Utilities Environment
ANNUAL REPORT
2020

ABBOTSFORD

DISTRICT OF Mission ON THE FRASER

Abbotsford Mission Water & Sewer Services

EXECUTIVE SUMMARY

Environmental Services is responsible for the management and operation of:

- **Source Control Program:**

The Municipal Wastewater Regulation (MWR) requires municipalities to regulate the introduction of non-domestic waste through a source control bylaw, or equivalent measures that provides for the pre-treatment of industrial, commercial and institutional (ICI) discharges to a municipal wastewater collection system. The Abbotsford/Mission Water and Sewer Commission Source Control Program (WSCSCP) is designed to reduce the amount of contaminants that industries, businesses, institutions and households discharge into the sanitary sewer system. Reduction of contaminants discharged to the sanitary sewer protects the sewage collection system, the treatment facilities, the biosolids quality, the receiving environment, and the health and safety of the public and sewer workers. The City of Abbotsford Sewer Rates and Regulations Bylaw No. 2664-2017 and the District of Mission Sewer Bylaw No. 5033-2009 serve as the main regulatory instrument for the WSCSCP.

Wastewater Discharge Permits (WWDP) are issued to industries, businesses, or other operations that discharge significant volumes of non-domestic wastewater into the sanitary sewer, or that discharge wastewater having the potential to contain high concentrations of contaminants. In 2020, 59 WWDP's were initiated within the combined area of City of Abbotsford and the District of Mission.

Codes of Practice (COP) regulate non-domestic waste discharged to the sanitary sewer from commercial, industrial, and institutional business sectors. Codes of Practice are different from WWDP's in that they set out minimum waste treatment, equipment maintenance, and record keeping requirements for specific types of operations. In 2020, WSCSCP staff completed 364 inspections for businesses operating under five separate COPs: Dental Operations, Photo Imaging Operations, Dry Cleaning Operations, Automotive Operations, and Vehicle Wash Operations.

In 2020, ongoing monitoring for Oil and Grease focused on industrial customers identified in the 2012 risk assessment study. The Bylaw limits are 150 mg/L for Total Oil and Grease and 15 mg/L for Oil and Grease Hydrocarbons. In 2020, 34 grab samples were collected and analyzed for Oil and Grease after a visual inspection confirmed the presence of these contaminants. The results from an external accredited laboratory found that 97% of these grab samples were above the Bylaw limits.

High-risk dischargers such as metal finishers were monitored in 2020. A total of 62 samples were collected from two metal finishing companies for Total Metals. The collected data showed 4% of the samples were outside the Bylaw limit for Copper and Nickel.

In 2020, a total of 1,076 samples (285 grab and 791 composite) were collected from industrial businesses and analyzed for pH compliance. The collected pH data showed 26% of the samples were non-compliant and outside the Bylaw limit of 5.5 to 9.5 pH units. A continuous pH monitoring system using in-line sensors is an application used at various locations for compliance monitoring. In 2020, 26 sessions of continuous pH monitoring were successfully completed.

- **Class IV Wastewater Plant Laboratory:**

The Joint Abbotsford-Mission Environmental Systems Wastewater Treatment Plant (JAMES WWTP) operates and monitors liquid and solid discharges under the Municipal Sewage Regulation (MSR), the Wastewater Systems Effluent Regulations (WSER) and the Organic Matter Recycling Regulations (OMRR). The JAMES WWTP Laboratory performs testing as required by each regulation and performs a variety of special projects and other testing for plant performance requirements. It operates using well defined Quality Assurance and Quality Control (QA/QC) methods and procedures based on the *Standard Methods for the Examination of Water and Wastewater* 23rd *Edition*. It also participates in the PT Canada Proficiency Testing Program twice a year.

In 2020, the JAMES WWTP Laboratory saw a 5.6% overall increase in sample workload that produced a total of 25,362 test results. 35% (8,775) of the test results were attributed to internal QA/QC testing. The laboratory also saw a 39% increase in sample submission resulting in 1,860 samples submitted to external laboratories for analysis. These samples are grouped into 13 projects sent on an ongoing basis. In-house analyses include pH, Ammonia, Biochemical Oxygen Demand, Chemical Oxygen Demand, Total Suspended Solids, Total Solids, Volatile Solids, Settleable Solids, Total Alkalinity, and Volatile Acids. The laboratory also received six additional requests from JAMES Operations resulting in 133 test results. Additional requests include Total Ammonia, Dissolved Phosphorus, Dissolved Copper, Total Solids, Chemical Oxygen Demand, and Volatile Fatty Acids.

In 2010, efforts were taken by staff to develop and implement improved QA/QC practices in the laboratory. The QA/QC system provides written documentation that ensures the accuracy, precision, and reliability of laboratory analyses and that data produced in the laboratory meets or exceeds user requirements. In addition, Standard Operating Procedures (SOPs) for all analyses performed in the JAMES WWTP Laboratory were also developed and implemented to ensure consistency with all analytical procedures and to document variations from the procedures referenced in the *Standard Methods for the Examination of Water and Wastewater 23rd Edition*.

- **Biosolids Management**

Biosolids are a sustainable resource that are produced from the JAMES Wastewater Treatment Plant (WWTP) and managed in accordance with applicable Provincial and Federal regulations and in a beneficial manner that supports a commitment to protecting the public and the environment. The Provincial Organic Matter Recycling Regulation (OMRR) applies to the production, distribution, storage, sale and use or land application of biosolids.

The JAMES WWTP produces “Class A” biosolids that is identified in OMRR as the highest quality biosolids. The pasteurization process at the JAMES WWTP is the key treatment step in enabling the production of “Class A” Biosolids. However, if the pasteurization process is not in operation, the JAMES WWTP produces a Class “B” biosolids. The pasteurization process was taken out of service on March 2, 2020 and remained off-line for the rest of the year.

Historically, Class A biosolids have been used for mine reclamation, agriculture and range land, soil production, and tree farm applications. In 2015, the City of Abbotsford (City) implemented a biosolids management agreement with a third party contractor (Biocentral) to beneficially use JAMES WWTP biosolids in accordance with applicable Provincial and Federal regulations. In

2020 a new contractor (Sylvis Environmental) was appointed through an RFP process to provide these services for a period of three years.

Approximately 1,700 wt of biosolids produced in 2019 remained in storage at James WWTP and carried over for beneficial use in 2020. In 2020, 7,129 wet tonnes (wt) of the City's biosolids were removed from JAMES WWTP and delivered to two sites in British Columbia (BC) for grassland restoration and agricultural fertilization. All biosolids land applications were completed according to their respective Land Application Plan (LAP). Biosolids delivered after the land application season were stored on two different sites (1,432 wt Ok Ranch and 121 wt Pinnacle Farms) at the end of 2020 in preparation for land application in 2021.

Additionally, 3,723.6 wt of Class A biosolids stored on application sites in 2019 from the City's previous contractor (BioCentral) was applied by BioCentral in 2020. From the 3,723.6 wt of Class A biosolids applied by Biocentral in 2020, 16.5% (616.24 wt) was turned into Biosolids Growing Medium (BGM). BGM production and distribution followed OMRR requirements.

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A. Source Control Program

1.0 Introduction

The primary objective of the Abbotsford/Mission Water and Sewer Commission Source Control Program (WSCSCP) is to reduce the amounts of contaminants that industries, businesses, and institutions discharge into the sanitary sewer system. The Municipal Wastewater Regulation (MWR) requires municipalities to regulate the introduction of non-domestic waste through a source control bylaw, or equivalent measures that provides for the pre-treatment of industrial, commercial and institutional (ICI) discharges to a municipal wastewater collection system. These discharges may contain significant quantities of contaminants and other substances that can affect the collection and treatment system as well as the health of workers, the public, and the aquatic environment.

Wastewater treatment plants separate the solids from the liquid portion of the wastewater flow and treat those solids to an end product called biosolids. Some contaminants (i.e. heavy metals) are separated from the wastewater flow during wastewater treatment and cumulate in the biosolids, a condition that can restrict the beneficial use or result in costly remediation and recycling efforts. The efficiency of the treatment and its costs closely relates to the quantity and quality of the wastewater treated. Consequently, an effective source control program is an economical and sustainable means of managing wastewater treatment.

The objectives of the WSCSCP are to:

- Ensure the health and safety of sewer workers and the general public is not put at risk due to the presence of wastewater contaminants;
- Protect the aquatic receiving environment adjacent to the JAMES Wastewater Treatment Plant (WWTP) sewage outfall;
- Protect the JAMES WWTP against corrosion, blockage and other harmful effects related to the presence of wastewater contaminants;
- Protect the JAMES WWTP against treatment process upsets due to high contaminant loadings;
- Protect the quality of the biosolids produced at the JAMES WWTP to allow unrestricted options for beneficial use and recycling; and
- Promote responsible pollution prevention practices including reduction, reuse, recycling, recovery, and residuals management.

2.0 Source Control Program Activities & Accomplishments – 2020

The 2020 WSCSCP activities and accomplishments are discussed under the following broad groups of activities:

- Program administration;
- Aboveground sampling kiosks;
- BOD & TSS Waste program;
- Codes of Practice (COP);

- Wastewater Discharge Permits (WWDP);
- Wastewater Discharge Assessments (WWDA);
- Wastewater Compliance Plans (WWCP);
- Contaminant reduction;
- Key manhole monitoring; and
- Unauthorized discharge events.

2.1 Program Administration

The WSCSCP manages Wastewater Discharge Permit (WWDP) holders and Codes of Practice (COP) customers using a multiphase approach that ensures Bylaw compliance of non-domestic waste discharged into any sewers and drains connected to the sanitary sewer system. Codes of Practice are different from WWDP's in that they set out the minimum waste treatment, equipment maintenance, and record keeping requirements for specific types of operations. All correspondence is documented and serves as historical reference.

The administration of the WWDP process involves thorough assessment of WWDP applications and supporting documentation (e.g. analytical data, sewer volumes, schematic flow diagrams, site layout, etc.). Additionally, meetings and site visits are arranged to verify and supplement information presented in the application. It also provides an opportunity to share information between parties with the emphasis on meeting Bylaw requirements. In 2020, a total of 59 WWDP's were issued.

The administration of the Codes of Practice (COP) refers to conducting site inspections that determine compliance with the Bylaw. Customers are notified of an upcoming inspection at least two months in advance. These notifications also include pertinent information on regulatory rules such as the applicable Schedule of the Bylaw, checklists, logbooks, diagrams, and FAQs. During an inspection, a checklist is used to document and carefully identify items in contravention of the Bylaw. After inspection, customers are notified of either compliance or non-compliance of the COP or exemption from the COP. Customers with non-compliant items are required to complete and provide progress reports on remedial actions within a reasonable time. Customers exempt from the COP are inspected every three to five years to confirm validity of exemption.

A multilevel approach taken through a notification process was developed to ensure a consistent approach in managing customer's compliance requirements. Refer to Figure 1 for a schematic flow of the different levels.

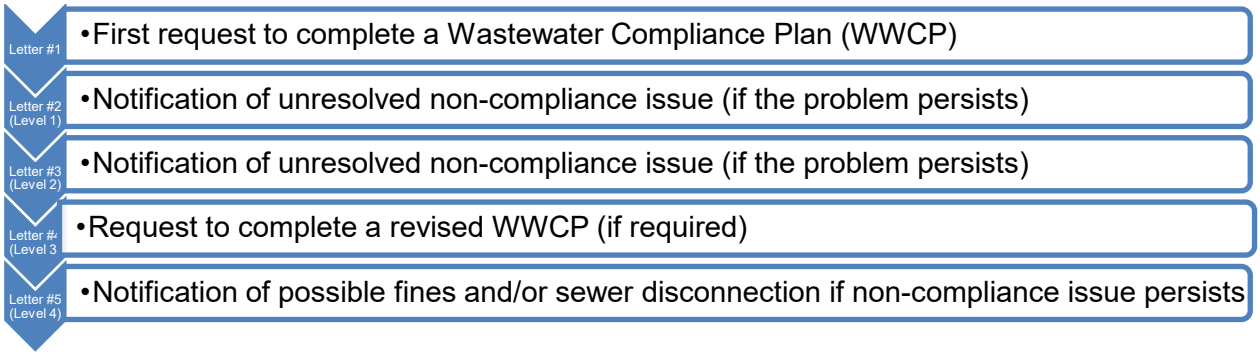

Figure 1. Schematic Flow of Non-compliance Notification Procedure

In 2020, the administration of the WSCSCP continued its environmental initiative by transitioning from paper-based communications to software and electronic solutions. This platform has significantly reduced costs associated with paper distribution and increased productivity from real-time delivery of documents. Refer to Figure 2 for a comparison of the letters distributed since the letter distribution's inception in 2008.

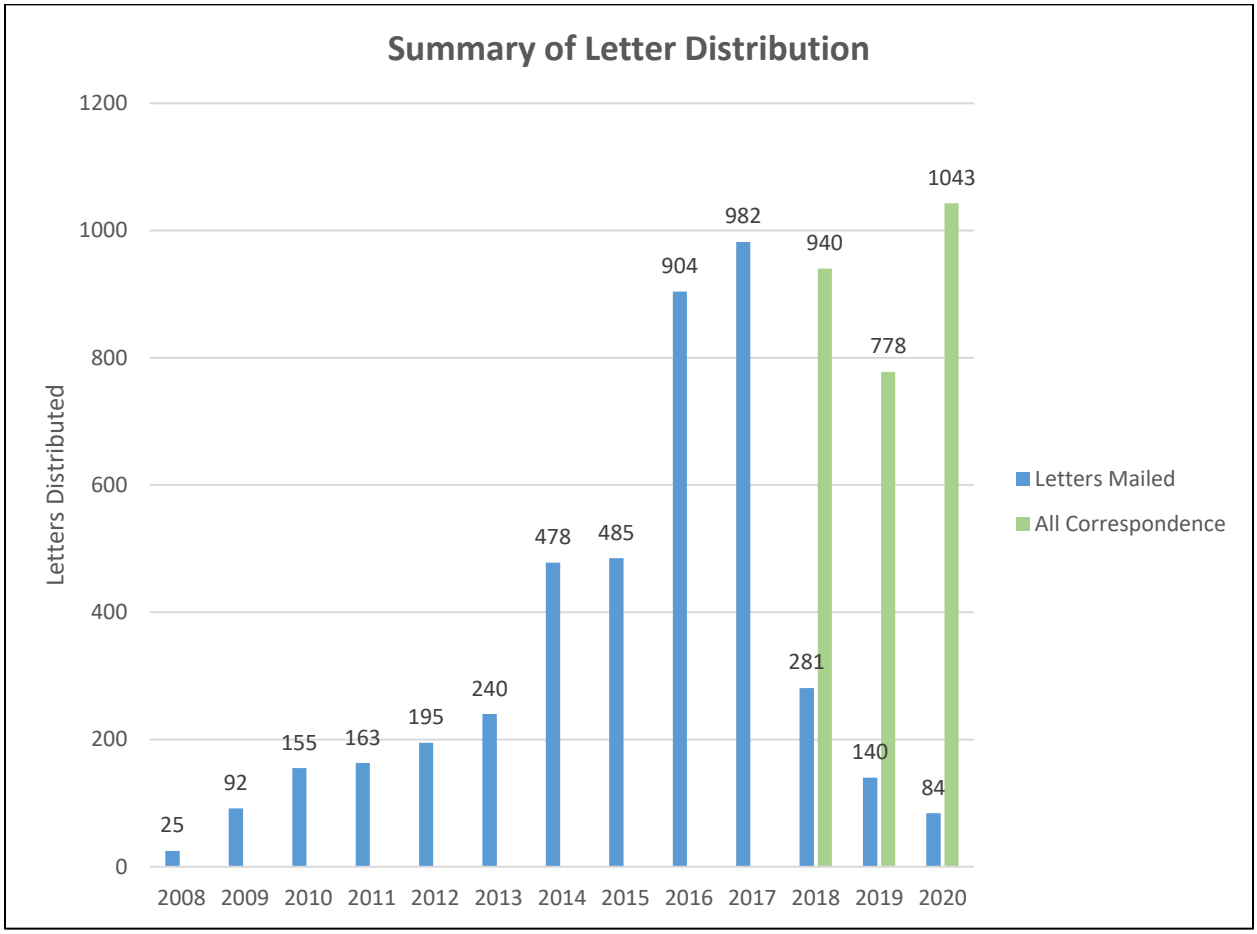

Figure 2. Summary of Letter Distribution from 2008 to 2020

It is important to note that the significant increase in letter distribution in 2016 is due to the addition of site visit notifications that provide customers with a timeline of when to expect an upcoming inspection. In 2020, only 84 of the 1,043 letters distributed were paper-based resulting in substantial reduction in cost and carbon footprint. Refer to Table 1 for a summary of letters distributed in 2020.

Table 1. Letters Distributed by the Source Control Program - 2020

	Number of Letters Distributed	
Letter Type	Mail	Email
WASTEWATER COMPLIANCE (WWCP)		
WWCP Approved	0	8
WWCP Required	0	8
WWCP Review	0	8
WASTEWATER DISCHARGE ASSESSMENTS (WWDA)		
WWDA Application Request	0	5
WWDA Review	0	5
WASTEWATER DISCHARGE PERMITS (WWDP)		
Request for WWDP Application	0	53
WWDP Approval/Review	0	53
CODES OF PRACTICE (COP)		
Site Visit Review (General)	1	259
Exempt Notification	1	71
Missing Progress Report	0	33
Compliance Achieved	0	88
Deadline Extended	0	12
Notification of Site Visit	82	440
Mobile Wastewater Assessment	0	0
Total	84	1,043

The amount of paper-based communication has decreased significantly after fully integrating into software for automation (AMANDA) for management, and document control of the administration of Codes of Practice. This application is also available in mobile devices and is used when conducting inspections resulting in improved accuracy of data collection and shortened inspection lifecycle.

2.2 BOD & TSS Waste Program

Heavy loadings of Biochemical Oxygen Demand (BOD) and Total Suspended Solids (TSS) in wastewater entering the JAMES WWTP from non-domestic sources can adversely affect the treatment process and can contribute to increased treatment plant expansion needs. To mitigate these effects, wastewater-monitoring programs developed in 1995 ensured cost recovery for treating this type of waste. Over the years, many changes and improvements made to the wastewater monitoring program led to the formation of the “BOD and TSS Waste Program”. The coordination and implementation of the BOD and TSS Waste Program is administered by WSCSCP staff.

In 2020, Source Control discontinued wastewater sampling from operations considered high risk for exposure and transmission of COVID-19. The BOD and TSS fees for these businesses are calculated using their average data until sampling can resume safely.

In 2020, the BOD & TSS Waste Program consisted of thirty-two industrial customers, with the addition of a correctional facility. WSCSCP staff routinely monitored these businesses (three located within the District of Mission and twenty-nine located within the City of Abbotsford) with sampling consisting of 24-hour composite samples collected on a random schedule every month.

Industrial customers with larger discharge volumes were monitored more frequently to capture a proper representation of their discharge. These samples were submitted to an accredited external laboratory for pH, BOD and TSS analysis. The monthly average BOD and TSS concentrations combined with the monthly sanitary sewer discharge volumes determined the BOD and TSS waste mass loading fees for each customer for that month. The 2020 mass loading fees rates remain the same as in 2014 and are provided in Table 2. An overall summary for the BOD and TSS Waste Program is also provided in Table 3.

Table 2. BOD & TSS Waste Fees – 2020

	Fee:
Biochemical Oxygen Demand (BOD)	$0.42/kg/month
Total Suspended Solids (TSS)	$0.47/kg/month

Table 3. BOD & TSS Waste Program Monitoring - 2020

	Total:
# of Samples Collected	999
Sewer Volume (m^3)	2,417,211
BOD Loading (kg)	2,305,213
TSS Loading (kg)	1,022,186
BOD Waste Fees Collected	$968,185
TSS Waste Fees Collected	$480,427.55
BOD & TSS Waste Fees Collected	$1,448,612.84

Refer to Figures 3, 4, 5, and 6 for the trends in 2020. Monitoring of the thirty-two locations will continue in 2021.

