Beneath the Surface: A Filter Evaluation in Anacortes

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Agenda

01 Objective

02 Source and Performance Overview

03 Event Identification

04 Alkalinity

05 RTW Modeling

06 Discussion

01

Objective

Objective

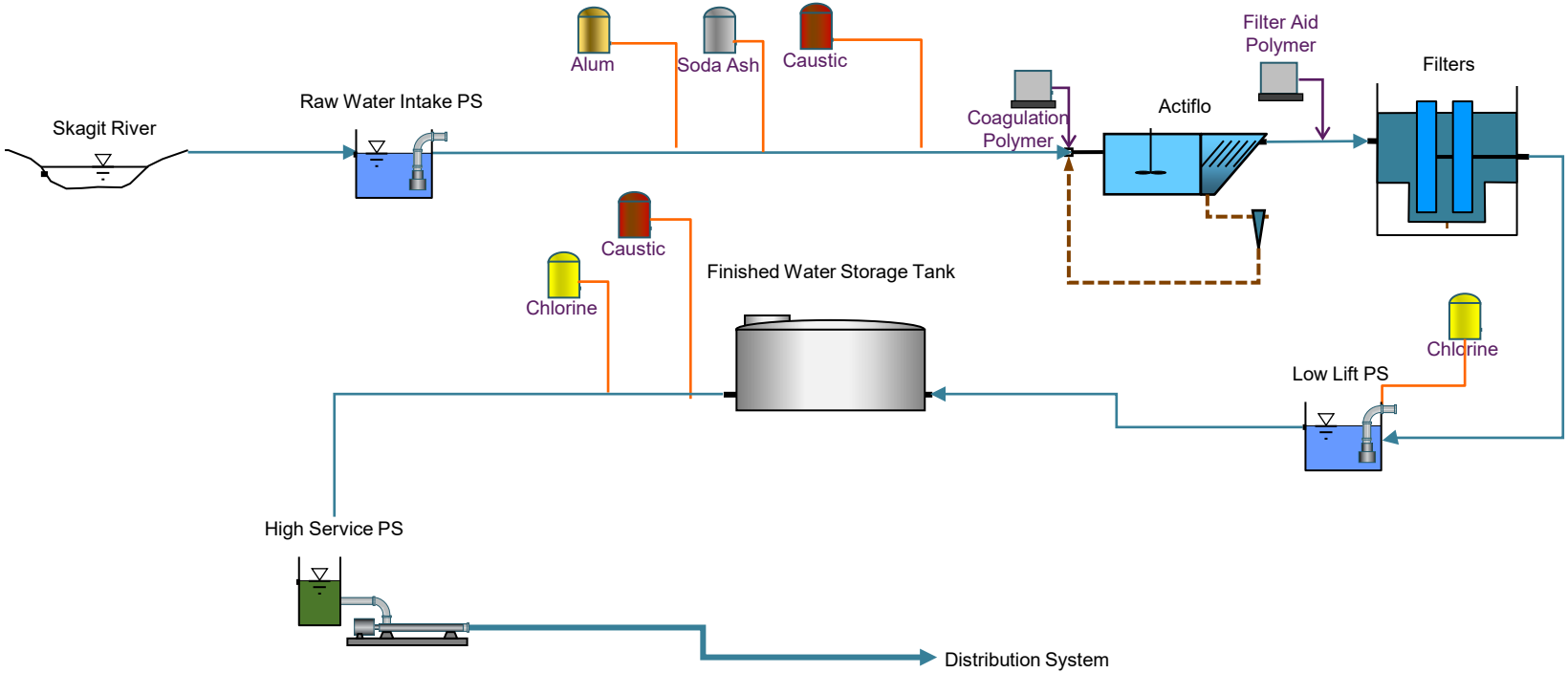
- Anacortes WTP draws from the Skagit River
- Identify lower filter performance at the WTP
- Important factors:
  - Skagit River is highly variable.
  - WTP can achieve 96-hour runtimes
  - Low runtimes create operational challenges
  - Takes away from other duties



Objective

- Backwash at 8 feet of headloss
- Types of low runtime events:
  - Low filter runtime occurs during periods of high throughput or heavy rain
  - Filter runtime also tends to be low in late spring/early summer
  - Filter runtime is low during periods of peak demand




