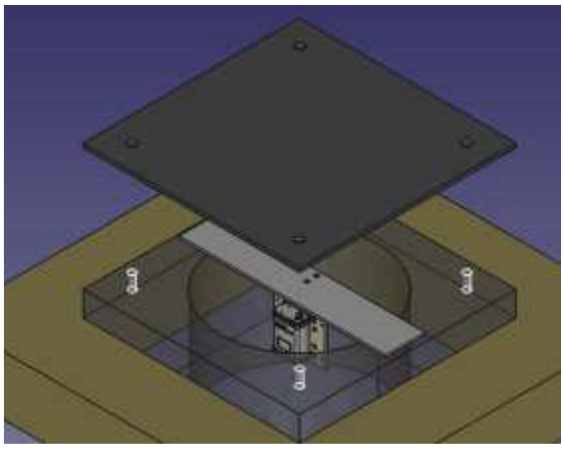


Illustration 1

Photo 2

Photo 3 shows the S330 and fabricated bracket installed in the manway opening. Photo 4 shows the complete setup with the cover on the manway access and the interface box located at the base of the city's control locker.

Photo 3

Photo 4

Once the S330 was in place, a tape measure was used to locate the sensor's position in relationship to the mounting point in the manway opening. Measurements taken were measurement span and instrument offset and current water level (See illustration 2).

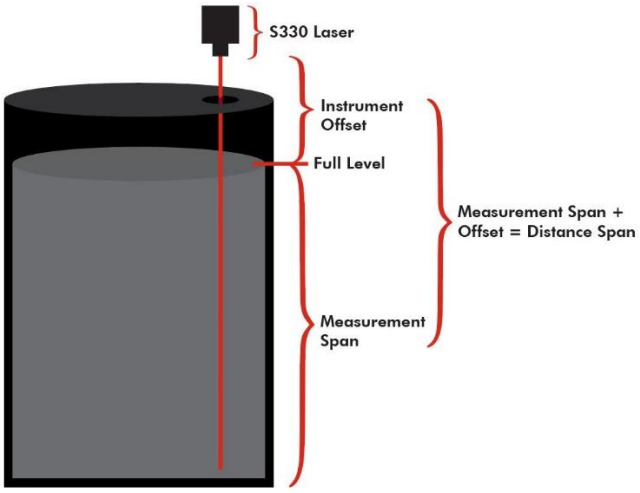


Illustration 2

The measured Instrument Offset and Measurement Span values were entered into the S330 Liquid Measurement setup software tool to program the 4-20mA loop boundaries (see Illustration 3). After the software tool programed the S330, the actual measured water level was compared to the S330 displayed output in the software tool to verify the sensor was reporting the same level. The city's requirements were to have the 4-20mA loop be updated every 5 seconds. This was also accomplished by using the S330 software tool.

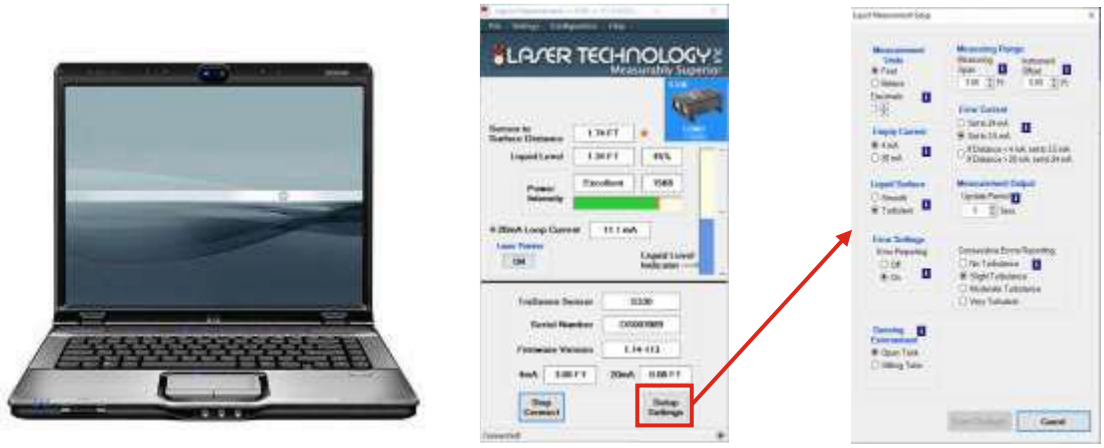


Illustration 3

Data Analysis

Sensor level data was captured by the City's SCADA system using the 4-20mA loop communication for both the City's bubbler sensor and the S330. In addition to the sensors level data, both filter pumps data from 5 and 6 were added to determine the surface conditions in the Wet-Well under the S330. The level and filter pumps on/off data were recorded every 30 min. The duration of the data was from 11/1/2019 to 05/20/2020. The first observation the data shows is that the S330 tracked the water level 100% of the time. The data shows the city's sensor was not measuring 24% of the time. In Graph 1 the red line is the level measurement of the S330, and the blue line is level output of the city sensor. When the city's sensor was not measuring, the level output was zero.