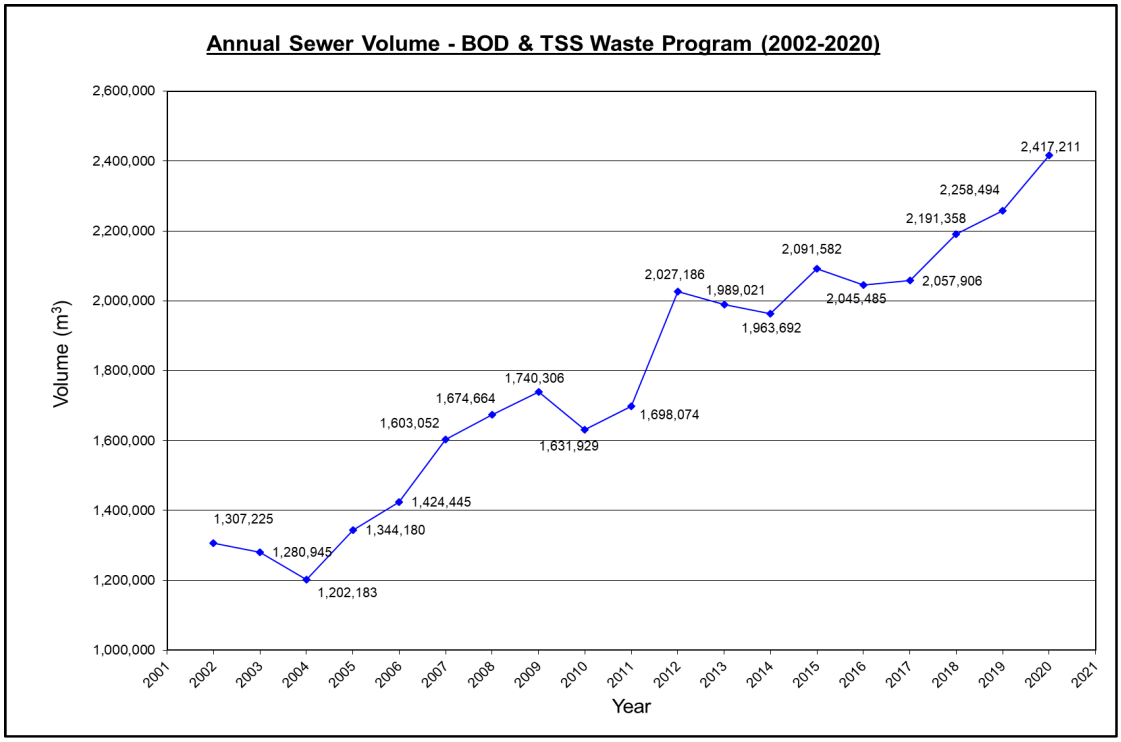

Figure 3. BOD & TSS Waste Program – Annual Sewer Volumes (2002–2020)

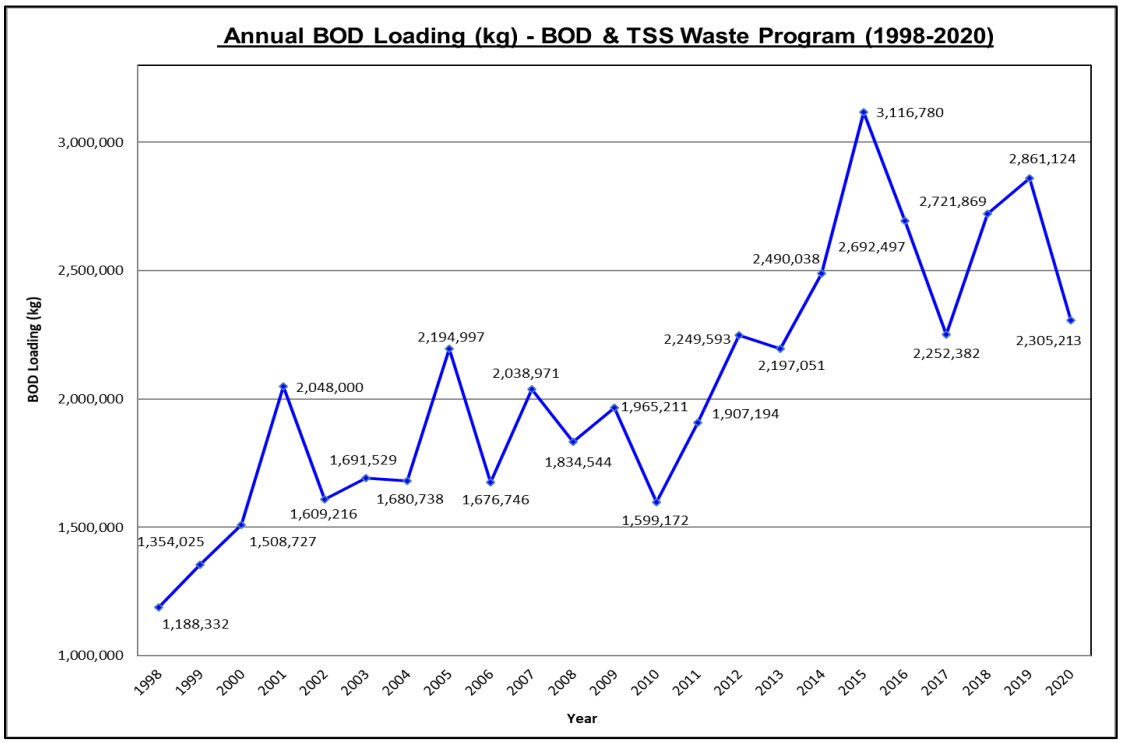

Figure 4. BOD & TSS Waste Program – Annual BOD Mass Loading (2002–2020)

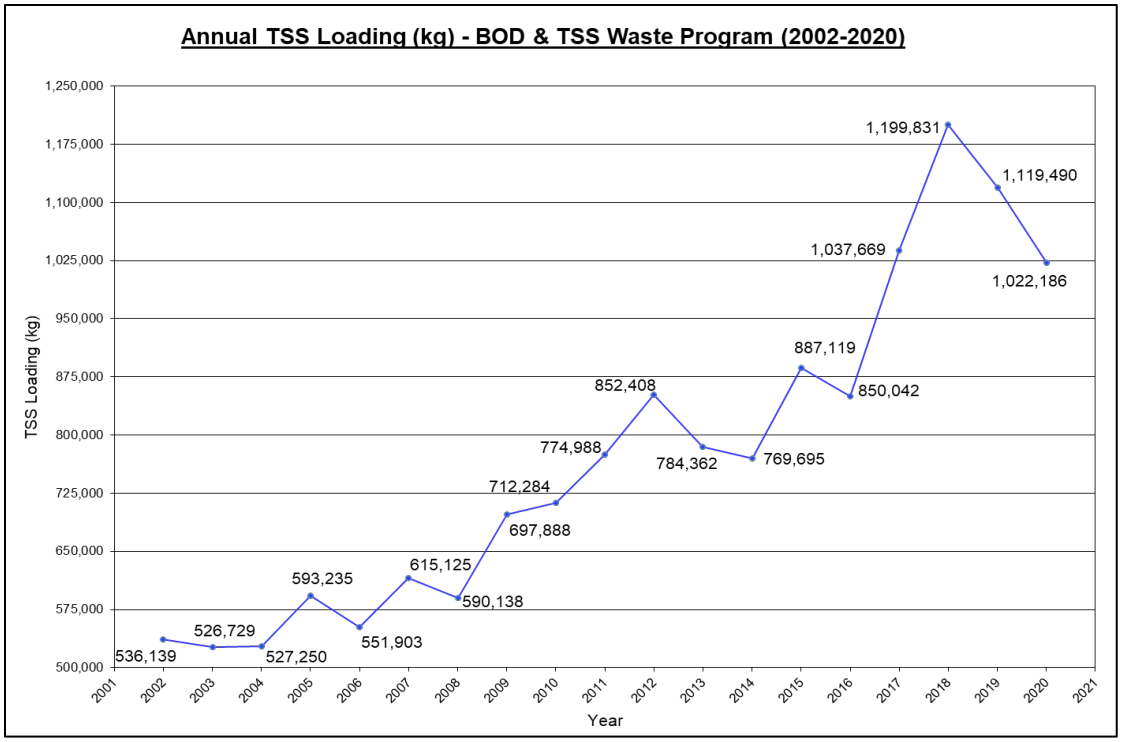

Figure 5. BOD & TSS Waste Program – Total TSS Mass Loading (2002–2020)

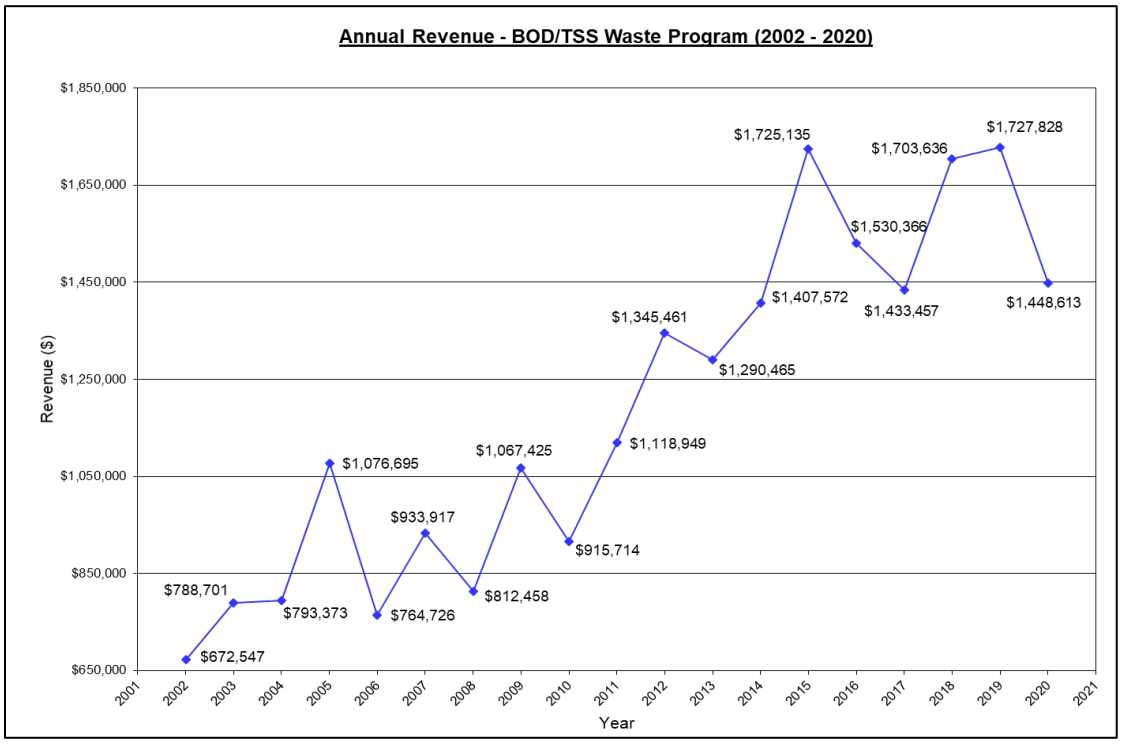

Figure 6. BOD & TSS Waste Program – Annual Revenue (2002 – 2020)

2.3 Codes of Practice

2.3.1 Background

The City of Abbotsford Bylaw No. 2664-2017, "Sewer Regulations Bylaw" and the District of Mission Bylaw No. 5033-2009, "Sewer Bylaw" defines Code of Practice (COP) as "a regulatory document, developed by the City/District which contains mandatory sanitary sewer discharge standards for specific industrial, institutional or commercial operations". It sets out requirements on minimum waste treatment, equipment maintenance, record keeping and retention, spill prevention of hazardous, prohibited, and restricted wastes, and off-site waste management. It does not apply to a discharging operation subject to a (WWDP) unless required by the City/District Engineer.

In 2018, WSCSCP staff started using available data management software (AMANDA) to streamline the administration and data management for the City of Abbotsford COPs until it was ready for full integration in 2019. In 2020, WSCSCP staff continue to refine the data management through AMANDA to improve workflow and optimize productivity. The District of Mission does have AMANDA data management software for WSCSCP staff to utilize. WSCSCP staff utilize other software to manage Mission COPs. Refer to Table 4 for a summary of the adoption and effective dates for the five Codes of Practice.

Table 4. Summary of Codes of Practice Adoption & Effective Dates

Codes of Practice	City of Abbotsford Adoption Date	District of Mission Adoption Date	Effective Date
Dental Operations	July 13, 2009	June 15, 2009	January 1, 2010
Photo Imaging Operations	July 13, 2009	June 15, 2009	January 1, 2010
Automotive Operations	December 19, 2011	April 23, 2012	*City of Abbotsford:* December 19, 2011 *District of Mission:* April 23, 2012
Vehicle Wash Operations	December 19, 2011	April 23, 2012	*City of Abbotsford:* December 19, 2011 *District of Mission:* April 23, 2012
Dry Cleaning Operations	December 19, 2011	April 23, 2012	*City of Abbotsford:* December 19, 2011 *District of Mission:* April 23, 2012

2.3.2 Development & Implementation Summary

2.3.2.1 Dental Operations

The Dental Operations COP is a regulation that applies to dental operations that produce non-domestic waste containing dental amalgam. It requires wastewater pretreatment using a certified amalgam separator to ensure restricted waste found in dental amalgam (e.g. mercury, silver, copper, and zinc) does not enter the sanitary sewer. Dental offices that produce liquid waste from photographic imaging containing silver are also required to comply with the COP for Photo Imaging Operations. WSCSCP staff began inspecting dental operations in early 2010 to ensure the codes were being adhered to. Refer to section 2.3.3 for a summary of inspections conducted in 2020.

2.3.2.2 Photo Imaging Operations

The Photo Imaging Operations COP is a regulation that applies to photo imaging operations that produce non-domestic waste containing silver. It requires wastewater pretreatment using silver recovery technology capable of reducing the concentration of silver in the liquid waste to 5 mg/L or less. Some examples of photo imaging operations include hospitals, veterinary clinics, chiropractic offices and dental offices. WSCSCP staff began inspecting photo imaging operations in early 2010 to ensure the codes were being adhered to. Refer to section 2.3.3 for a summary of inspections conducted in 2020.

2.3.2.3 Automotive Operations

The Automotive Operations is a regulation that applies to all automotive operations and requires installation of an oil-water separator to treat liquid waste. If work is limited to dry shop processes, the installation of the treatment works is not required but all other requirements under the COP will apply. Some examples of automotive operations include collision and mechanical repair shops, service stations, oil change operations, vehicle dealerships, vehicle maintenance facilities, vehicle recycling operations, radiator repair shops, and towing businesses. WSCSCP staff began inspecting automotive operations in early 2012 to ensure the codes were being adhered to. Refer to Section 2.3.3 for a summary of inspections conducted in 2020.

2.3.2.4 Vehicle Wash Operations

The Vehicle Wash Operations COP is a regulation that applies to all vehicle wash operations and requires installation of an oil-water separator for each manual and mechanical wash bays to treat liquid waste. Some examples of vehicle wash operations include any commercial, industrial, institutional, or public authority operation that conducts vehicle washing. WSCSCP staff began inspecting vehicle wash operations in early 2012 to ensure the codes were being adhered to. Refer to Section 2.3.3 for a summary of inspections conducted in 2020.

2.3.2.5 Dry Cleaning Operations

The Dry Cleaning COP is a regulation that applies to all dry cleaning operations that discharge waste containing Tetrachloroethylene. It requires wastewater pretreatment using a Tetrachloroethylene-Water separator to ensure wastewater containing Tetrachloroethylene does not enter the sanitary sewer. In 2015, inspections were put on hold after determining that most businesses use sealed dry cleaning machines thereby exempting them from the COP. In 2019, inspections resumed to ensure businesses remain in compliance. Refer to Section 2.3.3 for a summary of inspections conducted in 2020.

2.3.3 COP Inspection Summary

In 2020, the WSCSCP staff continued inspections of businesses operating under the following COPs: Dental, Photo Imaging, Automotive, Vehicle Wash, and Dry Cleaning operations. Inspections ensure businesses comply with the requirements under the Sewer Bylaw. Some of the requirements include:

- Installation and maintenance of equipment that prevent prohibited, restricted, and hazardous waste contained in the wastewater from entering the sanitary sewer;
- Spill prevention of prohibited, restricted, and hazardous waste;
- Implementation of offsite waste management; and
- Record retention of maintenance and offsite waste efforts.

Refer to Table 5 for the sector size estimates of active operations for each sector at the end of the year, Table 6 for a summary of all the inspection activities, Table 7 for a summary of exempt operations by sector, Table 8 for a summary of compliant businesses, and Table 9 for a summary of noncompliant businesses.

Table 5. Summary of Code of Practice Sector Size – 2020

	Sector Size		
Code of Practice	Abbotsford	Mission	Total
Automotive	356	77	433
Automotive & Vehicle Wash	10	0	10
Dental & Photo Imaging	76	13	89
Dry Cleaning	10	2	12
Photo Imaging	214	42	256
Vehicle Wash	40	3	43
Total	706 (84%)	137 (16%)	843

Table 6. Summary of Code of Practice Inspection Activity by Municipality - 2020

	Initial Inspections		Follow-up Inspections	
Code of Practice	Abbotsford	Mission	Abbotsford	Mission
Automotive	173	42	7	2
Automotive & Vehicle Wash	9	0	2	0
Dental & Photo Imaging	56	10	0	0
Dry Cleaning	3	1	1	0
Photo Imaging	24	7	0	1
Vehicle Wash	21	3	2	0
SUBTOTAL:	286 (82%)	63 (18%)	12 (80%)	3 (20%)
Total	349		15	

Table 7. Code of Practice Exempt Summary - 2020

	Exempt Operations		
Code of Practice	Abbotsford	Mission	Total
Automotive	11	11	22
Automotive & Vehicle Wash	0	0	0
Dental & Photo Imaging	6	1	7
Dry Cleaning	1	1	2
Photo Imaging	18	7	25
Vehicle Wash	1	0	1
Total	37 (65%)	20 (35%)	57

Table 8. Code of Practice In-Compliance Summary - 2020

	Inspections	
Code of Practice	Abbotsford	Mission
Automotive	148	29
Automotive & Vehicle Wash	8	0
Dental & Photo Imaging	49	7
Dry Cleaning	2	0
Photo Imaging	6	0
Vehicle Wash	18	2
SUBTOTAL:	231 (86%)	38 (14%)
Total	269	

Table 9. Code of Practice Non-Compliance Summary - 2020

	Inspections	
Code of Practice	Abbotsford	Mission
Automotive	12	1
Automotive & Vehicle Wash	2	0
Dental & Photo Imaging	1	2
Dry Cleaning	0	0
Photo Imaging	0	0
Vehicle Wash	3	1
SUBTOTAL:	18 (82%)	4 (18%)
Total	22	

2.3.4 Future Plans for Development

WSCSCP staff will continue conducting site inspections working with local businesses to ensure Bylaw compliance requirements are met.

Further enhance the AMANDA workflow data management experience. The main objective is flexibility in customizing COP documents such as inspection checklists, letter shells, and table of non-compliance items from the WSCSCP's existing repository, as well as adding features that will optimize the letter approval process.

Development and implementation of additional COP for Food Services is planned to limit the amount of fats, oils & grease (FOG) from entering the sanitary sewer system. The main problem related to FOG and other food waste is plugged sewer lines and sewage pump lift stations. This COP will set out minimum effluent treatment, equipment maintenance and record keeping requirements for grease discharges.

2.4 Wastewater Discharge Permits

Wastewater Discharge Permits (WWDP) are documents issued to industries and businesses under the City of Abbotsford Sewer Regulations Bylaw No. 2664-2017 and the District of Mission Sewer Bylaw No. 5033-2009. WWDP's are issued to allow for the discharge of non-domestic waste and are subject to terms and conditions appropriate for the protection of sanitary sewers, wastewater treatment system, human or animal health and safety, and the environment. WWDP's are issued to industries, businesses or other operations that discharge significant volumes of non-domestic wastewater or wastewater having the potential to contain high concentrations of contaminants entering the sanitary sewer.

Permit processing activities involve thorough assessment of applications and supporting documentations (e.g. analytical data, sewer volumes, schematic flow diagrams, site layout, future expansion plans, etc.) necessary in obtaining in-depth information about the customer's operations. Additionally, meetings and site visits are arranged to verify and supplement information presented in the application. It also provides an opportunity to share information between parties with the emphasis on meeting Bylaw & Sewer Capacity requirements. After careful assessment and ensuring compliance requirements are satisfied, the WWDP is issued and valid for a maximum of 365 days and must be renewed no less than 30 days prior to expiration. Refer to Table 10 for a summary of all permits approved in 2020 and Figure 7 for the workflow of the Wastewater Discharge Permit application process.

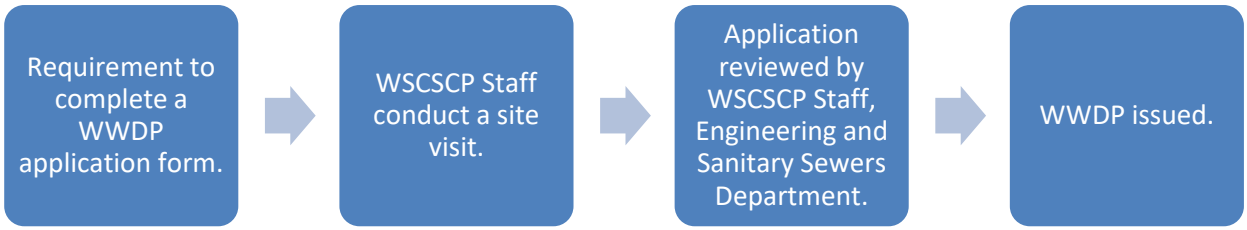

Figure 7. Wastewater Discharge Permit Application Process

New customers with wastewater that can potentially impact the conveyance system undergo an assessment process to determine whether they will be required to obtain a WWDP. It asks for

information such as nature and type of operation carried onsite, presence of prohibited, restricted, and/or hazardous waste onsite and in the wastewater, etc. Refer to Figure 8 for the workflow of the Wastewater Discharge Assessment process.

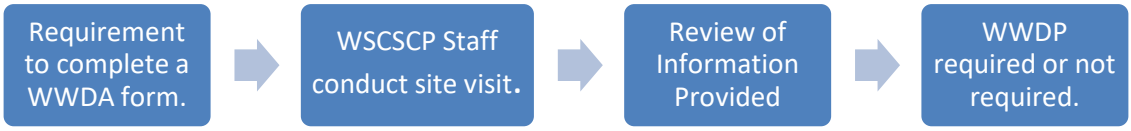

Figure 8. Wastewater Discharge Assessment Process

Table 10. Approved Wastewater Discharge Permits - 2020

Facility Type	Abbotsford	Mission
Biotechnology	3	0
Brewery / Winery	5	5
Cannabis Packaging	0	1
Correctional Facility	1	0
Crematorium / Funeral Home	2	0
Dairy Product Processing	3	1
Egg Processing	1	0
Fish Hatchery	1	0
Food Processing	6	0
Food Services	1	0
Fruits and Vegetable Processing	8	1
Granite / Stone Cutting	2	0
Hospital / Medical Facility	2	1
Industrial Laundry	1	0
Medical Waste Facility	1	0
Metal Finishers	2	3
Pet Food	1	0
Poultry Processing	3	0
Recycling / Waste Disposal Facility	1	1
Storage	1	0
Truck Wash Facility	1	0
Subtotal	46	13
Total	59	

2.5 Contaminant Reduction

Contaminant prioritization was determined through a risk assessment (see Appendix A) of prohibited and restricted wastes listed in the Sewer Bylaw for each municipality. The initial focus of the risk assessment was on highest risk contaminants, which later resulted in the identification of high-risk dischargers. Refer to Sections 2.5.1 through 2.5.6 for additional information regarding potential high-risk dischargers.

