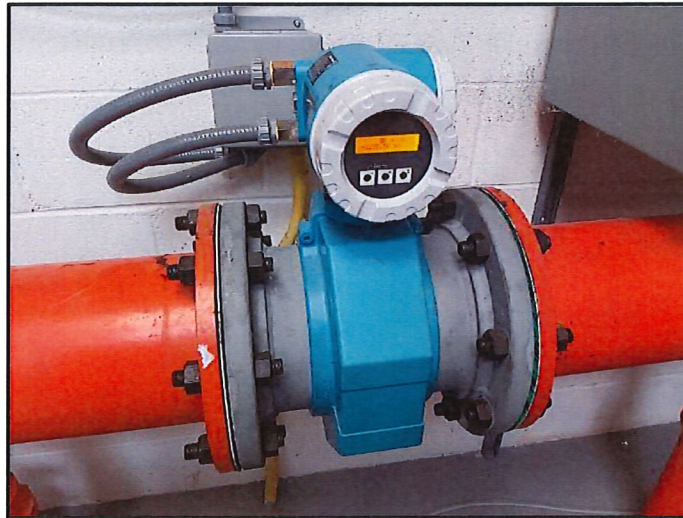




## TOWN OF LAKE COWICHAN WATER TREATMENT PLANT



### October 2020 Operations Performance Report



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## Permit to Operate

Operated water treatment plant under Operate Permit dated September 21, 2020.

## Certified Operators

The Vancouver Island Health Authority Operational Permit requires that the Town of Cowichan have a certified operator to match or exceed the Water Treatment Plant Certification, which is a level III plant. The Town of Cowichan has three certified operators on staff which agreements in place to call upon additional resources as required.

| Operator       | Title                 | Staff/Contractor       | Certification        |
|----------------|-----------------------|------------------------|----------------------|
| Mike Hewitt    | Chief Water Operator  | Staff (Public Works)   | WT4, WD2             |
| David Campbell | Water Operator        | Staff (Public Works)   | WT2, WD2, WWT1, WWC2 |
| Terry McMahon  | Water Operator        | Staff (Public Works)   | WT1, WD1             |
| Scott Jameson  | Professional Operator | Contractor (C2EP)      | WT4                  |
| Joe Woolls     | Professional Operator | Contractor (IFC Water) | WT1, WD3             |

## Notable Events

**Thursday, October 1** – Air dampener on P-512 reading 0 psi. Brought to 30 psi using hand pump. Rapidly lost pressure. Switched to P-522. P-522 lost prime. Swapped air dampeners and ran P-512.

**Friday, October 2** – Noted hypochlorite on pump skid. Inspected pumps and piping. Tightened loose coupling on P-461 and cleaned area. Received critical alarm at 17:44. Arrived at plant at 18:20. Reset B/W pumps and flocculation mixers on MCC. Encountered challenges restarting the soda ash system. Had system performing as normal by 20:45.

**Saturday, October 3** – Prepared two additional trouble-shooting guides pertaining to issues from previous day. Conducted first zeta sizer test on floc water which showed a value of -13.4.

**Sunday, October 4** – UV-311 Discharge Valve FCP-312 failed to fully close. Manually closed valve to read 0% placing UV-311 back in service.

**Tuesday, October 6** – Reduced coagulant dosage from 17 mg/L to 16 mg/L. Discussed with Stantec a means to resolve the insufficiency of the soda ash pumps and over-capacity of the polymer pump. Change programming from DUTY/STANDBY to LEAD/LAG will effectively double our maximum soda ash dosing capacity. Change programming of the polymer pump from continuous to intermittent pump.

**Wednesday, October 7** – Shut off chlorine gas at raw water station. Increased chlorine dosage at WTP. Gas cylinders taken to lagoon for use there. Zeta decreased to -17.0 with still great filter turbidity values.



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Lowered coagulant dosage from 16 mg/L to 15 mg/L. Noted loss of pressure in the coagulant pump air dampeners. Spoke to Alex Wigzell (604-970-6601) for guidance. Removed both dampeners and pressurized. Opened inlet and outlet to the calibration tube to prime P-522. Both pumps operational.

**Monday, October 12** – Loss of flow value at raw water pumping station resulted in plant shutdown. System restarted.

**Wednesday, October 21** – Frequency of comm loss alarms from raw water station increasing to unacceptable levels. Jeff Middlemiss and Joe Bourbeau at raw water pumping station to diagnose issue. Problem appears to be the flow meter. Circuit boards suspected to be unstable. Plug values assigned to various pumping configurations within the SCADA to continue plant operations while a new flow meter is procured.

**Thursday, October 22** – Reduced coagulation dosage from 14 mg/L to 13 mg/L. Jeff Middlemiss at plant to make changes to the SCADA program. 1) Critical alarm set for filter water turbidity. 2) Data logger records values from reservoir inlet and outlet analyzers. 3) SCADA to display reservoir inlet and outlet pH values.

**Friday, October 23** – Mark Kitching from Malvern at WTP to conduct zeta sizer training to staff.

**Monday, October 26** – Zeta readings at -15.0 and filtered water turbidity still great at 0.05 NTU. Reduced coagulant dosage from 13 mg/L to 12 mg/L. Tested emergency eyewash/shower systems. SCADA sent out critical alarm. Cleaned out spider cocoon from buzzer speaker on outside shower.

