

West Point Treatment Plant Flood & Restoration Effort

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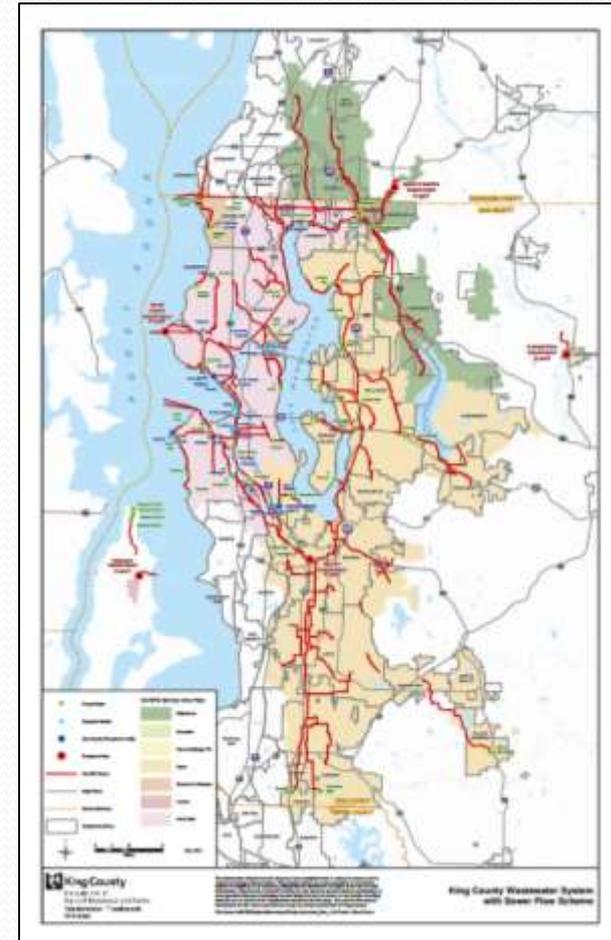
King County

Department of
Natural Resources and Parks

Wastewater Treatment Division

King County WTD System

- 5 WWTPs, 26 regulator stations, 47 pump stations, and 391 miles of sewer pipelines
- Serves 1.7 million over a 424-square-mile service area in King and parts of Pierce and Snohomish Counties
- Large portions of the system are combined wastewater and storm-water

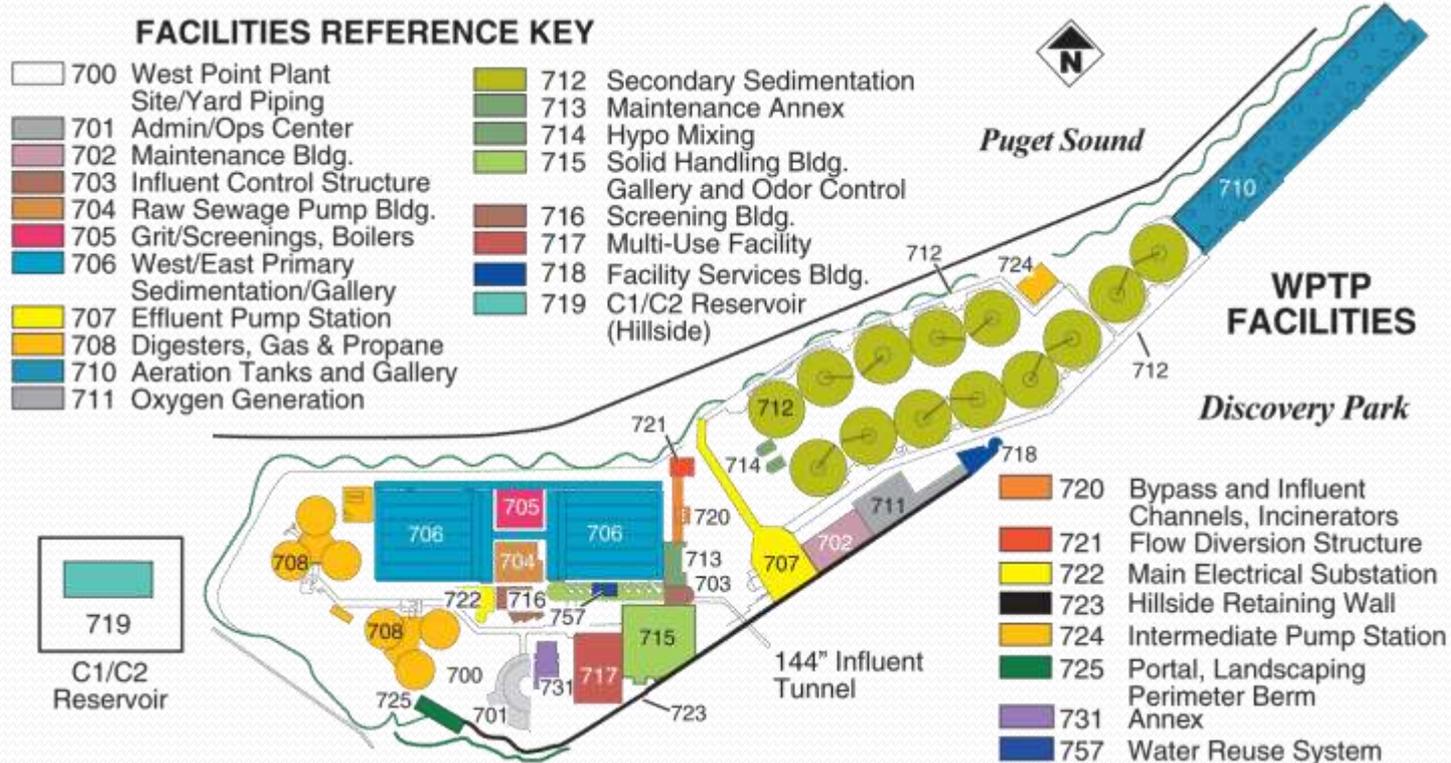


West Point Treatment Plant

- Plant averages 90 million gallons a day during dry months
- Wet weather design capacity of 440 million gallons a day
- Serves City of Seattle's combined stormwater and sewer system
- 14 years of excellent compliance with discharge permits



