EXECUTIVE SUMMARY

On behalf of the District of North Cowichan (DNC), G3 Consulting Ltd. (G3) was retained to conduct the second stage of an Environmental Impact Study (EIS) for the proposed relocation of the Duncan/North Cowichan Joint Utility Board (JUB) Sewage Treatment Plant (STP) outfall to marine waters from the current location in Cowichan River.

Conclusion

This study examined effluent flow rates (current and 40 years into the future), effluent quality and ambient receiving environment conditions, undertook plume modelling and assessed predictive parameter concentrations at various locations in Cowichan Bay and Satellite Channel. Potential impacts to human health and the receiving environment, from discharged effluent at the proposed outfall location, were carefully assessed. Given effective effluent treatment, high dilution rates and extended distances from any potential sensitive areas (i.e., Cowichan estuary, Satellite Channel Ecological Reserve, Saanich Inlet, shellfish beds, recreation, etc.) potential impacts associated with the proposed effluent outfall location were predicted to be low and effluent compliant with all regulatory requirements under normal operating conditions.

Based on these results, relocation of the outfall from the current location, above the estuary in the Cowichan River to the marine environment just beyond embayment, would reduce potential risk of impacts to both ecological and human health.

Background

The Cowichan Bay area is a socially, culturally and ecologically-valued environment, with a variety of flora, fauna and geography (wetlands, marshes, rivers and marine) and multiple areas of natural, cultural, recreational and commercial importance. As such, consideration to any activities or discharges within the bay must be taken cautiously.

The Duncan/North Cowichan Joint Utility Board (JUB) was tasked with relocating the JUB Sewage Treatment Plant (STP) outfall from its current location in the Cowichan River. The outfall relocation was deemed necessary for the following reasons:

- the JUB made a commitment to Cowichan Tribes, as part of the 2011 lease agreement for the JUB STP, to make reasonable efforts to remove the outfall from the Cowichan River;
- although effluent is effectively treated and meets provincial and federal standards, it is desirable to minimize potential exposure to effluent; however, extended low flow periods in the Cowichan River during summer has resulted in less than ideal effluent mixing, dilution and mitigation of exposure. As effluent discharge rates increase over time there will be less effective mixing and dilution in the river;
- the current outfall location is susceptible to erosion from high river flows during the winter. Logs carried down the River can also damage armouring protecting the outfall and shoreline; and,
- effluent discharged at the current location flows down the river and enters Cowichan Bay through a network of braided streams and rivulets into an ecologically-sensitive estuary which is not desirable.

Other options for effluent disposal and reuse were considered leading up to the Stage 1 EIS. In the end it was determined that relocating the existing outfall to Cowichan Bay was the preferred option. In 2015/2016 a Stage 1 Environmental Impact Study (EIS) identified an outfall terminus location roughly in the middle of Cowichan Bay (denoted by the green triangle in the figure above). In 2016, Amendment #3 to the Central Sector Liquid Waste Management Plan (CSLWMP) proposed the relocated outfall and was submitted to the province for approval. This amendment (based on the revised proposal for the outfall location) will be considered once the Stage 2 EIS has been completed.

In 2018, G3 Consulting Ltd. (G3) was retained to conduct the Stage 2 EIS for the proposed location and is the subject of this study. This study was originally intended to examine the location recommended in the Stage 1 EIS (green triangle location) in more detail; however, based on discussions with local First Nations the terminus was relocated further east to a new location just beyond the entrance to the bay, approximately 900 m south of Separation Point (denoted by the red dot in the figure above). This relocation was predicated on the potential reconfiguration of anchorages in Cowichan Bay. For that reason, the scope of this study was adjusted to account for the change in proposed location.

This report includes an assessment of the outfall terminus location only. A separate report, to be released this summer, will assess potential routes for the effluent pipeline from the high-water mark to the proposed outfall terminus.

Key findings of this study are provided in the following sub-sections.

Methodology

This Stage 2 EIS (Outfall Terminus) study consisted of an evaluation of ambient conditions in the bay and how the relocated discharge could potentially affect ambient conditions. An assessment of potential impacts to public health and the receiving environment is presented in accordance with requirements set forth in the Municipal Wastewater Regulation (MWR). Assessments were conducted throughout 2018 over different seasons and flow conditions and are based on Stage 1 EIS report recommendations. Water and sediment quality, benthic macroinvertebrate communities, water current and profiles, effluent quality and potential dilution and bioaccumulation (tissue chemical concentrations) in biota were all assessed.

