OUZINKIE WATER TREATMENT SYSTEM

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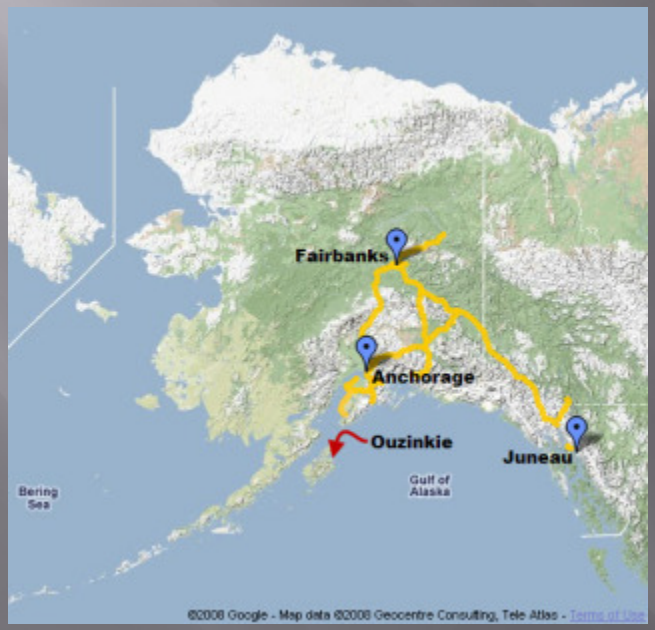
Ouzinkie Improvements

- 2 million dollar facility improvements
  - New 1800 sq ft direct filtration water treatment plant with ferric chloride addition, pre and post soda ash treatment and chlorination
  - System on line February 2012

About Ouzinkie

- Located on Spruce Island, 10 minutes NE of Kodiak in a small plane.
- Name derived from Uzenkiy meaning Village of Russians and Creoles
- Ouzinkie is an Alutiq village with a population of 180
- Commercial fishing and subsistence activities

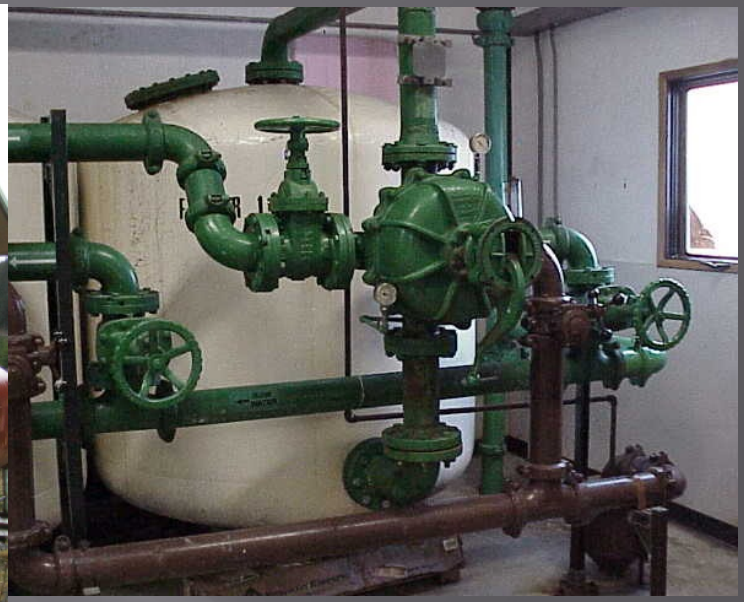


About Ouzinkie

Older Water Treatment Plant

- Constructed in 1986
- Pressure sand filtration/bag filters/disinfection
- Did not comply with EPA LT1 Surface Water Treatment Rule
- Did not comply with EPA Stage 1 Disinfection Byproducts Rule (Stage 1 DBPR)

Older Treatment Plant



EPA Regulations(Brief)

- Surface Water Treatment Rule
  - Filtration requirements
  - Pathogen regulation
  - Residual disinfection requirements
  - Turbidity performance standards
- Disinfection Byproducts Rule (DBP) (Stage 1)
  - Monitoring requirements
  - Regulation of contaminants and disinfectants MCL
    - TTHM 0.080 ug/l
    - HAA5 0.060 ug/l
    - Bromates 0.010 ug/l
    - Chlorine Dioxide 1.0 mg/l

DBP Terms

- Natural Organic Matter (NOM)
  - Found in all surface water and comes from decaying plant and animal matter
- Total Organic Carbon (TOC)
  - Measure of all the carbon in the water and includes NOM, petroleum products, pesticides etc
- Dissolved Organic Carbon
  - The portion of TOC that is dissolved and usually the largest fraction of TOC and of the most concern

