CITY OF
BAINBRIDGE ISLAND

Department of Public Works Memorandum

Date: January 11, 2021

To: City Council; Interim City Manager

From: Christopher Wierzbicki, Public Works Director

Subject: January 2021 Wastewater Treatment Plant (WWTP) Illicit Discharge Summary and Follow-up Action Plan

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Executive Summary

During the late evening of January 2nd and early the following morning of January 3rd, the City's WWTP discharged approximately 250,000 gallons of partially treated wastewater that was in violation of the City's wastewater discharge permit issued by the Department of Ecology. An evaluation of the incident, a summary of which follows in this memo, indicates that the discharge resulted from a number of factors, including increasingly frequent intensity of sustained weather events, and increasing demands on the plant capacity, coupled with related errors in judgement and a lack of some standard operating procedures.

To help prevent such discharges in the short-term, standard operating procedures to ensure the consistent use of additional plant capacity during the wet season will be developed and investments in key short-term minor physical/mechanical improvements will be made. Additionally, Public Works staff are engaged in a number of plant evaluation projects and processes that will result in the identification of longer-term infrastructure investments that the City will need to make to ensure compliance with the current and future iterations of the discharge permit.

Overview of Incident

At approximately 9:30 PM on Saturday, January 2nd, the Public Works on-call technician was notified by the City's remote monitoring system that an alarm was triggered at the WWTP, at which point he notified the plant stand-by staff. Upon arriving at the plant, the stand-by staff determined that the alarm was caused by consistent heavy rainfall influent flows of 1.4 MGD with peak flows exceeding 2.0 MGD. This exceptionally high amount of inflow caused solids to wash out of the main clarifier (a large tank that separates and removes solids out of the wastewater) into the effluent, overloading the UV disinfection system (the last stage of wastewater treatment). The stand-by staff person notified Kitsap Public Health, and was also able to bring an additional clarifier online (which allows for more capacity to separate and remove solids), which was already prepped for potential use. By Sunday, January 3rd at 12:30AM, the discharge was stopped. It is estimated that 250,000 gallons of partially treated effluent (not raw sewage) not meeting the City's NPDES permit

requirements for Biological Oxygen Demand (BOD), Total Suspended Solids (TSS), and Fecal Coliform was discharged to Puget Sound through the plant outfall during the event.

Incident Analysis

The WWTP and management staff have decades of experience with the City's plant – and wastewater treatment in general – and have received numerous awards for the plant's performance over the last several years, which makes the analysis of recent events challenging to understand. Given the history of effective personnel and plant performance, it is likely that a confluence of factors contributed to the discharge event: an anomalous weather event that is slowly becoming a more frequent and more intense occurrence; increasing pressures on the plant capacity; and, a related error in judgement that was based upon past experiences in similar situations.

Plant operations and relationship to weather

The Department does not have a standard practice of maintaining additional plant capacity (keeping more than one clarifier on at any given time) during the wet season, when ground and surface water (also known as Inflows and Infiltration (I&I)) often contribute to higher flows into the plant. Having more than one clarifier online at all times is not typically necessary, as the additional clarifiers are available primarily to serve as a back-up when the main needs to be cleaned or maintained. They also contribute to the plant's permit-required rating capacity – a number that corresponds to *peak* demands, not average, or even above average demand, which can normally be handled by the main clarifier.

In lieu of making a standard practice of having more than one clarifier online at a time, management delegates the decision to the plant operators to determine based on their evaluation of the plant performance at any given time (there are many variables that affect the plant's performance, which almost functions like a living organism). This flexibility in the decision-making process allows the operator to conserve energy at the plant and reduce the time-intensive process of maintaining a second or third clarifier when they are not needed for performance.

Looking back at the last 10 years of data, the main clarifier was the only unit in service for 50% of the peak inflow events (see Appendix A, Figure 1), indicating that it is not unusual for an operator to make the decision not to bring additional clarifiers online if the plant is performing well under the current conditions. With this understanding of the plant's capacity, and the plant performing optimally, the operators made the decision not bring additional capacity online before the recent event.