For plume modelling, the proposed discharge was assumed to be through a 100 m long multiport diffuser located at the new proposed discharge location, at a depth of approximately 60 m. Computer models were developed to predict the magnitude and extent of discharged effluent and dilution ratios at various locations in the receiving environment. Four effluent flow rate scenarios were considered:

- Maximum Daily Flow (MDF_0) for the current (time zero) time period (year 2014 to 2018; 41,800 m^3/day);
- Maximum Daily Flow (MDF_{40}) for the projected 40-year period (Year 2058; 57,100 m^3/day);
- Peak Hourly Flow (PHF_0) for current (Year 2014 to 2018; 44,000 m^3/day); and,
- Peak Hourly Flow (PHF_{40}) for the projected 40-year period (Year 2058; 101,000 m^3/day).

Population growth and increased inflow and infiltration were considered in the development of the projected 40-year flows. In addition, the possibility that the JUB STP will be replaced with a secondary or tertiary treatment plant was also considered as doing so will result in higher peak hourly flow rates.

Modelling was completed for seasonal (i.e., spring, summer, and winter) and tidal (flood, ebb, and slack) conditions. Key predictions included an estimate of the minimum dilution ratio and shallowest trapping depths under each scenario (i.e., examination of worst-case conditions for each scenario) at the proposed outfall. Parameter concentrations were calculated from the worst-case dilution scenario.

Effluent Quality

JUB wastewater treatment data from 1996 to 2018 were compared to the Operational Certificate (ME-01497) to assess compliance, both in the past and currently. In previous years (1996 to 2017) effluent for total suspended solids (TSS), 5-day carbonaceous biochemical oxygen demand ($CBOD_5$), pH, fecal coliforms, toxicity and total residual chlorine was compliant 91.1% to 98.2% of the time. Substantial upgrades to the JUB STP from 2000 to 2003 (screening/degritting facilities, new completed mixed aeration system and new phosphorus removal system) greatly improved effluent quality. In 2018, all stipulated limits were met with the exception of total residual chlorine, compliant 99.7% of the time.

Contaminants of Emerging Concern (CEC) refers to chemicals generally present at very low levels and for which risks are not well understood. CECs range from pharmaceuticals and personal care products to persistent organic pollutants. Select CECs, identified as being important and potentially present in municipal waste discharge, were tested in JUB STP final effluent (March 2019). Sugar substitutes, antibacterial agents, alkylphenol (an emulsifier and solubilizer) and various flame-retardant chemicals were detected; however, all were below applicable Water Quality Guidelines (WQGs).

Receiving Environment Ambient Conditions

Receiving Waters

Fecal coliforms in waters of Cowichan Bay were low and met MWR and *BC Approved Water Quality Guidelines* (BCAWGQs) for shellfish waters (≤14/100mL), except in December and in the estuary. Fecal coliform levels met the MWR limit and BCAWQGs for recreation waters at all stations. A similar pattern was observed for *Enterococci* with low levels generally throughout Cowichan Bay, with maximum levels near surface in December and estuary stations (all sampling events), above BCAWQGs at most stations.

In December, BCAWQGs for shellfish harvesting and primary contact were exceeded (at the surface) at a majority of stations for enterococci and, to a lesser extent, fecal coliforms. Given that the JUB STP was consistently compliant with fecal coliform discharge criteria (as stipulated in the provincial operating certificate) in all seasons, winter exceedances were likely more attributable to other winter-affected sources including natural (e.g., soil erosion, wildlife) and other anthropogenic sources (e.g., septic systems, agriculture, marinas, etc.) entering Cowichan Bay and estuary, directly and indirectly through runoff and groundwater.

Bottom Sediments

Bacteria levels in marine sediment were generally low or not-detected. Stable nitrogen and carbon isotopes were assessed in sediment as indicators of sewage in the ecosystem. Results showed sediments typical of a marine environment and did not indicate the presence of sewage.

Sediments assessed were characteristic of muddy substrates (>90% silt-clay content), except Station S5 (coarser), affected by higher currents in Satellite Channel. Arsenic, copper, nickel, barium, cobalt, manganese and vanadium slightly exceeded sediment quality guidelines at various stations.

Benthic Macroinvertebrates

Macro benthic invertebrates (communities used as indicators of aquatic ecosystem health given their sensitivity to pollution and changes in the environment) were sampled at six stations and were generally indicative of a healthy, diverse community. Total abundance and species richness (number of taxa) generally represented increasing abundance and richness with increasing distance from the estuary. The type of sediment present (e.g., sand) appeared to have a direct influence on the number and type of benthic invertebrates represented.

Biological Tissues

Chemicals in invertebrate tissues were assessed in benthic macroinvertebrates in subtidal bay waters and in the Pacific Oyster (*Crassostrea gigas*) from intertidal waters in the estuary. Bacteria levels in oysters were below the BCAWQGs for shellfish. Metals in tissues met applicable guidelines, except for a marginal exceedance of lead in benthic invertebrate tissue. Exceedances of these parameters in sediment, water and tissue were attributed to natural sources (e.g., soil erosion, wildlife), the STP and other anthropogenic sources (e.g., industry, upland and waterfront development, infrastructure, agriculture, marinas, etc.) entering Cowichan Bay directly and indirectly through runoff and groundwater.

