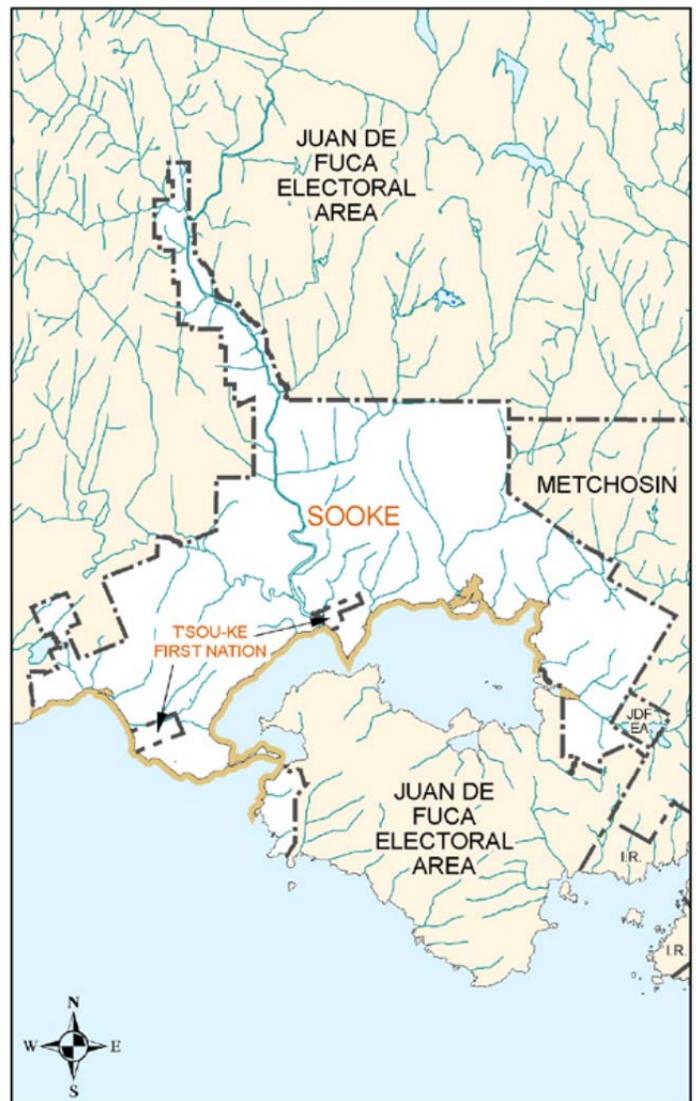


# District of Sooke Stormwater Quality 2013 Annual Report

Parks &amp; Environmental Services

Environmental Protection



Prepared By  
Integrated Watershed Management Program

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Additional data associated with this report is available on request or on the CRD website under the title "2013 Sooke Data Report" at: <https://www.crd.bc.ca/about/document-library/Documents/annual-reports/environmental-protection/integrated-watershed-management>



**DISTRICT OF SOOKE STORMWATER QUALITY  
2013 ANNUAL REPORT**

**EXECUTIVE SUMMARY**

**INTRODUCTION**

This report summarizes the work completed in 2013 by the Capital Regional District (CRD) Integrated Watershed Management Program (IWMP) in the District of Sooke. The program works in cooperation with the District of Sooke to limit the impacts of contaminated stormwater runoff on the environment, to protect public health and to meet the district's commitments in the *Liquid Waste Management Plan, 2010*.

The District of Sooke has a growing population of 11,435 residents (based on 2011 census data) and varied land uses (i.e., residential, commercial, agricultural and institutional). These land use activities and increasing development have the potential to impact stormwater, creeks and the marine environment. Failing onsite sewage systems have resulted in sewage contamination in the District of Sooke. However, a wastewater collection system and secondary wastewater treatment plant was completed in the more developed area of the District of Sooke in 2006.

IWMP monitors stormwater flows and the receiving environment for changes in environmental fecal coliform levels (an indicator of sewage contamination) as a result of sewage collection and treatment. In addition, IWMP staff continue to collect monitoring data in areas using onsite sewage treatment including areas being considered for sewer expansion.

The CRD IWMP sampled stormwater, surface water and sediment to identify contamination; its potential to cause adverse effects on human or environmental health; prioritize stormwater discharges of concern; conduct source investigations, and provide direction for mitigative efforts by municipal staff.

Data was collected and assessed through the following activities in 2013:

**Stormwater discharge assessment:** IWMP staff measured fecal coliform bacteria levels in 76 discharges and metals, and polycyclic aromatic hydrocarbons (PAH) in sediment within six stormwater discharges. IWMP staff compared the data to guidelines and thresholds and prioritized discharges based on IWMP public health and environmental concern ratings to allow the District of Sooke to address areas of most concern in a priority manner.

**Watercourse surface water monitoring:** IWMP staff measured water quality in 14 watercourses during winter and 10 during summer. Measurements were compared to guidelines for aquatic life protection, IWMP's fecal coliform guideline and historical data to assess changes.

**Marine surface water monitoring:** IWMP staff measured fecal coliform levels in 28 marine stations (23 nearshore and five centreline). Results were compared to guidelines for recreational primary contact (e.g., swimming) and shellfish harvesting.

The results of this annual report have been discussed with District of Sooke staff.

**RESULTS AND DISCUSSION**

**1. Fecal Coliform Levels: Stormwater Discharges, Watercourses and Marine Surface Water**

**Stormwater Discharges and Watercourses**

IWMP staff measured fecal coliform contamination (counts greater than 200 FC/100 mL) in 30% (23 out of 76) of the stormwater discharges (including seven creeks). This level of contamination indicates sources of sewage or animal waste with the potential to cause adverse human health effects from primary contact activities (e.g., swimming, ingestion). The fecal coliform contamination measured in 2013 was higher than the 2011 and 2012 results (19 and 23%, respectively); however, fecal coliform data is variable

and depends on weather conditions and time of sampling. IWMP staff assigned a high public health rating to three of these discharges based on the potential for the public to come in contact with the stormwater flows (discussed in more detail below).

IWMP staff also compares the fecal coliform data from the District of Sooke to two thresholds (500 and 2,000 FC/100 mL) as requested by Sooke council in 2000. Of the 76 discharges assessed in 2013:

- 15 had at least one fecal coliform count between 500 and 1,999 FC/100 mL.
- 13 had at least one count greater than or equal to 2,000 FC/100 mL.

More discharges exceeded the thresholds in 2013 compared to 2012 (14 were above 500 FC/100 mL and five of them exceeded 2,000 FC/100 mL). Discharges that exceed these thresholds are shown in Figure A.

IWMP staff observed fecal coliform contamination in seven of the 14 watercourses monitored in 2013. In addition to fecal coliforms, other parameters were measured in watercourses. Those results, in relation to watercourse health, are discussed further below.

In the past, IWMP staff avoided collecting samples during first flush or heavy rainfall to avoid extreme or unusual values; however, recently, it has become of interest to measure the effects of heavier rainfall on contaminant levels in stormwater, streams and the ocean. Therefore, sampling planned for a certain date was carried out despite moderate to heavy rainfall in 2013. This factor likely contributed to the higher than usual fecal coliform counts found in winter marine samples collected during heavy rainfall in 2013. Staff have measured higher than usual fecal coliform levels in other areas in the CRD during heavy rainfall in recent years.

### **Marine Surface Water Fecal Coliform Levels**

Marine fecal coliform concentrations were compared to the value of 14 FC/100 mL as it is higher than background level and gives an indication of contamination and potential for impacts to shellfish harvesting. Data was also compared to the IWMP guideline (200 FC/100 mL) as an indication of more significant contamination and potential adverse human health effects from direct contact through recreational activities such as swimming.

The 2013 data provides further indication that stormwater from some discharges is impacting the marine environment: 15 of the 28 samples collected in winter 2013, during heavy rainfall, had a fecal coliform count above 14 FC/100 mL and two of those stations had a count above 200 FC/100 mL. In summer, four of the 28 measurements were above 14 FC/100 mL, while none were above 200 FC/100 mL.

Although the summer 2013 results are similar to those from previous years, the winter fecal coliform levels were higher than usual as 15 of the measurements were above 14 FC/100 mL in 2013 compared to zero or one in the previous five years; the winter geometric mean of all 28 samples is the highest ever measured by IWMP (13 FC/100 mL). The cause of higher than usual fecal coliform levels in 2013 is unknown, but stormwater is likely a source. There was heavy rainfall on the day of sampling and elevated fecal coliform counts were near the shoreline and not in the centre.

It is uncertain whether the bacteria detected during these sampling events are of human or animal origin. Potential sources of contamination are birds, wildlife, farm animals or failing onsite sewage disposal. Later in the year (December 02, 2013), bacteria from humans (one location) and ruminant animals (three locations) were detected in marine surface water around Billings Spit.

IWMP staff will continue to monitor these stations and discuss results with Sooke staff.

## 2. Public Health Concern Ratings

IWMP staff assign public health concern ratings to stormwater discharges based on the fecal coliform level and the potential for members of the public to come into contact with this contamination. Each shoreline segment is assigned a public shoreline use rating (low, moderate, or high) based on public accessibility and activity that commonly take place (e.g., walking, kayaking and swimming). Ratings provide guidance on mitigation priority when there are a number of contaminated discharges to address. In 2013, IWMP assigned the following public health concern ratings to the 76 stormwater discharges assessed for public health concern:

- three discharges were rated high [2035 (Cooper's Cove), 2042A (Alderbrook Stream) and 2067A (1643 Dufour Road)]
- 18 discharges were rated moderate
- 55 discharges were rated low

Of the three discharges assigned a high rating, two of them have been high-rated intermittently for a number of years (2035 and 2042A), while one has occasionally had elevated fecal coliform levels, but the flows are often low or dry. The sources of contamination for the high-rated discharges are likely animals for discharges 2035 and 2042A [based on bacterial source tracking (BST) analysis] and are unknown for discharge 2067A.

Four high-rated discharges were found in 2012 and in 2011; however, only one discharge was high-rated in all three years (2035, Cooper Cove).

Public health ratings are based on fecal contamination and do not address potential effects from other contaminants that may be associated with sewage or animal waste, and could adversely affect human health or aquatic life.

Discharges of concern are shown in Figure A.

### Wastewater Collection and Treatment

A wastewater treatment plant and conveyance system was constructed in the District of Sooke in 2006. IWMP data indicate that fewer fecal coliform counts above 500 and 2,000 FC/100 mL have been measured in stormwater. The number of discharges within the sewered area that exceeded 500 FC/100 mL was reduced from nine in 2005 to six in 2013. Five of those exceeded 2,000 FC/100 mL compared to eight in 2005. Remaining contamination may be related to properties that have not connected to the wastewater system and animal waste.

IWMP staff have identified some marine fecal coliform contamination adjacent to the sewered area. Marine surface water samples taken in front of the sewered area in 2013 showed fecal contamination above 14 FC/100 mL at all three stations (SO-22, SO-23 and SO-24) in winter and two of the stations (SO-22 and SO-23) in summer. In addition, one measurement at station SO-24 was above the IWMP guideline 200 FC/100 mL in winter. Winter samples in Sooke Harbour and Basin are rarely above 14 FC/100 mL; however, there was heavy rainfall during sampling in 2013. Results indicate that observed fecal contamination is from stormwater as there was heavy rainfall and elevated fecal coliforms were measured near the shore and not the middle of the harbour and basin.