Disinfection Byproducts (DBP's)

- DBP's are caused by the reaction of a disinfectant with DBP precursors. The most significant is NOM
- DBP's can have serious health impacts
- Only a few are regulated
  - Trihalomethanes (THM)
  - HaloaceticAcids (HAA)
  - Chlorite
  - Bromate

DBP Formation

- Temperature
  - Increasing temperature increases formation rate
- pH
  - THM increase with pH,HAA's increase with decreasing pH
- Time
  - Reaction will continue as long as there is disinfectant and DBP precursors
- Disinfection Dose
  - Increasing dose results in increasing DBP formation
- DBP precursors

DBP Solutions

- Mitigate DBP formation
  - Minimize water temperature
  - Adjust water pH
  - Minimize free chlorine contact time
  - Minimize free chlorine residual
  - Alternate disinfection (Ozone, UV, Chloramination)

DBP Solutions

- Remove DBP precursors
- Can generally correlate with remaining DOC in water
  - DOC < 1mg/l — very low
  - DOC >1 < 2 mg/l — Low to moderate
  - DOC >2 < 3 mg/l — Moderate to high
  - DOC > 3 mg/l — Very high potential

Ouzinkie Pilot Study

- Raw Water Quality
  - TOC 4 mg/l
  - DOC 3.11 mg/l
  - TTHM FP 229 ug/l
  - HAA5 FP 290 ug/l
  - Alkalinity 26 mg/l
  - Color 30 pcu
  - pH 5.8
  - Turbidity 2.33 NTU
  - UV 254 .15 CM-1

Pilot Study

- Nalco 8185
  - Cationic polymer
- Nalco 8105
  - Cationic polymer
- Ferric chloride
  - Metal salt
- Miex exchange resin with 8105

Pilot Study

- Direct filtration verified
- All coagulants were effective in removing turbidity and color
- All coagulants demonstrated effective filter runs
- Ferric Chloride was most effective in removing DBP precursors

Ferric Chloride ($FeCl_3$)

- Turbidity reduction
- Extremely effective in removal of DBP precursors
- Works over wide pH range (3.5 – 8.5)
- Lower dosage requirement than other metal salts.
- Forms strong enough floc for direct filtration
- Low cost and economical

Water Treatment Plant Design Criteria

Current population	200
Design population	350
Water storage	240,000 Gallons
Average demand	200 GPCD
Daily average demand	72,000 GPD
Filter loading rate	1 GPM/SQFT
Filter backwash rate	16 GPM/SQFT
Filter air scour rate	4 CFM/SQFT

OUZINKIE WATER TREATMENT PROCESS SUMMARY AND FLOW DIAGRAM

PROCESS NARRATIVE

HYDRAULIC PROCESS

RAW WATER WILL TYPICALLY GRAVITY FLOW FROM AN EXISTING RAW WATER RESERVOIR THROUGH THE PROPOSED WTP AND INTO AN EXISTING 240,000 GALLON WATER STORAGE TANK (WST). AN EXISTING INFILTRATION GALLERY WILL BE USED AS A BACKUP RAW WATER SOURCE.

WATER TREATMENT PROCESS

THE PROPOSED WATER TREATMENT PROCESS WILL CONSIST OF COAGULATING RAW WATER CONTAMINANTS USING FERRIC CHLORIDE FOLLOWED BY FILTRATION THROUGH TWO SAND FILTERS OPERATED IN PARALLEL. SODA ASH WILL BE INJECTED PRIOR TO WATER FILTRATION TO MAINTAIN THE OPTIMUM PH FOR COAGULATING RAW WATER CONTAMINANTS. SODA ASH WILL ALSO BE INJECTED AFTER FILTRATION TO RAISE THE WATER PH FOR CORROSION CONTROL IN THE DISTRIBUTION SYSTEM.

FILTERED WATER WILL BE CHLORINATED AND SENT TO THE 240,000 GALLON WST. THE 240,000 GALLON WST WILL PROVIDE THE NECESSARY CHLORINE CT FOR GIARDIA AND VIRUS DISINFECTION. DISINFECTED WATER WILL GRAVITY FLOW TO THE DISTRIBUTION SYSTEM.

