

Government of Yukon
Department of Community Services
Community Development Division
Community Infrastructure Branch

ISSUED FOR USE

COMPREHENSIVE SOLID WASTE STUDY
FOR YUKON TERRITORY WASTE FACILITIES

W23101149

August 2009



EXECUTIVE SUMMARY

EBA Engineering Consultants Ltd. (EBA) was retained by the Government of Yukon (YG) to conduct a comprehensive study of the waste management practices at Yukon solid waste facilities located in unincorporated communities. This study was divided into a number of tasks based on the proposal that was accepted by YG Community Infrastructure Branch on July 29, 2008. These tasks included:

- Task 1 – Review of Current Waste Management Practices.
- Task 2 – Protection of Human and Environmental Health.
- Task 3 – Cost Analysis of Proposed and Existing Practices.
- Task 4 – Public and Stakeholder Meetings.
- Task 5 – Analysis of Third Party and Community Management of Solid Waste Facilities.
- Task 6 – Development of a Sustainability Model for Various Waste Management Practices.
- Task 7 – Updating the Yukon Solid Waste Management Strategy and Guidelines.

The waste facility alternatives considered included the current practices of burning of waste in a trench and the burning of waste in a burning vessel, as well as new alternatives such as transfer stations, regional landfills, and incinerators. Each alternative was reviewed according to environmental and human safety risks, carbon footprint, and cost. Additional considerations included the level of service provided to the public, as well as public, municipal, and First Nation Government input on the current practices and desired direction.

In order to evaluate the different waste facilities, EBA developed a waste model that took the contributing population, waste composition, and a variety of other site specific information (i.e. distances, environmental controls, etc.), and produced the following outputs for each facility:

Environmental Hazard Rating – a subjective ranking system based on point totals from a variety of considerations meant to give a general indication of a facility's environmental impact in comparison to other facilities.

Carbon Footprint – an estimate of the equivalent CO₂ (eCO₂) emissions a facility generates on an annualized basis based on the waste management practice (i.e. burning of waste vs. landfill) and transportation distances for users and hauling.

Operation and Maintenance Costs – EBA predicted the annual operations and maintenance costs for each facility under the different waste management alternatives available.

Capital Costs – EBA prepared capital cost estimates for each facility to upgrade the existing practice to a more advanced alternative.

Air dispersion modelling was added during the course of the work to better understand the risks associated with the burning of wastes, and the review of current waste management practices was expanded to include incorporated communities to provide a more complete picture of waste in the Yukon.

Additionally, public and stakeholder meetings were conducted to provide a contrast between public opinion and the research compiled. The objectives pertaining to the public and stakeholder meetings included:

- identification of public and stakeholder comments, concerns, and ideas;
- identification of public understanding of waste management; and,
- identification of public perceptions and waste management priorities.

The results of these public and stakeholder meetings supplemented the research compiled and provided insight at a community level on how well the waste facilities are able to meet user needs. The questions, comments, and suggestions put forth at the public meetings contributed to this study in a variety of areas, and held a significant influence on the conclusions and recommendations prepared as part of this final volume of reporting.

Once a thorough understanding of each facility's needs and challenges were identified, EBA prepared a number of recommendations for YG to consider based on the results from the model and literature review. The categories of recommendations made, as summarized in Table 20 include:

- Yukon Wide Programs – These recommendations include those pertaining to those program recommendations that would be implemented territory wide, offering services to every resident.
- Government Policy or Legislation Changes – These recommendations are geared towards government-related initiatives that would require policy changes and new legislation.
- Waste Handling and Acceptance at Disposal Facilities – Refers to recommendations that should be taken into consideration at the unincorporated waste facilities themselves (i.e. facility upgrades, staffing).
- Specific Facility Actions – These recommendations are specific to individual facilities.
- Additional Strategies – Remaining recommendations that do not fall into the categories described above.

A significant recommendation put forth in this study is the establishment of a working group dedicated to waste management in the Yukon. While the name of the group and its precise function is yet to be determined, the premise would be to have key representatives of waste management jurisdictions and organizations cooperate in developing programs and initiatives to better waste management practices in the territory. Additional information regarding the formation of this group will be provided by Community Services once details are better finalized.

This document was prepared over a series of mid-progress publications that have considered public and stakeholder input and have been issued for review at select project milestones. This release represents the final instalment of the Comprehensive Solid Waste Study and provides a complete overview of waste management practices in the Yukon.

Finally, this document lends to the preparation of the Yukon Solid Waste Strategy, which is scheduled for release in the fall of 2009 and will provide a basis for future waste related activities in the Yukon now and for years to come.

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1.0 INTRODUCTION

EBA Engineering Consultants Ltd. (EBA) was retained by the Government of Yukon (YG) to conduct a comprehensive study of the waste management practices at Yukon solid waste facilities in unincorporated communities. The objective being to develop an understanding of the waste management challenges faced in the Yukon and the options available to overcome them.

YG desires a standard approach in waste management across the Yukon that considers new alternatives for the solid waste facilities it operates (i.e. those located in unincorporated communities). YG would also like to compare waste management practices in other jurisdictions and provide input on how to segregate and handle certain types of wastes.

While originally limited to the solid waste facilities that Community Infrastructure Branch operates, the scope of work has since been expanded to include incorporated communities as well. This comprehensive study provides an overview of all waste management practices and infrastructure available in the Yukon, and the results presented herein are meant to contribute towards a Solid Waste Strategy that can be applied territory wide. The Community Services website will provide up to date information on when this document will be made available to the public in the future.

2.0 METHODS

This study was divided into a number of tasks based on the proposal that was accepted by YG Community Infrastructure Branch on July 29, 2008. These tasks included:

- Task 1 – Review of Current Waste Management Practices.
- Task 2 – Protection of Environment and Human Health.
- Task 3 – Cost Analysis of Proposed and Existing Practices.
- Task 4 – Public and Stakeholder Meetings.
- Task 5 – Analysis of Third Party and Community Management of Solid Waste Facilities.
- Task 6 – Develop a Sustainability Model for Various Waste Management Practices.
- Task 7 – Updating the Yukon Solid Waste Management Strategy and Guidelines.

This document has been structured in accordance with the tasks as outlined above, although over the course of this work, additional components have been identified as being necessary for inclusion. Specifically, air dispersion modelling was added to better understand the risks associated with the burning of wastes, and the review of current waste management practices was expanded to include incorporated communities to provide a more complete picture of waste in the Yukon.

This document was prepared over a series of mid-progress publications that have considered public and stakeholder input and have been issued for review at select project milestones. This release represents the final instalment of the Comprehensive Solid Waste Study and provides a complete overview of waste management practices in the Yukon.

3.0 SCOPE OF WORK

EBA's scope of work for this study involved an examination of current solid waste practices, which included an assessment of the capacity for change of existing waste facilities (such as shifting from a burning vessel operation to a transfer station) and an evaluation of each site's relative functionality (i.e. how well the site is maintained and operated).

In completing this study, EBA has accomplished the following objectives:

- Review of current operational practices.
- Preparation of cost analysis for current capital and operational expenditures.
- Evaluation of environmental impacts and human health effects.
- Exposure assessments for each waste management facility.
- Carbon footprint calculations relating to transfer stations.
- Environmental and economic comparisons of facility alternatives.
- Cost analysis that considers both present and 20 year horizons for each waste management practice.
- Identification of resource requirements.
- Identification of best practices across waste management facility types.

It is noted that waste management consists of three components: waste reduction, waste diversion, and waste disposal. While waste reduction and waste diversion are important components of solid waste management, these aspects were not a specific part of EBA's objective and mandate for this project. Waste diversion is touched upon in some capacity within this study, but the major focus has been placed upon waste disposal practices at this time.

A major component in achieving the objectives of this study is to produce a waste model capable of evaluating the different waste facilities in the Yukon and determining which waste operation alternative is most practical on a case by case basis. This model, discussed further in Section 9.0, incorporates the majority of study components and as is referred to throughout this report as an integral resource. As waste management practices in the Yukon will evolve over time, this model is designed to be easily updated to reflect the most up to date information available.

Additionally, public and stakeholder meetings were conducted as part of this study to gather user-based input on the territory's waste management practices. These meetings provided a contrast between public opinion and the research compiled. The objectives pertaining to the public and stakeholder meetings included:

- identification of public and stakeholder comments, concerns, and ideas;
- identification of public understanding of waste management; and,
- identification of public perceptions and waste management priorities.

The results of these public and stakeholder meetings supplemented the research compiled and provided insight at a community level on how well the waste facilities are able to meet user needs. The questions, comments, and suggestions put forth at the public meetings contributed to this study in a variety of areas, and held a significant influence on the conclusions and recommendations prepared as part of this final volume of reporting.

4.0 TASK 1 – REVIEW OF CURRENT WASTE MANAGEMENT PRACTICES

4.1 PAST RELEVANT DOCUMENTS

The documents that were reviewed as part of the background information for this project included:

- Solid Waste Management Procedures & Guidelines (Yukon Government 1996)
- Evaluation of a Ban on Burning as a Means of Garbage Disposal in the Yukon (Yukon Government 1997).
- Solid Waste Strategy (Gartner Lee 2001).
- Solid Waste Management Plans for each site, as available (**Dawson¹**, **Mayo**, Ross River, **Watson Lake**, **Faro**, Beaver Creek, Burwash Landing/Destruction Bay, Stewart Crossing, Pelly Crossing, **Carmacks**, **Haines Junction**, **Teslin**, Carcross, Tagish, Marsh Lake, Braeburn, Mt. Lorne, Deep Creek, Champagne, and Old Crow).

A summary table highlighting key information for each facility, provided by YG, was used as the starting point for summarizing the information available. This table was expanded upon for the purposes of the waste model (discussed in Section 9.0), and incorporates all the information that is required to analyze each site as a whole, or as part of a network.

4.2 OTHER RELEVANT DOCUMENTS

Other documents utilized by EBA for this study included similar waste oriented research projects that EBA has conducted recently for the YG. These documents included:

¹ Bold text indicates that the facility is part of an incorporated community and not under Community Infrastructure's jurisdiction.

- EBA – Summary Report on e-Waste Research (March 2008) – This study involved a review of the various e-waste programs throughout Canada and provided recommendations for the establishment of such a program in the Yukon, taking into consideration the unique challenges faced.
- EBA – Yukon Solid Waste Operations Research (October 2008) – In this study, EBA collected the solid waste regulations for every waste governing jurisdiction in Canada, as well as the State of Alaska, and evaluated each in terms of landfill siting and construction standards, waste handling practices at remote camps, and environmental monitoring requirements. From this review, a framework for Yukon waste regulations was recommended and a collection of Canadian best practices are currently under consideration with the YG Department of Environment.
- Solid Waste Disposal Facility Permit, Waste Disposal Facilities in Unincorporated Communities (April 2009) – These permits, issued by Environment Yukon, contain the most up to date waste facility requirements that unincorporated and incorporated community waste facilities must adhere to.

4.3 YUKON WASTE FACILITY TYPES

There are presently 19 solid waste facilities for unincorporated communities that YG operates. The current solid waste management practices in the Yukon, dependant on the geographical area and needs of the surrounding communities, typically fall into one of the following categories:

- burial of waste in a trench;
- open trench burning and burial;
- burn vessels and burial of the ash;
- unsupervised transfer station disposal; or,
- supervised transfer station disposal.

This study involved visiting representative sites from the facility types outlined above and observing the efficiencies and deficiencies associated with each. The intent being to evaluate whether or not the current operations should change and to provide recommendations that would improve the waste management practices at YG solid waste facilities.

4.4 YUKON WASTE FACILITY SITE VISITS

EBA visited a number of waste facilities in the Yukon accompanied by Community Infrastructure Branch staff. These sites included:

- Marsh Lake (supervised transfer station);
- Johnson's Crossing (burning vessel);

- Taku Subdivision (Tagish) (burning vessel);
- Carcross (open trench burning);
- Mt. Lorne (supervised transfer station);
- Braeburn (burning vessel);
- Deep Creek (unsupervised transfer station);
- Canyon Creek (burning vessel);
- Champagne (burning vessel);
- Burwash Landing (burning vessel);
- Destruction Bay (metals deposit); and,
- Silver City (burning vessel).

Through these site visits, EBA gained a first hand understanding of current waste handling processes in the Yukon. In many cases, the timing of the site visits was beneficial, as the majority of sites visited were being used by the public during visits.

In addition to the unincorporated facilities, EBA also observed the operations at the incorporated landfills (i.e. Whitehorse, Haines Junction, Mayo, Carmacks, Watson Lake, Faro, and Dawson), as well as the recycling operations of Raven Recycling and P&M Recycling.

The following provides a summary of the types of unincorporated Yukon waste facilities observed. The observations made during the incorporated community site visits are discussed in Section 10.0.

4.4.1 Burning Vessels and Burial of the Ash

In most instances, burning vessels were relatively new additions at the respective waste facilities. The burning vessels are constructed of large, recycled, steel fabricated underground or above-ground storage tanks that have been modified with doors and vents to accept varying capacities of waste. It should be noted, however, that these facilities were not engineered to any specifications (because such specifications do not exist), and that no controls are in place regarding temperature or emissions (i.e. these vessels do not constitute incinerators).

The configuration of these burning vessels varied only slightly from each another, but their size differed in proportion to the volume of waste expected at the respective facility. The wastes accepted and segregated at each site are generally the same, though some sites have better signage than others, and some are limited by the space available.

The burning vessels were observed as being effective in containing the wastes accepted and minimizing the litter that escapes, not to mention the reduction in scavenging from animals and birds in comparison to open trench burning.

The difficulty, however, is that there are large quantities of non-burnable items (metals, mostly) that find their way into the vessel and later must be separated from the ashes². The possibility of a propane tank, paints, or car batteries entering the vessel is also a risk (due to the unsupervised nature of the sites), and despite adequate warning signage, this poses a risk to the environment as well as the health and safety of those using the facility.

Additional risks of burning vessels include the warping of the tanks due to extreme heat generated by burning, the smoke resulting from burning, and the potential for a member of the public to burn themselves should they come into contact with the vessel during/after a fire.

Community Infrastructure staff also indicated a lack of policing capacity to enforce the rules at the burning vessel sites, which increases the likelihood of an incident resulting from the risks discussed above.

4.4.2 Supervised and Unsupervised Transfer Stations

When it comes to transfer stations, the major factor contributing to site performance is the level of staffing.

The Mt. Lorne and Marsh Lake facilities are supervised transfer stations. Whilst operated differently, they were more or less kept tidy, with the waste well segregated into separate storage areas that were clearly identified. At both facilities there is staff available during operating hours and access to the site is limited to those hours only.

Deep Creek, on the other hand, is an unsupervised facility, and could greatly benefit from improved waste management practices. In principle, the site should operate as the Yukon's other transfer stations, but the absence of staff and the unlimited access to the facility has been detrimental to the operation. This combination provides no supervision, and the public has taken advantage of the consequence-free environment on a regular basis. Also, the absence of tipping fees, in contrast to Whitehorse, provides monetary incentive for unplanned use of the Deep Creek facility, particularly considering the site's proximity to the Whitehorse landfill. Compounding these challenges is that the site is located on a silt and clay subgrade, which provides for a less than ideal working area for site maintenance.

Recently, due to public and stakeholder input, a facility operator was hired for the Deep Creek facility, and controlled access hours have since been established. As such, it is anticipated that some of the challenges the site has faced previously will be resolved.

² The removal of metal wastes from residual burning vessel ash is currently not practiced due to a lack of available resources (i.e., funding, equipment).

4.4.3 Open Trench Burning and Burial

One site viewed by EBA still utilized the open trench burning practice (Carcross). This, however, can be attributed to the surrounding community's reluctance to accept a burning vessel, due to concerns that this would delay the establishment of a transfer station³.

Having viewed a number of the burning vessel sites first, the greater quantity of uncontrolled litter and the greater presence of scavenger birds at the open trench facility was apparent. This particular site was divided into two parts – domestic waste (to be burned in the trench) and other wastes (including construction wastes, appliances, waste metals, batteries, tires, etc.) that were piled separately for future collection. The domestic waste portion of the facility appeared untidy due to the abundance of litter scattered by wind and birds, but overall the site was well maintained, with the majority of wastes segregated in tidy piles, despite a lack of clear signage.

Overall, there is no apparent operational difference noted between a burning trench facility and burning vessel facility, other than litter control.

Burning time was the only other difference noted during the inspection. Burning vessels burn much more quickly and in a more controlled manner than in a trench. Open trench burning has greater potential to smoulder for longer periods of time due to uneven temperatures and incomplete combustion of wastes. Exposure to the elements (i.e. wind, rain, and snow) increases this effect. However, it was noted at several community meetings that burning vessels can also smoulder for days.

4.5 GENERAL OBSERVATIONS AND DISCUSSION

The following bullets denote a number of EBA's general observations and discussion points that have been taken into consideration for this study:

- Public use of waste facilities appears to be influenced by the appearance of the site. If a site is not very well kept, users, in general, will dispose of their waste in an untidy fashion. Conversely, if a site is well organized, users will tend to respect the tidiness of the facility and dispose of their waste more appropriately.
- The contractor hired to manage each facility is directly responsible for each site's relative functionality and tidiness. Each contractor is hired as a result of a tendering process. There is often a learning curve associated with the contractors executing the waste management contracts, as there is no guarantee that a previous well-performing contractor would be successful on subsequent tender. At times, this can result in onerous micro-level management for the YG, where contractor performance has to be closely monitored, and often contracts either have to be renegotiated, cancelled, or reissued (as per communication with Community Infrastructure staff).

³ Determined through discussions with Community Infrastructure staff.

