TECHNICAL MEMORANDUM

MORRISON HERSHFIELD

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FROM:	Todd Baker, Morrison Hershfield	Email:	tbaker@morrisonhershfield.com
CC:	Maura Walker, Maura Walker and Associates	PROJECT No.:	513080100
RE:	Technical Memo #2 - Resource Recovery and Residual Waste Options for the SLRD	DATE:	May 9, 2014

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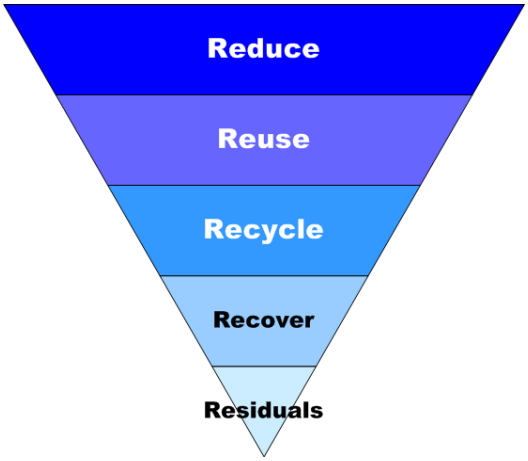
Introduction

The Squamish Lillooet Regional District (SLRD) is updating its 2007 Solid Waste Management Plan. The plan will be updated in two phases. The first phase focuses on an assessment of the current system for managing solid waste in the SLRD. The second phase identifies and assesses various waste management options for inclusion in the updated plan. This phase also includes a consultation program to obtain public input on the selected options.



Technical Memo #2 focuses on the interrelated 4th and 5th Rs, Resource Recovery and Residual Waste Management. The following sections provide an overview of the technologies and options for managing waste within the 4th and 5th Rs.

Technical Memo #2 includes the following sections:

- **Resource Recovery** – technology overview including potential applications in the SLRD
- **Residuals Management** – overview of landfilling and issues to be considered
- **Transfer and Waste Export** – overview of waste transfer and out-of-region waste export
- **Waste Flow and Flow Control** – summary of waste flow and flow control measures being considered by others
- **Existing Resource Recovery and Residuals Management** – overview of existing practices and system components in the SLRD
- **Regional Challenges and Options** – overview of potential challenges that need to be addressed and potential long term options

Summary of Issues and Challenges

The SLRD faces similar challenges to other regional districts. The key issues to be addressed include long term waste disposal capacity, long term costs and continued environmental compliance. Most of the waste in the region is currently disposed at one of three facilities:

- District of Squamish (DOS) Landfill – 11,700 tonnes
- Roosevelt Landfill in Washington State via the Whistler Transfer Station – 12,800 tonnes
- Lillooet Landfill – 2,500 tonnes

Within the current disposal management operations, the DOS landfill has 4 years of capacity remaining. The DOS has developed a conceptual plan to expand the landfill and has applied to the Province for the expansion. The DOS may not receive approval to expand the landfill and short term solutions for the DOS need to be considered. A feasible short term solution is to transfer waste to an out-of-region facility. Options include the Roosevelt Landfill in Washington State and the Cache Creek Landfill, both privately run facilities.

The Resort Municipality of Whistler (RMOW) operates a transfer station near Whistler. The facility is used to transfer waste to the Roosevelt Landfill in Washington State. The tipping fee at this facility is relatively low. If the DOS landfill expansion proceeds the RMOW may have the opportunity to send its waste to the Squamish Landfill. It is currently not known which option would be more economical for the RMOW.

Long term solutions for the region include continued transfer to landfills outside the region, development of a new regional disposal facility or transfer to one of the resource recovery facilities proposed to handle waste generated in Metro Vancouver and the Fraser Valley Regional District. These facilities include Metro Vancouver's proposed waste-to-energy facility and mixed waste materials recover facilities (MRFs) planned for Metro Vancouver and the Fraser Valley. These options would need to be explored further once the facilities are constructed – they do not represent feasible short term options.

Landfills in British Columbia are designed and operated in accordance with the BC Landfill Criteria for Municipal Solid Waste. The "Landfill Criteria" are currently being updated. A draft of the new Landfill Criteria is available for public comment. The new Landfill Criteria could significantly impact smaller landfills such as the Lillooet Landfill, requiring increases in design and operating budgets to remain compliant. Options for the Lillooet Landfill include continuing to operating with an increased budget or closing the landfill and transferring the area's waste to another landfill such as the Cache Creek Landfill.

For all options it will be important to understand the economics prior to making any decisions. The costs per tonne for transfer stations, waste hauling and disposal will need to be considered for all options. It will also be important to consider the potential impact of reduced revenue at disposal facilities if waste diversion numbers increase. Tipping fees may then need to be adjusted accordingly.