**Tuesday, October 27** – Took monthly samples for phosphorus, nitrogen, aluminum, and microcystin. Took quarterly samples for THM and TAA. Sent samples to MB Labs in Sidney, B.C. Day 1 of filling the Slopes reservoir until 16:00.

**Wednesday, October 28** – Day 2 Slopes reservoir filled. Reduced coagulation dosage from 12 mg/L to 11 mg/L.

**Thursday, October 29** – Reduced coagulation dosage from 11 mg/L to 10 mg/L.

**Friday, October 30** – Cleaned reservoir inlet and outlet chlorine analyzer. Reduced coagulation dosage from 10 mg/L to 9 mg/L.

**Saturday, October 31** – Reduced coagulation dosage from 9 mg/L to 8 mg/L.



## Performance Standards

The Operating Permit for the Town of Lake Cowichan Water System dated October 21, 2020 stipulates the following performance requirements:

| PARAMETER                                 | GUIDELINE  |
|---|--|
| Turbidity                                 | ≤ 0.3 NTU in ≥ 95% of samples                                    |
|   | Never to exceed 1 NTU  |
| <i>Giardia</i> and <i>Cryptosporidium</i> | 2.5-Log (99.7%) removal coagulation, flocculation and filtration |
|   | 1-Log (90%) inactivation via UV                                  |
| Viruses                                   | 1-Log (90%) removal coagulation, flocculation and filtration     |
|   | 3-Log (99.9%) inactivation via UV                                |
| Free Available Chlorine                   | Sufficient for CT <sub>CALC</sub> and not to exceed 4.0 mg/L     |
| Trihalomethane (THM)                      | ≤ 0.100 mg/L   |
| Haloacetic Acid (HAA)                     | ≤ 0.080 mg/L   |
| Total Aluminum                            | ≤ 0.1 mg/L   |
| pH  | Be between 7.0 and 10.5  |
| Microcystin-LR                            | ≤ 1.5 µg/L   |

## Chlorine Contact Time Calculations

Step 1: Calculate Theoretical Detention Time ( $TDT = V / Q$ )

5,400 m<sup>3</sup> and peak flow of 62 L/s for a total retention time of 24.2 hours

Step 2: Calculate Actual Detention Time ( $T = TDT \times BF$ )

Table 1 - Baffling Factors

| Baffling Condition     | Baffling Factor | Baffling Description  |
|------------------------|-----------------|---|
| Unbaffled (mixed flow) | 0.1             | None, agitated basin, very low length-to-width ratio, high inlet and outlet flow velocities               |
| Poor                   | 0.3             | Single or multiple unbaffled inlets and outlets, no intra basin baffles                                   |
| Average                | 0.5             | Baffled inlet or outlet with some intra basin baffles   |
| Superior               | 0.7             | Perforated inlet baffle, serpentine or perforated intra basin baffles, outlet weir or perforated launders |
| Perfect (plug flow)    | 1.0             | Very high length-to-width ratio (pipeline flow), perforated inlet, outlet, and intra-basin baffles        |



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24.2 hours X 0.3 = 7.26 hours (435.6 minutes)

### Step 3: Calculate $CT_{\text{CALC}}$

$$CT_{\text{CALC}} = C \times T$$

$$CT_{\text{CALC}} = 0.81 \text{ mg/L} \times 435.6 \text{ minutes}$$

$$CT_{\text{CALC}} = 352.8 \text{ minutes} \bullet \text{ mg/L}$$

### Step 4: Calculate *Giardia lamblia* log inactivation

Table 2 - 3-log inactivation of *Giardia lamblia* (designated as  $CT_{99.9}$ )

| Chlorine<br>Conc.<br>(mg/L) | Temperature 15°C |     |     |     |     |     |     |
|-----------------------------|------------------|-----|-----|-----|-----|-----|-----|
|                             | pH               |     |     |     |     |     |     |
|                             | ≤ 6.0            | 6.5 | 7.0 | 7.5 | 8.0 | 8.5 | 9.0 |
| ≤ 0.4                       | 49               | 59  | 70  | 83  | 99  | 118 | 140 |
| 0.6                         | 50               | 60  | 72  | 86  | 102 | 122 | 146 |
| 0.8                         | 52               | 61  | 73  | 88  | 105 | 126 | 151 |
| 1.0                         | 53               | 63  | 75  | 90  | 108 | 130 | 156 |

Conclusion: Our retention time of 352.8 minutes • mg/L is 4.8-fold that as required for 3-Log removal of *Giardia lamblia* as per Table 2 above.

### Step 5: Calculate virus inactivation

Table 3 - 4-log inactivation of viruses (designated as  $CT_{99.99}$ )

| Temperature<br>(°C) | pH  |    |
|---------------------|-----|----|
|                     | 6-9 | 10 |
| 0.5                 | 12  | 90 |
| 5                   | 8   | 60 |
| 10                  | 6   | 45 |
| 15                  | 4   | 30 |
| 20                  | 3   | 22 |
| 25                  | 2   | 15 |

Conclusion: Our retention time of 352.8 minutes • mg/L is 88-fold that as required for 4-Log virus removal as per Table 3 above.



