

Core Area Stormwater Quality Program

2019 Report

Capital Regional District | Parks & Environmental Services, Environmental Protection

Including the jurisdictions of:

City of Colwood
Township of Esquimalt
City of Langford
District of Oak Bay
District of Saanich
City of Victoria
Town of View Royal
Esquimalt First Nation
Songhees First Nation
Department of National Defence

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**CORE AREA STORMWATER QUALITY PROGRAM
2019 REPORT**

Table of Contents

1.0	INTRODUCTION.....	1
2.0	RESULTS AND DISCUSSION	1
2.1	STORMWATER DISCHARGE EVALUATIONS	1
2.1.1	<i>Public Health Ratings</i>	<i>1</i>
2.1.2	<i>Environmental Concern Ratings.....</i>	<i>2</i>
3.0	SOURCE INVESTIGATIONS	7
3.1	BACTERIAL INVESTIGATIONS.....	7
3.2	CHEMICAL CONTAMINANT INVESTIGATIONS	8
4.0	MAJOR WATERCOURSE MONITORING	8
4.1	WATER QUALITY DATA.....	9
4.1.1	<i>Bowker Creek</i>	<i>9</i>
4.1.2	<i>Bee and Selleck Creeks</i>	<i>9</i>
4.2	BENTHIC INVERTEBRATE COMMUNITY DATA	10
5.0	2020 PROGRAM.....	11

List of Tables

Table A.	Number of Discharges with a High Public Health Concern Rating from 2006 to 2019	4
Table B.	Stormwater Discharges Assigned a High Public Health Concern Rating in 2018 and 2019	4
Table C.	Discharges Recommended for Action Due to Elevated Sediment Chemical Contaminant Levels	7
Table D.	2019 Summary of Stormwater Bacterial Source Investigations by CRD and Municipal Staff ..	8
Table E.	Summary Data for Parameters of Concern in Bowker, Bee and Selleck Creeks Monitored in 2019.....	10

List of Figures

Figure A.	Number of Discharges Assigned a High Public Health Concern Rating Over Time	2
Figure B.	Core Area 2019 Stormwater Discharges Requiring Action for Public Health and Environmental Concerns (Metchosin to Esquimalt Border).....	5
Figure C.	Core Area 2019 Stormwater Discharges Requiring Action for Public Health and Environmental Concerns (Esquimalt to Central Saanich Border)	6

CORE AREA STORMWATER QUALITY PROGRAM 2019 REPORT

1.0 INTRODUCTION

The Capital Regional District (CRD), Stormwater Quality Program plans and coordinates stormwater quality monitoring and communicates results to participating municipalities. In the core area, this work is guided by the Core Area Liquid Waste Management Plan (LWMP) and done in consultation with municipalities, First Nations, and community groups, with the goal of protecting human health and the environment. The program works to identify and reduce contamination in stormwater, creeks and the ocean through monitoring, assessment, collaboration and education.

CRD staff identify contamination and impacts from stormwater, due to various land use practices, through bacterial and chemical sampling. The program assesses stormwater discharges in the core area and assigns priority ratings for mitigative action for municipalities to consider. Where contamination is found, CRD staff conduct additional investigations and work with municipal staff to find and eliminate the source.

This report summarizes the results of work completed in 2019 (newer data is considered in any conclusions when possible). In addition to routine monitoring, CRD conducted intensive sampling in Bee, Selleck and Bowker creeks. Water and sediment quality data, including details about how discharges are rated for public health and environmental concern and sampling locations, are available in the *Core Area Stormwater Quality Program 2019 Supplemental Data* on the CRD website (www.crd.bc.ca).

2.0 RESULTS AND DISCUSSION

2.1 Stormwater Discharge Evaluations

The program evaluates water and/or sediment quality in approximately 550 core area stormwater discharges from the coastline between the Colwood-Metchosin border in the west and the Saanich-Central Saanich border in the east, including Esquimalt Lagoon, Esquimalt and Victoria harbours, the Gorge, Portage Inlet and the City of Langford coastline along Saanich Inlet (See Appendix A).