The SLRD may not have enough waste to make a new resource recovery facility feasible. However, since these technologies are part of the 4th R in the waste management hierarchy, and because they are being considered in other regions, a summary is provided. It is important for the Committee and the region to understand and continue to stay current on these technologies and developments in other regions.

Resource Recovery – the 4th R

Resource recovery is the 4th R in the waste management hierarchy. Resource recovery involves the extraction and utilization of materials and/or energy from the waste stream prior to disposal. This can include reuse or recycling of materials managed at resource recovery facilities. The following sections provide an overview of resource recovery technologies.

Mechanical separation of residual waste for additional recycling

This process is often also referred to as a "mixed waste material recovery facility" or "mixed waste MRF". The process takes the residual waste stream, either right from the source or after removal of recyclables and organics at source and processes it to remove additional recyclables. If the at-source recycling programs (source separation) are highly effective, few additional materials of value may remain in the waste stream.

Mixed waste MRF's are being implemented and considered in other regions in North America. For example, a mixed waste MRF in San Jose, California may be diverting approximately 50% of material currently sent to landfill. This facility accepts the entire waste stream including organics and recyclables. The Fraser Valley Regional District recent commissioned a study reviewing the performance criteria of mixed waste MRF's and anticipates that report to be available to the public in the Summer of 2014.

The private sector is in the process of implementing this technology in Metro Vancouver with the potential to add facilities in the Fraser Valley. Belkorp Industries Inc. has proposed to construct a $30 million mixed waste MRF in Coquitlam, BC. The facility would be capable of processing 260,000 tonnes of mixed waste annually and could divert up to 80% of the inbound material. Belkorp owns the proposed site in Coquitlam and would cover all capital and operating costs. Belkorp has applied to Metro Vancouver for a licence to receive waste from multi-family residential and commercial / institutional sources. Northwest Waste Solutions is currently constructing a similar MRF facility in Surrey, BC and Belkorp is also looking at the possibility of constructing another similar MRF in the Fraser Valley and in Cache Creek.

The feasibility of the mixed waste MRF's depends on the materials remaining in the waste stream, the value of the materials and the amount of waste that still contains high value materials that can be diverted. There needs to be enough high value materials in the residual waste to justify the potentially high capital cost. It is important to consider the unique conditions in other jurisdictions that have resulted in the successful implementation of this technology.

Mechanical separation and biological treatment of residual waste for additional recycling and production of refuse derived fuel

This process is also referred to as MBT (mechanical biological treatment). The primary purpose is to make a refuse derived fuel (RDF) that can be used on-site, or exported to other users (such as cement kilns) to displace fossil fuels. Metals are removed and recycled as part of the mechanical preparation process. The end result of MBT is a dried waste that can be shredded and formed into pellets that resemble wood chips and can be sent to cement kilns or other industries for use as fuel to replace coal or natural gas. The use of RDF has the same advantages as other forms of thermal resource recovery. The heat content in the residual waste is recovered, metals are extracted and recycled, and landfill life

is substantially extended (especially if the ash is not returned to the landfill, for example if the RDF is burned in cement kilns). This is a proven technology; however, large economies of scale and significant investment are required to make this technology feasible.

Anaerobic digestion

Separated wet or semi-wet organic materials can be anaerobically digested (AD) to create a biogas, which in turn can be combusted to make electricity and heat or used as an alternate fuel. This technology is common for agricultural manures and is being increasingly used to recover energy from food waste. The City of Surrey is currently in the process of developing an anaerobic digestion facility that will handle kitchen scraps and yard waste. The facility will produce compressed natural gas for use by waste collection vehicles. Anaerobic digestion is a proven technology, however, there needs to be sufficient amounts of organic feedstock to make this technology technically and financially feasible. In general, it is only cost effective in combination with substantial tipping fees and attractive subsidies for the energy sold, i.e. the value of energy at market prices will not cover the cost to implement AD.

Bio-drying

While composting was addressed in Technical Memo #1, there is a variation on the technology that involves producing a fuel from the composting process. Bio-drying involves the use of composting technology to dry organic waste to increase its calorific value for use as a fuel. The fuel is then used in other applications such as cement kilns. The option of using the Resort Municipality of Whistler's composting facility to produce a bio-dried fuel is currently being explored. The business case analysis for bio-drying at the RMOW facility is currently being undertaken.

Conventional waste-to-energy

The most common technologies for waste-to-energy (WTE) in use today are mass burn, or for smaller systems, controlled air combustion technology. The heat content of the waste is utilized, either for the production of electricity and/or as a large scale heat source. If the plant is located near an energy user such as an industrial facility or high density residential area, then heat can be sold as well as electricity, increasing the thermal recovery efficiency of the plant to well over 60% (versus under 30% for electricity only).

The BC Ministry of Environment has a policy since March of 2010 that defines the status of resource recovery utilizing WTE technologies:

- "The Ministry of Environment expects local governments to have a minimum target of 70% reduction of waste, before utilizing a WTE facility as a waste management option. The 70% target is calculated only from Reduce, Reuse and Recycle initiatives."
- "The Ministry expects that the resource recovery (energy recovery) facilities (4th R) meet at least 60% of the energy potential of the MSW used as fuel."

