

**SOLID WASTE MANAGEMENT
Annual Operations and Monitoring Report
Revelstoke Refuse Disposal Site MR-15821
2016**



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1.0 INTRODUCTION

The Revelstoke refuse disposal site (hereinafter referred to as “the site”) is located at 330 Westside Road Revelstoke, British Columbia, approximately 3 km northwest from the core of Revelstoke. The site area is contained on two individual sites bisected by Westside Road. The existing landfill is located west of Westside Road and is the area where the active landfill is being constructed. The East site is located approximately 400 meters south of the active landfill on the East side of Westside Road and is where the scale, scale house, composting area, transfer station and marshaling areas are located. The East property is the source of soil cover for the existing landfill site and will be an active landfill once the West site is closed.

The properties are located along western portions of Legal Sub-division 13 of Section 4, Legal Subdivisions 4 and 5 of Section 9, and all of Legal Sub-division 1 of Section 8, all in Township 24, Range 2, and West of the 6th Meridian. Kootenay Division Yale District. The two sites are leased from the Crown and contain 54 acres.

The site has been in operation since the early 1970’s as a natural attenuation landfill and regulated under Operational Certificate MR-15821, issued by the Ministry of Environment. The site came under the management of the Columbia Shuswap Regional District (CSRD) in the late 1970’s and was operated under contract by SCV Contractors Corporation in 2016. The site is being developed as per an approved Design and Operations Plan (D&O Plan).

The site provides solid waste disposal and residual processing services to residents, businesses, and institutions located within the municipality of Revelstoke and surrounding area and to Electoral Area B. The CSRD operates a refuse transfer station in Trout Lake which delivers solid waste to the Revelstoke refuse disposal site.

Environmental monitoring which includes groundwater sampling, analysis and reporting continued at the site in 2016. Data collected from the groundwater monitoring program has been compared to the historical records to determine whether the site has affected groundwater quality and, if so, to what extent. The qualified professionals report is currently in draft form and will be posted to the CSRD’s webpage upon completion.

In accordance with the user-pay principles of the Solid Waste Management Plan, fees are charged for the disposal of all waste materials. The disposal fee for co-mingled municipal solid waste across scaled sites is set at \$70 per tonne, as per changes in 2009 in accordance with the new Solid Waste Management Plan. Furthermore, in 2010 a differential tipping fee was introduced to encourage recycling by creating disincentive fees for loads which are not separated.

2.0 BACKGROUND

With the exception of statutory holidays, the site was open to the public in 2016 on the following schedule:

Year Round Monday to Saturday from 10:00 am to 4:00 pm

The site contains a lockable gate, a single truck scale with electronic weighing and reporting software, a scale house, and an internal transfer station. The site operates on a user pay system where payment is collected on a load weight basis.

3.0 OBJECTIVES

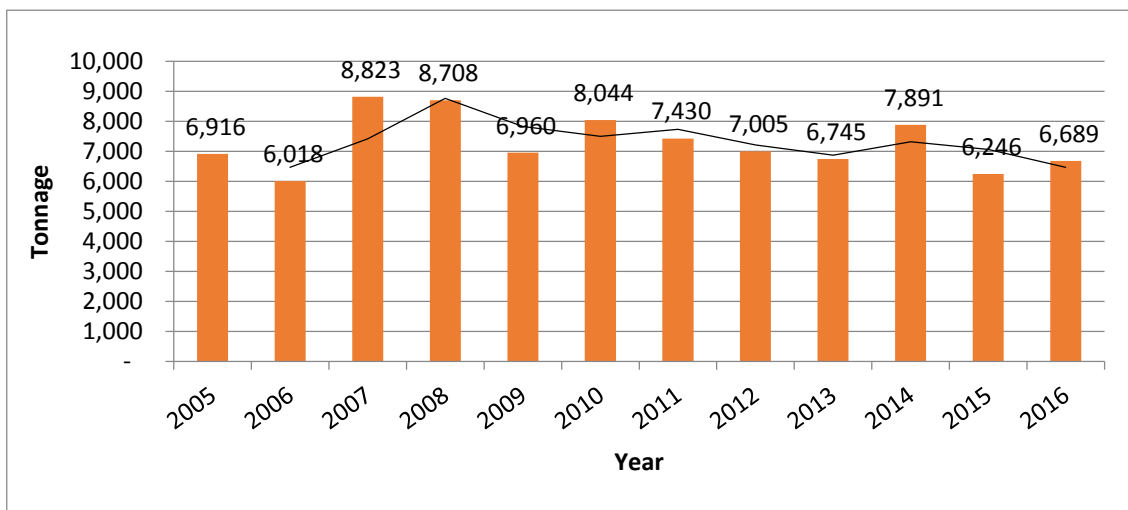
The objective of this report is to provide information required to meet the annual reporting requirements in Section 5.1 of Operational Certificate MR-15821 issued by the BC Ministry of Environment (MOE) on March 1, 2011.