2.1.1 Public Health Ratings

Each year, CRD staff sample a selection of stormwater discharges for analysis of bacterial levels. *E.coli* is measured as an indicator of fecal contamination and possible presence of pathogens. Relating the extent of *E.coli* contamination in the discharge flow, and potential for the public to contact the flow, CRD staff assign a “public health concern rating” to each discharge. While the CRD does not actually evaluate public health risk, it uses these methods to prioritize the discharges. This service allows the appropriate jurisdictions to undertake remedial measures where they will have most benefit. Appendix G describes the CRD public health concern rating system.

The CRD sampled 175 stormwater discharges twice for *E.coli* concentrations in 2019 (in both winter and summer). These discharges represented all those previously rated as high and moderate priority with a subset of low priority discharges (to monitor for change).

Sixty-four percent of the discharges had one or more *E.coli* counts greater than 200 colony forming units (CFU)/100 mL, a level that indicates sources of sewage or animal waste with potential to cause adverse effects for public members engaging in primary recreational activities (e.g., swimming, diving). However, many of these discharges have low flows or are located where there is little risk of public contact. Considering the likelihood for contact, CRD staff assigned the following public health concern ratings:

- 63 low ratings
- 80 moderate ratings, and
- 31 high ratings (Table A, Figures B and C)

The number of high-rated discharges has remained stable for the last four years (Figure A and Table A). However, while the total number has remained nearly the same, some of the discharges on this list have changed. In 2019, six of the previously high-rated discharges were assigned lower ratings, due to lower bacterial counts, while seven discharges were added to the list, due to newly-identified sources.

The high-rated discharges include 13 that have remained high-rated for five or more years. Sources of contamination in these discharges are costly or difficult to repair or remediate, and some discharges have multiple sources of contamination in a single catchment, making it difficult to track.

The rather steady number of high-rated discharges over the past few years, despite aging infrastructure and continuing development and renovations (which create the potential for stormwater-sewage cross-connections), indicate the ongoing efforts by many of the municipalities to continue to replace, repair and reline old infrastructure and work with residents and property owners to repair cross-connections.

Bacterial stormwater data and the public health concern ratings for each discharge can be found in appendices B and C, respectively.

