TECHNICAL MEMORANDUM

DATE September 8, 2022 **Project No.** 21459099

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CIMA+

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HAVELOCK WWTP ASSIMILATIVE CAPACITY – LAGOON STORAGE UPDATE

1.0 INTRODUCTION

Golder Associates Ltd. (Golder), a member of WSP, was retained by CIMA+ to carry out an assimilative capacity study (ACS) of Plato Creek for the proposed expansion of the Havelock Wastewater Treatment Plant (WWTP) servicing the Township of Havelock-Belmont-Methuen (Township). The previous study was finalized in September 2022. Following completion of the memo, CIMA+ requested additional analysis to assess the assimilative capacity assuming the use of the on-site lagoons to store treated WWTP during the low-flow periods in Plato Creek. This memorandum describes the changes from the pervious report stemming from the use of the lagoon as storage and represents an addendum to said report.

2.0 BACKGROUND

The background for the site, including existing objectives and proposed flow rates, is described in the September 2022 report. The two key differences for this lagoon assessment includes the following:

- Of two WWTP discharge scenarios examined in the previous report, only the future projected growth scenario (1,580 m^3/day) is being considered for this assessment.
- The on-site lagoon system (which was not described in the previous report) included two on-site lagoons with a total storage volume of approximately 135,820 m^3 (based on the 7399-7YTUGW CofA). This storage volume represents approximately 85 days of storage, considered to have the capacity to store two complete months of effluent at the 1,580 m^3/day WWTP discharge rate for the purposes of this evaluation. The condition of the lagoons, and their suitability for holding WWTP discharge, was not confirmed as part of this work and will need to be verified independently. This option can be further refined as part of the Environmental Assessment alternatives.

3.0 OBJECTIVES

The September 2022 report characterizes the existing water quality and flow conditions in Plato Creek. This technical memorandum will provide an update of the WWTP effluent concentrations described in the report assuming the use of the on-site lagoons to store WWTP discharge during low-flow periods (described in Section 4.0) in Plato Creek.

4.0 DATA REVIEW AND COMPILATION

The estimates of background water quality and flows in Plato Creek are described in the September 2022 report. The flows listed in Table 5 of the report show that the lowest assumed Plato Creek $7Q_{20}$ flows occur over the August-September-October period with flows of 0.003 m^3/s, 0.001 m^3/s, and 0.005 m^3/s (respectively), subsequently increasing in December (0.040 m^3/s) and January (0.055 m^3/s).

Based on these creek flows, the WWTP is assumed to discharge to the lagoons during the two months of lowest flow in Plato Creek (August and September), be withheld in lagoons while the WWTP discharges directly to the creek during October and November, and be decanted at to Plato Creek along with WWTP effluent during December and January. Resulting discharge flows to Plato Creek over the period influenced by lagoon storage are presented in Table 1 below.

Table 1: Assumed Monthly Effluent Discharge to Plato Creek using Lagoon Storage in August and September

Months	Discharge to Plato Creek (m^3/day)	Notes
February to July	1,580	WWTP to Plato Creek
August and September	0	WWTP to lagoon storage
October and November	1,580	WWTP to Plato Creek
December and January	3,160	Lagoons and WWTP to Plato Creek

Notes: The proposed WWTP discharge flow for the scenario using lagoon storage is 1,580 m^3/day. This flow rate is based on the projected flow for the proposed growth scenario in the September 2022 report.

5.0 ASSESSMENT METHODOLOGY

The assessment methodology is essentially the same as presented in the September 2022 report, with the only differences being that only one selected operational scenario was assessed (future growth) and the discharge flows to the creek were assumed based on lagoon storage in August and September and active discharge of stored effluent being added to WWTP discharges in the December and January (as presented in Table 1 above).

Proposed ECA effluent limits were estimated by:

- Identifying the maximum effluent concentration that would still result in regulatory (PWQO/CCME) objectives or Policy 2 requirements following complete mixing under the selected assessment scenario for each month; or

- In the case of total phosphorus, maintaining the annual loading limit associated with the existing CofA; or
- In the case of ammonia, based on technologically feasible treatment solutions, where $7Q_{20}$ flow conditions between August and September limited attainment of instream regulatory criteria.

6.0 ASSESSMENT RESULTS

Key assessment results are summarised below for each parameter of interest.

Dissolved Oxygen

As stated in Section 5.2 of the September 2022 report, effluent dissolved oxygen concentration was assumed as 5.7 mg/L between June and October, and 7.1 mg/ between November and May. These periods were chosen to match the periods for Ammonia and Phosphorus, with the proposed minimum effluent concentrations determined by a mass balance such that the resulting dissolved oxygen concentration in Plato Creek at the mixing point did not drop below the PWQO.

$CBOD_5$

For the operational scenario, the lowest assimilative capacity in Plato Creek occurs in August, resulting in an estimated maximum allowable effluent concentration for $CBOD_5$ of 52 mg/L. As discussed in Section 5.3 of the September 2022 report, the MECP has asked that the 10 mg/L limit in the 2009 ECA be maintained; that concentration is therefore recommended as the proposed effluent limit for this system.

Total Ammonia

As the limit for ammonia is typically set as total ammonia, monthly unionized ammonia objective (0.016 mg/L as N) was converted to monthly total ammonia objectives using the Plato Creek monthly 75^{th} percentile for pH and temperature from Table 3 in the September 2022 report.

