TECHNICAL MEMORANDUM

West Point Flooding Investigation

Preliminary Findings Report

Prepared for

King County

Wastewater Treatment Division

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Seattle, WA 98104

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Acronyms and Abbreviations

DCS	Distributed Control System
EMO	Emergency Marine Outfall
EPS	Effluent Pump Station
ICS	Influent Control Structure
IPS	Intermediate Pump Station
kV	Kilovolt
MGD	million gallons per day
PE	primary effluent
RSP	Raw Sewage Pump

Executive Summary

This summary provides an update on circumstances and information known regarding the flooding incident at the West Point Treatment Plan on February 9, 2017. Ongoing testing and data analysis continues to define the root cause(s); this preliminary summary will be updated as more information is gathered.

Timeline

On the morning of February 9, 2017, a rain storm in Seattle produced an extremely high influent flow to the West Point Treatment Plant. Plant records show that at 2:12AM, electrical switchgear feeding two of four Effluent Pumping Station (EPS) pumps failed. The EPS is the final hydraulic element of the plant that delivers flow to the outfall, which is located 220 feet under Puget Sound. At the time, Pump 1 was in standby mode and Pumps 2, 3, and 4 were operating at full speed. Because Pumps 1 and 2 are fed from the electrical switchgear that opened, Pump 2 stopped and was not operational. Because Pumps 3 and 4 are fed from a different switchgear than Pumps 1 and 2, these were operational until 2:14AM, when they failed due to high vibration when the discharge valves closed from power loss.

If flow out of the plant stops, tank levels within the plant will begin to rise in sequence. The elements of the treatment plant are protected by a series of float switches and hydraulically-actuated gates that are designed to systematically stop flow through that plant, and eventually initiate an emergency bypass to protect personnel and the facility. In the event of an EPS pump failure, an EPS wet well high-level float switch initiates action to prevent continued flow into secondary treatment. At 2:15AM, the EPS wet well increased and the high-level float switch tripped. Gates then automatically closed to stop primary effluent (PE) flow from the primary treatment tanks.

Primary treatment occurs at the front end of the plant, and consists of two extremely large tanks meant to slow the velocity of the sewage to allow solids to settle and scum to float. The solids and scum are removed as the PE moves on to secondary treatment and then on to EPS. The primary treatment system also has float switches designed to detect high wastewater levels. The float switches' function is to automatically stop the entry of wastewater into the plant from raw sewage pumps (RSPs). During the event, all of the float switches failed to engage and the automatic shutdown of the RSPs did not activate. As a result, the two primary treatment tanks began to overtop at 2:25AM, causing extensive damage to components located in galleries beneath the tanks.

At 3:03AM operators manually stopped the RSPs, and the level in the influent control structure (ICS) upstream of the pumps began to rise. At 3:04AM the ICS float switches performed their intended function and caused the emergency bypass (EB) gate to open, which allowed flow to automatically bypass the plant and divert into the emergency marine outfall (EMO). At 3:05AM the level in the primary tanks began to subside and fell below the overflow point, stopping the flooding of the facility.

Once the decision was made to stop the RSPs, the bypass mode was achieved in 12 minutes (3:15AM). Over 180 million gallons of untreated storm water mixed, with small amounts of sewage, was discharged into Puget Sound through the EMO.

Preliminary Root Cause Observations

Events unfolded very quickly. Three minutes passed between when electrical failure occurred in the EPS, and when PE flow automatically stopped leaving the primary treatment system. Ten minutes passed between when PE flow was prevented from leaving the primary treatment system, and when the primary tanks first started to overflow. Based on information known at this time, these first 13 minutes of this event (between 2:12AM and 2:25AM) were a critical time period that resulted in extensive damage to the underground electrical and mechanical components of the plant.

Tests and data analysis are ongoing to determine the root cause of the electrical failure that precipitated the loss of power to EPS Pumps 1 and 2. We do know that operation of the EPS pumps was prevented by the closure of the hydraulically-actuated discharge valves when the hydraulic skid lost power. Operators repeatedly tried to bring EPS Pumps 3 and 4 back online following the 2:12AM power failure, including at 2:21AM and again at 2:31AM. Operators also attempted to start only Pump 3 at 3:00AM.

Upstream from the EPS pumps, the failure of the primary treatment float switches is believed to be due to bending of the float support rods. There are two float switches in each of the two primary tanks. The float is a 4-1/2 inch stainless steel ball, which is supported by a rod that travels within a guide tube. The entire assembly is mounted within a 6-inch pipe, which acts as a stilling well. The floats are set to actuate the safety circuit when the level in the tanks rises to an elevation of 1-foot below the overflow point.