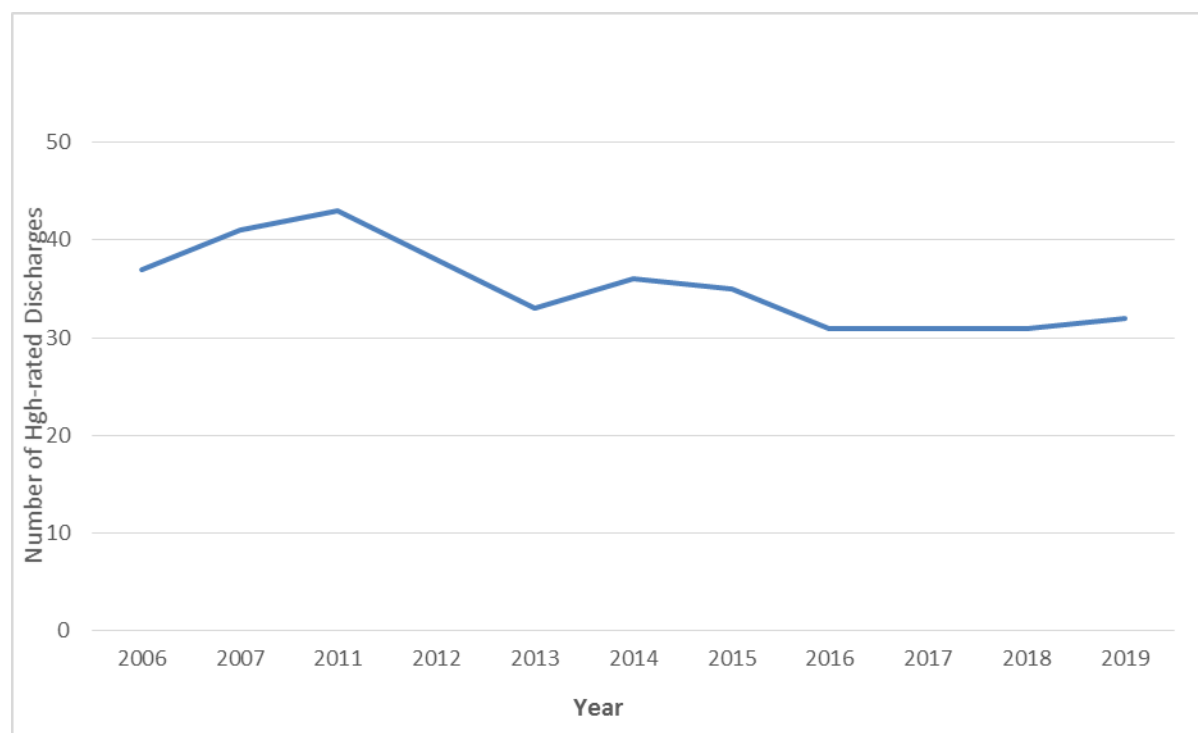


Figure A. Number of Discharges Assigned a High Public Health Concern Rating Over Time

2.1.2 Environmental Concern Ratings

CRD staff also prioritize stormwater discharges through measurements that indicate potential environmental impact. Ratings are based on the concentrations of metals and organic contaminants [polycyclic aromatic hydrocarbon (PAH)] measured in sediment within the stormwater collection system (i.e., pipes, manholes, ditches and creeks) relative to sediment quality guidelines (for the protection of marine aquatic life). Discharges are sampled annually until the rating and contaminant(s) are confirmed. Once confirmed as a high-rated discharge, it is targeted for corrective action starting with an investigation to locate the contaminant source(s). Appendix G contains detailed information about the CRD environmental concern rating system. Stormwater discharge sediment data and ratings can be found in Appendix E.

In 2019, CRD staff collected 44 stormwater sediment samples (26 at discharge points and 18 at upstream locations). Based on the levels of metals and PAHs, this data resulted in environmental concern ratings for 23 discharges, as follows:

- 13 were assigned a low rating,
- 5 were assigned a moderate rating, and
- 5 were assigned a high rating

Staff make recommendations for corrective action to find and eliminate sources of chemical contamination when a rating remains high for two consecutive years and the parameter(s) of concern are determined. Based on data up to 2020, CRD recommends 21 discharges for corrective action in the core area (shown in Table C). Of the five discharges assigned a high rating in 2019 (307, 324, 505, 692 and 712) two of these are identified as needing corrective action (307 and 505). Locations of high-rated discharges in 2019, and those identified for corrective action, are shown on figures B and C.

The number of discharges recommended for action has fluctuated from 18 to 22 for the past six years. Many discharges recommended for action have been a concern for more than five years. Many of the discharges with elevated metals are in large catchments with industrial land use and along shorelines where historical practices or contaminated fill may have resulted in contamination (614, 620, 627, 629, 634, 636). Spills are more common in these areas. These sources are challenging to narrow down and remediate.

Sources of contaminants in stormwater sediment can be complex to find and eliminate, as sediment is not always present when sampling, and contaminant levels fluctuate. In addition, non-point sources (e.g., from roadways, parking lots) and transient point sources (e.g., spills) exist. In some cases, sediment can remain for a long time, therefore, samples can reflect past practices that are no longer occurring. Therefore, recently CRD staff started to collect water samples for contaminant analysis as well. This data will be used to supplement the sediment data and provide information on current conditions in a form that is more bioavailable to aquatic life.

Source control education has increased awareness of products used on commercial and private sites and contaminant levels leaving their properties. As well, the use and maintenance of stormwater rehabilitation units continues to increase. The CRD and municipalities will continue to work together to identify and eliminate potential sources of contamination for these discharges.

2.1.2.1 Aqueous Metals in Storm Drains

In 2019, CRD staff started to routinely measure contaminants in water as well as stormwater sediment to provide more information about contaminant sources, bioavailability, loadings, and to determine if a source is ongoing or dependent on precipitation. Data collected in 2019 are provided in Appendix E.

Previous data collected intermittently in 2013 and 2018, showed that several storm drains along Victoria Harbour (between Bellville Street and Jutland Road) are discharging stormwater with elevated metals (including aluminum, arsenic, cadmium, copper, lead, manganese, silver, selenium, vanadium and zinc). Storm drains 613 (which drains into James Bay) and 629 (which drains into Rock Bay) had the highest concentrations of metals. Staff measured elevated zinc and copper in three locations in the ocean adjacent to these discharges, indicating that the storm drains are likely impacting the marine environment.