2.5.1 Hospitals

In 2020, wastewater sample collection discontinued on May 19, 2020 to minimize possible exposure to COVID-19 as these facilities were considered high risk. 2019 BOD and TSS data was used to calculate extra strength fees at these facilities for 2020. Sample monitoring will resume when the pandemic is over. Refer to Table 11 for a summary of the monitoring program at these locations.

Table 11. Summary of Hospitals Monitoring - 2020

	Number of Samples Collected	
Parameter	Hospital #1	Hospital #2
pH	19	8
BOD		
TSS		
Total Collected:	87	

2.5.2 Metal Finishing Industry

In 2020, sample monitoring of metal finishing businesses continued under Project 10 Metal Finishers. A composite sample from each business was submitted on a weekly basis to an accredited external laboratory. Overall, total metals from metal finishing industries showed a decline in levels of heavy metals due to the combined efforts of businesses and the WSCSCP staff. Wastewater monitoring and testing will continue to ensure businesses meet compliance requirements. Refer to Table 12 for a summary of samples collected and the percentage of non-compliance.

Table 12. Metal Finishing Industry Monitoring - 2020

Parameter	Number of Samples Collected	Number of Non-Compliant Samples
pH	61	3 (4.9%)
Total Copper	61	1 (1.6%)
Total Nickel	61	1 (1.6%)

2.5.3 Oil & Grease

Oil & Grease is a restricted waste with a Bylaw limit of 150 mg/L for total oil and grease and 15 mg/L for oil and grease hydrocarbons. A business that could potentially discharge oil and grease in their wastewater is required to install, operate, and maintain interceptors. Businesses with discharges exceeding the Bylaw limits for oil and grease are required to remove the waste immediately and submit a compliance plan outlining a remedial action and a timeline of its completion. Frequency of sample monitoring may increase until the results improve.

In 2020, WSCSCP staff submitted samples from five industrial customers under Project 14 Total Oil and Grease. Sample monitoring is based on an “as required” basis using visual examination of the sample to minimize cost and focus on other projects that required more frequent sampling. Refer to Table 13 for a summary of monitoring results.

Table 13. Oil and Grease Monitoring - 2020

Parameter	Number of Samples Collected	Number of Non-Compliant Samples	Range of Results
Total Oil and Grease	34	33 (97%)	234 – 2,190 mg/L

Refer to Figure 9 for the maximum total oil and grease result from 2007 to 2020. Highest maximum concentrations were due to high grease loads from one industry. Reduction in these concentrations and others is a result of WSCSCP staff working with industry to identify and remedy the issue.

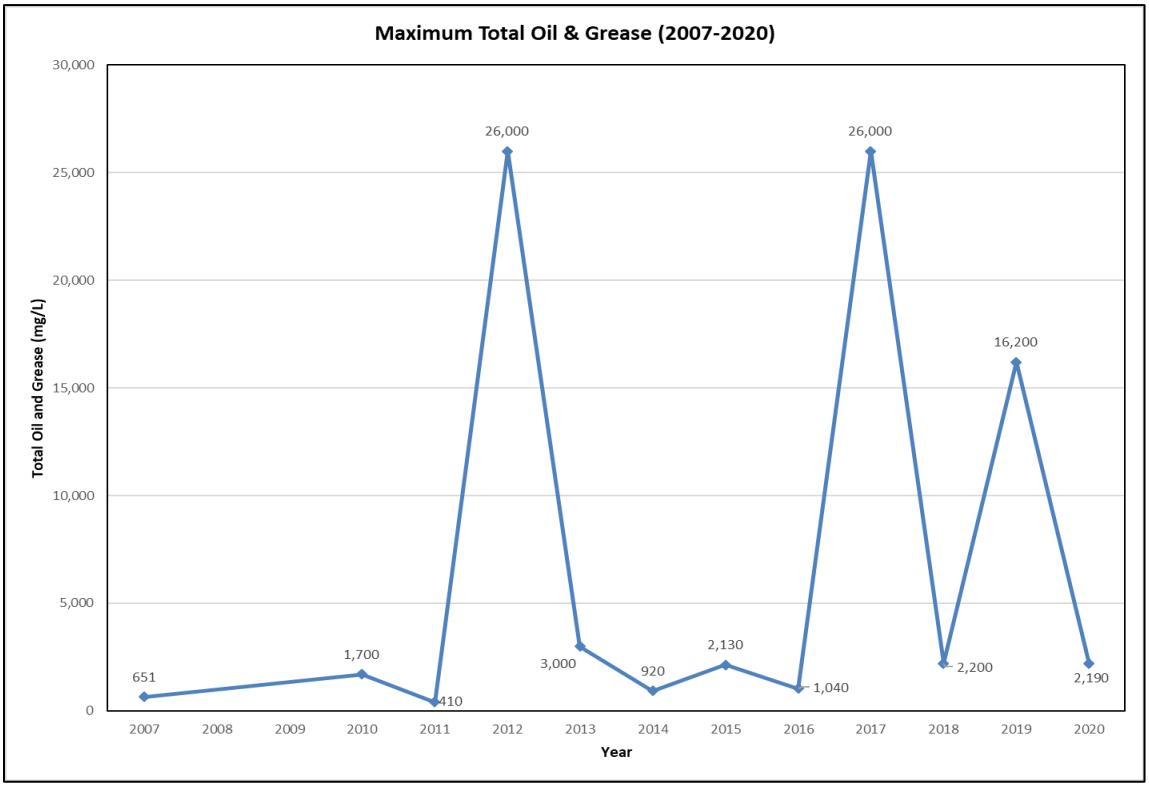

Figure 9. Maximum Total Oil and Grease from Various Industries (2007-2020)

WWDP holders included in the WSCSCP contaminant monitoring program are provided with all oil & grease monitoring data as it becomes available. Providing this data ensures the customers are aware of the quality of their wastewater discharge. Sample monitoring will continue in 2021. Table 14 is an example of fats, oil, and grease data sent to a business in 2020.

Table 14. Example of FOG Data from a Food Processing Facility - 2020

Sample Date:	Sample Time:	Total Oil and Grease (mg/L):
5-Mar-20	11:30 AM	1,230
26-Jun-20	10:00 AM	2,010
24-Jul-20	10:20 AM	918
15-Sep-20	11:00 AM	264
2-Oct-20	11:25 AM	490
14-Oct-20	11:00 AM	1,480
20-Oct-20	11:15 AM	1,260

2.5.4 Granite & Stone Cutting Industry

In 2020, sample monitoring of two granite and stone cutting customers continued under Project 11 Granite & Stone. Wastewater discharges from these businesses were analyzed for pH, TSS, and Total Metals and the results showed 87% compliance. Sample monitoring will continue in 2021.

WWDP holders included in the WSCSCP contaminant monitoring program are provided with all monitoring data as it becomes available. Providing this data ensures the customers are aware of the quality of their wastewater discharge. Table 15 is an example of data sent to a business in 2020.

Table 15. Example of Project 11 Granite & Stone Data - 2020

		Sample Date:	11-Sep-20	22-Sep-20	30-Sep-20
Analyte:	**Units:**	**Bylaw Limit:**		**RESULTS**	
Hardness	mg/L	-	9.85	10.1	9.86
Total Suspended Solids	mg/L	-	177.0	114.0	122.0
pH (grab)	---	**5.5 - 9.5**	7.6	8.2	7.7
Aluminum	mg/L	**50.0**	0.026	0.035	0.0503
Antimony	mg/L	-	0.00042	0.0020	0.00042
Arsenic	mg/L	**1.0**	0.00024	0.00022	0.00028
Barium	mg/L	-	0.0067	0.0092	0.00749
Beryllium	mg/L	-	<0.00010	<0.00010	<0.00010
Bismuth	mg/L	-	<0.000050	<0.000050	<0.000050
Boron	mg/L	**50.0**	0.021	0.027	0.022
Cadmium	mg/L	**0.2**	0.000088	0.000091	0.000096

Table 15. Example of Total Metals Data – 2020 *(Continued)*

		Sample Date:	11-Sep-20	22-Sep-20	30-Sep-20
Analyte:	**Units :**	**Bylaw Limit:**	**RESULTS**		
Calcium	mg/L		3.54	3.6	3.56
Cesium	mg/L		<0.000010	<0.000010	<0.000010
Chromium	mg/L	**4.0**	0.0083	0.559	0.0599
Cobalt	mg/L	**5.0**	0.00017	0.00025	0.00031
Copper	mg/L	**2.0**	0.064	0.108	0.187
Iron	mg/L	**10.0**	0.090	0.093	0.108
Lead	mg/L	1.0	0.0099	0.0129	0.018
Lithium	mg/L		<.0010	<0.0010	<0.0010
Magnesium	mg/L		0.25	0.263	0.233
Manganese	mg/L	**5.0**	0.0018	0.00412	0.00282
Mercury	mg/L	**0.1**	<0.0000050	<0.0000050	<0.0000050
Molybdenum	mg/L	**1.0**	0.00044	0.000506	0.000296
Nickel	mg/L	**2.0**	0.22	0.186	0.0894
Phosphorous	mg/L		<0.050	<0.050	<0.050
Potassium	mg/L		0.72	0.207	1.41
Rubidium	mg/L		0.00024	0.00021	0.00057
Selenium	mg/L	**1.0**	<0.000050	<0.000050	<0.000050
Silicon	mg/L		2.89	2.89	2.49
Silver	mg/L	**1.0**	0.000029	0.000089	0.000022
Sodium	mg/L		1.52	2.45	2.33
Strontium	mg/L		0.00982	0.0106	0.00919
Sulphur	mg/L		0.66	1.19	1.84
Tellurium	mg/L		<0.00020	<0.00020	<0.00020
Thallium	mg/L		<0.000010	<0.000010	<0.000010
Thorium	mg/L		<0.00010	<0.00010	<0.00010
Tin	mg/L		0.00041	0.00052	0.00046
Titanium	mg/L		<0.00030	<0.00030	0.00063
Tungsten	mg/L		<0.00010	<0.00010	<0.00010
Uranium	mg/L		<0.000010	<0.000010	0.000026
Vanadium	mg/L		<0.00050	<0.00050	<0.00050
Zinc	mg/L	3.0	0.0212	0.0235	0.0252
Zirconium	mg/L		<0.00020	<0.00020	<0.00020

2.5.5 pH

The Bylaw limit for pH of wastewater is 5.5 to 9.5 pH units. This limit is designed to protect the public, municipal staff, collection system, treatment systems, and the environment. In 2020, WSCSCP staff continued to collect composite samples from businesses for pH analysis. WSCSCP staff also measured field pH on composite and grab samples at each monitoring location, and set-up continuous monitoring of pH and temperature using in-line sensors in rotation at various locations. In 2020, WSCSCP staff continued discrete pH monitoring at three facilities to identify the pH at specific times during a 24-hour period. Discrete sampling method involves aliquots collected per individual sample interval for a 24-hour period. Discrete pH monitoring is

scheduled on a weekly basis and will continue in 2021. Refer to Table 16 for a summary of the field pH compliance monitoring, Table 17 for a summary of continuous monitoring sessions completed, and Table 18 for a summary of discrete sampling sessions.

Table 16. Wastewater pH Compliance Monitoring (Field Analysis) - 2020

	Number of Grab Samples Collected (for Field Analysis)	Number of Composite Samples Collected (for Field Analysis)	Number of Non-Compliant Samples
Total:	114	717	288 (40%)

Table 17. Continuous pH/Temperature Monitoring - 2020

	Number of Sessions Completed
In-line sensors (2 sensors)	32

Table 18. Summary of Discrete pH Testing Sessions - 2020

	Number of Sessions Completed
Discrete pH Testing	96

In 2020, contaminant monitoring of Wastewater Discharge Permit holders continued under Project 12 BOD & TSS Waste. WSCSCP staff provides the data collected at each location with each permit holder including continuous pH monitoring data and field pH of grab and composite samples, when available. Providing sample data ensures the customers are aware of the quality of their wastewater discharge.

In 2020, three businesses working towards compliance also received discrete pH data. Figure 10 is an example of continuous monitoring chart and Figure 11 is an example of discrete pH chart. Table 19 is an example of pH, BOD, and TSS data. All contaminant monitoring will continue in 2021.

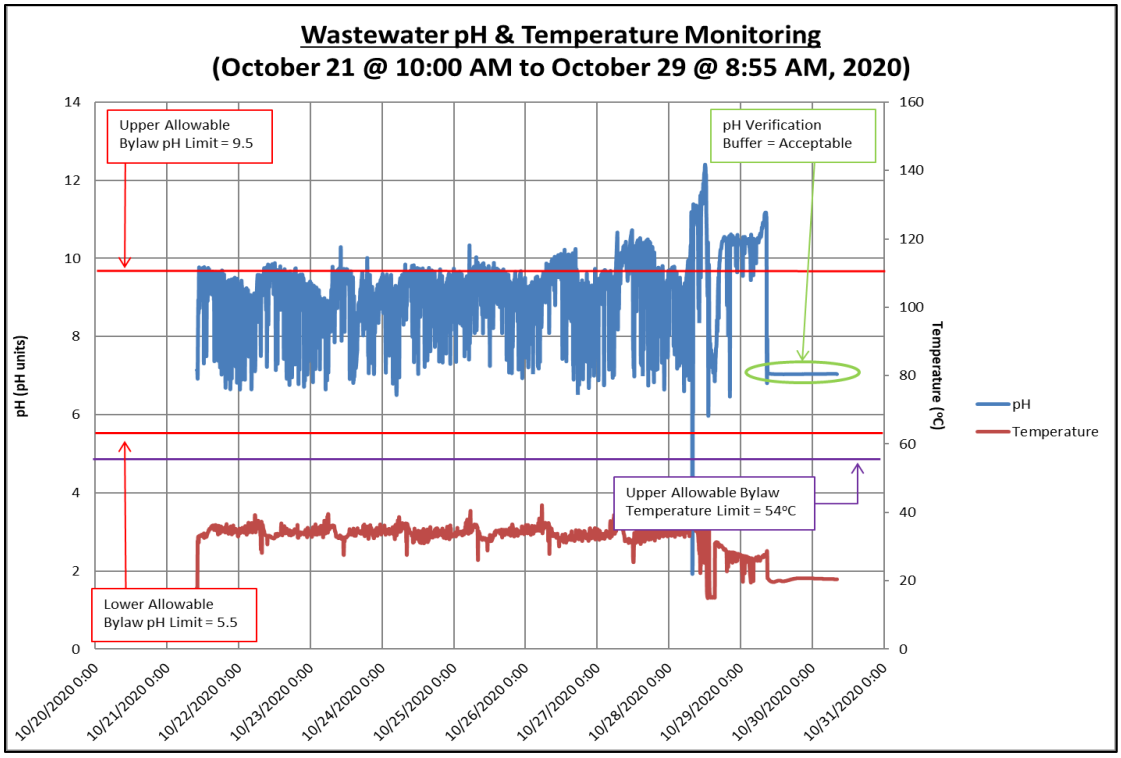

Figure 10. Example of Continuous pH and Temperature Monitoring Chart

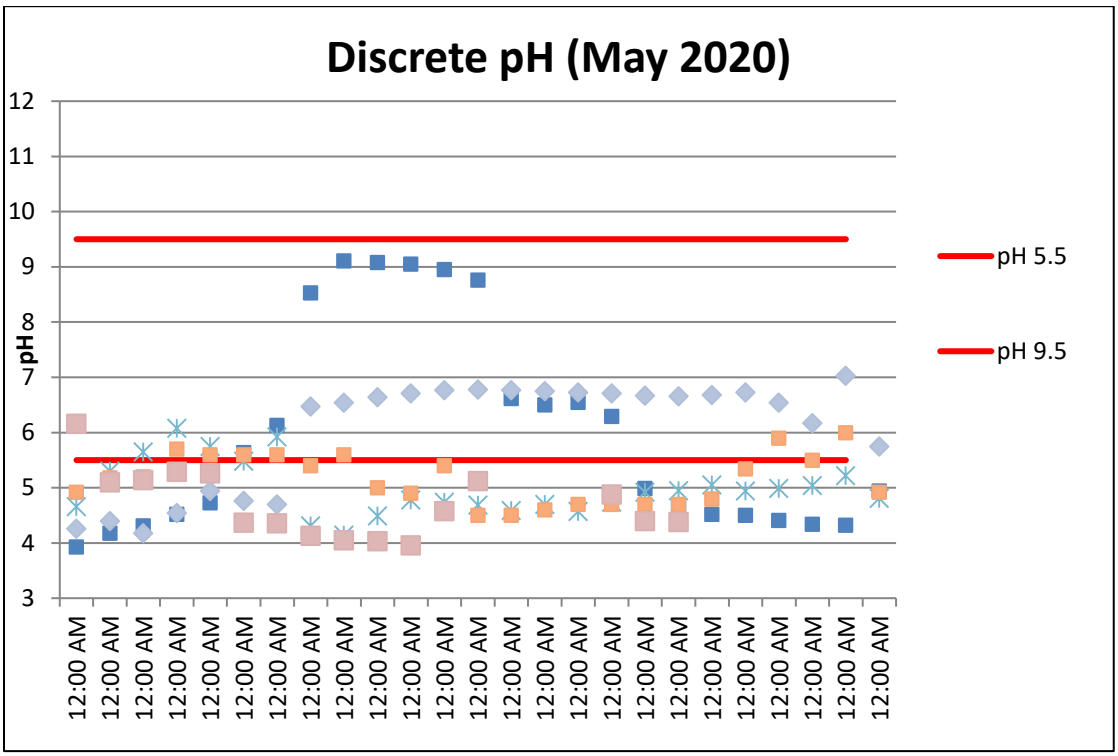

Figure 11. Example of Discrete pH Monitoring Chart

Table 19. Example of Contaminant Monitoring at a Dairy Processing Plant - 2020

Sample Date:	Data from Accredited External Laboratory:			Field Data (from sampling technician):		
	pH:	BOD (mg/L):	TSS (mg/L):	Analysis Time:	Composite pH:	Grab pH:
3-Jan-20	6.3	690	190	10:42 AM	6.5	7.0
6-Jan-20	7.1	1,110	283	8:30 AM	6.9	6.9
8-Jan-20	6.7	1,260	344	10:06 AM	6.7	6.8
13-Jan-20	6.7	836	449	10:00 AM	6.6	6.8
17-Jan-20	6.8	934	182	11:50 AM	6.7	6.5
22-Jan-20	6.0	803	320	9:38 AM	6.1	6.7
23-Jan-20	6.9	704	381	10:42 AM	6.9	6.9
30-Jan-20	6.4	857	298	8:30 AM	6.3	7.1

2.5.6 Total Metals

There are hundreds of potentially harmful contaminants in industrial, commercial and institutional (ICI) sewer discharges. Contaminant prioritization was determined through a risk assessment of prohibited and restricted wastes listed in the sewer use bylaw for each municipality. The initial focus of the risk assessment was on highest risk contaminants first and resulted in the identification of high-risk dischargers. The WSCSCP utilizes biosolids concentrations of specific metals to determine the reduction effectiveness for these contaminants.

The effectiveness of the WSCSCP indicates 17% reduction in biosolids total metals concentrations alone since 2006. Table 20 shows the effectiveness of the WSCSCP in the reduction of individual contaminants of concern (metals) from 2006 to 2020 and Figure 12 shows the reduction in Total Metals (total metals combined) from 2006 to 2020.

Table 20. Effectiveness of the WSCSCP Contaminant Reduction in Biosolids (2006-2020)

Contaminant	Reduction %	2006 (mg/kg)**	2020 (mg/kg)**	Biosolids Class A Limit (mg/kg)**
Arsenic	**70%**	14.6	4.4	75
Cadmium	**48%**	2.7	1.5	20
Chromium	**63%**	80	29.7	1060
Cobalt	**34%**	3.5	2.3	150
Copper	**35%**	901	585	2200
Lead	**54%**	43	20	500
Mercury	**57%**	3.1	1.6	5

Table 20. Effectiveness of the WSCSCP Contaminant Reduction in Biosolids (2006-2020) *(Continued)*

Contaminant	Reduction %	2006 (mg/kg)**	2020 (mg/kg)**	Biosolids Class A Limit (mg/kg)**
Molybdenum	**42%**	10.9	6.4	20
Nickel	**53%**	40	18.9	180
Selenium	**18%**	6.5	5.3	14
Zinc	**-6%**	996	1051	1850
Silver	**68%**	9.1	3.0	No limit

**Annual average concentration mg/kg (ppm) dry weight.

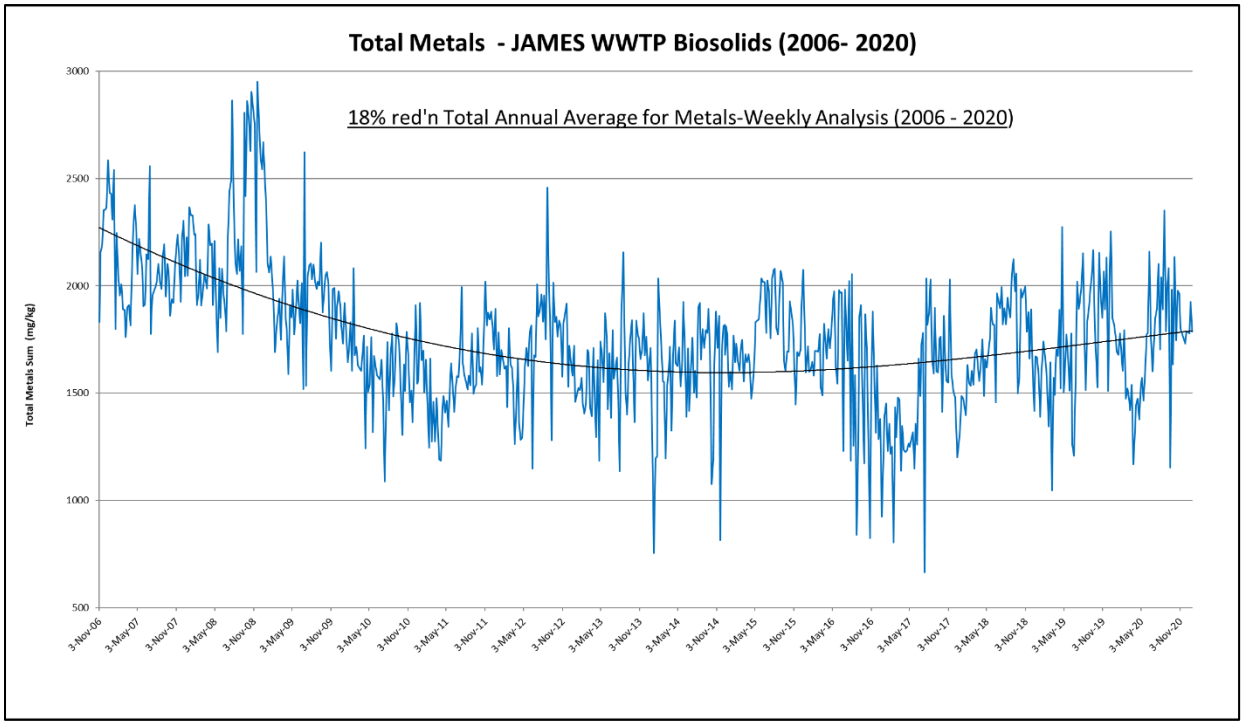

Figure 12. Total Metals Reduction in Biosolids (2006-2020)

2.6 Key Manholes

In 2020, the City of Abbotsford continued to accept sanitary sewer wastewater from the City of Sumas. WSCSCP staff monitored the wastewater for Bylaw compliance purposes and for the calculation of biochemical oxygen demand (BOD) and total suspended solids (TSS) waste fees. The monitoring program consisted of weekly 24-hour composite samples collected and submitted to an accredited external laboratory for pH, BOD and TSS analysis under Project 9 Key Manhole. Sampling access was obtained at a specific manhole located just north of the border on the trunk line from Sumas.

