BC Centre for Disease Control
An agency of the Provincial Health Services Authority

Environmental Health Services

Food Issue

Notes from the Field

Marine water for commercial use: safety and government oversight

Request received from:	Regional Health Authority
Date of request:	October 29, 2013
Issue (brief description):	Operator wants to draw marine water from foot of Clark St, treat, and sell to restaurants for live animal holding systems (provide marine aquarium tank water)

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Summary of search information

1. Internet sources: found some information on MOE site for aquatic species.
2. Ovid (define your search terms): Agricola [marine water or seawater or water analysis, n=2881] and [food safety, n=16,583] resulted in 12 abstracts, none of interest; and [human health, n=10,667] resulted in 21 abstracts, one of interest.
3. Other: contact Ministry of Agriculture and Ministry of Environment, Aquarium, DFO and request information on water quality at Burrard Inlet; review with EH.

Background information

The operator plans to draw marine water "at the foot of Clark St" in Vancouver BC. This water will be subjected to a sand filtration and UV light treatment before being sold to restaurants for live tank use with marine food species such as crabs, lobsters, shrimps and possibly marine fish.

What are the risks associated with marine water drawn from Clark Street in Vancouver?

Marine water is subject to contamination from biological and chemical hazards. Biological hazards result from the presence of pathogens found naturally in the marine environment, such as *Vibrio parahaemolyticus*, as well as from pathogens occurring from anthropogenic activities, human sourced enteric pathogens from sewage contamination, such as norovirus, hepatitis A, and *E.coli* organisms.

Site specific concerns with the Clark Drive location exist for biological hazards. There are 3 combined sewer overflows (CSO's) located at this site.[1] In addition, just west of this location are permitted sewerage discharge permits. These can be visualized in Figure 1, on the following page. Of more concern are the volumes of discharge that occur from these CSO's. In 2008, there were 95 and 94 discharges from CD (Clark Drive) sites #1 and #2, with volumes of 1,883,346 m^3 and 7,076,851 m^3 respectively.