However, the recent plant failure indicates that there was an error in judging the plant's capacity in this instance. The characteristics of the weather event that led to the discharge was unlike any seen in the last 22 years (quickest increase in cumulative rainfall since 1999, see Figure 2), and the resulting inflows to the plant were unmatched in a review of the last 10 years of plant data (6 days of sustained inflows above 1 million gallons, see Figure 3.) These changes in weather patterns that negatively impact plant performance are increasing in frequency (there were almost the double the amount of 2-day events in the last 5 years, than in the 5-years prior, see Figure 3) which aligns with long-term weather predictions associated with a changing Northwest climate.

Plant operations and relationship to increasing demands

In addition to the foreseeable long-term changes in weather patterns that produce larger and more sustained peak *inflows* of wastewater into the plant, the Department's ongoing assessment of the

plant's capacity indicates that the wastewater inflow *characteristics* are also changing. These changes contribute to the need for re-evaluating short-term operating procedures, and also evaluating long-term policy changes and infrastructure investments that will allow the plant to continue to meet current and future discharge permit requirements.

The final results of the capacity study are still being developed by the Department's consultant (the Council will be receiving a briefing on the study in Q1 of this year), however, the initial results indicate that while the average inflow volumes to the plant are not increasing as originally predicted, the BOD and TSS levels coming into the plant are quickly pushing the plant's capacity to the limit (see Figure 4). There are some relatively minor procedural or physical reconfigurations that can be put in place to extend the life of the plant's treatment capacity, however, the inflow *characteristics* will likely continue changing in a manner that challenges the standard operating procedures – particularly when combined with higher and longer peak *inflows*.

Conclusions

Given the changing nature of weather conditions that lead to higher inflow volumes into the plant, and the changing nature of inflow characteristics that put pressure on the plant's performance, plant operators and Department managers can no longer rely on spot judgements to determine key operational parameters. In order to reduce the potential for a future event like the one recently experienced, standard operating procedures (SOPs) for maintaining additional capacity during the wet season will be developed, adhered to, and refined to adapt to changing conditions until more permanent plant upgrades are implemented. Additionally, a series of key short-term improvements, including operational changes, mechanical improvements and additional remote alarms will be assessed and/or implemented. A list of short-term actions are outlined below.

Follow-up Short-Term Action Plan (priority order)

Description	Planned Completion Date	Cost	Status/Remarks
Automatically forward National Weather Service to O&M staff	ASAP		1/7/21 Complete
Enact a clear staff chain-of-command policy that addresses regular and periodic staff absences	ASAP		1/7/21 Complete
Order polymer and install chemical pump to improve solids dosing and settling	1/15/21	$2000	Pump and chemical ordered 1/7, ETA 1/8, equipment will be set up, tested and in service complete by 1/15/21
Set aeration basin min, max, and target loading levels	1/8/21		1/6/21 Complete. Winter 17,000 lbs, Summer 16,000 lbs.
Stress test and set clarifier #1 min, max, and target sludge blanket levels	1/15/21		Data will augment WWTP high flow SOP

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Develop written WWTP storm high flow SOP	2/15/21		First draft due complete by 2/15, final draft complete by 3/1/21
Convert Clarifier #1 RAS pumps from fixed rate to variable speed to pace incoming flow	2/28/21	$2000	Not started
Convert Clarifier #2 and #3 RAS pumps from fixed rate to variable speed to pace incoming flow	3/31/21	TBD	Not started
Add SCADA sustained high influent flow rate alarm	2/28/21	$500	Not started
Purchase and replace UV lamps as necessary	2/28/21	$8500	1/7/21 Parts ordered, delivery pending
Schedule Wedeco UV tech onsite to PM system, install a manual switch, and provide planning level scope to add additional UV banks	3/5/21	$5000	1/7/21 Tech scheduling requested, estimated 3 – 6 weeks delay prior to site visit
Purchase pump and equipment to efficiently transfer final effluent to fill clarifier	1/30/21	$1000	Pending
Install effluent turbidimeter with SCADA alarm	TBD	$6000	Implementation under review, pending cost benefit analysis
Configure remote SCADA connection	TBD	TBD	Implementation under review, pending cost benefit analysis
Relocate effluent pump backup generator receptacle	TBD	$4000	Rewire to include UV if feasible
Develop recurring and on-call electrician Unit Bid Contract	9/30/21		Required for afterhours emergency service