While conventional WTE is a proven technology it is unlikely that the SLRD generates enough waste to make this a cost-effective and feasible option. Studies in regions larger than the SLRD, but smaller than Metro Vancouver, have shown that the economies of scale at current tipping fees and energy costs are insufficient to make WTE financially attractive at this time.

Depending on the location of a future Metro Vancouver WTE facility, there may be an opportunity for other regional districts to utilize the facility. Given the scale of the facility planned by Metro Vancouver, the tipping fee is likely to compete with rates for existing disposal facilities. More detail on Metro Vancouver's process is provided in a subsequent section of this memo.

Advanced thermal recovery technologies

Several newer technologies are being developed for the recovery of thermal energy from residual waste, usually based on some form of gasification or pyrolysis. These technologies are currently being tested, and may be proven in the next several years. The most advanced of these is currently under construction in Edmonton, Alberta and will gasify compost plant residuals and specially prepared RDF to produce methanol and ethanol. Early results of performance can be expected sometime in 2015. The technology being employed has a module size that is much larger than what would be needed in the SLRD.

Landfill gas capture

Landfill gas (LFG) consists primarily of methane (CH_4) and carbon dioxide (CO_2), and is generated when organic materials decompose anaerobically. LFG is both burnable (it has a heating value) and both methane and carbon dioxide are greenhouse gases (GHGs). Methane is significantly more potent than carbon dioxide as a GHG. Both active landfill gas control with flaring or energy recovery and other technologies such as biocovers and biofilters can be used to mitigate the GHG impact of LFG.

The British Columbia Landfill Gas Management Regulation was introduced under the Environmental Management Act (EMA) on January 1, 2009. The regulation requires that owners of municipal solid waste landfills with 100,000 tonnes or more of waste in place, or with an annual waste acceptance rate exceeding 10,000 tonnes, undertake an assessment of landfill gas generation and submit the results to the Ministry in a report by January 1, 2011. If, according to Landfill Gas Generation Assessment Procedure, a regulated landfill site is estimated to generate 1,000 tonnes or more of methane, the owner or operator of that site is required to complete a LFG management facilities design plan and to install the designed facilities at the landfill site.

Currently the RMOW's closed landfill is actively collecting and flaring LFG without energy recovery. Flaring the gas significantly reduces the GHG emissions for this site. None of the other landfills in the region are currently required under the regulation to install an active landfill gas management system.

Current applications of resource recovery

In Canada, waste disposal and diversion targets are set at the provincial level and municipalities and Regional Districts are responsible for developing and implementing plans for diversion. The first three R's are widely accepted and are being practiced country wide. Results vary, and diversion rates based on the first 3 R's (including organics) vary widely. The City of Edmonton, which has one of the largest indoor compost plants in Canada is diverting over 60% of its residential waste, and will boost its overall diversion of residential waste to 90% with the use of an energy recovery plant (waste to biofuel).

Metro Vancouver currently reports a 55% diversion rate (for residential, ICI and construction/demolition wastes) and, with the implementation of region wide organics collection, is targeting 70% by 2015. The ultimate goal is diverting 80% by 2020. For the balance of waste after this diversion, (almost a million

tonnes of waste per year will remain), the region is proposing a second WTE facility with a capacity of 250,000- 370,000 tonnes per year.

There are four energy recovery facilities in Canada, Burnaby, BC, Peel ON, Durham/York, ON and Quebec City, QC. There are two commercially operating AD systems for kitchen scraps in the City of Toronto and one near Vancouver. Many landfills recover energy in the form of landfill gas, primarily because it contains potent GHGs, and most larger landfills utilize that gas for the production of electricity or heat. Local examples include the Hartland Landfill in Victoria, the Nanaimo Regional Landfill and the City of Vancouver Landfill.

Regions in BC, Alberta and Ontario are considering adding WTE capacity to their existing waste management systems. In BC the Capital Regional District, Cowichan Valley Regional District, Regional District of Nanaimo, Comox Valley Regional District and Metro Vancouver have undertaken studies to assess the potential to add WTE capacity. Both the Comox Valley Regional District and Metro Vancouver have adopted updated Solid Waste Management Plans that allow for WTE technologies to be explored and potentially implemented.

Residuals Management – the 5th R

Residuals management is the final treatment or disposal of waste that cannot be used or managed through any of the other 4 Rs. Landfilling is the most common method of residuals management. Residuals management (also termed disposal) is often considered the least desirable means of managing wastes. The 4th and 5th Rs overlap since resources can be recovered at the landfill, for example by using landfill gas for generation of electricity. The following sections provide a brief overview of landfills and their place in the waste management system.