When examined post-event, the float rods were observed to have been bent to such a degree that the 4-1/2 inch ball would have been in contact with the inner surface of the 6-inch stilling well; this would cause friction on the float and between the rod and guide tube. It appears that this impingement inhibited free travel of the float, which then caused the safety circuit to fail. This appears to be the reason that the RSPs did not stop pumping, even though the level was rising in the primary treatment tanks.

The following report provides further detail for this event, and will be updated as testing and data analysis concludes.

Introduction

The West Point Treatment Plant is located on Puget Sound, next to Discovery Park in Seattle, Washington. This treatment facility is part of King County's regional wastewater treatment system and treats wastewater from Seattle, Shoreline, North Lake Washington, North King County and parts of Snohomish County. Flow through the facility ranges from 90 to 440 million gallons per day (MGD). Secondary treatment capacity is 300 MGD, while the facility can provide primary treatment for flows exceeding 300 MGD up to 440 MGD.

1.1 Treatment Plant Overview

The West Point treatment plant receives influent through two tunnels with diameters of 8 and 12 feet, respectively. These pipes convey influent to the Influent Control Structure (ICS). Under normal conditions, the influent is pumped by the raw sewage pumps (RSPs) to the primary sedimentation tanks.

Figure 01 illustrates the treatment plant influent and effluent pipelines and identifies the locations of the facilities discussed in this report.

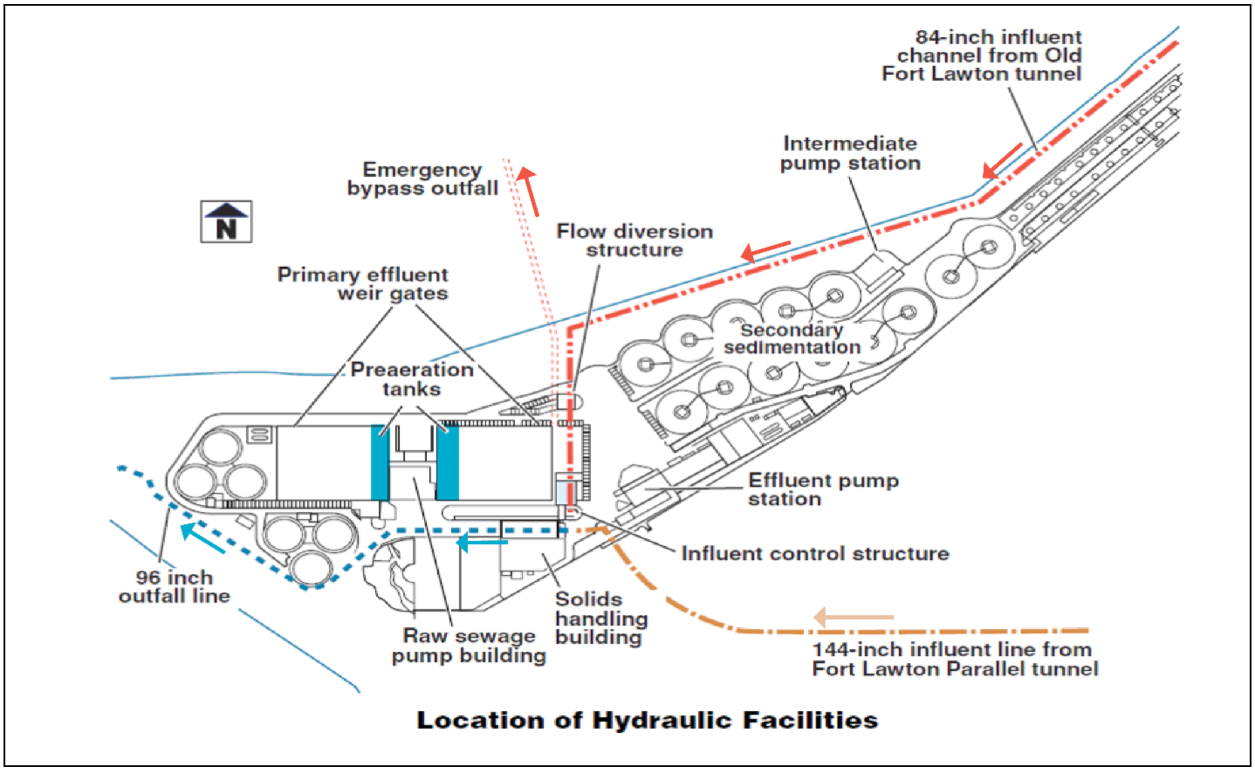


Figure 01. Influent/Effluent Diagram

Influent pipelines into the facility, primary outfall and emergency bypass outfall pipelines.