IWMP staff will continue to monitor all stormwater flows in the sewered area. Monitoring data will be used to evaluate the overall effect that sewerage the area has had on the quality of stormwater and the marine receiving environment.

### Sewer Service Area Expansion

The District of Sooke is considering other areas for expansion of the sewage service area. The two areas identified as the most likely candidates include Kaltasin and the Flats catchment and Whiffin Spit North. IWMP staff monitors six stormwater discharges from each area as well as three marine stations around Billings Spit (Kaltasin area) and one marine station adjacent to Whiffin Spit North.

## **Habitat**

CRD data has determined that marine habitat around both areas is highly sensitive and includes shellfish beds and eelgrass; however, there is less flushing around Billings Spit.

## **Public Use**

Swimming is more likely to occur around Billings Spit. Kayaking and other boating activities occur near the Whiffin Spit shoreline, but little swimming.

## **Fecal Coliform in Stormwater**

Fecal coliform levels in stormwater from both areas are similar. In 2013, a discharge from each area had a fecal coliform count above 2,000 FC/100 mL. However, the only high-rating in 2013 occurred in the Kaltasin area. Due to significant flow rates from three watercourses discharging from the Kaltasin area (Sooke River, Alderbrook Stream and Lannon/Saseenos Creek), high contaminant loadings to the marine environment are possible. Whiffin Spit flows are generally lower than the creeks from the Kaltasin area and they are dry in summer.

## **Fecal Coliform in Marine Water**

Fecal coliform contamination (levels above 14 FC/100 mL) is present in the marine environment in both areas. IWMP staff conducted additional marine sampling during rainfall around the Billings Spit shoreline to address the concern that the area is vulnerable to high groundwater and failing septic systems. All 11 samples were above 14 FC/100 mL and three were above IWMP guideline (200 FC/100 mL) that indicates a potential threat to public health.

IWMP staff have completed less wet weather sampling in the marine environment adjacent to Whiffin Spit North so the impact of stormwater on the marine environment is less certain. However, IWMP staff measured elevated fecal coliform in one marine station in winter 2013 (68 FC/100mL) indicating that stormwater from Whiffin Spit North is also having an impact on the marine environment.

## **Sources**

IWMP data indicates that contamination observed is mainly from agricultural animals; however, bacteria from a human source was measured in one marine sample collected in front of discharge 2040 (south of Lannon/Saseenos Creek) in 2013. More investigation is needed to determine the sources and their contribution, however, is likely that a significant amount of the observed contamination in both areas will not be mitigated through sewerage.



### **3. Fecal Coliform Source Investigations**

In 2013, IWMP continued to work towards identifying sources of fecal coliform contamination by undertaking investigations through upstream sampling and BST to identify if bacteria are from a human or animal source.

Staff conducted upstream sampling to narrow down the area of the source of contamination in two stormwater discharges (2053 and 2054). BST analysis was conducted in stormwater samples from these discharges as well as three marine samples off of Billings Spit (foot of Kaltasin, foot of Seabroom and in front of discharge 2040).

A summary of the 2013 investigations is as follows:

- the area of the source of contamination was narrowed down in one discharge (2053),
- the investigation is inconclusive in one discharge due to lower fecal coliform counts (2054),
- bacteria of human origin were detected in one stormwater discharge (2053) and marine surface water in front of discharge 2040 (Billings Spit),
- bacteria from ruminant animals were found in the marine surface water in three locations off of Billings Spit, and
- bacteria from dogs was found in one stormwater discharge (2053) and two marine surface water samples (Billings Spit).

IWMP collected marine samples for BST analysis from similar locations in 2011; however, a sample was not collected in front of discharge 2040. BST results from the three locations showed that agricultural or companion animal waste was present, no human bacteria were present.

### **4. Environmental Concerns**

Environmental health is evaluated by assessment of contaminants in sediments from stormwater discharges and by assessment of water quality parameters in the significant watercourses that discharge onto the Sooke coastline.

#### **Environmental Health Concern Ratings**

In 2013, IWMP staff collected a sediment sample from five stormwater discharges (2036, 2038, 2043A, 2048, 2051), and upstream in catchment 2054 (at 2054-2).

No sediment sampled in 2013 had concentrations of chemical contaminants (eight metals and two groups of hydrocarbons) above the CRD's Marine Sediment Quality Guidelines. Staff assigned a low contaminant rating to the five discharges sampled.

Upstream sampling resulted in a moderate rating at 2054-2 due to the sum of contaminant concentrations present. IWMP staff have been investigating the source of zinc and PAH in discharge 2054 (southwest of Murray Road) since 2000. Upstream samples collected in 2002, 2003, 2011 and 2012 were rated high due to zinc; however, a lower concentration of zinc was measured in 2013. Results indicate the source may be runoff from Sooke Road or the parking lot that services the post office.

#### **Watercourse Monitoring Results**

Development near watercourses and inputs of sewage from onsite treatment systems and agricultural waste pose the most risk to watercourses in the District of Sooke. CRD monitoring results indicate that water quality is moderate or good in most of the watercourses monitored. Exceedence of more than one guideline occurred in about half of the watercourses. CRD data collected in 2013, and previous years, suggest that water quality in Sooke watercourses is as follows:

- good in four creeks (Ayum Creek, Grouse Brook, Gillespie Creek and Wildwood Creek),

- moderate in seven creeks (Broom Hill Stream, Ella Stream, Kemp Lake Stream, Lannon/Saseenos Creek, Nott Brook, Sooke River and Wright Road Creek), and
- poor in three creeks (Alderbrook Stream, Throup Stream and Veitch Creek)

The water quality parameters of most concern in 2013, as in previous years, were fecal coliforms, turbidity and phosphorus. This is consistent with what is seen throughout the region wherever there is increased human presence or agriculture. The draft Vancouver Island phosphorus objective were exceeded in all CRD creeks due to human and animal presence in these watersheds; however, the levels measured in Sooke creeks were lower than measured in many other CRD creeks. The new objective is specific to Vancouver Island streams and is based on local data with the intent of limiting or preventing excessive nutrient loading and subsequent environmental damage.

### **Water Quality Trends**

Water quality in most of the watercourses appears to be constant over time. Unusually high fecal coliform levels were measured in Alderbrook Stream and the Sooke River Watershed in DeMamiel Creek. IWMP staff will continue monitoring these creeks to determine whether the results were anomalous or indicative of a trend of higher fecal coliform levels in these areas.

### **Future Sampling and Evaluation Efforts**

IWMP staff will conduct the following activities in 2014:

#### **1. Stormwater Discharge Sampling**

Sampling for analysis of fecal coliform counts and evaluation of public health concern for the following:

- stormwater discharges rated moderate and high in 2013
- significant watercourses
- discharges with a change in public health concern ratings from the previous year to confirm ratings

#### **2. Sediment Sampling and Assessment**

In 2014, sediment sampling and assessment will include:

- discharges that have not been visited for five years (2036, 2038, 2043A, 2048, 2051)
- discharge 2053 to confirm the absence of contamination
- discharge 2054 to confirm a 2007 high rating—sediment has not been available for several years. Upstream samples will be collected if there is no sediment at the discharge.

#### **3. Watercourse Monitoring**

IWMP staff will continue to monitor water quality in significant watercourses to assess health. However, it is anticipated that the sampling approach be more comprehensive as has been done in the CRD Core Area streams. The approach provides a better picture of watershed health through more intensive monitoring in fewer creeks per year. Monitoring includes weekly collection of water quality samples for five weeks in summer, winter or both seasons, resulting in more robust data for comparison to BC Ministry of Environment (MOE) water quality guidelines. This level of monitoring would also meet attainment monitoring proposed by the MOE draft water quality objectives in Sooke creeks.

#### **4. Marine Surface Water Monitoring**

IWMP staff will continue to monitor fecal coliform levels at all 28 marine sampling stations in winter and summer for comparison to shellfish harvesting and human health recreational guidelines.

#### **5. Source Investigations**

Source investigations will be conducted on a selection of discharges rated moderate for public health concern in 2013 and those with fecal coliform counts above 500 FC/100 mL.

## **PUBLIC EDUCATION**

IWMP includes a public education component which involves educating businesses, community groups and the general public on stormwater quality issues and what can be done to prevent and reduce pollution. Part of the public education component includes promoting the use of Best Management Practices (BMP) by the community. BMP are voluntary strategies for preventing stormwater pollution. IWMP staff also promote reporting of spills and are active by attending outreach events and hosting educational workshops.

## **TECHNICAL ASSISTANCE**

IWMP provides technical expertise and assistance to municipalities in the area of stormwater source control. Information on structural pollution prevention technologies, federal and provincial initiatives that involve stormwater quality, and changing environmental guidelines and regulations, are some of the broad topics where the program provides advice to municipalities.

## **RECOMMENDATIONS**

### **Public Health Concerns**

The following recommendations are based on the results of the fecal coliform sampling:

1. That IWMP staff continue to sample stormwater discharges along the District of Sooke coastline to monitor for fecal coliform levels.
2. That IWMP staff continue to work with the District of Sooke and Island Health staff to identify the source of elevated fecal coliform concentrations in stormwater.
3. That IWMP staff continue to monitor surface fecal coliform levels in Sooke Inlet, Harbour and Basin to measure contaminants and track changes in these water bodies over time.

### **Environmental Concerns**

The following recommendations are based on the results of the chemical contaminants survey:

1. That IWMP work with Sooke staff to implement a more comprehensive stream sampling program.
2. That IWMP staff continue to monitor discharges to determine source(s) of chemical contamination.
3. That IWMP staff discontinue monitoring (for five years) discharges where low contaminant levels have been confirmed.
4. That IWMP staff evaluate the effectiveness of the current sediment sampling program and make changes, as required, to protect watercourses and the nearshore marine environment.

### **Stormwater Source Control**

1. That IWMP staff continue to develop, as required, BMP and other tools for the protection of stormwater quality.

### **General**

1. That IWMP staff continue to work with community groups and others to promote stormwater protection.

**DISTRICT OF SOOKE STORMWATER QUALITY  
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## DISTRICT OF SOOKE STORMWATER QUALITY 2013 ANNUAL REPORT

### 1.0 INTRODUCTION

The Capital Regional District (CRD) Integrated Watershed Management Program (IWMP) works in cooperation with the District of Sooke to limit the impacts of contaminated stormwater runoff on the environment, to protect public health and to meet commitments in the district's *Liquid Waste Management Plan, 2010*. IWMP collects and assesses stormwater, surface water and sediment data and prioritizes areas of concern for municipal action. The CRD does not have authority to implement mitigative measures; this continues to be the responsibility of the municipality, property owners, First Nations, Island Health, Ministry of Transportation (MOT) and other government agencies. This annual report provides the results of work completed in 2013 as part of the program.

### 1.1 Study Area and Land Use

The District of Sooke is 6,854 hectares in size and has a growing population of 11,435 residents (based on 2011 census data). Land uses are varied and include agricultural, commercial, institutional, recreational and residential.

A sewage collection system and secondary wastewater treatment plant was completed in 2006 in the most developed area of Sooke. Until 2006, sewage treatment in the study area consisted of onsite sewage treatment systems (with in-ground disposal). IWMP had previously identified problems with some of these systems, especially during wet weather conditions. IWMP staff monitor the discharges adjacent to the sewered area (discharges 2047-2061) to measure changes in contamination levels as a result of the sewer system. As the District of Sooke considers other areas for sewer expansion, IWMP stormwater data will assist the District of Sooke in making decisions that are protective of public health and the environment.