THE SAND FILTERS WILL REQUIRE PERIODIC BACKWASHING. THERE IS SUFFICIENT HEAD PROVIDED BY THE 240,000 GALLON WST TO BACKWASH THE FILTERS USING GRAVITY FLOW. THE BACKWASH PROCEDURE WILL BE PRECEDED BY AN AIR SCOUR CYCLE. THE PURPOSE OF THE AIR SCOUR CYCLE IS TO BREAK UP CAPTURED ORGANIC "MUDBALLS", WHICH WILL IMPROVE BACKWASH EFFICIENCY AND INCREASE THE USEFUL SERVICE LIFE OF THE MEDIA.

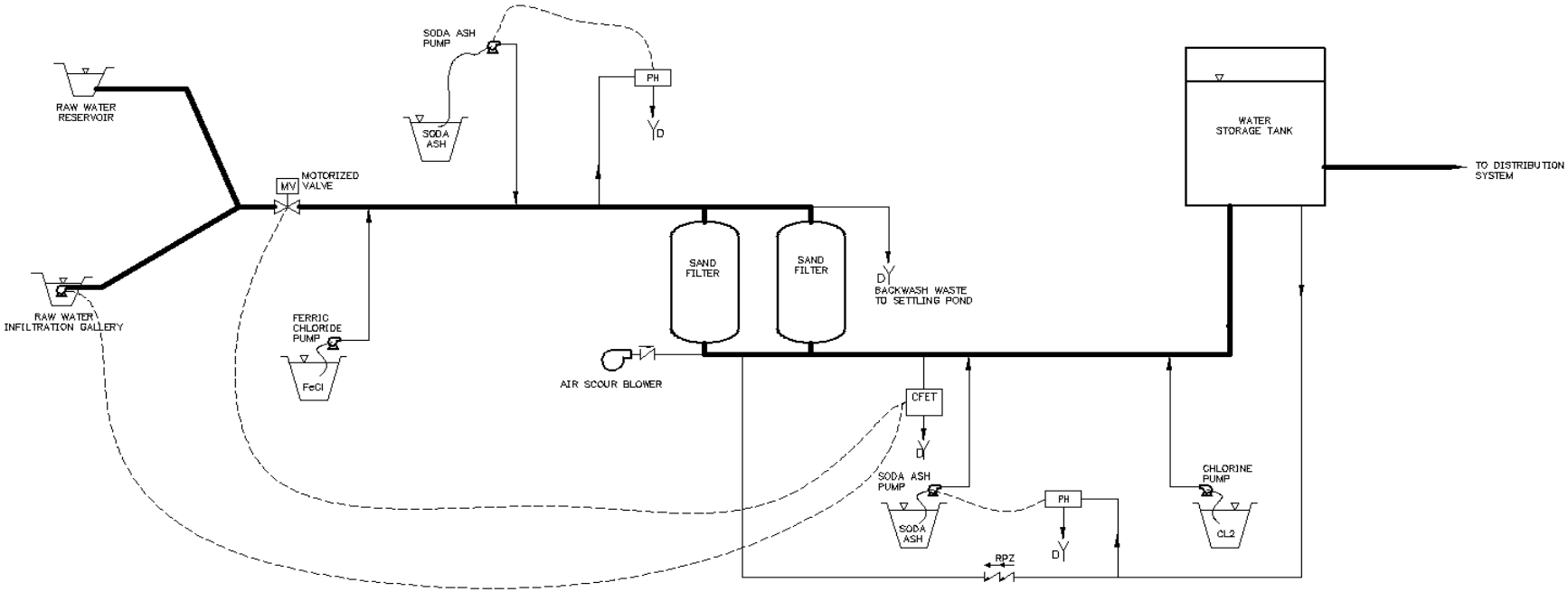
AN ONLINE TURBIDIMETER WILL CONTINUOUSLY MONITOR THE FILTERED WATER'S TURBIDITY. THE TURBIDIMETER WILL BE CONFIGURED TO SHUT DOWN THE GALLERY PUMP (IF ACTIVE) AND CLOSE A NORMALLY CLOSED MOTORIZED VALVE WHEN THE FILTERED WATER'S TURBIDITY EXCEEDS 0.30 NTU.