Plant Process Systems

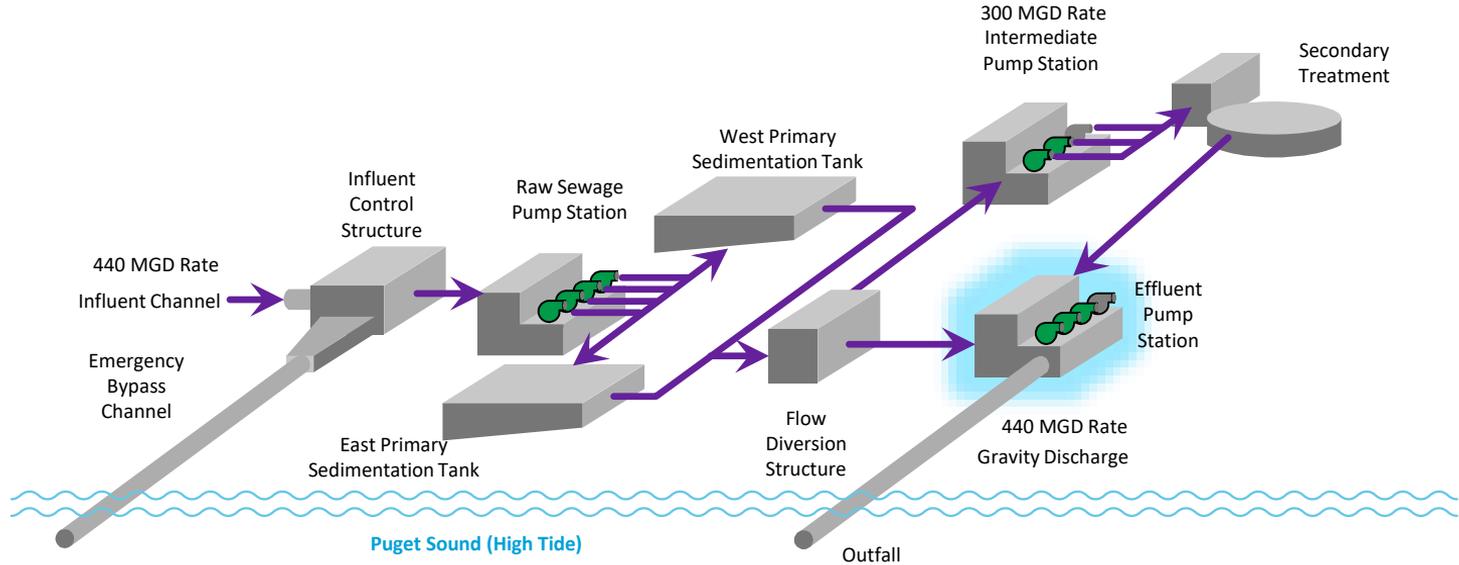




Timeline of February 9th Flood Event

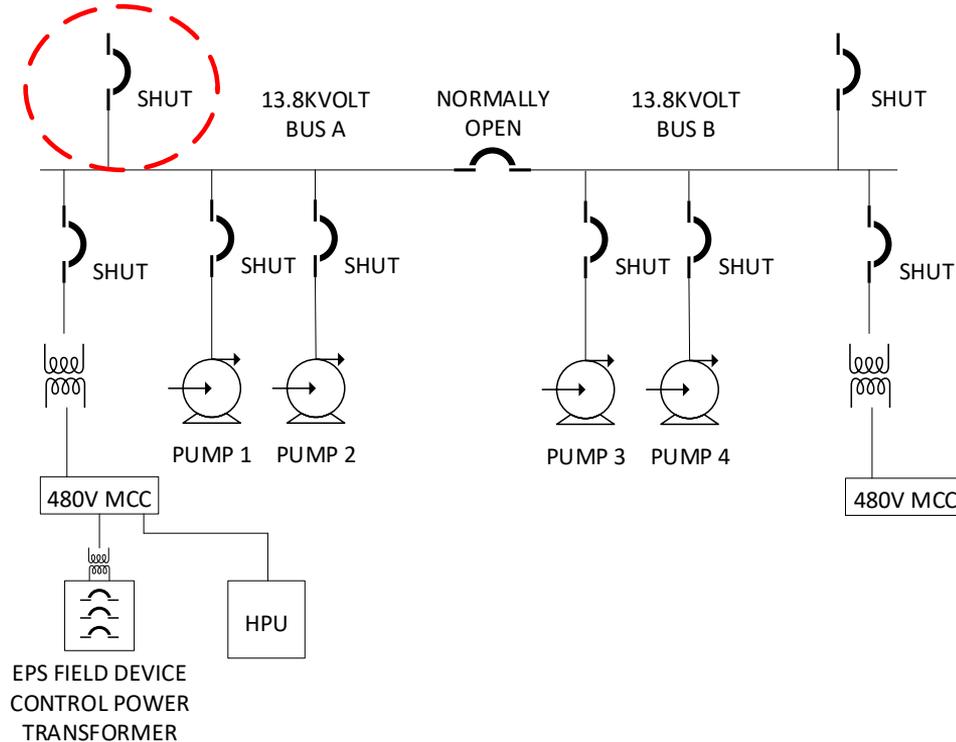
Timeline – 2:10:00AM (Before event)

A severe storm results in maximum influent (wastewater and storm water) being treated at 450 Million Gallons Per Day. High flow and high tide levels require that Effluent Pumps 2, 3, and 4 are running at near 100% speed; Pump 1 is on stand-by.