#### 1.1.1 Shellfish Beds

There are a number of shellfish beds along the District of Sooke coastline which are under threat from stormwater contamination. The Department of Fisheries and Oceans Canada (DFO) has closed these shellfish beds to recreational harvesting. Closures are based mainly on fecal coliform data collected by Environment Canada (EC).

### 1.2 Integrated Watershed Management Program Activities

In 2013, IWMP continued to provide services and technical assistance to the District of Sooke. As in previous years, IWMP assessed stormwater quality and impacts of stormwater contaminants on the receiving environment. This annual report covers four main CRD activities:

- 1. Stormwater Discharge Evaluations** – The IWMP samples and evaluates stormwater discharges for public health and environmental concern. Staff assign public health concern ratings based on the level of fecal coliform contamination and the potential for public contact. In addition, staff assign contaminant ratings based on the concentration of metals and polycyclic aromatic hydrocarbons (PAH) in sediment relative to environmental guidelines for protection of marine aquatic life.
- 2. Source Investigations** – IWMP staff investigate stormwater discharges assigned a high public health or environmental concern rating or those with significant contamination to determine the source. Investigations involve assessment of the catchment area land uses, upstream sampling and bacterial source tracking analysis (BST--genetic testing to differentiate between human and non-human bacterial sources). These investigations provide information that allows mitigative efforts to be focused in the appropriate direction.

3. **Watercourse Monitoring** – IWMP staff monitor water quality in 14 significant watercourses flowing through the District of Sooke to measure potential adverse effects on aquatic life and to monitor for change over time. Measurements included fecal coliform bacteria, temperature, pH, dissolved oxygen, specific conductance, turbidity, nitrate-nitrogen and phosphorus concentrations in the winter and summer.
4. **Marine Surface Water Monitoring** – IWMP staff monitor surface water in Sooke Inlet, Harbour and Basin to assess fecal coliform bacteria levels. This work provides information on where fecal coliform contamination is occurring and how levels are changing over time.

## **2.0 SAMPLING PROGRAM**

IWMP collects data from stormwater discharges, significant watercourses and the marine environment in and adjacent to the District of Sooke. The survey area for the 2013 program is shown in Figure 1.

### **2.1 Stormwater Discharge Sampling**

#### **2.1.1 Public Health Concern—Fecal Coliform Sampling**

IWMP staff monitor and prioritize designated stormwater discharges based on public health concern. Each visit includes an estimate of discharge flow rate and collection of a water sample for laboratory analysis of fecal coliform counts. Each year, staff monitor the following stormwater discharges for public health concern:

- those between Cooper Cove and Whiffin Spit (discharges 2035 to 2075)
- those with elevated fecal coliform counts (>500 FC/100 mL) or of high public health concern<sup>1</sup>
- significant watercourses
- approximately 20% of stormwater discharges previously rated low (to monitor for change)

IWMP staff sample discharges once during wet weather (January to April) and once during dry weather (June to September) to represent seasonal differences. Discharges are sampled at the point of discharge into the marine environment while avoiding marine water or sediment.

Water samples were analyzed for fecal coliform bacteria following the procedures in Standard Methods (APHA, 1998) and reported as colony forming units/100 mL (CFU/100 mL). However, to assist the reader, the more commonly used reporting of fecal coliform per 100 millilitres (FC/100 mL) is used in this survey.

Water samples were collected in sterilized sample bottles prepared by the analytical laboratory. Samples were analyzed by Maxxam Analytics in Victoria. Sampling methods are provided in the Sooke 2013 Data Report (CRD, 2014).

Monitoring is continued for discharges rated high and moderate for public health concern until the problems are resolved and the discharge is rated low. Discharges rated low usually do not require continued evaluation but are sampled at least once every five years, if possible, as part of a long-term strategy to monitor for change.

A detailed description of sampling methods and associated quality assurance and quality control (QA/QC) methods is provided in the Sooke 2013 Data Report (CRD, 2014).

### **2.2 Fecal Coliform Source Investigations**

IWMP staff investigate discharges with elevated fecal coliform counts and high public health concern ratings to determine the source of contamination. The following methods are used to identify the source or narrow down the area of contamination:

- assessment of land use within the catchment area
- analysis of fecal coliform levels in upstream samples within the catchment area
- BST, which involves genetic assessment of the bacteria to allow determination of human versus non-human sources
- adding dye to discharges to track the flow in the stormwater infrastructure to establish the source of the contamination (dye-testing)

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<sup>1</sup> In 2000, District of Sooke mayor and council requested that all stormwater discharges with elevated fecal coliform levels be monitored, regardless of the public health concern rating. The District of Sooke sampling program was modified to accommodate this request by sampling all discharges with fecal coliform counts >500 FC/100 mL during the previous year.





0 500 1,000 1,500 Metres  
 Projection: UTM ZONE 10N NAD 83

- ▲ High Environmental Concern
- ▲ Moderate Environmental Concern
- High Public Health Concern
- Moderate Public Health Concern
- Municipal Boundaries
- Major Roads
- Minor Roads
- Streams and Rivers
- Major Parks
- Sewer Specified Areas
- District of Sooke

**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 2**  
 District of Sooke  
 2013 Stormwater Discharges of Concern

## 2.3 Environmental Concern—Contaminant Sampling

Discharge sediments are collected and analyzed for concentrations of metals and organic contaminants. Each sediment sample is analyzed for high and low molecular weight polycyclic aromatic hydrocarbons (HPAH and LPAH) and eight metals: arsenic (As); cadmium (Cd); chromium (Cr); copper (Cu); lead (Pb); mercury (Hg); silver (Ag), and zinc (Zn). PAH comprise a large group of contaminants that occur naturally in petroleum, oil, coal and wood and occur as a result of combustion.

These discharges are assessed for environmental concern depending on their concentrations relative to CRD's Marine Sediment Quality Guidelines (MSQG) for protection of aquatic life to obtain a contaminant rating. Detailed information on sampling methods and quality assurance procedures are outlined in the Sooke 2013 Data Report (CRD, 2014).

Appendix A of the Sooke 2013 Data Report (CRD, 2014) provides the location of the discharges sampled for chemical contaminants.

Sampling is discontinued at a discharge for up to five years (depending on the rating) after contaminant levels have been confirmed. This allows limited funds to be re-allocated for sampling other discharges.

## 2.4 Marine Surface Water Monitoring

Each year, IWMP staff collect surface water at 28 marine locations (stations) by boat in the winter and summer. The locations are distributed to provide data on fecal coliform levels near the shoreline as well as the centre of these waterbodies. Sampling locations are shown of Figure 5. Data is assessed in relation to past findings as well as guidelines for protection of human health, aquatic life and shellfish harvesting.

IWMP data is insufficient for direct comparison to the BC guideline for protection of aquatic life as it relates to shellfish harvesting (median of 14 FC/ 100 mL) which requires more frequent data collection (five times in 30 days). However, IWMP data are compared to the value of 14 FC/100 mL as it is higher than background levels and gives an indication of low level contamination and potential for impacts to shellfish harvesting. IWMP does not have the authority to determine the safety of shellfish harvesting as that is carried out by DFO, EC and Canadian Food Inspection Agency (CFIA; see Section 4.4.1 for more detail). Marine fecal coliform concentrations were compared to the IWMP guideline (200 FC/100 mL) as an indication of more significant contamination and potential adverse human health effects from direct contact through recreational activities such as swimming.

## 2.5 Watercourse Monitoring

IWMP staff monitor 14 creeks that flow onto the District of Sooke coastline each year to assess creek health. Fish including steelhead, coho and chum salmon, cutthroat trout (anadromous and resident), small mouth bass, rainbow trout and three-spine stickleback have been identified in some of these watersheds. Stream sampling locations are shown on Figure 7. These watercourses monitored are as listed:

- 2001C (Grouse Brook)
- 2027 (Wildwood Creek)
- 2029 (Gillespie Creek)
- 2030 (Veitch Creek)
- 2036 (Ayum Creek)
- 2039 (Saseenos/Lannon Creek)
- 2042A (Alderbrook Stream)
- 2043 (Sooke River)
- 2046 (Throup Stream)
- 2064 (Wright Road Creek)
- 2100 (Nott Brook)
- 2101 (Ella Stream)
- 2102 (Broom Hill Stream)
- 2103 (Kemp Lake Stream)

IWMP staff collected water samples from the point of discharge into the marine environment and at upstream stations at the confluence of high-flowing tributaries or where watercourses crossed a jurisdictional boundary. Each watercourse was sampled once in winter and once in summer to measure seasonal differences.

Samples were analyzed for fecal coliform bacteria, temperature, pH, dissolved oxygen, specific conductance, turbidity, nitrate-nitrogen and phosphorus. Results were compared to provincial guidelines for protection of aquatic life to assess:

- whether adverse effects to fish and other aquatic life may be occurring
- whether watercourse health is changing over time

Table 1 provides guidelines used by the IWMP. Exceedences of these guidelines indicate a potential for adverse effects to aquatic life. One exception is the BC fecal coliform guideline, intended to protect humans consuming shellfish. As shellfish harvesting does not occur in these watercourses, the guideline is used as a conservative benchmark to indicate potential contamination before watercourses enter the marine environment. A draft phosphorus objective for Vancouver Island has been prepared by MOE. The objective applies to summer conditions from May to October.

**Table 1 Water Quality Guidelines Used to Assess Watercourses**

Parameter	Units	BC Water Quality Guidelines for Aquatic Life	IWMP Guidelines for Human Health
Fecal Coliform	FC/100 mL	Median: 14 <sup>1</sup>	200 <sup>2</sup>
Temperature	°C	19 <sup>3</sup>	na <sup>4</sup>
pH	pH units	6.5 to 9.0	na
Dissolved Oxygen	mg/L	Min:5 Mean:8 <sup>5</sup>	na
Specific Conductance	µS/cm	na <sup>6</sup>	na
Turbidity	NTU	Max: 9 Mean: 6 <sup>7</sup>	na
Nitrate (NO <sub>3</sub> -N)	mg/L	Max: 32.8 Mean: 3 <sup>8</sup>	na
Phosphorus (total as P)	mg/L	Max: 0.01 Mean: 0.005 <sup>9</sup>	na

**Notes:**

Unless otherwise stated, BC guidelines are based on a minimum of 5 samples in thirty days.

<sup>1</sup> BC MOE shellfish harvesting guideline. Based on a minimum of 5 samples collected over 30 days, the median fecal coliform concentration should not exceed 14 FC/100 mL.

<sup>2</sup> Based on the BC guideline for recreation for human health protection from primary contact (e.g., swimming, kayaking). The 30-d geomean must not exceed 200 FC/100 mL. IWMP compares single samples to the guideline.

<sup>3</sup> Maximum daily water temperature for streams with unknown fish distribution. However, to protect juvenile salmonids, in particular coho (the most sensitive species present in some Sooke streams), the average weekly temperature at any location should not exceed 17°C at any time.

<sup>4</sup> na = not applicable.

<sup>5</sup> Minimum dissolved oxygen levels for the protection of freshwater aquatic life.

<sup>6</sup> Due to high variability in specific conductance, MOE has not developed a guideline for aquatic life protection. However, natural levels range from 50 to 1,500 µS/cm.

<sup>7</sup> Based on a background of 1 NTU for Vancouver Island streams.

<sup>8</sup> Expressed as nitrate-nitrogen (NO<sub>3</sub>-N). Individual samples are compared to the max.