ESTIMATED CONSUMABLES COSTS PER MILLION GALLONS OF TREATED WATER

CONSUMABLE	QUANTITY	COST
FERRIC CHLORIDE	35 GALLONS	$210
SODA ASH	280 LBS	$168
CHLORINE	16 GALLONS	$90

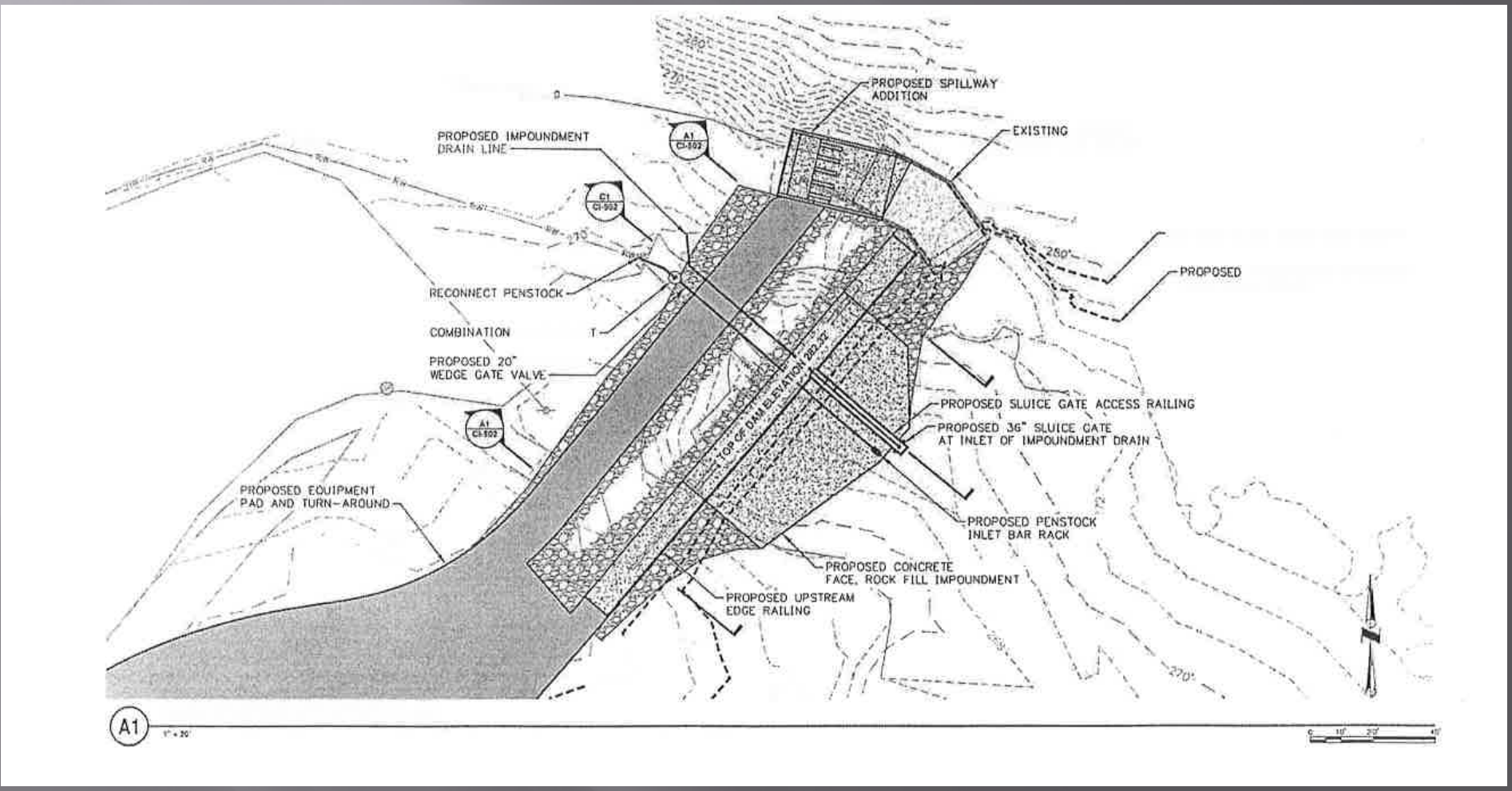
TOTAL: $468

NOTE: ABOVE COSTS DO NOT INCLUDE SHIPPING FEES



Emergency Level Control (2012)

Proposed Dam (2013 Construction)



Mahoona Lake Water Source

- Mahoona lake reservoir (ELEV = 270 ‘)
- Six inch (6”) off 22” -18” hydroelectric supply pipeline
- WTP (ELEV = 50 ‘0 WST (ELEV = 155’)