In addition to the weekly samples, one sample was collected quarterly and submitted to an accredited external laboratory for the following parameters:

- Total metals
- Hexavalent chromium
- Trivalent chromium
- Sulfide
- Sulfate

In 2021, the parameters listed below will be added to meet the 2008 Sumas Wastewater Agreement.

- Total cyanide
- Total oil and grease
- Total BTEX
- Tetrachloroethylene
- Organic contaminants
- Oil and grease (hydrocarbons)
- Polycyclic aromatic hydrocarbons (PAH)

Refer to Table 21 for a summary of the monitoring program. Monitoring of the Sumas trunk line will continue in 2021.

Table 21. Key Manhole Monitoring - 2020

Parameter	Number of Samples Collected
pH	48
BOD	
TSS	
Total Metals	4
Hexavalent Chromium	
Trivalent Chromium	
Sulphate	
Sulphide	
Total:	52

2.7 Unauthorized Discharge Events

WSCSCP staff encountered 9 separate unauthorized discharge events in 2020. Wastewater Discharge Permit holders are required to immediately notify the City as specified in Schedule "I" of the City of Abbotsford Sewer Rates and Regulations Bylaw, and to undertake appropriate remedial action. They are required to provide information such as the cause, source, volume of the unauthorized discharge, details of the remedial action plan and timeline leading up to its completion. The quality and volume of the discharge may result in fines and penalties. Refer to Table 22 for a summary of all unauthorized discharge events that occurred in 2020.

Table 22. Unauthorized Discharge Events and Non-compliances – 2020

Discharger	Date of Event	Details of Event	Corrective Action Taken
Egg Processing	February 7, 2020	Obstructive waste (paper towels and gloves) in the sampling manhole.	Business trained their staff to dispose of wastes appropriately.

Table 22. Unauthorized Discharge Events and Non-compliances – 2020 *(Continued)*

Discharger	Date of Event	Details of Event	Corrective Action Taken
Truck Washing Facility	February 24, 2020	Obstructive waste (silt) in the sampling manhole.	Business hired a disposal company to clean out the sampling manhole.
Food Processing	March 26, 2020	Obstructive waste (flour and dough) caused sewer main blockage at the business's property.	Business trained their staff to dispose of wastes appropriately.
Egg Processing	May 28, 2020	Obstructive waste (paper towels and gloves) in the sampling manhole.	Business trained their staff to dispose of wastes appropriately.
Dairy Processing	June 5, 2020	Restricted waste (lactose permeate) entered the sanitary sewer.	Business repaired faulty outlet valve and reinforced internal policy to cap all unused outlets.
Egg Processing	June 22, 2020	Obstructive waste (paper towels and gloves) in the sampling manhole.	Business trained their staff to dispose of wastes appropriately.
Food Processing	July 24, 2020	Obstructive waste (sprouted grains) found in sewer line.	Business trained their staff to dispose of wastes appropriately and installed screens on all drains inside the facility.
Food Processing	September 3, 2020	Restricted Waste (50% diluted Hydrogen Peroxide, Peroxyacetic Acid, and Acetic Acid) entered the sanitary sewer.	Business installed engineering controls and they purchased a larger spill containment.
Food Processing	November 1, 2020	Obstructive waste (oat grain) entered the sanitary sewer and caused sewer backup.	Business contacted a disposal company to purge lines in the building. They also discontinued using the equipment that caused the accidental discharge.

2.8 Unusual Wastewater Influent Events at the JAMES Plant (2020)

The JAMES Plant receives occasional wastewater discharges with unusual properties and reports it to WSCSCP staff. The WSCSCP staff will then investigate for possible source of these unusual discharges using the provided information on the report along with available analytical data. The JAMES Plant collects two grab samples and submits it to the JAMES Plant Laboratory where it is stored until investigation is complete. Refer to Table 23 for a summary of all the unusual events at the JAMES Plant that occurred in 2020.

Table 23. Summary of Unusual Wastewater Influent Events (2020)

Date of Discharge	Details of Unusual Wastewater Discharge Event
April 21, 2020	Combined influent flow was foamy.
August 16, 2020	The pH of the Abbotsford influent flow decreased to 6.0.
September 3, 2020	The pH of the combined influent flow decreased to 6.0.
December 10, 2020	Combined influent flow was darker and pH was lower than average.

3.0 Budgeting & Expenditures

Refer to Table 24 for the breakdown of the budget items and expenditures in 2020. Refer to Table 25 for the budget for 2021.

Table 24. Source Control Budgeting & Expenditures – 2020

	Budgeted Amount	Actual Expenditure
Labor	$280,970	$284,981
Equipment & Installation Costs	$23,000	$14,871
Analytical Costs	$49,000	$30,698
Total:	352,970	330,550

Table 25. Source Control Budget – 2021

Budget Item	Budgeted Amount
Labor	$280,970
Equipment & Installation Costs	$23,000
Analytical Costs	$52,000
Total:	$355,970

4.0 Program Planning & Development

The following is a summary of the main activities and achievements related to the management, planning, and administration of the WSCSCP in 2020:

- Continued reduction in residuals contaminants (metals) through COP inspections;
- Continued working with industries and commercial businesses to reduce oil and grease discharges;
- Continued participation with BC Wastewater Association Source Control Community of Practice meetings;
- Identified items within the Sewer Regulations Bylaw No. 2664-2017 that need to be removed, added, or amended;
- Integrated into AMANDA software for automation, management, and document control of Codes of Practice inspections; and
- Resumed inspections of businesses under the Code of Practice for Dry Cleaning Operations.

5.0 Next Steps – 2021

- Bylaw amendments (Sewer Bylaw and Ticketing Bylaw);
- Development and implementation of the Code of Practice for Food Services;
- Adding required and recommended PPE controls based on biohazard risk assessment; and
- Integration into AMANDA software for automation, management, and document control of Wastewater Discharge Permits.

B. JAMES WWTP Laboratory

1.0 Introduction

The Joint Abbotsford Mission Environment System (JAMES) Wastewater Treatment Plant (WWTP) is co-owned by the City of Abbotsford and the District of Mission. Governance is provided through the Abbotsford/Mission Water and Sewer Commission (WSC), which is comprised of elected representatives and employees of the City of Abbotsford and the District of Mission. The City of Abbotsford is the operator of the JAMES WWTP including the laboratory. The laboratory is part of the Utilities Environment division within the Engineering / Project Management / Solid Waste and Environmental Services department of the City of Abbotsford.

The JAMES WWTP operates and monitors liquid and solid discharges under the federal Wastewater Systems Effluent Regulations (WSER), the provincial Municipal Wastewater Regulation (MWR), and the provincial Organic Matter Recycling Regulations (OMRR). In addition, the JAMES WWTP is required to report data annually to the National Pollutant Release Inventory (NPRI) under the Canadian Environmental Protection Act, 1999 (CEPA 1999). The laboratory performs Quality Assurance / Quality Control (QA/QC) testing as required by each regulation and performs a variety of sampling and analysis for special projects and other plant performance requirements. Customers for the JAMES WWTP Laboratory include, but are not limited to, the JAMES WWTP Operations, City of Abbotsford, District of Mission, British Columbia Ministry of Environment, and Environment Canada.

Samples are collected and analyzed in the laboratory for the following objectives:

- To monitor plant performance;
- To monitor plant influent and effluent quality;
- To monitor quality of biosolids produced; and
- To meet WSER, MWR, OMRR and NPRI requirements.

1.1 JAMES WWTP Laboratory Values

The JAMES WWTP Laboratory believes in:

- Modeling the highest standards of fair and ethical conduct, as well as technical and professional expertise to, and for, its Customers and other stakeholders of the JAMES WWTP Laboratory;
- The critical importance of consistency and scientific validity in the quality of data and information generated by the JAMES WWTP Laboratory;
- The maintenance of a safe working environment and participating in change for the protection of public health and safety;
- Fostering transparency between the JAMES WWTP Laboratory, it's Customers, stakeholders and other organizations involved in the success of the JAMES WWTP Laboratory.

1.2 JAMES WWTP Laboratory Quality Policy and Quality Objectives

The JAMES WWTP Laboratory's highest priority is to produce and deliver consistent, technically valid results to Customers by allotting 27% of laboratory resources on meeting quality policy and quality objectives. It sets the following Quality Objectives:

- Maintain a documented quality system that incorporates traceability and high quality assurance of laboratory data;
- Employ qualified and trained staff that consistently demonstrate proficient work;
- Use only valid test methods while incorporating work instructions on quality control;
- Use equipment, supplies, and reference materials that are certified and/or meet required specifications of individual test methods; and
- Handle all samples, from acquisition to disposal, with adequate security, protection of integrity using well-defined processes.

1.3 Proficiency Testing

Proficiency Testing (PT) is a special type of inter-laboratory comparison study; a quality assurance tool that enables laboratories to monitor their performance and compare their results against similar laboratories. PT Canada Proficiency Testing Program consists of four samples per study, two studies per year. The analyte concentrations in these samples are unknown to the participating laboratory, which analyses the samples and reports the results for evaluation. Successful participation is also used as one of the surveillance tools in support of laboratory accreditation to ISO/IEC 17025.

PT Canada is accredited by the American Association for Laboratory Accreditation (A2LA) and has recently been acknowledged to be fully conformant to the new international PT standard ISO/IEC 17043:2010.

Here is a summary of all parameters the JAMES WWTP Laboratory participates in:

- Ammonia
- Biochemical Oxygen Demand
- Total Suspended Solids
- pH

In October 2020, the results for BOD were unacceptable due to equipment failure. The laboratory has implemented some internal corrective actions to prevent this moving forward. Refer to Table 26 for a summary of proficiency tests completed in 2020.

Table 26. Proficiency Testing (PT) Results – 2020

Parameter:	March	October
Ammonia	Acceptable	Acceptable
TSS	Acceptable	Acceptable
BOD	Acceptable	Unacceptable
pH	Acceptable	Acceptable

2.0 Laboratory Activities & Accomplishments – 2020

2.1 Internal Laboratory Analysis

Internal laboratory analysis performed at the JAMES WWTP Laboratory included the following parameters in 2020:

- Acids/Alkalinity of Digested Sludge;
- Ammonia;
- Biochemical Oxygen Demand (BOD);
- Carbonaceous Biochemical Oxygen Demand (cBOD);
- Chemical Oxygen Demand (COD);
- pH;
- Settleable Solids (SS);
- Total Chlorine;
- Total Solids (TS);
- Total Suspended Solids (TSS); and
- Volatile Solids (VS).

Table 27 provides a summary of the overall number of tests performed in the JAMES WWTP Laboratory in 2020. Non-routine tests include additional requests from JAMES WWTP Operations.

Table 27. Annual Laboratory Analysis Summaries – 2020

Type of Sample:	# of Tests Performed:
Routine	11,537
Non-Routine	134
Quality Control (QA/QC)	9,725
PT Canada	36
Total:	21,432

JAMES Laboratory staff continued to follow test methods documented in the JAMES WWTP Methods Manual for all analyses performed in the JAMES WWTP Laboratory. Table 28 provides a summary of the test methods followed in 2020.

Table 28. Summary of Test Methods at the JAMES WWTP Laboratory – 2020

SOP Name:	Document #:
Test Method for the Determination of pH	TM2014-01-V3
Test Method for the Determination of Ammonia by SIE	TM2014-02-V3

Table 28. Summary of Test Methods at the JAMES WWTP Laboratory – 2020 *(Continued)*

SOP Name:	Document #:
Test Method for the Determination of Total Suspended Solids	TM2014-03-V3
Test Method for the Determination of Total Solids	TM2014-04-V4
Test Method for the Determination of Settleable Solids	TM2014-05-V1
Test Method for the Determination of Volatile Solids	TM2014-06-V3
Test Method for the Determination of Biochemical Oxygen Demand	TM2014-07-V3
Test Method for the Determination of Chemical Oxygen Demand	TM2014-08-V2
Test Method for the Determination of Total Chlorine	TM2014-10-V3
Test Method for the Determination of Acid/Alkalinity of Digested Sludges Using Manual Titration	TM2014-11-V5
Test Method for the Determination of Acid/Alkalinity of Digested Sludges Using Automated Titration	TM2018-21-V2
Method for the Use of Automatic Pipettes	TM2014-13-V1
Method for the Sample Collection and Acceptance Criteria for Composite Samples	TM2014-14-V1
Method for the Operation and Maintenance for the ELGA Purelab Unit	TM2014-15-V2
Method for the Use and Maintenance of the Emergency Shower and Eyewash Station	TM2014-16-V1
Method for Biosolids and Sludge Grab Sample Collection for Microbiological Analysis	TM2014-17-V1
Method for Effluent & Reclaim Grab Sample Collection for Microbiological Analysis	TM2014-18-V1
Method for Bio-filter Sample Collection for Total Solids Analysis	TM2014-19-V1
Method for SCT MLSS Sample Collection for Total Suspended Solids Analysis	TM 2014-20-V1

2.1.1 Acid/Alkalinity of Digested Sludge Analysis

Volatile Acids/Alkalinity analysis is an indicator for potential upset in the digester. Volatile acids are short chain organics produced by the breakdown of various substances such as carbohydrates, proteins, and fats in the digestion process at a wastewater treatment plant. Alkalinity is the measure of the ability of a sample to neutralize acids. Excessive concentrations of volatile acids in a digester can have a negative effect on treatment processes. Too low of concentrations of alkalinity in a digester can also negatively affect the treatment processes. The "Test Method for the Determination of Acid/Alkalinity of Digested Sludge" (TM2014-11-V5) is used

for this analysis. Refer to Tables 29 and 30 for the summaries of the annual Acid/Alkalinity analysis performed in the JAMES WWTP Laboratory in 2020.

Table 29. JAMES WWTP Laboratory Total Alkalinity Analysis Summaries – 2020

Sample Location:	# Tests Performed:	% Change in # of Tests Performed (2018 vs 2019):	Average Result (mg/L):
Digester #1	350	+2.3%	3,363
Digester #2	350	+2.3%	3.480
Digester #3	351	+2.0%	3,011
SBR Initial	95	+10.5%	3,224
SBR Final	90	+9.8%	460
Influent (Composite)	44	+12.8%	180
Effluent (Composite)	44	+12.8%	78
QC Samples	355	+7.1%	-
Total Samples Analyzed:	1,679	+3.4%	-

Table 30. JAMES WWTP Laboratory Volatile Acids Analysis Summary – 2020

Sample Location:	# Tests Performed:	Average Result (mg/L):
Digester #1	350	318
Digester #2	350	330
Digester #3	351	347
Total # of Volatile Acids Tests Performed:	1,051	-

2.1.2 Ammonia Analysis

Ammonia is naturally present in wastewaters and produced by the deamination of organic nitrogen-containing compounds and by hydrolysis of urea. This method is applicable to wastewater samples with a concentration up to 100 mg/L. Ammonia analysis is performed in the JAMES WWTP Laboratory using a Thermo Scientific Ammonia Ion Selective Electrode and an Accumet XL250 pH/Ion Meter. The "Test Method for the Determination of Ammonia by Selective Ion Electrode" (TM2014-02-V3) is used for this analysis and is based on Method 4500-NH3 D. Ammonia-Selective Electrode in the Standard Methods for the Examination of Water and Wastewater, 22nd Edition. Refer to Table 31 for the summary of the annual ammonia analysis performed in the JAMES WWTP Laboratory in 2020.

Table 31. JAMES WWTP Laboratory Ammonia Analysis Summaries – 2020

Sample Location / Type:	# Tests Performed:	Average Result (mg/L):
Combined Influent	329	30
Abbotsford Influent	296	33
Mission Influent	214	27
Primary Effluent	98	38
Trickling Filter Effluent	97	17
Final Effluent	333	14
SBR Initial	93	1,055
SBR Final	90	462
LC50 Grab	4	16
CALA PT Samples	8	-
QC Samples	718	-
Total # of Ammonia Tests Performed:	2,280	-

2.1.3 BOD & cBOD Analysis

The Biochemical Oxygen Demand (BOD) test is an empirical test used to determine the oxygen requirements of wastewaters and effluents using standardized laboratory procedures. The test has its widest application in measuring waste loadings to treatment plants and in evaluating the BOD-removal efficiency of such treatments systems. BOD analysis is performed in the JAMES WWTP Laboratory using an Accumet Self-Stirring DO Probe and an Accumet XL600 Dissolved Oxygen Meter. Samples are placed in a Fisher Scientific Brand incubator at 20°C. The "Test Method for the Determination of Biochemical Oxygen Demand" (TM2014-07-V5) is used for this analysis and is based on Method 5210 B. 5-Day BOD Test in the Standard Methods for the Examination of Water and Wastewater, 22nd Edition.

In 2020, the requirement for BOD tests continued to be limited to the Sequence Batch Reactor samples (SBR Initial & SBR Final), Seed (Primary Effluent Grab), CALA Proficiency Testing samples and its accompanying Quality Control samples. Oxidation of reduced forms of nitrogen, such as ammonia and organic nitrogen, can be used by microorganisms and exert nitrogenous demand. Some BOD analyses completed in the JAMES WWTP Laboratory involve the use of nitrification inhibitors and are reported as Carbonaceous Biochemical Oxygen Demand (cBOD) to differentiate from uninhibited BOD results. Refer to Tables 32 and 33 for the summaries of annual BOD and cBOD analyses performed in the JAMES WWTP Laboratory in 2020.

Table 32. JAMES WWTP Laboratory cBOD Analysis Summaries – 2020

Sample Location / Type:	# Tests Performed:	Average Result (mg/L):
Combined Influent	289	209
Combined Influent (Soluble)	50	62
Abbotsford Influent	261	275
Mission Influent	190	275
Primary Effluent	95	184
Primary Effluent (Soluble)	49	85
Trickling Filter Effluent	93	35
Trickling Filter Effluent (Soluble)	46	3
Final Effluent	289	5
Final Effluent (Soluble)	50	1
SBR Initial	59	144
SBR Final	57	26
QC Samples	560	-
Total # of Tests Performed:	2,088	-

Table 33. JAMES WWTP Laboratory BOD Analysis Summaries – 2020

Sample Location / Type:	# Tests Performed:	Average Result (mg/L):
SBR Initial	48	156
SBR Final	46	60
Seed	89	245
CALA PT Samples	8	-
QC Samples	232	-
Total # of Tests Performed:	423	-

2.1.4 COD Analysis

The Chemical Oxygen Demand (COD) test is a measure of the oxygen equivalent of the organic matter content of a sample that is susceptible to oxidation by a strong chemical oxidant. COD analysis is performed in the JAMES WWTP Laboratory using a HACH COD reactor, HACH COD2 Mercury-Free COD Reagent (0-1500ppm range) and a HACH D/R 2000 Direct Reading

Spectrophotometer. The "Test Method for the Determination of Chemical Oxygen Demand" (TM2014-08-V1) is used for this analysis and is based on Method 5220 D. Closed Reflux, Colorimetric Method in the Standard Methods for the Examination of Water and Wastewater, 22nd Edition. In 2020, only CALA Proficiency Testing samples and its accompanying Quality Control samples undergo COD analysis. Refer to Table 34 for the summary of annual COD analysis performed in the JAMES WWTP Laboratory in 2020.

Table 34. JAMES WWTP Laboratory COD Analysis Summaries – 2020

Sample Location / Type:	# Tests Performed:
CALA PT Samples	8
QC Samples	6
Total # of COD Tests Performed:	14

2.1.5 pH Analysis

Measurement of pH is one of the most important and frequently used tests in water chemistry. Practically every phase of water supply and wastewater treatment is pH dependent. pH is defined as the negative log of the concentration of hydrogen ions, or pH = -log [H+]. pH Analysis is performed in the JAMES WWTP Laboratory using a ROSS Sure-flow pH Electrode (Orion 9109WP) and an Accumet Model 25 pH/ion meter. Calibration of the electrode uses three buffers (pH 4, 7 and 10) and a pH 8 control standard validates the calibration. The "Test Method for the Determination of pH" (TM2014-01-V3) is used for this analysis and is based on Method 4500-H+ pH Value in the Standard Methods for the Examination of Water and Wastewater, 22nd Edition. Refer to Table 35 for the summary of the annual pH analysis performed in the JAMES WWTP Laboratory in 2020.