- Overall, signage appeared to have a varied influence at each site. While the number or clarity of signs varied from site to site, the waste disposal from the public was not dependant on directions, but more or less guided by the waste areas clearly identified through already deposited wastes. In addition, it seems as though facility users will only stop at so many areas before tiring of separating their wastes and leaving the remainder in one place. This is a universal problem with waste disposal, and is difficult to combat, even under supervision.
- The waste deposit practices are variable in the Yukon. Due to the remoteness of residents, and the lack of some services in the territory (i.e. affordable repair services), it is common that users store their wastes at their residences for an extended period of time and then unload a large quantity of waste at once, temporarily overloading a site's capacity. This is particularly apparent when it comes to auto hulks, appliances, construction and demolition (C&D) waste, and tires.
- Another source of site overloading can be attributed to some residents and commercial operators of Whitehorse that choose to deposit their wastes at a facility other than the Whitehorse landfill. The tipping fee at Whitehorse landfill is \$5 to \$17 depending on the size and type of the load. Some residents choose to avoid this fee and deposit their wastes for free at another facility. Commercial waste deposits (though beyond the scope of this study) further illustrate this allure, as tipping fees range between \$39 and \$68 for such deposits, which are typically larger in size. Without charging a tipping fee at other facilities, this will remain problematic (this trend is particularly apparent at the Deep Creek facility).
- Throughout the Yukon, the level of community "volunteerism" varies quite significantly. It seems that some communities are attuned to environmental and solid waste issues in the Yukon, and the others are more inclined to "keep things the way they've always been". This presents challenges when adopting a common framework for standardizing waste management approaches.
- Recycling practices in many unincorporated communities can likely be improved based on the observed abundance of metal products in the ashes of burn based operations.
- Electric fences have apparently been effective in keeping wildlife out of the waste facilities, though their upkeep needs to be monitored constantly, as vegetation often shorts out the fencing, rendering it ineffective, and the solar battery packs require monitoring and maintenance.
- People that live outside of a municipality do not pay for garbage disposal, making waste deposits "free" for unincorporated community residents, thus making YG operated facilities an attractive alternative to municipal waste facilities that charge tipping fees.
- Waste management practices in southern Canada may not be practical or possible in the north due to smaller population and tax base, longer distances, higher costs, and more severe climate.

4.6 CAPITAL AND OPERATIONAL EXPENSES

EBA has prepared cost estimates that consider both capital and operational expenses for each type of facility alternative. These estimates were developed through communication with YG, with respect to known expenses and estimated unit costs, and supplemented by additional information found in published reports from similar jurisdictions.

For existing waste practices, EBA was supplied the annual contract values the YG has in place with each unincorporated community. These contracts were incorporated into the estimates developed in the waste model. Cost estimating is further discussed in Section 6.0.

4.7 YUKON SOLID WASTE LEGISLATION

EBA was retained in 2008 by the Department of Environment to research and summarize solid waste management regulations across Canada and Alaska and to make recommendations for set of best management practices (BMPs) appropriate to the unique conditions of the Yukon (EBA 2008). Environment Yukon has used the results of this study to update the permit template for solid waste disposal facilities in the territory.

This section provides a summary of Yukon's current legislation with respect to solid waste management.

4.7.1 Current Yukon Legislation Applicable to Solid Waste Management

The YG has several acts and regulations that are used to address solid waste in the Yukon. Perhaps the most significant of these is the Environment Act (Yukon), within which can be found specific regulations addressing issues such as solid waste disposal facilities and special waste, among others.

Environment Act

The Environment Act (Yukon) consists of 14 parts, of which Part 6 through Part 10 are the most pertinent with regards to the handling and management of waste. These parts are outlined as follows:

Part 6 – Development Approvals and Permits

Part 6 broadly outlines what information would be required to permit new regional solid waste facility.

Part 7 – Waste Management

Part 7 is perhaps the most pertinent part, as it broadly outlines what is required in a solid waste management plan.

Part 8 – Waste Reduction and Recycling

Part 8 highlights the importance of waste reduction and recycling, and sets out the Recycling Fund. It provides a means for certain materials or products to be banned from sale or use if "If the Minister is satisfied that the normal use of a

package or manufactured product will cause a significant impairment of the natural environment that cannot otherwise be prevented or mitigated”.

Part 9 – Release of Contaminants

Part 9 discusses contaminated sites and the actions required to address such sites. This part might apply to solid waste facilities that are improperly managed or designed, or where illegal dumping occurs due to a lack of policing capacity.

Part 10 – Hazardous Substances and Pesticides

Part 10 identifies substances that cannot be disposed of in a solid waste facility.

In addition to the above-cited parts of the Environment Act, there are also regulations developed pursuant to the Act that provide further detail. The pertinent regulations affecting solid waste management practices are described below:

- **Beverage Container Regulations (O.I.C. 1992/136):** Sets out how the Yukon’s beverage recycling program is funded and operates.
- **Special Waste Regulations (O.I.C. 1995/47):** Defines what a special waste is, and how such wastes should be handled and transported. The regulations provide the requirements for special waste permits.
- **Air Emissions Regulations (O.I.C. 1998/207):** Provides specifics on allowable emissions in the Yukon, and defines what opacity of visible emissions is acceptable. It also states that “No person shall release or allow the release of any air contaminant to such extent or degree as may (a) cause or be likely to cause irreparable damage to the natural environment; or (b) in the opinion of a health officer, cause actual or imminent harm to public health or safety”.
- **Solid Waste Regulations (O.I.C. 2000/11):** Outlines what is required in an application for a solid waste permit, and the subsequent monitoring and record keeping required to maintain the permit. Also provides details on the information required, solid waste management plan, and guidelines on the operation of solid waste facilities.
- **Contaminated Sites Regulation (O.I.C. 2002/171):** Provides requirements for identification and restoration of contaminated sites, and provides soil and water standards to help determine whether or not a site is considered contaminated.
- **Designated Materials Regulation (O.I.C. 2003/184):** Designates the materials for which retailers can collect recycling surcharges; currently, only vehicle tires of certain size are designated.

Municipal Act

- Under Section 248 of the Municipal Act, a municipality may own and operate a public utility as defined in the Public Utilities Act, but only with the approval of the

Commissioner in Executive Council and if not prohibited under that Act or any other Act.

- Under Section 278 of the Municipal Act, the council of a municipality shall, within three years of formation or alteration of municipal boundaries, adopt or amend by bylaw an official community plan.
- Under Section 279 of the Municipal Act, the official community plan must address the development of utility and transportation systems.

Forest Protection Act

This Act regulates burning in or near forested areas.

Wildlife Act

Under Section 93 of the Wildlife Act, practices that cause wildlife to become a nuisance are discouraged. Such practices might include open storage of food wastes.

Public Health and Safety Act

- **General Regulations Respecting Public Health (C.O. 1958/79):** Under Section 13 (Dwellings) of the Regulation, no building used for human habitation shall be nearer than 500 yards to a waste disposal ground. Under Section 29 (Disposal of Garbage and Other Wastes), every incorporated municipality shall provide for the use of the inhabitants a scavenging system for the collection and disposal of garbage and refuse and such system shall be operated and maintained to the satisfaction of the Medical Health Office. Under Section 32, every incorporated municipality shall provide adequate waste disposal grounds for the disposal of all garbage, refuse, excreta, and other waste matter and shall cause such waste materials to be burned, buried, or covered with a layer of earth or other innocuous material as necessary to deodorize the matter or thing deposited thereon and prevent the breeding of flies. Under Section 33, every waste disposal ground shall be (a) located at least 100 yards from any public road allowance, railway, right-of-way, cemetery, highway or thoroughfare, (b) located at least 500 yards from any building used for human occupancy or for the storage of food, and (c) situated at such a distance from any source of water or ice for human consumption or ablution that no pollution shall take place.

Territorial Lands (Yukon) Act

- **Land Use Regulation (O.I.C. 2003/51):** Outlines what information is required in a land use permit application, land use restrictions/prohibitions, and the general permitting process.

Waters Act

Prohibits the depositing of waste into a waterbody.

Canadian Environmental Protection Act

Regulates the environmental protection of federal lands, federally funded projects, and projects that cross jurisdictional boundaries (i.e. the Yukon/Northwest Territories border).

4.7.2 Future Direction of Yukon Regulations Applicable to Solid Waste Management

The YG's Department of Environment (Environment Yukon) has recently updated its permit template for solid waste facilities in the Yukon. Many of the permits for the Yukon's solid waste facilities were renewed in the spring of 2009. Renewal of the solid waste permits will trigger environmental assessments under the Yukon Environmental and Socio-economic Assessment Act (YESAA). As the issuer of the solid waste permits, Environment Yukon will be the decision body in the environmental assessment process; thus, there is additional onus on Environment Yukon to study best practices and regulations in other jurisdictions to harmonize and modernize approaches. Hence, Environment Yukon retained EBA to complete a separate study to solid waste best practices in the rest of Canada (outlined in Section 4.2), with particular attention on jurisdiction that have northern and remote facilities similar to the Yukon.

4.7.3 Potential Changes and Their Effects on Waste Handling Practices

There are a number of potential changes (i.e. legislative, operational, policy) that may arise in the Yukon in the future that will affect the way YG operates its facilities. Portions of these potential changes have already been addressed as part of the permits that were renewed for these facilities on April 29, 2009 (discussed further in Section 4.7.4.). These permits signal the direction the legislative authorities envision for the territory. Some of the more significant changes that may be considered in the future include those discussed in the following sections.

4.7.3.1 Controls on the Burning of Wastes

Currently, the Yukon is the only jurisdiction in Canada that does not prohibit the burning of waste. While in practice some areas in Canada do still use burning as a waste management alternative, the official stance, in general, is that the low temperature burning of wastes is no longer a preferred practice.

As mentioned in Section 4.4.1, the burning vessels in place are not engineered facilities, and no controls exist pertaining to heat and emissions. Without these controls, it is difficult to determine the effects these vessels may have on the environment or human health. As such, this unknown causes concern, and these concerns have presently become an area of contention within the Yukon.

Should a "no-burn" policy come into effect, the majority of the waste facilities in the Yukon will face a change. This should be taken into consideration when evaluating the results of the model (Section 9.0) as an argument for proactive planning. The recent permit issuances,

discussed in Section 4.7.4.3, indicate that the cessation of the open burning of wastes must be adhered to by January 1, 2012.

4.7.3.2 Minimum Requirements for all New Facilities or Expansion of Existing Facilities

When considering the establishment of a new facility, it must be understood that current waste regulations in the Yukon do not require the level of engineering that most other jurisdictions in Canada must adhere to. This may change, however, if the Yukon harmonizes its practices with the rest of Canada, and amends its waste regulations. The possible result is that new or expanding landfills will require stricter engineering controls, which will lead to both higher costs and better environmental protection. As discussed in Section 4.7.4.2, this upgrade to engineering controls is recognized to a certain extent as part of the recent permits issued to unincorporated waste facilities.

4.7.3.3 Environmental Monitoring

Minimum environmental monitoring (i.e. air quality, surface water, and groundwater) requirements may become a part of Yukon waste legislation in the near future. Currently, only three unincorporated waste facilities in the Yukon are equipped with environmental monitoring (Carcross, Marsh Lake, and Upper Liard). Environmental monitoring is critical with respect to waste facilities, particularly groundwater and surface water monitoring, as it is imperative that the risks associated with waste be monitored so that action can be taken to rectify any negative impacts that may occur (i.e. provide early warning).

Environmental monitoring would require additional funds with respect to both capital and operational expenses. Again, the recent permits address this potential, as discussed in Section 4.7.4.3 below.

4.7.4 Solid Waste Disposal Facility Permit - 2009

On April 29, 2009, the Solid Waste Disposal Facility Permit was issued to the Community Operations Branch for the 19 facilities under their jurisdiction. The following sections highlight the key points of this permit that may require significant changes to take place at the majority of existing facilities.

4.7.4.1 Waste Diversion and Recycling

Section 2.1.4. of the permit states:

The permittee shall investigate options to divert recyclable materials from the waste stream and implement them as soon as possible.

While in part to be addressed by the solid waste strategy, this permit requirement signals the recognition that diversion initiatives are required in unincorporated communities. This theme was prevalent throughout the public meetings where community members emphasized that diversion should form a higher priority than disposal. Waste diversion is

an important part of waste management, and is preferable to waste disposal, and this call for investigation into waste diversion initiatives supports this view.

EBA has included a number of diversion-related recommendations in this document. However, additional examination of diversion initiatives is recommended as an ongoing practice in the Yukon.

4.7.4.2 Engineered Containment Barriers

Section 2.1.6. and Section 2.1.7. of the permit states:

The permittee shall ensure that new waste disposal cells are designed so that the bottom of the cell is at an appropriate distance from the groundwater level, as determined by the required hydrogeological assessment.

- and -

The permittee shall ensure that an appropriate impermeable barrier having a maximum hydraulic conductivity of 1×10^{-7} cm/s is installed at the bottom of all new waste disposal cells.

These requirements call for an increased level of engineering at each facility to ensure better environmental protection, similar to the discussion included in Section 4.7.3.2. Moving forward, waste disposal areas in the territory will have this additional environmental assurance.

4.7.4.3 Cessation of Burning

Section 2.5.3. of the permit states:

The permittee shall develop an Operational Plan to manage solid waste using methods other than open burning at each site. This Operational Plan shall include an Implementation Strategy detailing how the permittee intends to switch to the new method of operation as soon as possible or by January 1, 2012 at the latest.

According to this requirement, the open burning of waste in the Yukon must cease by January 1, 2012. Open burning includes the use of burning vessels. This permit item has the most significant effect on the waste management practices in the territory as it fulfills a commitment to the cessation of an unpopular practice, and will result in a major infrastructure change at the majority of waste facilities in the territory.

Given the expense of converting all burn-based operations to other waste management alternatives, this change will not be immediate, and there will be a plan in place to phase-out the burn-based facilities gradually up to the January 1, 2012 deadline. This plan will be developed prior to the March 31, 2010 deadline as outlined in the permit. To this effect, the burn-based operations need to be assessed to determine the most suitable alternatives available as well as which sites should receive priority in the conversion process. The waste model developed for this study, as well as the air dispersion modelling conducted by SENES (see Section 5.4), contribute towards this goal. EBA's recommendations for facility upgrades are discussed later in this document. EBA understands that Community Services

intends to have additional waste stakeholders consulted when evaluating the available alternatives prior to making a change.

The public meetings that were conducted as part of this study were also part of the investigatory process for identifying potential waste management alternatives in the respective communities.

4.7.4.4 Hydrogeological Assessments

Section 2.6.1. of the permit states:

The permittee shall submit to the Branch, by December 31, 2009, a prioritized plan to conduct hydrogeological assessments at any site that accepts domestic or special wastes in order to determine the potential impact to nearby surface water and groundwater. The plan shall include timelines by which the hydrogeological assessments at each site will be completed.

The requirement for a hydrogeological assessment addresses the need at most facilities for environmental monitoring, or at minimum, an evaluation as to whether ongoing monitoring is required. Through the hydrogeological assessment, groundwater monitoring wells will need to be installed at the respective facilities which will allow for better records to be kept of environmental effects resulting from the burial of wastes (or ashes). A bi-annual monitoring program has also been included in the solid waste permits. This permit requirement is similar to the discussion in Section 4.7.3.3.

4.7.4.5 Special Waste Containment

Section 3.2.1. of the permit states:

The permittee shall ensure that the listed special wastes are handled and stored in such a manner as to prevent their release into the environment. This includes, but is not limited to ensuring that:

a) all drums and other portable containers containing the listed special wastes are covered or stored out of the weather to prevent container degradation from the sun or contamination by water from snow or rain.

Special wastes, according to the solid waste permit, include: household hazardous waste, waste oil, waste batteries, waste paints, waste solvents, and waste fuels.

Presently, the majority of these wastes are exposed to the elements at the majority of facilities, though some do have containers that meet these requirements. As a result of this new requirement, additional facility infrastructure (i.e. effective signage, storage units) will be required at the majority of unincorporated waste facilities, which will result in better environmental protection. A recommendation addressing this need is included in Section 11.2.

4.8 FUTURE MANAGEMENT OF SOLID WASTE IN YUKON

As discussed in Section 4.3 and Section 4.4., the existing waste management practices in the Yukon involve open trench burning and burial of ash, burn vessels, and supervised or

unsupervised transfer stations. Moving forward, the burning of waste will no longer be a viable waste option in the Yukon, and as such, additional alternatives need to be considered.

The alternatives considered within this study beyond current operations in the Yukon included:

- **Transfer Stations** – With a number of these facilities in place already, transfer stations present a practical alternative for burn-based waste operations. It has been assumed that only supervised transfer stations, for the most part, should be considered for larger sized unincorporated waste facilities. Unsupervised transfer stations may be viable in communities with low population bases, though controlled access hours would likely still be necessary to ensure proper facility use.
- **Incineration Facilities** – An incinerator is a more technologically advanced burning vessel that uses fuel to burn wastes in a pair of chambers, where gases are filtered rather than being directly released into the atmosphere. Within an incinerator, waste burns at higher temperatures, which generates cleaner residue gases as well as enough heat that could potentially be tapped as an energy source. For the purposes of this study, the term “incinerator” is meant to include multi-chamber, batch-starved air systems, variably called “thermal waste oxidizers”, “thermal oxidation systems (TOS)”, and “batch-oxidation systems (BOS)”, as defined by an Alaskan publication for burning garbage in rural communities (Alaska 2004).
- **Regional Landfills** – Landfills operate as an anaerobic process⁴ (that is, degradation occurs in the absence of oxygen), that encapsulates waste under cover of soil. Over time, the waste degrades and produces “landfill gas”; in fact a mix of gasses with high methane and carbon dioxide levels that, unless otherwise captured, penetrate the soil cover and enter the atmosphere. These gases are known “greenhouse gasses” (GHG). A regional landfill is meant to operate as a single landfill facility accepting wastes from numerous contributing unincorporated waste facilities.

Within each site, there are also a number of other measures to be considered that would improve the current operations, but not necessarily change the overall operating structure or operating cost. These recommendations are discussed later in this document (Section 11).

In addition to these alternatives, waste facility closures are also to be considered in some cases.

Each facility alternative discussed above was evaluated as part of this study based on environmental and human safety risks, carbon footprints, costs and future cost projections, and relative political viability. The following waste sections describe the methods used in conducting these evaluations.

⁴ Note that landfills only operate as an anaerobic process once the oxygen within the landfill has dissipated (i.e., once aerobic processes are exhausted).

5.0 TASK 2 – PROTECTION OF ENVIRONMENT AND HUMAN HEALTH

As part of the assessment prepared for Yukon's existing waste management facilities, EBA evaluated the impact that these facilities have on the surrounding environment from two perspectives: relative effect on the environment and/or human health and safety, and carbon footprints.

The following sections describe the relative risks that facility alternatives might pose to the environment and/or human health and safety, as well as the assumptions made for the carbon footprint calculations. This information forms the basis upon which the waste model will evaluate these factors, as later discussed in Section 9.0.

