



**SOLID WASTE MANAGEMENT
Annual Operations and Monitoring Report
Salmon Arm Refuse Disposal Site MR-5479
2012**



**Prepared by:
Ben Van Nostrand B.Sc., P.Ag., ASCT.
Waste Management Coordinator
Columbia Shuswap Regional District**

Columbia Shuswap Regional District
781 Marine Park Drive NE
SALMON ARM BC V1E 4P1
Telephone (250) 832-8194 / Toll Free 1-888-248-2771 / Fax (250) 832-8165
<http://www.csr.bc.ca>

1.0 EXECUTIVE SUMMARY

This report has been prepared in accordance with Section 4.4 of Operational Certificate MR-05479. The main objective of the report is to provide the Ministry of Environment with an overview of the operations at the Salmon Arm landfill for 2012 and to address the specific requirements outlined in Section 4.4.

In 2012, approximately 16,767 tonnes of waste was directed to the active face and landfilled. This figure represents a 7% increase over 2011 and, based on 2011 census data for the area, a per capita disposal rate of 0.52 tonnes per person. However, it should be noted that due to flooding events on Mara Lake, the Sicamous landfill was closed from June 23 to October 1, 2012. Using 2011 data, it is estimated that the closure resulted in approximately 1,400 tonnes being diverted to the Salmon Arm landfill. In addition, contract changes resulted in approximately 67 tonnes of refuse from the Malakwa transfer station being transferred into the Salmon Arm landfill. Therefore, one could argue that the actual tonnage for the Salmon Arm area in 2012 was 15,300 tonnes, which is a slight decrease over 2011 tonnage.

Environmental monitoring at the site is being conducted by Summit Environmental Consultants (Summit) and their report will be available on the CSR D's website in May, 2013. Results from 2012 indicate that landfill indicator parameters do not show a significant increasing trend at any of the wells.

Major projects at the Salmon Arm landfill in 2012 included the development of composting infrastructure for the yard and garden materials collected through diversion programs and the commissioning of the landfill gas upgrader works. The composting facilities have been registered under the Organic Matter Recycling Regulation. Presently, Fortis BC is continuing to work on the commissioning of the landfill gas upgrader system, designed to divert landfill gas from the existing flare and upgrade to pipeline quality for distribution to homes and businesses in Salmon Arm.

2.0 INTRODUCTION

The Salmon Arm refuse disposal site (hereinafter referred to as "the site") is located at 4290 20th Ave SE Salmon Arm, approximately 3.5 km from the downtown Salmon Arm. The legal description of the property is Lot 1, Plan 45716, Section 7, Township 20, Range 9, West of the Sixth Meridian, Kamloops Division of the Yale District.

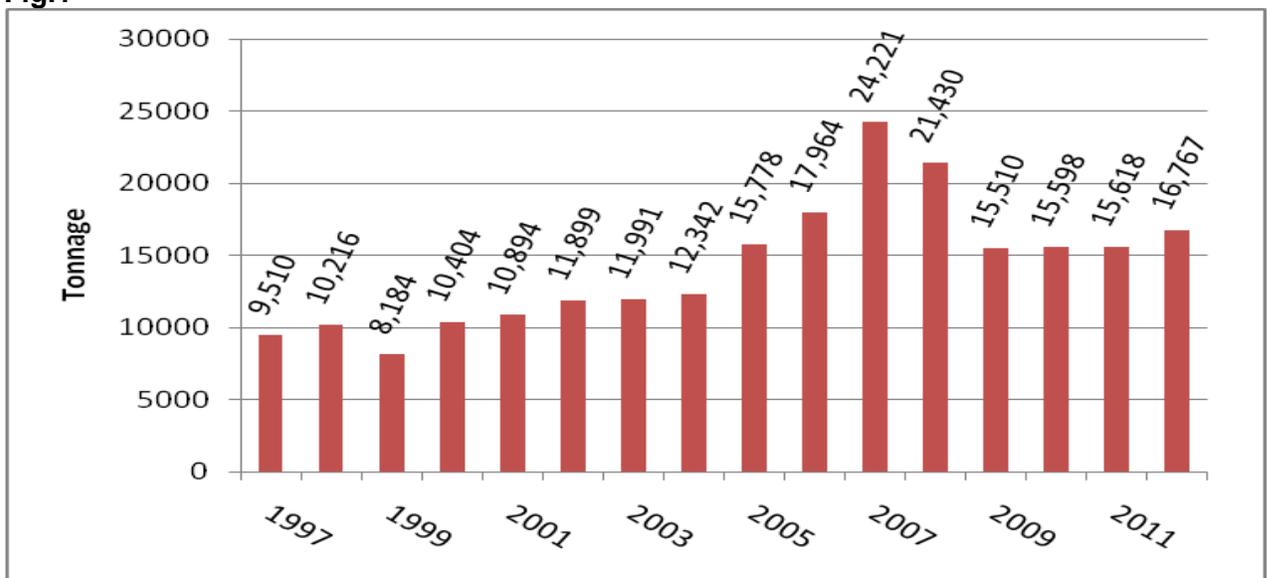
The site has been in operation since 1979, when the Ministry of Environment, Lands and Parks issued Permit PR 5479 to the District of Salmon Arm. In 1997, the permit was transferred to the Columbia Shuswap Regional District (CSR D). The property is owned by the CSR D and covers an area of approximately 22 hectares. The site is operated by Craig Hillson under contract with the CSR D (expires June, 2014).