Table 35. JAMES WWTP Laboratory pH Analysis Summaries – 2020

Sample Location / Type:	# Tests Performed:	Average Result (mg/L):
Combined Influent	330	7.2
Abbotsford Influent	297	7.3
Mission Influent	215	7.1
Primary Effluent	99	7.1
Trickling Filter Effluent	96	7.3
Final Effluent	334	7.5
Final Effluent Grab	325	7.1
SBR Initial	96	7.8
SBR Final	90	6.5

Table 35. JAMES WWTP Laboratory pH Analysis Summaries *(Continued)*

Sample Location / Type:	# Tests Performed:	Average Result (mg/L):
Digester #1	336	7.3
Digester #2	336	7.4
Digester #3	336	7.3
Seed (for BOD)	90	6.7
Pasteurized Sludge in Holding Tank (PSHT)	12	6.1
Hypo-feed Water	57	6.7
QC Samples	1,874	-
CALA PT Samples	8	-
Total # of pH Tests Performed:	4,931	-

2.1.6 Settleable Solids Analysis

Settleable Solids is the material in a sample that settles out of suspension within a defined period. Settleable Solids analysis is performed in the JAMES WWTP Laboratory using Imhoff glass cones. The "Test Method for the Determination of Settleable Solids" (TM2014-05-V1) is used for this analysis and is based on Method 2540 F. Settleable Solids in the Standard Methods for the Examination of Water and Wastewater, 22nd Edition. Refer to Table 36 for the summary of the annual Settleable Solids analysis performed in the JAMES WWTP Laboratory in 2020.

Table 36. JAMES WWTP Laboratory Settleable Solids Analysis Summaries – 2020

Sample Location / Type:	# Tests Performed:	Average Result (mg/L):
Combined Influent	325	15.6
Final Effluent	328	0.1
Total # of Settleable Solids Tests Performed:	653	-

2.1.7 Total Chlorine Analysis

In 2020, JAMES WWTP upgraded the wastewater disinfection system from Chlorine gas and Sulphur Dioxide to ultraviolet light. This upgrade eliminates chemical handling requirements in the treatment process thereby improving the health and safety of the JAMES WWTP operators and lowering greenhouse gas emissions. JAMES WWTP Laboratory discontinued Total Chlorine analysis.

2.1.8 Total Solids Analysis

Total Solids (TS) is the residue left in the vessel after evaporation of a sample and its subsequent drying in an oven at a defined temperature. Total Solids analysis is performed in the JAMES Treatment Plant Laboratory using disposable aluminum pans. The "Test Method for the

Determination of Total Solids" (TM2014-04-V4) is used for this analysis and is based on Method 2540 B. Total Solids Dried at 103-105°C in the Standard Methods for the Examination of Water and Wastewater, 22nd Edition. Refer to Table 37 for the summary of the annual Total Solids analysis performed in the JAMES WWTP Laboratory in 2020.

Table 37. JAMES WWTP Laboratory Total Solids Analysis Summary – 2020

Sample Location / Type:	# Total Solids Tests Performed:	Average Result (%):
Digester #1	70	1.52
Digester #2	70	1.45
Digester #3	70	1.72
Raw Sludge	70	3.54
Waste Solids Thickener (WST)	67	4.58
Waste Bottom Sludge (WBS)	68	0.62
WST Filtrate	66	0.057
Polymer	68	0.59
Bottom Center	68	1.48
Centrifuge Biosolids	68	21.86
Centrate	69	0.27
Biofilter #1	50	31.86
Biofilter #2	50	33.85
Biofilter #3	50	33.61
QC Samples	502	-
Total Solids Tests Performed:	1,406	-

2.1.9 Volatile Solids Analysis

The residue obtained from the Test Method for the Determination of Total Solids (TS) (TM2014-04-V1) is ignited to constant weight at 550°C. The remaining solids represent the fixed total, dissolved or suspended solids while the weight lost on ignition is the volatile solids. The determination is useful in control of wastewater treatment plant operation because it offers a rough approximation of the amount of organic matter present in the solid function of wastewater, activated sludge, and industrial waste. The JAMES WWTP Laboratory uses the Standard Methods for the Examination of Water and Wastewater, 22nd edition, Method 2540 E Fixed and Volatile Solids Ignited at 550°C. Refer to Table 38 for the summary of annual Volatile Solids analysis performed in the JAMES WWTP Laboratory in 2020.

Table 38. JAMES WWTP Laboratory Volatile Solids Analysis Summary – 2020

Sample Location / Type:	# Volatile Solids Tests Performed:	Average Result (%):
Digester #1	70	78.0
Digester #2	70	77.2
Digester #3	70	79.9
Raw Sludge	70	91.5
Waste Bottom Sludge (WBS)	68	83.6
QC Samples	451	-
Total Tests Performed:	799	-

2.1.10 Total Suspended Solids (TSS) Analysis

The type of filter holder, the pore size, porosity, area, and thickness of the filter and the physical nature, particle size, and amount of material deposited on the filter are the principal factors affecting separation of suspended from dissolved solids. Total Suspended Solids (TSS) is the portion that is retained on the filter. TSS analysis is performed in the JAMES WWTP Laboratory using a fiber filter circles. The "Test Method for the Determination of Total Suspended Solids (TM2014-03-V3)" is used for this analysis and is based on Method 2540 D. Total Suspended Solids Dried at 103-105°C in the Standard Methods for the Examination of Water and Wastewater, 22nd Edition. Refer to Table 39 for the summary of the annual TSS analysis performed in the JAMES WWTP Laboratory in 2020.

Table 39. JAMES WWTP Laboratory TSS Analysis Summary – 2020

Sample Location / Type:	# Tests Performed:	Average Result (mg/L):
Combined Influent	323	251
Abbotsford Influent	290	362
Mission Influent	210	193
Primary Effluent	99	182
Trickling Filter Effluent	98	153
Final Effluent	328	8
SCT #1	12	2313

Table 39. JAMES WWTP Laboratory TSS Analysis Summary – 2020 *(continued)*

Sample Location / Type:	# Tests Performed:	Average Result (mg/L):
SCT #2	12	2,271
QC Samples	763	-
CALA PT Samples	8	-
Total # of TSS Tests Performed:	2,143	-

2.1.11 Additional Analysis Projects

JAMES WWTP Laboratory receives requests for additional analysis from the JAMES WWTP Operations and Drainage & Wastewater engineers. The data is used for future planning and project management at the JAMES Wastewater Treatment Plant. Refer to Table 40 for a summary of all the additional analyses performed in the JAMES WWTP Laboratory and Table 41 for a summary of all the additional analyses submitted for external laboratory testing in 2020.

Table 40. JAMES WWTP Laboratory Additional Analysis Project Summary – 2020

Additional Analysis:	# Tests Performed:	Period:
Chemical Oxygen Demand	12	January-July
Total Solids	1	March
Chemical Oxygen Demand	2	March
Total # of TSS Tests Performed:	15	-

Table 41. JAMES WWTP External Laboratory Additional Analysis Summary – 2020

Additional Analysis:	# Tests Performed:	Period:
Volatile Fatty Acids	3	January and March
Total Ammonia	5	February and March
Dissolved Phosphorus	5	February and March
Dissolved Copper	5	February and March
Volatile Fatty Acids	1	March
Resins / Fatty Acids	1	March
Total # of TSS Tests Performed:	20	-

2.2 External Laboratory Projects

External laboratory analyses performed by an accredited external laboratory in 2020 include the following projects:

- Project #1 - Weekly Influent / Effluent
- Project #2 - Bi-Monthly Influent / Effluent
- Project #3 - Effluent Toxicity (LC50)
- Project #4 – JAMES Laboratory Water
- Project #5 – Total Dissolved Solids
- Project #6 – WSER Samples
- Project #7 – Weekly Biosolids
- Project #8 – Monthly Biosolids
- Project #9 – Key Manhole Project
- Project #10 – Metal Finishers
- Project #11 – Granite / Stone Cutting
- Project #12 – BOD & TSS Waste Program
- Project #13 – Biosolids Quality Control
- Project #14 – Total Oil & Grease
- Project #15 – Total Metals
- Project #16 – Weekly Fecal Coliform
- Project #17 – Digester Total Metals
- Project #18 – TLW (Truck Liquid Waste)
- Project #20 – Miscellaneous

Refer to Sections 2.2.1 to 2.2.9 for detailed information regarding the above-listed projects. Table 42 gives an overall summary of the number of samples submitted to an external laboratory in 2020.

Table 42. Annual External Laboratory Sample Submission Summary – 2020

Samples Submitted to:	# of Samples Submitted in:	% Change (2019 vs. 2021):
Source Control Samples	1,383	+2.1%
JAMES WWTP Samples	1,582	+34.1%

2.2.1 Project #1 - Weekly Influent & Effluent Project

On a weekly basis, samples of the combined influent flow entering the JAMES WWTP and of the final effluent leaving the JAMES WWTP are collected. These samples are submitted to an external laboratory for total metals analysis. Refer to Table 43 for the summary of the annual Weekly Influent and Effluent Project in 2020. Sampling for this project will continue in 2021.

Table 43. Weekly Influent & Effluent Project Summary (External Lab Data) – 2020

	Annual Average Result (mg/L)	
Analyte:	Combined Influent	Final Effluent
Total Hardness ($CaCO_3$)	72.3	70.7
Ortho-Phosphate (P)	N/A	5.35

Table 43. Weekly Influent & Effluent Project Summary (External Lab Data) – 2020 *(cont.)*

	Annual Average Result (mg/L)	
Analyte:	Combined Influent	Final Effluent
Aluminum	0.30	0.049
Antimony	0.0004	0.00028
Arsenic	00012	0.00089
Barium	0.024	0.0094
Beryllium	<0.0001	<0.0001
Bismuth	0.0025	0.00046
Boron	0.11	0.11
Cadmium	0.0001	0.000030
Calcium	20.4	19.65
Chromium	0.0019	0.00063
Cobalt	0.00014	0.00028
Copper	0.08	0.041
Iron	0.93	0.26
Lead	0.0021	0.00071
Lithium	0.0020	0.0020
Magnesium	5.2	5.24
Manganese	0.095	0.066
Mercury	0.00006	0.00002
Molybdenum	0.0013	0.00098
Nickel	0.0033	0.0023
Phosphorus	6.45	5.92
Potassium	19.8	20.11
Selenium	0.00058	0.00027
Silicon	5.45	5.49
Silver	0.00024	0.00006
Sodium	47.5	49.22
Strontium	0.088	0.082
Sulphur	9.26	9.30
Tellurium	0.00025	<0.0005
Thallium	0.000017	0.00005
Thorium	<0.00010.0001	<0.0001
Tin	0.0015	0.00056
Titanium	0.019	0.0057
Uranium	0.0001	0.00003

Table 43. Weekly Influent & Effluent Project Summary (External Lab Data) – 2020 *(cont.)*

	Annual Average Result (mg/L)	
Analyte:	Combined Influent	Final Effluent
Vanadium	0.0011	0.0006
Zinc	0.13	0.067
Zirconium	0.0017	0.00073
Total # of Samples Submitted:	196	51

2.2.2 Project #2 - Bi-Monthly Influent & Effluent Project

Every two months, composite and grab samples of the JAMES WWTP Combined Influent and the JAMES WWTP Final Effluent are collected. These samples are submitted to an external laboratory for an extended list of analysis including total metals, dissolved metals, nutrients and other inorganic and organic parameters. This analysis is completed as part of the requirements under the MWR. Refer to Table 44 for the summary of the annual Bimonthly Influent & Effluent Project in 2020. Sampling for this project will continue in 2021.

Table 44. Bimonthly Project Summary (External Laboratory Data) – 2020

	Annual Average Result (mg/L)	
Analyte:	Combined Influent	Final Effluent
Total Kjeldahl Nitrogen (TKN)	41.0	17.0
Nitrate	<0.001	11.7
Nitrite	<0.005	0.7
Total Phosphorus	6.1	5.8
Total Hardness (Dissolved, as $CaCO_3$)	44.9	64.8
Dissolved Aluminum	0.05	0.04
Dissolved Antimony	0.0002	0.0003
Dissolved Arsenic	0.0007	0.0008
Dissolved Barium	0.2	0.05
Dissolved Beryllium	<0.0001	<0.0001
Dissolved Bismuth	0.0003	0.0002
Dissolved Boron	0.1	0.1
Dissolved Cadmium	0.0001	0.0001
Dissolved Calcium	14.8	17.7
Dissolved Chromium	0.001	0.0005
Dissolved Cobalt	0.0002	0.0003
Dissolved Copper	0.05	0.03
Dissolved Iron	0.4	0.2
Dissolved Lead	0.001	0.0006
Dissolved Lithium	0.002	0.002
Dissolved Magnesium	4.2	5.0
Dissolved Manganese	0.06	0.06
Dissolved Mercury	<0.00001	0.00001

Table 44. Bimonthly Project Summary (External Laboratory Data) – 2020 *(continued)*

	Annual Average Result (mg/L)	
Analyte:	Combined Influent	Final Effluent
Dissolved Molybdenum	0.001	0.001
Dissolved Nickel	0.002	0.002
Dissolved Phosphorus	4.0	6.1
Dissolved Potassium	18.1	19.7
Dissolved Selenium	0.0003	0.0002
Dissolved Silicon	4.9	5.2
Dissolved Silver	0.0001	0.0001
Dissolved Sodium	48.0	48.4
Dissolved Strontium	0.07	0.08
Dissolved Sulfur	7.4	8.0
Dissolved Tellurium	<0.0005	<0.0005
Dissolved Thallium	<0.00002	<0.00002
Dissolved Tin	0.0007	0.0005
Dissolved Titanium	0.01	0.01
Dissolved Uranium	<0.00002	<0.00002
Dissolved Vanadium	<0.001	<0.001
Dissolved Zinc	0.1	0.1
Dissolved Zirconium	0.002	0.0006
Total # of Samples Submitted	6	6

2.2.3 Project #3 - Effluent Toxicity Project

Effluent Toxicity Project involves collecting 40 litres of composite sample of the JAMES WWTP Final Effluent and submitting it to an external laboratory for LC50 analysis every two months. An LC50 analysis determines the concentration of JAMES WWTP Final Effluent that will kill 50% of the test subjects (usually rainbow trout) when administered as a single exposure. LC50 analysis determines the relative acute toxicity of the JAMES WWTP Final Effluent when discharged to the Fraser River. This analysis is completed as part of the requirements under the provincial Municipal Sewage Regulations (MSR).

A grab sample of the Final Effluent with pH stabilization is also included in the project. The procedure for pH stabilization during the testing of acute lethality of wastewater effluent to rainbow trout “EPS 1/RM/50” by Environment Canada is the reference method used for this analysis. This test addresses the potential for residual ammonia toxicity in wastewater effluent due to pH drift. Refer to Table 45 for the summary of the annual Effluent Toxicity Project in 2020. Sampling for this project will continue in 2021.

Table 45. Effluent Toxicity Project Summary (External Laboratory Data) – 2020

Analyte:	Final Effluent – Average Results (@ 100% vol.)
LC50 (rainbow trout)	Passed
Total # of Samples Submitted:	10

2.2.4 Project #4 - JAMES WWTP Lab Water Project

Samples of the JAMES WWTP Laboratory reagent water are collected and submitted to an external laboratory for analysis on a monthly basis. The reagent water is analyzed to confirm the supply meets "high quality" specifications given in Table 1080 II of the latest edition of Standard Methods for the Determination of Water and Wastewater. Refer to Table 46 for the summary of the annual JAMES WWTP Laboratory Water Project in 2020. Sampling for this project will continue in 2021.

Table 46. Laboratory Water Project Summary (External Laboratory Data) – 2020

Parameter:	Units:	Average Result:	Limit Specified in Standard Methods:
Conductivity	umho/cm	<0.1	<0.1 umho/cm at 25°C
Silica	mg/L	<0.05	<0.05 mg/L
Resistivity	ohm-cm	>500,000	>100,000 ohm-cm at 25°C
Total # of Samples Submitted:	-	12	-

2.2.5 Project #5 - Total Dissolved Solids (TDS) Project:

On a weekly basis, a grab sample of the JAMES WWTP Centrate is collected and submitted to an external laboratory for TDS analysis. Refer to Table 47 for a summary of the annual TDS Centrate Project in 2020. Sampling for this project will continue in 2021.

Table 47. Total Dissolved Solids Project Summary (External Laboratory Data) – 2020

	Annual Average Result (mg/L)
Parameter	SBR Initial (Centrate)
TDS	897
Total # of Samples Submitted:	52

2.2.6 Project #6 - WSER Effluent Sample Project

On a weekly basis, a total of three composite samples of the JAMES WWTP Final Effluent are collected and submitted to an external laboratory for cBOD, TSS, Total Ammonia, Unionized Ammonia, and pH analyses as required under the Wastewater Systems Effluent Regulations. Refer to Table 48 for a summary of the annual WSER Effluent Project in 2020. Sampling for this project will continue in 2021.

Table 48. WSER Effluent Project Summary (External Laboratory Data) – 2020

	Annual Average Result (mg/L)
Parameter	Final Effluent
cBOD	4.0
TSS	9.8
Total Ammonia	10.8
Unionized Ammonia	0.1
pH	7.5
Total # of Samples Submitted:	155

2.2.7 Project #7 - Weekly Biosolids Project

Biosolids composite samples are collected each week and submitted to an external laboratory for total metals analysis. The analytical data is reviewed to ensure all total metals concentrations meet the "Class A" biosolids requirements set out under the provincial Organic Matter Recycling Regulations (OMRR). Refer to Table 49 for the summary of the annual Weekly Biosolids Project in 2020. Sampling for this project will continue in 2021.

Table 49. Weekly Biosolids Project Summary (External Laboratory Data) – 2020

Analyte:	Average Results (mg/kg):	OMRR Limit (mg/kg):
Arsenic	4.4	75
Cadmium	1.4	20
Chromium	29.7	1060
Cobalt	2.3	150
Copper	585	2200
Lead	20	500
Mercury	1.6	5
Molybdenum	6.4	20
Nickel	18.9	180
Selenium	5.3	14
Silver	3.0	-
Zinc	1,0514	1850
Total # of Samples Submitted:	53	-

2.2.8 Project #8 - Monthly Biosolids Project

The collection of biosolids composite samples occur monthly and submitted to an external laboratory for an extended list of analysis including total metals, nutrients and other inorganic parameters. The analytical data was reviewed to monitor the quality of the biosolids. Refer to Table 50 for the summary of the annual Monthly Biosolids Project in 2020. Sampling for this project will continue in 2021.

Table 50. Monthly Biosolids Project (External Laboratory Data) – 2020

Analyte:	Units:	Average Result:	OMRR Limit:
Total Nitrogen	%	5.25	-
Total Phosphorus, P	%	13.5	-
Total Sulphur	%	1.20	-
Total Carbon	%	39.4	-
Organic Matter	%	78.6	-
Moisture	%	77.7	-
Ammonium – N (available)	mg/kg	6,251	-
Nitrate – N (available)	mg/kg	<6.5	-
pH	pH units	6.91	-
C:N Ratio	-	7.8	-
Arsenic	mg/kg	4.31	75
Cadmium	mg/kg	1.36	20
Chromium	mg/kg	29.1	1,060
Cobalt	mg/kg	2.25	150
Copper	mg/kg	564	2,200
Lead	mg/kg	19.7	500
Mercury	mg/kg	1.63	5
Molybdenum	mg/kg	6.47	20
Nickel	mg/kg	18.4	180
Selenium	mg/kg	5.17	14
Zinc	mg/kg	1,039	1,850
Total # of Samples Submitted:	-	12	-

2.2.9 Project #9 – Key Manhole

This project monitors a municipal customer on a quarterly basis for Total Metals, Hexavalent Chromium, Trivalent Chromium, Total Cyanide, Sulfate, and Sulfide. Refer to Table 51 for the summary of the results in 2020. Sampling for this project will continue in 2021.

Table 51. Key Manhole Project (External Laboratory Data) – 2020

	Annual Average Result (mg/L)	
Analyte:	Composite Sample	Bylaw Limits
Hexavalent Chromium	0.002	-
Trivalent Chromium	0.004	-
Total Hardness	330.8	-
Aluminum	0.35	50.0
Arsenic	0.01	1.0
Boron	0.1	50.0
Cadmium	0.0002	0.20
Chromium	0.005	4.0
Cobalt	0.0005	5.0
Copper	0.03	2.0
Iron	0.89	10.0
Lead	0.001	1.0

Table 51. Key Manhole Project (External Laboratory Data) – 2020 *(Continued)*

	Annual Average Result (mg/L)	
Analyte:	Composite Sample	Bylaw Limits
Manganese	0.08	5.0
Mercury	0.00004	0.1
Molybdenum	0.003	1.0
Nickel	0.005	2.0
Selenium	0.002	1.0
Silver	0.0001	1.0
Zinc	0.08	3.0
Total # of Samples Submitted	4	

2.2.10 Project #10 – Metals Finishers

In 2020, sample monitoring of metal finishing customers continued. Overall, total metals from metal finishing industries showed a decline in levels of heavy metals due to efforts by the businesses and the WSCSCP sample monitoring will continue in 2021. Refer to Table 52 for a summary of samples collected and the percentage of non-compliance.

Table 52. Metals Industry Monitoring – 2020

Number of Samples Collected	Number of Non-Compliant Samples
67	1 (1.5%)

2.2.11 Project #11 - Granite & Stone

In 2020, sample monitoring of two granite and stone cutting customers continued. Wastewater discharges from these businesses were analyzed for total suspended solids and total metals and the results showed compliance. Sample monitoring will continue in 2021. Refer to Table 53 for a summary of samples collected from the granite and stone industry.

Table 53. Granite & Stone Industry Monitoring – 2020

Parameter	Number of Samples Collected
Total Suspended Solids	13
Total Metals	16
pH	9
Hardness	16

2.2.12 Project #12 – BOD, TSS, pH (Extra Strength Project)

In 2020, WSCSCP staff routinely monitored thirty-two industrial customers as part of the BOD and TSS Waste Program (three located within the District of Mission and twenty-nine located within the City of Abbotsford). The monitoring program consisted of 24-hour composite samples collected on a random schedule, one to ten times per month. Industrial customers with larger discharge volumes were monitored on a more frequent basis than customers with smaller discharge volumes. These samples were submitted to an accredited external laboratory for pH,

BOD and TSS analysis. Refer to Table 54 for a summary of all the extra strength samples collected in 2020. Sampling for this project will continue in 2021.

