

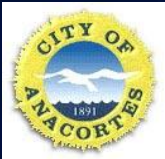
Water Treatment Plant Operations, Water Quality Challenges and Source Water Protection

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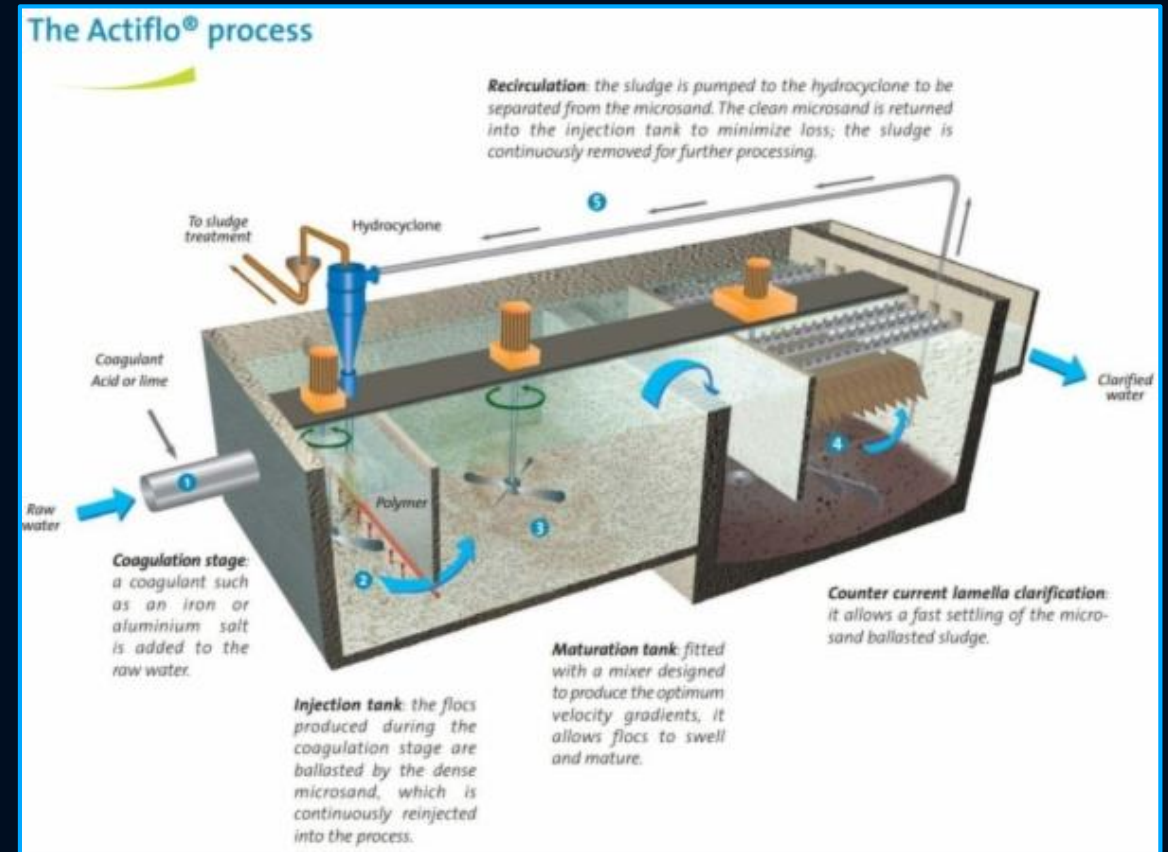
City of Anacortes Water Treatment Plant

- The city owns and operates a regional water treatment plant on the west bank of the Skagit River.
- The plant's capacity is 42 million gallons per day, expandable to 55 mgd.
- The dozen plus operators and maintenance workers at the plant use a multi-barrier approach to turn the raw river water into drinkable tap water.
- The first step is pulling water from the river through traveling screens at an intake station on the west bank and feeding it through an under-river pipe to the plant.
- Alum, soda ash, caustic soda and sodium hypochlorite can be injected into the raw water for coagulation, alkalinity adjustment, pH adjustment and disinfection before it is pumped through to two Actiflo ballasted sedimentation units.