The site provides solid waste disposal and residual processing services to residents, businesses, and institutions located within the municipality of Salmon Arm and to Electoral Areas 'C', 'D', 'E' and 'F'. CSR D manned transfer stations in Malakwa, Skimikin, Scotch Creek, Seymour Arm, Glenemma, and Falkland deliver solid wastes to the site in 50 yard containers on a regular frequency. Refuse from the Malakwa transfer station is new, as the contract to haul was awarded to a Salmon Arm company which now transfers the waste to the Salmon

The increase in tonnage is most likely attributed to the incoming waste from the Malakwa transfer station (67 tonnes) and the District of Sicamous during the flooding events in 2012 (1,400 tonnes based on 2011 estimates). Using the most recent census date (2011) the per capita disposal rate for 2012 was 0.53 tonnes/person/year, based on a population of 31,760 for the service area.

One third of all incoming materials, 9,919 tonnes, were diverted to marshalling areas for recovery. Existing diversion programs include; drywall, asphalt shingles, concrete, contaminated soil, wood waste, metal and reusable items.

Fig.1



3.2 Design Volume/Life Expectancy

The Salmon Arm Landfill Design and Operations Plan was prepared by Sperling Hansen Associates in December 2008. According to the plan, the site will be constructed and progressively closed in four phases. The first scheduled closure is phase 1 and the majority of work to close phase 1 was completed in 2010. During the closure work, phase 2 was prepared, incorporating a liner system and leachate collection works.

The D&O Plan required revisions to detail the phase 1 Closure work, which were forwarded to the MOE. In addition, as per the requirements of the British Columbia Landfill Gas Regulation, an Initial Assessment Report was submitted to the MOE in December, 2010.

It was determined by survey that 27,881 m³ of air space was consumed at the site in 2012, representing a 3% increase over 2011. The surveyed air space represents the refuse that has been landfilled in Phase 2.

3.3 Accomplishments in 2012

The CSRD continued to manage and maintain 2,300 hybrid poplar trees, planted on top of the closed Phase 1 of the landfill, for the purposes of leachate disposal. A report on the activities related to phytoremediation was prepared by the CSRD's summer student with the help of Forsite Engineering. The report discusses moisture assessments, foliar analysis and leachate quality results and can be made available upon request.

Site improvements at the Salmon Arm landfill included the paving of the transfer area and improving signage around the site. In addition, the southeast corner of the landfill was donated to the milfoil function of the CSRD for the purposes of constructing a storage facility and related works yard. A separate entrance has been established to restrict access to the landfill. A recycling storage bay was constructed to allow short term storage of recyclables to facilitate recycling compactor operations. Improvements were made to the yard and garden, and wood marshalling areas to reduce contamination. More directional signage was added to ease navigation for site users.

The major capital project for 2012 was the establishment of a composting facility, registered under the Organic Matter Recycling Regulation (OMRR), in the south east section of the landfill. The facility consists of a 14,000 m² area to accommodate composting and storage requirements. The area was cleared of timber, leveled and a semi-impervious pad consisting of compacted recycled concrete was constructed. In October, 5,000 m³ of yard and garden material was chipped and windrowed. Monitoring and management of the composting area will be done by CSRD staff in accordance to an operating plan prepared by Ruth McDougall, P.Ag. and the OMRR.