Skagit River
Raw Water Intake PS
Alum
Soda Ash
Caustic
Coagulation Polymer
Actiflo
Filter Aid Polymer
Filters
Caustic
Chlorine
Finished Water Storage Tank
Chlorine
Low Lift PS
High Service PS
Distribution System

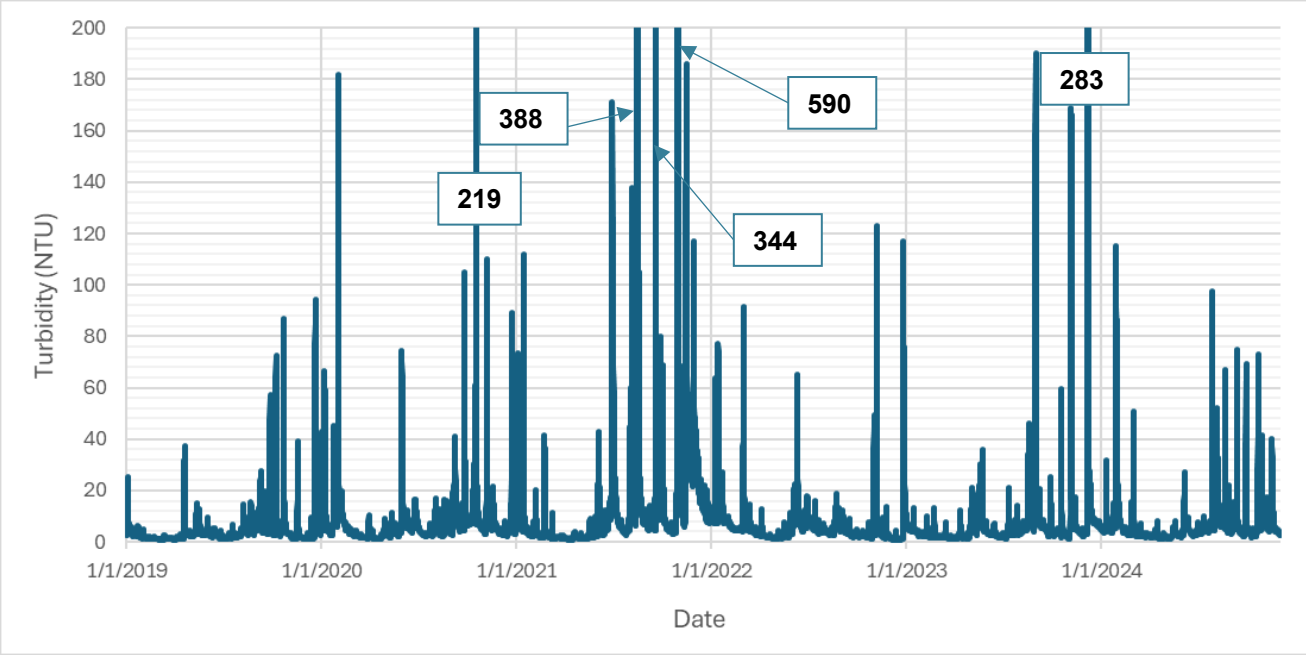
Data Analyzed

- Source Water Quality
- Unit Filter Run Volume(UFRV)
- Headloss through the filters
- Throughput
- Filter Runtime
- River Level
- Dosage of chemicals
- Operational Parameters