5.1 RELATIVE IMPACT ON THE ENVIRONMENT AND HUMAN HEALTH AND SAFETY

In evaluating the extent of environmental and human health effects related to each waste facility alternative, three categories of exposure were examined:

- **Wastes Accepted** – These considerations represent the relative risks associated with the acceptance of select waste types. Each type of waste accepted at a waste facility poses certain risks to both the environment and the health and safety of those using the facility. While domestic wastes and yard trimmings should have minimal risks associated with them, wastes such as car batteries, household hazardous waste (HHW), and propane tanks fall into a more severe risk category.
- **Operational Risks** – The activities and day-to-day operations of a waste facility vary from site to site, and each process poses a certain risk to site users and the surrounding environment. For example, the absence of environmental monitoring (i.e. groundwater or air quality) poses a risk because the impacts of the waste facility are unknown and cannot be compared against any baseline data. A burning vessel also causes a hazard due to the potential for a user to burn him/herself on the unit. In addition, air quality concerns pose a potential hazard as well.
- **Distance to Sensitive Receptors** – These risks are those related to a waste facility's proximity to sensitive receptors. Considered within the model are the distances to waterbodies, water wells, and residences. Also considered as a risk within the model is the potential for illegal dumping where users would have to travel a greater distance to their waste facility. Within the waste model, these calculations are evaluated on a relative scale from 0 to 10 as distances increase or decrease, respectively.

Additional factors not included in this analysis, due to a lack of published information, include the volumes and concentration of select waste types, which would require an in depth auditing process at each facility. Also discounted from evaluation are site conditions such as groundwater depths, which are not available due to the absence of environmental monitoring controls at the majority of facilities.

5.1.1 Model Incorporation of Environmental Assessment

The environmental and human safety risk calculations made in the model (discussed further in Section 9.0) are based on a scoring system according to the relative risk associated with the environmental and safety hazards present at any given facility or alternative.

The risk ratings (low, moderate, and high) are assigned to each potential hazard by the user. The user is also able to assign a weighting scheme to the risk ratings to establish the desired level of disparity between scores. At the present time, default weighting for low, moderate, and high risk ratings have been set at 1, 5, and 10, respectively. Where information gaps are present, the relative hazard rating is assessed a score of zero.

In general, the environmental risks at a landfill (air, groundwater, and surface water concerns) are calculated as being half of those present at a burning operation, due to the engineering controls in place. A transfer station also has less associated risk as the waste materials are not permanently stored at the facility, and operations are relatively safe and environmentally friendly, assuming that there is controlled and supervised access to the facility.

It should be noted that the scoring system utilized in these calculations is relative and only provides an indication of how environmentally unfriendly a particular facility may be in comparison to another. The results do not reflect a scientific quantification. Please refer to Table 1 for a typical environmental risk calculation summary.

5.2 CARBON FOOTPRINT

The carbon footprints for each facility and the available alternatives are based upon recently published information on GHG and how they relate to waste management. Specifically, the document entitled *Determination of the Impact of Waste Management Activities on Greenhouse Gas Emissions: 2005 Update Final Report, Submitted to: Environment Canada and Natural Resources Canada, ICF Consulting, October 31, 2005* (ICF Consulting 2005) was used almost exclusively for equivalent carbon dioxide (eCO₂)⁵ release factors to be applied to the Yukon's waste practices.

The carbon footprints examined in this study are representative of GHG inventories consistent with the methodology established by the Intergovernmental Panel on Climate Change (IPCC), as clarified in the following excerpt (ICF Consulting 2005):

⁵ Equivalent Carbon Dioxide (eCO₂) is the term preferred by the Intergovernmental Panel on Climate Change to denote the emission inventory of a particular process. All emissions are put in terms of carbon dioxide equivalence in order to establish a standardized unit quantity of emissions (e.g. methane emissions are equivalent to 21 to 27 times that of carbon dioxide, or 21 to 27 eCO₂ on a unit to unit basis). Positive eCO₂ values denote a release of emissions above and beyond the natural carbon cycle, whereas negative eCO₂ values denote a negative emission of carbon dioxide (i.e., carbon dioxide equivalents are actually removed from the atmosphere).

“Canada and all other parties to the Framework Convention on Climate Change agreed to develop inventories of GHGs for purposes of (1) developing mitigation strategies and (2) monitoring the progress of those strategies. The Intergovernmental Panel on Climate Change (IPCC) developed a set of inventory methods to be used as the international standard (IPCC, *Guidelines for National Greenhouse Gas Inventories* (three volumes), 1997). The methodologies used in this project to evaluate emissions and sinks of GHGs will be consistent with IPCC’s guidance.”

The ICF Consulting document provides a waste-by-waste breakdown of eCO₂ based on waste disposal practices (recycling, combustion, landfilling, etc.). Additionally, the document provides emission factors on a per tonne of waste basis for landfill equipment, transportation, and energy use. Refer to Table A for a sample selection of the information utilized.

Waste Type (Samples Only)	Net Recycling Emissions (tonnes eCO ₂ /tonne of waste)	Net Composting Emissions (tonnes eCO ₂ /tonne of waste)	Net Combustion Emissions (tonnes eCO ₂ /tonne of waste)	Landfill Without Landfill Gas Collection (tonnes eCO ₂ /tonne of waste)
Newsprint	-0.3	0	-0.05	0.32
Cardboard	-0.21	0	-0.04	1.66
Steel	-1.18	0	-1.03	0.01
Glass	-0.1	0	0.01	0.01
HDPE	-2.27	0	2.89	0.01
Food Scraps	0	0.02	0.02	1.23
Yard Trimmings	0	0.02	0.01	0.59

Of note for carbon footprint calculations is the definition used in Canada as to what contributes to emissions (ICF Consulting 2005):

“[...] for processes with CO₂ emissions, if (a) the emissions are from biogenic materials (i.e. organics), and (b) the materials are grown on a sustainable basis, then those emissions are considered to simply close the loop in the natural carbon cycle – that is, they return to the atmosphere CO₂ which was originally removed by photosynthesis. In this case, CO₂ emissions *are not* counted.”

This distinction is of particular importance when considering the burning of organic wastes versus the burial of these wastes. Following this methodology, the burning of organic wastes, in part, “closes the loop” of the natural carbon cycle, whereas the burial of organic wastes in a landfill generates methane that is above and beyond the emissions of the waste’s natural carbon cycle. This trend is evident in examining the emission factors from the sample table above.

The components that make up the carbon footprint for each waste facility evaluated in the model are discussed in the following sections.

5.2.1 Waste Acceptance and Handling

The carbon footprint calculation for waste acceptance and handling at a facility is based on three parameters: total waste (in tonnes) deposited at the facility, the waste stream composition (currently represented by 1994 Whitehorse landfill waste audit data), and emission factors (in tonnes eCO₂/tonne of waste) according to the waste handling practice employed for each respective waste type (i.e. burn, bury, recycle, compost). For example, in a burning vessel facility, food scraps are burned, whereas in a landfill, they are buried. Each handling procedure has a respective eCO₂ factor applied to it (ICF Consulting 2005), and the respective totals are tallied along with the other materials.

Example Calculation:

Note: Upper Liard, a burning vessel facility located approximately 15 km away from Watson Lake (an incorporated community that would likely accept Upper Liard's waste if Upper Liard were to function as a transfer station) has been used as the basis for all carbon footprint calculations.

Total tonnes of waste received at the Upper Liard facility, annually – 215 tonnes

Waste composition sample (as per 1994 Whitehorse landfill waste audit):

Newsprint – 5.2% = 11.2 tonnes

Food Scraps – 27.8% = 59.8 tonnes

Glass – 5.4% = 11.6 tonnes

Note: The wastes included in the list above only represent a sample of the entire waste stream and are used to depict the typical calculations that are made for every waste type within Yukon's waste stream.

Burning Vessel Sample Calculation:

11.2 tonnes newsprint, burned = 11.2 tonnes x (-0.05 eCO₂tonnes/tonne) = -0.56 tonnes eCO₂

59.8 tonnes food scraps, burned = 59.8 tonnes x (0.02 eCO₂ tonnes/tonne) = 1.20 tonnes eCO₂

11.6 tonnes glass, recycled = 11.6 tonnes x (-0.1 eCO₂ tonnes/tonne) = -1.16 tonnes eCO₂

Total waste acceptance eCO₂ for newsprint, food scraps, and glass: **-0.52 tonnes eCO₂**

Landfill Sample Calculation:

11.2 tonnes newsprint, buried = 11.2 tonnes x (0.32 eCO₂ tonnes/tonne) = 3.58 tonnes eCO₂

59.8 tonnes food scraps, buried = 59.8 tonnes x (1.23 eCO₂tonnes/tonne) = 73.55 tonnes eCO₂

11.6 tonnes glass, recycled = 11.6 tonnes x (-0.1 eCO₂ tonnes/tonne) = -1.16 tonnes eCO₂

Total waste acceptance eCO₂ for newsprint, food scraps, and glass: **75.97 tonnes eCO₂**

In performing these calculations, one assumption that has been made is that a transfer station will have the same carbon footprint as a landfill (for waste acceptance and handling totals only), as the waste collected at a transfer station is delivered to a landfill and experiences the same anaerobic digestion process discussed in Section 4.8.

The landfill eCO₂ factors are based on a Canadian landfill average, and while the Yukon may have less methane generation than the average Canadian landfill, this cannot be confirmed without a separate study. In general, the methane generation may be delayed somewhat in the dry and frozen climate, but over time, methane generation capacity is expected to be similar.

Table 2 presents a typical carbon footprint summary for a typical Yukon waste facility (Upper Liard). As seen in this table, the lowest carbon footprints are actually associated with burning of wastes (assuming that recycling is a separate waste handling process employed in a community regardless of the facility type in place). Conversely, transfer stations represent the most significant carbon footprint generation, largely due to the burial of wastes and generation of methane at the waste's final destination (i.e. a landfill). These calculations are based on the assumption that the waste burned in the burning vessels comprises 65.7% biogenic material and 8.7% non-biogenic material (plastic containers, bags, etc.). The remainder of the waste stream is considered bulk or recyclable waste that is transported to a municipal landfill and handled separately.

Waste Model Assumptions

For the purposes of the carbon footprint calculations within the model, the waste materials are assumed to be handled as follows.

TABLE B: WASTE TYPES AND ASSUMED HANDLING PRACTICES	
Waste Type	Handling Practice
Newsprint	Burn/Bury
Cardboard	Burn/Bury
Other Paper	Burn/Bury
Aluminum	Recycled
Steel	Recycled
Copper Wire	Recycled
Glass	Recycled
HDPE	Burn/Bury
PET	Burn/Bury
Other Plastic	Burn/Bury
Food Scraps	Burn/Bury
Yard Trimmings	Burn/Bury
White Goods	Recycled
Personal Computers (Estimated – No Data Available)	Recycled
Televisions (Estimated – No Data Available)	Recycled

TABLE B: WASTE TYPES AND ASSUMED HANDLING PRACTICES (CONTINUED)

Waste Type	Handling Practice
Microwaves (Estimated – No Data Available)	Recycled
VCRs (Estimated – No Data Available)	Recycled
Tires (Estimated – No Data Available)	Recycled

The immediate question that comes to mind when examining the list in Table B likely pertains to why paper and plastics are not considered as recyclables. This is due to the perspective from which the waste model is examining the waste stream.

The waste audit data that is being used (1994 Whitehorse landfill survey data) represents the waste that was received at the landfill at that time. It is fair to assume, however, that “traditional recyclables” (e.g. newsprint, paper, cans) have since been removed from this waste stream and are not buried at the landfill any longer; either the recyclables are diverted at the landfill itself, or diverted by the community at recycling depots. As such, the 1994 data is not ideal for use in the model, but it is the only data presently available.

The wastes that are treated as recyclables for the carbon footprint calculations (e.g. white goods, metals) are those wastes which are not to be deposited in a burning vessel if an average user makes a trip to their local waste facility. These are wastes that are segregated at the facilities themselves and collected separately. In addition, glass and aluminum have been considered recyclables in all cases in an attempt to reflect improvements to waste disposal practices in the Yukon since 1994. The Yukon is noted as having one of the highest participation rates for beverage container recycling in Canada, and it was felt that this should be reflected in the carbon footprint estimates.

If a burning vessel facility were to be converted to a transfer station, the assumption has been made that the facility will operate in the same manner, except that instead of depositing wastes into a burning vessel, the user is instead putting the waste in transfer station bins. As such, there is no increase in recycling after the conversion.

Certainly, there are ways to increase diversion, and thereby lower the carbon footprint of a facility, regardless of whether it is a transfer station or burning vessel. Keeping in mind that that the model is looking at the waste stream from the facility acceptance level, staff at the facility can direct recyclable waste deposited by users into special areas, as presently occurs at Mt. Lorne and Marsh Lake. If these wastes are then taken from the transfer station to Raven Recycling rather than the Whitehorse landfill, the carbon footprint associated with their disposal will be reduced.

The model does not look at this reduction potential, however. It is generalized to assume that the only practice that changes from current operations to transfer station operations is that the burning vessel is swapped out for transfer bins. As Mt. Lorne and Marsh Lake do operate more responsibly, however, it is fair to perform more reflective carbon footprint calculations specific to their waste diversion practices.

Please refer to Table 2A that highlights the changes that come into effect for Marsh Lake and Mt. Lorne, assuming 60% diversion of “traditional recyclables”, and 60% diversion of compostable food scraps and brush. These diversion rates are conservatively generous. Looking at the results, the carbon footprints can be drastically reduced based on diversion efforts, but if the same diversion tactics are employed at a burning vessel facility, the burning vessel still reflects the lower score. It is clear, however, that diversion efforts are critical to lowering a facility’s overall carbon footprint total.

Carbon Footprint Updates and Comparisons

The carbon footprint data is based on waste audit data from 1994, but can be updated with more recent or site specific waste audit data. When considering a new waste audit, it is important to ensure the data collected suits the carbon footprint categories (i.e. food scraps, glass, cardboard, etc.) outlined within this report.

Environment Canada recently published a similar model that utilized the same base reporting from ICF Consulting. The Environment Canada model, however, includes carbon sinks in their evaluation, which have the effect of reducing the overall emission inventory of certain waste alternatives, most noticeably landfilling. In theory, a landfill “sequesters” carbon dioxide through the burial of waste, which prohibits its escape into the atmosphere. This sequestration relates to a carbon sink that represents a net reduction in overall emissions. However, the potential exists that this trend can be reversed should the carbon dioxide be allowed to escape through intentional activities or accidental occurrences. The emission rates EBA has used are therefore more conservative estimates of carbon footprints, but the distinction between the methods is important to recognize if detailed reporting of carbon footprint inventories is required in the future. Overall, the general trend that the combustion of waste has a lower carbon footprint than landfilling holds true, though the advantage is not as great if the Environment Canada carbon sink concept is followed.

Also, when considering the emissions of the waste facilities in the Yukon, it should be recognized that while certain alternatives score higher carbon footprints than others, these values are still relatively low in comparison to other carbon generators, e.g. the carbon footprints generated by aircraft travel.

5.2.2 Energy Use

Energy use in the landfill scenario is the amount of electricity required to operate the facility on a per tonne of waste equivalent basis (ICF Consulting 2005). Incineration energy use is based on the amount of diesel fuel required to operate the incinerator. Energy consumption is assumed to be zero for facilities that don’t incinerate or landfill.

Example Calculation:

Energy use at waste management facilities = 0.6 kilograms eCO₂/tonne waste

Waste acceptance at Upper Liard: 215 tonnes

Total energy use at landfill: 0.6 kilograms eCO₂/tonne x 215 tonnes = 0.13 tonnes eCO₂

5.2.3 Landfill Heavy Equipment

“Landfill heavy equipment” has been taken to mean compactors and grading equipment utilized at a landfill for the burial of wastes. As such, this calculation only applies to landfills, and is calculated from a per tonne of waste factor meant to represent the carbon footprint of the heavy equipment required to operate a landfill (ICF Consulting 2005). It should be noted that while this factor’s contribution to the overall carbon footprint is small, it may still be overestimated due to the Yukon’s northern setting and limited heavy equipment requirements in comparison to a typical Canadian landfill. Also note, however, that cold weather typically decreases fuel efficiency and increases air emissions.

Example Calculation:

Landfill heavy equipment use emission factor = 4 kilograms eCO₂/tonne waste

Waste acceptance at Upper Liard: 215 tonnes

Total emissions at landfill: 4 kilograms eCO₂/tonne x 215 tonnes = 0.86 tonnes eCO₂

5.2.4 Waste Collection and Transportation

The waste collection and transportation carbon footprint calculation is based on the distance a large haul truck would have to travel to collect the waste at a burning facility, transfer station, or incineration facility and take it to a landfill. This vehicle is assumed to be a large diesel truck with an efficiency of 7 miles per gallon (GHG 2005). There is no haul distance required for a regional landfill, as the users of the facility would deposit the waste themselves. It has been assumed that a transfer station would require twice the number of hauls in comparison to other waste management alternatives, as there will be more waste to transport if organics (e.g. food scraps, brush) are not burned on site.

Example Calculation:

Distance from Upper Liard to nearest incorporated community (Watson Lake): 15 km

Number of haul loads per year: 12

Emission factor for diesel truck with fuel efficiency of 7 mpg: 0.9226 kg eCO₂/km

Total waste collection emissions: 15 km x 2 (roundtrip) x 12 loads x 0.9226 kg eCO₂/km = 0.3 tonnes eCO₂

5.2.5 Average User Distance Travelled

This factor assumes that the average waste facility user operates a pickup truck with a gasoline engine and efficiency of 14 miles per gallon. The roundtrip distance is multiplied against an eCO₂/km factor (GHG 2005).

The user distance calculated for most facilities is conservatively based on half the distance between the respective facility and the closest other facility. For a regional landfill, the roundtrip distance is based on the distance from the respective facility to the nearest incorporated community (i.e. where a regional landfill would likely be located). The number of trips that have been assumed on an annual basis is 26 (bi-weekly). As many of the users share their waste facility trips (i.e. as families), however, a factor of 0.5 has been applied to the number of trips assumed for a total of 13, annually.