Ballasted Sedimentation - Actiflo

- The water flows into a tank where the coagulant promotes small particles to agglomerate into larger ones.
- The water is mixed with micro-sand and polymer, causing agglomerated particles and sand to flocculate together, increasing in size and weight.
- In a separate tank the flocculated particles settle to the bottom and are pumped to the hydrocyclones, which separate the sand from the solids/sludge.
- Water from the settling tank flows up through lamella tubes (settlers), over weir troughs and into settled water mixing chambers.
- Filter-aid, either alum or polymer, is injected as needed into the settled water-mixing chamber to aid filters in catching any remaining turbidity.



Filtration

- From there the water flows to the filter influent channel and then onto dual media filters comprised of granular activated carbon and sand, which remove all the remaining particles.
- Between the low lift pumping station and the plant reservoir, the water is injected with sodium hypochlorite, and can be further injected with sodium hydroxide or sodium hypochlorite before reaching the high service pumping station for pH control or disinfection.
- The plant is staffed 24 hours per day, 365 days per year by certified water treatment plant operators to continuously and closely monitor the entire treatment process.
- Water samples from each phase of the process are tested according to a strict daily schedule at the plant's laboratory as well as independent laboratories.



Distribution

- The treated water is pumped into a distribution system to service approximately 56,000 residential, commercial and industrial customer in Skagit and Island counties.
- The first stop in the City of Anacortes is the Blue Heron Reservoir Station, equipped with two brand new 1.5-million gallon-reservoirs that hold the treated water until needed by residents and businesses.
- The Anacortes plant also provides treated water to:
 - Skagit Public Utility District
 - Town of La Conner
 - Swinomish Indian Tribal Community
 - City of Oak Harbor
 - Naval Air Station Whidbey
 - Shell Puget Sound Refinery
 - Andeavor Refinery in Anacortes



Water Quality Challenges

- Changing River Turbidity
 - Raw water from 1 NTU to 300 NTU, up to 1000 NTU at times
 - Raw river turbidity fluctuates seasonally and with rain events
 - Spring run-off
 - Operators see higher river turbidity and colder water temps as the snow melts
 - Summer
 - Warmer water, lower river level means cleaner water
 - Operators use fewer chemicals in summer due to warmer water conditions
 - Fall organic loading, low turbidity levels, but high color causes issues
 - Operations must dose alum at higher levels to maintain the coagulation/flocculation process
 - Winter
 - Most challenging due to colder water and unplanned rain events
 - River elevation changes rapidly from 15' to over 27' within hours, causing massive raw water turbidity swings