In the fall of 2012, Conestoga-Rovers & Associates (CRA) was hired to develop a Phase 2 optimization report for the Salmon Arm landfill. The intent of this report was to assess existing compaction and cover techniques in an effort to maximize the lifespan of Phase 2. In addition, the report makes recommendations for expanding the gas collection system by installing horizontal piping to capture methane as the Phase is developed rather than waiting until closure. This report is available upon request.

The site was inspected four times in 2012. The contractor was found to be in compliance with the contract and the design and operations plan during all inspections.

3.4 Wildlife Occurrences

According to the scale attendant and the site contractor, there were no reported occurrences of wildlife at the site in 2012.

3.5 Closure Fund

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 'B'.

3.6 Landfill Gas

The CSRD continued to flare landfill gas in 2012 and monitor the associated flow rates and composition to comply with the existing agreement with Pacific Carbon Trust (PCT) which was signed in 2010. The agreement with PCT allows the CSRD to collect carbon credits and sell those credits to PCT. Carbon credits will be verified through an independent 3rd party verifier, Ruby Canyon Engineering out of Colorado.

In September of 2012, Fortis BC began work on installing their landfill gas upgrader infrastructure, designed to upgrade the biomethane to pipeline quality standards. The system consists of vessels to remove hydrogen sulphide, soloxanes and carbon dioxide from the gas. Fortis anticipates having their system up and running in the first quarter of 2013.

3.7 Plans for 2013

Projects planned for 2013 include improved educational signage for yard and garden waste to reduce contamination in the composting operations. General information signage will be added around the scale shack to help educate the public. The area below the transfer bays and run-off control around the transfer area will be improved.

Staff will continue to manage the phytoremediation area to dispose of leachate generated on site. Results of the CRA's Phase 2 Optimization report will see the planning and prep work for the installation of landfill gas collection horizontals in Phase 2.

The Xebec/Fortis BC upgrading equipment finally arrived in September and commissioning of the gas plant has been ongoing since. It is estimated that approximately 8,000 CO₂ equivalents will be claimed for 2012.

4.0 WASTE HIERARCHY

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. The programs offered within each category along with successes and challenges experienced in 2012 are indicated below.

4.1 Rethink

4.1.1) Composter Incentive Program

In the fall of 2009, the CSRD launched a region wide Composter Incentive Program. The CSRD purchased a number of Earth Machine outdoor compost units at a cost of \$45 per unit. These composters were then offered to residents in the spring of 2012 in Salmon Arm and Electoral Area 'C', 'D', and 'F' for the same price. To ensure that all residents receiving a composter understood the benefits of home composting, as well as how to properly use

the Earth Machine composter, all individuals purchasing a composter were given the option to attend a 30 minute training seminar hosted by CSRD staff.

4.1.2) Reuse Website

The CSRD, in partnership with the Recycling Council of BC, continues to promote our reuse website, www.csrdruses.com. The website allows users to post items for sale, or post wanted items for free, up to a maximum of value of \$99.00. The site has seen exchanges ranging from clothing, furniture and appliances, to musical instruments and construction materials. By the end of 2012, over 74 new members had signed up with 69 exchanges taking place.

4.2 Reduce

4.2.1) Media Communications and Advertising

The CSRD continues to utilize local radio advertisements aired on the EZ Rock Network (FM Stations – 91.5) and newspaper advertisements in the local papers (Shuswap Market, Salmon Arm Observer, Sorrento Wave, The Kicker, Friday AM) to make residents aware of special events, and to promote various waste reduction themes. The CSRD also published The Loop Newsletter in the Shuswap Market, which included local event information, as well as ways to reduce household waste and promote sustainability in our communities. More recently the CSRD has entered into the social media world, utilizing Facebook to grow a network of engaged residents.

4.3 Reuse

4.3.1) Marshalling Areas at Refuse Disposal Sites

The site contains reuse marshalling areas for wood waste and propane tanks. A large portion of wood waste material is chipped and reused as alternate daily cover (in a soil/wood blend) or placed on the unloading pads of the active face when the ground is saturated and un-drivable.

4.3.2) Woodwaste Grinding and Composting

In 2012, 14,000 m³ of white wood waste was chipped at the landfill site, along with 7,000 m³ of organic wood waste. This fall, a windrow composting operation was started at the site. 5,600 m³ of the organic waste was chipped in the fall and placed into windrows. 3,100 m³ of green waste was cleared to make the composting pad, which was chipped and hauled to Tolko in Armstrong for their co-generation unit to produce green energy. 2,246 tonnes of wood waste and 2,000 tonnes of yard waste was received at the site in 2012.

