TOWN OF LAKE COWICHAN

Public Works and Environmental Services Committee
Tuesday, October 2nd at 5:00 p.m. – Council Chambers

AGENDA

1. CALL TO ORDER **Page #**

INTRODUCTION OF LATE ITEMS (if applicable)

2. APPROVAL OF AGENDA

3. BUSINESS ARISING AND UNFINISHED BUSINESS

(a) Watermain Upgrades for:
  (i) Ohtaki Footbridge and Greendale Trestle- status
  (ii) Signage on Public Washrooms.

(b) Water Treatment Plant Upgrade – status.

(c) **Ongoing Items Still Being Addressed:**
  (i) Boat Ramp Improvements.
  (ii) CLEC Water System-update.
  (iii) Garbage Collection Services at Grosskleg Townhouses.

4. DELEGATIONS AND REPRESENTATIONS

None.

5. CORRESPONDENCE

(a)Negin Tousi, EIT and Trevor Dykstra, P. Eng, WSP re: Effluent Discharge and Precipitation Data Analysis. **3**

6. REPORTS

None.

7. NEW BUSINESS

None.

8. NOTICES OF MOTION

9. PUBLIC RELATIONS ITEMS

10. MEDIA/PUBLIC QUESTION PERIOD
- Limited to items on the agenda

11. ADJOURNMENT

Please note: Should this meeting end sooner than 6 p.m., the next meeting may start no later than 10 minutes after adjournment of this meeting.

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Memorandum

To	Joseph Fernandez
Copy	Al Gibb, P.Eng
From	Negin Tousi, EIT and Trevor Dykstra, P.Eng
Office	North Vancouver Opus Office
Date	September 13, 2018
File	D-28515.00
Subject	Effluent Discharge and Precipitation Data Analysis

1. Purpose

The Town of Lake Cowichan (Cowichan) has retained WSP (formerly Opus) to analyze the historical effluent discharge volumes from the Sewage Treatment Plant (STP) and precipitation data and advise if a 10% increase in the permitted discharge volume will be sufficient to prevent exceedances.

2. Background

Cowichan has experienced exceedances of the allowable daily effluent discharge volume at its STP lagoons, as outlined by Permit 247, issued by the *Ministry of Environment and Climate Change Strategy.* The Ministry has provided Cowichan with the option to apply for a one-time, 10% increase to the allowable effluent discharge volume, above which a major permit amendment may be triggered. In cases where a major permit amendment would be required, the Ministry typically directs discharges to register under the Municipal Wastewater Regulation, which requires an Environmental Impact Study for the outfall discharge.

WSP has been retained to analyze effluent discharge data and precipitation trends to determine the extent to which precipitation accumulated on the two existing lagoons may contribute to the effluent volume and whether the one-time 10% increase to the allowable daily effluent discharge volume will be sufficient in addressing future exceedances based on historical effluent discharge volumes and precipitation. The allowable effluent discharge volume is currently 4,500 m^3/day. With the addition of 10%, this limit would be increased to 4,950 m^3/day.

This memorandum summarizes the analysis of the precipitation data from Cooperative Observations On-Line (COOL) by the *Government of Canada* and the effluent discharge volumes provided by Cowichan and offers recommendations on next steps in addressing the effluent discharge exceedances.

3. Data Summary

Effluent discharge data for the years 2005 to 2016 were reviewed. Table 3-1 summarizes the effluent data, the number of exceedance occurrences, and the percentage of the total days in the year where the effluent discharge volume exceeded the existing permit. The table also summarizes the same information for a scenario where Cowichan has received the one-term 10% increase to the allowable discharge volume. No exceedances were observed between 2005 to 2008. There appears to be an increasing pattern in the number of exceedances between 4,500 m^3 to 4,950 m^3; however, the same pattern is not observed for exceedances above 4,950 m^3.

Table 3-1: Effluent Discharge Data

Year	Max Effluent Discharge Volume (m^3)	Current Permit		Current Permit + 10%	
		Exceedance Occurrences 4500m^3 to 4950m^3	% of Days 4500m^3 to 4950m^3	Exceedance Occurrences >4950 m^3	% of Days Exceeding 4950m^3
2005	2953	-	-	-	-
2006	3171	-	-	-	-
2007	2789	-	-	-	-
2008	3493	-	-	-	-
2009	5531	3	0.8%	8	2.2%
2010	5777	1	0.3%	10	2.7%
2011	5801	2	0.5%	5	1.4%
2012	5874	2	0.5%	16	4.4%
2013	4912	1	0.3%	-	-
2014	5868	-	-	3	0.8%
2015	5799	5	1.4%	5	1.4%
2016	5618	6	1.6%	3	0.8%

Precipitation data was reviewed to evaluate the possible contribution to the volume discharged from the STP. The precipitation data was compared with the effluent data to observe if any trends between effluent volume and precipitation exist. Figures 3-1 and 3-2 show the maximum and average precipitation and effluent volumes for the years 2005 to 2016 respectively. No significant pattern can be observed between maximum day effluent volume and precipitation shown on Figure 3-1.