Water Quality Challenges

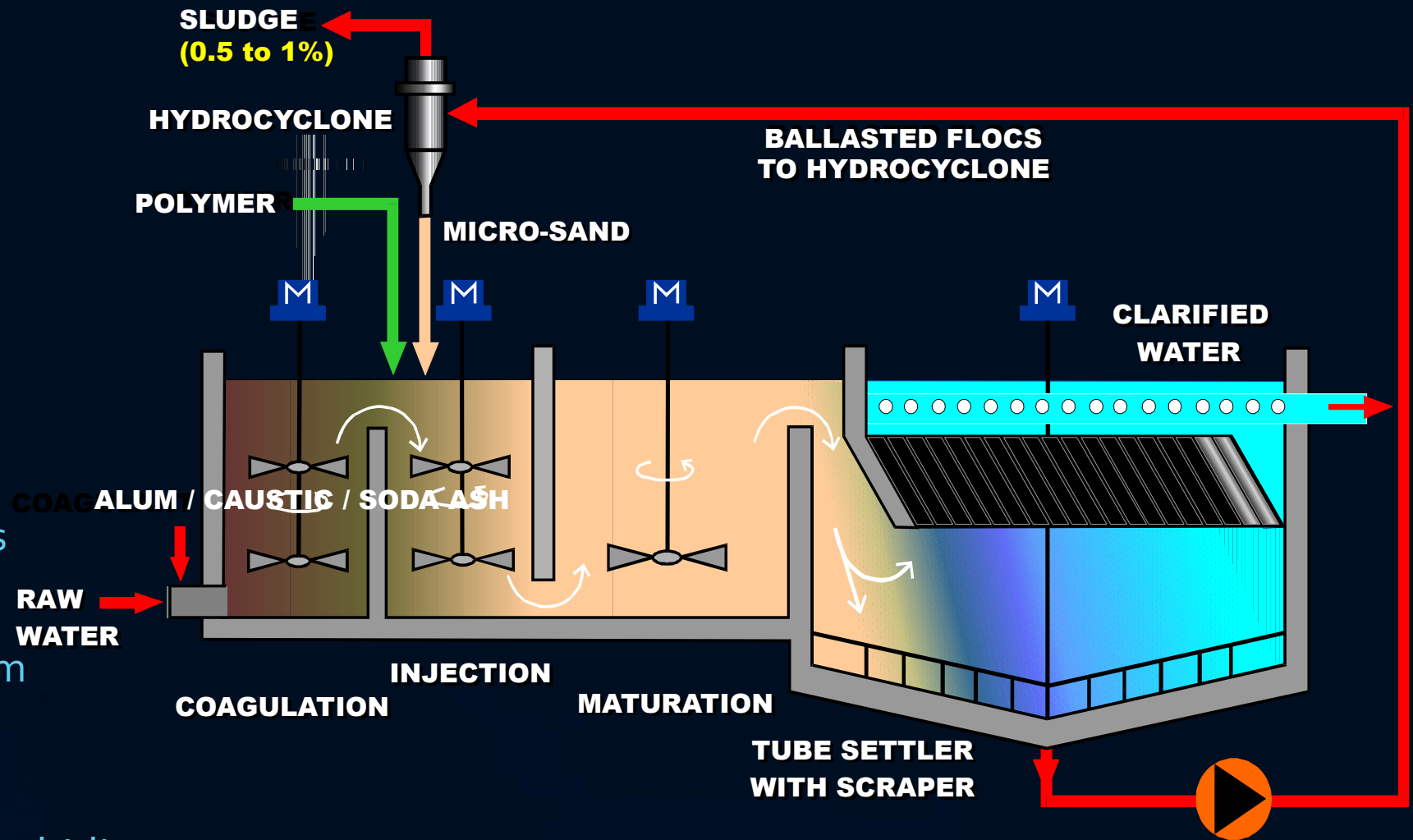
- Operators and Process Controls

- Operators use Aluminum Sulfate, Caustic Soda, and Coagulant Polymer

- Goal is to maintain the Coagulation/ Flocculation Process

- Optimize this process, downstream processes perform better (ie. filters)

- Increased raw water turbidity equals an increase in chemical dosing to maintain a stable Actiflo system



Water Quality Challenges

- Operators use tools to guide chemical dosing decision making and particle/charge neutralization
 - Streaming Current Meters
 - Rapid mix, settled water before filter aid alum, and filter deck
 - Zetasizer - Malvern
 - Rapid mix – analyzes particles for a positive or negative charge
 - Operators maintain a 0 to -5 charge in the process for optimization
 - pH
 - As river turbidity increases, pH decreases and requires caustic addition
 - Adding caustic to the Actiflo BAS train helps alum work better by adjusting the pH, thus helping the coag/floc process.



Water Quality Challenges

- Solids Handling
 - The Anacortes plant manages three lagoons
 - Rotate effluent discharge from BAS trains into one of three lagoons
 - Cleanout one lagoon annually and haul sand offsite, collaborating with dike district