## UV Dose Log Inactivation Credits

Table 4 - UV Dose Log Inactivation Values for *Cryptosporidium*, *Giardia*, and Viruses

| Log Inactivation | UV dose (mJ/cm <sup>2</sup> ) |                |          |
|------------------|-------------------------------|----------------|----------|
|                  | <i>Cryptosporidium</i>        | <i>Giardia</i> | Viruses* |
| 0.5              | 1.6                           | 1.5            | 39       |
| 1.0              | 2.5                           | 2.1            | 58       |
| 1.5              | 3.9                           | 3.0            | 79       |
| 2.0              | 5.8                           | 5.2            | 100      |
| 2.5              | 8.5                           | 7.7            | 121      |
| 3.0              | 12                            | 11             | 143      |
| 3.5              | 15                            | 15             | 163      |
| 4.0              | 22                            | 22             | 186      |

\* Based on adenovirus inactivation.

Table 5 - Lake Cowichan Daily UV Dosages

|                                 | Minimum | Average | Maximum |
|---------------------------------|---------|---------|---------|
| UV Dosage (mJ/cm <sup>2</sup> ) | 35.4    | 53.8    | 115.1   |

## Water Quality Results

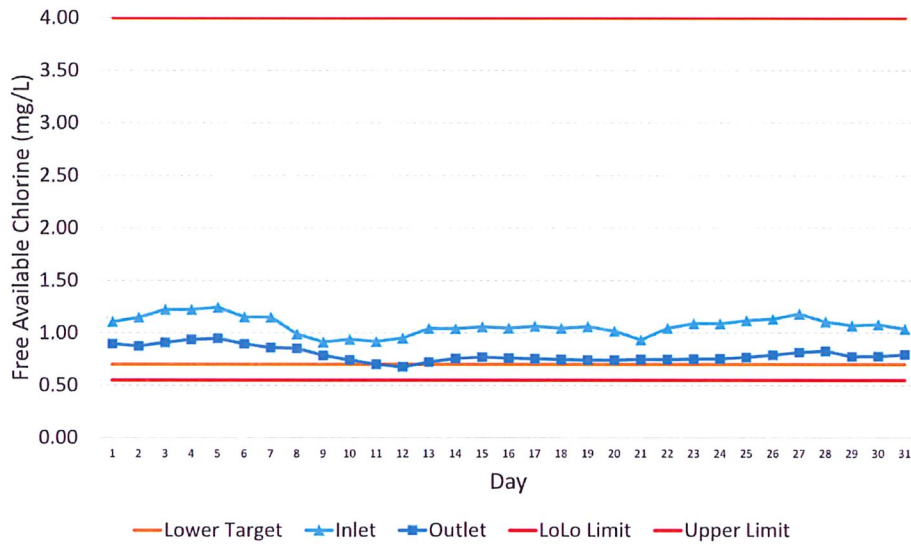
### Highlights

- FAC remained well above the LoLo limit set at 0.55 mg/L
- pH of the treated water leaving the reservoir outlet was spot checked once per day by the operator. On two days the pH was below 7.0 as noted below
  - Oct 6 the pH was recorded at 6.99
  - Oct 17 the pH was recorded at 6.88
- The pH values of the treated water leaving the reservoir are being logged every minute as of Oct 22. This data will be reported on as it represents a much more superior sampling than the single operator spot check.
- Heavier rains during Oct 11 & 12 resulted in elevated raw water turbidity.
- End of month rise in filtered water turbidity and pH a result of deliberate coagulation dosage reductions for zeta potential testing to determine optimal operation.
- UV dosage below operator low level set at 40 mJ/cm<sup>2</sup> on Oct 27 & 28. Overall 4.0 inactivation of viruses achieved by chlorination during all days.