<sup>9</sup> MOE draft phosphorous objective for Vancouver Island (in press). The objective applies to summer conditions; monthly samples from May to October. CRD compares single samples to the maximum value.

### 3.0 STORMWATER DISCHARGE RATING SYSTEM

The CRD evaluates stormwater discharges for public health and environmental concerns using a rating system for stormwater discharges developed by the CRD (Drinnan, 1997).

Ratings allow the jurisdictions involved to better manage limited funds and undertake remedial measures where necessary. A copy of the rating system and the coastline sensitivity evaluations are available upon request from the CRD (stormwater@crd.bc.ca / 250-360-3109).

#### 3.1 Public Health Concern

IWMP staff measure the level of fecal coliform bacteria<sup>1</sup> as an indicator of water contamination from sewage or animal waste. IWMP staff rate each discharge as a high, moderate or low level of concern for public health based on the level of fecal coliform contamination in the stormwater and the potential for human contact. The parameters used to assess the level of concern for public health are:

- fecal coliform concentrations in the stormwater discharge: low (0 – 200 FC/100 mL<sup>2</sup>), moderate (200 to 5,000 FC/100 mL) or high (greater than 5,000 FC/100 mL)
- discharge flow
- location of the discharge (e.g., public beach, below high-water line)
- public use of the shoreline (e.g., swimming, fishing, or kayaking)

#### 3.2 Environmental Concern

Environmental concerns are based on a contaminant rating of discharge sediments. The contaminant rating is determined by comparing the sediment concentration (Cn) of each of eight metals and two groups of organic contaminants with the CRD MSQG to obtain a ratio (Cn/MSQG). To account for potential additive effects, these ratios are summed to calculate the toxic equivalent unit (TEU).

All discharges sampled for environmental concern are sampled for at least two years to confirm the contaminant concentrations and contaminant(s) of concern. Only a small number of discharges can be sampled each year due to budgetary constraints; therefore, each discharge selected for sampling can only be sampled once per year.

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<sup>1</sup> Fecal coliform bacteria are found in the guts and feces of warm-blooded animals and indicate the presence of sewage, improper manure storage, or human or animal presence in the watershed.

<sup>2</sup> FC/100 mL = fecal coliform bacteria (colony forming units) per 100 millilitres



High	Shoreline Zone ID	Streams and Rivers
Moderate	Municipal Boundaries	Major Parks
Low	Major Roads	District of Soke
	Minor Roads	

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**Figure 3**  
Public Use Ratings of  
The District of Soke Coastline

## 4.0 RESULTS AND DISCUSSION

Summary data collected in 2013 is discussed in the following sections. The raw and summarized data collected for the program in 2013 and previous years is presented in a separate document. The District of Sooke Stormwater Quality 2013 Data Report is available on the CRD website or by contacting the CRD at [stormwater@crd.bc.ca](mailto:stormwater@crd.bc.ca).

### 4.1 Public Health Concern

IWMP staff evaluated 76 discharges for public health concern in 2013. Figure 2 shows the 2013 discharges of concern (those that received a high and moderate rating for public health or environmental concern in 2013). The Sooke 2013 Data Report (CRD, 2014) provides detailed figures showing the location of each discharge and its most recent public health concern rating (Appendix A), fecal coliform and flow data (Appendix C), and public health concern ratings for each discharge assessed in 2013 (Appendix D).

#### 4.1.1 Fecal Coliform Concentrations

In 2013, IWMP staff visited 76 stormwater discharges for assessment of fecal coliform levels and flow rates. Fourteen of the discharges were significant watercourses (creeks, streams or rivers).

A third (30%; 23 out of 76) of the stormwater discharges had at least one measurement of fecal coliform bacteria above the IWMP guideline (200 FC/100 mL). This is higher than the 2012 results (23%); however, fecal coliform data is variable and there is some inherent fluctuation each year. Fecal coliform counts above the guideline suggest that:

- there are sources of sewage or animal waste present
- primary contact (i.e., head immersion, ingestion) with these discharges has the potential to cause adverse health effects

#### Comparison to District of Sooke Thresholds

IWMP staff compare fecal coliform data from the District of Sooke to two thresholds (500 and 2,000 FC/100 mL) as requested by council in 2000. Table 2 presents the fecal coliform results of discharges that have exceeded the thresholds from 2008 to 2013. Discharge locations are shown in Figure 4.

Of the 76 discharges assessed in 2013:

- 15 had at least one fecal coliform count between 500 and 1,999 FC/100 mL.
- 13 had at least one count greater than or equal to 2,000 FC/100 mL.

More discharges exceeded the thresholds in 2013 compared to 2012 (14 were above 500 FC/100 mL and five of them exceeded 2,000 FC/100 mL).

Seven of the discharges with counts above 500 FC/100 mL have not had elevated counts in the past, while eight have. Of the discharges with a count above 2,000 FC/100 mL, five are within the sewered area.

#### 4.1.2 Wastewater Collection and Treatment

A wastewater treatment plant and conveyance system was completed in the District of Sooke in 2006. Results from the past seven years of sampling indicates that fecal coliform contamination is lower, but still remains in some stormwater discharges and the marine environment. The number of discharges within the sewered area above 500 FC/100 mL was reduced from nine in 2005 to six in 2013 and only five of those were above 2,000 FC/100 mL compared to eight in 2005. Remaining contamination is likely related to properties that have not connected to the wastewater system and animal waste.

Marine surface water samples taken in front of the sewered area in 2013 showed fecal contamination above 14 FC/100 mL, in winter at all three stations (SO-22, SO-23 and SO-24) and in summer at two of the stations (SO-22 and SO-23). In addition, one measurement at station SO-24 was above the IWMP guideline 200 FC/100 mL. (Table 6). The BC shellfish harvesting guideline is a median of 14 FC/100 mL. Median levels at the marine sampling stations from data collected twice a year since 2009 are not above 14 FC/100 mL (Table 7). Winter samples in Sooke Harbour and Basin are rarely above 14 FC/100 mL; however, there was heavy rainfall during sampling in 2013. Results indicate that observed fecal contamination is from stormwater as there was heavy rainfall and elevated fecal coliforms were measured near the shore and not the middle of the harbour and basin.

IWMP staff will continue to monitor all stormwater flows in the sewered area. Monitoring data will be used to evaluate the overall effect that sewerage the area has had on the quality of stormwater and the marine receiving environment.

### **Sewer Service Area Expansion**

The District of Sooke is considering other areas for expansion of the sewage service area. The two areas identified as the most likely candidates include the Kaltasin and the Flats and Whiffin Spit North catchment areas. CRD staff monitor six stormwater discharges in each area as part of the annual sampling program; however, the Kaltasin and Flats has a larger area and more shoreline. IWMP monitors six stormwater discharges in the Kaltasin area (2039, 2040, 2041A, 2042, 2042A, 2043) and six discharges in the North Whiffin Spit area (2061, 2062, 2063, 2064, 2065, 2065A). The Kaltasin discharges include the Sooke River and two creeks that flow continuously (Alderbrook and Sassenos), as well as three pipes that are dry most of the year. The Whiffin Spit discharges are small creeks and ditches that are dry in summer. In addition, staff annually monitor three marine stations around Billings Spit and one marine station adjacent to Whiffin Spit North.

The CRD has assessed habitat sensitivity, stormwater flow rates and marine flushing rates of the areas. Marine habitat around both areas is highly sensitive and includes shellfish beds and eelgrass; however, there is less flushing around Billings Spit. Public use of the two areas is different. Swimming is more likely to occur around Billings Spit. Kayaking and other boating activities occur near the Whiffin Spit shoreline, but little swimming.

Elevated fecal coliform levels have been identified in creeks from both areas; however, three high-flow watercourses discharge into the marine environment from the Kaltasin area (Alderbrook Creek, Saseenos/Lannon Creek and the Sooke River). The fecal coliform levels, combined with the significant flow rates, could lead to high contaminant loadings into the marine environment. Whiffin Spit flows are generally lower than the creeks from the Kaltasin area and they are dry in summer.

In 2013, IWMP staff assigned one high rating (Alderbrook Creek) and one moderate rating (Saseenos/Lannon Creek) in the Kaltasin area while the remaining four were rated low. Two discharges draining Whiffin Spit North were rated moderate (2064, 2065) while the other four were rated low.

CRD data show that fecal coliform contamination is present in the marine environment adjacent to both areas; however, more study has been done around the Kaltasin area. IWMP monitors three marine stations each year that have the potential to receive stormwater from the Kaltasin area (SO-18, SO-19, SO-20). Elevated fecal coliform counts were measured in winter and summer 2013 at SO20 (60 and 45 FC/100 mL). The 2013 marine monitoring results can be found in Section 4.4 of this report.

In 2010, IWMP conducted further marine sampling during and following rainfall around the Billings Spit shoreline to address the concern that the area is vulnerable to high groundwater and failing septic systems. All 11 samples were above 14 FC/100 mL and three were above IWMP guideline (200 FC/100 mL). The concentrations in the marine environment ranged from 38 to 2,400 FC/100 mL, indicating stormwater runoff from the Kaltasin area is having an impact on the surrounding marine environment. Details of this survey are provided in the 2010 Sooke Stormwater Quality annual report.

IWMP monitors one marine station each year that has potential to receive stormwater from the Whiffin Spit North area (SO-25). Fecal coliform concentrations are generally low at this station (below 14 FC/100 mL); however, an elevated count was measured in winter 2013 (69 FC/100 mL) following heavy rainfall. The summer measurement at SO-25 was lower (8 FC/100 mL).

IWMP data indicates that contamination observed is mainly from agricultural animals; however, bacteria from a human source was measured in one marine sample collected in front of discharge 2040 (south of Lannon/Saseenos creeks) in 2013. More investigation is needed to determine the sources and their contribution; however, is likely that a significant amount of the observed contamination in both areas will not be mitigated through sewerage.

**Table 2 Number of Stormwater Discharges with Fecal Coliform Counts above 500 and 2,000 FC/100 mL from 2008 to 2013**

Years	2008	2009	2010	2011	2012	2013
<b>Thresholds (FC/100 mL)</b>	<b>Number of Discharges above Thresholds</b>					
≥ 500 to 1,999	10	4	4	4	9	2
≥ 2,000	5	2	7	4	5	13
<b>Total ≥ 500</b>	<b>15</b>	<b>6</b>	<b>11</b>	<b>8</b>	<b>14</b>	<b>15</b>

**Notes:**

Fecal coliform count units are colonies per 100 mL (FC/100 mL)

**4.1.3 Public Health Concern Ratings**

In 2013, IWMP staff rated 76 discharges for public health concern based on their fecal coliform levels and the potential for public contact. The following public health concern ratings were assigned:

- three discharges were rated high (2035, 2067A, 2042A)
- 18 discharges were rated moderate
- 55 discharges were rated low

A list of the moderate and high-rated discharges with a brief description is shown in Table 3. Higher public health concern ratings are associated with shorelines where there is greater potential that people will come in contact with stormwater. All sections of shorelines that fall within Sooke Harbour and Sooke Basin are rated moderate (based on activities such as widespread kayaking) or high (based on primary contact activities such as swimming or diving). The public shoreline use ratings are shown on Figure 3.

Three high-rated discharges were found in 2013, while four were found in 2012 and 2011; however, only one discharge was high-rated in each of these years (2035; Cooper Cove). The remaining 2012 high-rated discharges (2001E, 2053 and 2054) have lower ratings in 2013; as bacterial counts are variable in these discharges.