Source: WPTP Operations Manual

From the primary sedimentation tanks, the flow is pumped to the high purity oxygen (HPO) basins by the Intermediate Pump Station (IPS). Flow then travels by gravity through the secondary clarifiers, through a hypochlorite disinfection system, and finally into the Effluent Pump Station (EPS) wet well (Figure 02). The treated effluent is then discharged into Puget Sound by gravity or by pumping, depending on tide conditions.

Plantwide Hydraulic Profile

1 The ICS elevation varies.

Influent Control Structure

At elevation 111.0, the emergency bypass gate opens, the four influent gates close when the RSP wet well reaches elevation 110.2.

2 The raw sewage pumps maintin a constant level in the RSP wet well.

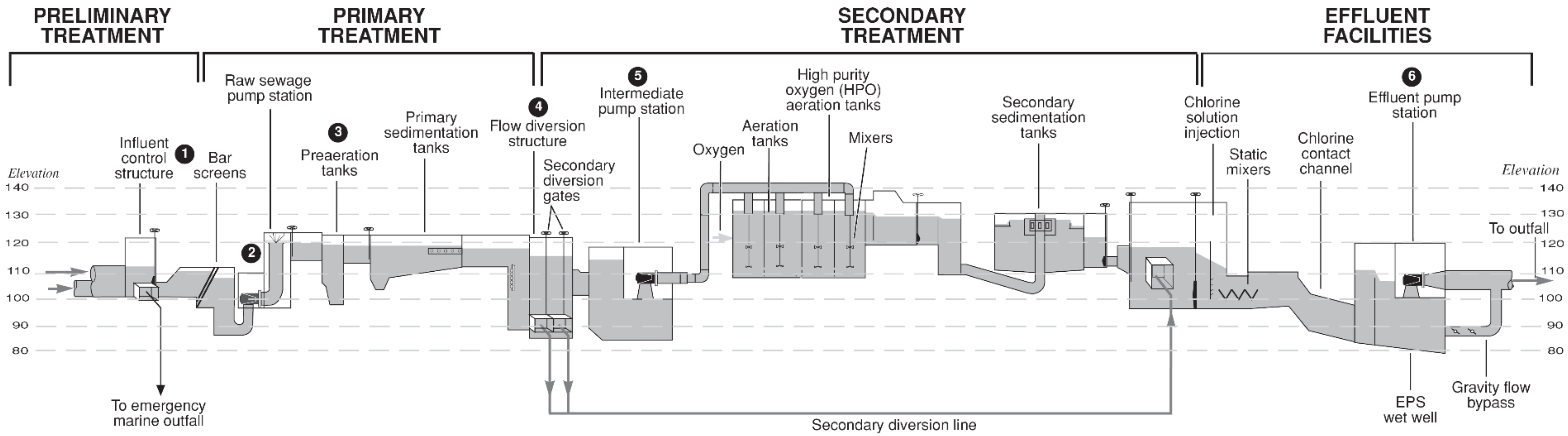
Raw Sewage Pump Wet Well

At elevation 110.2, the four influent gates close.

3 The normal elevation is around 118.75.

Preaeration Tanks

At elevation 119.6 the raw sewage pumps automatically switch to ratio control and a level alarm is sent to main control. At elevation 121.0, the raw sewage pumps shut down.



4 The normal elevation at flow diversion structure is 115.0 to 118.0.

Flow Diversion Structure

At elevation 120.0, the primary effluent gates close, stopping the flow of primary effluent to FDS. At elevation 118.0, the CSO gates open

5 Intermediate Pump Station

At elevation 115.0, an alarm is sent to main control. The level at the flow diversion structure is eaching its high-high level. At elevation 108.0, the IPS pumps fail.

6 The effluent pump station wet well normal level is elevation 106.0.

Effluent Pump Station

Below elevation 108.0, flow is by gravity and no pumps are operating.
At elevation 108.0, pumps start automatically.
At elevation 112.0, the HIGH level alarm is triggered.
At elevation 115.0, the HIGH-HIGH level alarm is triggered, and the PE gates close.