Water Current Analysis

Ocean currents were described using temperature and magnitude and direction vectors, as collected using an Acoustic Doppler Current Profiler (ADCP) at multiple stations and several seasons. Currents were strongest at the surface. Water direction in the bay was generally in (west) during flood tides, out (east) during ebb tides and variable during slack tide during each season and depth, with complex mixing patterns noted nearest Separation Point.

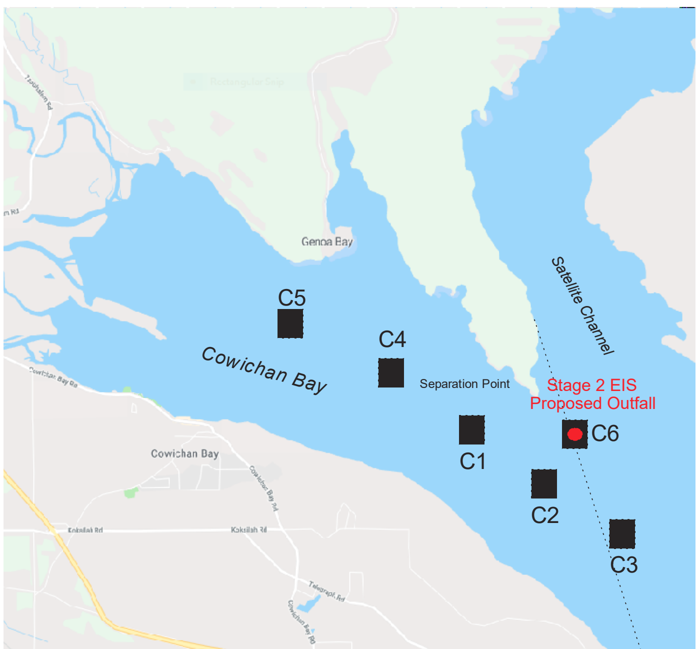
Plume Modelling Results

Trapping Depths

Modelling predicted that the effluent plume would remain trapped below the surface under all modelled effluent flow scenarios (MDF_0, MDF_{40}, PHF_0 and PHF_{40}), seasons and tidal conditions. Minimum trapping depth was predicted to be 27.5 m below the surface in winter, under slack tide. For the existing and the projected 40-year MDF and under average tidal velocity, trapping depths were predicted to be approximately 45 m (spring and summer) and 35 m (winter).

Dilution Ratios

The minimum (worst-case) dilution ratio at the MWR-defined 100 m Initial Dilution Zone (IDZ), was predicted to be >152.6:1 under the maximum (worst-case) effluent discharge scenario (PHF_{40}; 101,000 m^3/day) occurring on an ebbing (outflowing) tide.



Plume Direction

The new proposed outfall terminus (near Site C6; see adjacent figure) is located near Separation Point, an area that demonstrates complex current patterns and directions. Plume dispersion, was predicted to be variable, based on location, depth, season, and tide. Under flood scenarios, plume direction was estimated to travel in a northeast to north direction (East North East at C2 in spring and summer; North East at C3 in spring; and, North West at C3 in winter). At the new proposed outfall location (C6), under flood conditions, the plume was predicted to travel southeast and south during ebb conditions in winter. Modelled ebb scenarios at other stations suggested that the plume would travel west (northwest to southwest at C2 in spring; NW at C3 in winter; NW at C3 in spring; and, SW at C3 in summer). Station C2, under summer ebb conditions, indicated that the plume would travel east.

Predicted Parameter Concentrations

The lowest predicted dilution ratio (>152.6:1) was used to estimate worst-case concentrations for bacteria and chemicals of interest by the edge of the MWR-prescribed 100 m Initial Dilution Zone boundary.

Fecal coliforms were predicted to be well below the MWR limits and BCAWQGs.

Ammonia levels were also predicted to meet the most stringent site-specific guidelines. The maximum allowable ammonia level in effluent, meeting the BCAWQGs at the edge of the IDZ, was estimated to be 67.14 mg/L, well above the maximum ammonia concentrations observed in STP final effluent.

Summary

In summary, given the effluent quality, dilution rates and extended distances from potentially sensitive areas, possible impacts associated with the new proposed outfall location were determined to be low. The relocation of the outfall from the current location in the Cowichan River to Satellite Channel is predicted to reduce current potential impact risks to ecological and human health with low risk to degrade environmental conditions in Cowichan Bay, Satellite Channel, Saanich Inlet and further afield.