



**REPORT TO CORE AREA LIQUID WASTE MANAGEMENT COMMITTEE
MEETING OF WEDNESDAY, 26 JULY 2006**

SUBJECT CORE AREA LIQUID WASTE MANAGEMENT PLAN – SEAWATER TRIGGER

PURPOSE

To approve a seawater trigger for the Clover and Macaulay Point outfalls for submission to the Minister of Environment.

BACKGROUND

Introduction

The Minister of Environment's approval letter for the Core Area Liquid Waste Management Plan (LWMP) (March 2003) contained the condition that the Capital Regional District (CRD) "provide me with a trigger process for surface water and water column monitoring" and that this process "be developed in conjunction with, and be acceptable to, ministry staff." This trigger is called the seawater trigger and applies to the Clover and Macaulay Point outfalls. The seawater trigger is to be submitted to the Minister of Environment by 31 August 2006.

The overall objective of the seawater trigger is to ensure that wastewater discharged through the Clover and Macaulay Point outfalls does not cause adverse effects to the receiving environment or human health. When a trigger point is reached, wastewater treatment must be provided by the CRD within three years.

A seafloor trigger was approved by the Minister of Environment on 15 August 2003 and has been in place since that time. As with the seawater trigger, wastewater treatment must be provided within three years of a seafloor trigger point being reached.

The Seawater Trigger

A seawater trigger has now been developed. The executive summary of the seawater trigger for the Clover and Macaulay outfalls is attached as Appendix A. Copies of the full report are available from the Environmental Services department. This seawater trigger has two components:

1. human health – to prevent adverse effects to human health
2. aquatic life – to prevent adverse effect to life in the seawater

The human health component has been further divided into two parts: one to define conditions on the seasurface and the other to define conditions at depth. For both the human health and aquatic life components, sampling is carried out and the results are compared to water quality guidelines to determine if trigger points have been reached.

CRD and Ministry of Environment (MOE) staff have agreed on most aspects of the seawater trigger. Agreement has not been reached on three issues. These issues are detailed in Appendix B and summarized below (the seawater trigger document contains Environmental Services staff recommendations on these issues):

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1. The analysis of sampling data and comparison to water quality guidelines
2. The use of samples from areas of seabird concentrations or visible slicks in assessing whether trigger points have been reached
3. The need for immediate followup sampling.

The majority of the unresolved issues center around human health aspects of the trigger. Reaching trigger points in the seawater trigger leads to the implementation of sewage treatment. It is, therefore, important that the human health aspects of this decision-making process decision are assessed and determined by qualified professionals. This has been recognized in the past by MOE in its previous requests to the CRD to consult the Ministry of Health (MOH) on other health aspects of the seawater trigger.

Issue	CRD Position	MOE Position
1 A. Human health – seasurface conditions, sampling technique	For each sampling event, geometric means calculated for each of the eight stations.	For each sampling event, one geometric mean by taking the highest sample value from eight stations from each of five days.
1 B. Human health and aquatic life – conditions at depth, sampling technique	Average of three highest samples taken on each day.	The highest sample of eight taken on each day.
2. Use of samples from areas of seabird concentration or visible slicks	Samples used to determine if area of plume surfacing can be identified.	Samples used to determine if trigger reached.
3. Followup sampling	Followup sampling when guidelines exceeded not required in first year. Reassessed for the second year.	Immediate followup sampling when a guideline is exceeded. Initiated two weeks following exceedence.

ALTERNATIVES

1. That the CRD Board submit CRD staff's version of the seawater trigger to the Minister of Environment by 31 August 2006 and that the Board request that the Minister of Environment refer the outstanding issues related to human health to the provincial health officer, MOH, for resolution prior to 31 December 2006 (see Appendix B for details of CRD staff's version).
2. That the CRD Board submit the MOE staff's version of the seawater trigger to the Minister of Environment by 31 August 2006 (see Appendix B for details of the MOE staff's version).