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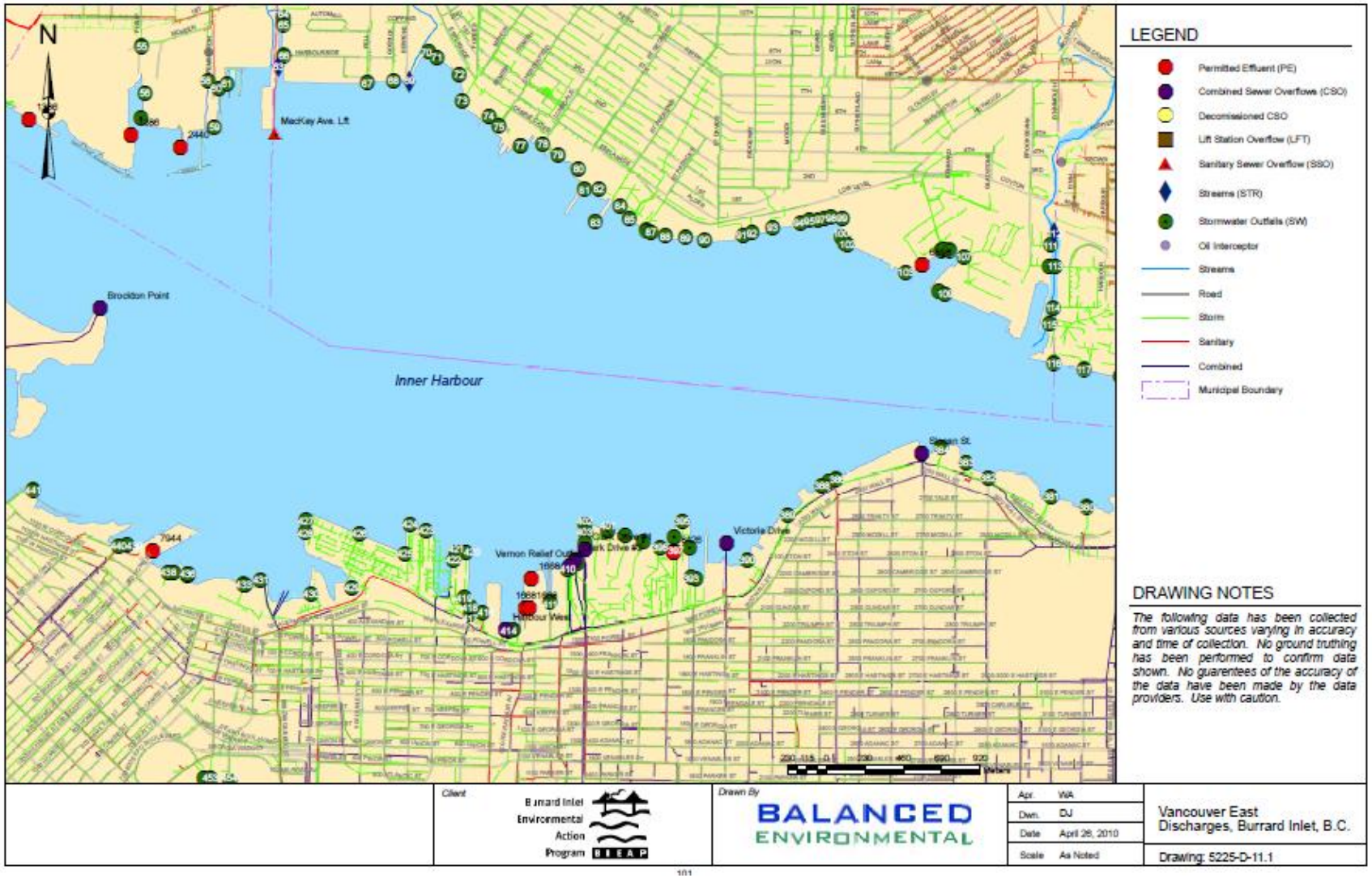

Figure 1
Locations of discharges for storm and sewerage drains, and permitted effluent disposals in east Vancouver.[1]

In 2009, at CD#1 there were 81 discharges for a total volume of 2,161,694 m^3 and at CD#2 there were 82 discharges for a total volume of 12,128,939 m^3. When added together, these 2 sites account for just under 50% of the total discharges from all CSO's in the Metro Vancouver area.[2] (described in Appendix C1 and C2). Prior to this period, it was reported that the CSO's in this area accounted for 70 to 80% of all CSO discharges.[3] The Ministry of Environment has collected and compiled bacteriological results from sites along Burrard Inlet that were recently published in a July 2013 document, *Status of Water Quality Objectives Attainment in Burrard Inlet and Tributaries 1990 to 2010*.[3] They list sources of potential contamination can originate from bulk loading facilities, oil refineries, chemical plants, stormwater discharges, discharges from CSOs, boats and marinas, as well as general surface runoff.[3] In particular they note that "CSO discharges and urban stormwater can contribute to elevated bacteriological, nutrient, petroleum, polycyclic aromatic hydrocarbon (PAH), polychlorinated biphenyl (PCB) and metal concentrations in localized areas of receiving waters and sediments. Elevated levels of contaminants in water, sediment and biota have been recorded."

A review of the records for the Clark St. site from this report demonstrate that the following chemicals, heavy metals and water parameters are not found at elevated levels (not of concern): ammonia, arsenic, cadmium, iron, lead, suspended solids and turbidity. Barium and chromium were not tested at this site, but were also found at acceptable levels in nearby locations. Copper was found at slightly elevated levels, but amounts detected were lower than those in the 1990's, so this was judged an improvement. Nickel was found at slightly higher levels. Dissolved oxygen in the water column was an issue, at this site, as well as in many other sites. There is no data available on many other compounds of concern, however, such as tributylin, chlorine-produced oxidants, chlorophenols, phenols and styrene (Table 22). No data was collected for these as testing costs for them are prohibitive (personal communication, Ministry of Environment, Nov 7, 2013). There does not appear to be any record of whether these could be an issue.