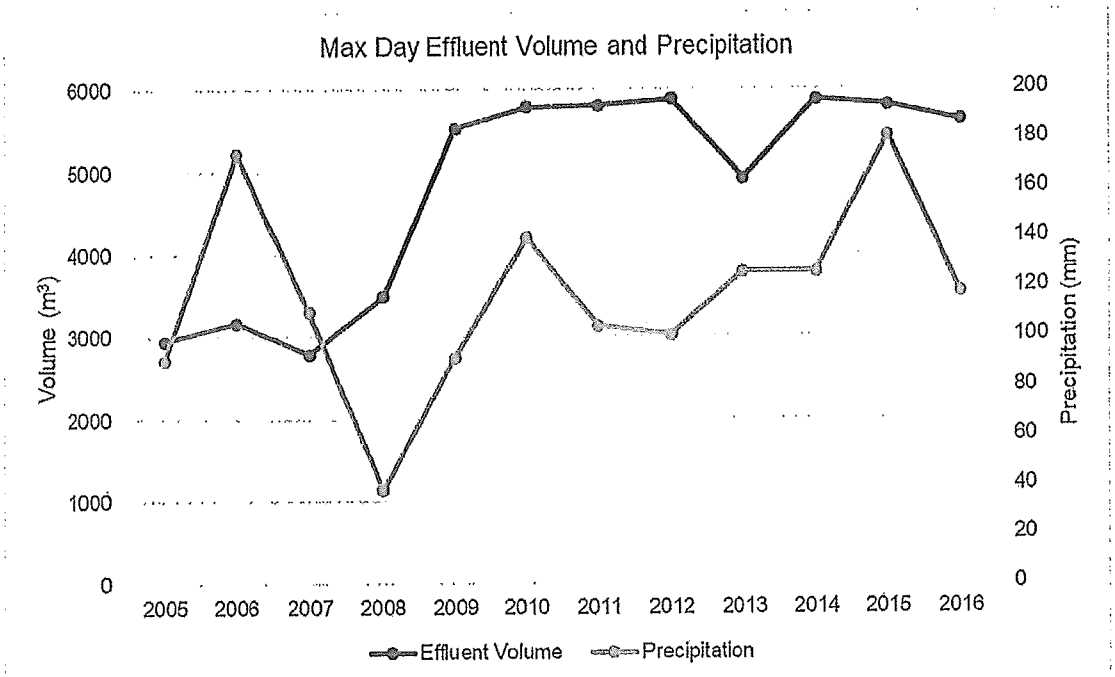

Figure 3-1: Historical Maximum Precipitation and Effluent Volume

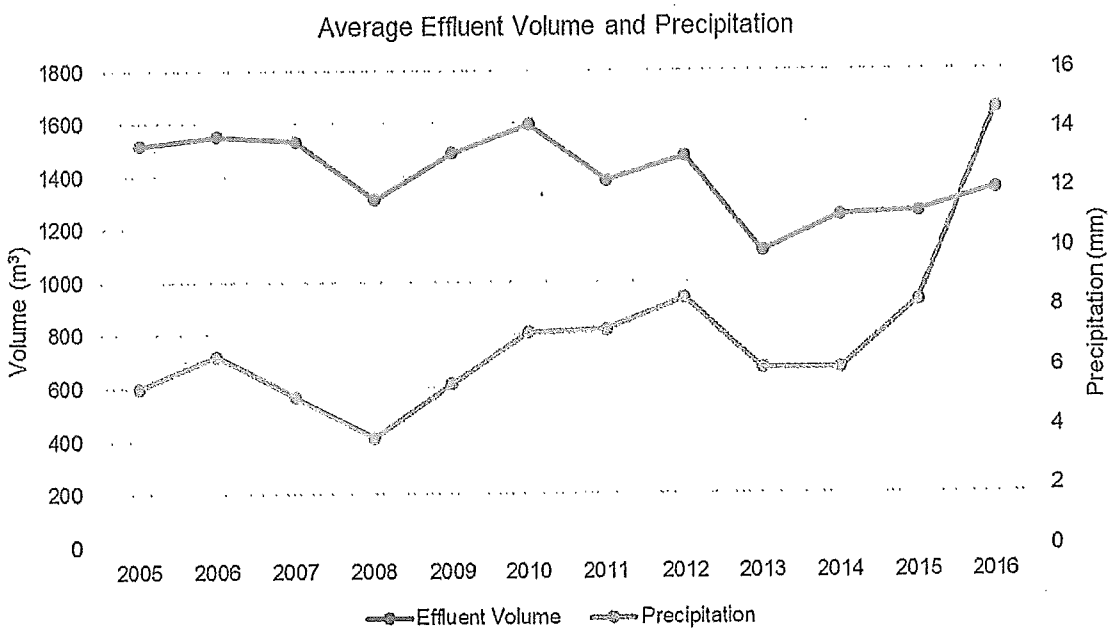

Figure 3-2: Historical Average Precipitation and Effluent Volume

The precipitation and effluent volume appear to follow a similar pattern between 2005 and 2013, however this pattern is disrupted starting in 2014 as the average precipitation increases significantly as compared to the pattern observed for the effluent volume.

Figure 3-3 shows the effluent discharge volume trends and the precipitation data for year 2011. The pattern observed in Figure 3-3 is typical for all years between 2005 to 2016: The majority of the high effluent flow days occur between October to April and are preceded by significant precipitation events 2 to 5 days earlier.