- During the low flow period (June to October), the lowest assimilative capacity in Plato Creek for ammonia occurs in July, resulting in an estimated maximum allowable effluent concentration for total ammonia of 0.9 mg/L as N. It is noted, as reflected in Section 7.0, that for reasons of technological feasibility, this estimated total ammonia maximum allowable effluent concentration has been set to 1.0 mg/L (as N) for the June to October period.
- For the remainder of the year (November to May), the estimated maximum allowable effluent concentration was set to the lowest value for that period (i.e., 3.9 mg/L in November).

Total Phosphorus

Background creek total phosphorus concentrations above the 0.030 mg/L PWQO concentration in 8 of 12 months trigger a Policy 2 condition with respect to the PWQO. In those months, the background 75^{th} percentile concentrations range from 0.0325 mg/L to 0.0835 mg/L.

The previous ECA proposed total phosphorus discharge limits for the dry season (July to October) and wet season (November to June). With the discharge being held back in the lagoons for August and September (half of the dry season), total phosphorus loading from the existing WWTP for the dry season would be below the existing summer loading, while the total annual load from the new and old WWTPs would remain identical. As a result, a

proposed maximum allowable effluent concentration limit of 0.18 mg/L was used to match the annual loading from the previous discharge rate and objectives.

pH

The effluent pH should match the PWQO range of 6.5 to 9.5 range.

Escherichia coli

The *E. coli* concentration should match the PWQO limit of 100 CFU / 100 ml.

Total Suspended Solids

For the operational scenario, the lowest assimilative capacity in Plato Creek occurs in October, resulting in an estimated maximum allowable effluent concentration for TSS of 8.5 mg/L.

Summary

Table 2 below summarises the estimated maximum allowable effluent concentration developed for WWTP expansion under the operational scenario with lagoon storage for the months of September and October until the months of December and January.

Table 2: Estimated Maximum Allowable Effluent Concentrations for the Operational Scenario Expansion to 1,580 m3/day

Parameter		Maximum Monthly Mean [1]
Dissolved Oxygen Concentration (mg/L)	June to October	5.7 (minimum)
	November to May	7.1 (minimum)
$CBOD_5$ (mg/L)[2]		10
Total Ammonia (mg/L as N)	June to October	1.0
	November to May	3.9
Total Phosphorus (mg/L)		0.18
pH		6.5 to 9.5
E. coli (cfu/100 mL)		100
TSS (mg/L)		8.5

Notes:

1. Unless otherwise noted, concentrations represent maximum values.
2. Based on the MECP request to maintain the CBOD5 limit in the 2009 ECA, or 10 mg/L.

7.0 CONCLUSIONS AND RECOMMENDATIONS

Based on the analysis and modelling presented in the September 2022 report and this technical memorandum, the following conclusions are drawn with respect to the operational scenario (WWTP expansion from 1,200 m^3/day to 1,580 m^3/day and use of the lagoons for effluent storage in September and October, following lagoon discharge to the creek in December and January):

- The proposed use of the lagoons eliminates WWTP discharge during the two months with the lowest flow in Plato Creek (August and September); mitigating the assimilative capacity constraint for Phosphorus (June to October) identified in the September 2022 report of WWTP discharge for those two months. In summary, the use of lagoon storage results in:
  - No change to the proposed objective/limit for dissolved oxygen.
  - No change to the proposed maximum monthly mean limit for $CBOD_5$.
  - No change in proposed effluent objective/limit for total ammonia.
  - A slight increase in proposed maximum monthly mean limit from 0.11 mg/L to 0.18 mg/L for total phosphorus (June to October).
  - A slight decrease in proposed maximum monthly mean limit from 0.23 mg/L to 0.18 mg/L for total phosphorus (November to May).
  - The proposed objectives/limits for pH and *E.coli* remain unchanged as they are based on the PWQO.
  - No change in proposed effluent objective/limit for TSS.
- Investigations must be undertaken to confirm the suitability of the lagoons for holding discharged WWTP effluent before any further consideration is given to these results.

The resulting proposed effluent objectives/limits are summarized in Table 3.

Table 3: Proposed ECA Effluent Objectives/Limits for the Operational Scenario (WWTP Expansion to 1,580 m^3/day)

Parameter		Effluent Objectives	Effluent Limits
		Maximum Monthly Mean Concentration[1]	Maximum Monthly Mean Concentration[1]
Dissolved Oxygen Concentration (mg/L)	June to October	7.6 (minimum)	5.7 (minimum)
	November to May	9.5 (minimum)	7.1 (minimum)
$CBOD_5$ (mg/L)[2]		6.6	10
Total Ammonia (mg/L as N)	June to October	0.8	1.0
	November to May	3.0	3.9
Total Phosphorus (mg/L)		0.13	0.18
pH		6.5 to 9.5	6.5 to 9.5
E. coli (CFU/100ml)		100	100
TSS (mg/L)		6.4	8.5

Notes:
1. Unless otherwise noted, concentrations represent maximum values.
2. Based on the MECP request to maintain the CBOD5 limit in the 2009 ECA, or 10 mg/L.

8.0 CLOSURE

We trust this submission meets your current requirements. If you have any questions about this technical memorandum or the original ACS, please contact Christopher Davidson or Gerard Van Arkel.

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https://golderassociates.sharepoint.com/sites/143155/project files/6 deliverables/assimilative capacity/rev4/21459099_tm_rev4_havelock_wwtp_storage memo_6sep2022.docx

REFERENCES

Golder Associates Ltd. “Havelock WWTP Assimilative Capacity Study”, September 2022.

Ontario Ministry of the Environment, “Amended Certificate of Approval, Municipal and Private Sewage Works Number 7399-7YTUGW”, December 22, 2009.