Fecal coliforms and enterococci levels at this site were also tested in 2002 and 2009. The guidelines applied to these samples were recreational, rather than for food purposes. If food level guidelines were to be applied, the most likely candidate would be to use the standards for shellfish. The difference between recreational guidelines and those set by the Canadian Shellfish Sanitation Program (CSSP) are described below.

	Fecal coliform	Enterococci
CSSP[4]	geometric mean of 88/100 mL	
Recreational	geometric mean of ≤200/100 mL	geometric mean of ≤20/100 mL

The results from the Clark Drive sampling area in 2002 and 2009 were:

	2002 (Oct – Nov)	2009 (Jan – Feb)
Fecal coliforms CFU/100mL	16 – 660 geomean=112	22 – 9,200 Geomean=448
Enterococci CFU/100mL	4 – 290 geomean=41	18 – 2,300 Geomean=282

Applying the standards for recreational use, this water exceeded the enterocci guidelines in both sampling years, 2002 and 2009, and exceeds the fecal coliform guidelines in 2009. Applying the CSSP standards, this water exceeded the guidelines in both sampling years.

This data would suggest that a well functioning and rigorous water treatment system would need to be in place to adequately remove enteric pathogens from the water before it could be reused in marine tanks.

Previous guidance on marine water commercial use from British Columbia

There does not appear to be a government agency responsible for oversight of marine water drawn for commercial purposes. The Canadian Food Inspection Agency will apply rules from the Canadian Shellfish Sanitation Program (CSSP), but this is intended **for bivalves only**. The CSSP guidance prohibits collection of shellfish within a 300 metre radius of intermittent sewage discharge areas or industrial outfalls (Section 2.3.6).[5] Under these rules, fresh untreated marine water may not be draw from an area closed for biotoxin or sanitation areas. If an area is unclassified the operator will have to demonstrate treatment is adequate. Tanks intending to receive marine water, if they are recirculating tanks, must be able to achieve a filtration/disinfection for bivalve of 2 total coliforms per 100 mL and a maximum of 20 NTU (Section 5.2.1).[4] The treatment system must also be able to remove toxic marine algae before it reaches the tanks (holding area).

Currently marine water is being drawn, filtered and sold for processors intending to export crustaceans to other countries, for example, China. Although the CFIA is aware of this activity, there is currently no oversight provided for these species, and there are no regulations by the importer that Canada would need to comply with.

Guidance on marine water for commercial use (elsewhere in the world)

In the UK, there are no water quality standards for depuration systems. The guidelines simply state the "seawater should be free from microbiological contamination and toxic and objectionable substances".[6] An end product standard for live bivalve molluscs (LBMs)of <230 *E.coli* /100 g shellfish is used for safety. Further, they do not appear to allow "moulariums" or live holding tanks for LBMs in either restaurants or at retail, in accordance with their interpretation of EC Regulation 853/2004, Annex III, Section VII.

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The FAO document on bivalve depuration states that natural seawater for use in depuration should have the following properties:[7]

- If it is to be subjected to disinfection prior to use: be taken from an area that at least conforms to the requirements for a production area suitable for depuration (EU class B, US Restricted);
- If it is NOT to be subjected to disinfection prior to use: be taken from an area that at least conforms to the requirements for a production area suitable for direct human consumption (EU class A, US Approved);
- Be free of chemical contaminants in such concentrations that may either interfere with the physiological functioning of the animals or, following uptake, result in the possibility of taints or human health effects;
- Be taken from an area free of significant concentrations of potentially toxic phytoplankton species or biotoxins;
- Have a salinity between 19 and 35 ppt (depending on species to be depurated and the salinity of the harvesting area); and
- Have a turbidity less than or equal to 15 NTU (Nephelometric TurbidityUnits).
- It is therefore implicit that source water should NOT be taken from areas that are currently closed for harvesting for regulatory purposes on the basis of microbiological, chemical or toxin events.