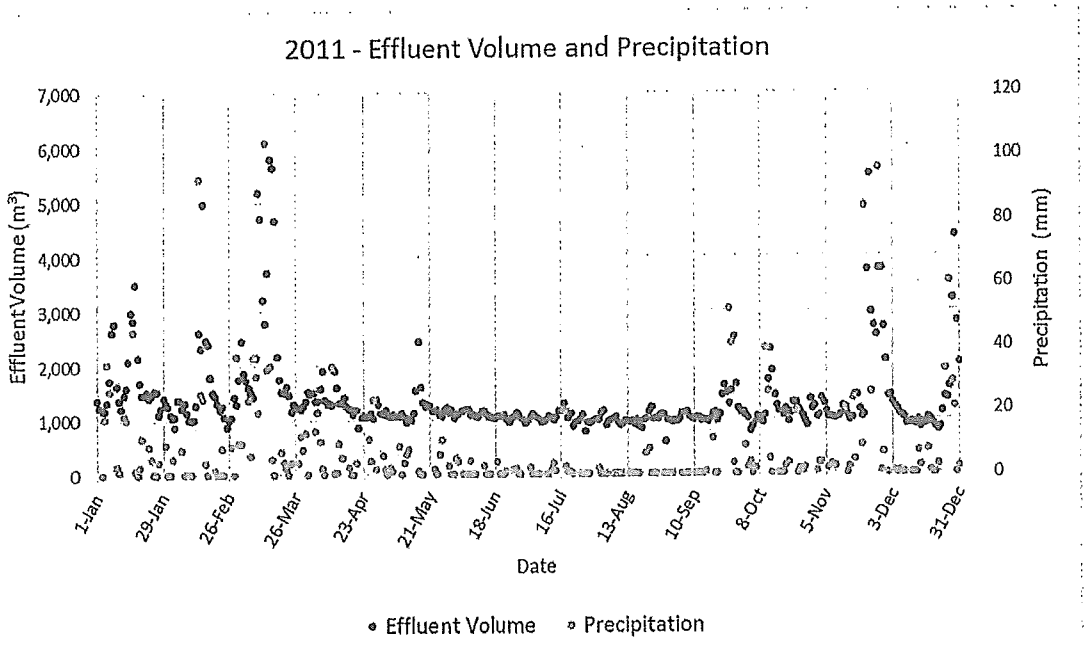

Figure 3-3: Effluent Flow and Precipitation Trends for 2011

4. Data Analysis

Possible contribution to effluent volume discharge other than sanitary sewer flows include Inflow and Infiltration (I&I) and possibly precipitation on the STP lagoons surface area. To estimate the volume of rain that may contribute to the effluent volume, the theoretical volume of precipitation on the surface of the lagoon was calculated using surface areas of 3,794 m^2 and 10,285 m^2 for Cell 1 and Cell 2 respectively multiplied by the daily precipitation. For context, the number of occurrences where the calculated precipitation contribution was greater than 450 m^3/day (or 10% of the allowable limit) is shown in Table 4-1.