The sources of contamination for the high-rated discharges are likely animals for discharges 2035 and 2042A and are unknown for discharge 2067A. The following is a discussion of the stormwater discharges rated high in 2013:

- **Discharge 2035** (Cooper Cove near Stone Pipe Landing Bar and Grill) was also high-rated in 2011 and 2012 and has had elevated fecal coliform counts intermittently for a number of years. Fecal coliform counts were 360 and <10 (FC/100 mL) in 2013 and 3,200 and <10 (FC/100 mL) in 2012. Three BST samples collected in this area have indicated that the bacteria are of animal origin; no human bacteria were present.
- **Discharge 2042A** (Alderbrook Steam) has had elevated fecal coliform counts in the past. In September 2013, the fecal coliform count was 2,300 FC/100 mL. Investigations by IWMP staff indicate that the contamination is due to animal waste. Three BST samples have identified fecal bacteria from ruminants, pigs and horses.

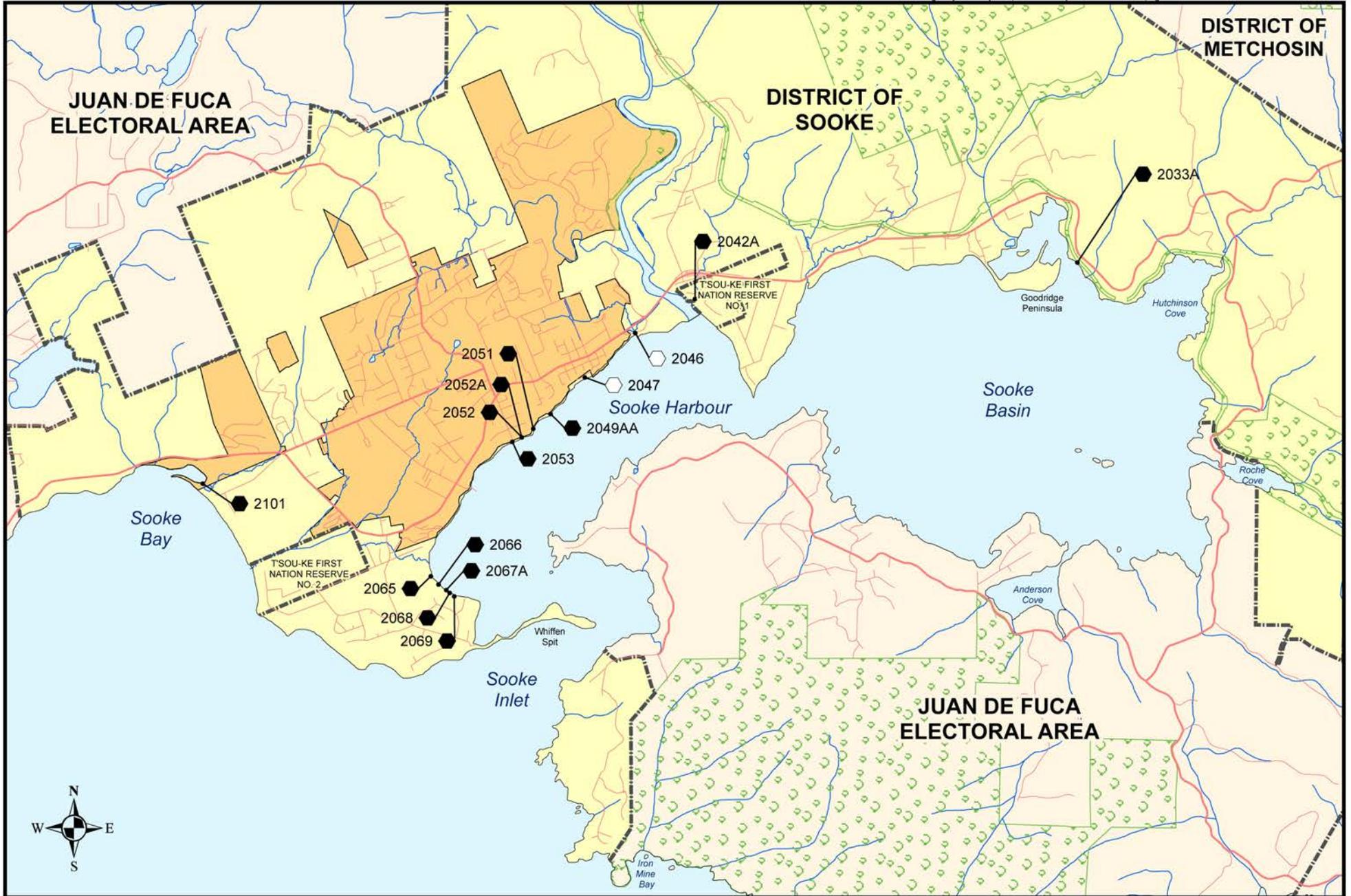
- **Discharge 2067A** (end of Dufour Road) has displayed elevated fecal coliform counts intermittently for a number of years, however, flows are generally very low or absent. In 2013, the fecal coliform count was elevated in winter (370 FC/100 mL) but high in summer (35,000 FC/100 mL), resulting in a high rating. IWMP staff will conduct source investigations in 2014.

Eighteen stormwater discharges were rated moderate in 2013 (2030, 2033A, 2039, 2046, 2047, 2049AA, 2051, 2052, 2052A, 2053, 2056, 2057, 2060A, 2064, 2065, 2066, 2068, 2069). Ten of these had a fecal coliform count greater than 2,000 FC/100 mL, however, they were assigned a moderate rating due to a lower potential for public contact.

Five of the moderate-rated discharges in 2013 are within the sewered area (2049AA, 2051, 2052, 2052A, 2053). Elevated fecal coliform counts are common in 2051 and 2053, while the elevated fecal coliforms counts identified in 2049AA and 2052A are anomalous as previous and subsequent testing measured low levels. BST identified bacteria of human and dog origin in discharge 2053, while the sources of fecal coliform contamination in the other discharges remain unknown.

**Table 3 Stormwater Discharges Assigned Moderate and High Rating in 2013**

CRD Discharge No.	2012 Level of Concern	2013 Level of Concern	Comments	Monitoring Recommendations
2035	high	<b>high</b>	FC: low in winter, elevated in summer	monitored annually
2042A	low	<b>high</b>	Alderbrook Creek, FC: low in winter, elevated in summer	monitored annually
2067A	low	<b>high</b>	FC: elevated in winter, high in summer	monitored annually
2030	low	moderate	Veitch Creek, FC: slightly elevated in October,	monitored annually
2033A	na	moderate	stream, FC: elevated in winter, no flow in summer	confirm rating in 2014
2039	low	moderate	Saseenos (Lannon) Creek, FC: low in winter; elevated in summer	monitored annually
2046	low	moderate	Thrup Stream, FC: low in winter, elevated in summer	monitored annually
2047	low	moderate	FC: low in winter, elevated in summer	monitored annually
2049AA	low	moderate	FC: high in winter for first time, no flow in summer	confirm rating in 2014
2051	moderate	moderate	FC: elevated in winter, low in summer	monitored annually
2052	low	moderate	FC: elevated in winter, no flow in summer	confirm rating in 2014
2052A	low	moderate	FC: low in winter, high count in summer very low flow	monitored annually
2053	high	moderate	FC: elevated in winter and summer	monitored annually
2056	low	moderate	FC: elevated in winter, no flow in summer	monitored annually
2057	low	moderate	FC: low in winter, elevated in summer	monitored annually
2060A	low	moderate	FC: low in winter, elevated in summer	monitored annually
2064	moderate	moderate	Wright Road Creek, FC: slightly elevated in summer	monitored annually
2065	low	moderate	FC: low in winter, elevated in summer	monitored annually; confirm rating
2066	low	moderate	FC: low in winter, elevated in summer	monitored annually
2068	low	moderate	FC: elevated in winter, no flow in summer	monitored annually
2069	moderate	moderate	FC: elevated in winter, no flow in summer	monitored annually



**Figure 4**  
 District of Sooke  
 2013 Stormwater Discharges Exceeding  
 Thresholds (500 and 2,000 FC/100mL)

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## 4.2 Fecal Coliform Source Investigations

In 2013, IWMP continued to work towards identifying sources of fecal coliform contamination by undertaking investigations. Staff conducted upstream sampling to narrow down the area of the source of contamination in two stormwater discharges (2053 and 2054). BST analysis was conducted in stormwater samples from these discharges as well as three marine samples off of Billings Spit (foot of Kaltasin, foot of Seabroom and in front of discharge 2040) to determine if the bacteria present was from human or animal. Three marine surface water samples were collected for BST analysis to determine if a source of elevated fecal coliform counts were from a human or non-human source on December 02, 2013. Bacteria from agricultural or companion animals were present in all three samples. Bacteria of human origin were present in front of discharge 2040 (south of Saseenos/Lannon Creek).

IWMP collected marine samples for BST analysis from similar locations in 2011; however, a sample was not collected in front of discharge 2040. BST results from the three locations showed that agricultural or companion animal waste was present, no human bacteria were present.

A summary of the investigations is present in Table 4.

**Table 4 Summary of 2013 Fecal Coliform Source Investigations**

Sample Type	Sample Location	Summary of Upstream Investigation	Fecal Coliform Count (FC/100mL)	BST Result
Stormwater Discharge	Discharge 2053	Narrowed down the source to downstream of Horne Road	2,100	human, dog, general bacteroides
Stormwater Discharge	Discharge 2054 Ed Macgregor Park	Inconclusive due to lower FC counts	10	general bacteroides
Marine Surface Water	Billings Spit - foot of Kaltasin	na	55	ruminant animal, gull, general bacteroides
Marine Surface Water	Billings Spit - Foot of Seabroom	na	18	ruminant animal, dog, general bacteroides
Marine Surface Water	Billings Spit - in front of discharge 2040	na	12	human, ruminant animal, dog, general bacteroides

**Notes:**

Upstream sampling was carried out in October, 2013.  
BST samples were collected December 02, 2013.

### 4.2.1 Quality Assurance Results

The analyses of the fecal coliform quality assurance data from the laboratory were satisfactory. A detailed description of the results is provided in the Sooke 2013 Data Report, Appendix B (CRD, 2014).

## 4.3 Environmental Concern

### 4.3.1 Chemical Contaminant Sampling

IWMP staff collected six sediment samples (plus a duplicate) in July 2013 from six stormwater catchment areas in the District of Sooke. Samples were analyzed for eight metals and two groups of PAH to determine a contaminant rating as described in Section 3.2.

Table 5 provides the 2013 sediment data compared to the guidelines for aquatic life protection (MSQG). Stormwater sediment data and contaminant ratings, habitat ratings and recommendations from 1998 to 2013 are in Sooke 2013 Data Report, Appendix F (CRD, 2014). Appendix A shows the location and recent ratings of discharges monitored for public health and environmental concern.

### 4.3.2 Chemical Contaminant Ratings

IWMP staff collected a sediment sample from five stormwater discharges (2036, 2038, 2043A, 2048, 2051), and upstream in catchment 2054 (at 2054-2). Staff assigned a contaminant rating, to samples collected at the discharge point (all except 2054-2) to determine the 2013 environmental concern rating. Upstream samples are used to find sources of contamination previously measured at the discharge.

Staff assigned a low contaminant rating to the five discharges sampled in 2013. There were no exceedences of the MSQG.