Landfill disposal

Methods for managing residuals are limited to landfilling and in some cases conversion technologies such as combustion. Landfilling involves the controlled placement and management of wastes on or within surficial soils of the earth. Modern landfills are highly engineered facilities that employ liner systems, cover systems, landfill gas management systems, leachate collection / treatment systems and surface water management works as environmental controls. Typical landfill operations require that waste be adequately covered daily, therefore the availability of locally available soil or aggregate is important for cost effective operations. Alternate daily covers (ADCs), such as tarps or metal plates, can be used at landfills with a shortage of locally available soil.

Landfill gas is generated through decomposition of organic material under anaerobic conditions. As a greenhouse gas, methane is 21 times more potent than carbon dioxide. Landfill gas is also hazardous. It is explosive between methane concentrations of 5 and 15% by volume and landfill gas can displace oxygen in confined spaces (i.e. it is an asphyxiate). In BC, the explosive gas concentration must be below specific limits at the property boundary. Landfill gas can migrate laterally in adjacent soils or by other means and in some cases must be monitored regularly in the soils around the landfill.

Leachate is a contaminated liquid that contains a number of dissolved and suspended chemicals. Leachate is produced from water in the form of precipitation and surface run-on coming into contact with the waste. Leachate typically percolates through the waste and may travel into the underlying soils

in the absence of a liner and leachate collection system. Leachate is managed at landfills by installing engineered systems for leachate extraction / treatment or by natural attenuation at sites without engineered liner systems.

The creation and consumption of landfill airspace are important considerations that ultimately dictate the lifespan of the landfill. Regions faced with limited landfill capacity must consider more costly alternatives and there is also great uncertainty with siting new landfills. There are a variety of methods for extending the lifespan of a landfill. Landfills can be expanded both laterally and vertically. It is also possible to gain vertical airspace by constructing an engineered retaining wall near the edge of the landfill against which waste is placed. This requires less land area than a typical lateral expansion; however cost and technical constraints are key considerations. The Regional District of Nanaimo has employed this approach and the Capital Regional District is considering similar retaining walls.

Other methods for extending the lifespan of a landfill involve changing one of more of the following:

- Waste disposal rate – through diversion, composting and recycling
- Types of waste disposed – for example by removing bulky wastes that use up landfill airspace
- Waste compaction – changing operations or equipment to improve waste compaction
- Cover material usage – reducing the amount of cover used and / or employing alternate daily covers to reduce airspace consumption

An existing landfill is an asset that should be operated in a manner that is not only environmentally sound but preserves airspace and extends landfill life. Most regional districts throughout British Columbia utilize one or more landfills for waste disposal. Regional districts that have been faced with limited landfill airspace capacity have taken measures to increase their capacity at existing landfills. An option being employed by the Cowichan Valley Regional District involves exporting waste to a landfill in Washington State. Faced with very limited permitted capacity at both of its regional landfills, the Comox Valley Regional District reviewed regional disposal options including exporting waste to Washington State. The Comox Valley Regional District concluded that expansion of existing landfills would be the most secure and cost effective alternative. Based on a similar review of disposal alternatives, the Regional District of Nanaimo constructed an engineered retaining wall to increase capacity at the Nanaimo Regional Landfill. During the process to update the Capital Regional District's Solid Waste Management Plan a detailed review was undertaken of options to significantly increase the Hartland Landfill's capacity and to extend the lifespan by reducing airspace consumption.

Even regions that are exploring WTE as a key element of their waste management system cannot eliminate the need for landfills. WTE facilities produce residuals such as ash that must be managed at landfills.

The District of Squamish has prepared plans for expansion of the Squamish Landfill to the east. If this goes ahead, the Squamish Landfill could accept waste from the southern part of the region including Whistler. If it does not, it may be necessary to transfer all of the southern part of the region's waste out of the region. This is discussed further in subsequent sections of the memo.

Updated Landfill Criteria

The existing British Columbia Landfill Criteria for Municipal Solid Waste was issued in 1993. The Criteria is a guideline document and Operational Certificates are issued for landfills that have additional requirements. The Criteria is being updated to reflect modern best management practices and the draft document is available publicly for comment. While the new document is similar to the existing document in its format, there are some significant differences in the requirements for landfills that will impact landfills across BC. The new Criteria has the potential to greatly impact owners of smaller landfills, since these landfills are typically run on much smaller budgets and there are fewer resources available for these sites as compared to larger landfills. Examples of new requirements in the updated Criteria are below.

- Landfills must be designed such that the service life exceeds the contaminating lifespan.
- Landfill liners must consist of a minimum of a high-density polyethylene liner over a compacted clay or geosynthetic clay liner.
- Leachate collection and treatment systems must be implemented.
- More stringent final cover specifications for landfills in non-arid regions.
- Determination of the contaminating lifespan of the landfill.
- Determination of the post-closure period based on the contaminating lifespan – the post-closure period shall be a minimum of 30 years and in the absence of evidence to suggest otherwise, the contaminating lifespan is assumed to be 1,000 years.
- Preparation of new reports including a Landfill Criteria Upgrading Plan, Environmental Monitoring Plan, Hydrogeology and Hydrology Characterization Report and Construction Reports.