3.1 Total Tonnage of Waste Discharged (Figure 1)

In 2016 approximately 14,194 tonnes of refuse and recoverable wastes were managed at the site. The quantity of municipal solid waste landfilled at the site in 2016 was 6,689 tonnes, which represents a 7% increase over 2015. Using the most recent census date (2016) the per capita disposal rate for 2016 was 0.82 tonnes/person/year, based on a population of 8,145 for the service area.

In 2016 7,505 tonnes were diverted to marshaling areas for recovery. Existing diversion programs include; mattresses, drywall, asphalt shingles, concrete, contaminated soil, wood waste, yard and garden waste, metal and reusable items.

Figure 1



3.2 Design Volume/Life Expectancy

The D&O Plan was prepared by Sperling Hansen Associates (SHA) in January of 2007. According to the plan, the existing site will be constructed and progressively closed in four phases which would consume an overall 582,319 m3 of air space. However, in 2015 SHA revised the fill plan to maximize the airspace available in Phase I and the following table outlines the new lifespan assessment for landfill closure liability purposes and landfill closure planning:

Landfill Phase	Available Airspace* (m ³)	Airspace Consumed**(m ³)	Airspace Remaining (m ³)	Lifespan Remaining*** (years)	Year of Expected Closure
I	98,535	44,682	53,853	4.00	2020
II	156,212	66,491	89,721	6.66	2026
III	160,688	10,000 est.	150,688	11.19	2037
IV	111,329	0	111,329	8.27	2045

* Based on 2006 SHA D&O Plan

** Based on 2016 Survey Results

*** Based on current average annual airspace consumption (13,464 m³/year)

It was determined by survey that 12,794 m³ of air space was consumed at the site in 2016, representing a 2% decrease over 2015.

3.3 Accomplishments and Inspections in 2016

The site was inspected by CSRD staff seven times in 2016. Inspections on April 19, May 19, and July 13 found the contractor to be out of compliance with the contract and the D&O Plan due to improper grades on outside slopes of the active landfill phase. The compliance issues were fixed and the site was found to be back in compliance during an inspection on August 31. The contractor was found to be out of compliance with the contract and the D&O Plan during an inspection on November 30 due to exposed refuse at the active cell. A follow up inspection on December 9 confirmed the Contractor had corrected the issue. Inspection reports are available upon request.

In 2012, an infiltration ditch was constructed along the east slope of phase 1 to catch any leachate outbreaks and allow for re-infiltration into the landfill. In 2015 an infiltration ditch was constructed along the west slope of phase 2 to catch any leachate outbreaks and allow for re-infiltration into the landfill. These measures were installed and upgraded in an effort to ensure water coming into contact with refuse is managed on site. These ditches and infiltration areas worked well in 2016 to manage leachate on site.

The CSRD has partnered with the BC Used Oil Management Association and TerraPure to construct a household hazardous waste/used oil storage and containment centre. The CSRD redesigned a portion of the marshaling area, provided increased staffing and installed the infrastructure required to manage the new materials. This provides residents of Revelstoke and Area B with an approved drop location for used oil and hazardous waste.

The transfer bay safety railings were upgraded to comply with the CSRD's engineered safety railing design. Continued repairs were made to the safety railings in 2016.