In 2019, CRD staff collected water samples for measurement of aqueous metals in 28 stormwater discharges throughout the core area (18 streams/ditches and 10 pipes/manholes). Samples collected in 16 of the locations did not have any exceedances of marine or freshwater aquatic life guidelines for the following metals (aluminum, arsenic, cadmium, copper, chromium, lead, iron and zinc). In the remaining 12 locations, copper and zinc most commonly exceeded guidelines (10 and 8 locations, respectively). There were exceedances of iron (six locations) and cadmium (three locations) as well. The highest concentrations occurred in a stormwater discharge (discharge 636) along the Victoria shoreline at South Bay.

Table A. Number of Discharges with a High Public Health Concern Rating from 2006 to 2019

Area	2006	2007	2011	2012	2013	2014	2015	2016	2017	2018	2019
Colwood	0	0	1	0	0	1	0	0	0	1	0
View Royal	2	1	1	1	0	0	0	0	0	0	1
Esquimalt	7	8	7	7	8	7	5	6	6	7	5
Esquimalt private ¹	*	*	*	*	0	0	1	0	2	1	1
DND	0	0	0	0	0	0	0	0	0	0	0
Saanich	1	2	2	3	4	5	5	6	4	1	3
Saanich private ¹	*	*	*	0	0	0	0	0	0	0	0
Victoria	15	15	20	17	13	12	14	11	11	15	14
Victoria private ¹	3	5	3	1	1	2	2	2	2	1	1
Oak Bay	9	10	9	9	7	9	8	6	6	5	6
Langford	0	0	0	0	0	0	0	0	0	0	0
Total	37	41	43	38	33	36	35	31	31	31	31

Notes:¹ Discharges that are not part of the municipal infrastructure are not under municipal jurisdiction and are separated out from the municipal totals.

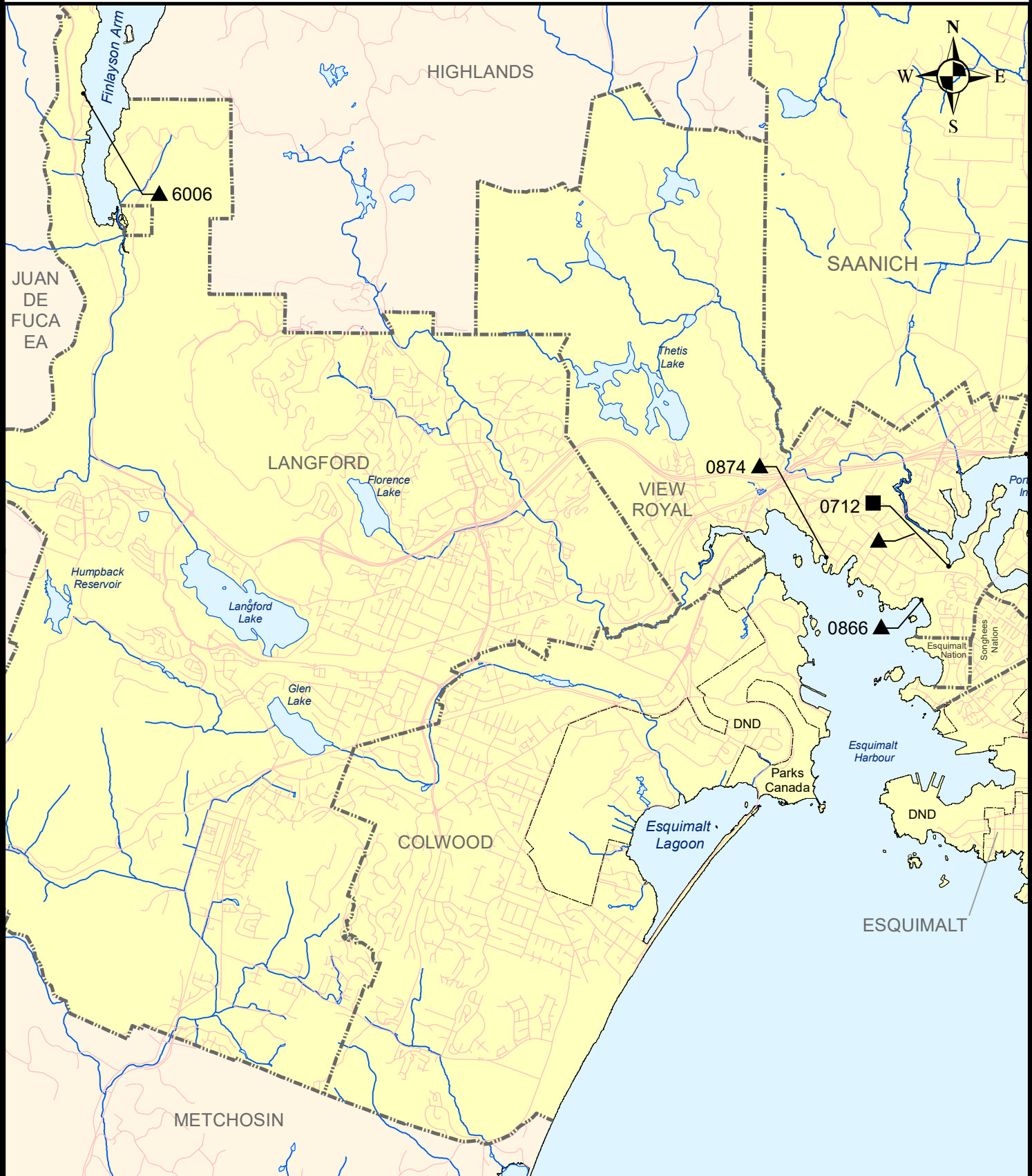
*Private discharges included in the municipal totals.