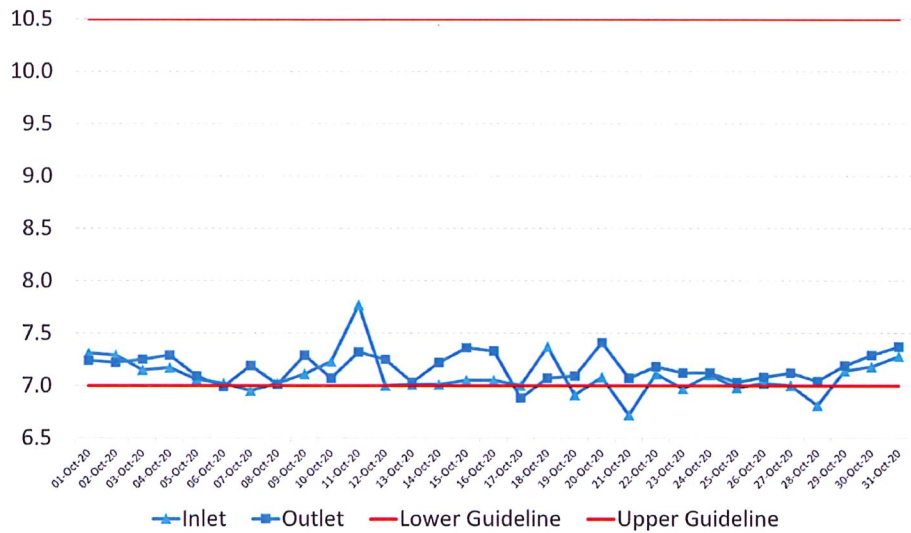


Individual Parameter Charts

Free Available Chlorine (Oct 2020)  
Source: SCADA Daily Averages



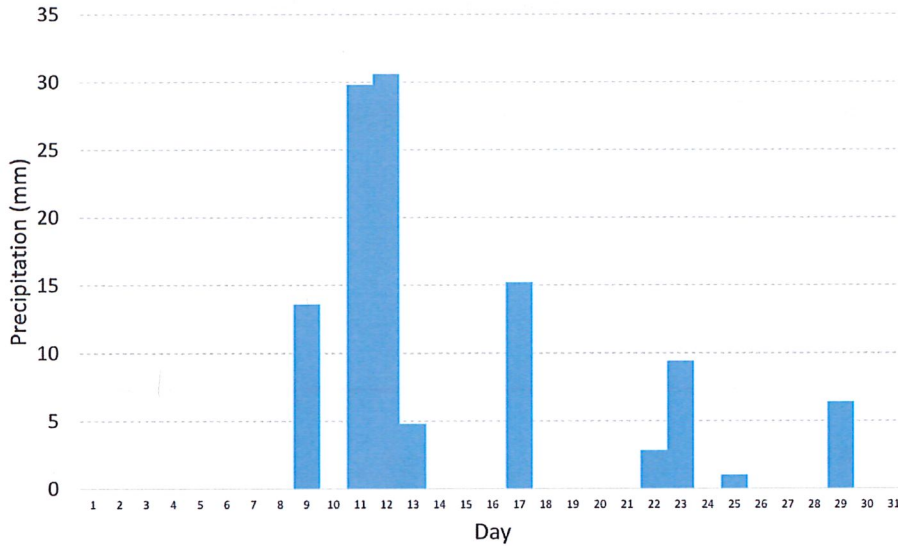
pH (Oct 2020)  
Source: Operator Testing





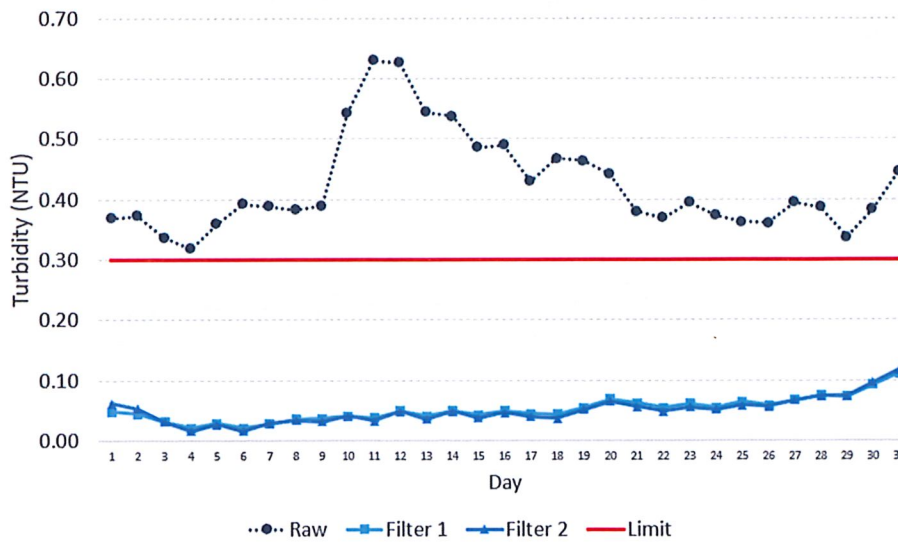
### Total Precipitation (Oct 2020)

Source: Environment Canada - North Cowichan Station



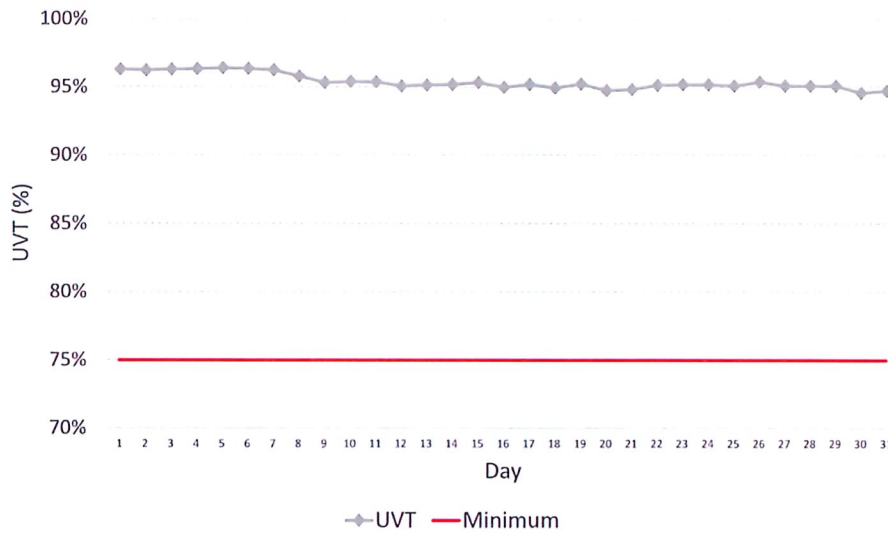
### Turbidity (Oct 2020)