Upstream sampling resulted in a moderate rating at 2054-2 due to the sum of contaminant concentrations present. IWMP staff have been investigating the source of zinc and PAH in discharge 2054 (southwest of Murray Road, Appendix A; Figure 14) since 2000. Upstream samples collected in 2002, 2003, 2011 and 2012 were rated high due to zinc. Results indicate the source is upstream of 1967 Atherley Close. Runoff from Sooke Road or the parking lot that services the post office could be a source.

In 2014, sediment contaminant sampling will be completed in the following areas if sediment is available:

- discharges that have not been visited for five years (2035A, 2056 and 2065)
- discharge 2053 and 2061 to confirm the previous rating
- discharge 2054 to confirm the high rating—sediment has not been available downstream since 2007.

**Table 5 Contaminant Concentrations in Stormwater Sediments Collected in 2013**

Parameter	Concentration in CRD discharges (µg/g)							Guideline (MSQG)
	SW2036	SW2038	SW2038 (dup)	SW2043A	SW2048	SW2051	SW2054-2	
Arsenic	1.05	4.66	4.8	3.73	2.02	2.81	5.54	57
Cadmium	0.451	0.296	0.235	0.141	0.051	0.237	0.749	5.1
Chromium	58	41.4	41.6	50.1	26.9	40.1	64.6	260
Copper	99.6	52.2	54.3	30.3	55.6	49.9	95	390
Lead	3.84	7.59	7.59	3.63	18.5	13.2	91.6	450
Mercury	0.0058	0.0379	0.0379	0.0096	0.01	0.0152	0.079	0.41
Silver	0.095	0.08	0.089	0.054	0.064	0.064	0.18	6.1
Zinc	85.5	131	136	73.9	98.4	193	284	410
LPAH	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.037	5.2
HPAH	<0.01	0.11	0.12	<0.01	0.027	<0.01	0.32	12
<b>Rating</b>	<b>Low</b>	<b>Low</b>	<b>Low</b>	<b>Low</b>	<b>Low</b>	<b>Low</b>	<b>Moderate</b>	

**Notes:**

MSQG is CRD's Marine Sediment Quality Guideline; concentrations above this may result in adverse effects on aquatic life.

### 4.3.3 Quality Assurance Results

The quality assurance (QA) analysis results for the 2013 sediment sampling program were considered acceptable for assigning chemical contaminant ratings. Refer to Sooke 2013 Data Report, Appendix F (CRD, 2014) for sampling procedure and analysis information.

### 4.4 Nearshore Marine Surface Water Monitoring

In 2013, IWMP staff sampled surface water from 28 stations in Sooke Inlet, Harbour and Basin (23 nearshore and five centreline; Figure 5) on March 24 and September 24, 2013. Sampling stations are close to stormwater flows, shellfish beds or environmentally sensitive areas. The 2009 to 2013 data are provided in Table 6 and centre values (median and geometric means) for each station are provided in Table 7. The BC guidelines are based on median and geometric mean values collected in shorter time spans, but are provided as an indication of contamination and potential adverse effects to public health through swimming or shellfish harvesting.

The 2013 data provides further indication that stormwater from some discharges is impacting the marine environment. A summary of the 2013 fecal coliform results in marine surface water is as follows:

- Fecal coliforms were elevated above 14 FC/100 mL in 15 stations in winter and four in summer.
- Fecal coliforms were elevated above 200 FC/100 mL in two stations in winter and none in summer.
- The geometric mean for all three waterbodies was 13 FC/100 mL in winter and 3 FC/100 mL in summer
- Elevated measurements occurred along the shoreline in both seasons; and were concentrated in the more inhabited area of Sooke Harbour in summer while more widespread in the winter.

Although the summer 2013 results are similar to those from previous years, the winter fecal coliform levels were higher than usual as 15 of the measurements were above 14 FC/100 mL in 2013 compared to zero or one in the previous five years; the winter geometric mean is the highest measured. The cause of higher than usual fecal coliform levels in 2013 is unknown, but stormwater is likely a source. Heavy rainfall on the day of sampling was noted and fecal coliform levels are elevated near the shoreline; none of the centreline stations (SO-1, SO-3, SO-21, SO-27, SO-28) had elevated counts.

It is uncertain whether the bacteria detected during these sampling events are of human or animal origin. Potential sources of contamination are birds, wildlife, farm animals or failing onsite sewage disposal. Later in the year (December 02, 2013), bacteria from humans (one location) and ruminant animals (three locations) were detected in marine surface water around Billings Spit.

#### **Future Marine Sampling Efforts**

In 2014, IWMP staff will continue to monitor the 28 stations in both winter and summer.

**Table 6 IWMP Marine Fecal Coliform Data for Sooke Inlet, Harbour and Basin (2009-2013)**

Station	Fecal Coliform Concentrations (FC/100 mL)									
	2009		2010		2011		2012		2013	
	Mar-12	Jul-15	Mar-02	Jul-21	Mar-29	Sep-08	Mar-21	Jul-24	Mar-14	Sep-24
SO-1	<1	<1	2	<1	<1	<1	1	3	4	9
SO-2	1	<1	5	<1	2	<1	3	<b>310</b>	<1	11
SO-3	2	1	<1	2	<1	3	1	3	<1	4
SO-4	3	6	2	<b>15</b>	2	<1	3	2	<b>220</b>	2
SO-5	2	<b>22</b>	1	6	1	4	<1	<1	<1	11
SO-6	<1	5	<1	<1	<1	1	<1	3	<b>38</b>	<1
SO-7	<1	<b>21</b>	<1	1	<1	<1	<1	<b>130</b>	<b>26</b>	<1
SO-8	1	<1	<1	<b>14</b>	2	1	2	8	<b>62</b>	1
SO-9	<1	2	<1	1	<1	<1	<1	<1	1	<1
SO-10	<1	1	1	<1	<1	<1	<1	<1	3	1
SO-11	<1	<1	<1	1	<1	<1	<1	7	10	<1
SO-12	<1	<1	6	1	<1	<1	1	1	<b>22</b>	<1
SO-13	<1	<b>63</b>	4	2	1	<1	<1	1	<b>53</b>	1
SO-14	<1	<1	2	5	<1	<1	1	1	<b>100</b>	<1
SO-15	4	5	1	8	2	<1	<1	2	<b>43</b>	1
SO-16	<1	2	<b>73</b>	1	<1	<1	<1	4	<b>28</b>	4
SO-17	<1	<1	<1	<1	<1	1	1	1	<b>120</b>	1
SO-18	<1	3	4	<b>38</b>	1	<1	<1	<b>48</b>	10	1
SO-19	1	<1	2	4	<1	<1	<1	11	4	1
SO-20	2	<b>54</b>	2	10	<1	2	4	<b>57</b>	<b>60</b>	<b>45</b>
SO-21	5	<1	2	5	<1	4	<1	<b>16</b>	3	10
SO-22	6	<b>24</b>	4	10	1	<b>16</b>	1	<b>70</b>	<b>35</b>	<b>28</b>
SO-23	4	<b>42</b>	9	8	6	<b>28</b>	<1	<b>38</b>	<b>87</b>	<b>17</b>
SO-24	<1	<b>32</b>	5	<1	1	7	2	2	<b>220</b>	12
SO-25	1	1	5	1	1	7	2	4	<b>69</b>	8
SO-26	1	<1	2	<1	1	2	3	<1	4	<b>36</b>
SO-27	<1	<1	<1	<1	<1	>1	<1	1	<1	<1
SO-28	1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Summary										
Geometric mean	1	3	2	2	1	2	1	5	13	3
Median	1	1	2	1	1	1	1	3	24	1
Max	6	63	73	38	6	28	4	310	220	45
No. ≥14	0	7	1	3	0	2	0	7	15	4
No. ≥200	0	0	0	0	0	0	0	1	2	0

**Notes:**

Station locations are shown on Figure 5.

FC/100 mL = fecal coliform bacteria (colony forming units) per 100 millilitres

Where values were not detected, the detection limit (1 FC/100 mL) was used for calculations.

Values greater than 14 FC/100 mL are bolder and underlined

Values with a dark border are greater than or equal to 200 FC/100 mL

Heavy rain was noted during time of sampling on March 14, 2013

**Table 7 IWMP Marine Fecal Coliform Data Summary by Station (2009-2013)**

Parameter	Fecal Coliform Counts (FC/100 mL)	
	14	200
	Median	Geometric Mean
SO-1	1	2
SO-2	2	3
SO-3	2	2
SO-4	3	4
SO-5	2	3
SO-6	1	2
SO-7	1	3
SO-8	2	3
SO-9	1	1
SO-10	1	1
SO-11	1	2
SO-12	1	2
SO-13	1	3
SO-14	1	2
SO-15	2	3
SO-16	2	3
SO-17	1	2
SO-18	2	3
SO-19	1	2
SO-20	7	9
SO-21	4	3
SO-22	13	10
SO-23	13	13
SO-24	4	5
SO-25	3	3
SO-26	2	2
SO-27	1	1
SO-28	1	1

**Notes:**

Values are the median or geomean over previous five years (2009 to 2013) in FC/100 mL for comparison to guidelines  
 Station locations are shown in Figure 5

<sup>1</sup> Guidelines:

EC Shellfish Harvesting Guideline (median of 14 FC/100 mL) based on a minimum of 15 data points

BC Aquatic Life Guideline - Shellfish Harvesting (median of 14 FC/100mL) based on at least five samples collected in 30 days

BC Recreational Primary Contact Guideline (geomean of 200 FC/100 mL) based on at least five samples collected in 30 days



**Figure 5**  
 Nearshore Marine Surface Water  
 Sampling Stations and Shellfish Closures  
 in Sooke Inlet, Harbour and Basin

**CRD**  
 Making a difference...together

0 500 1,000 1,500 Metres  
 Projection: UTM ZONE 10N NAD 83

- Surface Water Stations
- Major Roads
- Minor Roads
- Municipal Boundaries
- Streams and Rivers
- Major Parks
- Shellfish Beds
- ▨ Shellfish Closure Area 20.1
- Sewer Specified Areas
- District of Sooke

**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.

#### 4.4.1 Shellfish Bed Closures

##### **BACKGROUND**

Shellfish are an important food source to First Nations people and the community within the District of Sooke.

The DFO, EC and CFIA are involved in a multi-agency approach to regulating and monitoring shellfish harvesting. Sooke Harbour and Basin are closed for recreational shellfish harvesting.

##### **Sooke Inlet, Harbour and Basin**

The waters and intertidal foreshore of Sooke Harbour and Basin are closed for recreational shellfish harvesting (Figure 5). Commercial harvesting is allowed under permit with treatment by depuration or relay (contaminants are flushed out with clean sea water in an approved area). Some areas are closed due to elevated fecal coliforms, others due to proximity to permanent boat moorage (Tyers, pers. comm.).

EC collects samples to assess water quality from 73 stations from six sectors in Sooke Inlet, Harbour and Basin. Sampling locations are shown on Figure 6. EC's standards for determining shellfish closures based on fecal coliform bacteria concentrations are as follows:

- median fecal coliform concentration in water must not exceed 14 FC/100 mL
- more than 10% of the samples must not exceed a fecal coliform concentration of 43 FC/100 mL

EC uses data from a minimum of 15 samples from each station for comparison to the standards. As two to five samples per year are collected, multiple years of data are included in a set of 15 data points. Data collected up to the end of 2013 showed no exceedence of the median fecal coliform concentration standard; median results were all less than 14 FC/100 mL. However, more than 10% of the samples exceeded the concentration of 43 FC/100 mL at three of the 22 stations (SK011, SK043, and SK020).