Timeline – 2:12:30AM

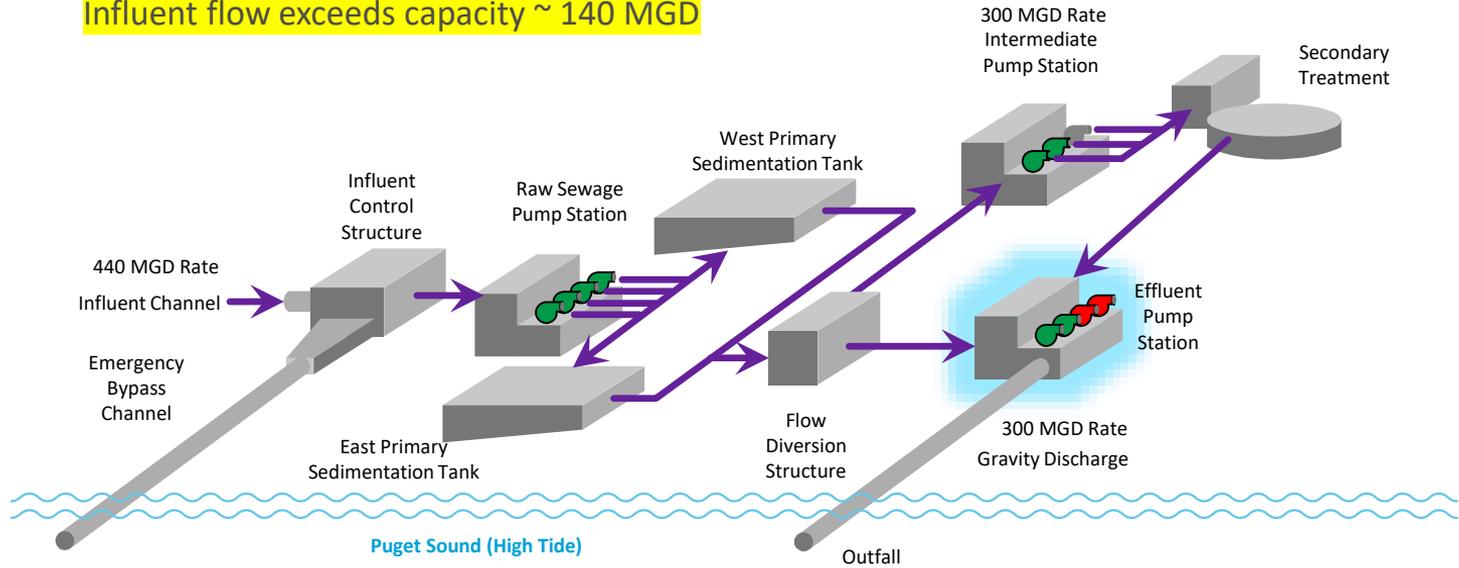
Electrical ground fault detected on the 13.8KV Bus A supply breaker.
Immediately stopping Effluent Pumps 1 and 2.



Timeline – 2:12:30AM

Effluent Pumps 1 and 2 stopping would have reduced capacity to 300 MGD rate.

Influent flow exceeds capacity ~ 140 MGD

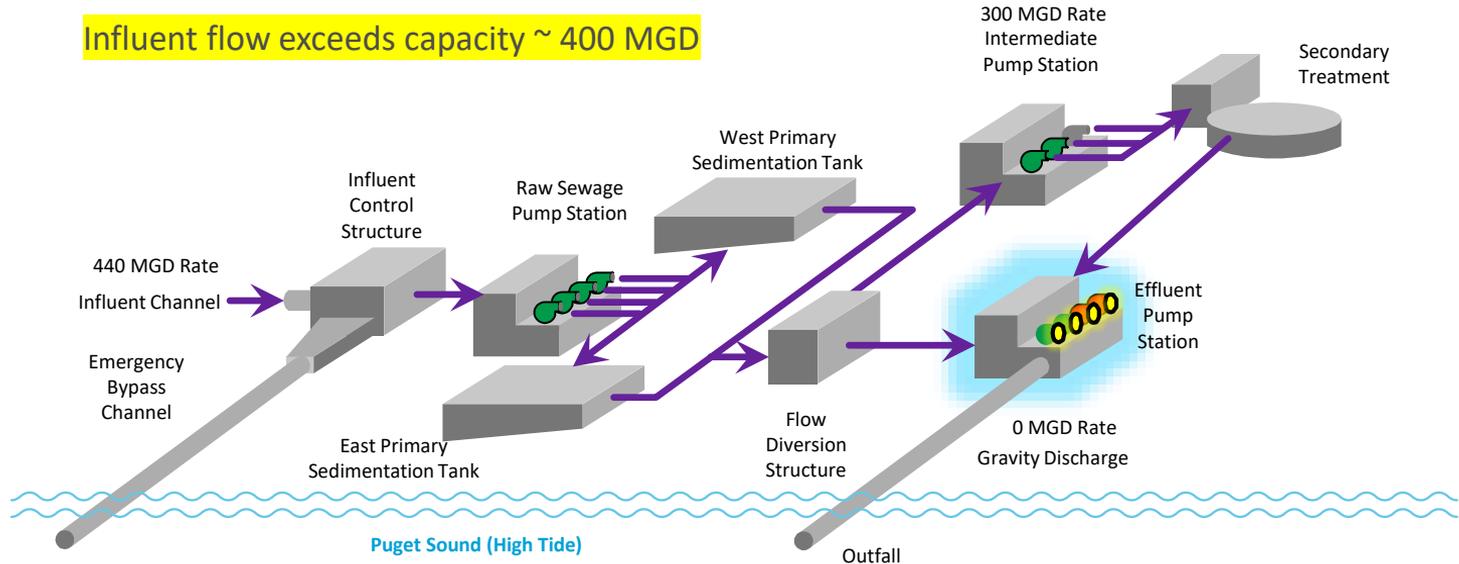


Timeline – 2:12:40AM

After power is lost, all four Effluent Pump discharge valves close.