Table B. Stormwater Discharges Assigned a High Public Health Concern Rating in 2018 and 2019

Jurisdiction	Stormwater Discharges Rated High for Public Health Concern	
	2018	2019
City of Colwood	931	-
Township of Esquimalt	744, 744B, 749, 780, 781, 805, 806	744B, 780, 781, 805, 806
Township of Esquimalt – private ¹	749A	749A
City of Langford	-	-
District of Oak Bay	245, 307, 318, 320, 322	245, 249, 306, 310, 318, 320
District of Saanich	503	503, 558, 567
City of Victoria	208/209, 214, 216, 222, 229, 603, 607, 610, 611, 613, 619, 641, 650, 769, 777A	208/209, 214, 216, 222, 603, 607, 610, 611, 613, 614, 619, 641, 650, 777A
City of Victoria – private ¹	649	649
Town of View Royal	-	712
Esquimalt First Nation	-	-
Songhees First Nation	-	-
DND	-	-

Notes:¹ Discharges that are not part of the municipal infrastructure are not under municipal jurisdiction.

Figure B - Core Area 2019
 Stormwater Discharges Requiring Action for Public Health and Environmental Concerns
 (Metchosin to Esquimalt Border)



0 0.5 1 Kilometres
 Projection: UTM ZONE 10N NAD 83

Discharges Requiring Action

- High Public Health Rating
- ▲ High Environmental Rating and/or Recommended for Action

- Municipal Boundaries
- DND Boundaries
- ~ Streams and Rivers
- Roads
- Stormwater Monitoring Area

Important This map is for general information purposes only. The Capital Regional District (CRD) makes no representations or warranties regarding the accuracy or completeness of this map or the suitability of the map for any purpose. **This map is not for navigation.** The CRD will not be liable for any damage, loss or injury resulting from the use of the map or information on the map and the map may be changed by the CRD at any time.