4.3.3) Propane Tank Collection

851 propane tanks were collected from the site in 2012, compared to 274 collected in 2011.

4.3.4) Reuse Centre

The CSRD installed a Reuse Centre at the site in the fall of 2009. In 2012, over 1,400 items were salvaged from the Reuse Centre by residents. Items include household items, sports equipment, building material, and appliances. Residents are required to pay the regular disposal rate for items, but can choose to place items that are in good working order in the Reuse Centre for someone to take home free of charge.

4.4 Recycling

4.4.1) Ozone Depleting Substance Removal

At the site, ozone depleting substances were removed from 453 refrigeration units, prior to recycling.

4.4.2) Household and Automotive Battery Recycling

In 2011, the battery bin was removed from the site due to repeated theft of auto batteries. Instead, local businesses in Salmon Arm receive batteries from the public for recycling.

4.4.3) Gypsum/Asphalt Shingles/Concrete

Marshalling areas for gypsum, asphalt shingles and concrete have been established at the site. 140 tonnes of shingles and 300 tonnes of drywall were collected for recycling in 2012. Concrete stockpiles had not accumulated enough to crush in 2012. 506 tonnes of drywall and 354 tonnes of shingles were received at the site in 2012, along with 181 tonnes of concrete.

4.4.4) Marshalling Areas at Refuse Disposal Sites

All CSRD landfills contain recycling marshalling areas for metal wastes including white goods and scrap metal, gypsum, asphalt shingles, concrete, and household recyclables, including mixed paper, newspaper, tin cans, glass containers, plastics #1 to #7 and corrugated cardboard.

4.4.5) Scrap Metal Recovery

In 2012 the CSRD added free metal drop off to the 12 week yard and garden free days in the spring and fall. The site recycled approximately 600 tonnes of scrap metal in 2012 which includes source separated metal wastes deposited at the site from commercial and residential sources, as well as loads brought in

from three CSRD Transfer Stations. This is compared to 965 tonnes in 2011. The amount of metal received at the site over all was 690 tonnes for 2012.

4.4.6) Residential Recycling Service

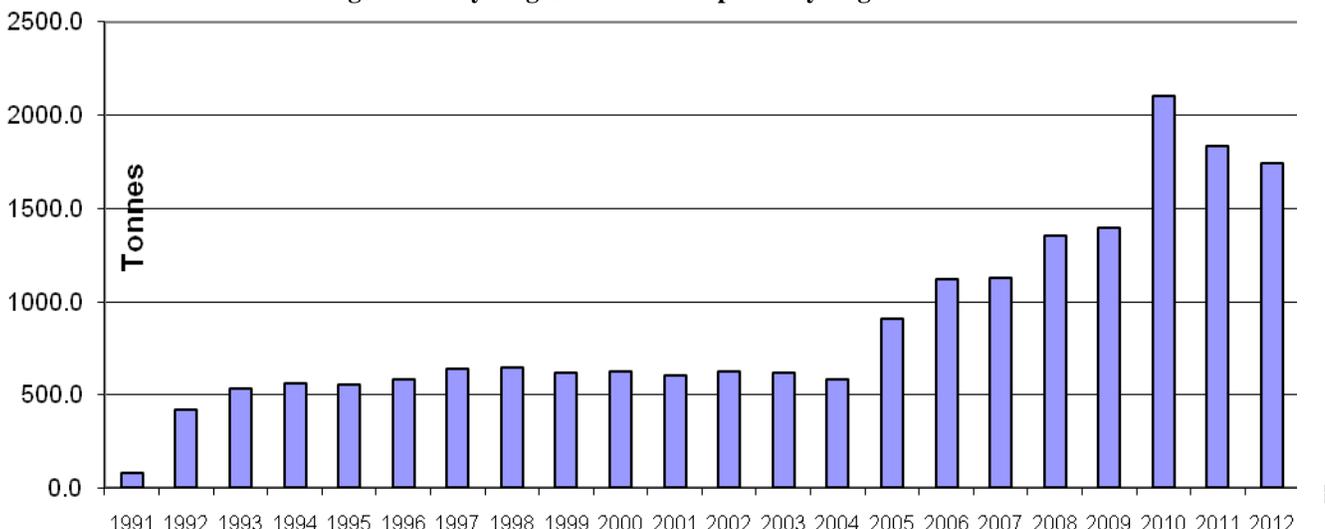
The City of Salmon Arm, in partnership with the CSRD, implemented a curbside residential recycling program in January of 2011. The City opted to provide a blue bag collection program with bi-weekly collection of unlimited recyclables. The program allows for the collection of mixed paper, newspaper, tin food cans, corrugated cardboard, plastics #1-7, and film plastic.