Katmai Creek Water Source

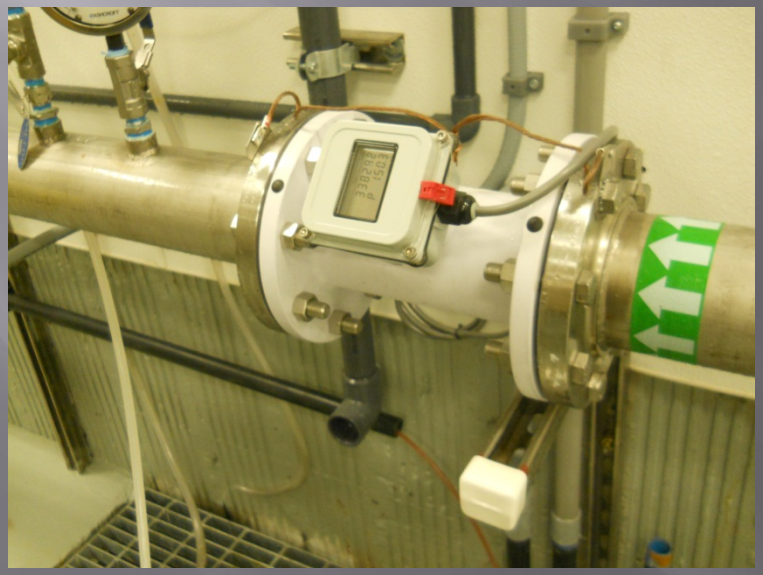
- Infiltration gallery/johnson well screen
- Submersible pump (7.5 hp)
- Control panel in WTP/Variable Speed Drive (VFD)

Inlet Piping and Controls

- Wye strainer
- Flow switch
- Flow pace
- Chemical control panel

Chemical Pump Flow Pacing

- Analog (4-20 ma)
- Seametics flow sensor
- Seametrics controller



Flow Control –Mahoona Dam

- Raw water flow controlled by WST level
- Modulating inlet valve
- Average community demand
- Ability to modify WST level and flow on MACP panel.

Flow Control - Gallery

- Flow controlled by WST Level
- Variable frequency drive motor

Ferric Chloride/Soda Ash

- Enhanced coagulation
- Soda ash is added (if needed) prior to addition of ferric chloride to ensure adequate alkalinity for ferric to react
- Target pH between 6.0
- Static mixer ensures thorough mixing
- Floc is filtered out in pressure filter

Process pH Control

- 500 gallon soda ash vat
- Milton Roy MDH pump
- Hach SC – 200 Controller
- Proportion Integral Derivative (PID) controller
- Target pH (6.0)
- Automatically adjusts Electronic Capacity Control (ECC) to maintain target pH
- Speed flow paced

Process PH Control

Ferric Chloride Addition Equipment

- 55 gallon drums
- Grundfos chemical pump
- Static Mixer
- Dose manually adjusted
- Flow paced

UV 254 meter

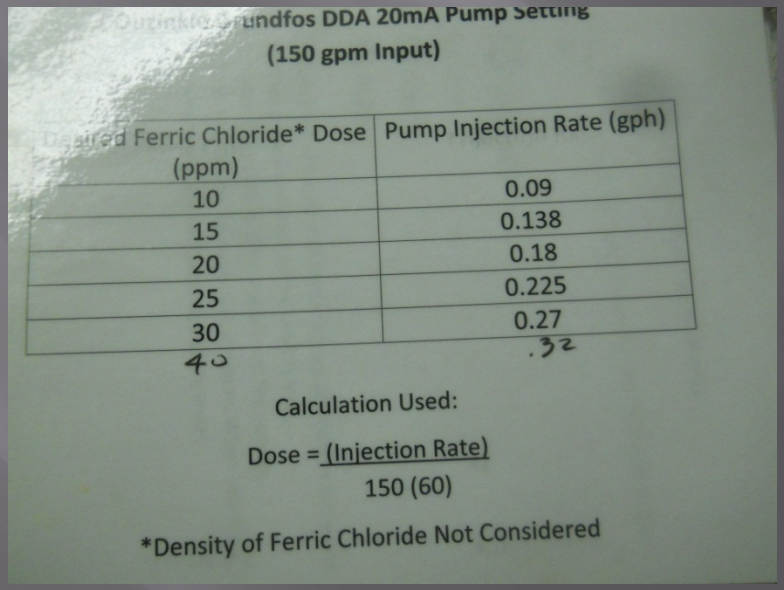
- Measures UV254 absorbance by organics
- Correlates with TOC removal – raw and filtered
- Optimize coagulation process
- Real tech portable UV meter

Portable Charge Analyzer

- Measures charge of water
- Optimize coagulant dose
- Minimize jar testing

Ferric Chloride Optimization

- Adjust dose to lower CFE turbidity
- Adjust dose to reduce filtered UV254
- Adjust dose to zero coagulant charge
- Adjust dose to near optimum pH



(150 gpm Input)

Desired Ferric Chloride* Dose (ppm)	Pump Injection Rate (gph)
10	0.09
15	0.138
20	0.18
25	0.225
30	0.27
40	.32

Calculation Used:

$$\text{Dose} = \frac{\text{(Injection Rate)}}{150\ (60)}$$

*Density of Ferric Chloride Not Considered

Dual Media Filters

- Two stainless steel pressure dual media filters
- Filter diameter 108”
- Max hydraulic loading rate 1 GPM/SQ FT or ~130 gpm.