Figure C - Core Area 2019
Stormwater Discharges Requiring Action for Public Health and Environmental Concerns
(Esquimalt to Central Saanich Border)



0 1 2 Kilometres
Projection: UTM ZONE 10N NAD 83

Discharges Requiring Action

- High Public Health Rating
- ▲ High Environmental Rating and/or Recommended for Action

- Municipal Boundaries
- DND Boundaries
- ~ Streams and Rivers
- Roads
- Stormwater Monitoring Area

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Table C. Discharges Recommended for Action Due to Elevated Sediment Chemical Contaminant Levels

Jurisdiction	Discharges Recommended for Corrective Action	Total
City of Colwood	-	0
Township of Esquimalt	737, 742, 749, 806	4
Township of Esquimalt – private ¹	-	0
City of Langford	6006	1
District of Oak Bay	250, 306, 307, 310	4
District of Saanich	505	1
District of Saanich – private ¹	-	-
City of Victoria	216, 603, 614, 620, 627, 629, 634, 636	8
City of Victoria – private ¹	649	1
Town of View Royal	866, 874	2
DND	-	0
Total		21

Notes:

¹ Discharges that drain from private property do not fall under municipal jurisdiction.

3.0 SOURCE INVESTIGATIONS

The program conducted source investigations in the catchment areas of 14 stormwater discharges identified as having a high public health concern rating or high environmental concern rating.

3.1 Bacterial Investigations

In 2019, CRD staff conducted bacterial source investigations in 10 stormwater catchment areas.

City of Victoria and CRD staff narrowed down a source of sewage entering the storm drain in discharge 610, which drains to the Inner Harbour. City of Victoria also identified a source of sewage entering discharge 619 and have worked on reducing that input. CRD staff have narrowed down one additional source in discharge 622, but the results need to be confirmed. A sewer-stormwater cross-connection thought to have been fixed from the BC Legislature building was also confirmed as still being present in discharge 611. Investigations or continued monitoring are ongoing in six of the discharges, due to inability to access a property, presence of multiple sources, lower bacteria counts or lack of flows to sample in 2019. The status of bacterial investigations completed by CRD staff in 2019 is summarized in Table D.

Table D. 2019 Summary of Stormwater Bacterial Source Investigations by CRD and Municipal Staff

Discharge	Municipality	Sampling Events	Status
320	Oak Bay	3	One source fixed; lower counts; ongoing for another source
323	Oak Bay	2	Inconclusive – need property access to narrow down a source
605	Victoria	1	Inconclusive – bacterial counts highly variable
610	Victoria	1	Narrowed to a property, but need to determine source
611	Victoria	1	Previously identified cross-connection at BC Legislature building; caffeine confirmed human source; waiting for action
618	Victoria	1	Narrowed, small catchment; otters use pipe; confirm human source
619	Victoria	1	Victoria confirmed source of sewage and made repairs; confirm repair
622	Victoria	2	Narrowed to a property, but needs confirmation
690D-11	Saanich	1	Inconclusive; dry upstream; ongoing
931	Colwood	2	Inconclusive; counts lower; may be wildlife; continue monitoring

3.2 Chemical Contaminant Investigations

In 2019, CRD staff conducted chemical contaminant source investigations in four stormwater catchment areas (307, 310, 505 and 742).

Investigations are ongoing in these catchments, however a number of details of note follow. Staff have eliminated Gorge Vale Golf Course as a source of mercury contamination in 742 and will continue investigating. Staff have identified a source of metals in catchment 310 (Oak Bay) that is likely from an accumulation of historical sediment. Oak Bay has agreed to remove this sediment. Additionally, Oak Bay and Saanich will also remove contaminated sediment in manholes within the catchments of 307 and 505. Once sediment is removed, CRD staff will follow-up with sampling to determine if the source is ongoing or was due to the historical accumulation of sediment.

Many of the discharges with elevated metals are in large catchments with industrial land use and along shorelines where historical practices or contaminated fill may have resulted in contamination (614, 620, 627, 629, 634, 636). Spills are more common in these areas. These sources are challenging to narrow down and remediate.

Overall, CRD staff have narrowed down sources in 10 of the 21 catchments on the action list and continue to work with municipal staff on eliminating or lessening these sources.

4.0 MAJOR WATERCOURSE MONITORING

In 2019, CRD staff continued to monitor Bee, Bowker, Cecelia, Colquitz, Colwood, Craigflower, Douglas, Hospital, Noble, Selleck and Tod creeks, and Mill Stream to provide information about watershed health.