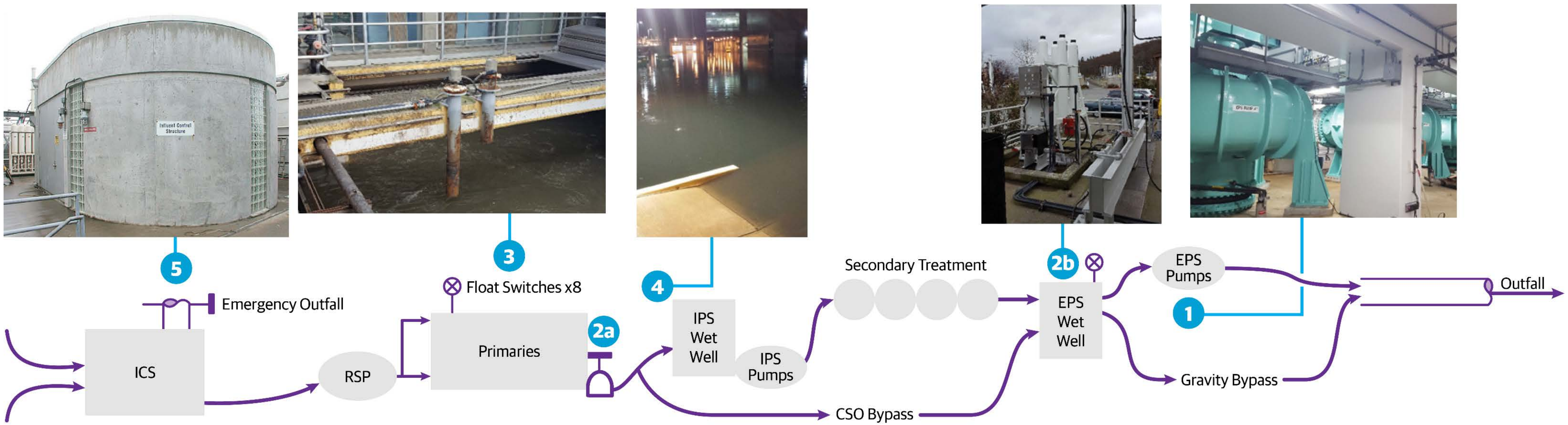
Figure 02. West Point Treatment Plant Hydraulic Diagram

Hydraulic Representation of the different elements of the West Point Treatment facility. Source: WPTP Operations Manual

Incident Event Summary

A rain storm occurred in Seattle on the morning of February 9, 2017. This storm produced extremely high influent flows to West Point. Based on the information known at this time, the flooding appears to have been caused by two driving factors: 1) a fault in the plant's main electrical switchgear that caused a breaker to open, and 2) the failure of the primary sedimentation tanks' high-level float switches to detect water level conditions (Figure 03).

2.1 Timeline of Events



#	Time	Event	Result
1	02:12:30	A circuit breaker in the plant's main electrical switchgear feeding half of the Effluent Pump Station ([EPS], A-side bus), which feeds two of the four 2200 HP EPS pumps, opened due to an assumed fault in the circuit. The switchgear that was tripped offline also feeds the 480V transformer and downstream motor control center (MCC), which powers the discharge valves hydraulic system. At the time of the electrical failure, Pumps 2, 3, and 4 were operating at full speed; Pump 1 was in standby mode. Pumps 1 and 2 are fed from the side of the switchgear that lost power due to the feeder breaker opening; thus Pump 2 stopped and Pump 1 was unavailable for operation.	Pumps 3 and 4 were fed from a different switchgear than Pumps 1 and 2 and still had power, but then failed as a result of high vibration..
2a	02:15:00	The EPS wet well level reaches high-high.	High-high-level switch activated.
2b		High-level float switch detected a high water level condition in the wet well, automatically initiating the closure of the primary sedimentation tanks effluent gate to stop flow from leaving the primary treatment system.	Primary sedimentation tank effluent gates raise to stop flow.
3	02:25:00	The primary sedimentation tanks high and high-high-level float switches failed to detect the water level conditions.	The level in the primary sedimentation tanks overtopped the walls of the basins and began flooding the surrounding areas. The normal response to a high-high water level condition is to automatically stop the RSPs that feed flow into the primary treatment tanks. This pump shutdown interlock did not activate because the float switches failed.
4	03:03:00	Operators put the RSPs into MANUAL and initiated them to stop.	Flooding of the facility stops shortly thereafter.
5	03:15:00	Emergency bypass begins.	Discharge into Puget Sound begins.