Example Calculation:

Distance from Upper Liard to nearest incorporated community (Watson Lake): 15 km

Number of users: 250

Number of trips per year: $26 \times 0.5 = 13$

Emission factor for gasoline pickup truck with fuel efficiency of 14 mpg: 0.4002 kg eCO₂/km

Total waste collection emissions: $(15 \text{ km}/2) \times 2 \text{ (roundtrip)} \times 250 \text{ users} \times 13 \text{ trips per year} \times 0.4002 \text{ kg eCO}_2/\text{km} = 19.5 \text{ tonnes eCO}_2$

5.3 CARBON FOOTPRINT VERSUS AIR QUALITY

When considering emissions, there is sometimes confusion over the terms “carbon footprint” and “air quality”, though these topics are largely independent of one another.

As explained in Section 5.2, carbon footprints represent an inventory of greenhouse gases in terms of eCO₂, based on methodology derived from the IPCC. Air quality, on the other hand, is a more subjective parameter that relates to pollutants in the atmosphere that may have an adverse effect on the environment and human health. These pollutants include a number of different particles and gases, but not necessarily greenhouse gases, and it is this distinction that is at times counter intuitive when comparing the terms.

In considering the combustion of organic materials, such as brush, burning releases carbon dioxide into the atmosphere, but this type of release is classified as being biogenic (see Section 5.2). It is not counted (or is at least less significant) through the carbon footprint methodology because it is not a release of “fossil” CO₂ but rather the return of absorbed carbon dioxide (through photosynthesis) to the atmosphere as part of the natural carbon cycle. Conversely, the degradation of organics in a landfill produces methane that would otherwise not enter the atmosphere, and produces a significant carbon footprint total (tonnes eCO₂) as a result. Methane is an especially potent greenhouse gas, considered to be 21 to 27 times more potent than CO₂.

Both carbon footprint and air quality have been taken into consideration in this study, and while carbon footprints are an important factor that should be targeted for reduction (e.g. through increased diversion of recyclables), it is not to outweigh or to be confused with air quality. Each effect has its own environmental impact, but carbon footprint is the topic of major discussions across the globe presently, largely because of its quantifiable nature.

5.4 AIR DISPERSION MODELLING

An important consideration for air quality arguments in the Yukon is that some of the solid waste facilities are located in valley depressions. These depressions can cause temperature inversions, which preclude dispersion of smoke and results in accumulation of airborne pollutants at these facilities. To this effect, EBA retained SENES Consulting Limited (SENES) on behalf of the YG to conduct air dispersion modelling for a number of representative waste facilities. These results were released in May 2009 in a report entitled “Air Dispersion Modelling of Solid Waste Facilities in the Yukon” (SENES 2009).

In general, the air dispersion modelling results indicated no serious concerns for human health outside the burning facility site boundaries, barring 24 hour constant exposure under the worst possible meteorological conditions. However, in the case of Carcross and Tagish, the levels of exposure were higher than other facilities examined, and setback distances for dwellings were recommended as a result. When taking into account the model’s level of accuracy, the assumptions that have been made, and additional safety factors, it is worth considering the conversion of these two facilities to a no-burn alternative. As such, the model’s results will likely contribute to a prioritization plan for the recommended and required facility changes.

The results of the air dispersion modelling, as well as the results from the waste model (to be determined), will factor into the prioritization of facility upgrades as required under the new permits that call for the cessation of burning by January 1, 2012. In the meantime, the SENES report went on to suggest that the waste facilities that do burn wastes be closed to the public while burning is in progress. Community Services is currently considering this course of action, though a noted barrier is the absence of fence and gate controls at many of the facilities.

6.0 TASK 3 – COST ANALYSIS OF PROPOSED AND EXISTING PRACTICES

The cost estimates prepared as part of this study, which are incorporated into the waste model later discussed in Section 9.0, included following waste alternatives:

- Open trench burning and burial.
- Burn vessels and burial of the ash and unburned waste.
- Regional landfills.
- Transfer stations and regional solid waste disposal.

- Incineration.

Based on these Class C estimates, site specific totals were developed for each facility and the available alternatives. A Class C cost estimate is meant to provide a budgetary indication of the costs to be expected. The accuracy of this level of estimate is not to be relied upon for quotation purposes, but is typically indicative of the order of magnitude anticipated. The methodology used to prepare these calculations is discussed in the following sections. The Burwash Landing facility was consistently used in the sample calculations as a representative facility.

6.1 BURN AND BURY IN TRENCH

Capital Costs – As only one such waste facility currently operates in the Yukon (Carcross), the capital cost for this option is considered to be zero. Burn and bury in trench is considered to be the least engineered alternative available, and so the other waste alternatives are not permitted to regress within the model.

User Cost – There is no additional user cost associated with the burn and bury in trench option than is currently present.

Operational Expense – The operational expenses are based on the 2007/2008 contract price the YG has in place with the Carcross burn and bury in trench facility. Please refer to Table 3 for a summary of these annual contracts that Community Infrastructure has in place for its unincorporated facilities.

6.2 BURN IN A BURNING FACILITY (I.E. BURNING VESSEL) AND BURY IN TRENCH

Capital Costs – As only one waste facility in the Yukon utilizing a burn and bury operation does not have a burning vessel in place (Carcross), the capital cost for this option is considered to be zero in all cases, barring the exception, where a \$10,000 lump sum would be required to upgrade the facility.

User Cost – There is no additional user cost associated with the burn in a burning facility and bury in trench option than is currently present.

Operational Expense – The operational expenses are based on the 2007/2008 contract prices the YG has in place with the burning vessel facilities. For evaluating Carcross as a burning vessel facility, a contract price was estimated by taking the total price of the contracts for all burning vessel facilities and dividing by the total number of users. Table 3 presents a summary of these costs.

Example Calculation

Average Burning Vessel Contract: \$24,166.62

Average Number of Burning Vessel Users: 156.2

Average Per User Cost of Burning Vessel Facility: $\$24,166.62/156.2 = \154.72

6.3 REGIONAL LANDFILL

A regional landfill considers a centralized landfill facility supported by a “circuit network” of other waste facilities, and assumes that these facilities would all close in favour of a regional landfill. This landfill’s location is based on a “circuit capital”, which is the largest incorporated community within the circuit. For example, Whitehorse could be the circuit capital for Johnson’s Crossing, Marsh Lake, Mt. Lorne, Carcross, Tagish, and Deep Creek. Figure 1 illustrates the other circuit networks considered within this study.

For the Mayo circuit, it has been assumed that a new landfill would not be required, and that both Stewart Crossing and Keno City (since these are small facilities) would be able to deposit their wastes at the Mayo facility at an annual cost based on a per tonne deposition (i.e. \$75/tonne). However, it has been assumed that the other circuit capitals would likely require the construction of new regional landfills, since use of existing landfills is not guaranteed.

When considering individual unincorporated waste facilities, the landfill costs calculated represent the portion of the total landfill that a specific facility would have to pay as a fraction of the circuit’s total (i.e. Burwash Landing represents 77 m³ of 355 m³ total waste volumes in the Haines Junction waste circuit, which is equal to 21.7% of the total price to construct and operate a landfill in Haines Junction).

Capital Costs – The capital cost for a landfill is based on a Class C cost estimate that was prepared by EBA for landfill construction costs. This cost does not include land acquisition. Please refer to Table 4 for this estimate.

User Cost – This cost is based on the round-trip distance a user would have to travel should their waste facility be closed in favour of a regional landfill. The scoring system used to reflect this cost is based on a scale from 0 to 10 according to the respective cost associated with the travel distance (i.e. if the cost is under \$5, the score is 2, if the cost is under \$20, the score is 6, and if the cost is over \$50, the score is 10).

Example Calculation:

Distance From Burwash Landing to Haines Junction: 125 km

Price of Gas: \$1.00/L (as of July 2009)

Vehicle Efficiency: 14 mpg (Pickup truck) = 5.95 km/L

Cost to User: 125 km x 2 x \$1.00/L x (1/5.95 km/L) = \$42.02

Operational Expense – The operational components of a landfill are divided into the following.

Annual Contract: This cost has been estimated as being the annual costs required to build a portion of a landfill cell to maintain the waste bearing capacity of the landfill. Please refer to Table 5 for this cost estimate.

Example Calculation:

Cost to Build Landfill Cell (8,000 m³ Capacity): \$286,000

Note: 8,000 m³ is meant to represent a five year waste capacity for the entire waste circuit.

Total Annual Volume for Haines Junction Circuit: 355 m³

$$355 \text{ m}^3 / 8,000 \text{ m}^3 = .044375$$

Burwash Landing Waste Volume = 77 m³

$$77 \text{ m}^3 / 355 \text{ m}^3 = 0.2169$$

$$\text{Annual Cost to Burwash Landing for Landfill Cell: } 0.044375 \times 0.2169 \times \$286,000 = \$2,752.72$$

Operation and Maintenance: This has been estimated from the actual average cost from larger waste facilities currently operating in the Yukon that receives similar volumes of waste to those expected (e.g. Mayo, Carmacks, Faro). Added to this cost are items that apply to an engineered landfill (e.g. litter control, leachate management, daily cover) as well as one full-time staff member required to operate a scale house. Please refer to Table 6 for the cost estimate utilized in these calculations.

Example Calculation:

Operation and Maintenance Cost per tonne of waste deposited: \$69.27 (includes O+M contract, litter control, leachate management, etc.)

Staffing Cost: \$60,000/yr/landfill

Waste Quantity at Burwash Landing: 110 tonnes/year

Waste Quantity in Haines Junction Circuit: 507 tonnes/year

$$\text{Operation Cost At Burwash Landing: } \$69.27 \times 110 \text{ tonnes/year} + [(110/507) \times \$60,000] = \$20,650$$

$$\text{Operation Cost for Full Haines Junction Landfill: } \$69.27 \times 507 \text{ tonnes/year} + \$60,000 = \$95,150$$

Haul Costs: Are assumed to be zero, as users will be required to transport the waste to the landfill themselves.

6.4 TRANSFER STATION AND REGIONAL SOLID WASTE DISPOSAL

All costs for transfer stations assume only those costs for the actual transfer station, and do not include any costs associated with the construction or operation of a regional landfill. However, it is assumed that a regional landfill is necessary in order for transfer stations to be viable. As such, the cost of a regional landfill would also apply to the transfer station option, but in order to determine the most suitable facility alternative in an individual community, a transfer station facility must be evaluated as an entirely separate entity.

Capital Costs – The transfer station capital costs were projected based on the cost estimates provided in the 2001 Solid Waste Strategy prepared by Gartner Lee

(Gartner Lee 2001). These costs have been verified using updated costs from a 1996 British Columbia Ministry of Environment publication entitled “Guidelines for Establishing Transfer Stations for Municipal Solid Waste”, which provides a detailed examination of many different sized facilities for different anticipated waste volumes. These estimates are based on using two 40 yd³ (30.6 m³ x 2 = 61.2 m³) containers. At a minimum, the two containers will be required, and this price is scaled upwards depending on the amount of waste received at a facility. Please refer to Table 7 for the cost estimate prepared for this study.

It should be noted that while the number of bins required at each site will vary, it has been assumed that the volume of waste accepted each year will reflect the number of bins required. This assumption is based on an understanding that the transfer station bins will be collected on a regular basis, but also that there will be a need for additional bins designated to receive different wastes.

Example Calculation:

Burwash Landing Annual Waste Volume (Uncompacted): 127 m³

Containers Required: $127 \text{ m}^3 / 61.2 \text{ m}^3 = 2.075$

Cost of Transfer Station for Two Bins = \$88,650

Cost Component to Increase as a result of More Bins: \$43,900 (includes retaining wall, concrete pad and bin and lid costs)

Cost of Transfer Station for Burwash Landing = $(\$43,900 \times 2.075) + (\$88,650 - \$43,900) = \$135,850$

User Cost – There is no additional user cost associated with the transfer station option.

Operational Expense – The operational components of a transfer station are divided into the following.

Annual Contract: The annual contract prices are based on the 2007/2008 contract price the YG has in place with existing transfer stations (Table 3), assuming that staffing would be required for any transfer station to operate effectively.

Operation and Maintenance: Assumed to be a part of the contract price.

Haul Costs: Haul costs are based on a \$0.75/km haul charge. Landfill tipping fees, if applicable, are assumed to be part of the contract price.

6.5 INCINERATION

Costs developed for an incineration facility assume that the incinerator would replace a burning vessel or burn and bury operation, and would accept wastes in a similar fashion to current practices.

Capital Costs – Costs for incineration facilities are balanced based on two estimates received; one from a Canadian company that has previously supplied an incinerator to

Skagway, Alaska, and the other from an Alaska report on the burning of wastes (Alaska 2004). Please refer to Table 8 for the cost estimate prepared for incinerator facilities.

User Cost – There is no additional user cost associated with the incineration option.

Operational Expense – The operational components of an incinerator facility are divided into the following.

Annual Contract: These costs are amalgamated with the operation and maintenance costs.

Operation and Maintenance: These costs are based on the fuel and labour required to operate the incinerator throughout the year.

Example Calculation:

Diesel Fuel Required for Burn: 100 Gallons (378.5 L)

Price of Fuel: \$1.00/L (July 2009)

Incinerator Capacity: 1 tonnes/day (burnable materials)

Amount of Waste at Burwash Landing: 110 tonnes/yr (Burnable Composition 65.7%)

Number of Burns Required Per Year: $110 \times 65.7\% = 72.3$

Length of Burn: 5 hrs

Staffing Cost: \$25/hr

Annual Training Cost: \$500

Total Incineration Cost: $(378.5 \text{ L} \times \$1.00/\text{L} \times 72.3) + (72.3 \times 5 \text{ hrs} \times \$25/\text{hr}) + \$500 = \$36,905$

Additional Cost = Half of contract required with a burning vessel facility for upkeep, maintenance, and collection of the materials that cannot be burned.

Haul Costs: Haul costs are based on a \$0.75/km haul charge for the bulk wastes that cannot be burned at the facility.

6.6 FUTURE COST PROJECTIONS

Table 9 and Table 10 depict the future cost projections determined for each waste facility alternative. The following sections discuss the methodology used in determining these projections.

Projecting the costs of starting up and operating the Yukon's solid waste disposal alternatives over a 20 year period has a number of challenges, some common to all long-term projections and some particular to solid waste disposal. Three major factors will drive the cost projections:

1. projected population;

2. expected per capita waste generation rates; and,
3. cost inflation.

6.6.1 Population Projections

Population is the single largest factor driving the quantity of solid waste produced in the Yukon; therefore, the costs of handling and disposing of the waste. Because we are projecting the costs of existing facilities and possible scenarios over a 20-year time horizon, the estimated population over that period becomes the key assumption.

Statistics Canada (Stats Can) provides a number of population projections for the Yukon based on different demographic and migration scenarios. It is also possible to do a linear projection following existing long-term trends. Finally, the Yukon Bureau of Statistics (YBS) provides three population projections for 2018 only that act as a cross-check for the other approaches. Summarized in the table below are a number of possible population projections for the Yukon, each with its own strengths and weaknesses.

YUKON POPULATION PROJECTION SUMMARIES					
Year	Stats Can Scenario 4	Stats Can Scenario 5	Linear Projection	YBS Medium Growth Scenario	YBS High Growth Scenario
2013	33,300	28,700	33,673	-	-
2018	34,700	27,900	36,086	35,107	38,606
2023	36,100	27,500	38,672	-	-
2028	37,400	27,300	41,444	-	-

Notes:

1. The Stats Can Scenario 4 produces the highest population figures of the 13 offered by the agency. It is based on medium natural population growth assumptions, a constant national immigration rate of 0.7% and the relatively high inter-provincial migration patterns seen between 1988 and 1996 for the Canadian west coast.
2. Stats Can Scenario 5 is based on the same natural population growth assumptions as Scenario 4 and the same national immigration rate, but a lower inter-provincial migration pattern seen in central-west regions of the country.
3. The linear projection figures come from applying the Yukon's average annual population growth rate from 1971 through to 2007 (1.39%) to the territory's current population.
4. The YBS medium growth scenario assumes that current demographic trends continue but holds net migration at zero.
5. The YBS high growth scenario assumes a 10% increase in the birth rate, a 10% decrease in the death rate, and a net in-migration of 300 people annually to the Yukon.

For this report, the Stats Can Scenario 4 projection has been used for these reasons:

- The linear projection has the advantage of including the effects of past population swings caused by abrupt changes in the territorial economy, and particularly the closing and reopening of the Faro mine in the 1980s and 1990s. However, using straight line projections from past data for extended future projections is inherently problematic.

In particular, it locks in the effects of past demographic patterns that have since substantially changed (i.e. total fertility rates dropped by 13% between 1974 and 2006).

- Both of the Stats Can projections rely on prudent demographic assumptions such as a fertility rate lower than the current one and a steady level of immigration.
- The higher inter-provincial migration assumption that drives the large difference between Stat Can Scenario 4 and Scenario 5 presupposes a reasonable degree of economic growth attracting newcomers to the Yukon but, given that the YBS is projecting a higher population in 2018 by natural growth alone, it does not appear excessive (Stats Can is using a total fertility rate of 1.50, while the YBS is projecting that the 2006 Yukon rate of 1.69 will continue).
- In summary, Scenario 4 appears to strike the most reasonable balance between the key factors that will drive population changes in the Yukon over the next 20 years.

For specific Yukon communities, EBA will be assuming that each scenario will contain the same proportion of the Yukon's population as it did in June 2008.

6.6.2 Per Capita Waste Production and Trends

In 2001 and 2002, waste surveys were undertaken in Whitehorse, Haines Junction, Watson Lake, and Carmacks⁶. The average of these surveys was a figure of 0.795 tonnes per person per year. This is higher than the average of 0.620 tonnes per capita found in British Columbia in the same two years, but quite comparable to the 0.879 tonnes in British Columbia in 1990⁷.

The City of Whitehorse landfill shows wide variations in the amount of waste entering the landfill, ranging from just over 15,000 tonnes in 2000 to 30,000 tonnes in 2002, with an average of approximately 22,500 tonnes from 2000 to 2005⁸. The average population of the Whitehorse area over those six years was 22,614 according to the YBS. This implies an average waste production of 0.995 tonnes per person per year but varying from 0.664 tonnes to 1.352 tonnes.