Updates on Other Related WWTP Work

WWTP Capacity Study (ongoing and future)

As mentioned previously, the Department is wrapping up a consultant study of the plant's capacity, including an analysis of high intensity commercial users (particularly wineries and breweries) and their contributions to the inflow characteristics. The results of this study, which will likely include a recommendation for a closer and more in-depth evaluation of plant operations and proposed infrastructure investments, will be available in February. A Council briefing is scheduled for Q1.

Tertiary Treatment Analysis (ongoing)

The previously mentioned consultant study will also contain information regarding a pre-evaluation of enhanced secondary treatment options and tertiary treatment options (the current plant encompasses secondary treatment to meet permit requirements). The enhanced secondary treatment options include improvements that may be necessary to meet anticipated near term permit limitation requirements (that will be applied state-wide by the Department of Ecology). The tertiary treatment options include improvements that may be required by Ecology in the longer term and could also lead to wastewater re-charge or re-use. A Council briefing is scheduled for Q1.

Biosolids Handling (future)

As a part of the more in-depth plant capacity evaluation, Department staff will be recommending the inclusion of a body of work that addresses biosolid handling at the plant. The plant biosolids (the compressed and de-watered sludge that is removed by the plant clarifiers) is presently trucked to an off-site landfill, however, the City's permit requires that additional treatment and disposal options be implemented in the next several years. The biosolids handling is a pinch point for treatment capacity, as storage is limited on the restricted site (being surrounded by a residential neighborhood), and space limitations also contribute to the inability to add further bio-solids processing facilities at the site.

Fats, Oils and Greases Ordinance (future)

As a sub-set of the above evaluation work being performed by Department staff, include the development of a pre-treatment ordinance that will increase regulations on commercial establishments for ensuring that fats, oils and greases are disposed of properly. These regulations, which will be proposed to the Council mid-year, will contribute to reducing BOD and TSS levels contained in the plant inflows by ensuring they are mitigated – or eliminated - at the source.

Appendix A

Influent Flow			
Max Day Flows >1.2 MGD are highlighted			
Monthly Ave Flows > 0.8 MGD highlighted			
Month	Mnthly Ave	Max D	Clarifier Data
1-Mar-11	0.720	1.457	Three clarifiers on line
1-Nov-12	0.622	1.472	Three clarifiers on line
1-Dec-12	0.770	1.355	Three clarifiers on line
1-Mar-14	0.807	1.412	Two clarifiers on line
1-Dec-15	0.795	1.261	One clarifer on line
1-Jan-16	0.843	1.829	One clarifer on line
1-Mar-16	0.811	1.241	One clarifer on line
1-Jan-17	0.677	1.504	One clarifer on line
1-Feb-17	0.872	1.768	One clarifer on line
1-Mar-17	0.869	1.356	One clarifer on line
1-Jan-18	0.846	1.290	Three clarifiers on line
1-Dec-19	0.579	1.326	Two clarifiers on line
1-Jan-20	0.758	1.201	Two clarifiers on line
1-Feb-20	0.737	1.464	Two clarifiers on line
1-Dec-20	0.644	1.222	One clarifer on line

Figure 1 – Ten-year summary of maximum daily WWTP inflows greater than 1.2 MGD. Source: WWTP SCADA system data