Table 4-1: Precipitation Contributions Exceeding 450 m^3 (or 10% of the Allowable Limit)

Year	Occurrences
2009	10
2010	8
2011	16
2012	16
2013	12
2014	12
2015	21
2016	30

Although there were a total of 125 occurrences where the calculated daily contribution of the precipitation on the lagoon surface was significant (above 450 m^3/day), the results of the data analysis are not conclusive as these events do not necessarily correspond to the exceedances of the allowable effluent discharge limit.

In order to assess any potential delayed contributions as a result of I&I, the relationship between the effluent volume and recorded precipitation, offset by 2 days, was plotted for 2011. Figure 4-1 is representative of the pattern for all years between 2009 and 2016 with a maximum trendline R^2 value of 0.54; this value for R^2 indicates that no significant linear relationship exists.

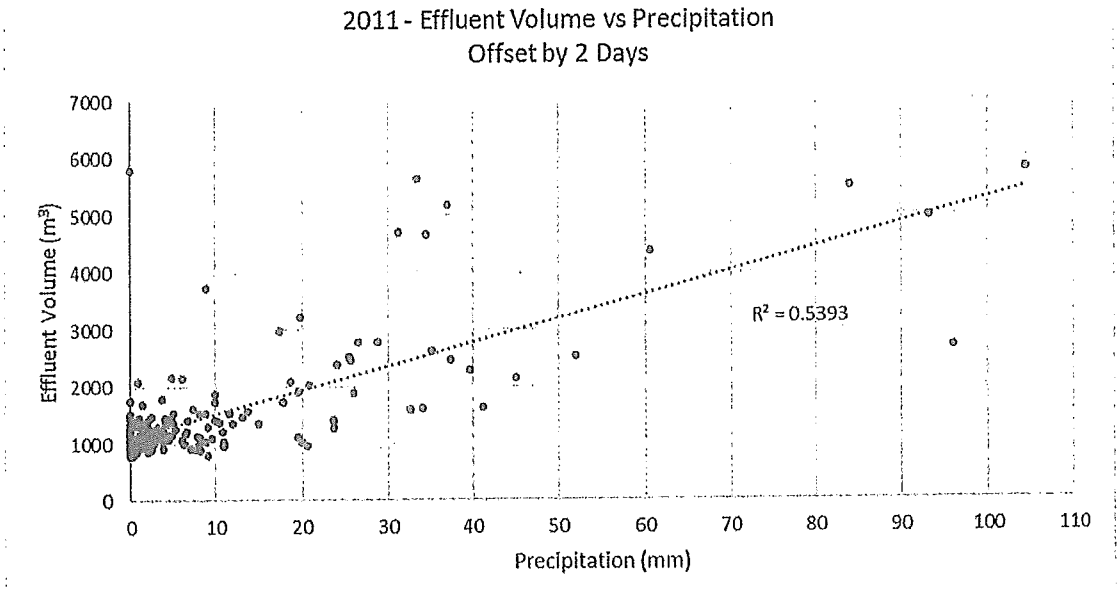

Figure 4-1: Effluent Flow and Precipitation Trends for 2011, Offset by 2 Days

The low R^2 for all years between 2009 to 2016 indicates that no correlation can be concluded without further data analysis and appropriate assessments.

In order to assess whether the one-time 10% increase to the allowable effluent discharge limit would be sufficient in eliminating exceedances, the effluent volumes were ranked and plotted on an exceedance diagram for each year between 2009 to 2016, years where exceedances were observed. Figure 4-2 illustrates the frequency of effluent discharge exceedances above the allowable 4,500 m^3/day and the proposed 4,950 m^3/day should Cowichan proceed with the 10% increase in the permitted discharge volume. As shown on Figure 4-2, the probability of exceedances is generally less than 5%; the probability of exceeding 4,950 m^3/day is less than for 4,500 m^3/day but is still in the range of 1% to 5%.