EC's Shellfish Growing Water Quality Protection program is designed to identify and evaluate sources of pollution to shellfish growing and harvesting areas. IWMP works to assist this program through fecal coliform sampling of nearshore marine surface waters, stormwater discharges entering the marine receiving environment and through source investigations.

#### 4.5 Watercourse Monitoring

In 2013, IWMP staff measured water quality in 14 watercourses in the District of Sooke to provide information on watercourse health and change over time. Water quality data was collected from all 14 watercourses in the winter and 10 in summer (due to dry conditions in four streams). Monitoring stations are provided in Figure 7. Parameter descriptions and sampling results are shown in Sooke 2013 Data Report, Appendix E (CRD, 2014).

Staff compared measurements to BC water quality guidelines for the protection of aquatic life and the IWMP fecal coliform guideline intended to protect public health (Table 1). The BC guidelines are based on more rigorous data collection than that done by the IWMP (a minimum of five weekly samples in 30 days for most parameters compared to two measurements per year by CRD). Therefore, the CRD data is limited in determining creek health; however, some interpretation is possible as data has been collected for many years and exceedences still indicate a potential for adverse effects to aquatic life or human health.

The characteristics of each watershed and the general water quality findings by IWMP is in Table 8. Characterization information was taken from *Prioritization of Significant Watersheds Draining to Sooke Bay, Sooke Inlet, Sooke Harbour, and Sooke Basin* (SHIP Environmental Consultants Ltd., 1999).

IWMP results indicate that water quality is moderate or good in most of the Sooke watercourses. None of the 2013 measurements of dissolved oxygen, nitrate (NO<sub>3</sub>), pH, or temperature were outside the BC guidelines for protection of aquatic life. Fecal coliform, phosphorus and turbidity measurements exceeded guidelines. Exceedence of more than one guideline occurred in about half of the watercourses. CRD data collected in 2013 and previous years suggest that water quality in Sooke watercourses is as follows:

- good in four creeks (Ayum Creek, Grouse Brook, Gillespie Creek and Wildwood Creek),
- moderate in seven creeks (Broom Hill Stream, Ella Stream, Kemp Lake Stream, Lannon/Saseenos creeks, Nott Brook, Sooke River and Wright Road Creek), and
- poor in three creeks (Alderbrook Stream, Throup Stream and Veitch Creek)

Elevated fecal coliforms (>200 FC/100mL) occurred in seven streams: Alderbrook Stream, Kemp Lake Stream, Lannon/Saseenos creeks, Sooke River, Throup Stream, Veitch Creek and Wright Road Creek.

Turbidity was elevated in five out of six measurements in Alderbrook Stream, but no others in 2013. Phosphorus measurements were above the draft Vancouver Island objective in nearly all of the Sooke streams, as little human activity in the watersheds can easily cause phosphorus levels to rise above background and affect stream health.

The water quality parameters of most concern are discussed below:

### **Fecal Coliforms**

Fecal coliform bacteria act as indicators of contamination due to failing septic treatment systems, improper manure storage and human or animal presence in and around watercourses. Fecal coliform have been a parameter of concern in Sooke streams since IWMP began monitoring. In 2013, 52 samples from the 14 watercourses were analyzed for fecal coliforms. Thirty-two of the 52 exhibited some fecal coliform contamination (i.e., measurement greater than 14 FC/100 mL). The BC aquatic life guideline is a median of 14 FC/100 mL for protection of shellfish harvesting. As shellfish harvesting does not occur in these watercourses, the guideline is used to indicate low levels of contamination. However, 16 of the 52 samples also exceeded the IWMP guideline indicative of contamination that could be hazardous to aquatic life and the public from direct contact with the water.

Fewer measurements were above the fecal coliform guidelines in 2012 (only one was greater than 200 FC/ 100 mL, compared to 16 in 2013). Fecal coliform levels fluctuate each year due to precipitation levels and sample timing. Due to wetter conditions previous to and at the time of sampling more samples were collected in 2013 (52 versus 36).

### **Turbidity**

High turbidity can have a negative impact on spawning beds, smother benthic habitat, clog or damage sensitive gill structures and potentially interfere with feeding patterns of aquatic organisms. Exceedences of turbidity were measured in five of the six samples collected in Alderbrook Stream. Turbidity levels often exceed the aquatic life guideline in Alderbrook Stream (15 of the last 27 measurements were elevated). Turbidity was also elevated in Alderbrook Stream in 2012.

### **Phosphorus**

Elevated levels of phosphorus results in excessive algal growth which can adversely affect fish and insects and limits recreational use of streams (MOE, 2012). Nearly all 2013 measurements (47 of the 49) were above the draft Vancouver Island objective for phosphorus in streams (maximum of 0.1 mg/L). The new objective is specific to Vancouver Island streams and is based on local data with the intent of limiting or preventing excessive nutrient loading and subsequent environmental damage. Phosphorus measurements are also elevated in all streams monitored by IWMP staff in the region; however, in many of the urban streams measurements can often be 10 times greater than the objective; this is not the case in Sooke.

## **WATER QUALITY TRENDS**

Water quality in most of the watercourses appears to be somewhat constant over time. Unusually high fecal coliform levels were measured in Alderbrook Stream and the Sooke River Watershed in DeMamiel Creek. IWMP staff will continue monitoring these creeks to determine whether the results were anomalous or indicative of a trend of higher fecal coliform levels in these areas.

IWMP has initiated a more comprehensive monitoring program in the CRD Core Area streams. The approach provides a better picture of watershed health by including more intensive monitoring in fewer creeks. Due to the intensive nature of this type of sampling, IWMP staff focus on two to three streams per year, allowing all core area streams to be completed within approximately five years. After five years the cycle will restart to determine changes over time. Monitoring includes weekly collection of water quality samples for five weeks in summer, winter or both seasons, resulting in more robust data for comparison to BC MOE water quality guidelines. This level of monitoring would also meet attainment monitoring proposed by the MOE draft water quality objectives in Sooke creeks. A similar program would be useful in the District of Sooke to more fully determine the health of Sooke streams, contaminant sources and measure changes over time as the watersheds become more developed.

**Table 8 Characteristics of Significant Watersheds Monitored by IWMP**

Watershed	Stream(s)	CRD Discharge ID	Stations Monitored by CRD	Watershed Area	Land Use	Fish Present	Stewardship Groups/ Restoration Activities	Water Quality Parameters of Concern	2013 Water Quality Trends
Alderbrook Stream	Alderbrook Stream	2042A	2042A, 2042A-2, 2042A-3	0.5 km <sup>2</sup>	Residential, industrial, institutional, T'Sou-ke First Nation property	Cutthroat trout	T'Sou-ke First Nation has undertaken stream restoration activities	phosphorus, turbidity and FC	similar to previous years but FC unusually high upstream in one measurement
Ayum Creek	Ayum Creek	2036	2036, 2036-2, 2036-3	13.7 km <sup>2</sup>	Rural residential, park, undeveloped, CRD park reserve	Steelhead, coho and chum salmon, rainbow and cutthroat (anadromous, resident) trout, small mouth bass	Society for the Protection of Ayum Creek did restoration in past	phosphorus	similar to previous years
Broom Hill Stream	Broom Hill Stream	2102	2102, 2102-2	0.6 km <sup>2</sup>	Residential, industrial, undeveloped	None known	None known	phosphorus, turbidity	similar to previous years
Ella Stream	Ella Stream	2101	2101	21 km <sup>2</sup>	Urban and residential, park, industrial	Anadromous cutthroat	None known	FC, phosphorus	similar to previous years
Gillespie Creek	Gillespie Creek	2029	2029	0.8 km <sup>2</sup>	Regional park land, rural residential	None known	None known	phosphorus	similar to previous years
Grouse Brook	Grouse Brook	2001C	2001C	0.17 km <sup>2</sup>	Mostly agricultural, some undeveloped	None known	None known	phosphorus, pH	similar to previous years
Kemp Lake Stream	Kemp Lake Stream	2103	2103, 2103-2	6.2 km <sup>2</sup>	Rural residential, agricultural, forestry, industrial, logging	Rainbow and cutthroat trout (residential and anadromous)	None known	FC, phosphorus	similar to previous years
Nott Brook	Nott Brook	2100	2100	1.7 km <sup>2</sup>	Residential, agricultural, recreational, commercial, T'Sou-ke Indian Reserve No. 2	No longer present	None known	phosphorus	similar to previous years
Saseenos / Lannon Creek	Saseenos / Lannon Creek	2039	2039	1.6 km <sup>2</sup>	Rural residential, commercial, agricultural, industrial	Steelhead, coho and chum salmon and cutthroat trout (anadromous)	None known: gravel beds enhanced in 1980s	phosphorus	similar to previous years
Sooke River	Sooke River, DeMamiel Creek, Baker Creek, Todd Creek	2043	2043, 2043-1A, 2043-1B, 2043-2, 2043-3, 2043-4	>300 km <sup>2</sup>	Residential, agricultural, commercial, industrial, park, private logging	Coho and chum, chinook, sockeye salmon, rainbow and cutthroat trout, Dolly Varden char	Sooke River Salmon Enhancement Society, Juan de Fuca Salmon Enhancement Society, T'Sou-ke First Nation, Sooke Renfrew Forestry, CRD Water department	FC, pH, phosphorus	similar to previous years but FC unusually high upstream at 2043-1A (DeMamiel Creek)
Throup Stream	Throup Stream	2046	2046	0.5 km <sup>2</sup>	Rural, urban and high-density residential, agriculture	Coho and chum salmon	none known	phosphorus	similar to previous years
Veitch Creek	Veitch Creek	2030	2030, 2030-2, 2030-3, 2030-4	25 km <sup>2</sup>	Rural residential, agricultural, some commercial	No anadromous due to waterfall; residential cutthroat upstream	none known	FC, phosphorus	similar to previous years
Wildwood (Matheson) Creek	Wildwood (Matheson) Creek	2027	2027	9 km <sup>2</sup>	Rural residential, forest land reserve, park, agriculture	Cutthroat trout, coho, three-spine stickleback, small mouth bass	none known	phosphorus	similar to previous years
Wright Road Stream	Wright Road Stream	2064	2064	0.16 km <sup>2</sup>	Residential, agricultural, recreational	Stickleback; anecdotal reports of chum salmon and trout	none known	FC, phosphorus	similar to previous years

**Notes:** FC is fecal coliform bacteria



0 0.5 1 2 Kilometres  
 Projection: UTM ZONE 10N NAD 83

- Sampling Stations
- - - Municipal Boundaries
- Streams and Rivers

- Major Sooke Watersheds
- District of Sooke**
- Stormwater Monitoring Area

**Figure 6**  
 Monitoring of Significant Watercourses  
 within the Survey Area - 2013

**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.

## **5.0 CONCLUSIONS**

In 2013, as in previous years, the CRD IWMP assessed stormwater quality and impacts of stormwater contaminants on the receiving environment. IWMP staff collected monitoring data in 76 stormwater discharges, 14 streams and 28 marine surface water stations in winter and summer. In addition, staff collected a sediment sample from five stormwater discharges and one upstream location in summer. Monitoring data was used to identify contamination, prioritize stormwater discharges of concern and provide direction for mitigative efforts by municipal staff. IWMP staff prioritized discharges based on public health and environmental concern ratings to allow District of Sooke to address discharges of most concern first. Finally, IWMP conducted investigations to find the source of contamination in discharges of concern.