Source: SCADA Daily Averages

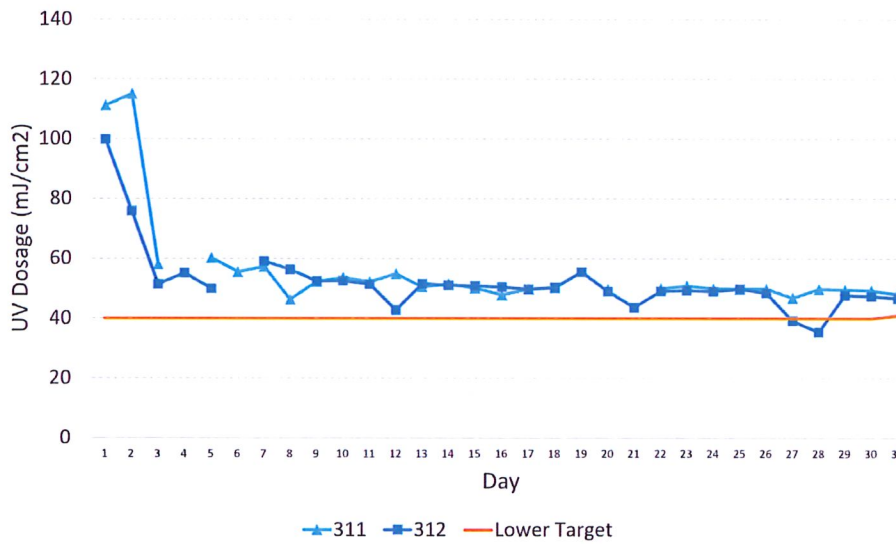




### UV Transmittance (Oct 2020) Source: SCADA Daily Averages

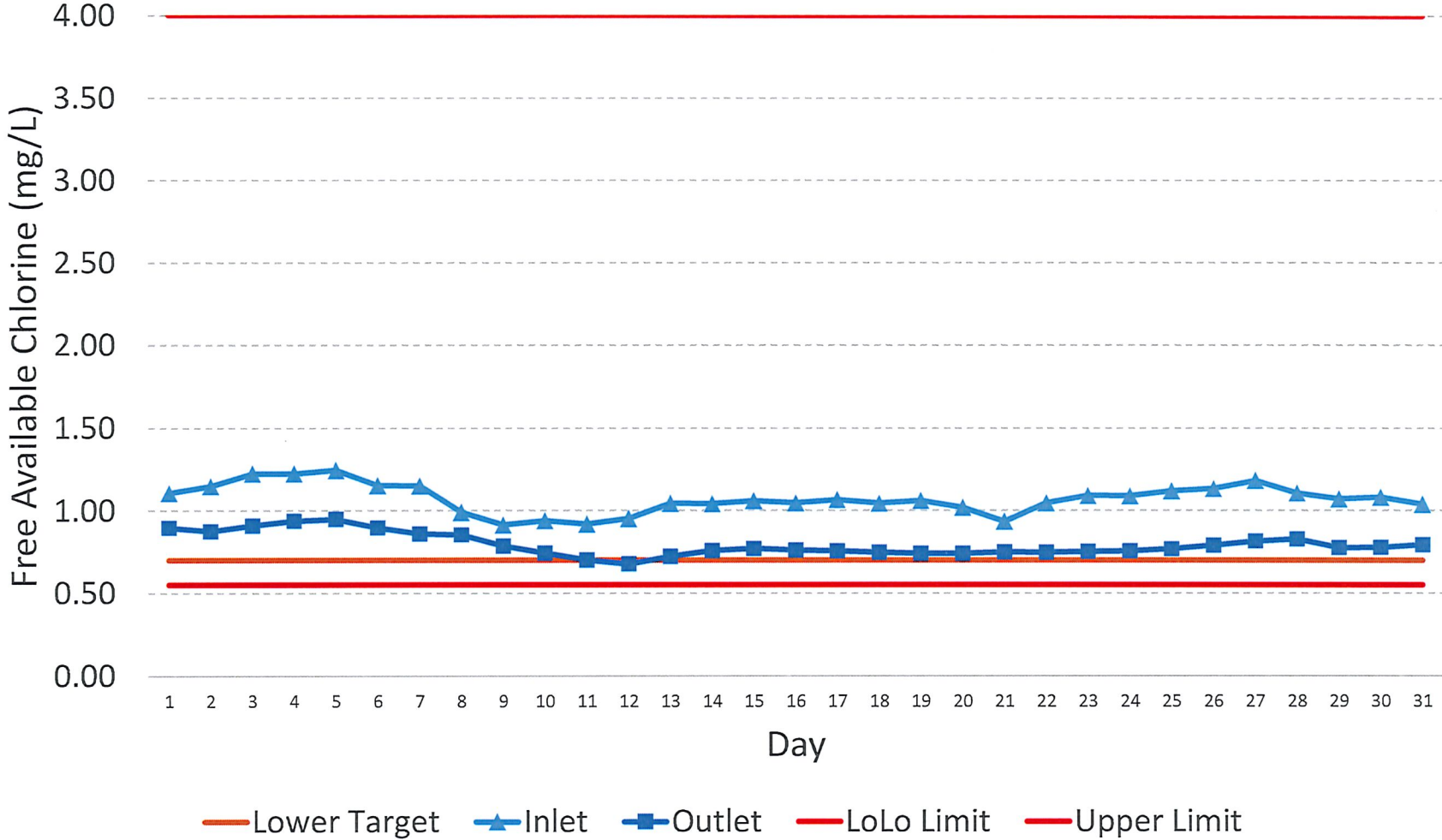