Each year, CRD staff collect water quality data twice at the discharge of each creek, providing a snapshot of creek health conditions in the wet and dry seasons. In addition, staff conduct more comprehensive watershed health assessments in two to three core area watercourses each year with the goal to assess each watercourse in this manner every five years.

In 2019, Bowker, Bee and Selleck creeks were assessed more extensively, including measuring water quality five times in 30 days in summer and fall at various locations in the watershed, and undertaking a health assessment of the benthic invertebrate animals living in the creeks. Additional water quality parameters, including metals were measured. Sampling five times in 30 days allows for comparison to BC Water Quality Guidelines (WQGs).

BC Ministry of Environment and Climate Change Strategy (ENV), with assistance from CRD, have started developing draft Water Quality Objectives for CRD streams. However, they are incomplete or the same as the guidelines; therefore, all data is compared to the BC WQGs (approved and working). These data were also compared to 2014 data, which was the last time these creeks were assessed in this manner.

4.1 Water Quality Data

4.1.1 Bowker Creek

The 2019 water quality data indicated that sewage inputs and urban development in the watershed continue to impact water quality. Data indicates there may be improvements in some water quality parameters since 2014, when the creek was previously monitored intensively, however, others appear to have degraded. Consistent with observations in 2014, copper, dissolved oxygen, phosphorus, suspended solids, temperature, turbidity and zinc are at levels that are potentially harmful to aquatic life. Fecal coliform, *E.coli* and caffeine measurements indicate sewage contamination is still present and recreational activities such as swimming in the mouth of the creek may be unsafe. Suspended solids and temperature were outside recommended guidelines in 2019 only, as well as one low measurement of pH. The parameters of concern (those that exceeded water quality guidelines for protection of aquatic life) are summarized in Table E. The full data set is presented in Appendix F.

Compared to 2014 data, higher maximum concentrations for copper, iron, suspended solids and zinc were measured in 2019 in Bowker Creek. The highest measurements (those that are higher than maximum concentrations in 2014) occurred during heavy rainfall events on October 7, 2019 (which may have been a first flush event) and October 21, 2019. CRD staff also sampled these creeks during rainfall in 2014, but it is uncertain if the intensity of the rainfall at the time of sampling was the same.

In 2019, lower concentrations of *E.coli* and phosphorus, and higher concentrations of dissolved oxygen were measured. This may reflect improvements in sewage and stormwater infrastructure in the watershed; however, due to variability in the data, it is difficult to confirm. CRD staff will continue to monitor for and investigate sources of sewage in the Bowker Creek watershed.

4.1.2 Bee and Selleck Creeks

2019 water quality data in Bee and Selleck creeks indicated that these creeks are healthy, relative to other CRD urban creeks, but water quality may be degrading. Physical parameters, including dissolved oxygen, pH and temperature were within guidelines protective of fish and other aquatic life (with the exception of one temperature measurement in Selleck Creek). The parameters of concern in Bee Creek included *E.coli*, nitrate, phosphorus, suspended solids and turbidity. These parameters, as well as iron and zinc, were also elevated in Selleck Creek.

Compared to 2014 data, higher maximum concentrations for *E.coli*, turbidity, phosphorus, suspended solids, iron and zinc were measured in 2019 in both creeks (with the exception of zinc in Bee Creek). As in Bowker, the highest measurements occurred during heavy rainfall on October 7, 2019 and October 21, 2019. CRD staff also sampled these creeks during rainfall in 2014, but it is uncertain if the intensity of rain was the same. However, land clearing and construction was taking place in both of these watersheds during the fall 2019 sampling period and significant vegetation has been removed since 2014.

Temperature and nitrate measurements were similar and historical data collected by the CRD indicates that nitrite is naturally elevated around Esquimalt Lagoon.

Table E. Summary Data for Parameters of Concern in Bowker, Bee and Selleck Creeks Monitored in 2019.