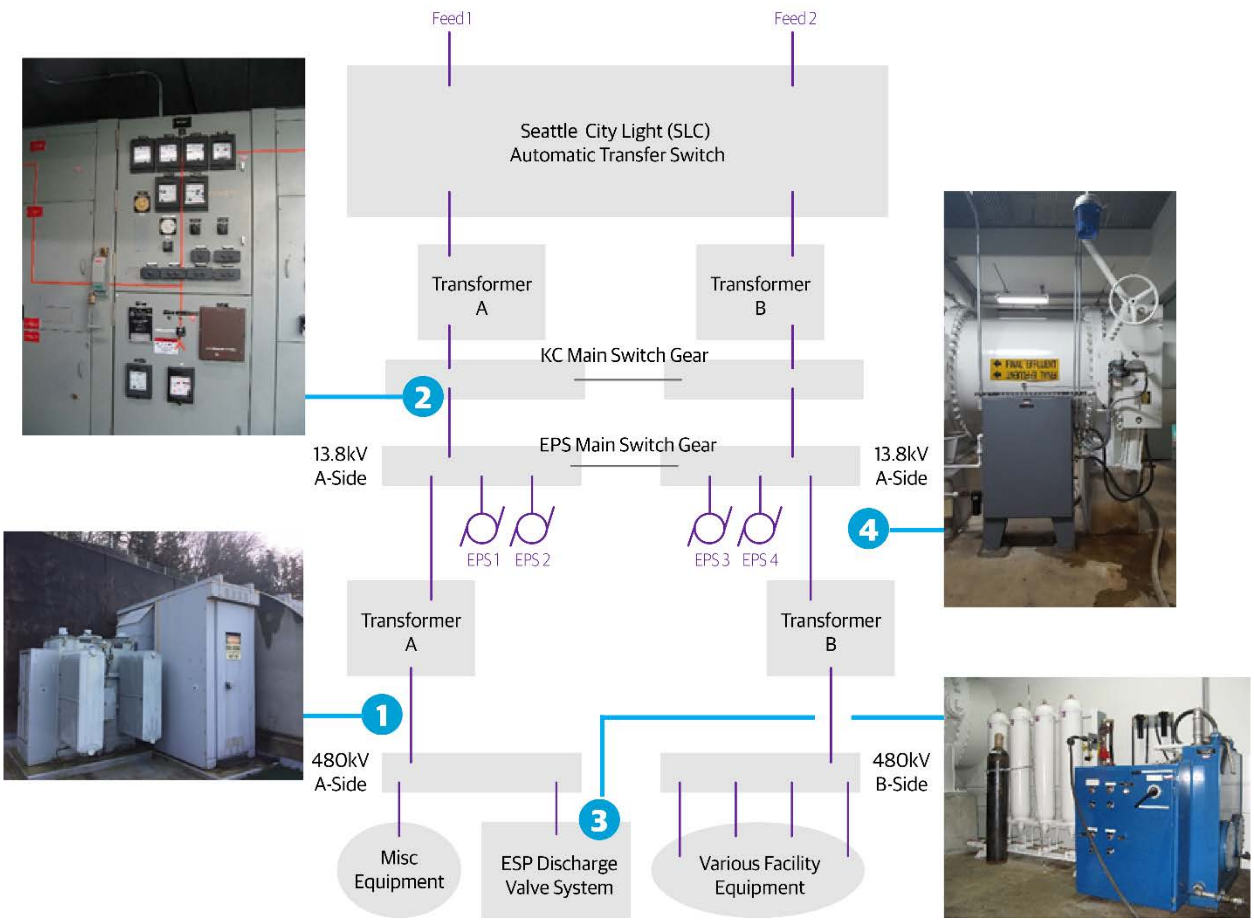
Figure 03. Event Timeline Diagram

Diagram of the event timeline and where the critical steps occurred in the facility (Appendix D and H).

2.2 Preliminary Electrical Switchgear Failure Investigation

2.2.1 Event Summary

During this event, an electrical fault occurred that resulted in an instantaneous trip of a 13.8kV (13,800 Volt) circuit breaker that is a part of the West Point primary electrical distribution system. The electrical distribution system is fed from two independent sources from Seattle City Light (SCL). West Point receives energy at 26.4kV and reduces to 13.8kV through a pair transformers that then feed the facility (Figure 04). These circuits are commonly known as the A-side and B-side feeders for the facilities. Most facilities at this treatment plant are fed from both the A- and B-sides that can be manually switched in the event of a failure.



#	Event
1	Possible fault in 480v transformer (707-XFMR01A)
2	Main A side breaker tripped (722-MSG-52-3)
3	A-side equipment loses power including EPS Pumps 1 and 2 and EPS discharge valve hydraulic system
4	Hydraulic system power loss closes all four discharge valves and EPS Pumps 3 and 4 shut down. Pumps are unable to be quickly restarted.

Figure 04. Electrical Fault Diagram

Diagram showing main electrical components where a failure occurred and the effected equipment.

2.2.2 Cause of Power Loss

The investigations into the cause of the electrical fault is an ongoing and has not been completed as of March 10, 2017. Below are the findings thus far, and conclusions may be subject to change.