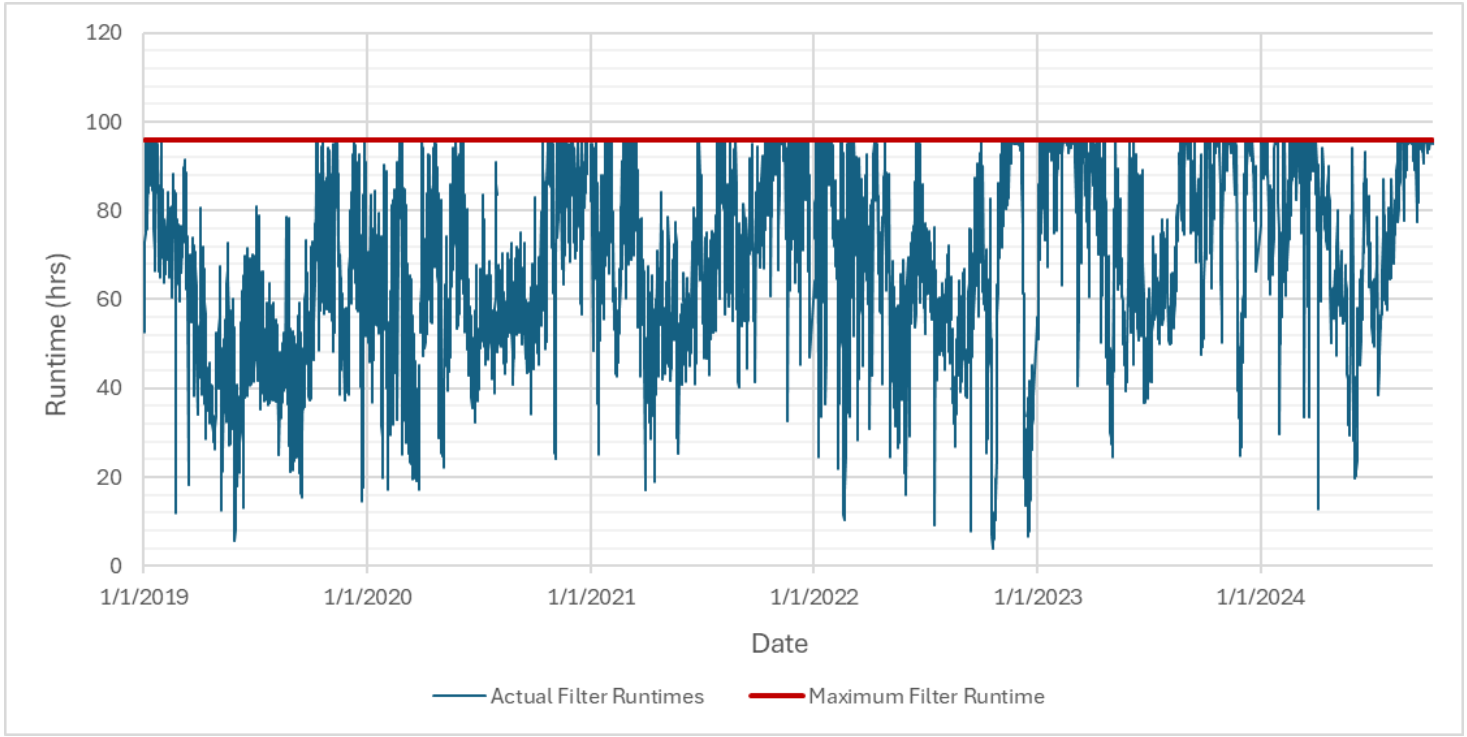
02

Source and Performance Overview

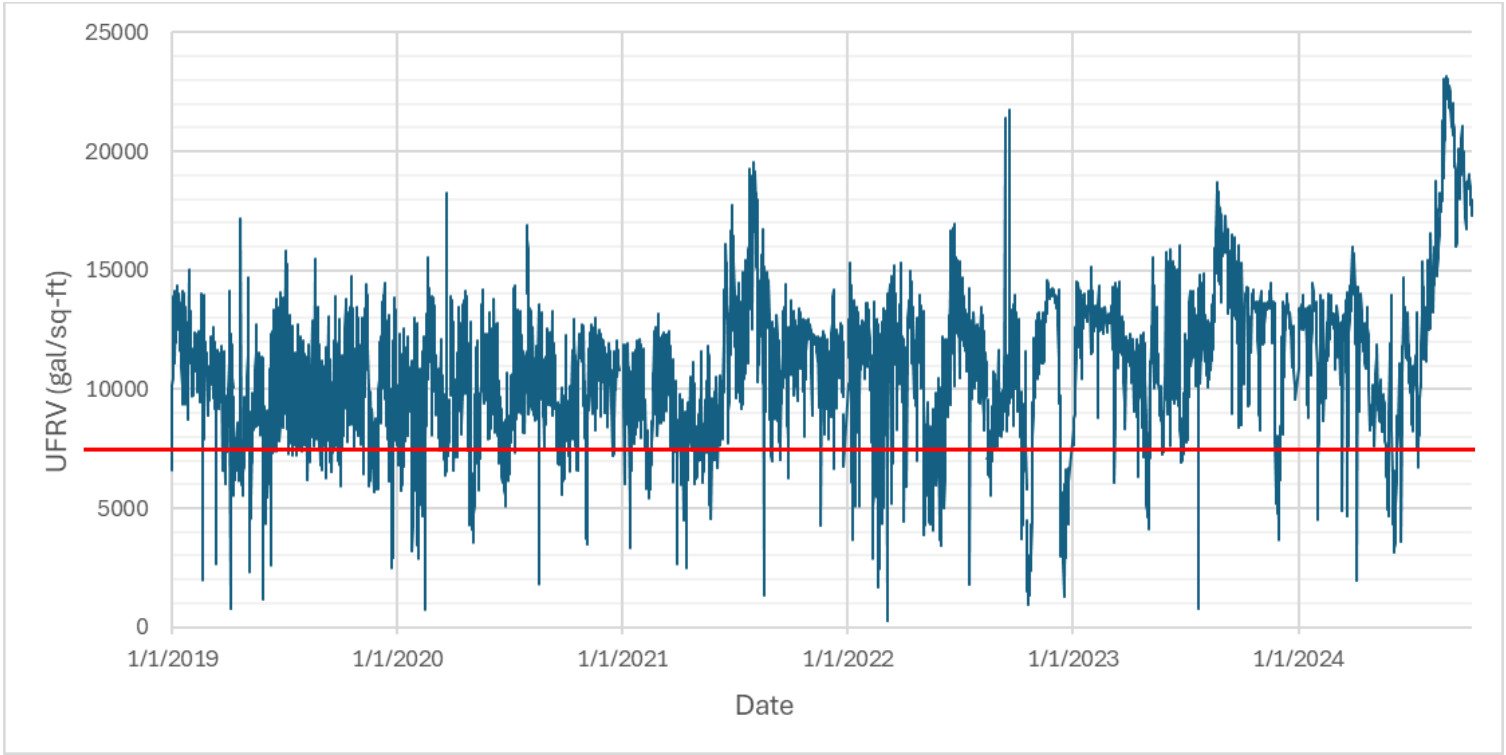