It is likely that owners of natural attenuation landfills such as the Lillooet Landfill will be required to conduct study work to justify continued operation as a natural attenuation landfill or to upgrade in accordance with the specific requirements of the Criteria. BC regional districts and other stakeholders have expressed some concern about the updated version of the Criteria and comments continue to be conveyed to the Ministry of Environment.

Transfer and Waste Export

Transfer stations and the waste export are components of many residual waste management systems. The following sections briefly describe these methods of managing waste.

Transfer Stations and Waste Transfer

Transfer stations are facilities that accept waste and recyclables for transfer to other facilities. Transfer stations can have a variety of configurations and use a variety of methods for transferring materials. Currently the RMOW utilizes a transfer station for collecting and transferring waste to a landfill in Washington State. There are also transfer stations in Pemberton, Devine and Gold Bridge that transfer waste to other facilities in the region.

Transfer stations are typically installed in communities that either do not have a landfill and that are not situated within a reasonable driving distance from the nearest landfill. In the case of the RMOW, the decision was made by RMOW to transfer waste to a landfill that is lined to collect and treat leachate. At

the time the decision was made, the Squamish Landfill was not lined. If expansion of the Squamish Landfill does not proceed, it will be necessary to transfer waste from Squamish to another disposal facility, likely located outside the region.

Waste Export and Import

Waste export is the term used to describe the practice of sending waste across a geographic border. In British Columbia it is typically used when waste is transferred out of region, meaning that the waste is destined for disposal at a location outside the regional district. Waste export can also be used when waste is transferred across provincial or national borders. For regions that have long term landfill disposal capacity, it is typically more cost effective to use the existing landfills in the region than to export waste. Waste export becomes a necessity when a region runs out of landfill disposal capacity and when it is unlikely that new landfills will be developed in the region.

The flip side of waste export is waste import. Waste import is sometimes considered to increase disposal rates at regional facilities in order to obtain the revenue from tipping fees. The additional revenue may be needed to operate the landfill cost effectively and to pay for other solid waste management programs.

Waste Flow and Flow Control

Market forces factor into the flow of waste. Waste can end up being exported by the private sector if lower cost disposal options are available outside the region. Within Metro Vancouver approximately one million tonnes of waste is taken to Metro Vancouver and City of Vancouver facilities for disposal. A percentage of the region's waste flows to facilities outside the region, where tipping fees are lower. Metro Vancouver estimates that this results in lost revenue of approximately $5 million. Hauling companies that ship waste out of region end up avoiding regional disposal bans that are in place to reduce waste being disposed and directing it to recycling facilities. Metro Vancouver has indicated that waste bypassing the regional system results in waste haulers not paying their fair share of the region's solid waste system costs, which places a financial burden on municipalities and tax payers.

In September 2012 the Metro Vancouver Board initiated a consultation on hauler licensing and requiring residential and commercial garbage to be delivered to Metro Vancouver facilities (waste flow management) as a preferred approach. Municipal Solid Waste and Recyclable Material Bylaw No. 280, 2013 was prepared to address the flow and flow management issues. This bylaw requires that all residential and commercial/institutional garbage to be delivered to Metro Vancouver facilities. The bylaw has been forwarded to the Ministry of Environment for review and is awaiting approval.

The Capital Regional District is also considering flow control measures. The Capital Regional District is currently updating its solid waste management plan. As part of the process, an assessment was undertaken of solid waste program revenues and costs. Currently the majority of revenue for the system is obtained from landfill and kitchen scraps tipping fees. The assessment showed that, due in part to waste diversion and reduced disposal numbers, costs will far exceed revenues over the long term unless changes are made. In order to make up the shortfall several options were presented including raising tipping fees and new tax requisition. Program cuts were also explored. In order to cover the shortfall, the tipping fee at the Hartland Landfill would need to increase from $107/tonne to

$172/tonne. If the tipping fee is increased to $172/tonne, some form of flow control would need to be implemented to keep waste and the associated revenue in the region.

When considering the long term revenue and costs for the solid waste management system, potential loss of revenue and waste flow management must be considered. When it comes to waste disposal, unless there are other incentives or controls in place, economics will be a key driver in determining where waste ends up, in particular the component of the waste stream managed by the private sector. If tipping fees are increased there will be a point at which it is more economical for waste haulers and facility operators to transport waste out of the region to a facility with lower tipping fees. It is therefore important to understand where facilities are located outside the region and the rates at these facilities. If there is a need to increase tipping fees to the point at which waste could flow out of the region, some form of waste flow management may be necessary to eliminate lost revenue.