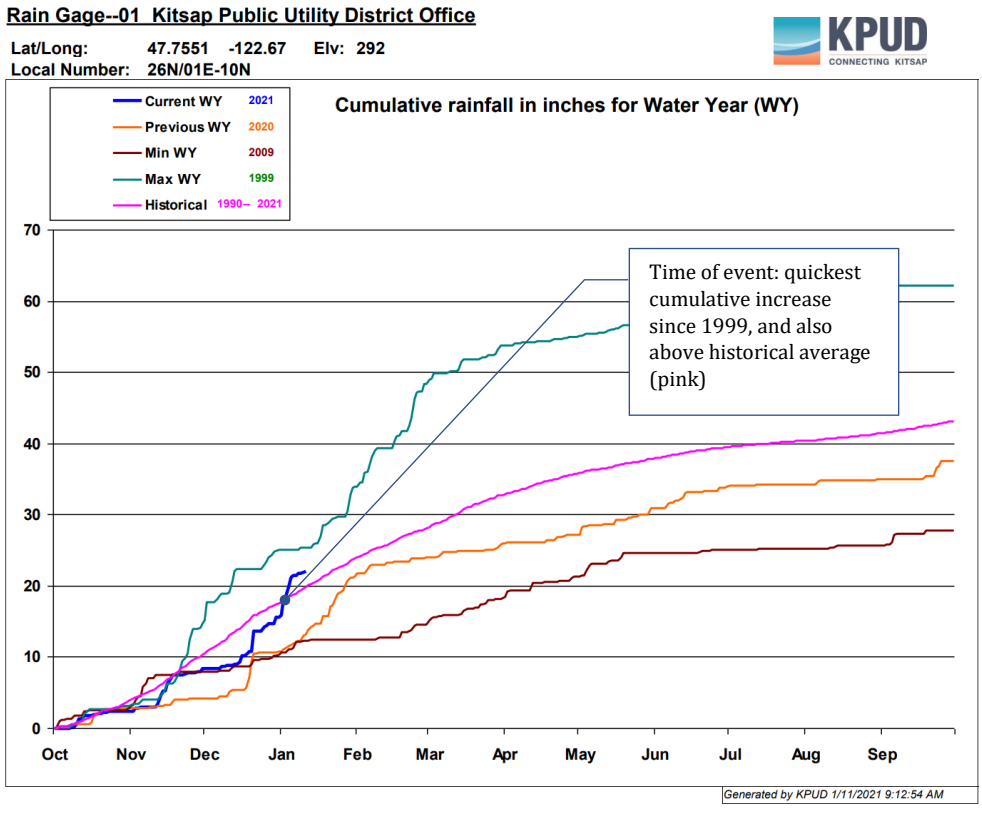

Figure 2 – Cumulative rainfall summary for 2021 compared to previous year, minimum and maximum

Influent Flows over 1 MG for more than 1 day					
Start Date & flow MG	Day 2	Day 3	Day 4	Day 5	Day 6
1/11/2010 1.117	1/12/2010 1.095				
12/11/2011 1.255	12/12/2011 1.578	12/13/2011 1.172			
3/14/2011 1.376	3/15/2011 1.219	3/16/2011 1.012			
11/19/2012 1.472	11/20/2012 1.091	11/21/2012 1.131			
12/1/2012 1.226	12/2/2012 1.033	12/3/2012 1.020	12/4/2012 1.133		
12/19/2012 1.042	12/20/2012 1.355				
3/5/2014 1.214	3/6/2014 1.229				
12/7/2015 1.099	12/8/2015 1.269	12/9/2015 1.221	12/10/2015 1.033		
1/21/2016 1.429	1/22/2016 1.322	1/23/2016 1.065			
3/12/2016 1.059	3/13/2016 1.106				
1/18/2017 1.368	1/19/2017 1.130				
2/9/2017 1.571	2/10/2017 1.099				
2/15/2017 1.362	2/16/2017 1.425	2/17/2017 1.007			
3/14/2017 1.099	3/15/2017 1.063				
1/29/2018 1.084	1/30/2018 1.002				
2/12/2019 1.098	2/13/2019 1.071				
12/20/2019 1.301	12/21/2019 1.349				
1/23/2020 1.061	1/24/2020 1.162				
1/28/2020 1.201	1/29/2020 1.069				
2/3/20 1.4640	2/4/2020 1.0420				
12/21/2020 1.220	12/22/2020 1.0440				
1/2/2021 1.0470	1/3/2021 1.4260	1/4/2021 1.4090	1/5/2021 1.2190	1/6/2021 1.4410	1/7/2021 1.0060

Figure 3 – Ten-year summary of sustained WWTP inflow events over 1 MGD. The longest sustained event over 1 MGD is the last row of the chart representing the recent event. Additionally, there were 8 events greater than 1 MGD in between 2010-2015 (yellow), and 14 events between 2016-2020 (blue).