Source Overview



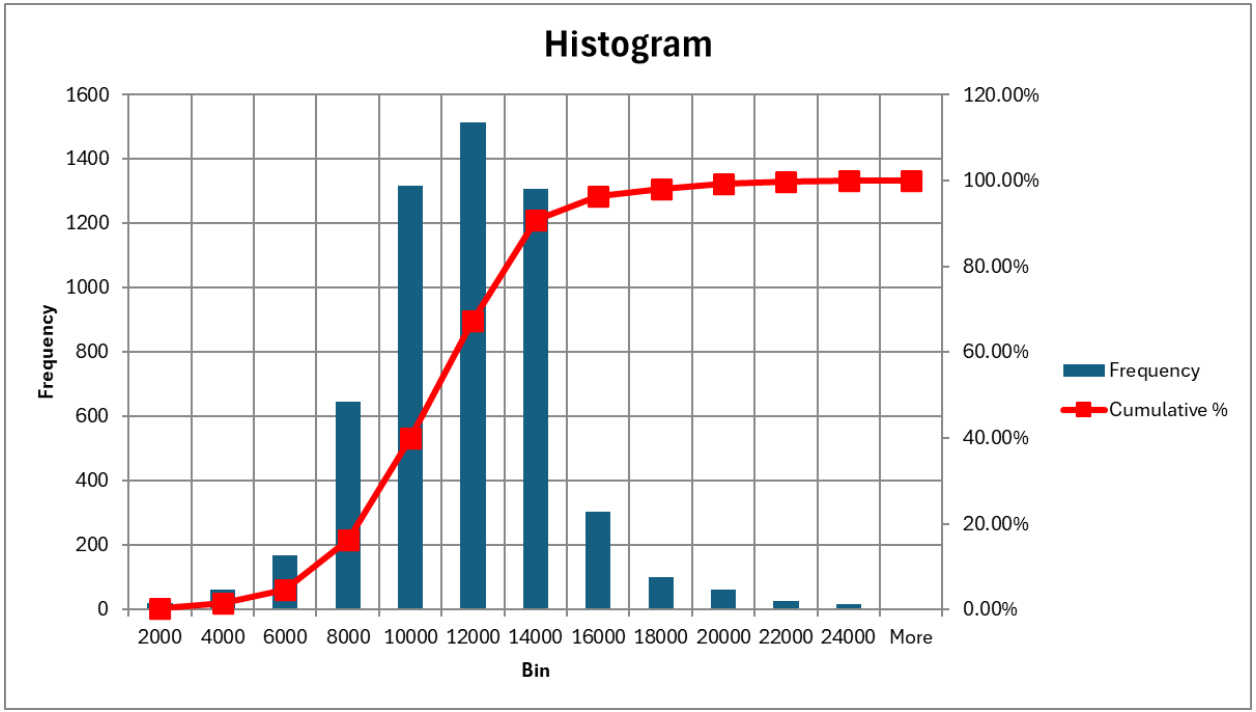
Performance Overview - Filter Runtime