It is not known whether waste currently flows out of the SLRD due to disposal market drivers. Currently the Squamish Landfill tipping fee is $108/tonne and the RMOW's transfer station tipping fee is $120/tonne. If tipping fees in the region need to be increased to cover increasing costs, flow control measures may need to be considered.

Existing Resource Recovery and Residuals Management

The following sections provide an overview of the existing resource recovery and residual waste management system components.

Existing resource recovery

Resource recovery in the region consists of recovery and use of waste heat at the RMOW's composting facility and the use of contaminated wood as a fuel at Howe Sound Pulp and Paper. Contaminated wood from both Whistler and Squamish is sent to Howe Sound Pulp and Paper to generate energy using its power boiler.

The RMOW's composting facility is currently recovering waste heat for the operations building and this is reducing propane costs by approximately $30,000 per year.

The RMOW is also investigating opportunities to utilize the composting facility to bio-dry organics to produce a fuel that could be used by other industries. Initial testing indicated a lower than optimum heat value and further testing may be undertaken to determine if better results can be achieved by making changes to the incoming feedstock. If the feasibility work shows that a fuel can be made that is attractive to industry, the resulting fuel could be shipped to places like Lehigh Cement where it would be used to displace coal as a fuel source. A business case analysis is currently being undertaken.

Existing residual waste management

There are four transfer stations operating in the region; the Whistler, Pemberton, Devine and Gold Bridge transfer stations. In addition, there are two depots located in Whistler, where residential garbage can be dropped off.

There are two operating landfills in the SLRD. These are the Squamish Landfill and the Lillooet Landfill. The SLRD currently manages closed landfills near Pemberton and the RMOW manages one closed landfill. Since the closure of the Whistler Landfill, garbage from the Whistler transfer station and depots

has been compacted and transported to Roosevelt Regional Landfill (also known as Rabanco) in Washington State, US.

Table 1 shows a summary of the landfills and transfer stations in the SLRD and quantity of residual waste (garbage) handled at each facility and the destination of the garbage delivered to depots and transfer stations.

Table 1 - Summary of Garbage Receiving Facilities in the SLRD

Location	Services Area(s)	Garbage Flow To Landfill (tonnes/year, 2012)
Squamish Landfill	Squamish, Pemberton and Areas C,D	11,692 landfilled on-site
Whistler Transfer Station	Whistler, Pemberton and Areas C,D	12,795 to Rabanco Regional Landfill (including quantities from depots and transfer stations)
Whistler Function Junction Depot	Whistler, Pemberton and Areas C,D	1,021 to Whistler Transfer Station
Whistler Nester's Depot	Whistler, Pemberton and Areas C,D	1,407 to Whistler Transfer Station
Pemberton Transfer Station	Pemberton and Area C	534 to Squamish Landfill
Lillooet Landfill	Lillooet and Area A,B	2,479 (including Gold Bridge Transfer Station)
Devine Transfer Station	Area C	55 to Squamish Landfill plus 2 to Rabanco Regional Landfill via Whistler Transfer Station
Gold Bridge Transfer Station	Area A	130 to Lillooet Landfill

The Squamish Landfill, located on the Squamish Valley Road in Squamish, is owned by the District of Squamish (DOS) and operated under contract by Carney's Waste Systems. The landfill receives garbage from the DOS and the communities of Furry Creek and Britannia Beach (Electoral Areas C and D) directly as well as from the Pemberton and Devine Transfer Stations. The landfill received 11,692 tonnes of garbage in 2012. The planned closure date for the landfill is 2018, however there is potential to expand the site to accommodate for waste disposal until 2059.

RMOW provides a transfer station and two depots where residents and visitors can drop-off garbage. Commercial businesses are not permitted to use the depots at Function Junction and Nester's Road. In 2012, a total of 1,021 and 1,407 tonnes were received at the Function Junction and the Nester's depots respectively. The garbage is compacted on-site and transported to the Whistler Transfer Station. From the transfer station, garbage is trucked to Surrey for rail transfer to Roosevelt Regional Landfill in Washington State, U.S. In 2012 a total of 12,795 tonnes of garbage was sent from the Whistler transfer station.

The Pemberton Transfer Station receives small loads of residential and commercial garbage primarily from the Village of Pemberton and Electoral Area C residents. Large commercial loads of refuse are not accepted at the transfer station and must be hauled directly to the Whistler transfer station or Squamish landfill. The Pemberton transfer station does not have a scale. The facility received 534 tonnes of garbage in 2012. Garbage received at the transfer station is transported to the Squamish Landfill for disposal.

The Lillooet Landfill is owned by the SLRD and serves the DOL and Electoral Areas A and B with the exception of the Seton and Bridge River Bands. The Lillooet Landfill is also used by some First Nations communities in the area. The landfill, which recently added a scale, received an estimated 2,479 tonnes of garbage in 2012. The projected year of closure, based on the current design and rate of filling, is approximately 2068. There may be an opportunity to expand the landfill and extend the lifespan beyond 2068.