Current information indicates that the cause of the electrical disturbance is in, or associated with, the circuit that feeds equipment 707-XFMR01, a 13.8kV to 480/277V, 2000/2576KVA oil-filled transformer with forced air fan cooling (Appendix B). This transformer sits on the upper deck of the EPS facility. King County maintenance personnel performed a routine noise evaluation of this transformer a few weeks ago, where some sounds emanating from the primary side termination enclosure were investigated.

Preliminary review of available information and onsite staff observations have identified several areas of interest that are being vetted. Below are some preliminary observations:

- Feeder 3 circuit breaker in 722-MSG01 tripped on the protective relay instantaneous element sensing a ground fault.
- Transformer protection circuit breaker 52-A1 in 707-SWGR01 did not trip, which is still under investigation and further tests are planned. This circuit breaker is closest to the suspected transformer described above.
- All of the medium-voltage switchgear transformers have been tested within the past year, and those results indicate they are good working order (Appendix A).

Following the incident, the transformer has been electrically isolated and the primary feeder and switchgear reenergized via the B-side circuits. The A-side feeder fed from 722-MSG01 circuit 3 has been placed back into service and the A-side of the 480 volt switchgear has been reenergized through the tie circuit breaker. There have been no known issues with any of this equipment since they were reenergized. On February 24, 2017, the primary termination compartment of the transformer was opened and visually observed. There were no visual indication of any issues in the termination compartment. Thus, as of February 24, 2017, the A-side feeder from 722 to 707 has been reenergized, the A-side MCC has been reenergized, and effluent Pumps 1 through 4 have all operated.

The electrical system operating data has been collected from the switchgear power meters, and is being compiled and compared to the timeline of events to evaluate the outage extent. Preliminary results point to no definitive source of fault (Appendix A), but investigation is ongoing and final analysis will be detailed in an addendum to this report.

2.3 Effluent Pump Investigation

2.3.1 Event Summary

At the time of the electrical failure, Pumps 2, 3 and 4 were running with Pump 1 on standby. Immediately after losing power to the A-side electrical gear, the main drives of EPS Pumps 1 and 2 (and the hydraulic system that operates the discharge valves for all four pumps) lost power (Figure 05). Pump 1 was not running, but upon loss of power, Pump 2 immediately shut down. Due to the hydraulic system losing power, all of the discharge valves then drove to the closed position. Pumps 3 and 4 continued to run for approximately 30 seconds, initially showing high differential pressure alarms. Shortly thereafter, the pumps shut down due to high vibration. Operations attempted to start Pump 3 and Pump 4 twice, first at 2:21AM and again at 2:31AM. A final attempt to start Pump 3 occurred at 3:00AM. All of these attempts resulted in similar shutdowns due to high vibration (Appendix H).

Figure 05. Effluent Pump Station

Shown is the EPS. Left is the motor and drive which is upstairs from (right) the pump, discharge control valves, and hydraulic skid system.

2.3.2 Cause of EPS Pump Shutdown

Pumping against closed discharge valves likely caused the high vibration interlock in Pumps 3 and 4 (Figure 06). Available evidence suggests that the interlock caused vibration alarms and subsequent shutdowns when the operation team tried to restart the EPS Pumps 3 and 4 immediately after the initial electric fault (Appendix D).

There is a single hydraulic skid system that supplies pressurized hydraulic fluid to each of the four EPS pump discharge valve assemblies (Figure 07). The hydraulic skid is supplied from the motor control center (MCC), which was fed by the side that lost power. After losing power, the solenoid valves failed and caused the remaining pressure in the hydraulic accumulator bank to drive the discharge valves closed.

There is a mobile backup hydraulic skid that can be connected to the discharge valve system in the event of a failure. As outlined in the valve manual, there also is a method to physically actuate the discharge valves by isolating the hydraulic system and using the actuation wheels (Appendix C), which might have allowed Pumps 3 and 4 to be started. However, the operations team did not have enough time in the 2-minute window of the initial electrical failure before the water level in the EPS wet well reached the HiHi level.

Figure 06. Hydraulic Discharge Valve Assembly

All the ESP pump discharge control valves are fed from one Hydraulic System.

Figure 07. Hydraulic Skid
Hydraulic Skid system that drives all ESP pump discharge control valves.

2.4 Float Switch Failure Investigation

2.4.1 Event Summary

The initial electrical failure at the EPS cascaded into a chain of events that resulted in overflow from the primary sedimentation tanks, causing significant flooding throughout the facility and substantial damage to many critical systems and equipment.

After the EPS pumps ceased operation, the EPS wet well level rose quickly. Once the level in the EPS wet well climbed high enough, it triggered a high-level interlock that hydraulically closed the PE gates.