Table 54. Extra Strength Monitoring – 2020

Parameter	Number of Samples Collected
BOD, TSS, and pH	999

2.2.13 Project #13 - Biosolids Coliforms Project

Biosolids and feed sludge grab samples are collected each week and submitted to an external laboratory for Fecal Coliforms, Salmonella, and Total Metals analyses. The analytical data is reviewed to monitor the effectiveness of the pasteurization system as well as to ensure fecal coliform requirements were met for "Class A" biosolids under OMRR. Refer to Table 55 for the summary of the annual Biosolids Coliforms Project in 2020. Sampling for this project will continue in 2021.

Table 55. Biosolids Coliforms Project (External Laboratory Data) – 2020

Parameter	Number of Samples Collected
Fecal Coliform	42
Total Metals	5

3.0 Budgeting & Expenditures

The total amount budgeted for the JAMES WWTP Laboratory was $266,833 in 2020. Refer to Tables 56 for the breakdown of the 2020 budgeting and expenditures and Table 57 for the 2021 budgeting and expenditures.

Table 56. JAMES WWTP Laboratory Budgeting & Expenditures – 2020

Budget Item:	Budgeted Amount:	Actual Expenditure:
Labor	$193,883	$190,074
Laboratory Supplies & Equipment	$30,000	$25,770
External Analytical Costs	$43,000	$57,344
Total:	$266,883	$273,188

Table 57. JAMES WWTP Laboratory Budgeting & Expenditures – 2021

Budget Item:	Budgeted Amount:
Labor	$198,893
Laboratory Supplies & Equipment	$45,000
External Analytical Costs	$90,000
Total:	$333,893

4.0 Program Planning & Development

The following is a summary of the main activities and achievements related to the management, planning, and administration of the JAMES WWTP Laboratory in 2020.

- Continued development and implementation of the QA/QC program;
- Continued conformance through improvement and corrective action reports (ICAR);
- Continued identification of workplace hazards through monthly workplace inspections;
- Continued review and training of Safe Work Procedures; and
- Successful completion of CALA Proficiency Testing and continued participation in the CALA Proficiency Test Program.

C. Biosolids Residuals Management

1.0 Introduction

Biosolids are the end product of wastewater treatment and a sustainable resource that contain valuable nutrients and organic matter. The JAMES Wastewater Treatment Plant (WWTP) produces approximately 5,200 wet tonnes of Class "A" biosolids per year. Historically, biosolids produced at the JAMES WWTP have been beneficially utilized for poplar tree plantations, agricultural and rangeland, mine reclamation, and production of a biosolids based growing medium.

1.1 Process Overview

The JAMES WWTP comprises the following wastewater treatment processes:

- Headwork's screens to remove coarse solids (screening product is sent to landfill for disposal);
- Settling chambers for grit removal (grit is sent to landfill for disposal);
- Primary clarifiers for removal of primary sludge (sludge removed is sent to pasteurization process);
- Trickling filters for removal of organic loading;
- Aeration tanks for removal of organic loading; and
- Secondary clarifiers for removal and recycling of activated sludge (activated sludge is sent to sludge thickener and then pasteurization process).

Refer to Figure 13 for an illustration showing the biosolids processing path within the JAMES WWTP.

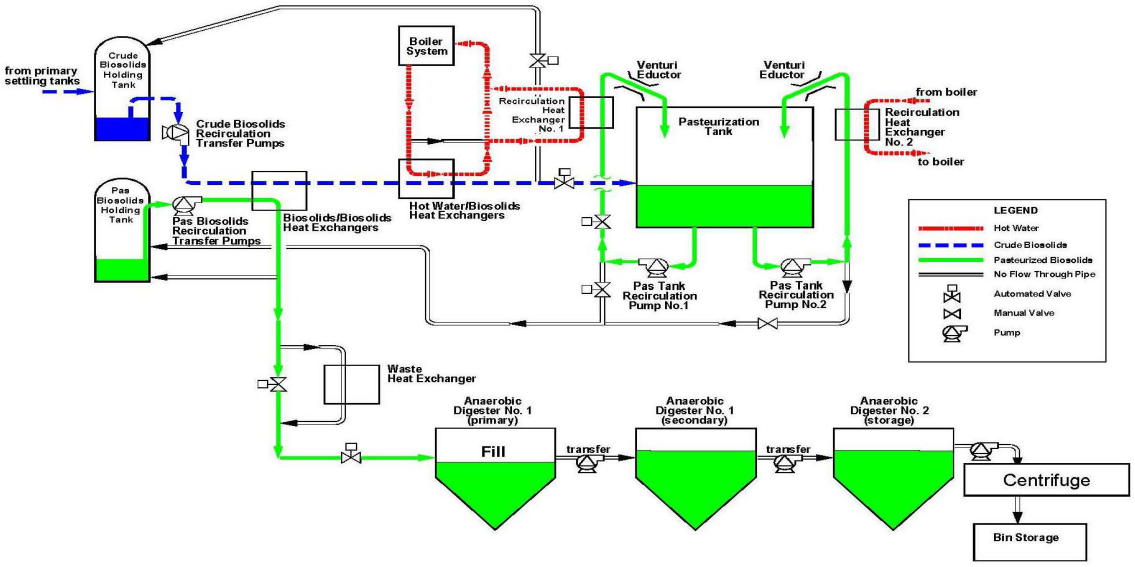

Figure 13. JAMES WWTP Biosolids Processing Path

Primary and secondary sludge is collected in the crude biosolids holding tank (approx. 60% primary settled solids and 40% secondary solids), before being sent to the pasteurization process. In the pasteurization process, the sludge is circulated and heated using steam, and air is inducted using a Venturi system to maintain aerobic conditions throughout the pasteurization tank. Sludge is retained in this process for sufficient time to achieve pathogen kill. This process is the key step enabling the JAMES WWTP to produce “Class A” biosolids.

Following the pasteurization process, sludge is sent to the digesters. Three mesophilic anaerobic digesters in series are used to treat the combined primary and secondary sludge. After treatment, solids are categorized as “biosolids” and produced at an approximate rate of 400 m^3/d with a solids content of 1.5%. From the digesters, biosolids are pumped to centrifuges which remove water and increase the biosolids content from 1.5% to 23% solids on average. Dewatered “Class A” biosolids are then conveyed to storage bins and stored prior to transport for their ultimate end use.

2.0 Organic Matter Recycling Regulation (OMRR)

The Provincial Organic Matter Recycling Regulation (OMRR), created under the Environmental Management Act, applies to the construction and operation of composting facilities, and the production, distribution, storage, sale and use or land application of biosolids and compost. OMRR also sets minimum standards for products based on the following criteria:

- Pathogen Reduction - The reduction of organisms such as bacteria, protozoa, viruses, and parasites that can cause disease in humans and animals;

- Vector attraction reduction - The reduction of the characteristic in biosolids that attracts rodents, flies, mosquitoes, or other organisms capable of transporting infectious agents, such as pathogens;

- Maximum allowable pathogen limits - The function of fecal coliform counts per gram of total solids (Note: Fecal coliforms are bacteria that typically originate from human or animal feces); and

- Maximum allowable concentrations of heavy metals - Sets limits of heavy metals concentrations for the biosolids products. The maximum concentration is dependent on the class of biosolids (“Class A” / “Class A” compost, “Class B” / “Class B” compost, biosolids growing media).

OMRR also stipulates how the various products can be used and/or distributed, as those with less stringent quality restrictions typically have greater restrictions on their end uses. Figure 14 illustrates how the various requirements of OMRR affect the different products for biosolids usage. Table 58 provides a summary of the permitted uses for each of the four products.

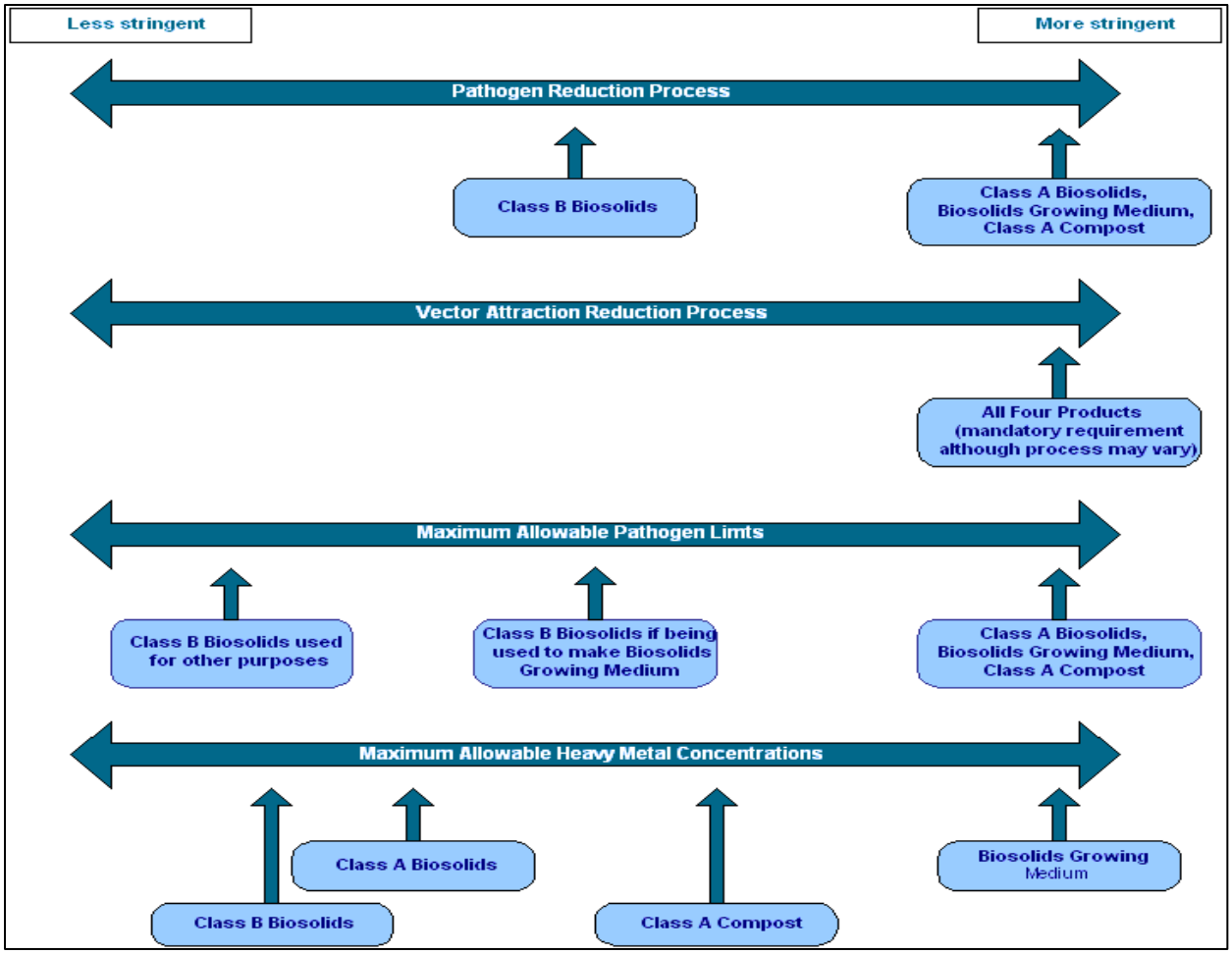

Figure 14. OMRR Product Requirements

Table 58. OMRR Permitted Uses for Biosolids

"Class A" Biosolids:	"Class B" Biosolids:	Growing Medium:	"Class A" Compost:
• Can be land applied, with limits on quantities • Land application plan required • Distribution volumes must be: ➢ <5 m^3 per vehicle per day ➢ in sealed bags (<5 m^3) • Compost or biosolids growing medium facilities only for quantities >5 m^3	• Can be land applied, with limits on quantities • Land application plan required • No land application in watershed used for drinking water • Can be distributed without restriction to compost facilities	No restrictions	No restrictions

As previously mentioned, the JAMES WWTP produces “Class A” biosolids by way of a pasteurization process. . However, if the pasteurization process is not in operation, the JAMES WWTP produces a Class “B” biosolids. The pasteurization process was taking out of service March 02, 2020 and remained off-line for the rest of the year.

3.0 Biosolids Quality Assurance & Control

Weekly composite biosolids samples are collected and analyzed for total metals, fecal coliform, and salmonella. Monthly grab samples are analyzed for nutrients and total metals. Refer to Table 20 and 49 for weekly composite averaged data and Table 50 for monthly grab sample data. Additional Quality Control measures are in place to monitor fecal coliform levels of stored biosolids at the James Plant just prior to distribution to ensure OMRR criteria are met. This provides and additional level of quality assurance

4.0 Beneficial End Uses for Biosolids

Since 2000, biosolids produced at the JAMES WWTP have been beneficially utilized for poplar tree plantations, agricultural and rangeland, mine reclamation, and production of a biosolids based growing medium. In 2020, the City of Abbotsford (City) initiated a new biosolids management agreement with a third party contractor to land apply biosolids under a Land Application Plan. Refer to table 59 for quantities of biosolids distributed and stored from the James Plant in 2020.

Table 59. Annual Wet Tonnes of JAMES Treatment Plant Biosolids by End Use (2020)

Year:	Biosolids Produced (wet tonnes/year):	Stored (JAMES Plant) Carry Over from 2019 (wet tonnes/year):	Biosolids Hauled Off-Site 2020 (wet tonnes/year):	Stored (JAMES Plant) Carry Over to 2021 (wet tonnes/year):
2020	5,858	1,700	7,129	429

Note: Biosolids tonnage balances from produced / hauled to stored can vary depending on moisture loss during storage

5.0 Land Application

5.1.1 Background

The specific objectives of land application plans are to ensure that biosolids are stored and applied in a beneficial manner that provides the greatest benefit for the crop grown on the properties, while minimizing risk to the environment. The plans consider the specific crops that are growing on each property, the trace element concentrations in the soil, as well as any other nutrient input that is used for growing crops or improving the soil.

5.1.2 Land Application Summary - 2020

In 2020, the City implemented a new biosolids management agreement with a third party contractor (Sylvis Environmental) to beneficially use JAMES WWTP biosolids in accordance with

applicable Provincial and Federal regulations. Additionally, biosolids stored on application sites in 2019 from the City's previous contractor (BioCentral) was applied by BioCentral in 2020.

BioCentral

BioCentral's contract with the City expired on December 31, 2019 therefore no biosolids were hauled off-site by BioCentral in 2020, however biosolids stored at land application sites in 2019 were applied by BioCentral in 2020.

A total of 3,723.6 wet tonnes (WT) of Class A biosolids were removed from the JAMES WWTP in 2019 and stored in different locations for 2020 land application and BGM fabrication.

BioCentral obtained six (6) authorizations from the Ministry of the Environment for application of Class A biosolids for beneficial reuse in agriculture. The focus for the land application was on properties that normally import either inorganic fertilizer or poultry litter as nutrient sources for either forage corn or forage grass production.

Out of the 3,723.6 WT of Class A biosolids applied during 2020, 16.5% (616.24 WT) was fabricated into BGM. BGM production and distribution followed OMRR requirements. See Appendix B for BioCentral's Annual Report.

Figure 15. Example of BGM land application area (2020).

Sylvis Environmental

The management of City biosolids in 2020 adhered to all of BC's *Organic Matter and Recycling Regulation* (OMRR) requirements including maximum authorized application rates, quality requirements for biosolids accepted, pre-application and predicted post-application soil concentration limits (to be confirmed by post-application soil samples in spring 2021), signage and storage, runoff prevention and sampling requirements. All biosolids land applications were completed according to their respective Land Application Plan (LAP) and were overseen by a SYLVIS Qualified Professional. See Appendix C for Sylvis Environmental's Annual Report.

In 2020, a total of 7,129 wt of City biosolids were removed from JAMES WWTP and delivered to two sites in British Columbia (BC) for grassland restoration and agricultural fertilization.

OK RANCH

In 2020, 5,810 wt of City biosolids were transported to the OK Ranch located approximately 60 km northwest of the Village of Clinton, BC. Biosolids were delivered intermittently between February 24 and December 30. Once transported to site, City biosolids were stored in designated stockpile areas to facilitate biosolids deliveries and applications. As part of the restoration program, City biosolids have been applied to grasslands to increase forage production and improve soil properties such as nutrient and organic matter content. The OK Ranch grassland restoration program requires Class B (or Class A managed as Class B) biosolids, and both types were delivered to the site.

A portion of these biosolids (4,378 wt) were land applied between September 22 and October 14, 2020. Biosolids were applied using an agricultural spreader to grasslands of the OK Ranch (Figure 2). Approximately 1,432 wt of City biosolids which were delivered after the land application season were stored on site at the end of 2020 in preparation for land application in 2021.

Figure 16. Sylvis Environmental Beneficial Use Signage Ok Ranch (2020).

Figure 17. Example of stored biosolids at land application area Ok Ranch (2020).

PINNACLE FARM

In 2020, 1,319 wt of City biosolids were transported to Pinnacle View Limousin Farm in Quesnel, BC. Biosolids were delivered between April 22 and May 5, and again between August 14 and October 7. Once transported to site, City biosolids were stored in designated stockpile areas to facilitate biosolids deliveries and applications. A portion of these biosolids (1,198 wt) were land applied at three different times to different fields – April, September and November 2020. Biosolids were applied using an agricultural spreader to agricultural land and incorporated into the soil surface at Pinnacle Farm (Figure 3 and Figure 4). Approximately 121 wt of City biosolids were stored on site at the end of 2020 in preparation for land application in 2021.

Class B biosolids land applied in April and November were used to fertilize feed crops with no harvest restrictions. Biosolids land applied in September were specifically selected as Class A biosolids from the JAMES storage tents as the crop grown on site (canola) may have entered the food chain once processed into oil. Once on the market, the harvest from this field was most likely mixed with other batches (farms) for transformation into oil for either human consumption, biodiesel production or other uses.

5.0 Budgeting & Expenditures

Land application costs to utilize JAMES WWTP biosolids in land application activities are at the expense of the biosolids producer and include transportation, application, quality control, and professional services. Table 63 summarizes the budget and expenditures in 2020.

Table 60. Biosolids Management Budgeting & Expenditures – 2020

Budget Item:	2020 Budget:	2020 Actual Expenditure:
Biosolids Beneficial End Use	$599,000	$679,941

6.0 Program Planning & Development

The following is a summary of the main activities and achievements related to the planning and development of biosolids management program in 2020.

- Developed strategies to meet logistical issues between storage and production, quality control measures and application site availability.
- Regular meetings conducted with contractor to ensure contract services and safety requirements are being met, and that biosolids beneficial use is achieved.
- Monitor OMRR intentions paper review process.

7.0 Next Steps – 2021

- Continued strategic and logistical planning with Sylvis for the distribution, storage and hauling of biosolids in 2021.

- Develop RFP for Biosolids Master Plan and select proponent to begin work.

Appendix A

RISK ASSESSMENT OF WASTEWATER SOURCES

Risk No. 4
Risk Name: Mercury (Total)
Risk Description: Wastewater mercury concentration of >0.05mg/L as per Bylaw 1361-2004
High Score **49** **High Risk**
Average 25

Rating	(A) Health & Safety of Workers & Public	(B) Demand for Service	(C) Infrastructure	(D) Treatment Processes	(E) Receiving Environment	(F) Quality of Biosolids	Practically Impossible	Not Likely to Occur	Could Occur or I've Heard of it Happening	It is Known to Occur or it has Happened	Common or Occurs Frequently
	CONSEQUENCES						LIKELYHOOD				
							1	3	5	7	10
1	First Aid Injury	Increased Maintenance	Slight Damage (<$1,000)	Slight Impact	Slight Impact	No Impact	1	3	5	8	10
		1	1								
3	Medical treatment Injury w/ Lost time < 7 days	Advances minor Capital projects	Component Level Replacement / Repair ($1 K - $10 K)	Minor Impact	Minor Impact	Minor increase in Contaminant Level	3	9	15	21	30
5	Lost Time Injury > 7 days	Advances significant projects more than 1 year	Equipment Level Replacement / Repair ($10 K - $100 K)	Moderate impact	Localised Impact	Contamination results in close to not meeting Class A	5	15	25	35	50
7	Lost Time Injury > 30 days	Advances several Project in a Process area < 5years	Process Facility Damage ($100 K - $1 M)	Major impact results in plant upsets > 1 day	Major Impact	Contamination results in not meeting Class A, but meeting Class B	7	21	35	49	70
	30			35	35	49					
10	Multiple Fatalities	Advances Projects in several Process areas > 5 years	Severe Damage to Multiple Areas (> $1 M)	Extreme impact results in plant upsets > 7 days	Massive Impact	Contamination results in not meeting Class B	10	30	50	70	100

Guide

Low Risk	1-9	**LOW**	Monitored and Managed by Plant No restriction on Customer
Medium Risk	10-25	**MEDIUM**	Additional Charges by WSC Mitigation may be required by the Customer
High Risk	26-60	**HIGH**	Second level additonal fees, charges or penalities, mitigation management plans in place by WSC Damage and Safety issue must be mitigated by Customer,
Extreme Risk	61-100	**EXTREME**	Must not be allowed. May discontect sewer if violated Customers must find alternate disposal methods

Notes:

(A) Routes of harmful human exposure include ingestion, inhalation and skin contact
(A) Mercury accumulates in the liver, spleen, kidneys and bone
(A) Methyl mercury also accumulates in the brain
(A) Mercury is a significant teratogen
(A) Mercury is considered extremely toxic to humans
(A,E) Organic compounds of mercury are generally more toxic than the inorganic compounds; organic methyl mercury being the most toxic
(E) Mercury is harmful to aquatic organisms at very low concentrations
(E,F) Inorganic forms can be methylated in sediments and withn the food chain
(F) Mercury levels have been above OMRR limits in the past
(F) Mercury is listed under OMRR with a limit of 5ug/g for Class A Biosolids

Possible Industrial & Commercial Sources:

Automobile Repair (incl. Body Shops and Radiator Shops)
Battery Manufacturing
Pharmaceutical Industry
Laundry and Dry Cleaning Industry
Dental Offices
Hospitals
Laboratories

References:

City of Abbotsford Consolidated Sewer Rates and Regulations Bylaw (Bylaw No. 1361-2004)
Sewer Use Control for Fraser River Basin and Burrard Inlet Drainage Basin (Environment Canada - July 1993)
Enviromental Management Act (BC Government - 2003)
Municipal Sewage Regulation (BC Government - 2004)
Organic Matter Recycling Regulation (BC Government - 2002)
Anaerobic Sludge Digestion (Water Pollution Control Federation - 1987)
Canadian Water & Wastewater Association Directory of Contaminants
Source Control staff personal professional experiences

Appendix B

2020 ANNUAL REPORT JAMES PLANT (CITY OF ABBOTSFORD) BIOSOLIDS BENEFICIAL USE

Prepared by:
G. Andres Murillo, P.Eng.
BioCentral General Manager

December 22th, 2020

Appendix B

Table of Contents

Appendix

Summary

BioCentral Green Depot Ltd. (BioCentral) has met and exceeded all of the OMRR requirements for Biosolids Growing Medium (BGM) production and land application of Class A biosolids from JAMES Plant (City of Abbotsford). A total of 3,723.6 wet tonnes (WT) of Class A biosolids were removed from the City of Abbotsford Wastewater Treatment Plant in 2019 and stored in different locations for 2020 land application and BGM fabrication. The Class A biosolids provided an excellent source of organic matter and nutrients for farms in the Fraser Valley, British Columbia.