### UV Dosage (Oct 2020) Source: SCADA Daily Averages



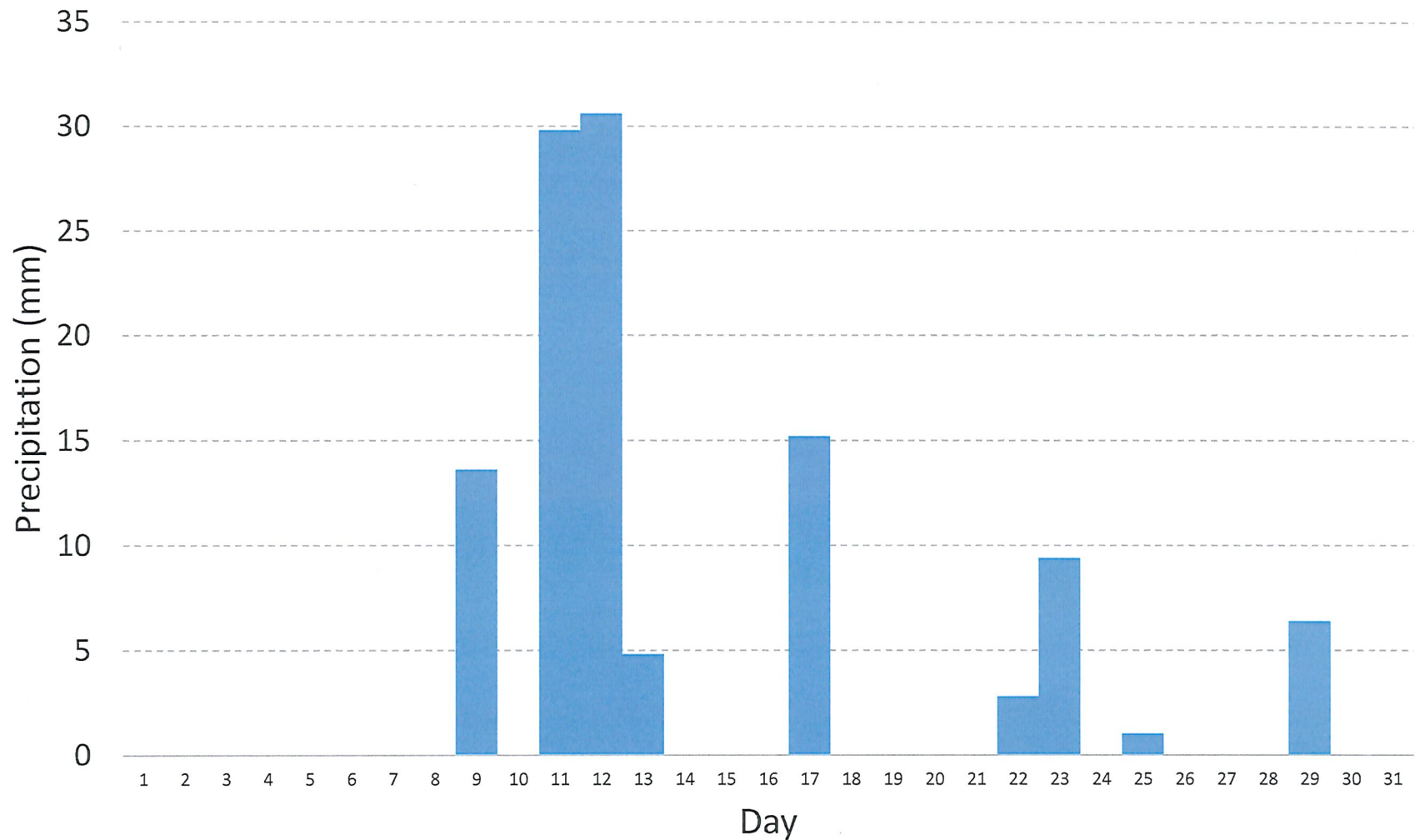
# Free Available Chlorine (Oct 2020)