FINANCIAL IMPLICATIONS

1. CRD staff's version of the seawater trigger will cost \$745,000 annually.
2. MOE staff's version of the seawater trigger will cost from \$895,000 to \$1,345,000 annually. The cost difference between the CRD and MOE version of the seawater trigger is that MOE's version

requires followup sampling, which must be budgeted for. One (\$150,000) to four (\$600,000) followup sampling events may be required.

CRD and MOE staff involved in the seawater trigger are not qualified professionals in the human health field. To engage human health professionals and to resolve the outstanding seawater trigger human health issues, it is proposed that the CRD request that the Minister of Environment refer these issues to the provincial health officer, MOH, for resolution prior to the implementation of the seawater trigger (scheduled for 01 January 2007). Both the CRD's and MOE's proposals would be presented to MOH, who would then recommend a way forward to the Minister of Environment.

Implementation of either version of the seawater trigger will require an additional staff member and supplementaries in the 2007 and 2008 northwest and northeast trunk budgets. The 2009 cost and beyond will depend on the outcome of the first two years of the seawater trigger monitoring.

SUMMARY/CONCLUSIONS

A seawater trigger has been developed for submission to the Minister of Environment. The objective of the trigger is to ensure that wastewater discharged through the Clover and Macaulay Point outfalls does not cause adverse effects to the receiving environment or human health. CRD and MOE staff have agreed on most aspects of the seawater trigger. Agreement has not been reached on some issues, the majority of which relate to human health (Appendix B). It is proposed that the human health related issues be referred to the provincial health officer, MOH, for resolution prior to 31 December 2006.

RECOMMENDATION

That the Capital Regional District staff's version of the seawater trigger be submitted to the Minister of Environment by August 31, 2006 and the Board request that the Minister of Environment refer the outstanding human health related issues in the seawater trigger to the provincial health officer, Ministry of Health, for resolution prior to 31 December 2006.

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COMMENTS

LAT/bc
Attachments: 2

SEAWATER TRIGGER FOR THE CLOVER AND MACAULAY POINT OUTFALLS

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July 2006

SEAWATER TRIGGER FOR THE CLOVER AND MACAULAY POINT OUTFALLS

EXECUTIVE SUMMARY

In the 2000 Core Area Liquid Waste Management Plan (LWMP) submittal, the Capital Regional District (CRD) committed to the development of an early warning process for surface water levels of indicator bacteria and proposed to use an oceanographic model to assess compliance with water quality criteria. In March 2003, Minister Murray approved a trigger process that would result in provision of treatment within three years of a trigger point being reached. The minister directed the CRD to expand the trigger process to include surface and water column triggers, to ensure discharges do not cause water quality parameters outside the initial dilution zone to exceed water quality guidelines (WQGs).

The two triggers were subsequently combined into one trigger with two components: the seawater trigger, with a human health component and an aquatic life component. A Seawater Trigger Work group was convened in October 2003 and continued working through February 2005. The results of the work group deliberations were presented to the CRD Marine Monitoring Advisory group (MMAG) and input from the MMAG was incorporated into the seawater trigger. Discussions between the Ministry of Environment (MOE) and CRD staff took place in 2005/2006. This document incorporates the results of these discussions.

The seawater trigger for both the aquatic life and human health components includes parameter effects levels (PEL) (numeric chemical or microbiological levels that are consistent with the WQGs), as well as decision rules for interpreting spatial data and temporal trends to determine whether the overall trigger has been exceeded.

The proposed trigger for fecal coliforms at surface will come into effect upon approval of this proposal by the minister. Monitoring for assessment of compliance with the seawater trigger will be initiated no earlier than 01 January 2007.