The trend of per capita solid waste production in British Columbia was very stable between 2001 and 2005, averaging 0.632 tonnes with a variation of +4.9% to -3.6%, after having fallen substantially from the 1990 baseline of 0.879 tonnes. The large decline to a relatively stable average is attributed to a substantial province-wide effort to divert waste, largely through recycling. The pattern that British Columbia has followed shows that it is unwise to project smooth changes in per capita waste production over time. The recent abrupt and precipitous plunge in the price of a wide variety of waste that is now commonly recycled,

⁶ Access Consulting Group, 2001 and 2002 and G.J. Bull & Associates 2001.

⁷ Recycling Council of British Columbia. BC Municipal Solid Waste Tracking Report, 2003 to 2005.

⁸ Posted at: www.city.whitehorse.yk.ca.

including cardboard, paper, and metals, also provides a warning that reductions in per capita waste production are not necessarily permanent.

From the above data and trends, we believe it is prudent to use a per capita waste production estimate of 0.9 tonnes per year.

6.6.3 Cost Inflation

Long-term cost projections are particularly sensitive to assumptions about how much costs will increase over time. Because Canada has not experienced a generalized decrease in prices (deflation) since the 1930s, assuming that costs will remain stagnant or decline over the long term would not be prudent.

The consumer price index (CPI) is the standard measure of inflation in the economy. In Whitehorse, the average annual inflation rate for 2000 to 2007 has been 1.7%. The CPI measures the prices of a basket of standard consumer goods, a basket that is gradually adjusted as new products and services become standard or popular items.

A better measure of inflation for projects such as incinerators or a transfer station is the industrial product price index (IPPI) tracked by Stats Can. No separate data is available for the Yukon, but the Canadian IPPI showed average annual price increases of 2.1% from 2003 through 2007. The IPPI includes a wide variety of categories including: metal fabricated products, machinery and equipment, and petroleum products. We have used the average IPPI as our measure of cost inflation.

7.0 TASK 4 – PUBLIC AND STAKEHOLDER MEETINGS

In order to obtain a clear picture of solid waste management in the Yukon, it was important to hear from the facility users and identify their concerns and suggestions.

Over the Spring of 2009, EBA, with the occasional accompaniment of Community Infrastructure staff, held meetings with the public, LACs, municipal governments, and First Nation Governments at each unincorporated and incorporated community in the territory, with the exception of Old Crow⁹.

The following sections discuss public and stakeholder meeting process, as well as the information that was obtained throughout.

7.1 MEETING MATERIALS AND PRESENTATION

The primary objective of this phase of meetings was to demonstrate the progress that had been made prior to the meetings, and explain and receive feedback on the preliminary results and potential future waste management alternatives for the Yukon.

⁹ Old Crow community representatives suggested that a community meeting during the spring would not be beneficial due to other recent meetings having been held that partly addressed the issue of solid waste and a potential new location for the landfill.

The materials used as part of the meetings included:

- a handout summarizing project purpose, progress, and direction;
- a PowerPoint presentation (copies available); and,
- a questionnaire for people to complete.

The handout distributed provided project context and a take-home source of information for participants. It also provided contact information where any questions or comments could be directed.

The PowerPoint presentation consisted of a number of slides highlighting:

- roles of government in waste management;
- project overview, progress update, and future direction;
- current waste management practices in the territory for unincorporated communities;
- challenges faced in waste disposal territory-wide;
- waste disposal alternatives available;
- preliminary cost estimates for existing facilities and conversion of current facilities to various alternatives;
- preliminary comparison of carbon footprint estimates for different waste disposal alternatives; and,
- an emphasis on the importance of public input and a request for discussion and feedback.

The format of the public meetings was a presentation setting, where EBA representatives presented the materials to the audience before opening the floor to any questions or comments. Any feedback that could not be addressed within the time allotted was encouraged to be submitted using the questionnaire provided. The following sections discuss the meeting organization and structure at the various communities, as well as the type of feedback anticipated and received.

7.2 MEETING ORGANIZATION AND STRUCTURE

The meetings held for the solid waste study were scheduled with the public consultation for the Building Canada program. This schedule sharing offered an opportunity to maximize participation by interested residents. A disadvantage of this approach was the overall length of the meetings often lead to participant fatigue. While EBA visited both incorporated and unincorporated communities, and presented the same materials at each respective meeting, the meetings differed between the two groups in terms of the type of comments anticipated and received.

Incorporated communities were included in the community meeting schedule because solid waste management is a Yukon wide issue and because there may be opportunities for efficiencies of incorporated and unincorporated communities working together on solid waste management. How this relates to the public meeting process and the influence on this study is discussed in the following sections.

7.2.1 Unincorporated Community Input

In unincorporated communities, where burning vessels represent the majority of waste facilities and where waste diversion or segregation programs are limited, the themes from the public meetings were focussed on what changes are desired and the future direction envisioned.

As the majority of research compiled prior to the public meetings focused on unincorporated communities, these meetings in particular provided a contrast between public opinion and the research compiled.

The results of these public and stakeholder meetings have supplemented the findings to date and provided insight from the community level for how well the waste facilities are able to meet user needs. The questions, comments, and suggestions put forth at the public meetings have contributed to this study in a variety of areas, and will have an influence on the conclusions and recommendations to be prepared as part of the final volume of reporting. This input has also had an influence on the waste model and its results, as discussed in Section 7.5.

7.2.2 Incorporated Community Input

The municipalities that were visited as part of the public and stakeholder meetings included Whitehorse, Haines Junction, Teslin, Carmacks, Watson Lake, Faro, Mayo, and Dawson City.

In contrast to unincorporated communities, the themes for municipalities focussed on how to improve existing operations, as the infrastructure for waste management is already largely in place. However, concerns also arose regarding operational and capacity limitations, and the often onerous obligations (i.e. regulatory upkeep, economic constraints, lack of resources for required maintenance) that are faced at the respective facilities.

As far as the public component of the meetings was concerned, the general objective was to present Community Services' current plans and progress and receive comment and feedback. Additionally, it was important to get a sense of how the public views their current facilities and if there were any suggestions or wishes they had for improvement.

Also of concern with respect to incorporated communities are the additional stakeholders that have a vested interest or role in waste management operations, from both disposal and diversion perspectives. Within these municipalities, the YG and EBA targeted communication with administrative staff and the respective local advisory committees to

discuss the possibility of cooperating with Community Services in the management of Yukon waste from outside these communities.

The information requested from these stakeholders was centered around the following objectives:

- getting a sense of the municipality's vision for their own waste; and
- gauging openness of the municipality as a whole for forming potential partnerships with other communities to manage solid waste.

YG will continue to develop a cooperative working relationship with these municipalities into the future.

7.2.3 First Nations Input

With respect to the waste facilities operated at both unincorporated and incorporated communities, First Nations Governments and their citizens utilize both types of facilities. In some cases, these facilities are leased from First Nation land.

While many of the First Nations comments were similar to other facility users, there is a unique perspective from these governments due to the more complex relationships between Yukon Government, municipalities, and First Nation Government in terms of the provision of services.

Additional input on waste management from First Nations focussed on the roles and responsibilities for such services. It appeared as though there is a level of uncertainty in some communities when it comes to which government and or government department is responsible for the waste facilities and how the costs are to be covered. While not addressed in the scope of this study, it is clear that further discussion is required between the various First Nation Governments, YG Community Services, and the incorporated municipalities.

7.3 PUBLIC AND STAKEHOLDER MEETING HIGHLIGHTS

The general themes from the public and stakeholder meetings with respect to future waste management strategies included the following:

- strong opposition to the burning of wastes;
- focus on waste diversion rather than waste disposal;
- sustainability of waste management alternatives under consideration; and,
- concern over carbon footprint estimates.

The following sections detail these themes in greater detail. A table highlighting all questions and comments received has been included in Appendix A. Additionally, there are some municipal level highlights to consider with respect to this study that have been included in the following sections as well.

Not all themes were unanimous across the various communities, and some concerns were voiced more emphatically than others. The following sections attempt to provide more information on the generalized questions and comments that were received through the public meetings specifically pertaining to this study. Section 7.4 and Section 7.5 go on to discuss additional concerns for waste management in the territory and how the public input will influence future decisions and directives.

7.3.1 Opposition to Burning

Open burning of wastes, whether it is in a trench or a burning vessel, is generally not well received by the public. This is understandable given the visual and odour effects of a burn. At the public meetings, residents repeatedly expressed concern for their health and the environment and questioned why action had not yet been taken.

At the outset of this study, the burning of wastes was an alternative that, while not ideal, still represented an acceptable practice in the Yukon. However, it was understood that a ban on burning would likely come into effect at some point in the future. In the meantime, an air dispersion modelling exercise was commissioned to better understand the implications of burning on the surrounding environment and residents. The results of this study are discussed in Section 5.4.

Since the commissioning of the air dispersion modelling, the solid waste permits for the unincorporated facilities have been renewed, and as discussed in Section 4.7.4, the new requirements state that the open burning of wastes will be prohibited in the Yukon as of January 1, 2012. As a result of this requirement, the majority of waste facilities in the Yukon will need to change their operations, and these changes will occur in phases leading up to January 1, 2012 based on a prioritization schedule to be determined. This change is directly correlated to the public's opinion on the practice.

7.3.2 Waste Diversion

The following questions have been paraphrased to address a number of similar comments put forth regarding waste diversion in the Yukon.

Why isn't the focus on waste management and diversion instead of waste disposal?

The scope of work for this project is mainly focussed on waste disposal. However, it has been recognized that diversion is critical to waste management in the Yukon, and Community Services is committed to ensuring that waste diversion is addressed. To this effect, a solid waste working group is presently under consideration. Additional information on the formation and mandate of this group is discussed in Section 11.4.

What about composting? Why aren't more efforts being made to reduce the amount of organics being burned or going to landfill?

Composting was discussed on a variety of levels from the need for a facility to the development of various types and qualities of compost. Composting, discussed further in

Section 11.1.1, is becoming a more popular practice in the Yukon with successful projects underway in Dawson City (pilot project) and Whitehorse. As discussed throughout this document, composting provides an alternative to the burial or burning of biogenic wastes such as food scraps, and provides a more sustainable practice that produces a nutrient-rich topsoil product in the process. This benefit is one that residents supported in opposition to the burning or burial of organics which does not provide any added or secondary value.

What about waste and recycling education/awareness programs? Are there plans to increase these efforts?

This was a comment expressed at most meetings independent of the type of meeting. There was an express concern that with the development of new facilities and programs in the Yukon, education and training will be necessary within the communities. In order to develop a recycling culture, public education and awareness programs are necessary to ensure the message is heard and understood. The Department of Environment and Raven Recycling have ongoing public education initiatives in place, and Community Services is committed to becoming involved with this work through future cooperation. Additional information on public education programs will be included in future volumes of reporting, and through the establishment of the solid waste working group discussed earlier in this section.

YG needs to focus on e-waste options.

E-waste was the focus of a number of questions during the public and stakeholder meetings. EBA has conducted a best management practice review across Canada, and there are a variety of e-waste management initiatives in place to consider. When considering any specific waste stream, there are a number of factors that must be addressed: ease of disposal for user, collection of the waste, processing of the waste, and the cost. E-waste is no exception, and has recently gained much attention worldwide as a targeted waste for better collection and recovery.

EBA understands that Environment Yukon is currently undertaking a comprehensive review of its existing recycling programs and is in the preliminary stages of research to support the development of an “Extended Producer Responsibility” (EPR) framework that can be applied to a number of product categories, including e-waste. Under an EPR framework, producers or first importers of identified products would be responsible for developing, implementing and running recovery and recycling programs for their products. Stakeholders and the public will be consulted during the development of the EPR framework regulation and appropriate education/awareness initiatives will be undertaken both during the regulation development and implementation phases, and in association with the new programs. The topic of e-waste, its management, and potential solutions is further discussed in Section 11.2.

7.3.3 Sustainability of Waste Alternatives

The following questions have been paraphrased to address a number of similar comments put forth regarding the sustainability of waste management alternatives available in the Yukon.

Why weren't anaerobic digestion and/or mobile incinerators considered as alternatives?

The alternatives that EBA has evaluated for this study are those that were felt to be the most realistic and feasible given the limited waste quantities, site remoteness, and northern setting. Mobile incinerators were investigated at the outset of the study, but due to the maintenance required over time and the large distances that would have to be travelled, this alternative was not considered feasible in the long term. Similarly, anaerobic digesters, which are essentially a waste to energy alternative that aims to collect methane gas produced by biogenics in a controlled environment, are not suitable to the Yukon presently due to the low waste volumes. Also, with increasing diversion of wastes with recycling and composting initiatives, the "fuel" required in anaerobic digesters becomes further inhibited. Other alternatives brought up through the meetings included landfills, gasification plants, and pyrolytic ovens, which have similar limitations.

Why isn't waste to energy being considered?

This item was discussed with consideration of gasification, burning of waste oil, and other such alternatives that aim to recover energy from waste products. As discussed in the paragraph above, waste to energy requires a significant fuel source in order to be worthwhile. Given the limited population in the Yukon, particularly outside of Whitehorse, this fuel source is simply not large enough to be sustainable, especially if waste diversion efforts are increased. Further discussion regarding waste to energy initiatives is discussed in Section 11.7.3.

What is the "full cost" of the waste management alternatives being evaluated?

Full cost accounting was raised in terms of a concern that the environment, future health care costs, and additional considerations were not being compared on equal terms with economics. The "full cost" of waste alternatives refers to the overall impact of the alternative in a number of different evaluation criteria, and is difficult to quantify. The waste model under development attempts to identify the considerations that need to be taken into account and attribute a weighting to these considerations to help determine which are most important for the decision making process. As the weighting process is somewhat subjective, it is important to ensure that the weightings are evaluated fairly, and the public input received to date will have a major influence on the model's calibration, as discussed further in Section 9.0.

The waste alternatives selected need to be able to adapt to future growth and waste generation.

Communities expressed interest in future waste disposal facilities being able to adapt to population growth or new waste management technologies. As discussed later in

Section 9.4, the concept of sustainability has been added as part of the evaluation criteria for the waste management alternatives under consideration. For each waste management alternative (i.e. burning of wastes in trench/burning vessel, transfer station, regional landfill, and incinerator), the relative sustainability of the option will be evaluated and attributed a weighting similar to the methods used for the impact on environment and human health and safety. Part of this assessment of sustainability will include the ability to adapt to future waste volumes and management initiatives.

7.3.4 Carbon Footprint Estimates

The following questions have been paraphrased to address a number of similar comments put forth regarding carbon footprint estimates presented at the public meetings.

Why is the carbon footprint lower for burning than for landfilling and transfer stations? How do they compare on a tonne of waste or per person basis?

The methods and assumptions used to determine the carbon footprint estimates in Section 5.2 have been expanded since the public meeting sessions in an effort to clearly explain what the numbers represent and their influence on this study. For a direct comparison of waste management options on a per tonne of waste basis, please refer to Table 11 that provides this information based on the research summarized in the ICF Consulting document see references.

What about Dawson City's sustainable landfill and recent waste audits? What effect does that have on the study?

Upon review of Dawson City's waste audit information, it was observed that the results were relatively similar to the 1994 Whitehorse waste audit data. Waste audits are often difficult to organize to provide statistically relevant data, as waste generation varies over the course of the year and from community to community. The ideal situation for the carbon footprint calculations would be site specific waste disposal trends over a long period of time, but given the expense and time required to produce such results, it is more practical to use the best available data and make rational assumptions based on general trends. As such, the carbon footprint estimates generated to date provide an indicative estimate only. When planning future waste audits, it is recommended that the waste characterization be broken into the respective categories for which carbon footprint emission data is available. The Dawson City data has many of these categories included, but not to the degree necessary to update the present carbon footprint estimates.

7.3.5 Municipal Level Concerns

The following questions have been paraphrased to address a number of similar comments and questions put forth regarding incorporated community concerns.

Would municipalities be willing to accept the waste of unincorporated communities in exchange for a tipping fee? Or would they rather see the establishment of a new regional landfill?

In general, the incorporated communities are not keen to accept outside waste in exchange for tipping fees. The main argument being that it would limit the lifespan of their existing facilities and in some cases there is limited space available. It has become clear that further communication and cooperation will be necessary between Community Services and incorporated municipalities moving forward.

What about Raven Recycling's plans, their current capacity limitations, and how that affects the territory?

According to the Environment Forum, held in May 2009, Raven Recycling is considering expansion plans for its current facility. These plans involve the establishment of a new building that would function as a materials recycling facility capable of handling the recyclables of the territory.

Raven Recycling represents a major resource for the territory that operates cooperatively and effectively in recycling Yukon's recyclables, and has received funding from YG in recognition of their importance and impact. Additional information regarding Raven Recycling is provided in Section 10.8.1.

The willingness of Whitehorse and Raven Recycling to accept more waste, unsegregated waste.

Initial discussions with the City of Whitehorse indicated a preference towards the establishment of a new regional landfill. However, it is recognized that in the short term, the City of Whitehorse has the necessary infrastructure in place, and can act as a regional landfill until an alternative is available.

The objective of waste management, in general, is to bury as little re-usable wastes as possible. If waste is received unsegregated (i.e. mixed wastes in a garbage bag), it is not feasible to separate the wastes on site, and as such, waste must already be segregated upon reaching the waste disposal site.

A two bin (or more) system at transfer stations should be available to separate the wastes received, in conjunction with additional waste segregation areas at the facilities themselves. One bin can be designated to accept mixed recyclables (which would theoretically be shipped to Raven Recycling and organized), and one would be designated to accept "garbage". In some communities it would be advantageous for residents to practice backyard composting so that the "garbage" going to landfill is limited. It is recognized, however, that backyard composting can be an attractant for bears and other wildlife, which may limit the practice in certain areas.

An additional concern is how the cost of accepting increased volumes of wastes and recyclables will be covered, and to this effect, additional communication and cooperation between YG, Raven Recycling, and the City of Whitehorse will be necessary.

The ability to ship recyclables from the communities to Whitehorse.

As discussed later in Section 11.1.1, many communities in the Yukon face a challenge with the transportation of wastes and recyclables to Whitehorse. This is due to a lack of backhaul opportunities and sporadic volumes of waste deposited at these facilities.

Clearly, this concern is an important to address to enable communities outside of Whitehorse to manage their wastes appropriately, and while EBA will include some recommendations regarding backhaul opportunities, additional cooperation and communication will be necessary in the future between the responsible parties.