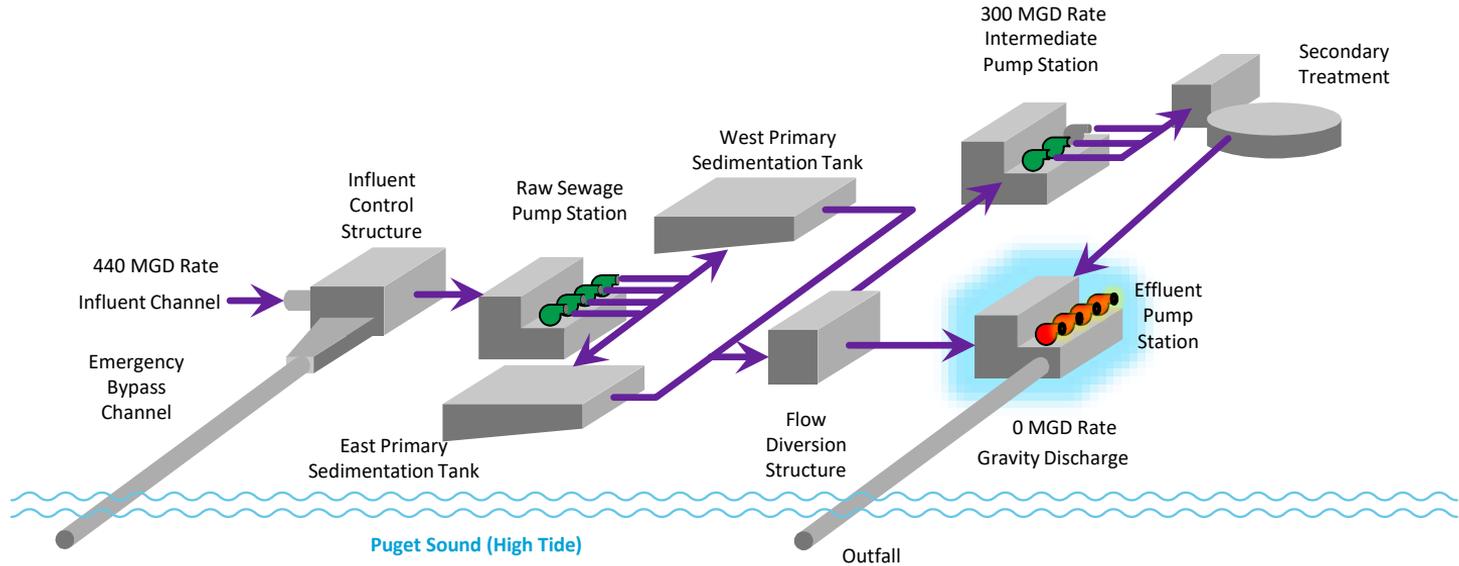
Reducing the capacity to gravity flow only, at high tide ~50 MGD.

Influent flow exceeds capacity ~ 400 MGD



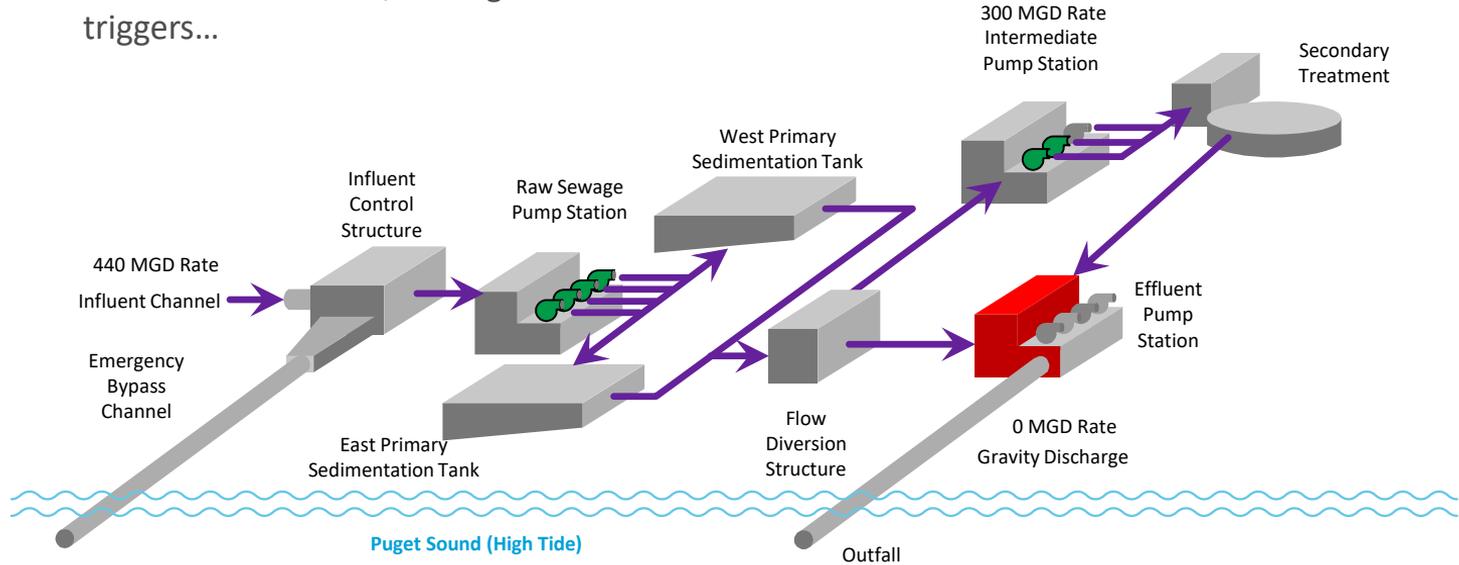
Timeline – 2:14:40AM

With hydraulic discharge valves closed, the remaining Effluent Pumps 3 and 4 fail and shut down.