Performance Overview - UFRV



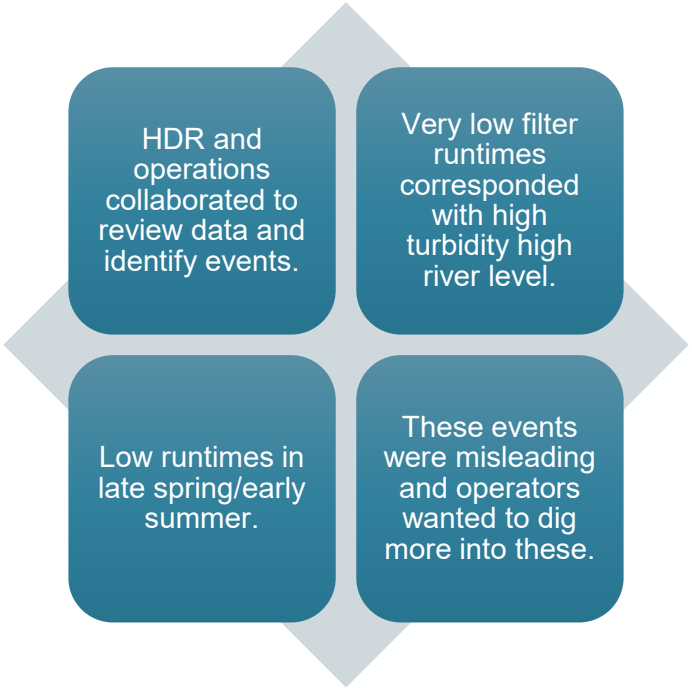
Performance Overview - UFRV Cumulative Distribution