Concern for liability associated with scavenging versus the diversion potential.

As site operators, Community Services and Municipalities (i.e. Whitehorse) are liable for any injuries that occur at their facilities. Scavenging, by nature, has such inherent risks, but also provides “last minute” diversion potential to keep reusable material outside of the landfill. In other Canadian jurisdictions, scavenging by the public is not permitted due to these liability concerns. Additional information regarding liability is discussed in Section 11.3.5.

7.4 PUBLIC MEETING OBJECTIVES AND RESULTS

As discussed previously, the primary objectives for the public and stakeholder meetings included:

- identification of public and stakeholder comments, concerns, and ideas;
- identification of public understanding of waste management; and,
- identification of public perceptions and waste management priorities.

The following sections speak to these objectives directly, and include discussion of the overall themes that EBA gathered first-hand at the meetings.

7.4.1 Public and Stakeholder Comments, Concerns, and Ideas

As discussed in the sections above, all of the specific feedback received was recorded during the public meetings and is summarized in table format within Appendix A. In addition to these specific comments, EBA also noted additional feedback and themes that are outlined below.

At many of the meetings, there was frustration expressed regarding the format of the public meetings. Many residents felt that the material presented neglected certain issues (i.e. environment and human health) and focussed too much on other issues (i.e. costs). Additionally, it was voiced on several occasions that the absence of relevant government staff was not appreciated given that the government is responsible for the waste facilities being discussed. As well, some participants were not happy with the timing of the public meetings and how they were combined with other consultation programs. This piggybacking at times gave the impression that waste management was not being treated with the attention it deserved or, due to fatigue the participants could not adequately express their concerns.

Additionally, there was a common inference from participants that the public meetings were being conducted simply so that the item could be checked off a list before the government

went ahead with their own plans. As such, they were skeptical that their input would be appropriately considered.

7.4.2 Public Understanding of Waste Management

While not directly addressed through the meeting process, EBA was able to infer from the comments, questions, and feedback received at the meetings the level of understanding residents had of their waste facilities and how they are managed. The level of understanding, as one might expect, was varied, with some residents having a very thorough understanding of waste management in the territory, and others not. There was a general awareness of advanced solid waste technologies such as gasification and anaerobic digestion and a general desire to make use of technology to reduce costs and negative environmental effects and improve efficiencies. However, there was less awareness about the details and suitability of such technologies in the Yukon.

In general, residents were familiar with their local waste facility. As far as responsibility goes, however, the public was not as familiar with how the sites were maintained or the costs involved. To this end, it appears as though there needs to be better communication between residents and Community Services in terms of both public education on waste management and the plans that are in place going forward.

7.4.3 Public Perceptions and Waste Management Priorities

In some communities, EBA observed a somewhat strained relationship between waste facility users and operators (i.e. Community Services). There were many concerns expressed regarding a lack of action and perceived inattention to needs and demands.

Action was the most prevalent theme when it came to discussing priorities. The practice of burning garbage has been opposed in the majority of communities for some time, and despite a number of studies and public meetings, the practice continues. It was often demanded that this practice stop immediately, with little interest for the costs or effort required. Residents expressed that they were tired of “yet another round of studies and consultation” and wanted to see results.

7.5 PUBLIC INPUT INFLUENCE ON SOLID WASTE STUDY

How is public input going to affect the decisions being made?

The input received from the public meetings has had a major influence on the decision making processes and waste management initiatives moving forward with the solid waste strategy. Public input has already resulted in the cessation of burning scheduled for January 1, 2012, and the comments received as part of the public meeting process will be taken into account for other decisions as well. This influence is further discussed in Section 9.4 with respect to the waste model.

As discussed in Section 7.3.2, because of the acknowledged importance of waste management in the territory, the formation of a solid waste working group is presently

being considered by Community Services, and is addressed as part of EBA's recommendations as outlined in Section 11.4. This concept was formulated from the public input to this process.

8.0 TASK 5 – ANALYSIS OF THIRD PARTY AND COMMUNITY MANAGEMENT OF SOLID WASTE FACILITIES

8.1 COMMUNITY INVOLVEMENT IN WASTE MANAGEMENT

Under the Municipal Act (Yukon), municipalities are able to operate solid waste disposal facilities for their residents. Outside of incorporated municipalities, however, the YG is responsible for managing all waste facilities. Unfortunately, the allotted budget for facility operation and maintenance is not ideal and in many cases volunteers have stepped forward to help improve these facilities. This volunteerism is to be commended, but cannot be relied upon as a long term solution to budget shortcomings.

Not surprisingly, larger communities in the Yukon have a larger volunteer base to draw support from, and many communities have committees that lead waste initiatives and planning.

Marsh Lake and Mt. Lorne, not coincidentally the only staffed (unincorporated) transfer stations in the Yukon, have the highest community participation.

The Marsh Lake site was converted into a transfer station by the community in order to eliminate the burning of waste there. The community was involved in the design of the new system through the use of community surveys, and community members participated in the construction of the new facility. Similar participation is drawn in Mt. Lorne, where the Mt. Lorne transfer station is run by the Lorne Mountain Community Association.

Looking at incorporated communities, where populations and potential volunteer resources are greater, there is also varied participation in waste management. Below is a list of some examples of waste related community associations in place in Yukon municipalities presently. Additional information on incorporated communities can be found in Section 10.0.

The Haines Junction Recycling Group (Haines Junction) – leads initiatives for increased waste diversion, including operation of the recycling depot located at the waste facility in Haines Junction, as well as a transfer station located at the entrance of the facility which that aims to educate waste facility users by sorting wastes on their behalf.

Conservation Klondike Society (Dawson) – CKS runs the recycling depot at the Dawson landfill (Quigley Solid Waste Facility), in addition to a separate facility downtown. The society is also responsible for a number of waste diversion initiatives in place throughout the community including a sustainable landfill project, reusable bag campaigns, reusable plates, and more.

Tantalus Recycling Society (Carmacks) – The Tantalus Recycling Society operates a recycling depot in the village, which currently operates at capacity. The facility collects beverage containers, paper, cardboard, tin cans, glass bottles, plastic, and vehicle batteries.

Raven Recycling (Whitehorse) – The Raven Recycling Society runs a recycling center that accepts and processes over 30 different recyclables. Raven also functions as a community service focused on public education programs for better waste management practices, and offers collection services for paper, cardboard and beverage containers from local businesses.

8.1.1 Future Community Involvement

Based on the participation garnered by the public meetings, though higher in some communities than others, there is seemingly a strong culture that has developed (and is developing) in support of better waste management practices in the Yukon. This interest and enthusiasm in waste management provides an opportunity to harness community support and resources to collectively improve these practices.

As there are already established community associations located throughout the Yukon, there is the potential to expand these groups and establish new groups in other, “less advanced” communities. Here, existing groups can help establish and foster new groups in smaller communities, or these smaller communities can cooperate to form their own regional waste groups to better manage the waste generated in their geographic area. Ideally, all waste groups in the Yukon would be able to work cooperatively to share ideas and programs that are found to be effective. Such cooperation could be facilitated in the future with the establishment of a Yukon waste group, as discussed later in Section 11.4.

8.2 AVAILABLE FUNDING

Each facility outside of an incorporated community is funded by YG. The majority of this funding goes towards maintenance contracts with various contractors throughout the Yukon to upkeep the respective facilities and remove the bulk wastes to areas better suited to accepting them.

There are a number of funding resources available in the Yukon that can help to offset government expenses. These funding alternatives include:

- Gas Tax Fund (GTF);
- The Green Municipal Fund;
- Infrastructure Canada Program; and,
- First Nation Infrastructure Fund (FNIF).

Please refer to Appendix B for additional information on these programs.

Additional government funding sources that have recently become available include Building Canada and Green Infrastructure Planning. Each of these funding resources are

related to the economic stimulus package the Federal Government has put into place to combat the economic recession currently facing Canada and the globe at large. Information on Building Canada was fortuitously provided as part of the public meeting process for this project as discussed in Section 7.0. Additional information on these programs has been added to Appendix B.

In southern Canada, waste management facilities are in large part funded by tipping fees. These fees are controlled by public, private, or cooperative regimes, and are effective in ensuring that operations and maintenance remain economically feasible. At times, tipping fees are also raised to better control and encourage waste diversion.

Currently, only the City of Whitehorse charges a tipping fee to facility users. As has been discussed earlier, this disparity is problematic at times in that facility users sometimes bypass the Whitehorse landfill in favour of a free deposit at less advanced facilities. There is also some concern that tipping fees might result in an increase in illegal dumping. However, in the future, when waste facilities are better equipped to offer higher levels of service, tipping fees might be a funding source worth considering. Such a proposal would require site supervision in order to be effective.

8.3 FUNDING TRIGGERS

Whenever the need for an operational change is identified at a waste facility, so too is the need for a change in funding. This study, for example, the public outcry against the burning of wastes, and the recent permits issued with the new facility requirements all relate to a required change in funding. In most cases, this translates to a need for increased funding.

Some of the funding sources available for waste management are identified in the section above. In addition to these sources, Community Services also maintains an operations and maintenance budget, which is applied for annually and is under constant pressure to be reduced.

Community Services may want to investigate ways of better facilitating community access to funding in the future to ease some of the pressure on Community Services budgets and help increase public responsibility for the facilities utilized. Such facilitation may tie into the collaboration of waste societies discussed in the sections above. In the meantime, the recommendations provided later in this study are aimed to provide a number of alternatives for operational changes, each of which will require funding considerations.

8.4 BEST COMMUNITY PRACTICES

The practices employed at each waste facility are largely dependant on the quality of work of the contractor that maintains the facilities, as well as the care demonstrated by the contributing public. The majority of burning vessel based facilities rely almost entirely on the contractor alone, so it is difficult to establish best practices outside of ensuring appropriate waste segregation is facilitated through space and signage, and that the burning vessel doors are closed between waste deposits.

Moving forward, waste diversion will become a more prominent practice within both unincorporated and incorporated communities. In addition, a number of recommendations that come out of this study will be implemented at these facilities that are considered best practices. Section 11.0 outlines a number of these recommendations for consideration.

9.0 TASK 6 – SUSTAINABILITY MODEL FOR VARIOUS WASTE MANAGEMENT PRACTICES

9.1 MODEL DEVELOPMENT

The waste model that has been developed for the Yukon's unincorporated waste sites is based upon readily available information and the aim to provide a medium where waste alternatives can be compared against one another on a site by site basis.

Adding to the model premise is the idea that a decision should be guided by the information presented, and as such, the model has been built to feed into a Kepner-Tregoe decision matrix. A Kepner-Tregoe decision matrix is a decision making tool that is based around a user defined scoring system that compares how well the available alternatives meet the desired goals, as well as any limitations that may arise. Here, the YG is able to assign relative weighting factors (see Section 4) to the parameters in the model and the results can be used to make a decision as to whether or not a change is necessary at a waste facility (e.g. economics, carbon footprint, environmental health and safety).

The waste alternatives explored within the model include:

- open burn and bury in trench;
- burning vessel and burial of ash in trench;
- regional landfill operations;
- transfer station and regional landfill operations; and,
- incineration.

Also to be considered as an option, though not quantified in the model, is site closure. This option is highlighted through two main points of information: distance to other waste facility, and average cost per user. Further discussion related to site closure is discussed in Section 11.6.4.

9.2 MODEL USE AND IMPLEMENTATION

The instructions for the model's use are included within the model itself (Appendix C, on compact disc). It is recommended that the model be used only by YG staff within the Department of Community Services when there is the possibility of a change in regulations, when funding considerations are altered, or when public pressures indicate the desire for change. It is intended that the model be used as a screening tool to be accompanied by a more comprehensive review of the highly ranked alternatives (particularly those that rank closely).

The site summary information tab within the model should be kept up to date at all times. The spreadsheet is based upon an existing summary that YG keeps up to date. This information is the basis of all the model's calculations, so accurate information is of critical importance.

Also, it is important to understand that the model merely provides a relative ranking of the waste management alternatives available, and that this ranking does not mean a change is necessary. The results of the model are to be used with judgement when evaluating the potential for change.

The green shaded cells within the Excel spreadsheet represent the model's inputs. Of particular importance are the weighting factors applied to the parameters and the waste composition estimates used to calculate a site's carbon footprint. These inputs are discussed in greater detail in the following sections. Table 12 presents for a typical user input summary.

9.3 FACILITY IMPERATIVES

Within the model, there are three categories of evaluation that must be met by the facility being evaluated in order for different waste alternatives to be considered. These categories include:

- Facility must be able to accommodate expected waste volumes – if a waste alternative for a particular facility cannot meet the expected waste volumes for the surrounding community, then this alternative is not ranked as an available option. An example would be for an incinerator or burning vessel that is no longer large enough to support the contributing community. Another example would be if there was no longer room available at a site for the burial of ash.
- Facility must be capable of implementing change – if a particular facility is incapable of implementing a change to a specific waste alternative, then that alternative cannot be considered. An example would be if an existing facility is too small to convert to transfer station.
- Facility must meet regulatory standards in the Yukon – the particular facility must meet the Yukon's regulations to be established in the Territory. For example, when the ban on burning is implemented on January 1, 2012, the model allows the option to remove burn based alternatives from consideration.

Within the model, the user must answer “yes” or “no” to the above facility imperatives in order to remove all “no” answers from consideration.

9.4 WEIGHTING FACTORS

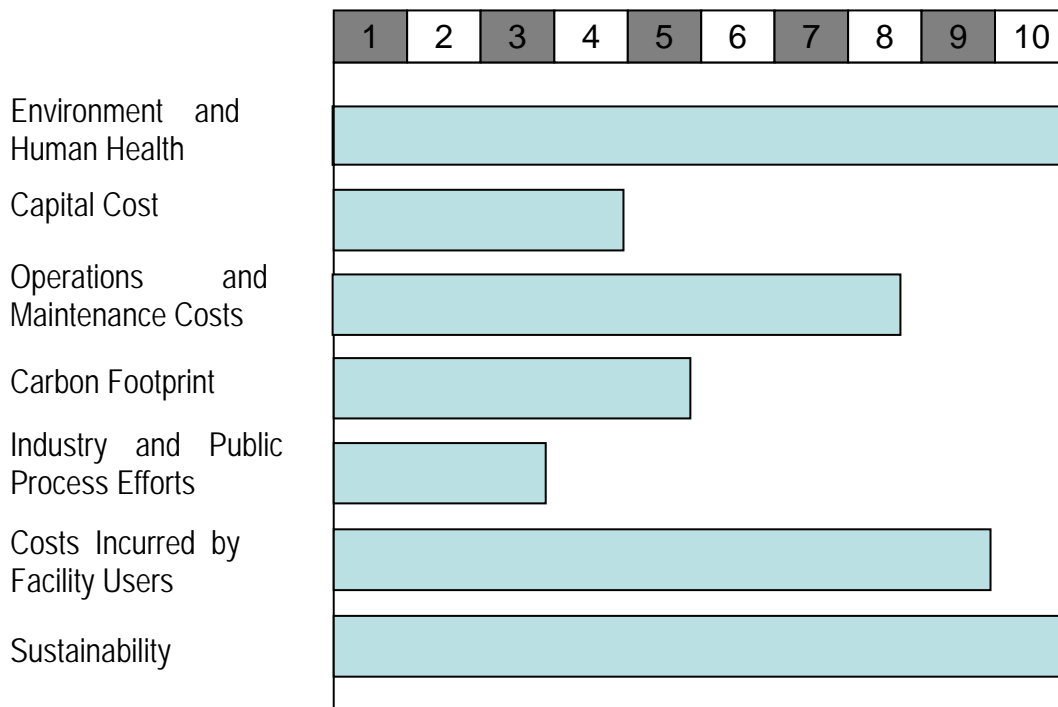
The weighting factors used within the model are to be applied to the following decision making categories according to the level of importance the user places on the considerations, respectively:

- the facility’s effect on environmental health and human safety should be deemed acceptable;
- the facility should be economically viable (considering capital and operational costs, respectively);
- the facility’s carbon footprint should be limited;
- industry and public process efforts (i.e. public consultation, regulatory applications, engineering) required on the government’s behalf for the facility’s use or establishment should be reasonable;
- user costs should be taken into consideration; and,
- the facility should represent a sustainable alternative to waste management practices.

It is important to note that there will always be a degree of subjectivity in weighting the above factors and that these factors can be changed at any time to represent a shift in values, should one occur. Current model weightings have been determined based on public and stakeholder input, direction from Community Services, and EBA recommendations based on professional opinion.

9.4.1 Finalized Weighting Factors

The figure below depicts the model weighting used in this study, followed by the thought process behind these decisions.



Environmental Health and Human Safety (Score of 10)

Throughout the public meetings, the questions, comments, and suggestions that came forth were recorded at every community visited. This information was reviewed and grouped into a number of different themes. Through this review, EBA attempted to establish a sense for what was most important to Yukoners when it comes to waste management. As a result of this process, it was inferred that the environment and human health and safety was the most important decision making factor in the eyes of the public. As such, its importance has been reflected in the model.

Capital Costs (Score of 4)

Costs, while not as important as environment and human safety, were also recognized by the public as being a factor in the decision making process, but the general consensus was that the government is responsible for ensuring appropriate and responsible services regardless of the cost. Recognizing that the costs associated with waste management are indirectly paid by Yukoners through taxes, however, this importance must not be ignored.

Capital costs have been weighted moderately in the model as these funds must be available in order to implement a change.

Operation and Maintenance (Score of 8)

Funding for operation and maintenance costs, like capital costs, must be available in order to keep the waste facilities operating effectively. This funding is set annually, however, and is under constant pressure to be reduced. As such, it is a more important consideration than capital costs, and this advantage has been reflected in the model accordingly.

Carbon Footprint (Score of 5)

Carbon footprint was a recurring concern in the public meeting process, but this was in part due to a lack of clarity with the information presented. Overall, the inference made regarding the importance of carbon footprints is that while it is a concern, the sustainability of the waste management alternatives was far more influential, as was environmental protection and human health concerns.

Industry/Public Process Effort Required (Score of 3)

(This category subtracts from a facility's total score)

This category refers to the amount of effort required on Community Services' behalf to gain public and industry support for the alternative selected. These efforts include additional public consultation, assessment and regulatory applications, and engineering consultation. In general, the public is less concerned with these efforts and more concerned with results. Community Services recognizes the responsibility for providing these services and is comfortable with the weighting assigned.