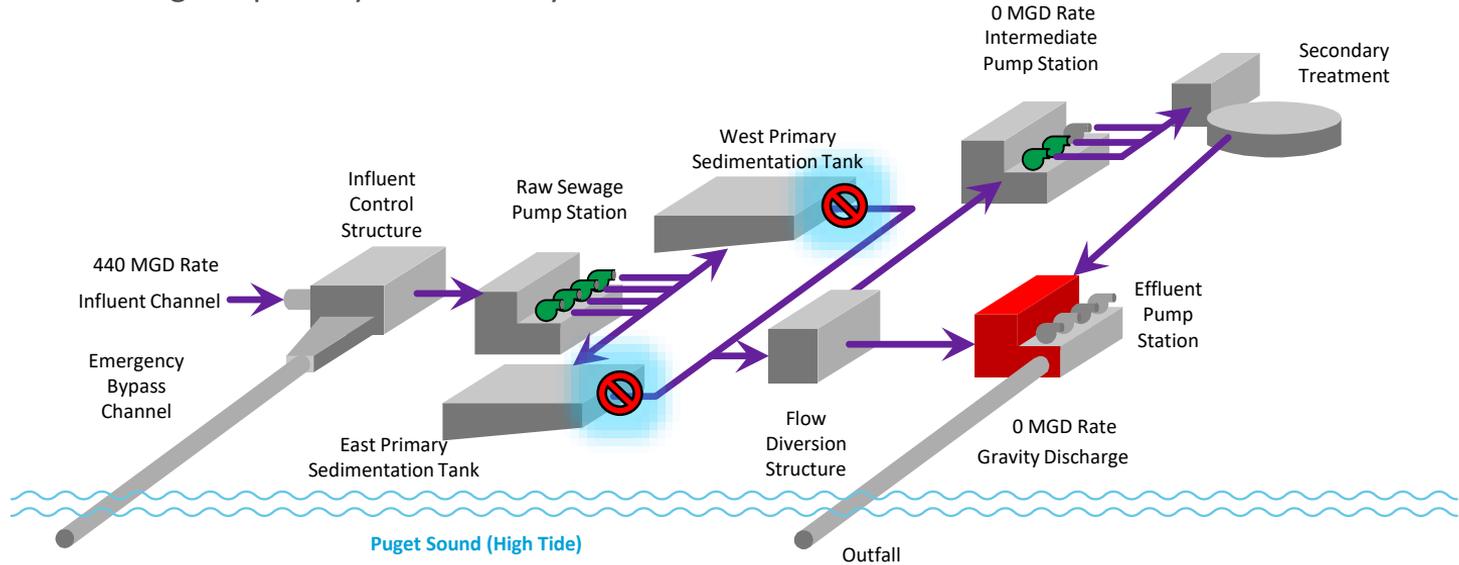
Timeline – 2:14:49AM

After Effluent Pumps shut down and cannot be restarted, the wet well water level rises. Once full, the high-level switch triggers...



Timeline – 2:14:59AM

... to close the release gates at the Primary Sedimentation Tanks, to stop flow from leaving the primary treatment system.