Opportunities to deposit recyclable items such as: newspaper mixed waste paper, food cans, glass containers, plastic containers #1,-7, and corrugated cardboard exist at all Regional District Refuse Disposal sites and in depots found in downtown municipalities. In Salmon Arm, the downtown recycle depot location is shared with a local bottle depot which also collects refundable beverage containers including milk containers, product care items (Paint Plus depot, Light Recycle, and small appliances), and electronics. The bottle depot also collects residential and commercial cardboard.

4.4.6.1) Depot Recycling

Recycle depots exist at all refuse disposal sites and within the municipalities of Salmon Arm, Sicamous, Revelstoke and Golden. In the fall of 2009, the recycling collection changed to a comingled collection system. A total of 725 tonnes of mixed waste paper, tin food cans, newspaper glass jars and bottles, corrugated cardboard and plastics #1 to 7 were collected in 2012 from the Salmon Arm landfill and downtown depot. This is a decrease of 105 tonnes from 2011, down 13%, which was expected with the increased usage of curbside recycling within the municipality. Figure 1 represents recycling collection quantities collected region wide since 1991 in the depot collection program only. A 7% decrease in recycling was noted in the depot collection program in 2012 region wide, which was expected with the introduction of curbside collection programs in member municipalities.

Figure 1-Recycling Collected in Depots only Region Wide



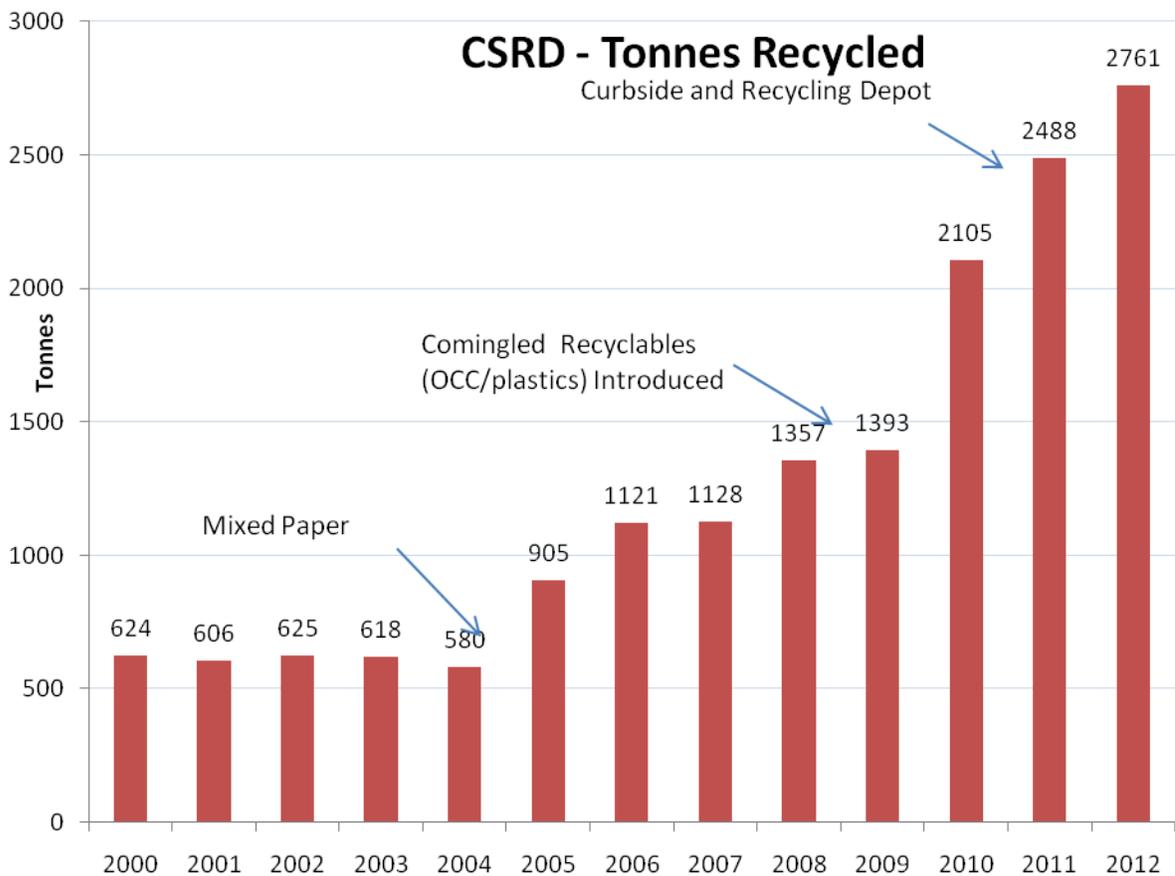
4.4.6.2) Curbside Recycling

Blue bag material is collected from all single family residences within the Municipality of Salmon Arm. The material is delivered to the reload station at the Salmon Arm Landfill, compacted in bins, and sent to Cascades Recovery in Kelowna. In the second year of the program, 685 tonnes of material was collected through the blue bag program, which is up 15% from 2011.