The CSRD acquired new GPS survey equipment to check current landfill design to ensure it is compliant with the D&O Plan. Site surveys were completed in 2016.

3.4 Wildlife Occurrences

The perimeter of the Revelstoke landfill has an electric fence which is winterized from November to March. Voltage is checked during inspections and is in the 6-7 kV range (except winter). The electric fence quit working once due to fence damage and evidence of bears entering the site during closed hours was present. The fence was repaired and voltage was restored. There were no bear occurrences when the electric fence was functioning properly.

3.5 Solid Waste Landfill Closure and Post-Closure Liability

Each spring the CSRD's Finance Department assesses closure reserves, future closure projects and landfill capacity to ensure adequate reserve funds are available for planned closure work. A copy of this assessment work has been included as Appendix 'A'.

3.6 Plans for 2017

The CSRD will continue to work with the site contractor on the new fill plan for phase 1. Newly acquired GPS survey gear will be used to ensure airspace is utilized and phase 1 is built as per the D&O Plan.

A site perimeter road will be constructed around the newly filled areas of phase 1 with surface water ditches. This road will help maintain access around the site for contractors and to ensure site monitoring.

New alternative daily cover plates will be purchased to replace damaged ones. This will help reduce vectors from accessing refuse.

3.7 Operator Training

No formal training was completed by the contractor in 2016.

4.0 ENVIRONMENTAL MONITORING

Western Water Associates Ltd. conduct all environmental (groundwater and surface water) monitoring and reporting for the Revelstoke Landfill, as per the requirements of the Operational Certificate. Western Water has provided conclusions and recommendations based on the 2016 data collected, which will be posted on the CSRD website for public review after April 1, 2017.

In addition to groundwater monitoring, in 2016 Western Water assessed the state of the drainage system to the west of the existing landfill area. The aim of the assessment work was to determine if the landfill is having an impact on the drainage system which ultimately feeds the Jordan River. A remediation/prevention plan will be prepared if it is shown that the landfill is causing surface water impacts.

5.0 WASTE HIERARCY

The CSRD emphasizes and encourages the 6R Hierarchy of Rethink, Reuse, Reduce, Recycle, Recovery and Residual management and continually strives towards a higher 'R' in waste management practice. At the Revelstoke landfill there are a number of programs established to facilitate the separation and salvaging of various recyclable materials.

The CSRD also manages a network of Multi Material BC (MMBC) recycling depots throughout the regional district, including one at the Trout Lake transfer station, one in downtown Revelstoke and one at the Revelstoke landfill. MMBC is the provincial stewardship group responsible for collecting packaging and printed paper, including but limited to; paper, cardboard, newsprint, containers, plastics, glass and styrofoam. Furthermore, the CSRD tracks and reports the amount of recycling collected via the City of Revelstoke's curbside recycling program.

5.1 Resource Recovery - Landfill Salvaged Materials

In 2016 over 7,500 tonnes of material was marshaled and recycled or reused on site. Wood waste and yard and garden waste are separated on site and are chipped by the CSRD wood grinding contractor. Wood chips are used on site for access roads, unloading pads, and blended with cover material for use on interior landfill cells. Metal, gypsum/drywall, asphalt shingles, mattresses, auto batteries, and propane tanks are separated from waste on site and are salvaged by CSRD contractors for recycling off site.

Concrete, asphalt, brick, and porcelain are separated on site and stockpiled to be crushed into an aggregate product for use on site. No concrete crushing was done in 2016. Appliances containing refrigerants and Ozone Depleting Substances are separated on site and these items are removed by a CSRD contractor before they are added to the metal area for salvage. Clean soil, contaminated soil, and chipped wood are separated for internal use at the site.