Source: SCADA Daily Averages



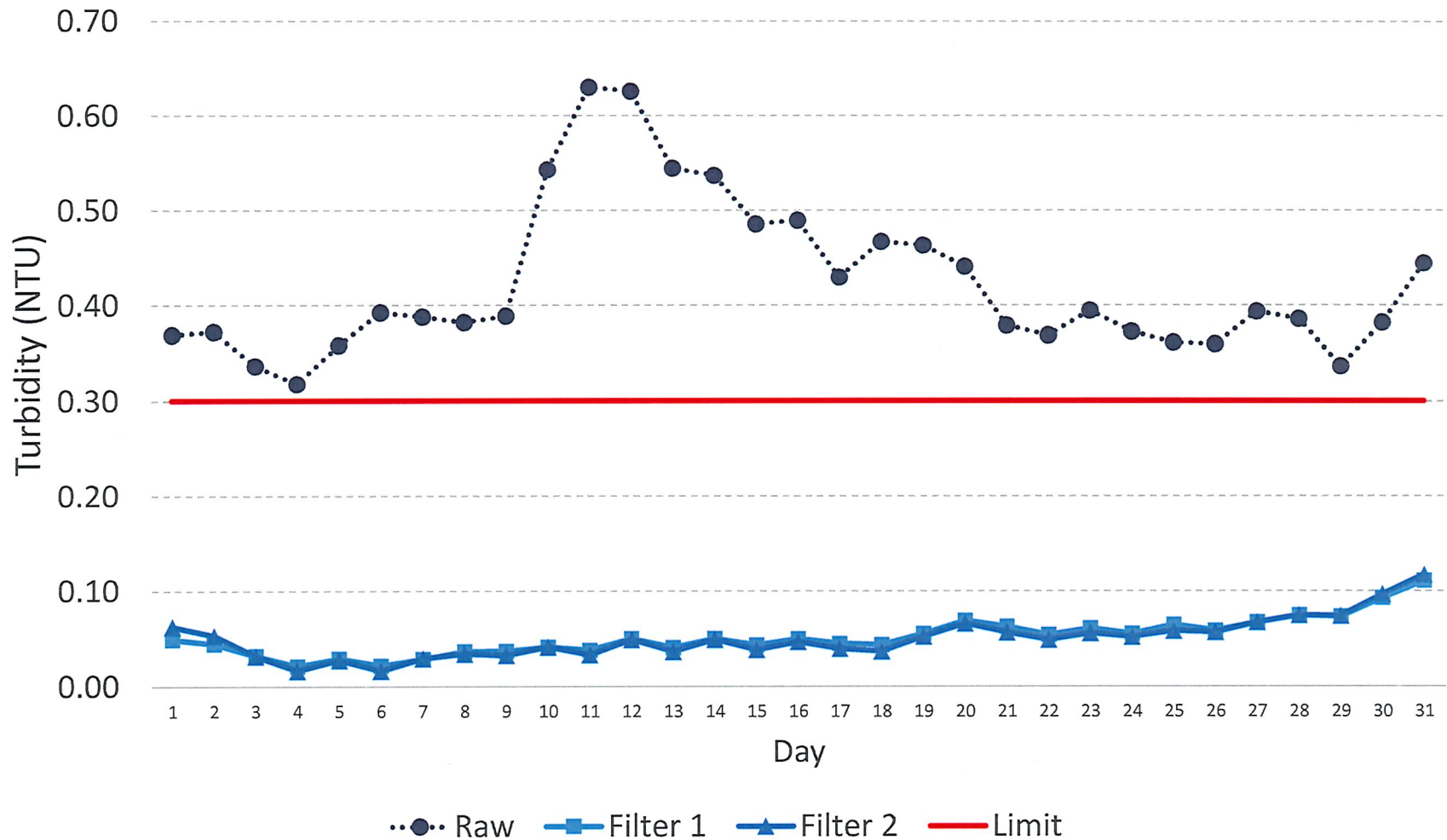
# Total Precipitation (Oct 2020)

Source: Environment Canada - North Cowichan Station



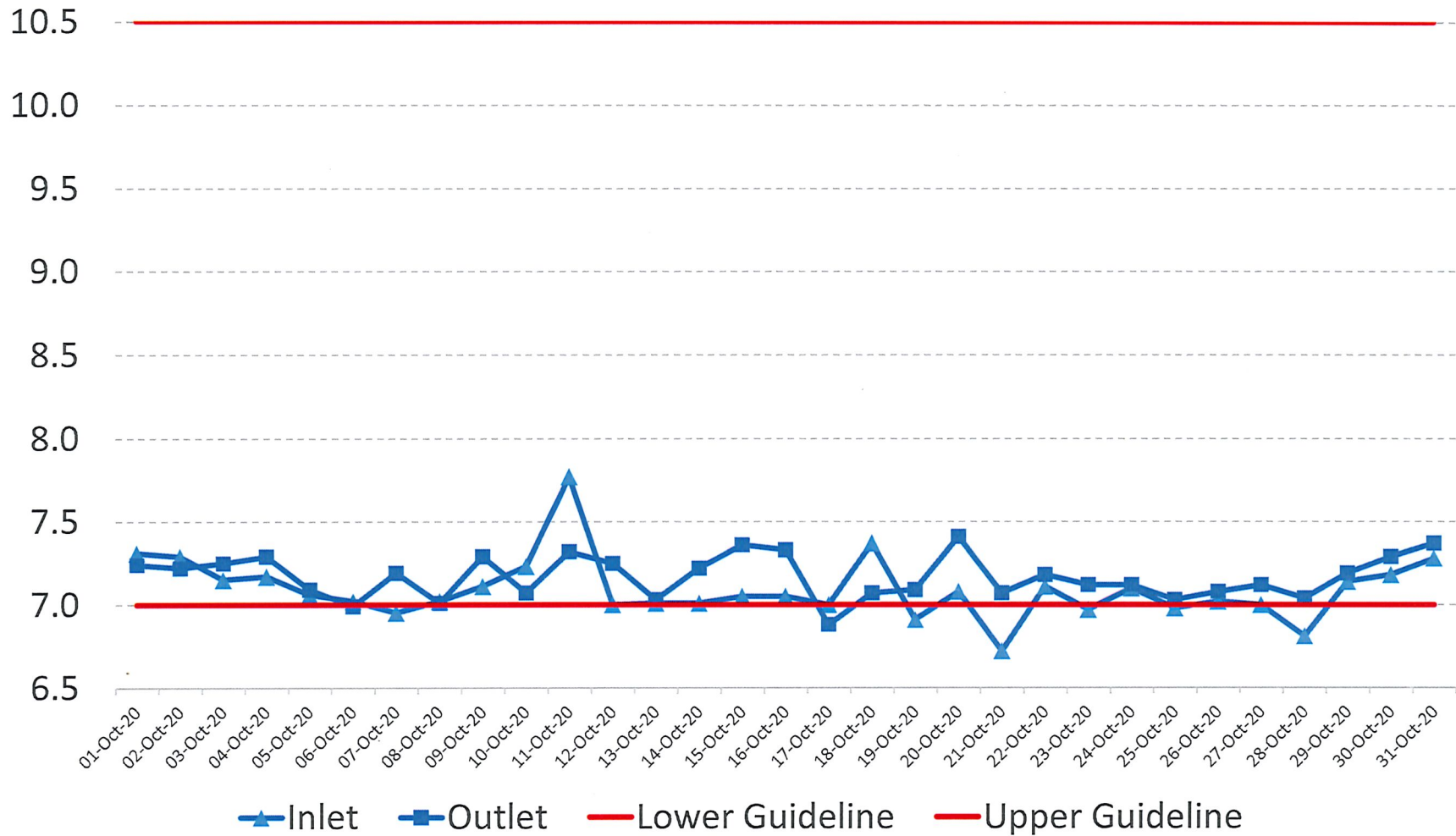
# Turbidity (Oct 2020)