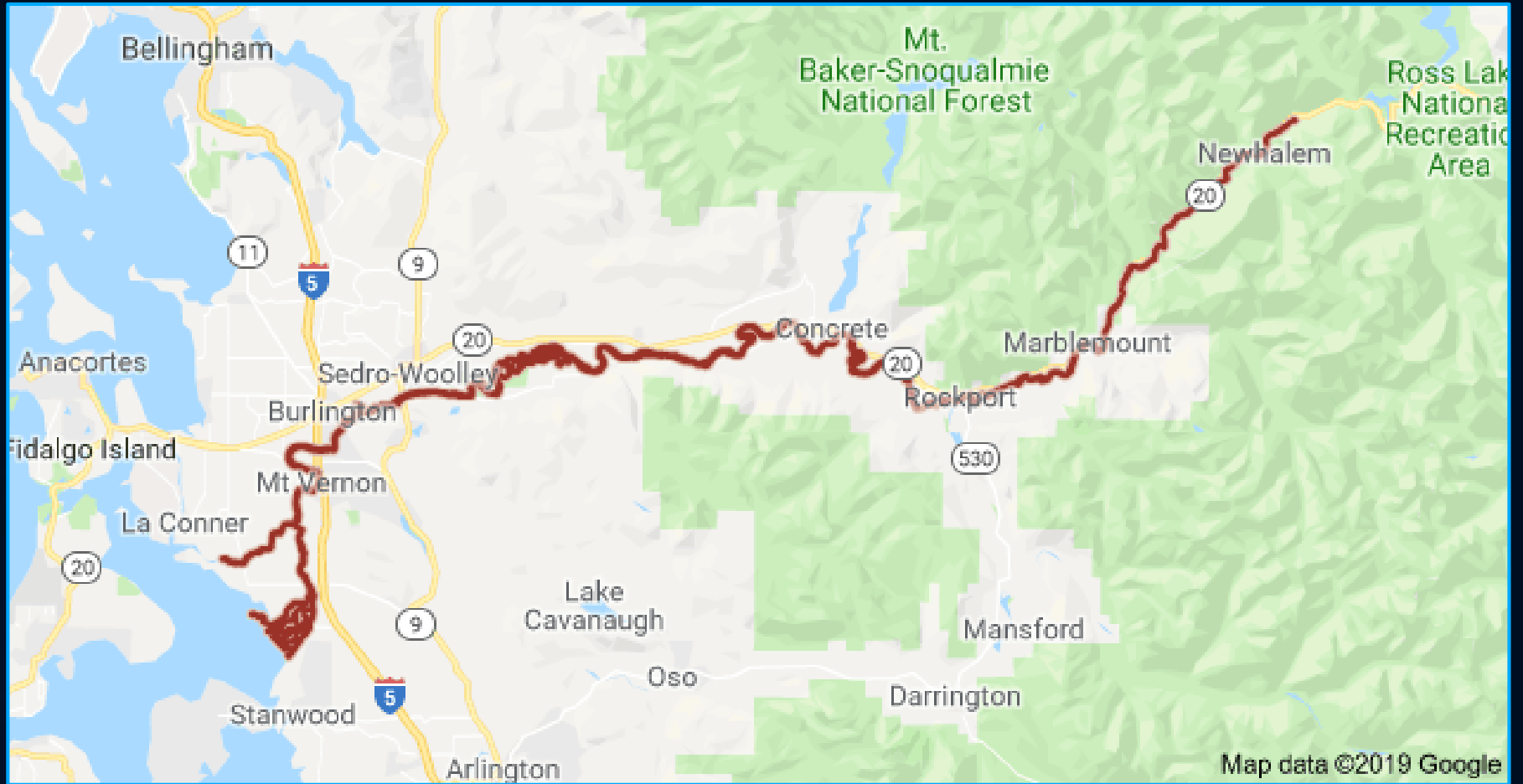
Skagit River

- The Skagit River is the largest river in Puget Sound and one of the biggest rivers in the entire state.
- It runs 150 miles long and drains a mountainous watershed that encompasses almost 1.7 million acres of the North Cascade Range and coastal Washington.



Skagit River

- The river begins off Allison Pass in the Canadian Cascade Mountains of British Columbia. Before reaching saltwater, the river splits into a north and south fork, forming Fir Island and then joins Puget Sound at Skagit Bay.



Google Maps

Source Water Protection

The Anacortes plant works with several county and state government agencies, neighboring utilities and conservancy groups to protect the quality of water coming from the river.



- Washington State Department of Ecology in 2001 adopted a rule, which established instream flow levels to help protect the ecosystem of the Skagit River.



- Skagit Watershed Council supports and endorses voluntary restoration and protection of natural landscape, floodplain, and estuarine processes that form and sustain the habitats to which salmon and trout are adapted.



- Skagit Dike, Drainage and Irrigation Districts provide and maintain the infrastructure that protects farmland, roadways and homes by providing drainage, flood control and essential irrigation.

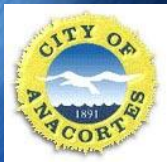


- Skagit River Hydroelectric Project consists of the Gorge, Diablo and Ross dams on the upper river owned and operated by Seattle City Light.

Questions?



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