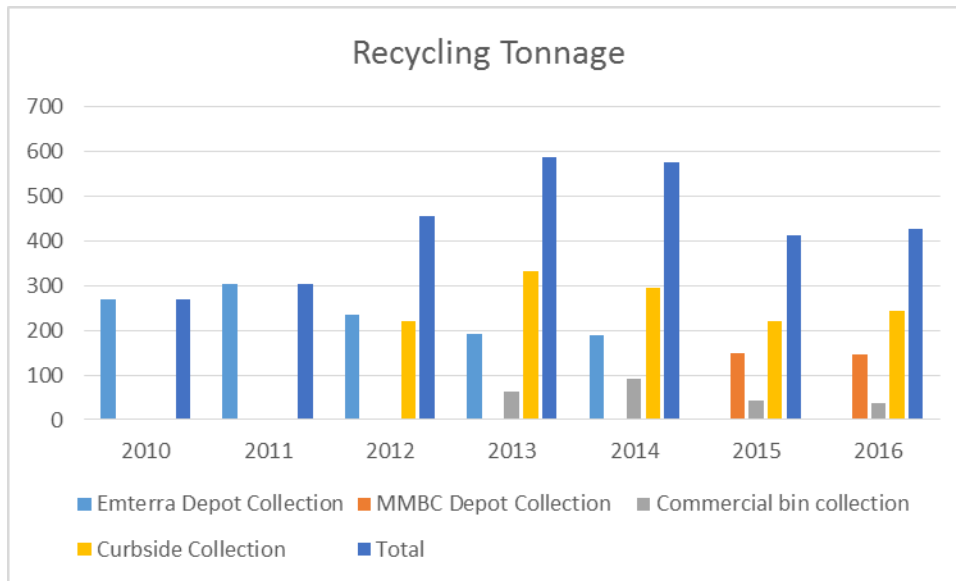
The following table provides an annual summary of 1) materials received and separated for processing and 2) categories and related tonnages processed for recycling or reused on the site for internal purposes:

Revelstoke Landfill - Resource Recovery							
Recoverable Resource	2010	2011	2012	2013	2014	2015	2016
Wood Waste - Received (MT)	1,220	1,710	1,102	1,132	982	1,121	924
Wood Waste - Processed (m ³)	6,592	8,531	7,290	6,313	4,008	6,293	8,572
Yard & Garden Waste - Received (MT)	821	771	1,200	1,388	1,397	1,223	1,832
Yard & Garden Waste - Processed (m ³)	1,200	1,398	1,625	1,750	1,998	4,081	1,538
Metal Waste - Received (MT)	157	205	114	80	124	159	339
Metal waste - Salvaged (MT)	430	449	97	117	77	162	263
Gypsum Drywall - Received (MT)	92	462	153	124	123	137	180
Gypsum Drywall - Salvaged (MT)	56	52	300	77	79	482	25
Asphalt Shingles - Received (MT)	22	181	139	111	101	92	95
Asphalt Shingles - Salvaged (MT)	-	57	140	109	-	302	-
Concrete/Brick/Porcelain - Received (MT)	24	161	127	332	346	273	743
ODS Units - Received	-	73	96	108	174	191	271
ODS Units - Processed	188	121	135	151	214	246	269
Propane Tanks - Salvaged	-	127	158	151	183	208	414
Auto Batteries - Salvaged	266	283	191	156	158	158	198
Mattresses - Received	-	-	-	-	423	709	747
Mattresses - Salvaged	-	-	-	-	423	707	464
Contaminated Soil Received (MT)	-	1,701	2,462	49	858	-	391
Clean Soil Received (MT)	-	312	3,599	568	753	62	1,963
Wood Waste Chipped Received (MT)	-	-	-	-	12	263	240
MT - Metric Tonne							
m ³ - cubic metre							

5.2 Recycling - Commercial and Residential Programs

In January of 2015, the residential recycling collection changed to the MMBC Packaging and Printed Paper collection Extended Producer Responsibility (EPR) program. Prior to the MMBC program the depot recycling program was not monitored which contributed to illegal dumping and inflated tonnage results.

The CSRD maintains a recycling program for commercial users, which is tracked separately. In addition, the CSRD has been working to add other stewardship materials, such as power tools and electronics, where there is a lack of program accessibility and partnerships with stewardship groups can be achieved.