When the depot tonnages are added to the curbside tonnages, Salmon Arm has an overall decrease in diversion of -1% from 2011. This decrease may be due to an increase in private sector cardboard recycling at the bottle depot for both commercial and residential cardboard.

Figure 2 represents depot collection tonnages and the curbside tonnages, combined for the entire region, showing an 11% increase in recycling.

Figure 2-Increases in Recycling Region Wide Combining Depot and Curbside Amounts



4.4.7) Extended Producer Responsibility

Provincial stewardship programs such as the beverage container deposit-refund system, paint, pesticides and other residuals, waste oil and oil

containers, tire recovery programs, pharmaceuticals and electronics contribute to diverting materials from local landfills. Unfortunately, the Province of British Columbia does not require Stewardship agencies to report quantities recycled on a regional district basis; therefore quantities diverted from CSRD landfills through extended producer responsibility programs are largely unknown.

4.4.8) Private Sector Recycling

At this time the Regional District does not have quantitative values of wastes collected through other programs and therefore cannot adequately determine the overall waste diversion rate from the landfill site.

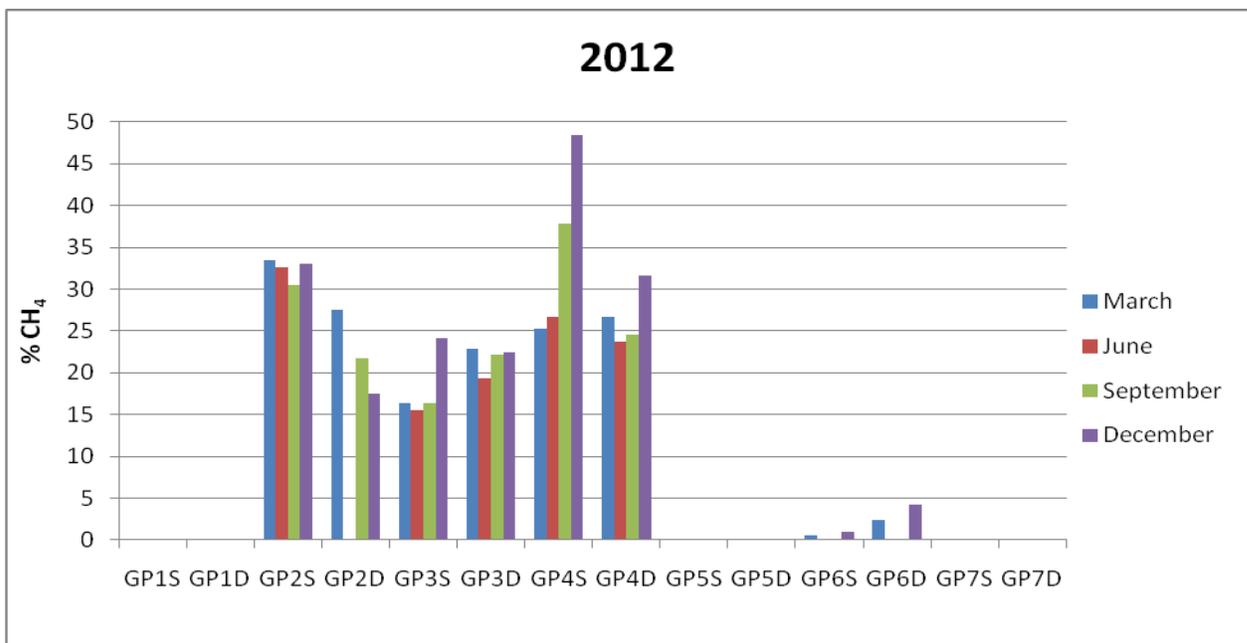
5.0 ENVIRONMENTAL MONITORING

5.1 Ground Water Monitoring

The CSRD has retained Summit to conduct Environmental Monitoring at the site, as per the requirements of the Operational Certificate. Summit has provided conclusions and recommendations based on the 2012 data collected, which will be posted on the CSRD website for public review after May 1, 2013.