03

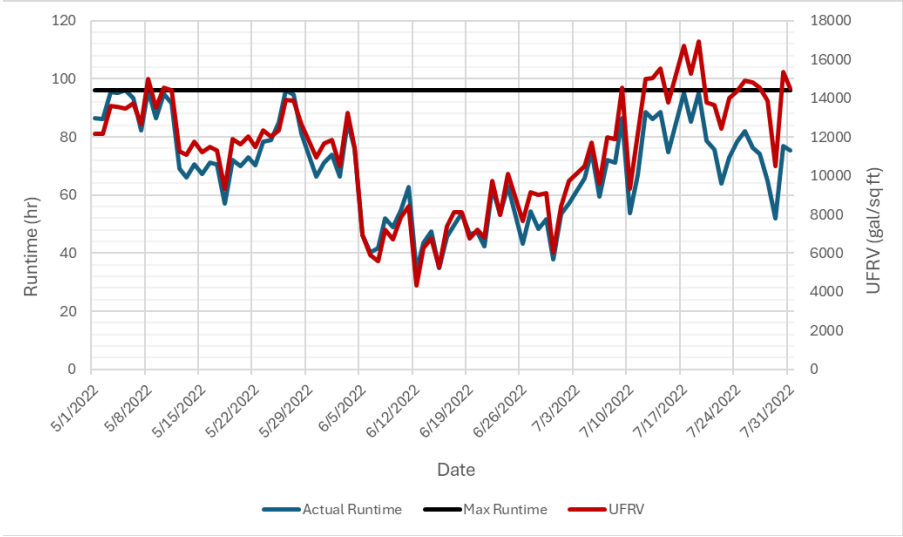
Event Identification

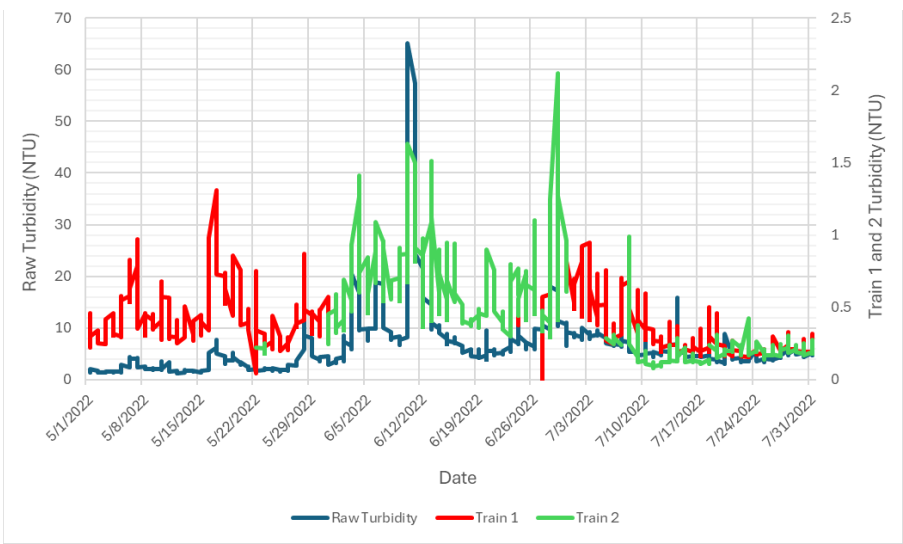
How were events Identified?



Event 1: May-July 2022

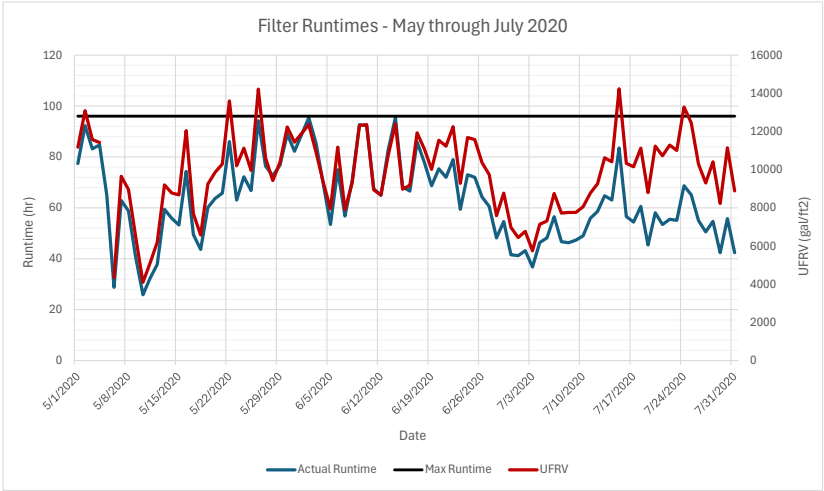
- Filter runtimes averaged 49 hours.
- UFRV near around 9,000 gal/sf.
- This event saw high throughput through the filters
- Maximum settled water turbidity was 2 NTU during this event.