User Cost (Score of 9)

(This category subtracts from a facility's total score)

User costs, that is, direct additional costs incurred by the user to travel to or utilize their closest waste facility, were not discussed in great detail at the public meetings, though it is understood that such costs would be strongly opposed.

Sustainability (Score of 10)

Again, as has been identified through the public and stakeholder meetings, the sustainability of waste management alternatives is to play a significant role in the decision making process.

Sustainability was a concept that was a recurring theme at the public meetings. So much, that it was decided that some measure of sustainability should be incorporated into the model. Heeding this preference, sustainability has been incorporated into the model and has been weighted to reflect its relative importance. Refer to Section 9.4.2 for the methods used to establish the criteria for sustainability in the model.

9.4.2 Sustainability Considerations

In examining the relative sustainability of one waste management alternative versus another, a number of categories were considered to contribute to the overall evaluation. These considerations included:

- Financial Sustainability – including the present and future costs associated with staffing, operation and maintenance, closure and reclamation.
- Environmental Sustainability – including the present and future impact on users and the surrounding environment, as well as alignment with present and future political intent and regulations.
- User Viability – including current and future levels of user acceptance, consideration of current and future populations to use and support facility.
- Flexibility – including the ability of the site to adapt to future waste initiatives, and the ability of the site to handle current and future waste volumes.

For each category, a relative evaluation was performed as to whether the waste management alternative achieved a high, medium, or low degree of sustainability. These ratings were assessed a score of 10, 5, and 1, respectively, with the total score indicating the “most sustainable” alternative under consideration. The results of this evaluation are presented in Table 13.

9.4.3 Additional Model Scoring

In addition to the weighting system discussed in the section above, the industry and public efforts must be further evaluated in the model to depict the relative difficulty of making a decision for the different waste management alternatives.

EBA has ranked the following alternatives as such:

- Open Burn and Bury in Trench (Score of 10) – The burning of wastes is largely opposed in the Yukon, and this alternative has been scored heavily to reflect this disadvantage as a result.
- Burning Vessel and Ash Burial in Trench (Score of 10) – See above.
- Sanitary Landfill Operations (Score of 5) – While a landfill may receive more public support than burning operations, there is a lot of regulatory framework that must be followed to establish a facility, and facility siting can at times present additional challenges with geology concerns and public consultations.
- Transfer Station and Regional Solid Waste Disposal Site (Score of 2) – transfer stations appear to be the most well-supported alternative available, and the regulatory framework in the Yukon for such a facility is less stringent than for a landfill.
- Incineration (Score of 6) – Though more efficient and environmentally friendly than a burning vessel or open burning, an incinerator is still essentially burning waste that could otherwise be diverted. EBA is of the opinion that a score of 6 is justified in comparison to the others scores assessed.

9.5 WASTE COMPOSITION

The waste compositions currently in place for the model are either sourced from a 1994 City of Whitehorse SWAP report, or estimated based on industry information where specific published information is lacking. EBA recommends that these numbers be updated regularly through a waste audit process conducted at a representative unincorporated facility to make the information more reflective of actual wastes deposited.

9.6 MODEL SENSITIVITY AND ASSUMPTIONS

The waste model is a qualitative tool meant to identify the rationale and justification for making a change in solid waste management practices at a particular facility, and the assumptions, inherent bias, and decisions on weighting factors made within the model have been explained in previous sections (i.e. the methods used in calculating environmental risks, carbon footprints, and costs).

It is important to understand that the model only provides a relative ranking of the waste management alternatives available, and that this ranking does not mean a change is necessary. The results of the model are to be used with judgement and appropriate context when evaluating the potential for change.

Further, the model is sensitive to certain user inputs that significantly affect model outputs, and some of these factors are subjective considerations that may vary depending on the user. The model parameters that hold the greatest bearing on model outputs are discussed further in the following sections.

9.7 MODEL LIMITATIONS

The model is limited by a number of factors, the most important of which is that the output is based solely on the accuracy of information provided and the weightings assigned by the user. Additional limitations include:

- While the weighting factors give a numerical indication of which decisions may work best for a waste facility, it must be understood that barriers may still exist. For example, “Sustainability” and “Environmental Protection and Human Health and Safety” may be weighted heavily during the model’s run, and a particular option may be indicated as being most reasonable based on this priority, but the cost of the resultant waste management option may still be prohibitive.
- The model ranking system contains some inherent bias in that close evaluations are differentiated with more significance in the scoring system. As an example, if a capital cost of \$1,000 is compared to \$100, the score differential may be 10 to 7.5. Similarly, if \$1,000 is compared to \$999, the score differential is also 10 to 7.5. Overall, this effect is not drastic, but can make similar evaluations appear more drastic.
- If ranking scores are within 10 points of one another, it should be assumed that the alternatives are essentially equal, and that further investigation may be required to make a decision.

It should be noted that the model may require reassessment after a number of years of use, as changes in operations at the waste sites themselves may not necessarily be reflected by the model as desired. The costs included in the model will also have to be updated regularly.

9.8 MODEL RESULTS

The model results presented in this study are based on the assumptions, inputs, and weightings discussed in the sections above. Table 14 presents a typical output summary that the waste model produces. Table 15 provides a summary of the model results for all unincorporated waste facilities analyzed, complete with a brief analysis of each facility’s results, respectively.

In general, the model results show that most sites favour a transfer station facility in conjunction with a regional landfill. This is understandable given the significance placed on environmental impact concerns and sustainability, which transfer stations score well under. As the majority of sites do indicate a preference towards transfer stations, it is important to recognize how well the current practices score in comparison to the preferred alternative in order to develop a sense of priority for phasing out such burn-based operations. This

prioritization plan is required as a result of the latest facility permits that aim to cease open burning practices by January 1, 2012.

Only in Old Crow was an incinerator indicated as the preferred alternative. In Old Crow's case, of course, a transfer station is not possible, and a landfill is cost prohibitive in comparison to an incinerator.

10.0 REVIEW OF WASTE MANAGEMENT PRACTICES IN INCORPORATED COMMUNITIES

The following sections provide a summary of each incorporated community in the Yukon and the waste management infrastructure in place presently. Additionally, the unincorporated communities in the respective geographic areas have been summarized to provide an indication of the potential waste volumes that could be expected in a regionalized solid waste management plan. Observations made during the incorporated waste facility site visits have also been included in the respective sections below.

For each incorporated community, a summary table is provided identifying the contributing population and predicted solid waste acceptance at these waste facilities. There are numerous sources that EBA has used to compile this data, and in some cases this information has conflicted. As such, the highest numbers encountered have been utilized for the purposes of this document.

10.1 CARMACKS

CARMACKS	Population: 472
Areas Serviced:	Carmacks
Number of regular users:	490
Solid Waste (tonnes/yr):	343
Remaining Lifespan (years):	+18
Items Accepted:	Domestic refuse, metal, tire, batteries, recyclables, brush and construction materials
Recyclables:	Separate recycling centre located in the village

Potential Unincorporated Waste Acceptance:

Pelly Crossing 260 tonnes/yr.

Braeburn 13 tonnes/yr.

TOTAL 273 tonnes/yr.

Waste Management Summary

The Carmacks waste facility has been a no-burn facility since 2000, though on occasion there is sufficient brush collected and burned by maintenance staff. The landfill site operates as an uncontrolled facility with an electric fence and domestic waste trench landfill area. Segregated areas at the landfill include C&D, grubbing, auto hulks, scrap metals, and white goods.

The landfill is located in a large topographic kettle, approximately 500 m east of the Nordenskiöld River. The subgrade consists of sand and gravel soils with some cobble.

Groundwater in the site area heads in northeast direction, the receptors of which are the Village of Carmacks and the Yukon River to the northeast.

The Village of Carmacks has expressed concerns regarding the cost of operating its landfill facility, as well as the challenges that arise as a result of its unsupervised nature. The site previously had uncontrolled 24 hour access, with routine inspection by community staff. As a result of the Carmacks solid waste management plan (2003), access hours were established to prevent site misuse, though the site remains unsupervised during these hours.

The Village of Carmacks holds a special waste permit for the collection of waste oil, waste batteries, and household hazardous waste. However, due to the unsupervised nature of the site, it was noted that waste oil and household hazardous waste may still find its way into the landfill. It is also noted that some local garages accept waste oil and ship to Whitehorse as needed.

It is estimated that the Carmacks facility receives 343 tonnes per year of waste including commercial and C&D waste streams. Based on this estimate, there is approximately 25 to 40 years remaining landfill capacity. Approximately 30% of the solid waste in Carmacks is collected (hauled). There is no compost program in place presently.

The Tantalus Recycling Society operates a recycling depot in the village, which currently operates at capacity. The facility collects beverage containers, paper, cardboard, tin cans, glass bottles, plastic, and vehicle batteries. These materials are shipped to Raven Recycling in Whitehorse as necessary.

As an additional waste management initiative, Carmacks currently appeals to tourist companies to encourage better waste practices, as tourist waste has a relatively significant impact at the landfill facility.

Observations and Comments

The most striking observation made during EBA's site visit to Carmacks was the quality and clarity of the signage in place at the facility. These signs have both depictions and descriptions of the waste accepted in the respective areas, as well as a number of warning signs in place for electric fencing and wildlife.

As noted in the discussion above, there is no staff at the Carmacks facility, which makes it difficult to control stray litter and irresponsible waste deposits (i.e. household hazardous waste (HHW) making its way into the landfill area). Overall, the bulk wastes are well segregated and kept tidy, which, again, is a credit to the signage in place. The domestic waste area, however, is subject to the wind, and it appears that the landfill area may be too large to cover regularly, which compounds this challenge and makes for an untidy operating area.

Since the implementation of the Solid Waste Management Plan completed in 2003, there has not been a significant change in the average amount of normal waste deposited at the

landfill. The Village of Carmacks currently does not accept waste from outside the community.

The Village of Carmacks is currently building a new recycling building at the landfill site which will continue to be operated by a community recycling society. Although this will improve the facilities, and hopefully increase usage, there will still be limitations on recycling. The new recycling centre will also still lack the ability to handle hazardous waste.

Source: Village of Carmacks, Integrated Community Sustainability Plan, 2006, Village of Carmacks Solid Waste Management Plan, 2003

10.2 DAWSON CITY

DAWSON CITY	Population: 1,923
Areas Served:	Dawson, Klondike Valley, surrounding area
Number of regular users:	3000
Solid Waste (tonnes/yr):	2550
Remaining Lifespan (years):	13
Items Accepted:	Domestic refuse, metal, tires, batteries, recyclables, brush and construction materials
Recyclables:	In centre of town, or directly at landfill

Potential Unincorporated Waste Acceptance:

No additional waste anticipated

Waste Management Summary

Located just south of Dawson, the Quigley Solid Waste Disposal Facility accepts the waste of the community, and is operated by the Conservation Klondike Society (CKS). The facility has a full time attendant in place and also accepts recycling at the landfill itself.

Dawson has a permanent population of 1900, but during the summer months, the waste generating population spikes due to an influx of visitors and seasonal workers (up to 4000).

The disposal site is located 1.6 km from the Klondike River and 1.3 km from the nearest dwelling. Groundwater monitoring wells are in place at the facility and results indicate that the direction of the groundwater is north towards the Klondike River. The subgrade generally consists of silty, sand gravel with some silts and sands.

Major capital improvements that have been undertaken from 1997 to 2008 include:

- Construction of a burn pit for brush, cardboard, and non-treated wood;
- Installation of a burning vessel in 2007 for clean wood, paper, and cardboard (brush is still burned in open pit);

- Segregation areas expanded to include metals, white goods, tires, batteries, waste oil, household hazardous waste, e-waste, gas cylinders, and C&D debris;
- Construction of an oil heated attendant shelter with small electric generator;
- Availability of incinerator for personal papers;
- Initiation of a composting program in 2008, where compost is collected from commercial establishments; and,
- Installation of an oil separator and lined basin for storage of waste oil. Waste oil is stored in drums in a fenced area with a 30 mil arctic liner.

There is a burning vessel in place at the facility presently, though only cardboard, brush and non-toxic construction materials are burnt. According to the Quigley Solid Waste Disposal Facility Operation Plan (2008), it is estimated that there is a 50 year lifespan of the facility remaining.

Dawson City has helped to fund and support CKS over the years, and the entities have formed a strong partnership. CKS runs the recycling depot at the landfill, in addition to a separate facility downtown. At these recycling depots, the society purchase beverage containers and ship to Raven Recycling in Whitehorse. In addition to recycling, there is also a re-use building on site that is utilized heavily by the community with items such as clothes, electronics, toys, tools, etc.

The management of the Quigley Solid Waste Disposal Facility includes regular cover material and compaction. There are established access hours at the facility, and closure and post closure plans are in place. Unique to the Quigley facility in comparison to other landfill facilities in the Yukon is a sewage screening area for the Dawson Sewage Screening Plant.

Within Dawson and the CKS, there is a strong volunteer commitment to solid waste management and the improved operation of their facilities. Dawson has recently made use of Environment Canada funding for multiple waste initiatives, including the development of a sustainable landfill. School programs are in place currently to educate children on waste management. Fact sheets, newsletters, and brochures are produced regularly.

Observations and Comments

The Quigley Solid Waste Disposal Facility is very well maintained and has benefited from the work of the CKS. The funding received from Environment Canada for the sustainable landfill project has also been advantageous to operations.

As has been noted at many facilities, there are significant quantities of bulk wastes stockpiled at the Quigley Solid Waste Disposal Facility, emphasizing the challenge of transporting these wastes to Whitehorse.

The Quigley Solid Waste Disposal Facility is a joint operation between YG and Dawson City. An agreement was signed that stated YG would provide the capital and Dawson City

would assume the operation and maintenance responsibilities. Dawson City passed a bylaw in 1998 that allows the town to levy a fee on all properties in the community to offset the cost of operations at the landfill.

Source: *The City of Dawson and the Tr'ondek Hwech'in First Nation, Integrated Community Sustainability Plan, 2008, Department of Community Services, Infrastructure Status Report, 2002*

10.3 FARO

FARO	Population: 395
Areas Served:	Faro and surrounding area
Number of regular users:	400
Solid Waste (tonnes/yr):	350
Remaining Lifespan (years):	+13
Items Accepted:	Domestic refuse, metal, tires, batteries, brush and construction materials
Recyclables:	Downtown

Potential Unincorporated Waste Acceptance:

Ross River 320 tonnes/yr.

Waste Management Summary

There are a number of waste management facilities located in Faro:

- Landfill
- Materials Collection Site
- Auto Salvage Yard
- Recycling Facility

The landfill itself is located in a kettle depression and operates as a no-burn facility. The landfill is approximately 1.5 km from Pelly River, and the groundwater in the area flows this direction. The site takes advantage of natural topography and has ample capacity for many years even at the most conservative of estimates. The subsurface stratigraphy consists of variable thicknesses of sand, gravel and dense clayey silt. The facility utilizes the trench method of landfilling, and native cover soil is applied and compacted once per week. Volunteers collect litter around the landfill annually.

The materials collection site accepts scrap metal, vehicles, appliances, waste oil, tires, construction materials, and lumber. There is also a waste oil and recovery tank at the site, as well as a sheltered battery area. Commercial users are to report intended use prior to depositing material. All facilities are open 24 hours a day, 7 days a week.

The Town of Faro maintains and operates garbage collection services and provide “Haul All” bear proof containers for user drop off that are located throughout town.

The town has a clear focus on waste diversion. The recycling facility located in downtown Faro accepts beverage containers, paper, cardboard, and plastics. Household composting is practiced in the community but is not actively collected.

The recycling depot owners practice scavenging on garbage haul days, and the materials collection site and vehicle salvage yard are strategically located near the landfill to keep waste out of the pit. This is organized to maximize diversion and recycling.

In 2002, Faro conducted a survey for recycling. The Faro Recycling Depot estimates that users drop 1.5 tonnes of bulk waste at the material collection site annually. It is estimated that approximately 50% of waste is diverted from the disposal pit.

The population and waste generation in Faro is based on having a fully operating mine nearby, which is not the case presently. Residential and commercial waste accepted at the landfill is estimated to be 152 tonnes/yr and 31 tonnes/yr, respectively. It is estimated that 60 tonnes of waste is diverted annually.

Observations and Comments

The condition of the solid waste facility is listed as “poor” in the Town of Faro, Integrated Community Sustainability Plan.

The Integrated Community Sustainability Plan indicated that residents, visitors and industrial users sometimes inappropriately use the landfill for disposal of hazardous wastes, oil, batteries and other items. Compost, plastics and other materials that could otherwise be recycled often end up in the landfill as well. Additionally, as a long-term negative impact, there is potential for ground water and soil contamination through leaching of waste and surface water runoff.

Source: *Town of Faro, Integrated Community Sustainability Plan, 2007, Town of Faro Solid Waste Management Plan, 2003*

10.4 HAINES JUNCTION

HAINES JUNCTION	Population: 848
Areas Serviced:	Haines Junction and Surrounding Area
Number of regular users:	1000
Solid Waste (tonnes/yr):	850
Remaining Lifespan (years):	10 years
Items Accepted:	Domestic refuse, metal, tires, batteries, recyclables, brush and construction materials
Recyclables:	Yes

Potential Unincorporated Waste Acceptance

Beaver Creek	110 tonnes/yr.
Burwash Landing	110 tonnes/yr.
Destruction Bay	254 tonnes/yr.
Silver City	20 tonnes/yr.
Canyon Creek	25 tonnes/yr.
<u>Champagne</u>	<u>45 tonnes/yr.</u>
TOTAL	564 tonnes/yr.

Waste Management Summary

At the Haines Junction waste facility, burning has been restricted since 1996 (with the exception of brush). Outside of the facility, burning within municipal limits was prohibited in 2001, which has resulted in more waste coming to the landfill.

A Haines Junction Recycling Group is present in the community, and leads initiatives for increased diversion. The recycling depot in place at the Haines Junction landfill was upgraded in 2001.

Haines Junction is attempting to maximize the available space at the landfill due to expansion concerns (i.e. cost and process). Based on 2007 estimates, there is approximately 10 years capacity remaining at the facility. Native material in the area consists of clayey silt and fine sandy silt, and the trench method of landfilling is currently utilized.