5.3 Recycling – Household Hazardous Waste

The CSRD is committed to providing residents with recycling opportunities for household hazardous waste materials by way of conducting round up events. Materials are collected, safely packed and consolidated in either drums or pails. The following table provides a summary of the amounts of materials collected, including but not limited to; flammable substances, corrosives, mercury, etc., since 2012:

	Drums	Pails
2012	18	29
2014	17	16
2016	29	75

In 2016 the CSRD, in a funding partnership with the BC Used Oil Recycling Association, constructed a permanent used oil and hazardous waste drop off facility at the Revelstoke landfill. The depot is open on Saturdays and accepts residential materials at no charge. As a result the CSRD no longer has the need to hold hazardous waste round up events in Revelstoke.

Appendix 'A' - Solid Waste Landfill Closure and Post-Closure Liability

COLUMBIA SHUSWAP REGIONAL DISTRICT

Notes to Consolidated Financial Statements

December 31, 2016

5. Solid Waste Landfill Closure and Post-Closure Liability

The Environmental Management Act of B.C. and the Ministry of Environment of B.C. set out the landfill criteria to properly close and maintain all active and inactive landfill sites. Under the guidelines, there is a requirement for closure and post-closure care of solid waste landfill sites. Provisions are therefore made over the estimated remaining life of the Regional District landfill sites based on scalehouse records and through tipping fees.

The main components of the landfill closure plans are: final capping using an engineered cap design and the implementation of a drainage and gas management plan. The post-closure care requirements may involve: cap maintenance; groundwater monitoring; gas management system operation and maintenance; inspections; leachate treatment and monitoring; and annual reports. Post-closure care activities begin once the entire landfill site no longer accepts waste and continues on for a period of twenty-five years. As the date of the site closure is unknown, management estimates the liability to begin after the closure of the current active phase, assuming another phase will not be opened. In the event another phase is opened, the start date for the liability will be adjusted to begin upon closure of the newly opened phase.

The table below sets out the liability based on the estimated capacities used in cubic metres, multiplied by the estimated total expenditures, expressed as discounted present values, assuming 1.80% (2015 - 1.10%) inflation and 2.10% (2015 - 2.75%) long-term borrowing rate (fall issue MFA 25 year rate). The amount remaining to be recognized in future years is \$1,869,700 (2015 - \$1,619,300). The annual provision is reported as an Operating Fund expense and the accumulated provision is reported as a liability on the Consolidated Statement of Financial Position. Reserve funds totalling \$1,347,230 (2015 - \$1,004,009) have been established to provide for this liability in the Landfill Closure Special Reserve Fund.

The table also indicates the remaining landfill life in years and remaining capacity (100 minus % used) on the open phases and the anticipated post-closure costs recognized on total site capacity used.

	Estimated Remaining Life (Years)	Estimated Total Expenditure for Closure	Cumulative Capacity Used (m ³)	Total Estimated Capacity (m ³)	Used (%)	Liability for Closure December 31, 2016
Salmon Arm (phase 2 of 5)	10	\$ 2,202,700	165,799	383,778	43	\$ 951,600
Golden (pre-phase)	12	356,400	613,416	613,416	100	356,400
Golden (phase 1 of 4)	12	407,400	75,147	157,000	48	195,000
Revelstoke (pre-phase)	4	324,800	70,000	70,000	100	324,800
Revelstoke (phase 1 of 4)	4	728,800	57,476	98,535	58	425,100
Revelstoke (phase 2 of 4)	10	749,500	65,000	156,212	42	311,900
Revelstoke (phase 3 of 4)	21	911,000	10,000	160,688	6	56,700
Sicamous (phase 2 of 4)	9	293,300	87,315	166,000	53	154,300
Sicamous (phase 4 of 4)	27	463,600	110,000	125,000	88	408,000
Closure liability subtotal		\$ 6,437,500	1,254,153	1,930,629	65	3,183,800
Post closure liability subtotal						1,384,000
2016 total liability						4,567,800
Less: expenses previously recognized						(3,430,700)
2016 increase in the liability for landfill closure						\$ 1,137,100