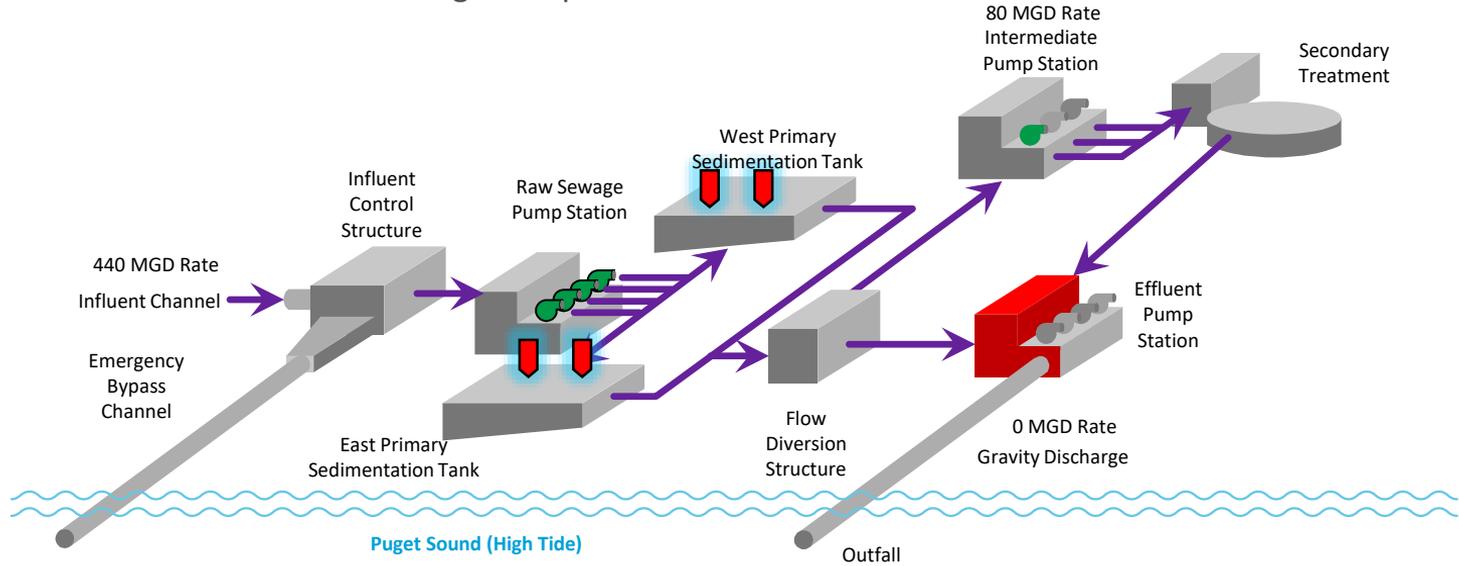


Control Room



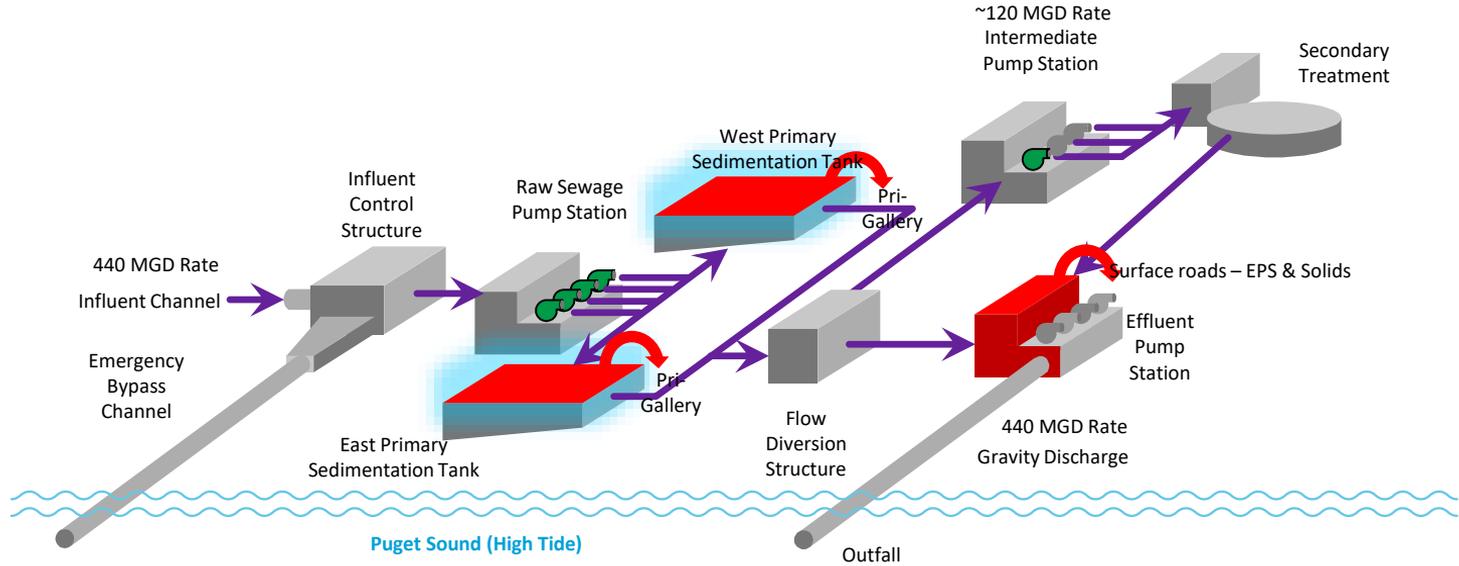
Timeline – 2:25:00AM

As levels in the Primary Sedimentation Tanks rise, the high-level switches fail to shut down the Raw Sewage Pumps...



Timeline – 2:25:00AM

... and both Primary Sedimentation Tanks begin to overflow.



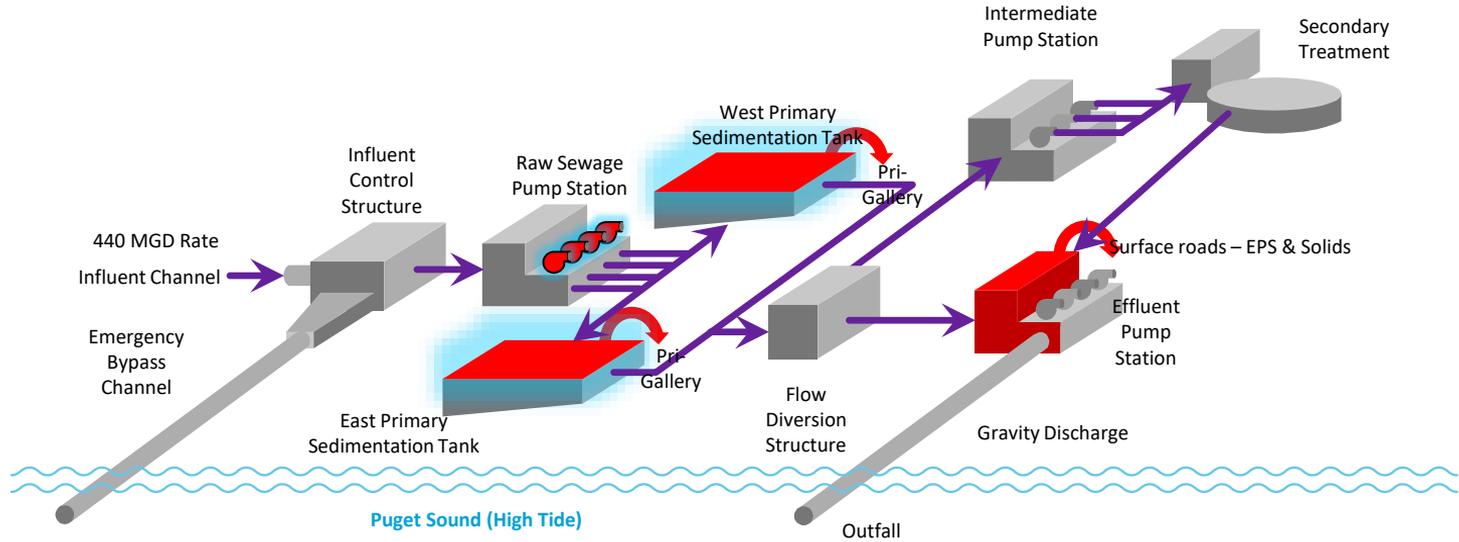
Flooding

Overflows from both Primary Sedimentation Tanks drop directly into underground maintenance access-ways and mechanical equipment galleries. Flooding is not visible from the surface, until galleries are completely full.