Backwash Operations

- Filter differential pressure of 8 p.s.i or turbidity breakthrough
- Gravity flow backwash with treated water 16 GPM/SQ FT (1000 GPM)
- Air scour 4 CFM/SQ FT (260 CFM/SQ FT)
- Backwash procedure
  - Air scour
  - Backwash
  - Rinse to waste
  - Return to service

Backwash Operations

Combined Filter Effluent Turbidity (CFE) Turbidity Meter

- Online Hach 1720 E turbidity meter and Hach SC200 Controller
- Continuos logs
- Plant shut down (.29 NTU)

Disinfection

- WST used for contact time and CT.
- CT value residual (0.5 mg/l) required at entrance to distribution system.
- Online chlorine analyzer feed off distribution system

Disinfection Equipment

- Sodium Hypochlorite 12.5 % Solution
- Grundfos chemical pump.
- Dose manually adjusted
- Flow paced

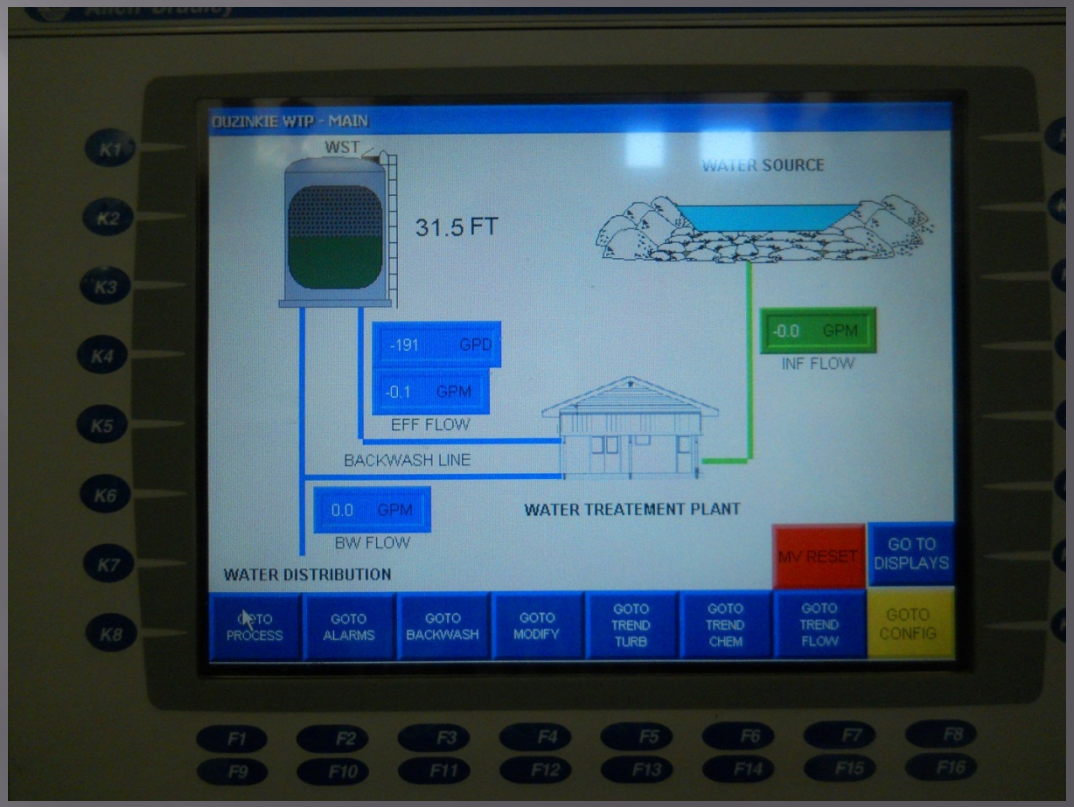
Post pH Adjustment

- Soda ash is added to raise pH to 7 – 7.5
- pH sensor feed off distribution system
- Manually controlled pump