The field conditions associated with sampling the outfalls below the surface may be challenging, particularly with respect to locating the plume and sampling within it. Similar sampling programs have not been previously undertaken and, therefore, an initial one-year period of time has been agreed to by MOE and CRD to develop and test sampling procedures at depth. During the initial one-year period, MOE and CRD will work jointly in the development and field testing of at depth sampling procedures. The agreed PELs for chemicals will come into force at the conclusion of this one-year period. The analytes and PELs will be updated prior to implementation based on current WQG and effluent monitoring data.

A two-year interim period will be established during which the MOE and CRD will work jointly to establish appropriate trigger levels for pathogens at depth. The trigger levels for pathogens at depth will come into force at the end of the two-year period upon approval by the minister.

The MOE may approve modifications to the seawater trigger at any time in the future. Modifications would be based on the results of the monitoring program, scientific advances, changes in guidelines or regulations and/or other new information. The CRD, MOE or MMAG may request changes to the monitoring program, and any changes would normally be discussed among all three before a final recommendation is reached. The goal would be to reach consensus prior to approval by the ministry.

Receptors

An important step in the development of the seawater trigger was the identification of the receptors in seawater that need to be protected and the types of adverse effects that are of concern. The work group identified a wide range of receptors and effects that could theoretically be associated with outfall discharges, and then narrowed down the list to those that could be affected by pathogens or contaminants in seawater. A review of receptors near the outfalls identified two groups of receptors of concern, each associated with a different component of the effluent. Human health is primarily a concern

with respect to pathogens, while exposure of aquatic life to chemical contaminants in water near the outfalls is the main concern for this group of receptors.

For human health, it was determined that divers, swimmers and windsurfers likely represented the most exposed individuals. These users are most likely to be recreating offshore in the area of the outfalls and experience full-body contact with the water. Fishermen and lower-contact recreational users would be protected by any levels established to protect divers, swimmers and windsurfers. Shellfish resources in the vicinity of the outfalls may represent a potential exposure pathway for pathogens to humans.

For aquatic life, fish, invertebrates, aquatic plants and phyto/zooplankton were considered most appropriate for use as part of the seawater trigger, as they would be most likely to have the highest exposure to chemicals associated with the effluent. Use of WQGs as part of the seawater trigger will address exposures to fish, epibenthic invertebrates, phyto/zooplankton and macroalgae, since all of these receptor groups are represented among the studies used to derive the criteria.

Human Health Component

In developing a seawater trigger to protect human health, the first task is to select a monitoring parameter that can serve as an indicator for pathogens in sewage effluent. The primary indicators in use today are fecal coliforms and enterococci. Fecal coliforms have been the most widely used indicator in the past.

A trigger for fecal coliform will be used on an interim basis, in accordance with current BC regulations, until a two-year enterococci pilot project is completed. The pilot project was reviewed by the MMAG and approved by the MOE.

During the first year of monitoring, sampling for fecal coliforms will occur during four seasonal events, each designed to represent possible peak exposure conditions. Samples will be collected from the top metre of water and at depth from the centre of the plume. The sampling frequency in the initial year is intended to: provide adequate opportunity to establish effective sampling procedures; confirm that the proposed approach is practical; and gather baseline data regarding seasonal variation. Upon completion of the program in the initial year, the frequency of sampling events will be reviewed.

Aquatic Life Component

The CRD Marine Monitoring program currently analyzes over 230 different analytes in effluent. The first step in developing a seawater trigger for aquatic life is to identify which ones should be included in the trigger. Effluent monitoring data for 1999 to 2003 were reviewed, and the analytes were classified into three lists, based on their likelihood of exceeding water quality criteria:

- **List A: Chemicals Included in the Trigger** – Analytes with the potential to exceed WQGs in effluent (may or may not exceed criteria in receiving water)
- **List B: Chemicals of Interest** – Not included in the trigger due primarily to lack of guidelines but could be moved to either List A or List C as new information is developed
- **List C: Chemicals Not of Concern** – Not an analyte of concern; never detected, detected but always below guidelines or non-toxic

The primary consideration for being included in the trigger was that a chemical had to have a WQG so that there would be a basis for setting a PEL, and it had to have exceeded the WQG in effluent at least once in the last four years. These lists will be reviewed every year to determine whether new chemicals should be added or whether chemicals should be moved to a different list.