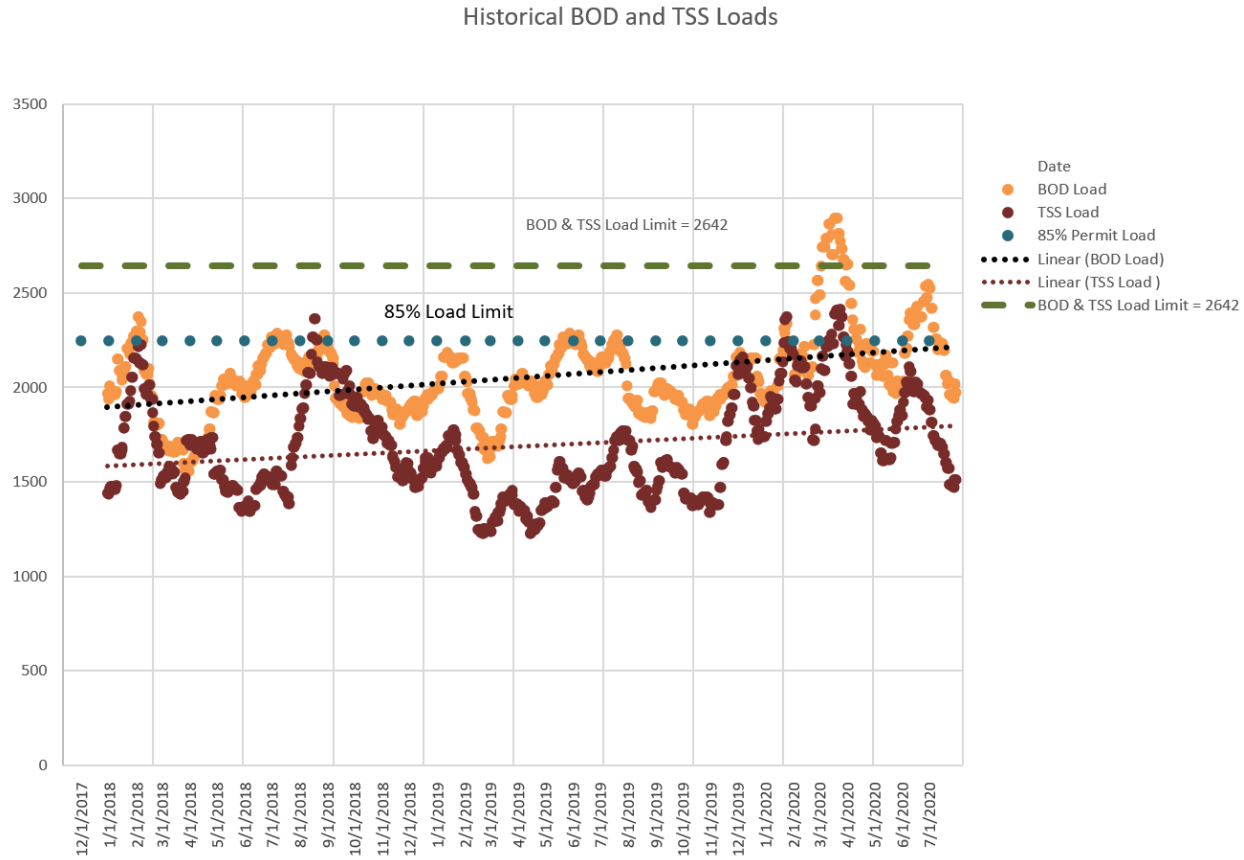

Figure 4 – Three-year summary of BOD and TSS loading into the WWTP (linear BOD trend, black dotted upward line; TSS trend brown dotted upward line). Source: Murray-Smith plant capacity study, to be released in Q1 2021