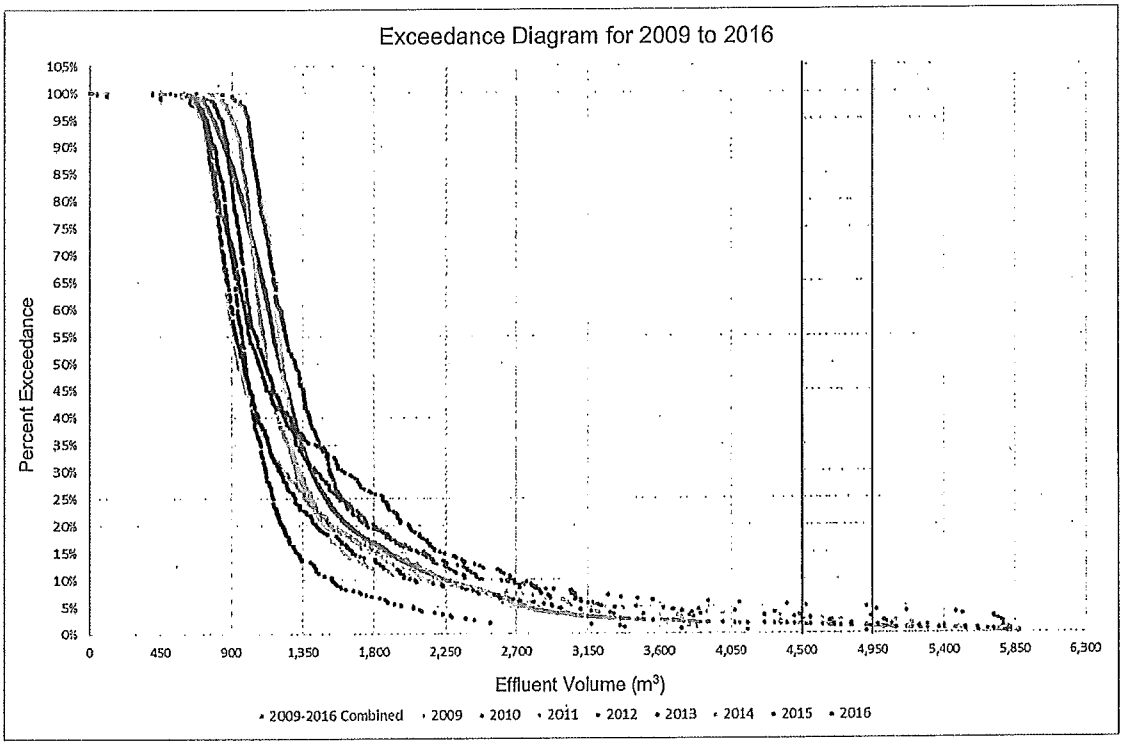

Figure 4-2: Effluent Histogram

5. Conclusions and Recommendations

This analysis was completed based on the assumption that the effluent discharge volume was equal to the sum of the volume of direct precipitation onto the surface of the two lagoons and the plant inflow to the lagoons. However, other factors may contribute to the effluent discharge volume in the lagoon such as I&I. In order to assess the true impact of precipitation on effluent discharge volumes, the plant inflow data must be monitored and analyzed.

Observation of higher effluent discharge volumes two to four days later than high precipitation events suggests that a correlation between discharge volumes and precipitation may exist. However, this would likely not be as a result of direct precipitation on the surface of the lagoons since the effects of this would likely be realized during or immediately after a high precipitation event, but rather that I&I could be contributing to the higher effluent discharge volumes. A better understanding of Cowichan's I&I and plant inflow could inform this analysis.

According to the 2013 I&I Assessment completed by Opus DaytonKnight (presently WSP), several components of Cowichan's sewer system were estimated to have a Rainfall Dependent Infiltration and Inflow (RDI&I) exceeding 140,000 L/ha/day. Further investigations were recommended as a result of insufficient data. Following the I&I Assessment, CCTV and Smoke Testing inspections were undertaken in 2016. The analysis of the inspection findings lead to further recommendation as follows: "...that the Town investigate incoming pipe connections to manholes. At this time, it is unknown if the pipes are sanitary connections. It is possible that these connections are conveying storm runoff into the sanitary sewer, drastically increasing I&I into the sanitary sewer".

According to the analysis, a 10% increase in the permit for allowable effluent discharge volumes will only address approximately 30% of the exceedance occurrences that have been observed since 2009. This will not be a sufficient measure in addressing the Ministry's concerns regarding permit exceedance.

Based on the precipitation and effluent discharge trends, it appears that high precipitation has some impact on the volume of the discharge effluent with the majority of the high effluent discharge events occurring within a few days of significant precipitation events; however, it is important to understand that potential I&I and plant inflow contributions prior to concluding the extent to which this may be a factor in the exceedances. As such, we recommend that the plant inflow data be collected and analyzed in order to provide more information.