PELs were selected for each of the List A chemicals from existing BC WQG or equivalent values from US Environmental Protection Agency (USEPA).

The effects of the Clover and Macaulay Point outfalls on water quality are determined by the concentration of compounds in effluent, effluent flow, tidal currents and stratification of the water column.

Both the discharge and the receiving environment are dynamic and are changing continuously. Consequently, field sampling of the Clover and Macaulay Point receiving environments to assess water quality has a number of challenges, including the difficulty of measuring very low concentrations of effluent chemicals, adequately characterizing the variability of water quality in the receiving environment, identifying where the highest concentrations are likely to be. The CRD proposed utilizing a hydrodynamic model to assess values in excess of WQGs related to the trigger. However, the MOE directed CRD to conduct a field sampling program to evaluate compliance with the WQGs. Consequently, water quality monitoring will be conducted in combination with computer modelling.

During the initial year of sampling, monitoring of parameters will occur during four seasonal events. Upon completion of the program in the initial year, the frequency of sampling events will be reviewed.

Seawater Trigger Summary

The seawater trigger and associated PELs for the human health and aquatic life components are summarized in Table ES-1 below, as discussed in detail in sections 5 and 6 of the report. Based on the results of evaluations, input from CRD and/or other information, MOE may approve mutually agreed-upon modifications to the trigger, analytes and PELs.

Table ES-1. Clover and Macaulay Point Outfalls Seawater Trigger Summary

Parameters Monitored	Parameter Effects Level (PEL)		Compliance Zone ⁽¹⁾ Effects Level
Fecal Coliforms			
at surface	200CFU/100 mL ⁽²⁾ (geometric mean)		Geometric mean of sampling event (five samples in 30 days ⁽⁴⁾) at or above PEL
at depth	To be determined ⁽³⁾		
Toxic Chemicals ⁽⁵⁾	<u>Acute⁽⁶⁾ (µg/L)</u>	<u>Chronic⁽⁶⁾ (µg/L)</u>	
Benzo(a)pyrene	N/A	0.01	Acute: single sample above PEL Chronic: Arithmetic mean of sampling event (five samples in 30 days ⁽⁴⁾) at or above PEL
Copper (total ⁽⁷⁾)	3	2	
Cyanide WAD	1	N/A	
DDE	0.13 ⁽⁸⁾	0.001 ⁽⁸⁾	
Nitrogen - Ammonia	⁽⁹⁾	⁽⁹⁾	
Sulphide ⁽¹⁰⁾	N/A	2	
Trigger Point	Analyte at or above effects level for two or more 30-day sampling events within 36 months.		

Notes:

- (1) Data collected from the compliance zone will be used to determine if the trigger point has been reached. The compliance zone is at the edge of the IDZ, 100m from the diffuser section of the outfalls.
- (2) Geometric mean of five samples over approximately 30 days.
- (3) To be established jointly by MOE and CRD upon approval by the minister at the conclusion of two-year interim development period.
- (4) BC MOE WQGs.
- (5) The measured concentrations of all 13 parent PAHs and any other metals analyzed by the same methods will be reported.
- (6) Acute – instantaneous maximum (BC MOE guidelines); Chronic – arithmetic mean of five samples over approximately 30 days (BC MOE guidelines).
- (7) As provided for in the BC WQGs, a site-specific criterion for copper that takes into account bioavailability in marine waters will be developed within three years of the seawater trigger being implemented.
- (8) These guidelines are for total DDTs. There is no guideline for DDE.
- (9) Select temperature and pH dependent values as per BC WQGs.
- (10) This working guideline for sulphide will be used as a chronic PEL until a review of the sulphide WQGs has been completed and a site-specific guideline adopted or developed.