Backwash Stabilization Pond/Percolation Cell

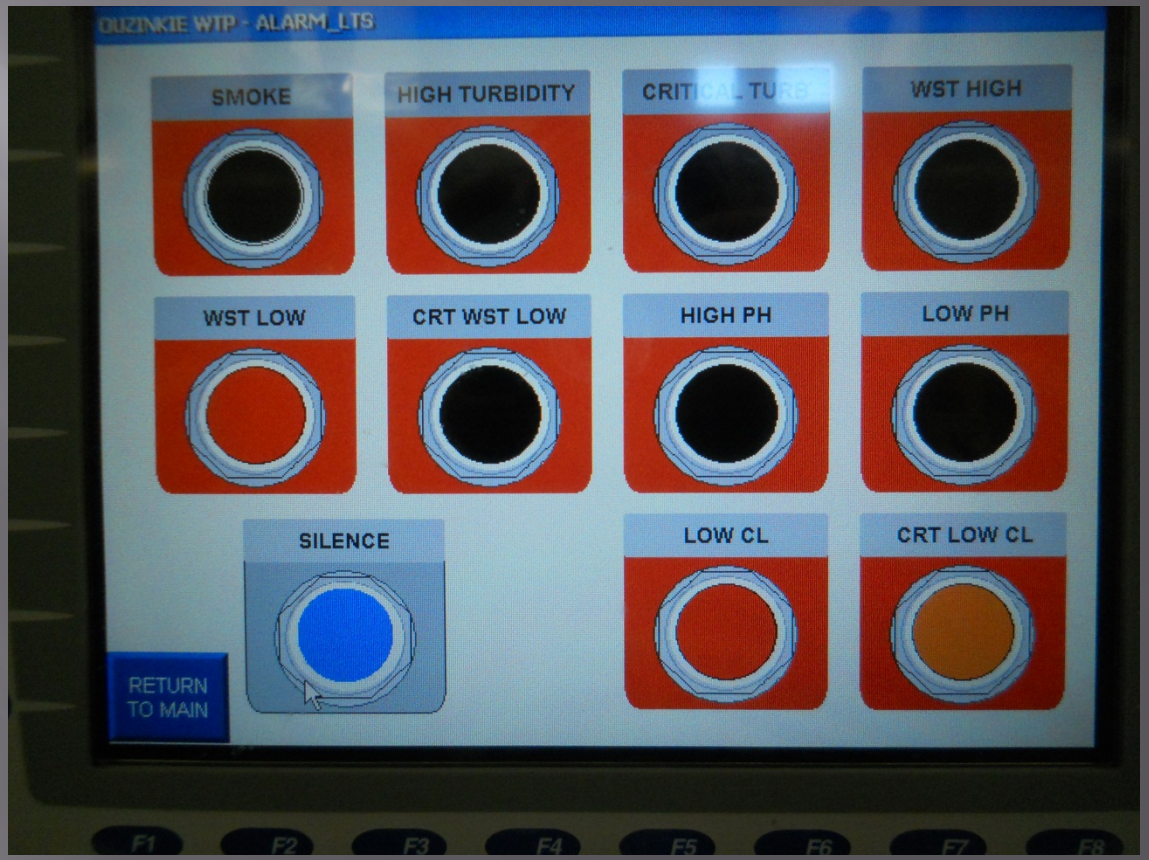
- 2400 Sq Ft backwash stabilization pond

Monitor and Alarm Control Panel (MACP)



Alarms (MACP PANEL)

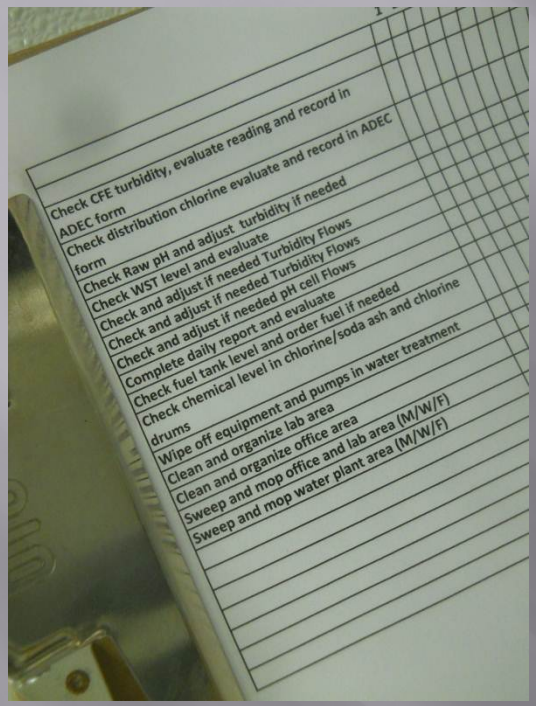
- High NTU
- High pH
- Low pH
- WST Low
- WST High