5.2 Perimeter Gas Monitoring

The Salmon Arm landfill has seven soil gas monitoring probes situated around the landfill property. Gas probes 1-4 are located along the north property boundary bordering the Salmon Arm airport. Gas probes 5 and 6 are on the northern portion of the west property boundary bordering an orchard. Gas probe 7 is located on the south property boundary as a control for natural soil conditions. A map of the soil gas monitoring probes is in Appendix A.



Each monitoring probe has two nested gas sampling probes for shallow and deep sampling indicated by an S or D in the tag. Each probe has 3 metres of screened pipe and nested probes are isolated by a 1 metre bentonite plug. Shallow probes are screened from approximately 1 to 4 metres depth and deep probes are screened approximately 5 to 8 metres depth.

Sampling was done quarterly using a Landtec GEM2000 portable gas analyzer. Each gas probe is purged for 10 minutes before the sample is taken. Methane extraction from phase 1 began in January 2011 after it was closed and capped in the summer of 2010. Overall averages show that soil methane concentrations dropped in 2012 by 5.1% from 15.0% in 2011 to 10.9% in 2012. The following is a summary of methane concentrations for each well for 2012:

- Gas probe 1S and 1D's methane concentrations remained at 0% this year after quickly dropping to zero in 2011 when methane extraction began.
- Gas probe 2S remained consistent at around 30-35% and 2D continued to drop to below 20% in 2012.
- Gas probe 3S and 3D remained constant around 20%.
- Gas probe 4 saw an increase in methane concentrations. An area between gas probe 4 and the landfill was excavated and filled with low permeability clay to improve the landfill gas containment. The effectiveness of this will be seen in 2013.
- Gas probe 5 remained at 0%.
- Gas probe 6 remained at 0-5% after dropping to this range from 20% in 2011.

Carbon dioxide was found in the soil gas in areas where methane is present as they are the two main constituents of landfill gas. Carbon dioxide was present from 0% – 35.5% and is an indicator of migrating landfill gas. Salmon Arm landfill gas has a hydrogen sulphide range of 200-300 ppm although gas probe samples had only trace amounts of H₂S. Carbon monoxide and hydrogen gas were detected in trace amounts with maximum readings of 3 and 42 ppm respectively.

Methane concentrations pose potential hazards with many readings above the UEL of 15%. All structures on site are elevated on skids or are well vented to avoid the buildup of migrating landfill gas.

Overall, reductions in landfill gas were observed in 2012 in the monitoring probes surrounding the landfill. The CSRD plans to continue quarterly gas readings to acquire more data and monitor landfill perimeter soil gas concentrations in 2013. With landfill gas extraction continuing at the landfill, soil gas concentrations should continue to drop in the coming years.