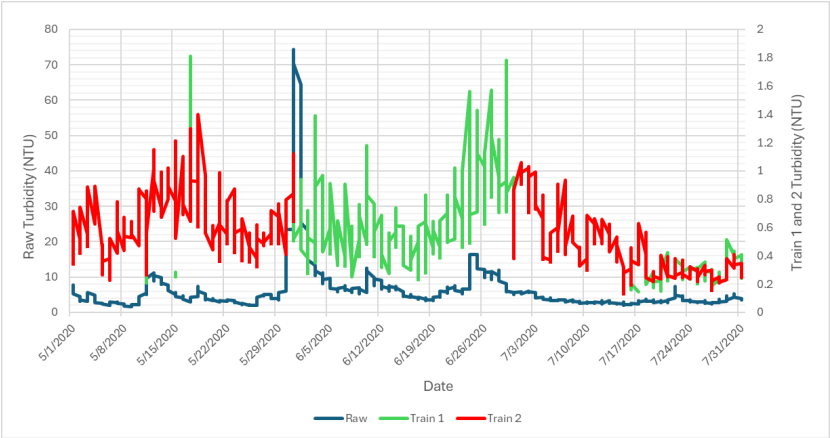




Event 2: May-July 2020

- Filter runtimes averaged 63 hours, 40 hours between May 9-11.
- UFRV near 10,000 gal/sf.
- This event saw high throughput through the filters
- Maximum settled water turbidity was 1.8 NTU during this event.

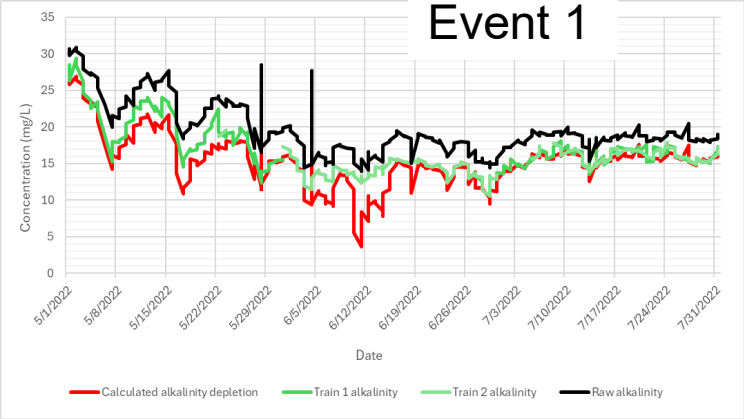




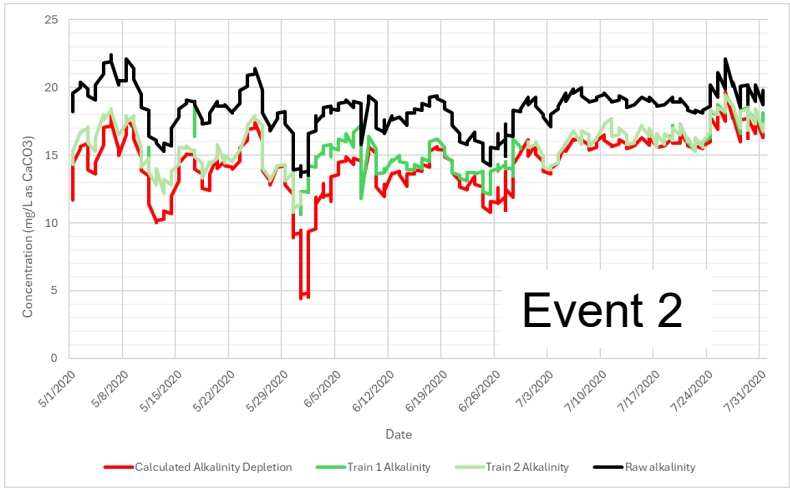
04

Alkalinity

Alkalinity and each event



- 1 part alum consumes 0.5 part alkalinity during coagulation
- Result is alkalinity starved water



Alkalinity and Pretreatment Chemical Dosing

- 1 part alum consumes 0.5 part alkalinity during coagulation
- Low water alkalinity limits water’s buffering capacity
- Difficult for alum to form large flocs
- Small flocs means particles are less prone to attach to polymer
- The small flocs to not bind to the microsand
- Low runtimes
- Soda Ash??

Parameter	Measured raw alkalinity (mg/L as $CaCO_3$)	Measured settled-water alkalinity (mg/L as $CaCO_3$)
Maximum	39.0	37.0
Average	22.0	19.0
Minimum	8.7	8.2

Alkalinity and Pretreatment chemical dosing

Alum is dosed as high as 47 mg/L, average is 9.90 mg/L.

Caustic dosed as high as 13 mg/L with an average of 0.61 mg/L.