The Gold Bridge Transfer Station receives small loads of residential and commercial garbage primarily from Electoral Area A users. The transfer station is administered by the SLRD and operated by a contractor. Garbage delivered to the transfer station is transported to the Lillooet Landfill by Lillooet Disposal and Recycling. The transfer station does not have a scale; however, garbage is weighed upon delivery at the Lillooet Landfill. In 2012, 130 tonnes of garbage in from the Gold Bridge Transfer Station was received at the Lillooet Landfill.

The Devine Transfer Station is located in Devine on Highway 99, 5 km south of D'Arcy, and primarily serves Electoral Area C residents living in the communities of Birken, D'Arcy and Devine. The transfer station does not have a scale. It is administered by the SLRD and operated under contract by Carney's Waste Systems. The garbage is delivered to the Squamish Landfill. Historically a small amount of garbage from the Devine Transfer station went to the Whistler Transfer Station. However, this is no longer occurring and all garbage is directed to the Squamish Landfill. Commercial loads of garbage are not accepted. Tipping fees are not charged at the Devine Transfer Station and it is funded exclusively through taxes. The facility received 57 tonnes of garbage in 2012.

First Nations collection and disposal

First Nations are responsible for providing their own waste management systems, as regulated under the federal Indian Reserve Waste Disposal Regulations. In the SLRD, some communities have their own landfills, while others contract with commercially available collection and disposal services or they self-haul to SLRD or municipal facilities. Some First Nations landfills in the region may be reaching capacity or may be required to close by Aboriginal Affairs and Northern Development Canada (AANDC).

The Pavilion First Nations Transfer Station: This community is in the process of opening its transfer station. There is door-to-door collection of garbage and they use a large bin, which is serviced by Lillooet Disposal, and is tipped at the Lillooet Landfill

The Lillooet Indian Band garbage collection: A member of the community provides the curbside service for 30-40% of its community. The rest of the community self-haul to one of the two transfer stations owned and operated by the band. Garbage is brought to the Lillooet Landfill.

Mount Currie Landfill: The Mount Currie landfill closed in November 2012 and was replaced with two transfer stations located on Lil'wat Bands lands. Garbage from these transfer stations is delivered to the Whistler Transfer Station.

Landfill at Tsal'álh/Seton Portage: The communities of Seton-Portage and Tsal'álh use the Seton Lake Landfill operated by the Seton Lake Indian Band with support from AANDC. Seton Portage band is building a transfer station and closing their landfill. The goal is to complete the project by late 2015/early 2016. Once the landfill is closed, all garbage will be going to the Lillooet Landfill. Additionally, the Band has signed up for the MMBC printed paper and packaging program.

Fountain Band Landfill: The Fountain First Nations community had a landfill which now is closed. There is door-to-door service to collect the garbage from this community. They have a transfer station where there is a large bin for waste. The bins are serviced by Lillooet Disposal and are tipped at the Lillooet Landfill.

N'quatqua Band (D'Arcy) garbage collection: the community has curbside service for garbage contracted with Carney's Waste Services. The majority of materials are tipped at the Squamish landfill with a smaller percentage going to the Whistler transfer station.

Lytton Band: While the Lytton Band has one reserve in the SLRD, all waste from this reserve is collected and sent to facilities in the Thomson Nicola Regional District (TNRD).

In Squamish, the Squamish First Nation has curbside garbage collection undertaken by Carney's Waste Systems. The garbage is hauled to the Squamish Landfill.

Closed Landfills

The SLRD is responsible for two closed landfills near Pemberton; one is approximately 10 km south-west of Pemberton and the other is located near the Motor Cross track and the Green River. The Pemberton Landfill ceased receiving waste in 1998. Both sites have undergone full closure and are subject to on-going environmental monitoring, as per Ministry of Environment requirements.

The Whistler Landfill, located on Cheakamus Lake Road in Whistler, was closed in October 2005. The RMOW owns the site and is responsible for the environmental monitoring and landfill gas management of the site. Landfill gas is captured and flared.

Unauthorized facilities

There is an unauthorized landfill approximately 12 km northwest of the Lillooet Landfill. The site is reportedly located on Bridge River Band reserve land and used by local residents (First Nations and non-native) and local commercial haulers. The site was recently inspected by the BC MoE. MoE

reports that there are no environmental or access controls in place at the site and therefore it is not operated in accordance with the BC Landfill Criteria. BC MoE has provided a list of public safety, design, operating and environmental concerns to the SLRD.

Regional Challenges and Options

The following sections outline potential challenges that may need to be addressed, considerations that may impact the region and potential long term options.

Regional issues and disposal capacity

Recent solid waste planning processes in British Columbia have focused on addressing long term disposal capacity, long term costs and remaining compliant with Provincial requirements. The priority issues to be addressed in the SLRD are similar.