Under conditions where the PE gates close, flow out of the primary tanks is stopped and levels will rise unless influent flow from the RSPs ceases. There are two critical levels: high (Hi) and high-high (HiHi). There are four inter-connected pre-aeration tanks before the PE flows directly into the East and West primary tanks. Each respective pre-aeration tank has a Hi and a HiHi level float switch, for a total of eight separate float switch mechanisms (Appendix G). The Hi level float switches are designed to activate when levels in the primary and pre-aeration tanks reach 119.6-foot elevation. When the Hi level switches activate, operators can see an alarm on the control system. The HiHi level switches are activated when the levels reach 120.5-foot elevation, at which point the RSP pumps shut down and influent flow ceases (Appendix F). Due to the equipment interlock and protection against false trips, the interlock circuit that shuts down the RSPs requires either BOTH the East HiHi level switches or BOTH the West HiHi level switches to be triggered before a shutdown occurs (Appendix E).

These floats, although wired into the plant's Distributed Control System (DCS) for alarming purposes, act independently of the DCS using hard wired relays. These interlock circuits are also supplied with battery back-up power to allow function even in the event of facility power loss. At the time of the event, the control system received no alarms associated with the Hi and HiHi float switches despite the very high tank levels. The RSPs were not automatically stopped and the primary sedimentation tanks overflowed approximately 12 minutes after the EPS electrical failure.

2.4.2 Cause of High-high Float Switch Failure

The switch mechanism is comprised of a float which is a 4-½-inch stainless steel ball supported by a rod that travels within a guide tube (Appendix I). The entire assembly is mounted within a 6-inch pipe that acts as a stilling well. The floats are set to actuate the RSP interlock circuit when level in the tanks rises to an elevation of 1 foot below the overflow point.

Figure 08. Float Switch Damage
Bent float support rod.

When examined post-event, the float rods were observed to have been bent to such a degree that the 4-½-inch ball would have been in contact with the inner surface of the 6-inch stilling well, causing friction on the float as well as between the rod and guide tube (Figure 08). After removing a float from the stilling well assembly, it was submerged in a bucket to simulate high water level. Due to the physical damage to the rod mechanism, this switch did not activate until the float was fully submerged and the mechanism was shaken. The observed impingement likely inhibited free travel of the float, preventing the RSP interlock circuit from tripping. The RSPs did not automatically stop even though the level was rising in the primary sedimentation tanks.

There is further evidence that the interlock circuit functions as designed, and the source of malfunction is mechanical in nature. During the most recent bi-weekly cleaning and inspection of these switches on January 28th, 2017, the DCS alarm log shows the floats triggering the alarms in the system (Appendix D). This bi-weekly cleaning activity involves removing the floats from the still well, cleaning away debris and reinstalling the switch mechanism. The DCS alarm log shows that this inspection procedure normally actuates the switch and sets off alarms in the control system. This indicates proper circuit function, but does not necessarily verify that the float will actuate in a high-level situation.

Additionally, following the flooding event on February 9, 2017, these float switches were inspected again as recorded in the DCS alarm log (Appendix D) (Figures 09 and 10). The condition and operation of the electrical circuit remains functional, yet during the event, the floats did not trigger the switch when submerged. It is unlikely these events caused the observed damage, as similar damage has been observed and recorded in the plant's maintenance records where past repairs have been made.

Figure 09. Float Switch Inspection

As part of this investigation, the floats were visually inspected after the flooding event on February 9, 2017. All showed the similar damage to the rod, preventing proper operation.

Figure 10. Float Switch Location

After the flooding event, covers of the pre-aeration tank were removed, allowing full view of the Hi and HiHi float switch mechanisms. This is one of four sets of switches in the primary sedimentation area.

Conclusions and Next Steps

Outlined in this section are summarized findings and preliminary recommendations related to the flooding event on February 9, 2017. Additionally, actions that are underway to bring the facility back to full capacity as quickly as possible are summarized.

3.1 Conclusions and Further Investigation Required

3.1.1 Electrical Equipment Findings and Recommendations

Continued electrical investigation is underway, in a coordinated effort between King County and CH2M. There are no definitive findings of the source of the electrical fault, but investigative efforts continue. To aide in the investigation of the electrical failure, CH2M has also engaged an in-house electrical expert Randall Denton (Electrical Fellow, P.E., WA). Mr. Denton was onsite on February 23-25, 2017, to collect additional information to aid the investigation.

A final detailed report of the analysis on the electrical equipment will be published as an addendum to this document.

3.1.2 Effluent Pumping Stations Findings and Recommendations

After the electrical fault on A-side, EPS Pumps 1 and 2 and the hydraulic skid that drives the discharge valves for all four of the pumps lost power. The closure of the discharge valves ultimately prevented operators from bringing EPS pumps back online during the event.