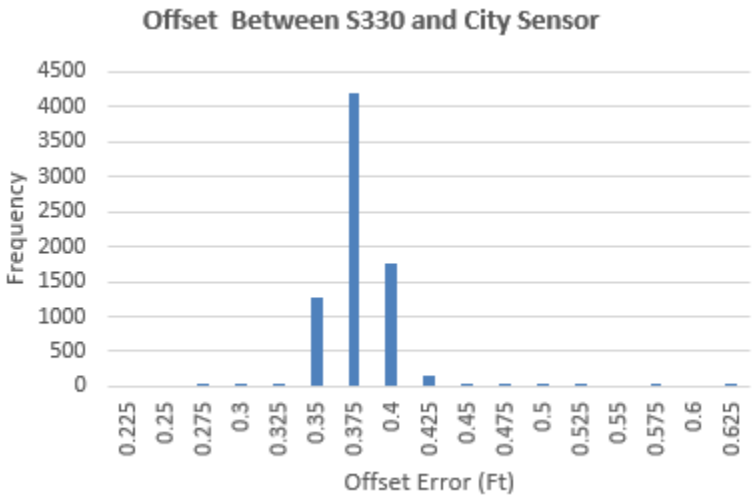
Graph 1

A closer look at the level output from both sensors shows a simple offset between the two sensors when the city's sensor is not in error. Graph 2 timeline is from 03/01/2020 to 03/07/2020.

Graph 2

Looking at the entire data file the average offset distance between the two sensors was 0.37 of a foot (4.44 inches) with a standard deviation of 0.18 of a foot. There is a normal distribution of the differences between the sensors reconfirming the separation of the readings is a simple offset with an uncertainty of about .1 of a foot (See graph 3).

a

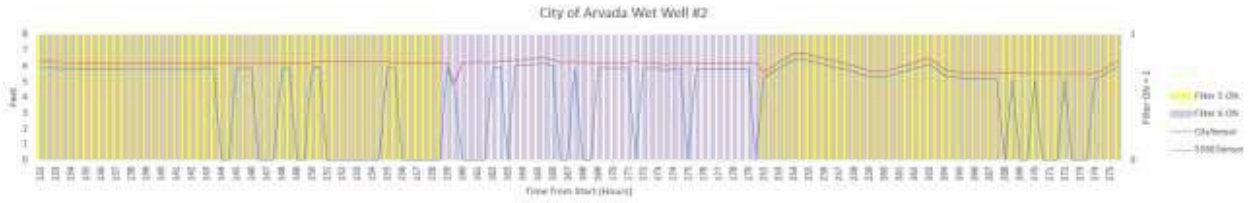


Graph 3

The TruSense S330 was installed using actual tank dimensions at the mounting location, where the bubbler system was installed at one end of the concrete tank. The dimensional differences in the concrete tank is the likely cause of the simple offset.

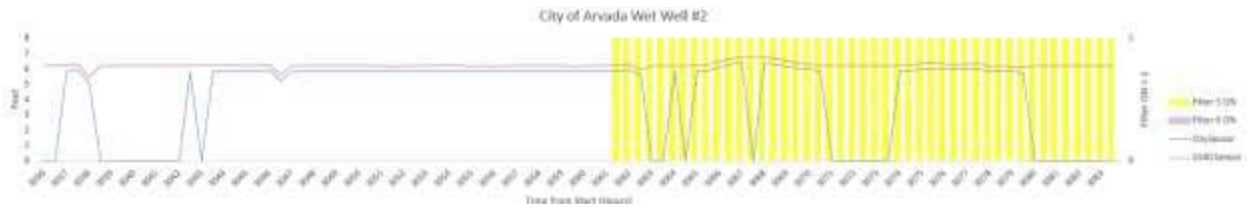
Another observation was the ability of the S330 to track water levels on changing surface conditions. When filter pumps 5 and 6 are off, the surface conditions were calm. When pumps 5 and/or 6 are on, surface conditions become disturbed.

In any surface conditions the S330 was able to track the level within .1 feet of the city sensor (when reading) considering the offset. Graph 4 is a 6-day window when both filter pumps were cycling off and on. Note that the S330 level measurements tracked along with the city sensor (when reading) no matter the pumps' state.



Graph 4

Graph 5 is a 48-hour time when both pumps where off for a long period then pump 5 turned on. Again, the S330 was able to track the water level regardless of surface condition.



Graph 5

Conclusion

The TruSense S330 continually provided accurate water levels from 11/01/2019 to 05/20/2020 with no down time. During this time, the S330 required no maintenance or adjustment. The city's aging sensor system had times when the sensor was not communicating with the SCADA system.

This beta test documents how the S330 can integrate into an existing level control system with minimal cost. The ease of installation required no downtime and had minimal impact to the existing vessel. This allows a retrofit to be done at very little cost compared to trouble shooting and repairing the existing bubbler system. Another consideration is that you can add additional S330s to provide redundancy for autonomous control systems at very low cost.

In closing, the S330 performs reliably within its operational specification in a clear water Wet-Well application.