### **5.1 Fecal Coliform Levels**

#### **5.1.1 Stormwater Discharges, Watercourses and Marine Surface Water**

Fecal coliform contamination above 200 FC/100 mL was present in nearly one-third (23/76) of the stormwater discharges, (including the discharge point of seven streams) sampled. This level of contamination indicates sources of sewage or animal waste with the potential to cause adverse human health effects from primary contact activities (e.g., swimming, ingestion). IWMP staff have assigned a high public health rating to three of these discharges [2035 (Cooper's Cove), 2042A (Alderbrood Stream) and 2067A (1643 Dufour Road)] based on the potential for the public to come in contact with the stormwater flows.

Of the three discharges assigned a high rating, two of them have been high-rated intermittently for a number of years (2035 and 2042A), while one has occasionally had elevated fecal coliform levels, but the flows are often low or the discharge is dry. The sources of contamination for the high-rated discharges are likely animals for discharges 2035 and 2042A (based on previous BST results) and are unknown for discharge 2067A.

The 2013 data provides further indication that stormwater from some discharges is impacting the marine environment: samples collected in winter 2013 during heavy rainfall displayed fecal coliform levels above 14 FC/100 mL in 15 stations and above 200 FC/100 mL in two stations. Measurements were higher in 2013 than previous years (the winter geometric mean is the highest measured 13 FC/100 mL) and elevated counts occurred near the shore and not the middle of the harbour and basin in both seasons.

Fecal coliform levels in 2013 were higher than those observed in recent years. Fecal coliform levels fluctuate each year due to precipitation levels and sample timing. Due to wetter conditions, previous to and at the time of stream monitoring, more samples were collected in 2013 (e.g., 52 stream samples in 2013 versus 36 in 2012). Heavy rainfall was also noted during the winter marine sampling likely causing higher than usual results.

#### **5.1.2 Wastewater Collection and Treatment**

Results indicate that fecal coliform contamination along the shoreline of the sewered area is lower, but still remains in some stormwater discharges and the marine environment. The number of discharges within the sewered area above 500 FC/100 mL was reduced from nine before the area was sewered (2005) to six in 2013 and only five of those were above 2,000 FC/100 mL compared to eight in 2005. Remaining contamination is likely related to properties that have not connected to the wastewater system and animal waste.

Fecal coliforms in marine samples collected along the shoreline of the sewered area in 2013 were above 14 FC/100 mL at all three stations in winter (SO-22, SO-23 and SO-24) and two of the stations in summer (SO-22 and SO-23). In addition, one measurement at station SO-24 was above the IWMP guideline, 200 FC/100 mL. Winter samples in Sooke Harbour and Basin are rarely above 14 FC/100 mL; however there was heavy rainfall during sampling in 2013. Results indicate that observed fecal contamination is from stormwater as there was heavy rain fall and elevated fecal coliforms were measured near the shore.

## **Sewer Service Area Expansion**

The District of Sooke is considering other areas for expansion of the sewage service area. The two areas identified as the most likely candidates include the Kaltasin and the Flats and Whiffin Spit North catchment areas.

CRD data has determined that marine habitat around both areas is highly sensitive and includes shellfish beds and eelgrass; however, there is less flushing around Billings Spit. Public use of the two areas is different. Swimming is more likely to occur around Billings Spit, while kayaking and other boating activities occur near the Whiffin Spit shoreline, but little swimming.

Although fecal contamination is present in the creeks and marine environment from both areas, significant contamination has been measured on and around the Kaltasin area. Three high flow watercourses discharge from the Kaltasin area. The fecal coliform levels combined with the significant flow rates, could lead to high contaminant loadings into the marine environment. Whiffin Spit flows are generally lower than the creeks from the Kaltasin area and they are dry in summer.

IWMP data indicates that contamination observed is mainly from agricultural animals; however, bacteria from a human source was measured in one marine sample collected in front of discharge 2040 (south of Lannon/Saseenos Creek) in 2013. More investigation is needed to determine the sources and their contribution; however, is likely that a significant amount of the observed contamination in both areas will not be mitigated through sewerage.

### **5.2 Watercourse Monitoring**

Development near watercourses and inputs of sewage from onsite treatment systems and agricultural waste pose the most risk to watercourses in the District of Sooke. CRD monitoring results indicate that water quality is fair in most of the watercourses monitored. Exceedence of more than one guideline occurred in about half of the watercourses. CRD data collected in 2013, and previous years, suggest that water quality in Sooke watercourses is as follows:

- good in four creeks (Ayum Creek, Grouse Brook, Gillespie Creek and Wildwood Creek),
- moderate in seven creeks (Broom Hill Stream, Ella Stream, Kemp Lake Stream, Lannon/Saseenos Creek, Nott Brook, Sooke River and Wright Road Creek), and
- poor in three creeks (Alderbrook Stream, Throup Stream and Veitch Creek)

The water quality parameters of most concern in 2013, as in previous years, were fecal coliforms, turbidity and phosphorus. This is consistent with what is seen throughout the region wherever there is increased human presence or agriculture. The draft Vancouver Island phosphorus objective were exceeded in all CRD creeks due to human and animal presence in these watersheds, however, the levels measured in Sooke creeks was less likely to be 10 times above the guideline.

### **Water Quality Trends**

Water quality in most of the watercourses appears to be somewhat constant over time. Unusually high fecal coliform levels were measured in Alderbrook Stream and the Sooke River Watershed in DeMamiel Creek. IWMP staff will continue monitoring these creeks to determine whether the results were anomalous or indicative of a trend of higher fecal coliform levels in these areas.

IWMP has initiated a more comprehensive monitoring program in the CRD Core Area creeks. The approach provides a better picture of watershed health by including more intensive monitoring in fewer creeks. Due to the intensive nature of this type of sampling, IWMP staff focus on two to three streams per year, allowing all core area streams to be completed within approximately five years. After five years the cycle will restart to determine changes over time. This approach results in more robust data for comparison to BC MOE water quality guidelines and would also meet attainment monitoring proposed by the MOE draft water quality objectives in Sooke creeks.

### **5.2.1 Environmental Health Concern Ratings**

There were no exceedences of the MSQG for the protection of aquatic life in the six sediment samples collected in 2013. As a result, staff assigned a low contaminant rating, to sediment samples collected at the discharge point of five storm drains.

Source investigations resulted in a moderate rating upstream in discharge 2054 (2054-2) due to the sum of contaminant concentrations present. IWMP staff have been investigating the source of zinc and PAH in discharge 2054 (southwest of Murray Road) since 2000. Upstream samples collected in the past were rated high due to zinc. Results indicate the source maybe runoff from Sooke Road or the parking lot that services the post office; however, contaminant levels fluctuate and are difficult to track.

#### **Future Sampling and Evaluation Efforts**

In 2014, IWMP staff plan to conduct the following activities:

##### **Stormwater Discharge Sampling**

Sampling for analysis of fecal coliform counts and evaluation of public health concern for the following:

- stormwater discharges rated moderate and high in 2013
- significant watercourses
- discharges with a change in public health concern ratings from the previous year to confirm ratings

##### **Sediment Sampling and Assessment**

In 2014, sediment sampling and assessment will include:

- discharges that have not been visited for five years (2035A, 2056 and 2065)
- discharge 2053 and 2061 to confirm the previous rating
- discharge 2054 to confirm the high rating—sediment has not been available downstream since 2007.

##### **Watercourse Monitoring**

IWMP staff will continue to monitor water quality in significant watercourses to assess health and determine if the observed measurements are indicative of established changes in water quality. However, it is anticipated that the sampling approach would change to a more comprehensive monitoring program as has been done in the CRD Core Area streams. The approach provides a better picture of watershed health by including more intensive monitoring in fewer creeks. Due to the intensive nature of this type of sampling, IWMP staff focus on two to three streams per year, allowing all streams to be completed within approximately five years. After five years the cycle will restart to determine changes over time. Monitoring includes weekly collection of water quality samples for five weeks in summer, winter or both seasons, resulting in more robust data for comparison to BC MOE water quality guidelines. This level of monitoring would also meet attainment monitoring proposed by the MOE draft water quality objectives in Sooke creeks.

##### **Marine Surface Water Monitoring**

IWMP staff will continue to monitor fecal coliform levels at all 28 marine sampling stations in winter and summer for comparison to shellfish harvesting and human health recreational guidelines.

##### **Source Investigations**

Source investigations will be conducted on a selection of discharges rated moderate for public health concern in 2013 and those with fecal coliform counts above 500 FC/100 mL.

## **Public Education**

IWMP includes a public education component which involves educating businesses, community groups and the general public on stormwater quality issues and what can be done to prevent and reduce pollution. Part of the public education component includes promoting the use of BMP by the community. BMP are voluntary strategies for preventing stormwater pollution. IWMP staff also attend outreach events and host educational workshops.

The program also emphasizes the importance of reporting spills that can cause harm to public health and/or the environment to the Emergency Management BC (EMBC) (formerly Provincial Emergency Program). To assist with the reporting of spills in stormwater, small signs have been installed at most stormwater discharges in the core area. These signs carry the discharge number and the EMBC phone number (1-800-663-3456). Signage of this nature can improve the response time and, therefore, increase the chances of identifying the source(s). EMBC staff will contact the appropriate agency for action (municipality, EC, MOE, fire department, etc.) or take action themselves.

## **Technical Assistance**

IWMP provides technical expertise and assistance to municipalities in the area of stormwater source control. Information on structural pollution prevention technologies, federal and provincial initiatives that involve stormwater quality, and changing environmental guidelines and regulations are some of the broad topics where the program provides advice to municipalities.

## **Reducing Shellfish Closures**

Stormwater flows are the major pathway for contaminants from the land to the marine environment. Sources of stormwater pollution can originate from residential, commercial, industrial and agricultural land uses. Fecal coliform sampling has focused primarily on human health issues. However, there are shellfish beds in the Sooke Inlet, Harbour and Basin closed for recreational harvesting due to bacterial contamination. Currently, shellfish can be harvested for depuration in these areas with a permit from the CFIA or DFO. IWMP works toward reducing pollution, through discharge and nearshore marine sampling and source investigations. This work, combined with the construction of the District of Sooke community sewer system, may eventually lead to the opening of shellfish beds in these waterbodies.

## **6.0 RECOMMENDATIONS**

### **6.1 Public Health Concerns**

The following recommendations are based on the results of the fecal coliform sampling:

1. That IWMP staff continue to sample stormwater discharges along the District of Sooke coastline to monitor for fecal coliform levels.
2. That IWMP staff continue to work with the District of Sooke and Island Health staff to identify the sources of elevated fecal coliform concentrations in stormwater.
3. That IWMP staff continue to monitor surface fecal coliform levels in Sooke Inlet, Harbour and Basin to measure contaminants and track changes in these water bodies over time.

### **6.2 Environmental Concerns**

The following recommendations are based on the results of the chemical contaminants survey:

1. That IWMP staff work with Sooke staff to implement a more comprehensive stream sampling program.
2. That IWMP staff continue to monitor discharges to determine source(s) of chemical contamination.
3. That IWMP staff discontinue monitoring discharges where low contaminant levels have been confirmed.
4. That IWMP staff evaluate the effectiveness of the current sediment sampling program and make changes as required to protect watercourses and the nearshore marine environment.

### **6.3 Stormwater Source Control**

1. That IWMP staff continue to develop, as required, BMP for the protection of stormwater quality.

### **6.4 General**

1. That IWMP staff continue working with community groups and others to promote the protection of stormwater quality.

## 7.0 REFERENCES

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