Parameters of Concern	Unit	BC WQ Guideline*		Bowker		Bee		Selleck	
		Inst	Ave	Inst	Ave	Inst	Ave	Inst	Ave
Copper	µg/L	3.5-15	1.5-5.2	16.2	7.7	2.12	1.1	5.71	2.5
<i>E.coli</i>	CFU/100 mL	400	200	9,800	1,947	3,400	125	1,000	95
Iron	µg/L	1.000	-	2,170	-	828	-	1,450	-
Nitrate**	µg/L	32.8	3.7	0.813	0.581 (u/s)	3.97	3.79	6.28	5.84
Oxygen	mg/L	5	8	4.86	5.15 (u/s)	10.72	10.2	9.5	9.01
pH	pH units	6.5-9.0		6.44 (u/s)	6.74 (u/s)	7.3	7.6	7.46	7.3
Phosphorus	µg/L	10	5	82	80	74	35	104	49
Temperature	°C	17		18.7 (u/s)	18.5 (u/s)	14.4	13.7	17.3	16.2
Turbidity	NTU	9	6	54.6	16	31.8	14	28.3	11.6
Solids	mg/L	26	6	64	16	42	18	80	31
Zinc	µg/L	33-69	7.5-38.3	52.8	19	1	<1	12.4	5.2

Notes:

*BC ENV water quality guideline for protection of aquatic life.

Inst = instantaneous or single sample max (or min in regards to pH or dissolved oxygen)

Ave = highest average (lowest for dissolved oxygen and pH) or highest geomean for *E.coli*

Copper and zinc guidelines are hardness-dependent

Measurements are for the discharge unless specified as upstream (u/s). See Appendix F for specific locations.

**Nitrate is elevated around Esquimalt Lagoon, but data indicates it may be naturally elevated in the groundwater.

X Indicates an exceedance of the water quality guideline.

CRD data indicate that the water quality parameters of most concern in core area creeks are bacteria, phosphorus, turbidity and metals. Some sites also experience low dissolved oxygen and elevated temperature in the summers. This is consistent with what is seen throughout the region wherever there is increased human presence. The draft Vancouver Island phosphorus objective was exceeded in all CRD creeks, due to human and animal presence in these watersheds.

Water quality is important in these creeks, but hydrological changes and physical alteration are also a concern. Therefore, benthic invertebrate community data and hydrological data are also collected.

4.2 Benthic Invertebrate Community Data

Benthic invertebrates live in or on the bottom of streams and are good indicators of stream health. Their community composition reflects the overall condition of the aquatic environment and depends on water and sediment quality, as well as hydrology.

CRD data for core area creeks indicate that the benthic invertebrate communities in Colwood and Tod creeks and Mill Stream (at the discharge) are healthy, based on their similarity to invertebrate communities in minimally impacted Vancouver Island creeks. Benthic invertebrate community data from downstream locations in Bee, Bowker, Cecelia and Colquitz creeks indicate that these communities are not healthy and it is recommended that activities impacting the watershed be identified and managed.

The Hilsenhoff Biotic Index (HBI) indicates the amount of organic and nutrient pollution in a stream, based on species distribution and their tolerance to such pollution. Mill Stream (at the discharge) was deemed "Very Good" with slight organic pollution probable. Colwood, Colquitz (downstream of Elk Lake), Craigflower, Douglas, Mill Stream (at Treanor Road) and Tod creeks were deemed "Good" with some organic pollution likely; Colquitz, and Bee creeks were deemed "Fair" with fairly substantial pollution likely; and Bowker and Cecelia creeks were deemed "Fairly Poor" with substantial pollution likely.

A slight degradation of the HBI in Colwood Creek in 2012 compared to 2017 (from 4.38 to 4.80), and Cecelia Creek and Mill Stream in 2013 compared to 2018 (from 6.38 to 7.49 in Cecelia and 4.28 to 5.03 in Mill Stream) suggests that pollution may be increasing in these creeks and further study is warranted. However lower HBI indices in 2019 for Bee and Bowker creeks (5.24 from 6.25 in Bee and 5.88 from 6.93 in Bowker) indicated that organic pollution may be decreasing in these creeks.

5.0 2020 PROGRAM

The program will continue to work with municipal partners, First Nations and community groups to achieve LWMP goals to identify stormwater discharges of public health and environmental concern and investigate the sources of contamination. In 2020, CRD staff will continue to work with our partners to identify and reduce bacteria and contaminant levels in stormwater discharges, creeks and the marine receiving environment. Focused watercourse sampling will be undertaken in Craigflower and Noble creeks.