BioCentral obtained six (6) authorizations from the Ministry of the Environment for application of Class A biosolids for beneficial reuse in agriculture. The focus for the land application was on properties that normally import either inorganic fertilizer or poultry litter as nutrient sources for either forage corn or forage grass production.

Out of the 3,723.6 WT of Class A biosolids applied during 2020, 16.5% (616.24 WT) were turned into BGM. BGM production and distribution followed OMRR requirements.

During 2020, BioCentral did not haul out of the JAMES plant any biosolids, due to the contract expired on December 31, 2019.

Farms in the Fraser Valley have been selected because biosolids, with their low potassium concentration, are better suited for forage production where high potassium such as found in poultry litter may result in animal health concerns.

Introduction

BioCentral issues this annual report as per contract requirement with the City of Abbotsford. The five years contract started on January 1st, 2015, where BioCentral has proved high competency and efficiency dealing with the undertaken biosolids from JAMES Plant.

This document constitutes the last report that BioCentral will prepare for the City of Abbotsford, due to the contract between both parties ended on December 31, 2019.

BioCentral is responsible for meeting the Organic Matter Recycling Regulation (OMRR) requirements for land application of the Class A biosolids and BGM production, whereas the City of Abbotsford is responsible to ensure that the biosolids meet Class A biosolids requirements as per the OMRR.

1. Monthly Volumes

During 2019, BioCentral removed from the JAMES plant a total of 5,917.4 WT of Class A biosolids. Out of this amount, 3,723.6 WT were stored for 2020 Spring land application and BGM fabrication. The summary of the 2020 applied quantities is showing in Table 1.

Table 1 Monthly Volumes Summary

Month	Wet Tonnes	JAMES Plant Storage	Application site	Wet Tonnes
May	600.34	Small Tent	1401 Kennedy Rd, Harrison Mills	318.21
			Harrison Bay Dairy Farm	282.13
	905.68	Large Tent	1401 Kennedy Rd, Harrison Mills	126.60
			3628 Hotsprings Rd, Agassiz (BGM)	300.61
Sept	681.67	Small Tent	3954 Hotsprings Rd, Agassiz	681.67
Oct	952.84	Medium Tent	3954 Hotsprings Rd, Agassiz	491.71
			1025 Kennedy Rd, Harrison Mills	369.73
			1995 Fir Rd, Agassiz	91.40
Nov	1,061.54	Large Tent	1280 Hamilton Rd, Agassiz	745.91
			3628 Hotsprings Rd, Agassiz	315.63

Biosolids hauled out of the JAMES plant in 2019, were properly stockpiled on the aforementioned properties for 2020 application and processing.

2. Authorizations for Land Application

During 2019, BioCentral obtained authorization from the Ministry of Environment (MoE) for six (6) properties as per OMRR requirements. Copy of the authorizations can be found in *Appendix A. MoE Authorizations*. Table 2 shows the summary of 2020 authorizations.

Table 2 2020 Authorizations for Land Application

Authorization #	Site Application Address	Applied 2020 (tonnes)
110006	1401 Kennedy Rd, Harrison Mills	444.81
110008	3954 Hotsprings Rd, Agassiz	1173.38
110081	1280 Hamilton Rd, Agassiz	745.91
110084	1995 Fir Rd, Agassiz	91.40
110092	Harrison Bay Dairy Farm	282.13
110093	1025 Kennedy Rd, Harrison Mills	369.73
BGM - No required	3628 Hotsprings Rd, Agassiz	616.24

Under an OMRR approved biosolids alternative use, BioCentral produced BGM at 3628 Hotsprings Rd property in Agassiz, BC. This alternative does not require any notification nor authorization to any authority. Nevertheless, OMRR has standards for the final product as per Schedule 11. These standards were followed by BioCentral during the fabrication of the BGM.

The process of obtaining authorizations for Land Application included providing a Notification as per the requirements of OMRR Part 4 Division 2 Section 22. The Notifications were provided to the MoE Permit Registration office in Victoria, the local MoE officer, the ALC planner for the region, and the Health Authority for the Region (Fraser Health).

The Notifications were followed up with the Land Application Plan, a comprehensive document providing details of the land application, the results of the biosolids testing, soil testing results, and the expected change in trace element concentrations resulting from the Land Application.

All Land Application Plans were provided to City of Abbotsford Engineering staff as well as to Ministry of the Environment, Fraser Health and the Agricultural Land Commission.

2.1 Actual Land Application of Biosolids in 2020

In total, 3,107.36 WT of class A biosolids were land applied during 2020 as follow; 2,662.55 WT were applied during the Spring of 2020, from material stockpiled between May to November 2019 in six (6) properties. The remnant 444.81 WT, were applied during 2020 early Fall. 616.24 WT of biosolids were turned into BGM and placed at 3628 Hotsprings Rd as a plan to enhance the soil quality. Table 3 has a summary of the material distribution during 2020.

Table 3 2020 Biosolids Distribution

2019	Wet Tonnes	JAMES Plant Storage	Wet Tonnes	Application Site	Status	Application Date
May	600.34	Small tent	282.13	Harrison Bay Dairy Farm	Applied	09-May-20
			318.21 [1]	1401 Kennedy Rd, Harrison Mills	Applied	10-Sep-20
	905.68[2]	Large tent	126.60	1401 Kennedy Rd, Harrison Mills	Stored	09-May-20
			300.61	3628 Hotsprings Rd, Agassiz	Turned into BGM	May - June
Sep	681.67	Small tent	681.67	3954 Hotsprings Rd, Agassiz	Applied	14-May-20
Oct	952.84	Medium tent	491.71	3954 Hotsprings Rd, Agassiz	Applied	14-May-20
			369.73	1025 Kennedy Rd, Harrison Mills	Applied	09-May-20
			91.40	1995 Fir Rd, Agassiz	Applied	10-Jun-20
Nov	1061.54	Large tent	745.91 [2]	1280 Hamilton Rd, Agassiz	Applied	15-Apr-20
			315.63	3628 Hotsprings Rd, Agassiz	Turned into BGM	May - June

[1] 73.4 WT of this stockpile were applied on May 9, 2020.
[2] 478.47 WT from that tent, were applied on May 2019 in 1280 Hamilton Rd and 3954 Hotsprings Rd.
[3] 200 WT were applied in Oct. 8, 2020, to a barley crop

2.2 Biosolids Growing Medium (BGM) production in 2020

Biosolids Growing Medium production was based on a volume ratio of 1 biosolids, 1.5 soil, and 2 carbon. This mix (S7 sample) was found after several tests done by BioCentral, lab data for these experimental mixes can be found in *Appendix B. BGM Results*. Table 4, presents the analysis results for the chosen mix.

Table 4 Lab results BGM selected mix

Parameter	Unit	Selected mix	OMRR limits[1]
Organic Matter	%	9.8	<15
Total Kjeldahl Nitrogen	%	0.178	0.6
C:N Ratio		23.5	>15
Arsenic (As)	mg/kg	3.75	13
Cadmium (Cd)	mg/kg	0.157	1.5
Chromium (Cr)	mg/kg	26.8	100
Cobalt (Co)	mg/kg	6.35	34
Copper (Cu)	mg/kg	44.8	150
Lead (Pb)	mg/kg	3.08	150
Mercury (Hg)	mg/kg	0.083	0.8
Molybdenum (Mo)	mg/kg	0.71	5
Nickel (Ni)	mg/kg	23.8	62
Selenium (Se)	mg/kg	0.33	2
Zinc (Zn)	mg/kg	69.5	150

[1] Schedule 4 (column 2) and schedule 11, OMRR

BioCentral BGM production was done between May and June 2020, at 3628 Hotsprings Rd. The scope of this application was enhancing the soil by improving its structure, as well as the nutrient and organic matter content. Mixing and placing of the product can be seen in Photo 2.

Photo 1 BGM production and placing

Approximately, BioCentral produced 3,030 m^3 of BGM. This material was placed by using excavators and dozers, once in place, it was incorporated to land through plowing (Photo 3). Right after the plowing, the new area was seeded with grass showing excellent results.

Photo 3 Placed BGM

On June 03, 2020, BioCentral tested the BGM, samples were sent for analysis to ALS Environmental lab in Burnaby BC. Table 5 shows analysis results. *Appendix B. BGM Results*, has the original report from the lab.

Table 5 Lab results BGM production at 3628 Hotsprings Rd

Parameter	Unit	Sample	OMRR limits[1]
Organic Matter	%	10.1	<15
Total Kjeldahl Nitrogen	%	0.77	0.6
C:N Ratio		7.73	>15
Arsenic (As)	mg/kg	6.59	13
Cadmium (Cd)	mg/kg	0.715	1.5
Chromium (Cr)	mg/kg	29.7	100
Cobalt (Co)	mg/kg	9.83	34
Copper (Cu)	mg/kg	145	150
Lead (Pb)	mg/kg	15.8	150
Mercury (Hg)	mg/kg	0.329	0.8
Molybdenum (Mo)	mg/kg	1.98	5
Nickel (Ni)	mg/kg	21.7	62
Selenium (Se)	mg/kg	0.92	2
Zinc (Zn)	mg/kg	287	150

[1] Schedule 4 (column 2) and schedule 11, OMRR

According to Table 5, most of the parameters met the requirements of schedules 4 and 11 of OMRR. Nitrogen and carbon to nitrogen ratio, are slightly off OMRR's standards. Even though Zinc concentration seems almost double of OMRR limit, this concentration was diluted almost 4 times from the biosolids Zinc content (1070 ug/g).

Despite some of the parameters are either lower or higher than the required specs, these values do not cause any harmful effects on the soil. Once the BGM is placed on the soil and plowed, the nitrogen will be

reduced due to leaching, volatilization and diluting effects. C:N ratio will balance out once the carbon in the soil breaks down.

Zinc (Zn) plays a substantial role in many biological processes and is an essential trace element for proper growth and reproduction of plants, and health of animals and humans. In unfertilized and uncontaminated soil, the content of Zn ranges from 10 to 300 mg/kg (overall mean of around 50–55 mg/kg) [*S.A. Barber, Soil Nutrient Bioavailability: A Mechanistic Approach, (second ed.), John Wiley & Sons, Inc, New York (1995)*]. Considering the importance of Zn and its typical concentration on the soil, the levels of Zn found on the BGM sample are not of concern.

3. Land Application Plans

Appendix C. LAP contained all the Land Application Plans (LAP) for the six (6) properties where biosolids were applied during 2020. Those LAP's were prepared by BioCentral's Qualify Professional, John Paul, PhD, P.Ag., following the requirements of OMRR Part 3 Division 1 and Schedule 7.

Through soil tests, performed by BioCentral, on the properties where biosolids were applied, BioCentral found that chromium concentrations were higher than expected. To determine the cause of those chromium levels, BioCentral's Qualify Professional performed a research, getting the following results:

- Chromium is found primarily in two oxidation states in the environment. One is hexavalent chromium – Cr (VI) which is relatively mobile and acutely toxic. The other is trivalent chromium – Cr (III)) which is relatively immobile and has a much lower toxicity (Palmer and Puls 1994).
- High soil chromium concentrations appear to originate from the Fraser River sediments. Phippen (2001) measured chromium concentrations of 52.8 mg/kg in the sediment near Barnston Island. Swain et al. (1998) measured chromium concentrations up to 42.9 mg/kg in the Fraser River sediments near Langley.
- We note that all of the land application sites are in locations that have received Fraser River sediments.
- It would be reasonable to conclude that the speciation of chromium would be relatively similar in the various Fraser River sediments that make up the agricultural fields used for the land applications. There is no other evidence of materials or chemicals used on the land that may have changed the amount of chromium or the speciation.

In order to complement the aforementioned research, BioCentral took soil samples in each of the six authorized properties to be analyzed for Cr (III) and Cr (VI) (*Appendix D. Chromium Results*). Results show that in average, 1.4% of the total chromium corresponds to hexavalent chromium – Cr (VI). Summary of the chromium concentrations are presented on Table 6.

Table 6 Chromium Speciation Results

Property	Sample	Unit	Cr	Cr (III)	Cr (VI)	%CrVI in Cr
1025 Kennedy	S2	ug/g	81	79.1	1.8	2.2%
	S5	ug/g	78	78.04	<0.7	0.9%
1280 Hamilton	S2	ug/g	59	58	1	1.7%
	S4	ug/g	68	65.1	2.4	3.5%
1401 Kennedy	S1	ug/g	75	74.2	1	1.3%
	S4	ug/g	66	66.35	<0.6	0.9%

Property	Sample	Unit	Cr	Cr (III)	Cr (VI)	%CrVI in Cr
1995 Fir	S1	ug/g	79	78.96	<0.7	0.9%
	S3	ug/g	84	84.32	<0.7	0.8%
3954 Hotsprings	S1	ug/g	86	85.8	0.7	0.8%
	S5	ug/g	83	82.6	0.7	0.8%
Harrison Bay Dairy Farm	S2	ug/g	81	80	1	1.2%
		Average	**76.4**	**75.7**	**1.2**	**1.4%**

In conclusion, BioCentral determined that chromium concentrations are not harmful for the soil, approximately, 99% of the chromium was in its trivalent form, which represents the immobile and much lower toxic chromium form.

After the land application of biosolids in each property, Dr. John Paul on behalf of BioCentral, prepared a written certification of land application, confirming that applications were done accordingly with the Land Application Plan. These letters were delivered to each landowner in order to notify them in regards the application including dates, amounts, and rates. Copy of these letters can be found in *Appendix E. Written Certifications*.

4. JAMES Plant Biosolids Data

"The biosolids produced at the JAMES Plant are sampled on a daily basis, with weekly and monthly composite samples being submitted to an external lab for analysis. The extra sampling allows the City of Abbotsford to monitor the quality of the biosolids and to ensure the biosolids produced at the JAMES Plant are consistently of exceptional quality" (City of Abbotsford, Biosolids Management 2019).

The Land Application Plans for 2020 were based on the data provided by the City of Abbotsford for 2018. Analysis of this data, compared with previous years, demonstrated that the quality and characteristics of the Class A biosolids did not change appreciably within the year or between years.

The 2018 biosolids quality data provided for the Land Application Plans required verification based on the 2019 biosolids characteristics, as these more accurately reflect the material that was land applied. The 2018 JAMES Treatment Plant data is found in *Appendix F. JAMES Plant quality data*.

Class A biosolids were approved for release by the City of Abbotsford following extensive fecal coliform testing to ensure that the biosolids met the Class A requirements. BioCentral, tested for fecal coliform and metals to verify that the biosolids are in compliance with Class A requirements (*Appendix G. BioCentral quality data*). A summary of the data testing results performed by BioCentral is presented in Table 7.

Table 7 BioCentral Quality Control Data 2019

Parameter	Sampling Date		CLASS A (OMRR)	CANADA T-4-93
	June 25th mg/Kg	Oct 30th mg/Kg	mg/Kg	mg/Kg
Arsenic (As)	3.05	3.35	75	75
Cadmium (Cd)	1.35	1.06	20	20

Appendix B

Parameter	Sampling Date		CLASS A (OMRR)	CANADA T-4-93
	June 25th mg/Kg	Oct 30th mg/Kg	mg/Kg	mg/Kg
Chromium (Cr)	26	22.3	1060	not included
Cobalt (Co)	2	1.42	150	150
Copper (Cu)	487	476	2200	not included
Lead (Pb)	16.9	14.7	500	500
Mercury (Hg)	1.11	1.05	5	5
Molybdenum (Mo)	5.29	5.67	20	20
Nickel (Ni)	15.8	12.7	180	180
Selenium (Se)	3.91	3.97	14	14
Zinc (Zn)	726	834	1850	1850
Fecal coliform (MPN/g)	<200	<200	<1000	-

During 2019, BioCentral took two (2) samples as per its Control Quality routine; both of them were taken from the large tent during two different batches. Results proved that biosolids were in compliance with OMRR standards.

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BioCentral General Manager

Appendix C

City of Abbotsford

2020 Biosolids Management Summary

March 2021

Prepared for:

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INTRODUCTION

The City of Abbotsford (the "City) operates the City's Wastewater Treatment Plant ("JAMES" Plant) which produces approximately 5,200 wet tonnes (wt) of Class A and Class B dewatered biosolids per year. The JAMES plant has three storage tents located within the site, used for temporary storage and curing of biosolids prior to transportation. In 2020 SYLVIS was contracted by the City to beneficially manage biosolids produced at this facility.

A total of 7,129 wt of City biosolids were removed from JAMES plant in 2020 and delivered to two sites in British Columbia (BC) for grassland restoration and agricultural fertilization.

This document contains a summary of the 2020 biosolids management program including biosolids quality monitoring data (Table 1 and Table 2), a summary of activities undertaken in the delivery of the biosolids management program (Table 3), a summary of biosolids managed by month (Figure 1) and maps of the application areas from land application sites (Figure 2, Figure 3, and Figure 4).

BIOSOLIDS MANAGEMENT ACTIVITIES

City biosolids were transported, stored, and land applied by SYLVIS at two different sites in 2020. Biosolids management activities are described below, separately for each site – the OK Ranch and Pinnacle Farm. Biosolids stored at JAMES plant at the beginning of 2020 and produced early in the year met Class A requirements. However, due to process changes biosolids produced starting March 2, 2020 did not meet pathogen reduction process requirements for Class A biosolids, and were assessed as Class B instead.

The management of City biosolids in 2020 adhered to all of BC's *Organic Matter and Recycling Regulation* (OMRR) requirements including maximum authorized application rates, quality requirements for biosolids accepted, pre-application and predicted post-application soil concentration limits (to be confirmed by post-application soil samples in spring 2021), signage and storage, runoff prevention and sampling requirements.

All biosolids land applications were completed according to their respective Land Application Plan (LAP) and were overseen by a SYLVIS Qualified Professional.

OK RANCH

In 2020, 5,810 wt of City biosolids were transported by Agri-Trans Services, Ridge Valley Farms, Sumas Transport, and Valley Carriers to the OK Ranch located approximately 60 km northwest of the Village of Clinton, BC. Biosolids were delivered intermittently between February 24 and December 30. Once transported to site, City biosolids were stored in designated stockpile areas to facilitate biosolids deliveries and applications. As part of the restoration program, City biosolids have been applied to grasslands to increase forage production and improve soil properties such as nutrient and organic matter content. The OK Ranch grassland restoration program requires Class B (or Class A managed as Class B) biosolids, and both types were delivered to the site.

A portion of these biosolids (4,378 wt) were land applied between September 22 and October 14, 2020. Biosolids were applied using an agricultural spreader to grasslands of the OK Ranch (Figure 2). Approximately 1,432 wt of City biosolids which were delivered after the land application season were stored on site at the end of 2020 in preparation for land application in 2021.

PINNACLE FARM

In 2020, 1,319 wt of City biosolids were transported by Agri-Trans Services, Sumas Transport, and Valley Carriers to Pinnacle View Limousin Farm in Quesnel, BC. Biosolids were delivered between April 22 and May 5, and again between August 14 and October 7. Once transported to site, City biosolids were stored in designated stockpile areas to facilitate biosolids deliveries and applications. A portion of these biosolids (1,198 wt) were land applied at three different times to different fields – April, September and November 2020. Biosolids were applied using an agricultural spreader to agricultural land and incorporated into the soil surface at Pinnacle Farm (Figure 3 and Figure 4). Approximately 121 wt of City biosolids were stored on site at the end of 2020 in preparation for land application in 2021.

Class B biosolids land applied in April and November were used to fertilize feed crops with no harvest restrictions. Biosolids land applied in September were specifically selected as Class A biosolids from the JAMES storage tents as the crop grown on site (canola) may have entered the food chain once processed into oil. Once on the market, the harvest from this field was most likely mixed with other batches (farms) for transformation into oil for either human consumption, biodiesel production or other uses.

BIOSOLIDS QUALITY

Biosolids quality is monitored by the City to ensure that quality requirements set forth in the OMRR for trace elements and pathogen reduction are met. In addition to City sampling, SYLVIS collects due-diligence samples to confirm concentrations of nutrients, trace elements and pathogen concentration.

One composite sample composed of eight equal volume sub-samples was collected from the JAMES plant storage tent on August 5, 2020. City biosolids were analyzed for physical parameters, nutrients, and trace elements (Table 1). This sample confirmed that biosolids produced in 2020 were in compliance with the trace elements quality criteria limits for Class A and Class B biosolids set out in the OMRR.