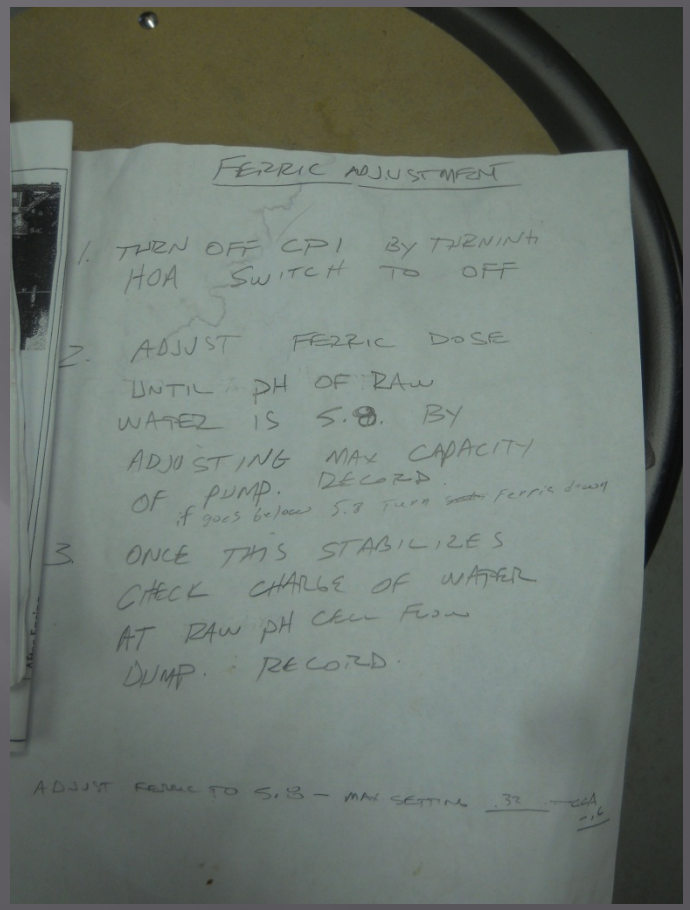


Operation and Maintenance

- Fairly complicated system
- Extensive labeling
- Extensive operation aids
- Operation and maintenance manual
- Daily checklists and treatment record
- Regulatory monitoring forms
- Preventative maintenance plans

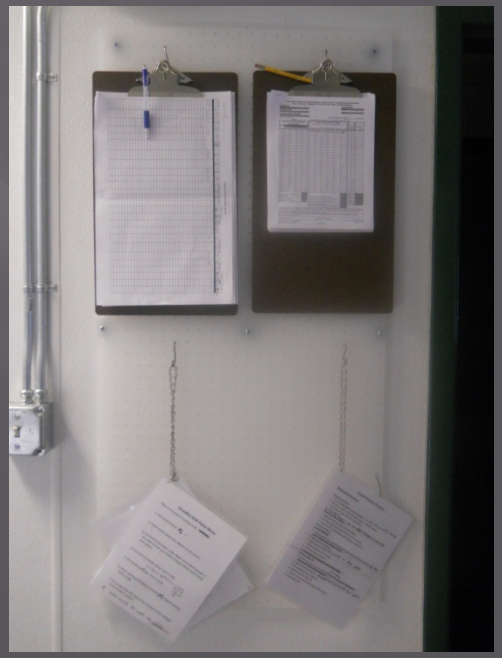
Operation and Maintenance





Plant Operation

- Continuos operation
- Automatic operation
- CFE turbidity monitoring
- Process and Distribution pH monitoring
- UV254 monitoring
- Optimize ferric chloride dose
- Monitoring and reporting



Performance Overview

- TOC Removal (UV 254)
  - 60 – 80 % removal
- Turbidity
  - Consistently low
  - Combined effluent Turbidity < .05 NTU
- Filter runs
  - 1,000,000 gallon +
- Chemical dose
  - Ferric chloride 15 – 35 mg/l
  - Process soda ash 0 – 75 mg/l
  - Post soda ash 0 – 50 mg/l
- DBP (August 2012)
  - HAA5 7.8 UG/L
  - TTHM 18.8 UG/l

Questions