SEAWATER TRIGGER – OUTSTANDING ISSUES

1. THE ANALYSIS OF SAMPLING DATA AND COMPARISON TO WATER QUALITY GUIDELINES

A. Human Health – Seasurface Conditions

Monitoring

The area of sampling for fecal coliforms at the seasurface is the initial dilution zone (IDZ), 100 meters in radius from the diffuser sections of the Clover and Macaulay Point outfalls. Eight stations are to be sampled, equally spaced along the IDZ. These stations are to be sampled five times over approximately 30 days. There will be four of these sampling events in a year, each consisting of five sample days each. Data from these sampling events are to be compared to the primary contact recreation guideline (a geometric mean of 200 fecal coliforms per 100 mL).

CRD Staff Proposal

For each sampling event, geometric means will be calculated for each of the eight stations. Each of these means will be compared to the guideline. If two stations are at or above the guideline, the sampling event is considered an exceedence. If there are two exceedences in 36 months, then the trigger point has been reached and wastewater treatment is to be provided in three years.

MOE Staff Proposal

For each sampling event, one geometric mean is to be calculated for the IDZ. This is to be done by taking the highest sample value from the eight stations from each of the five days and then taking the geometric mean of this highest value. If this mean is above the guideline, the sampling event is considered an exceedence. If there are two exceedences in 36 months, then the trigger point has been reached and wastewater treatment is to be provided in three years.

Discussion

The Capital Regional District's (CRD) method for calculating geometric means is consistent with methods used by Vancouver Island Health Authority (VIHA) to monitor beaches in the CRD. It is also consistent with the methods used in other jurisdictions and is the method recommended by the Canadian Council of Ministers of the Environment, US Environmental Protection Agency and Health Canada. The Ministry of Environment (MOE) method of using maximum values in the calculation of geometric means is not used elsewhere in British Columbia or, to the best of Environmental Services staff's knowledge, anywhere else. This method is non-standard and is a departure from that used by other jurisdictions. It would hold the areas over the Clover and Macaulay Point outfalls to a higher standard than is used on recreational beaches. The public use of the areas above the outfalls is much lower than that on regional beaches. The method of using maximum values has not been reviewed or approved by public health professionals.

The CRD's proposal requires two stations to be above the guideline for an exceedence to occur. This is primarily because there are other sources of fecal coliforms in the waters in the vicinity of the outfalls, such as ships and birds that may cause a station to be above the guideline. Requiring two stations provides a high degree of certainty that the guideline exceedence was caused by the outfall and would be addressed by providing wastewater treatment.

Proposed Action

The CRD request that the Minister of Environment refer these human health related issues to the provincial health officer, Ministry of Health (MOH), for resolution prior to the implementation of the seawater trigger (scheduled for 01 January 2007). Both the CRD's and MOE's proposals would be presented to the provincial health officer, MOH, who would then recommend a way forward to the Minister of Environment.

The CRD's proposal be submitted to the Minister of Environment as part of the seawater trigger document.

B. Human Health and Aquatic Life – Conditions at DepthMonitoring

The area of sampling for fecal coliforms and chemicals at depth is the IDZ, 100 meters in radius from the diffuser sections of the Clover and Macaulay Point outfalls from the seasurface to the seafloor. Using oceanographic modelling and possible real-time location of the plume, eight samples will be collected where the plume crosses the IDZ. This will be done five times over approximately 30 days. There will be four of these sampling events in a year, each consisting of five sample days each. Data from these sampling events are to be compared to the applicable water quality guideline.

CRD Staff Proposal

For human health (fecal coliforms), the average of the three highest samples taken on each day will be used to calculate the geometric mean for comparisons to the water quality guideline. For aquatic life (chemical levels), the average of the three highest samples taken on each day will be used to compare to the applicable water quality guideline. If a guideline is exceeded for a sampling event, this is considered an exceedence. If there are two exceedences in 36 months, then the trigger point has been reached and wastewater treatment is to be provided in three years.