Seven discreet samples were collected from City biosolids at the OK Ranch on August 26, 2020 for analysis of fecal coliforms (Table 2). The geometric mean of the seven samples for fecal coliform analysis was 4,800 most probable number per gram (MPN/g) dry weight, which is below the OMRR limit of 2,000,000 MPN/g for Class B biosolids. These samples confirmed that biosolids City biosolids produced in 2020 met the requirements for pathogen reduction for Class B biosolids set out in OMRR.

REGULATORY REPORTING

Biosolids management occurred in 2020 under a Land Application Plan for the OK Ranch (SYVLIS Document # 1268-19, Authorization # 110179) and two Land Application Plans for Pinnacle Farm (SYLVIS Document #1269-20, Authorization # 110181, and SYLVIS Document # 1338-20, Authorization # 110463).

SYLVIS has drafted and will soon finalize the 2020 Qualified Professional Certification Reports for the OK Ranch (SYLVIS Document # 1390-21) and for Pinnacle Farm (SYLVIS Document # 1359-20). These documents are available upon request.

2021 BENEFICIAL USE SUMMARY

In 2021, biosolids applications are expected to continue at both the OK Ranch and Pinnacle Farm. New land application sites may be identified by SYLVIS and presented to the City. Active OMRR notifications and LAPs will remain in place at all sites during 2021. SYLVIS will keep the City informed of any updates or changes regarding the identified management sites. SYLVIS looks forward to continuing the management of the City biosolids in a manner that is compliant with all applicable regulations.

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APPENDIX ONE – TABLES

Table 1: 2020 City of Abbotsford biosolids quality – nutrients, classification and trace elements.

Parameters	Aug-5-2020[a]	Class A Limits[b]	Class B Limits[c]	Units
Available Nutrients				
Ammonium	6,650	-	-	µg/g
Nitrate	< 10	-	-	µg/g
Phosphorous	3,300	-	-	µg/g
Potassium	674	-	-	µg/g
Sulphate	1,250	-	-	µg/g
Boron	13	-	-	µg/g
Classification				
Organic Matter (LOI)	70.97	-	-	%
Total Kjeldahl Nitrogen	6.79	-	-	%
Total Organic Carbon	42.99	-	-	%
C:N Ratio	7.0	-	-	-
pH	6.8	-	-	pH units
Electrical Conductivity	2.01	-	-	dS/m
Moisture	76.1	-	-	%
Wet Bulk Density	0.97	-	-	kg/L
Trace Elements				
Arsenic	5.6	75	75	µg/g
Cadmium	1.3	20	20	µg/g
Chromium	28	-	1,060	µg/g
Cobalt	2.6	150	150	µg/g
Copper	620	-	2,200	µg/g
Lead	26	500	500	µg/g
Mercury	1.7	5	15	µg/g
Molybdenum	8.4	20	20	µg/g
Nickel	20	180	180	µg/g
Selenium	6.7	14	14	µg/g
Zinc	1,200	1,850	1,850	µg/g

Note: Where the value was below detection limit, the detection limit was included in the determination of the mean

[a] One sample was collected by SYLVIS at the JAMES plant. Sample comprised of 8 equal-volume sub-samples.

[b] Limits specified in Trade Memorandum T-4-93 (September 1997), Standards for Metals in Fertilizers and Supplements.

[c] Trace element concentration limits for Class B biosolids contained in the *Organic Matter Recycling Regulation* (2002), Schedule 4.

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Table 2: 2020 City of Abbotsford biosolids quality – fecal coliform analysis.

Sample Number	Sample Date[a]	Fecal Coliform (MPN/g)
Sample 1	26-Aug-20	1,330
Sample 2	26-Aug-20	3,580
Sample 3	26-Aug-20	68,000
Sample 4	26-Aug-20	33,500
Sample 5	26-Aug-20	< 485
Sample 6	26-Aug-20	1,650
Sample 7	26-Aug-20	7,010
	Geometric Mean	**4,800**
	OMRR Class B Limit[b]	**2,000,000**

[a] Samples were collected by SYLVIS at the OK Ranch.

[b] The maximum concentration for Class B biosolids under the *Organic Matter Recycling Regulation* (2002).

Table 3: Summary of tasks and activities completed by SYLVIS in 2020 as part of the City of Abbotsford biosolids management program.

Task or Activity	Description
Regulatory Reporting	Management was undertaken as part of the following Land Application Plans (LAP): • OK Ranch LAP (SYLVIS Document # 1268-19, ENV Authorization 110179) • Pinnacle Farm LAP (SYLVIS Document # 1338-20, ENV Authorization 110463) 2020 Qualified Professional Certification Reports for the OK Ranch (SYLVIS Document # 1390-21) and Pinnacle Farm (SYLVIS Document # 1359-20) are available upon request. 2020 City of Abbotsford Biosolids Management Summary submitted to the City March 10, 2021.
Biosolids Transportation	Coordinated with Agri-Trans Services, Ridge Valley Farms, Sumas Transport, and Valley Carriers for the hauling of biosolids from the JAMES Plant to the OK Ranch and Pinnacle Farm. Managed a long-term contract with Agri-Trans Services and Valley Carriers to fit the needs of the biosolids management program.
Stockpile Management	Ensured biosolids storage at all application sites was in accordance with all applicable regulatory requirements. Maintained access to the stockpile locations at the OK Ranch during all times of the year. Road clearing equipment and operators were provided throughout the winter; road maintenance activities were undertaken throughout the spring, summer, and fall.
Biosolids Quality	Full Suite analysis of one composite sample was completed in 2020. Fecal coliform analysis of seven discrete biosolids samples were completed in 2020.
Biosolids Processing	As per the dates specified in the individual LAP's, biosolids land applications occurred between April and November 2020. Completed biosolids application tracking, mapping, and application rate confirmation.
Project Management	Provided Qualified Professional services to oversee the implementation of all LAPs. Engaged with local interested parties at the OK Ranch and Pinnacle Farm by providing information about the program and truck traffic. Provided the City with regular updates and monthly biosolids summaries throughout the year.

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APPENDIX TWO – FIGURES

Figure 1: Tonnage of City of Abbotsford biosolids managed by SYLVIS by month in 2020.

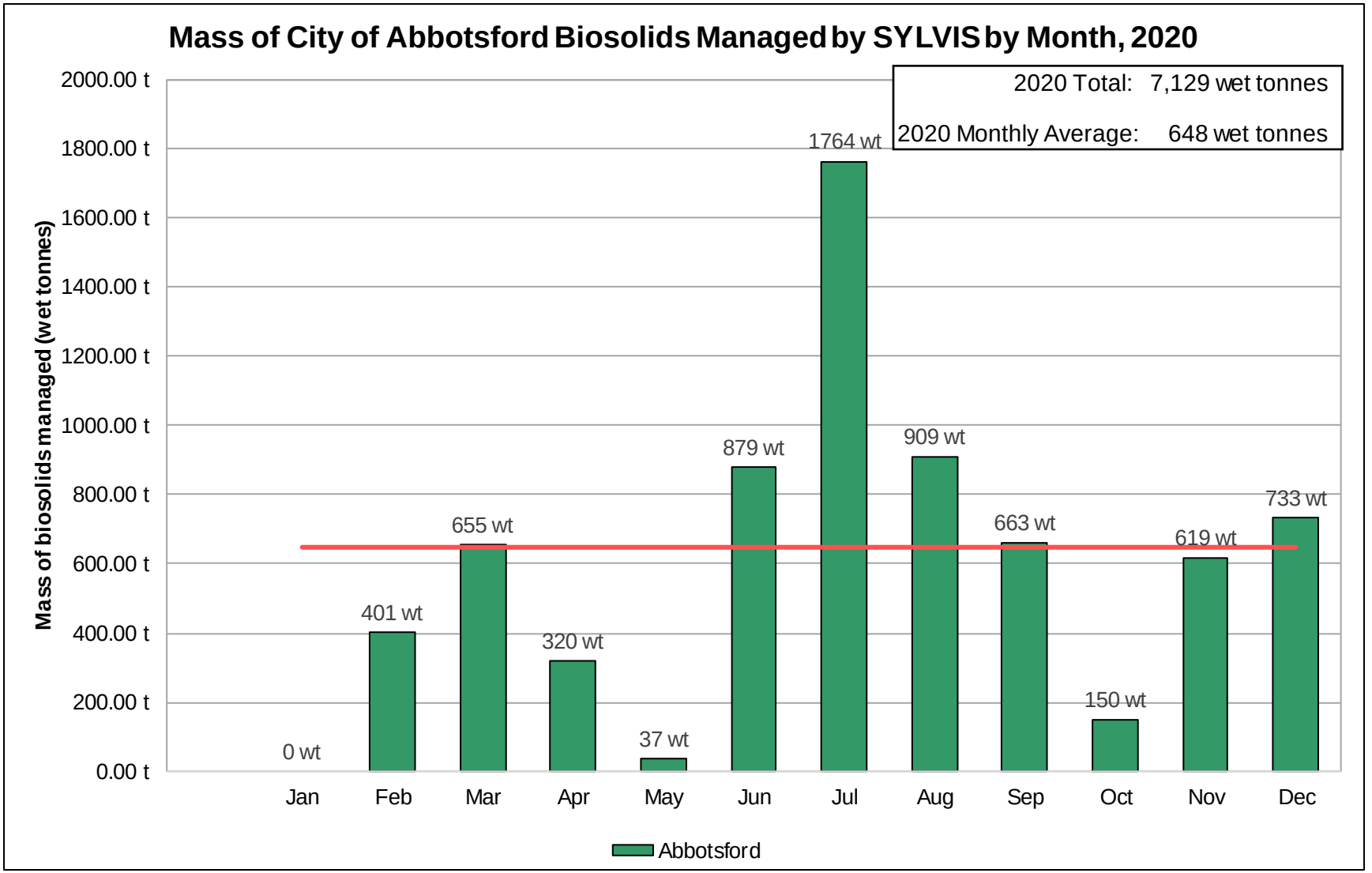

Figure 2: OK Ranch project site with 2020 City of Abbotsford biosolids land application areas.

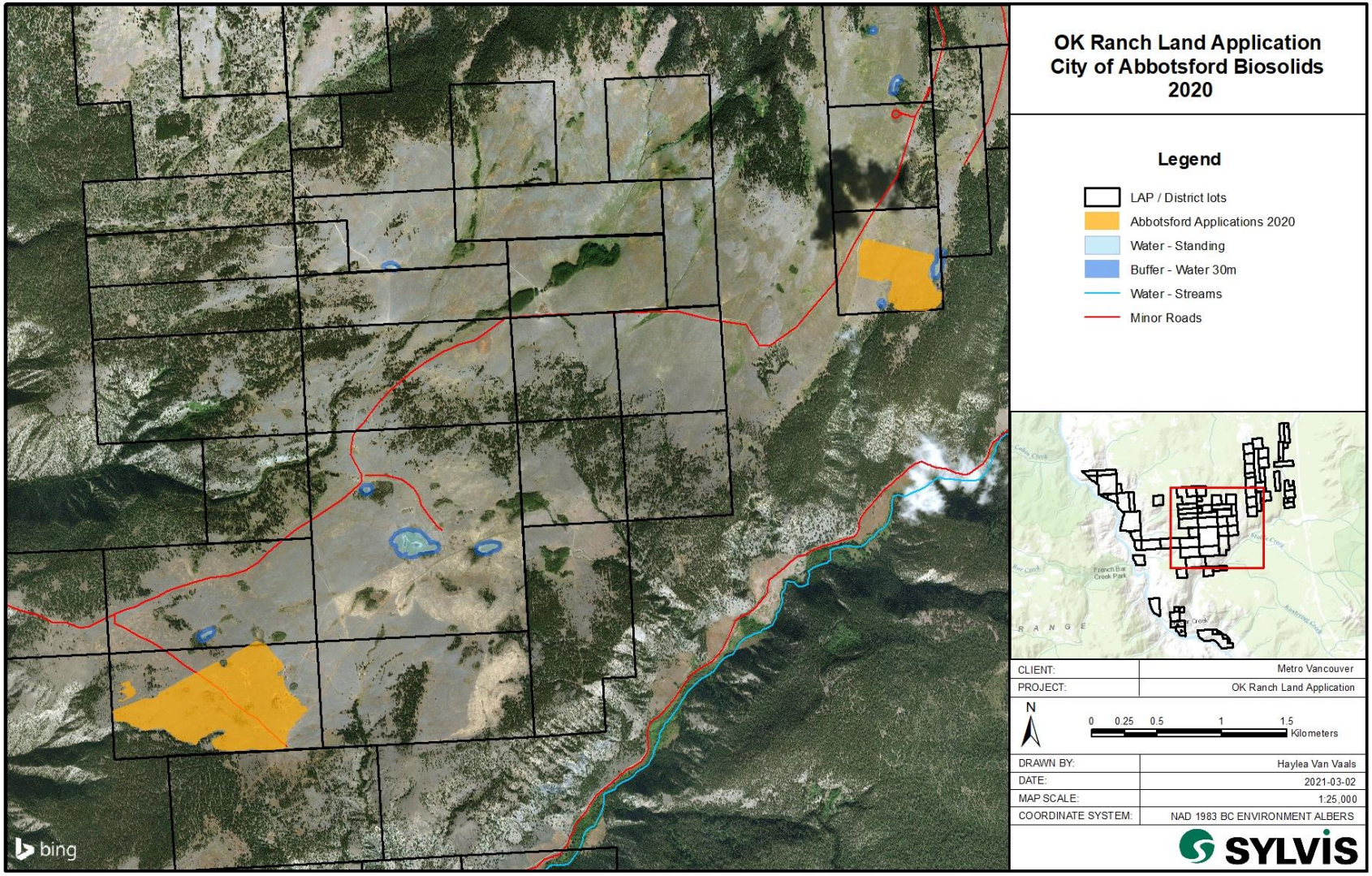

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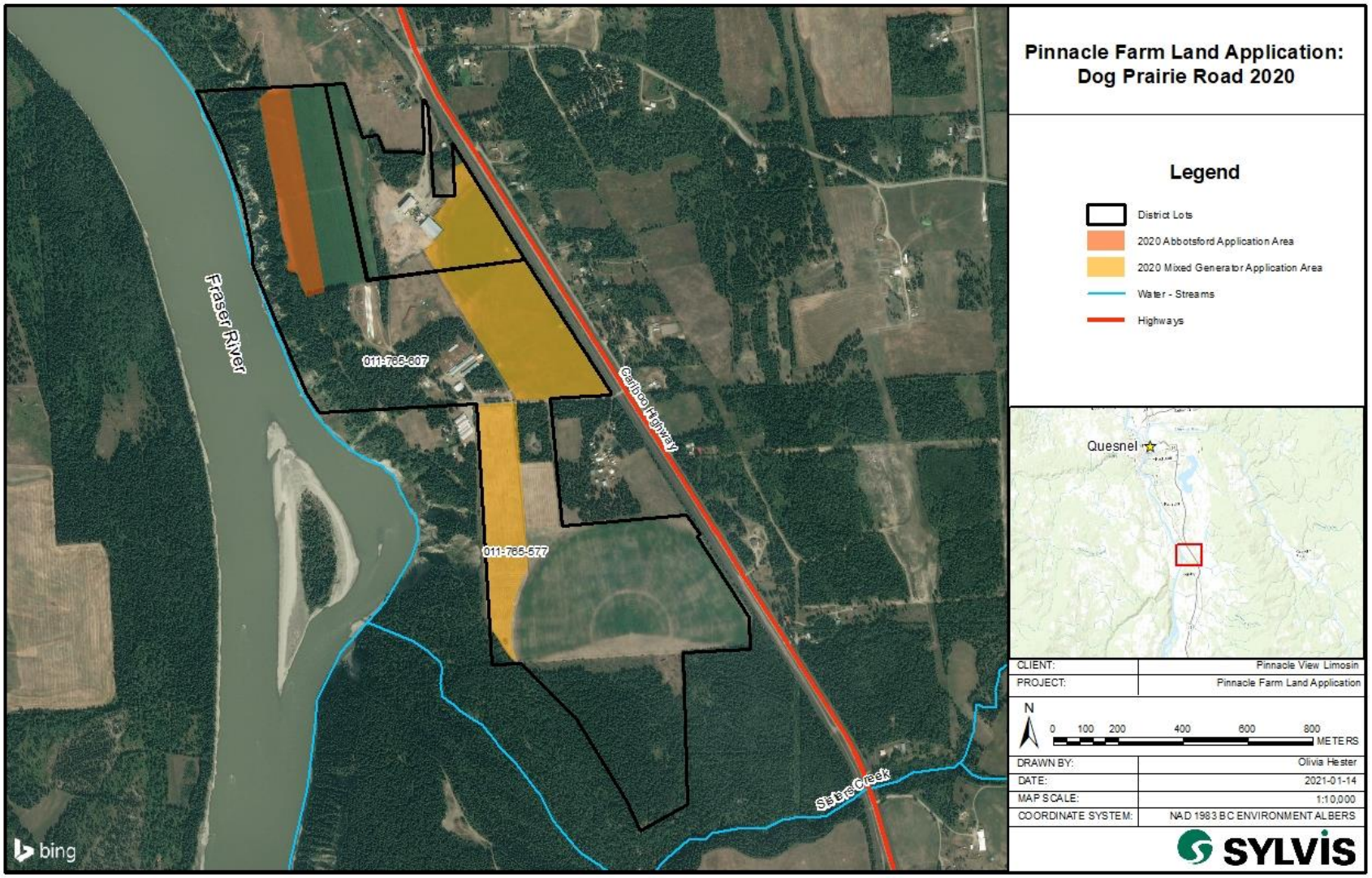
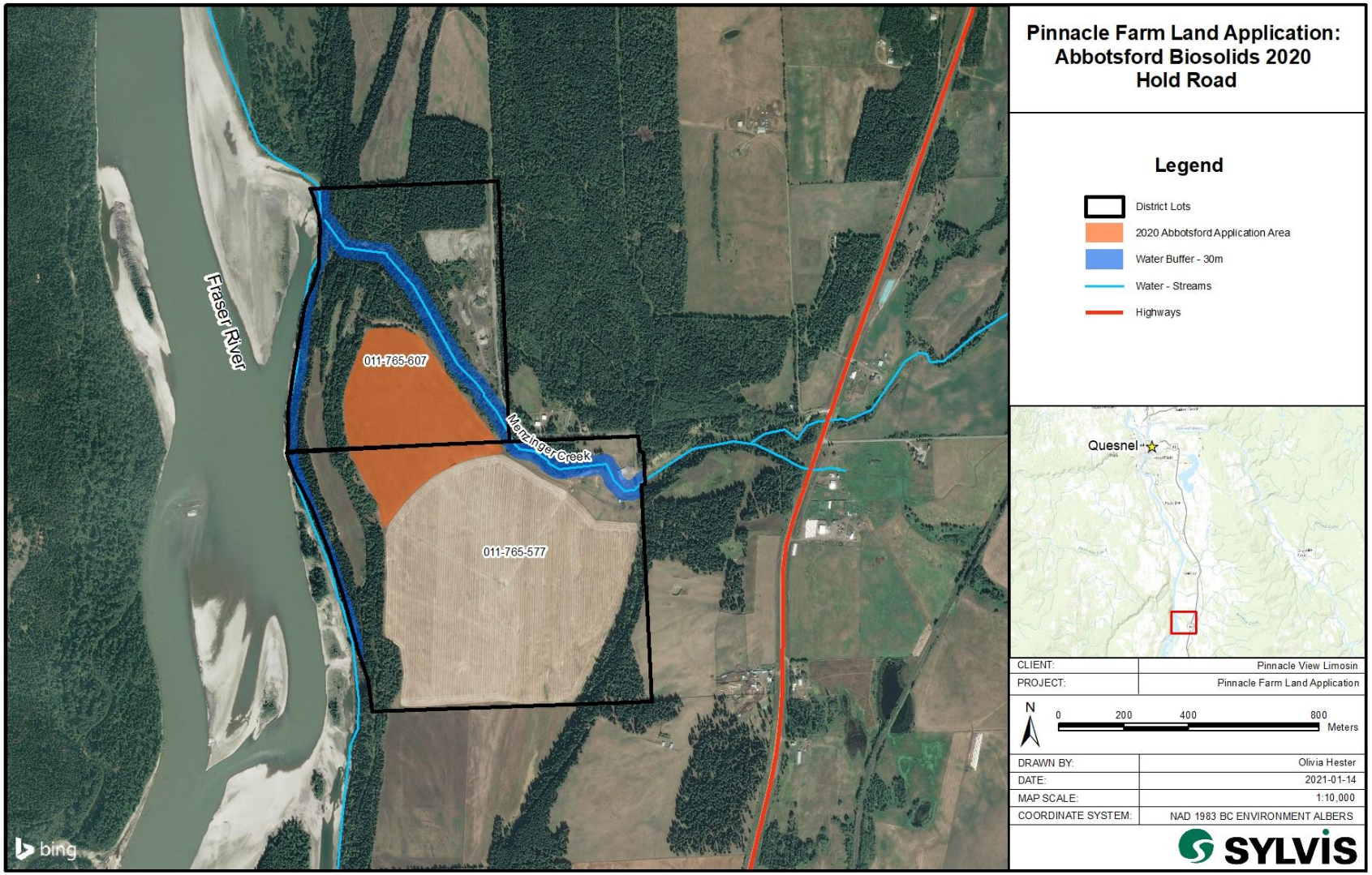
Figure 3: Pinnacle Farm – Dog Prairie Road project site with 2020 City of Abbotsford biosolids land application areas.



Note: Areas that received biosolids from only the City of Abbotsford are labelled in orange. Areas that received a mixture of biosolids from four different generators are labelled in yellow (City of Abbotsford, City of Chilliwack, District of Kent, and Tsawwassen First Nation).

Figure 4: Pinnacle Farm – Hold Road project site with 2020 City of Abbotsford biosolids land application areas.



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APPENDIX THREE – 2020 LAND APPLICATION PLANS FOR THE OK RANCH

Land Application Plans for City of Abbotsford biosolids management in 2020 are provided separately.