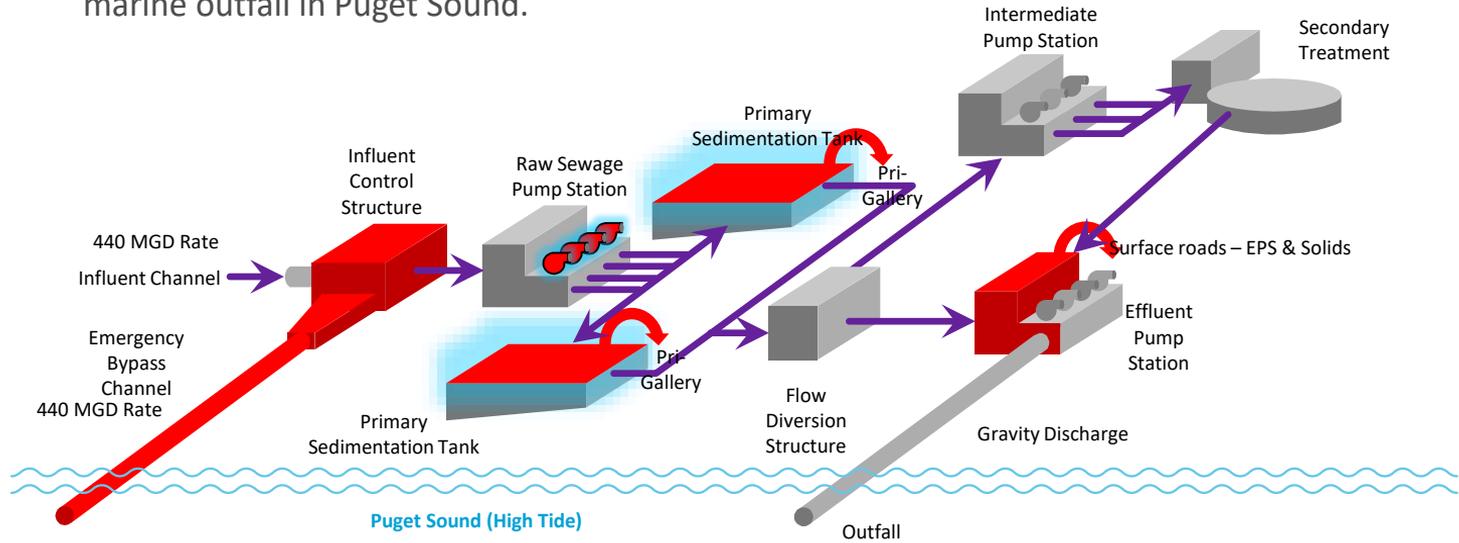
Timeline – 3:03:00AM

Raw Sewage Pumps manually stopped.



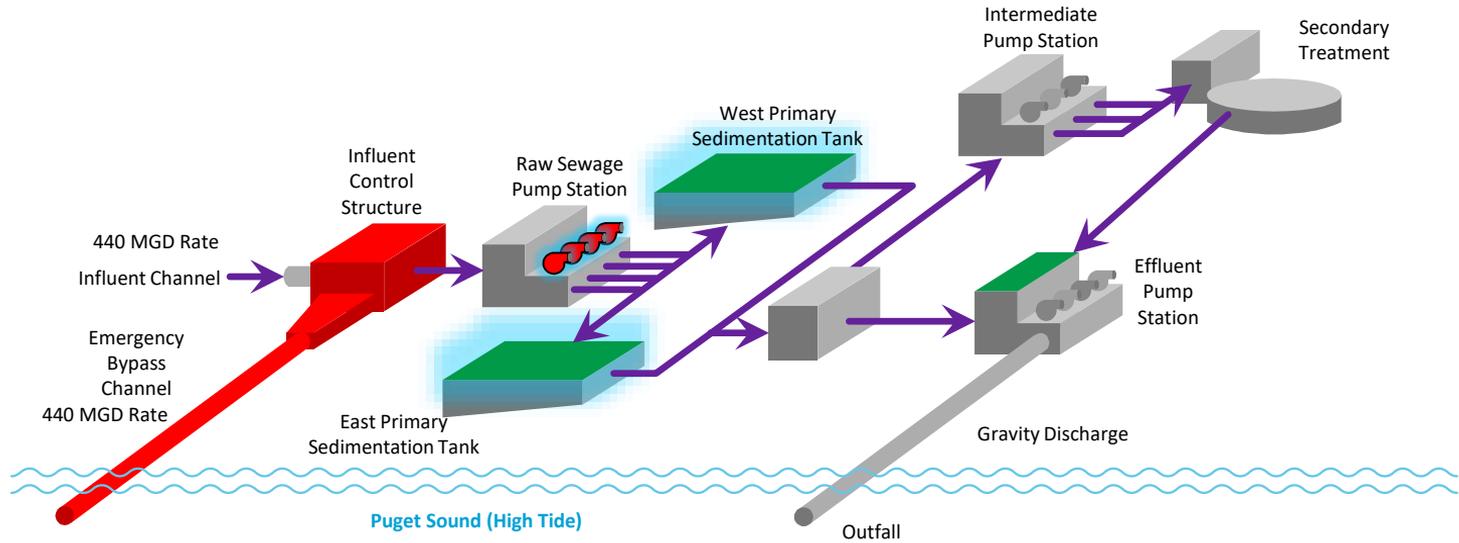
Timeline – 3:04:00AM

With Raw Sewage Pumps stopped, the Influent Control Structure diverts untreated discharges to the emergency marine outfall in Puget Sound.



Timeline – 3:05:00AM

Levels in both Primary Sedimentation Tanks drop, and plant flooding stops.



Primary Sedimentation Tanks High & High-High Float Switch Failures – Stems were all bent and binding in stilling well tubes





Incident & Recovery Effort

February 9, 2017

- Employee safety paramount
 - No major injury!
- Flood damage temporarily halted plant operations
- 180 million gallons of a 90/10% storm-water/wastewater discharged to Puget Sound



Flood Damage



Flooded galleries

Flood Damage



The force of the flood

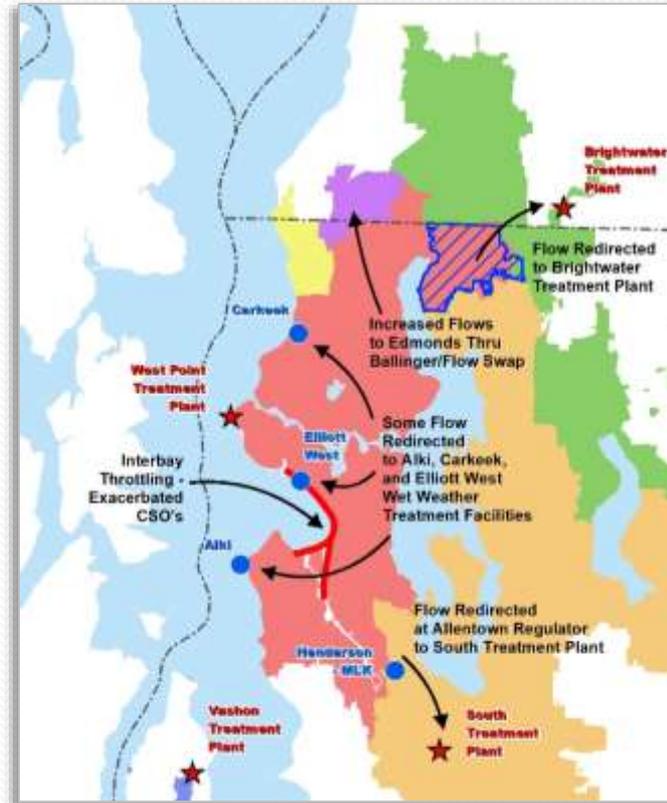
Immediate Response

- Plant was quickly brought back on-line with reduced capacity & level of treatment
- Diverted flows to other facilities
- Mobilized crews and equipment for 24/7 response
- Posted beaches and monitored water quality to protect public
- Assess damage