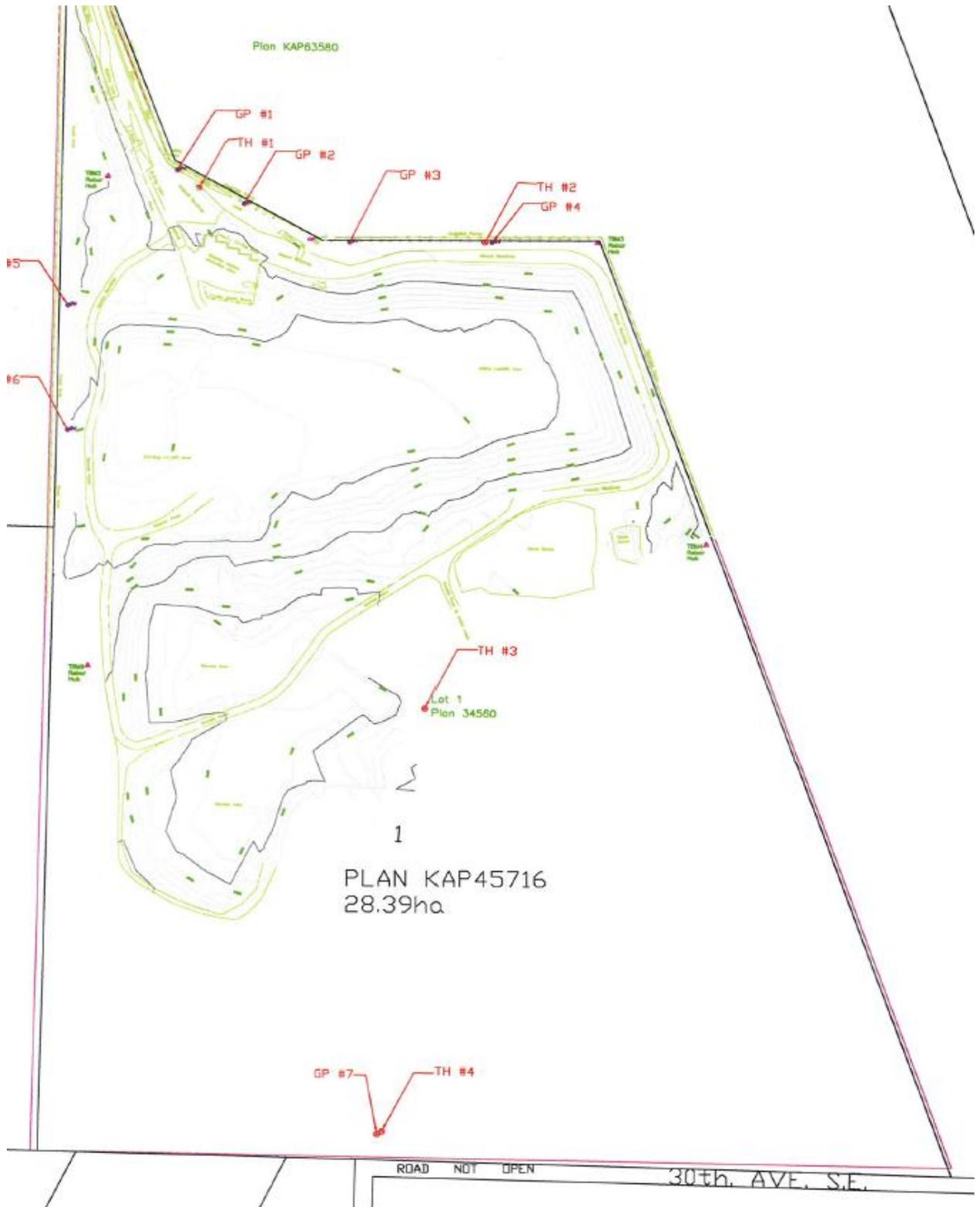
5.3 Litter, Dust and Vector Control

Dust is controlled by the application of Magnesium Chloride to the high use dirt roads on an as need basis. Vectors were not an issue in 2012.

5.4 Bird Control

Bird control services continued at the site in 2012, provided by an independent contractor. Bird control is achieved through the use of predatory hawks and pyrotechnics, which consist of bird bangers and screechers. The use of the predatory hawks is governed by a permit issued by the Federal Government.

Appendix A



Appendix B

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 CSRD 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.						
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 1.1% (2.4% - 2011) inflation and 1.06% (1.03% - 2011) investment rate (annual MFA money market fund). The amount remaining to be recognized in future years is \$ 3,831,100 (2011 - \$ 5,270,200). 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 \$ 830,505 (2011 - \$ 824,304) 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). Post-closure care is estimated to continue for a period of approximately 25 years.						
			cubic metres			
Site	Estimated Remaining Life (yrs)	Estimated Total Expenditure for Closure	Cumulative Capacity Used	Total Estimated Capacity	% Used	Liability for Closure to Dec 31, 2012
Salmon Arm (phase 2 of 5)	11	2,063,700	60,273	383,778	15.7%	324,100
Golden (pre-phase)	0	371,600	613,416	613,416	100.0%	371,600
Golden (phase 1 of 4)	13	2,528,900	38,407	146,000	26.3%	665,300
Revelstoke (pre-phase)	0	293,900	70,000	70,000	100.0%	293,900
Revelstoke (phase 1 of 4)	2	659,300	84,408	83,991	100.5%	662,600
Sicamous (phase 2 of 4)	13	270,500	57,553	166,000	34.7%	93,800
Sicamous (phase 4 of 4)	31	454,000	110,000	125,000	88.0%	399,500
Total		\$ 6,641,900	1,034,057	1,588,185	65.1%	2,810,800
					less expenses previously recognized:	2,954,800
					2012 reduction in the liability for landfill closure:	\$ (144,000)