SLRD is faced with limited long term disposal capacity. With its current design and at the current rate of disposal the Squamish Landfill has another 4 years of disposal capacity. From a planning perspective this is a relatively short period. The DOS has applied to expand the landfill to the east and this would provide up to 46 years of additional life, which includes waste from RMOW. The Squamish Nation, who's traditional territory covers the District of Squamish and the RMOW, has been consulted on the expansion and has expressed some concerns. The Squamish Nation is currently not in favour of the expansion. The DOS is currently in negotiations on several things with the Squamish Nation, including the potential landfill expansion.

If the Squamish Landfill expansion proceeds, the landfill could meet the disposal needs of the region for many years. And the RMOW would have an in-region option for disposal that could reduce the total costs for the RMOW for disposal.

If the expansion does not proceed, both the DOS and RMOW, and communities sending waste to their facilities, will need to consider out-of-region options. The DOS will need to explore options and implement a solution before the landfill runs out of capacity. A large-scale transfer station would need to be constructed either at the landfill or another location within the DOS.

If the region's landfill capacity runs out, the economics of disposal will be dictated by the disposal costs at out-of-region facilities and the cost of transporting waste to these facilities. There is an increased risk associated with running out of landfill capacity since there is no guarantee that cost-effective out-of-region solutions will be available over the long term. Additional long term disposal capacity will provide the surety that local and regional government in the region will be able to manage waste within its own borders. Local and regional government will have control over the waste and the costs.

The RMOW chose to export waste to an out-of-region landfill that, at the time the decision was made, was able to provide robust environmental controls including leachate collection and treatment. These controls were not in place at the Squamish Landfill. Expansion of the Squamish Landfill would involve installing new liners and leachate collection infrastructure. Therefore, the RMOW may want to reassess the Squamish Landfill as a disposal option should the expansion proceed.

If the Squamish Landfill expansion does not proceed, another option is to site and construct a new landfill in the region. However, there is great uncertainty with this option – siting a new landfill can be

challenging, costly and time consuming. If this option is explored, it will be necessary to implement other short term measures while new sites are explored.

Waste-to-energy

Other regions have undertaken technical and economic studies to assess the feasibility of waste-to-energy (WTE) in their regions. For example, several regional districts on Vancouver Island have assessed technologies, potential greenhouse gas emissions and costs for developing new WTE capacity. These regional districts have found that there is not enough waste available within their regions, even with combining their waste streams, to make a conventional WTE technology financially viable. Based on general cost information available from the WTE vendors, the cost to establish and operate a new WTE facility for the SLRD's waste could be over $200/tonne, significantly higher than the current cost for disposal.

While it may not be economically viable to establish WTE capacity within the SLRD, it is important to understand and consider Metro Vancouver's process for establishing WTE capacity. Metro Vancouver has initiated a multi-phase procurement process to implement new WTE capacity. Phase 2 will be complete soon and the next phase will involve soliciting qualifications packages that match technology proponents with shortlisted sites. There is much interest around the province in Metro Vancouver's process and the potential locations. Taking waste to a Metro Vancouver WTE facility may end up being a cost effective option for waste from regions other than Metro Vancouver, depending on its location and a number of other economic, social and political factors. The SLRD and its member municipalities will need to monitor Metro Vancouver's process and potential opportunities for the SLRD.

Waste management on First Nations land

First Nations are responsible for managing waste generated in their communities. For the most part waste from First Nations land ends up at regional and municipal disposal facilities. The SLRD should continue to work with local First Nations and Aboriginal Affairs and Northern Development Canada (AANDC) to ensure that waste is disposed of properly and that waste is ending up at approved facilities.

Concerns have been raised about a landfill on Bridge River Band land. The facility has been inspected by the Ministry of Environment and concerns have been noted. It is understood that waste from outside the First Nation boundaries is being disposed at this facility. While the regional district does not have the authority to close the landfill, efforts should be made to direct waste to authorized facilities in the region. Also, the SLRD and its Board should work with the First Nation, Aboriginal Affairs and Northern Development and the Ministry of Environment to foster a solution.

Lillooet Landfill and the updated Landfill Criteria

As outlined previously, the new Landfill Criteria has the potential to have a significant impact on small landfills and the owners of these landfills. For the Lillooet Landfill, several new technical reports may be required to meet the requirements of the Criteria and to determine compliance. It may be necessary to determine whether the site can continue to operate as a natural attenuation landfill (i.e. no liner or leachate collection system) and if this is not considered appropriate, the site may need to be lined and leachate would need to be collected and treated.

The SLRD will need to consider whether the budget for the site can be increased to address the additional requirements of the new Criteria. Additional study work may also be required to determine whether the continued operation of the site is financially viable. If the site cannot continue to operate over the long term, it may be necessary to construct a transfer station that would collect waste to be transferred to the Cache Creek Landfill, the nearest large-scale landfill that has the controls and resources to meet the new Landfill Criteria requirements.