Flashlight shows water line

Flow Diversion



Assessing Damage



Inundated Equipment

Type of Equipment Damaged	Equipment Count
12 x 12-foot tunnels	1 Mile
Electric Motors	149
Pumps	127
Electrical Motor Control Centers Buckets	200
Electrical Panels	125
Electrical Transformers	25
Local Electrical Control Stations	125
Light Fixtures	>2000
Outlets and Switches	>1200
Instruments	>125
Solenoids	>200
Equipment Control Systems	3



Recovery Management

- Proactive community engagement
- A mind-set of transparency to the community and internally
- Transition from incident response to plant restoration
- Needed resources



Emergency Resources

- Emergency declaration
- Broad response effort
- Critical path scheduling
 - Support recolonization of biology in secondary and solids
- Set goal to restart all plant processes by April 30

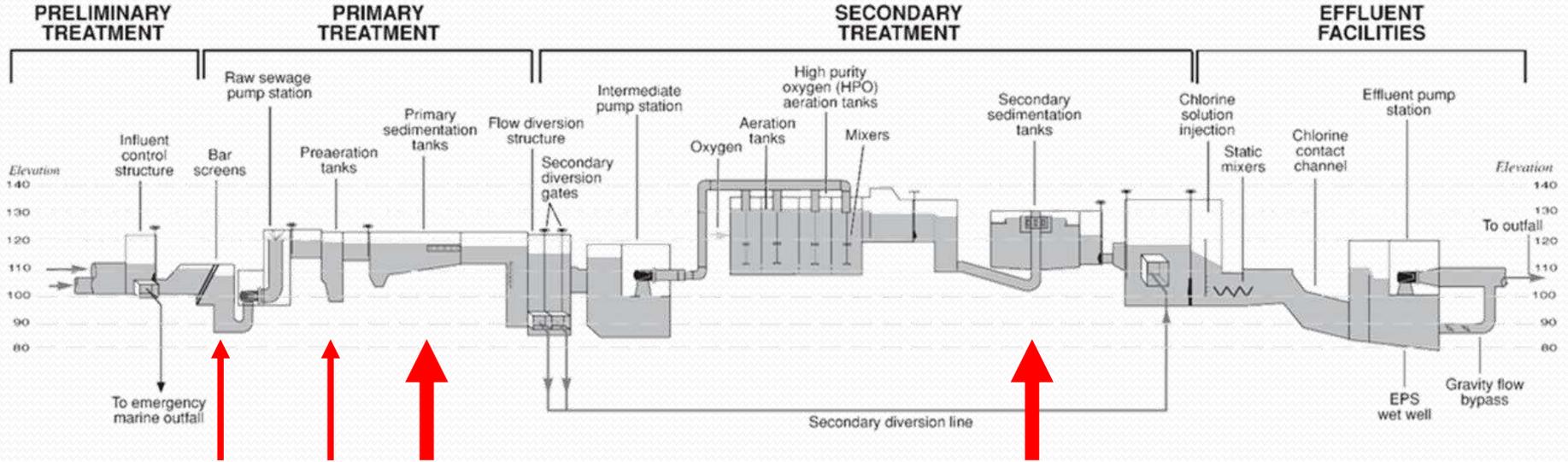


Emergency Recovery Approach

- Establish a plant recovery RAM
- Communicate, communicate, communicate
- Be agile & accepting of change
- Consider insurance requirements early and document appropriately
- Critical path led through solids



Critical Path Through Solids



Physical Restoration Work

- Plant cleanup and sanitation
- Critical path repair of pumps, motors, and electrical equipment
- Sustain biological systems for restart
- Address non-critical building and equipment damage





Equipment Control Panels – Cleaned, inspected, and ready for repair/replacement



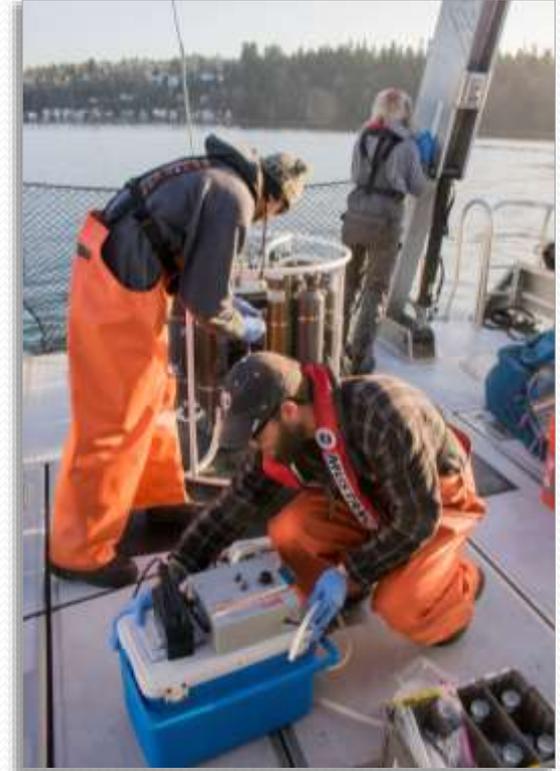
Gravity Belt Thickener Feed Pumps - Ready for replacement motors



Pump being repaired

Recovery Milestones

- All necessary plant operations were back online on April 27, 2017
- West Point achieved NPDES permit compliance on May 12, 2017
- Final repairs made in March, 2018
- Comprehensive plant improvements currently underway
- Comprehensive assessment of conveyance system and growth underway



What's Next

- Address independent inquiries & reports
- Pursue opportunities to add further resiliency to the system
- Prepare and train for emergencies
- Looking at system-wide loads
 - Address future population growth
 - Maintain affordability
- Share our experience



Thank you!

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