Seawater entering (depuration) tanks should not have detectable fecal coliforms or *E. coli* in 100mL of disinfected seawater (pg. 50).[7]

Recommendations from BCCDC

- The operator should be asked to provide a map detailing the exact site description for the drawing of commercial water from the Clark St. location.
- The water site is not recommended to be within 300 m of a CSO or permitted sewerage discharge (per CSSP recommendations).
- If the guidelines of the FAO were to be followed, as this site is currently closed for harvesting, the recommendation would be to not permit this activity.
- The operator is drawing water from a site known to be heavily influenced by CSO and run-off from streets, and known to have elevated fecal and enterococci issues. Treatment for marine water includes filtration and UV disinfection – these must be adequate to provide water quality that has <2 total coliforms/100mL and absence of fecal coliform and *E.coli* in 100mL. Further the turbidity of the water should be less than 20NTU, and preferably less than 15 NTU. BCCDC would recommend regular monitoring of water quality post-treatment. A minimum frequency of monthly sampling and additional sampling taken after adverse high rain weather events should occur to ensure the treatment system is in functioning correctly.

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- While presence of heavy metals at this site do not appear to be an issue, there is very little known about other persistent organic pollutants, such as PCBs, tributyltin, styrene and others. It is likely that fish and shellfish will be present in the tank water for a short duration before consumption, therefore, as long as animal health is not impacted, the presumption is that human health would not be adversely affected by consuming animals held in this water.
- BCCDC has not heard back from the Vancouver Aquarium. An assessment of their water quality is advised, to ensure water quality from Brockton point do not pose a health risk for live animals intended for human consumption do not pose a health risk.
- BCCDC should update their retail tank water holding guidelines to include information about purchasing water from commercial suppliers.

References

1. Balanced Environmental Services Inc. Burrard Inlet point source discharge inventory. North Vancouver, BC: Burrard Inlet Environmental Action Program (BIEAP); 2010.

2. Metro Vancouver. Metro Vancouver liquid waste management plan. Vancouver2010. Report No.: Document No. 4344679. Available from: http://www.metrovancouver.org/boards/Waste%20Management%20Committee/Metro_Vancouver_Liquid_Waste_Management_Plan-July_2010-Biennial_Report.pdf.

3. Bull J, Freyman L. Status of water quality objectives attainment in Burrard inlet and tributaries 1990 to 2010. Surrey, BC: Ministry of Environment; 2013. Available from: http://www.env.gov.bc.ca/epd/regions/lower_mainland/water_quality/reports/burrard_inlet/bi_attain2011.pdf.

4. Canadian Food Inspection Agency. Canadian Shellfish Sanitation Program. Chapter 5 - wet storage. 2013 [November 8, 2013]; Available from: http://www.inspection.gc.ca/food/fish-and-seafood/manuals/canadian-shellfish-sanitation-program/eng/1351609988326/1351610579883?chap=8.

5. Canadian Food Inspection Agency. Canadian Shellfish Sanitation Program. Chapter 2 - shellfish area survey and classification. 2013 [November 8, 2013]; Available from: http://www.inspection.gc.ca/food/fish-and-seafood/manuals/canadian-shellfish-sanitation-program/eng/1351609988326/1351610579883?chap=5.

6. Food Standards Agency Scotland. Guidance for inspection of shellfish purification systems for local food authorities2009.

7. Lee R, Lovatelli A, Ababouch L. Bivalve depuration: fundamental and practical aspects. Rome, Italy: Food and Agriculture Organization of the United Nations; 2008.

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