Source: SCADA Daily Averages



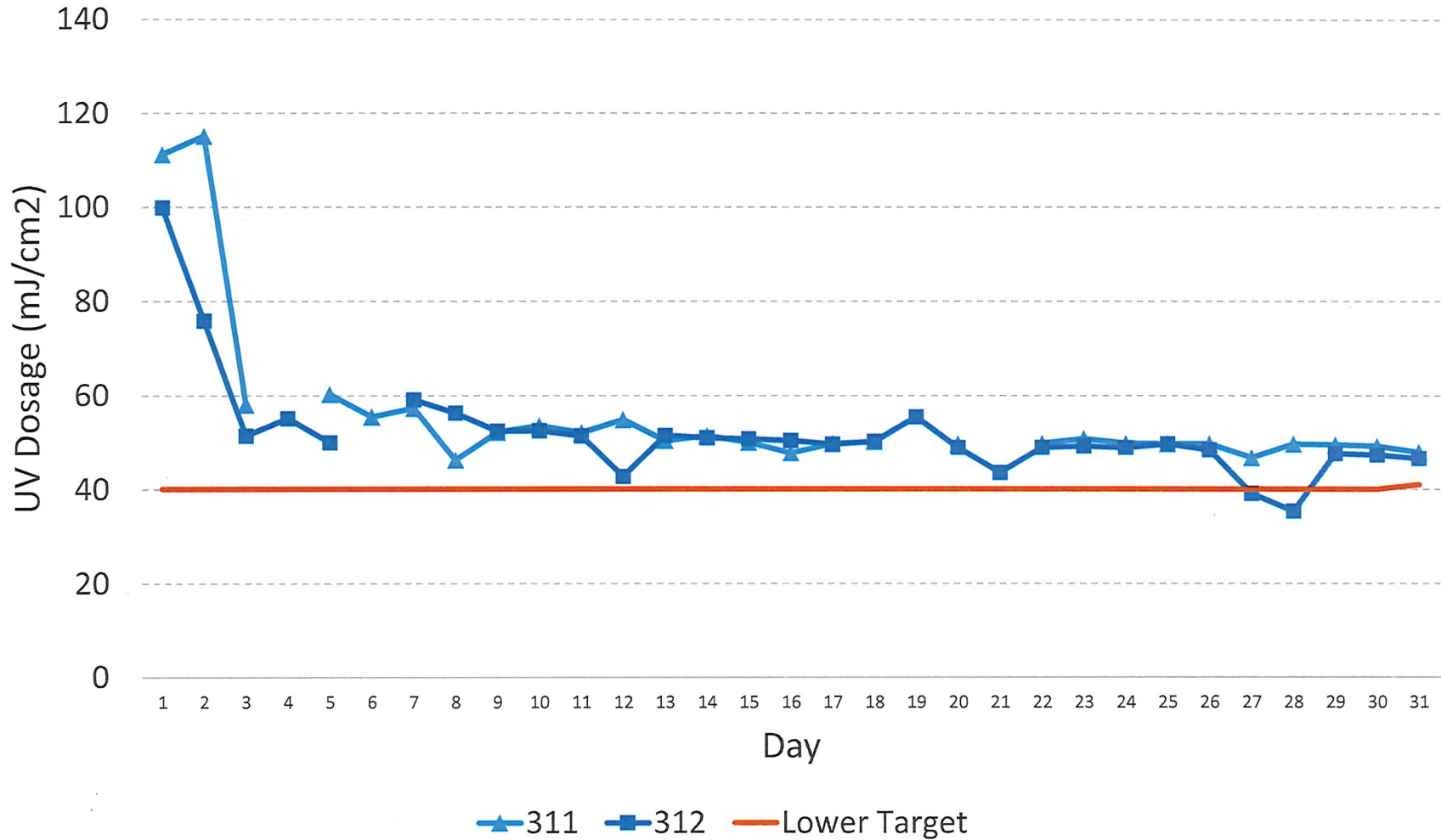
# pH (Oct 2020)

Source: Operator Testing



# UV Dosage (Oct 2020)

Source: SCADA Daily Averages



# UV Transmittance (Oct 2020)

Source: SCADA Daily Averages