05

RTW Modeling

RTW Model

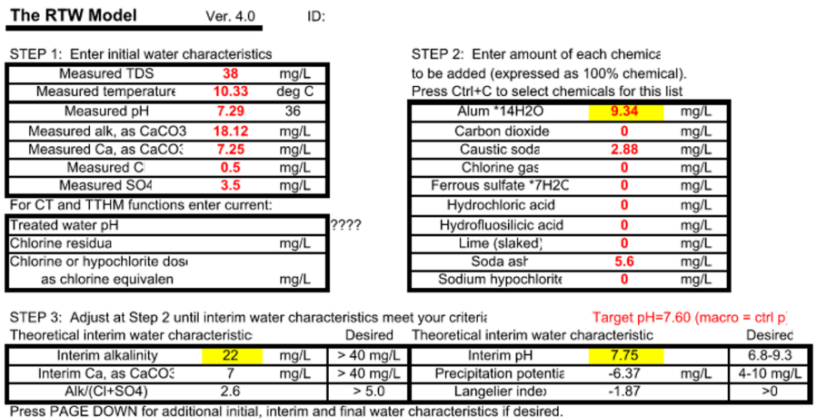
The RTW Model is a tool used predict water chemistry outcomes, optimize chemical dosing, and support corrosion control strategies.

It models how changes in pH, alkalinity, disinfectant dose, and treatment chemicals affect finished water quality, scaling, and corrosion behavior.

Model was used to determine how the addition of soda ash would impact both events.

RTW Model Results

- A soda ash dosage of 5.6 mg/L was modeled in Event 1
- A soda ash dosage of 4.8 mg/L modeled in Event 2
- Both events saw increases the interim alkalinity and interim pH
- Soda ash dosage at the WTP should average at 5 mg/L with a range of 1 to 7 mg/L, so the modeled dosage is appropriate for the treatment process.



The RTW Model Ver. 4.0 ID:

STEP 1: Enter initial water characteristics

Measured TDS	38	mg/L
Measured temperature	10.33	deg C
Measured pH	7.29	36
Measured alk, as CaCO3	18.12	mg/L
Measured Ca, as CaCO3	7.25	mg/L
Measured C	0.5	mg/L
Measured SO4	3.5	mg/L

For CT and TTHM functions enter current:

Treated water pH		????
Chlorine residua		mg/L
Chlorine or hypochlorite dosa as chlorine equivalen		mg/L

STEP 2: Enter amount of each chemica to be added (expressed as 100% chemical). Press Ctrl+C to select chemicals for this list

Alum *14H2O	9.34	mg/L
Carbon dioxide	0	mg/L
Caustic soda	2.88	mg/L
Chlorine gas	0	mg/L
Ferrous sulfate *7H2C	0	mg/L
Hydrochloric acid	0	mg/L
Hydrofluosilicic acid	0	mg/L
Lime (slaked)	0	mg/L
Soda ash	5.6	mg/L
Sodium hypochlorite	0	mg/L

STEP 3: Adjust at Step 2 until interim water characteristics meet your criteria Target pH=7.60 (macro = ctrl p

Theoretical interim water characteristic			Desired	Theoretical interim water characteristic			Desirec
Interim alkalinity	22	mg/L	> 40 mg/L	Interim pH	7.75		6.8-9.3
Interim Ca, as CaCO3	7	mg/L	> 40 mg/L	Precipitation potentia	-6.37	mg/L	4-10 mg/L
Alk/(Cl+SO4)	2.6		> 5.0	Langelier index	-1.87		>0

Press PAGE DOWN for additional initial, interim and final water characteristics if desired.

06

Discussion and Path Forward

Design Intent of Soda Ash

- Benefit to dose soda ash year round
- Seasonal soda ash system was a cost saving measure
- Intent that supersack of soda ash will be used until it runs out
- Storage onsite for extended period of time





Issues with Soda Ash

- Labor Intensive
- Soda ash system consists of supersack system

Next Steps

- Seasonal Usage of soda ash
- Jar testing
- Soda ash on a trial scale



Summary

- Plant Operators are amazing
- High performing plant
- Soda Ash is something that could be considered but not essential



Questions?