MOE Staff Proposal

For human health, the highest sample of the eight taken on each day will be used to calculate the geometric mean for comparison to water quality guidelines. For aquatic life, the highest sample of the eight taken on each day will be used to calculate comparisons to water quality guidelines. If a guideline is exceeded for a sampling event, this is considered an exceedence. If there are two exceedences in 36 months, then the trigger point has been reached and wastewater treatment is to be provided in three years.

Discussion

Sample results for fecal coliforms and chemicals in water are variable. This is caused by field variability and variability in laboratory results. Experts in the field were contacted on this issue and they agree that, to address this variability and make a good estimate of the actual value of a compound in water, a number of samples are typically collected and the average of the sample values used to estimate the real concentration. Using only the highest value from a sample set will typically overestimate the real value. It is usual for field sampling programs to take a number of samples at a station for this reason. The Greater Vancouver Regional District follows this procedure in its outfall sampling programs.

Proposed Action

The CRD request that the Minister of Environment refer the human health related issues to the provincial health officer, MOH, for resolution prior to the implementation of the seawater trigger (scheduled for 01 January 2007). Both the CRD's and MOE's proposals would be presented to the provincial health officer, MOH, who would then recommend a way forward to the Minister of Environment.

The CRD's proposal for aquatic life be submitted to the Minister of Environment as part of the seawater trigger document.

2. THE USE OF SAMPLES FROM AREAS OF SEABIRD CONCENTRATIONS OR VISIBLE SLICKS IN ASSESSING WHETHER TRIGGER POINTS HAVE BEEN REACHED.

Monitoring

Areas on the seasurface where the effluent plume is predicted to surface using oceanographic modelling (this is predicted to occur rarely) or where there are seabird concentrations or visible slicks will be sampled for fecal coliforms.

CRD Staff Proposal

Samples collected from these seasurface areas will be used to determine if areas of plume surfacing can be identified and differentiated from other sources, such as fecal coliforms coming from concentrations of birds. This investigation will take one year and, during this time, these samples will not be used to determine if trigger points have been reached. Following one year, the use of these samples in the trigger will be evaluated based on the success of plume location.

MOE Staff Proposal

Samples collected from these seasurface areas will be used to determine if trigger points have been reached in the first year of the seawater trigger. They will be combined with samples from the eight stations at the IDZ and included when the maximum value for the day is determined.

Proposed Action

The CRD request that the Minister of Environment refer this issue to the provincial health officer, MOH, for resolution prior to the implementation of the seawater trigger (scheduled for 01 January 2007). Both the CRD's and MOE's proposals would be presented to the provincial health officer, MOH, who would then recommend a way forward to the Minister of Environment.

The CRD's proposal be submitted to the Minister of Environment as part of the seawater trigger document.

3. FOLLOWUP SAMPLING

CRD Staff Proposal

Immediate followup sampling when a guideline is exceeded in a sampling event would not be required in the first year of the seawater trigger. The need would be reassessed in the second year based on the sampling frequency.

MOE Staff Proposal

Immediate followup sampling when a guideline is exceeded in a sampling event would be required in the first year of the seawater trigger and in subsequent years. The followup sampling would be initiated two weeks following the determination of an exceedence.

Discussion

In the seawater trigger, there are four sampling events. Each event is approximately five weeks long. Sampling events start approximately every 13 weeks. This is an intense and expensive sampling program. The need for followup sampling could almost double the budget for the seawater trigger. In addition, in some instances, it will not be possible to carry out the followup sampling prior to the next regular sampling event due to the time required for laboratory and data analysis.

Proposed Action

It is recommended that the CRD's proposal be submitted to the Minister of Environment as part of the seawater trigger document.