As part of standard operating procedures, a backup portable hydraulic system is available to plug into the hydraulic lines in the event of an emergency. There also is an option to isolate the discharge valves from the hydraulic lines, and manually actuate them with a hand wheel. A more automated solution for EPS pump restart procedures should be evaluated, so that response and corrective actions can occur more quickly during emergencies.

3.1.3 Primary Treatment Float Switch Findings and Recommendations

The float switch mechanism designed to stop the RSPs when the primary sedimentation tank reaches a high-level failed. This is due to mechanical impingement caused by the observed damage to the float and rod system. It is unlikely that the flooding event caused the observed damage to the floats, as damage to these floats have been observed previously (Appendix J). For example, in August 2008, it was observed during a function test that none of the switches in question operated correctly due to damage to the floats and rods. Maintenance personnel repaired the switches based on work orders and the repaired mechanisms passed functional tests. It appears that between the 2008 repair and this event, that the float mechanisms sustained similar damage.

The electrical circuit and control system for the pre-aeration tank float switches appeared to have functioned as designed, but damage to the floats' mechanisms prevented the float to rise with the water level, resulting in no alarms to the control system or shutdown commands to the RSPs. Re-evaluation of testing procedures should be conducted.

Also, it is recommended that the cause of the damage to this style of float switch be further investigated. Other float switches throughout the plant that have a different design functioned as intended during the event (e.g., most notably the EPS wet well high-level floats). The damaged float mechanism should be re-designed to prevent similar damage from occurring again. In addition, alternative methods of level measurement for triggering RSP stoppage and main influent gate closure should be investigated and re-evaluated.

3.2 Current Status of Facility

King County continues to operate the facility at about 50 percent of normal capacity, and is providing primary treatment for approximately 250 MGD. Full restoration of the plant is planned for April 30, 2017. Prior to full restoration of the plant, King County will continue to maximize the volume of flows that can be redirected to satellite treatment facilities. However, additional bypasses will occur during heavy rains to protect the safety of employees and the facility.

Since February 9, 2017, the recovery process has transitioned from cleanup and sanitization, to damage assessment, to developing and implementing a recovery plan. The assessment has identified that more than 200 pump motors and more than 100 various electrical panels need to be replaced; that list continues to grow as the team evaluates which mechanical and electrical equipment can be salvaged and rehabilitated.

3.3 Recovery Plan Summary

West Point was significantly damaged during this flooding event. The recovery plan currently has prioritized plant systems that require repair or replacement. The order of priority is as follows:

1. Heat Loops – This system is comprised of three boilers, instrumentation for temperature and flow, valves, recirculation pumps and insulated piping that runs throughout the facility. The damage to this critical system is extensive. All three boilers will likely need replacement, as well as most of the instrumentation. Most challenging will be removing and replacing the wet contaminated insulation on the piping system. This system needs to be brought back online before the digesters can be utilized.
2. West Primary Sedimentation Tanks – A number of pumps transport sludge from the bottom of the sedimentation tanks to ultimately the digesters. These pumps, along with valves and instrumentation, were fully submerged and will need replacing.
3. Grit and Raw Sludge Pumping System – This system removes solids from the primary sedimentation tanks. All the motors and controls for this system were submerged and will need to be fully replaced and recommissioned before the primary sedimentation tanks can be brought into operation.
4. Raw Sludge Blending – Some instrumentation and controls will need to be replaced for the receiving tank for primary and secondary sludge before this system can be operated.
5. Gravity Belt Thickeners – The feed pumps and instrumentation to the thickeners for raw sludge (prior to feeding the digesters) were submerged and will need replacement.
6. Digester Feed Pumps – All of the feed pump motors and controls to the digester were submerged and will need replacement.
7. Samplers – EPA sample collection devices for outfall compliance were submerged and will need replacement.
8. Digesters – The basement level of the digesters that process sludge for disposal was submerged, and all pump motors and control equipment in this area will need replacement.
9. Truck Loading – The feed pumps and controls for the centrifuges that thicken digested sludge and load trucks for disposal were submerged and will need replacement.

3.4 Recovery Timeline

Major Recovery Milestones are as follows (Appendix K):

Heating Water Utility Online – 2/28

Temp Power Online – 3/2

Pump/Clean Disinfect Galleries – 3/6

Gallery Temporary Ventilation – 3/10

Digester Infrastructure – 3/17

Analyze Digester Biological Health – 3/31

Digester Warmup – 4/12

Digester Stabilization – 4/21

Digester Startup – 4/24

Primary Startup – 4/24

Dewatering Startup – 4/24

Secondary Treatment Startup 4/24