A “transfer station” located at the entrance of the landfill facility accepts wastes from users and, with their permission, workers sort through the waste separating out the recyclables. Once a week the waste is transferred to the landfill cells where it is compacted and covered. The intent of the facility is that staff can educate users on better waste practices, and helps to take advantage of salvaging. The facility is fenced and gated with controlled access hours. The landfill face itself is not accessible to the public.

Bulk goods and household hazardous wastes are stored separately at the landfill. There are also segregated areas for asbestos, scrap metal, white goods, auto hulks, clean wood, tires, grubbing and stripping materials, and clean dirt. The landfill is separated into three distinct areas: household waste and construction debris, white goods and bulk materials, dirty wood wastes.

Observations and Comments

The landfill site is on the south end of the Village of Haines Junction and consists of a series of pits within a fenced area. Separate pits exist for domestic waste, compost, metal, brush, and tire waste. Domestic waste is collected at a transfer station outside the landfill

and the domestic pit is closed to the public. There is no burning at the site outside of special approval brush burning.

Next to the transfer station is a compost area and a recycling depot privately run by the Haines Junction Recycling Group. The group offers in-town recycling collection at no charge to residents and goods are shipped to Whitehorse for processing with backhauls offered by various trucking companies in the Territory. The Village of Haines Junction built the recycling centre with funds from the Yukon Canada Infrastructure Program.

According to the Village of Haines Junction Integrated Community Sustainability Plan, the lifespan of the landfill site, which was previously estimated at twenty years, now only has 10 years left. This is partly a result of compacted waste, which is not bound, expanding over time. The landfill currently employs a compactor at the landfill to reduce the volume of waste entering the pits. But there is nothing in place to bind the compacted waste resulting in severely decreased effectiveness of the system. In conjunction with increased waste diversion efforts, the capacity to bail the compacted waste would increase the limited lifespan of the facility. It was recommended in the Integrated Community Sustainability Plan that bailer/compacting system be established at the landfill to address this issue.

Source: *Village of Haines Junction, Integrated Community Sustainability Plan, 2007*

Solid Waste Management Plan, Village of Haines Junction, 2001

10.5 MAYO

MAYO	Population: 466
Areas Served:	Mayo and surrounding area
Number of regular users:	600
Solid Waste (tonnes/yr):	365
Remaining Lifespan (years):	15 years
Items Accepted:	Domestic refuse, metal, tires, batteries, recyclables, brush and construction materials
Recyclables:	In town

Potential Unincorporated Waste Acceptance

Stewart Crossing 25 tonnes/yr.

Keno City 17 tonnes/yr.

TOTAL 42 tonnes/yr.

Waste Management Summary

The Mayo waste facility is located 4.2 km northwest of Mayo. The nearest resident is approximately 3 km to the southeast, and the closest water bodies include the Mayo River

(1 km east) and Stewart River (2 km to the south). Mayo operates a Recycling Centre 3.5 km southeast of the dump.

Presently, municipal solid waste, construction and demolition (C&D) debris, and grubbing wastes are burned at the facility, two to four times a month as required. During a burn, smoke is visible to the community, but little or no opposition to the practice has been recorded to date.

Soil in the area consists of gravel and sand. At present time, no information is available for groundwater, though the installation of monitoring wells was being investigated at time of solid waste plan (2003). There is an electric fence in place at the site, but scavenger birds are occasionally an issue.

The waste facility is located in a natural depression. It has been noted as being difficult to compact the waste due to the vertical working face, and similar challenges are faced with cover material.

Segregated areas on site include domestic waste, white goods, tires, scrap metal, and wood. Salvaging of materials within the facility is encouraged prior to burn. HHW sometimes ends up in trench and is burned, while C&D waste is reused as possible but also burned on occasion. At current waste acceptance rates, there is 15 to 20 years capacity remaining at the facility, assuming that burning practices continue, though there is adequate land west, north, and east to accommodate expansion if required.

No waste collection services are provided in Mayo, though private contractors do collect some commercial and institutional waste. There are no weigh stations or staff in place to estimate waste quantities. Village of Mayo Public Works staff maintains the facility using a small backhoe, grader, and loader as necessary. The facility is checked on a weekly basis.

Current concerns for the site include unmonitored access, site remoteness, and the low priority from Public Works staff to maintain the facility.

Reusable bags are encouraged at local shops, and the Mayo recycling center accepts beverage containers, paper, cardboard, glass, plastics, tin, and batteries, which are collected and shipped to Raven Recycling with backhaul once per month. There is mixed recycling participation in the community and no compost programs in place currently. A free store is also in place and is used regularly.

Observations and Comments

The Mayo facility appears to have a lot of space available for the segregation of select waste types. These areas are kept relatively tidy, though at the time of the site visit, there appeared to be a large stockpile of most bulk wastes, particularly miscellaneous oil barrels, which are not appropriate for this facility.

The actual landfill portion of the site, however, is not ideal. During EBA's site visit, evidence of windblown litter was frequent. Additionally, the working face of the landfill is too steep to operate effectively, and could benefit from significant re-grading. Alternatively,

the landfilling practice could be altered to the area method, where the steep face could be used as a backstop for lifts of waste. Such suggestions would require an engineering and regulatory assessment to ensure its suitability.

The current landfill has approximately 15 years left on its lifespan and a future landfill site has been identified and is being set aside as a reserve.

According to the Village of Mayo Integrated Community Sustainability Plan, the community would like to completely eliminate the burning of solid waste at the landfill. Without burning or diverting waste from the dump, the lifespan of the landfill could be less than the projected 15 years.

Mayo does have a recycling facility but it is limited in the types of materials that can be accepted (i.e. primarily beverage containers). It is suggested in the Village of Mayo Integrated Community Sustainability Plan that a new recycling centre with the capability to handle hazardous wastes would extend the life of the existing landfill as well as divert these products from the landfill.

Source: *Na-Cho Nyak Dun, Integrated Community Sustainability Plan, 2008, Village of Mayo, Integrated Community Sustainability Plan, 2006*

10.6 TESLIN

TESLIN	Population: 458
Areas Serviced:	Teslin and surrounding areas
Number of regular users:	600
Solid Waste (tonnes/yr):	510
Remaining Lifespan (years):	N/A
Items Accepted:	Domestic, refuse, metal, tires, batteries, brush and construction materials
Recyclables:	Yes

Potential Unincorporated Waste Acceptance:

No additional waste anticipated

Waste Management Summary

In 2008, the Village of Teslin received funding under the Gas Tax program to develop a transfer station to replace the existing waste facility (previously a burn-based operation). All solid waste and recyclables are now transported to the City of Whitehorse for processing. Waste oil is also stored on site and transferred to appropriate facilities outside of the community as needed.

The Village of Teslin is interested setting up a compost program and would also like to acquire a waste oil burner. A waste oil burner would replace some existing fossil fuel use

and reduce the costs of shipping it outside the community. It may also help to eliminate some of the illegal disposal of waste oil that is occurring.

Due to the recent upgrade of the facility, there is no updated Solid Waste Management Plan in place for the community.

Observations and Comments

Teslin represents the only municipal transfer station in the Yukon. The site's operating hours see it closed on Monday and Tuesday during the week, and the remainder of days it is open from noon to 7:30PM. While a common stream of thought brought out in the research to date suggested that such hours might result in an increase in illegal dumping, this has not been the case in Teslin. Teslin is also one of few facilities to shelter its hazardous or special wastes, providing shacks for batteries and waste oil. A recycling facility is also located on site. Again there are significant stockpiles of bulk wastes built up in Teslin, suggesting irregular collection due to high costs.

Source: *Teslin Tlingit Council & Village of Teslin, Integrated Community Sustainability Plan*

10.7 WATSON LAKE

WATSON LAKE	Population: 1594
AREAS SERVICED:	Watson Lake and surrounding areas
NUMBER OF REGULAR USERS:	1800
SOLID WASTE (TONNES/YR):	1600
REMAINING LIFESPAN (YEARS):	3+
ITEMS ACCEPTED:	Domestic refuse, metal, tires, batteries, brush and construction materials
RECYCLABLES:	Recycling depot is located in town and capable of handling hazardous wastes

Potential Unincorporated Waste Acceptance

Upper Liard 215 tonnes/yr.

Waste Management Summary

The Watson Lake waste facility is a burn-based operation. It is estimated that approximately 5% of all the solid waste generated in the community is recycled or reused through the local depot or territorial programs. Meanwhile, 95% of the solid waste is deposited into a trench and burned. Hazardous and special wastes are collected and transported to Whitehorse once a year.

The Integrated Community Sustainability Plan completed by the Town in 2007 indicates that it would like to move to a no-burn policy within 2 years.

The Town will soon be in the process of decommissioning its landfill site located on the east end of town and would like to establish a new facility on the west side of town where it is believed that prevailing winds may better direct emissions away from residential areas.

In addition to the new waste processing facility, which is to include a recycling component, the Town is also interested in the following proposed features:

ANAEROBIC DIGESTER: Compostable waste would be conveyed to an anaerobic digester where it will be broken down into material that would be sold as fertilizer. This unit would produce methane gas as a by-product which may be used to power the gasification unit (discussed below). The digester will also accept solid waste from surrounding mining sites so its capacity will need to be designed to be capable of accepting substantial volumes of solid waste.

GASSIFICATION UNIT: The gasification unit would burn non-recyclables at high temperatures and render the waste to ash. The unit would be fuelled by a combination of methane gas (from the anaerobic digester) and or propane.

TIRE SHREDDING PLANT: Tires would be accepted from all over the Yukon and northern BC at the proposed shredding plant. The shredded tires would be binned and delivered south to manufacturing plants in Alberta, BC, and in the United States.

CARDBOARD BAILER: Cardboard and other recyclables would be shredded or crushed and bailed. Bales would be kept in a dry storage area and trucked south to recycling manufacturers in Alberta.

METAL CRUSHING, SMELTING: Metal, including cars will be crushed in a special crusher designed for this purpose. Engine blocks could be cut out to facilitate more efficient crushing and all drained oil diverted to a storage facility. The crushed metal would be bailed and shipped south. Smelting the waste metal could be considered at a later date and the raw material forged into sellable slabs. Other waste products such as fridges could be processed on site to reclaim the gas and redistribute it for future use. The metal parts would be crushed, bailed and sent south for smelting.

WASTE OIL: This would be collected and shipped for processing out of province.

Observations and Comments

Watson Lake is one of few municipalities to burn all of its domestic waste. During the public meeting process, the opposition to this practice was particularly vocal, including an impromptu presentation by the Watson Lake Social Justice Club. The burning at the present site is continued, in part, due to the limited lifespan of the facility, which is presently at capacity. Watson Lake is currently exploring the establishment of a new facility, but in the meantime have to work with what is available. The management of bulk wastes appears tidy based on EBA's site visit.

Source: *Town of Watson Lake, Integrated Community Sustainability Plan, 2007, Town of Watson Lake, Rural Infrastructure Funding Proposal, September 2008*

10.8 WHITEHORSE

WHITEHORSE	Population: 25,403
Areas Served:	City of Whitehorse
Number of regular users:	23,000
Solid Waste (tonnes/yr):	22,500
Remaining Lifespan (years):	+13
Items Accepted:	Domestic refuse, metal, tires, batteries, brush and construction materials
Recyclables:	In town – Raven Recycling

Potential Unincorporated Waste Acceptance

Mount Lorne	320 tonnes/yr.
Marsh Lake	850 tonnes/yr.
Deep Creek	200 tonnes/yr.
Carcross	365 tonnes/yr.
Tagish	240 tonnes/yr.
<u>Johnson's Crossing</u>	<u>30 tonnes/yr.</u>
TOTAL	2005 tonnes/yr.

Waste Management Summary

The City of Whitehorse War Eagle Landfill operates as a regional facility. Residential waste from Mt. Lorne, Marsh Lake, Teslin, and Deep Creek are all brought to the Whitehorse landfill where it is buried or segregated as appropriate. The City and Yukon Government also have a disposal plan for tires from other communities in the Territory.

The City operates the landfill site on a no-burn basis. The Whitehorse landfill is the only managed landfill in the territory, as well as the only waste management facility to charge tipping fees. Additionally, the City of Whitehorse charges a monthly fee to residents for garbage collection, including an additional fee for residents that exceed four bags.

Presently, there may be opportunities to expand the use of the landfill as a regional landfill for other communities. The Yukon Government has suggested that a 100 mile radius could be considered, which would then include the communities of Carcross, Tagish, and Carmacks. Given the responsibilities associated with increased waste acceptance, however, the preference would be for the establishment of a new regional facility outside of the City.

Potential projects under consideration at the War Eagle landfill currently include landfill upgrades, improvements to compost facilities, and the paving of the site's access road.

Source: *City of Whitehorse, Integrated Community Sustainability Plan, 2007*

Observations and Comments

Whitehorse represents both the largest and most advanced landfill in the Yukon. The facility operates similar to southern based landfills, where waste is placed and compacted in waste “cells”, complete with a daily cover of soil. The engineering controls in place are lacking in some areas in comparison to modern landfills, however, as there is no engineered liner beneath the waste, as well as no leachate collection system to control the liquids produced by the waste.

Additional infrastructure at the landfill includes a compost pad for windrows and segregated areas for scrap metal, gas cylinders, furniture, white goods, auto hulks, tires, and construction and demolition waste. The facility is also capable of handling HHW and waste oil, which is accepted twice a year on designated collection days. A waste sorting guide is available on the City of Whitehorse website for additional information on proper waste disposal practices.

10.8.1 Central Recycling Centres

Whitehorse is home to the largest recycling facility in the Yukon, represented by Raven Recycling. In addition, Whitehorse is also home to P&M Recycling, another prominent recycler/processor in the territory.

The Raven Recycling Society has been around since 1989 when it was known as the Recycling Committee of the Yukon Conservation Society. The organization runs a recycling centre that accepts and processes over 30 different recyclables (i.e. paper, cardboard, glass, etc.).

Raven also functions as a community service focused on public education programs for better waste management practices, and offers collection services for paper, cardboard, and beverage containers from local businesses. Additionally, the Society provides recycling bins and containers for community events. Raven Recycling also functions as a private contractor that currently administers the Recycling Club program for children in the Yukon under a contract with Environment Yukon, and provide waste audit services and expertise to those that need it. The Recycling Club contract is issued by Environment Yukon to public tender every two years.

The processing of recyclables is a financial investment on behalf of Raven Recycling, the bulk of which is made up through Raven’s functionality as a refund depot for beverage containers.

The Raven Recycling Society is the largest recycler in the Yukon Territory for household and commercial waste. EBA understands there are currently 19 additional recycling depots in the Yukon (registered and supported by Environment Yukon). The majority of these recycling depots (i.e. those located in Mayo, Dawson City, Teslin, Watson Lake, Haines Junction, and Carmacks) transport their recyclables to Raven Recycling for processing.

Throughout the years, Raven has established the viability of recycling, and continues to be the groundbreaker in accepting and processing new and different recyclable items.

Currently, the Raven Recycling facility is operating at capacity due to the limitations of equipment, storage and working space, leading to the inefficient processing of materials. Also, large stockpiles of certain materials must be generated when commodity prices are low (i.e. certain materials must be stored until it is economically viable to ship them out of the territory).

To this effect, Raven Recycling currently has expansion in mind to enable them to better process all of the Yukon's recyclables. In the fall of 2008, Raven began planning for a proposed new facility, which is to include a materials recycling facility (MRF) component. At a gross floor area of 4,466 square metres, the program area for the proposed facility would be significantly larger than the existing 900 square metre facility, much of this additional area owing to the addition of the MRF, which will function as a weather-protected facility where recycling materials are sorted in a controlled environment leading to higher quality and more valuable commodities for sale to southern markets.

10.9 COSTS

The approximate operation and maintenance costs for the incorporated facilities have been highlighted in Table 6. However, given the recent permits issued to these facilities, a number of changes are required that may affect these estimates.

The regional landfill costs prepared for unincorporated communities (i.e. Table 4 and Table 5) depict the estimated cost of a fully engineered and supervised landfill.

10.10 RELATIVE IMPACT ON ENVIRONMENT AND HUMAN HEALTH

As per the methods outlined in Section 5.1, relative hazard scores were prepared for the incorporated community facilities to give a general indication of which facilities have a larger potential to impact the environment or human health and safety. The results of these estimates are highlighted in Table 16.

10.11 CARBON FOOTPRINTS

Carbon footprint estimates similar to those calculated for unincorporated communities have been performed for each of the incorporated communities as shown in Table 17. The methods and assumptions discussed in Section 5.2 regarding these calculations are unchanged.

10.12 BEST MANAGEMENT PRACTICES

Through the review of waste management practices in incorporated communities, a number of best practices have been identified. These practices should be considered at each landfill facility to reflect a standardized approach to waste management in the Yukon. Such practices include:

- The clarity of the signage at the Carmacks facility was exceptional. The graphics on the signs are particularly useful in clearly demonstrating the types of waste accepted in the respective areas. Waste category terms such as “white goods”, “household hazardous wastes”, and “auto hulks” are not necessarily common knowledge, and having a picture to represent the specific items under these categories is beneficial to all users.
- In Dawson, the partnership between Dawson City and the Conservation Klondike Society has been instrumental in the landfill’s management success. Volunteerism and community support is important for waste management practices. As such, an organization dedicated to community waste management would be ideal in every municipality, or a shared society amongst smaller communities where volunteers are lacking. There are a number of established groups in the Yukon already that could likely assist in the establishment of additional groups.
- The Whitehorse landfill practices, while supported by a larger budget than other municipalities have available, should be the objective of all regional landfills to be established in the future (if considered). While additional engineering controls would be necessary (i.e. engineered liner, leachate collection system), the basic operations of burying and compacting domestic waste, composting organics, and separating bulk recyclables is ideal at this time.
- The Haines Junction “transfer station” sorting facility is an interesting practice that could be considered elsewhere. Here, workers sift through residence’s waste (with permission) and separate out the recyclables accomplishing two goals; better waste segregation leading to increased waste diversion, and education for users in how to better manage their personal wastes for disposal. Such a practice would likely require a volunteer base, and could perhaps be considered as a temporary practice (i.e. two weeks) once a year.
- Faro’s materials collection site provides a waste diversion opportunity to be considered, though a site separate from the landfill itself isn’t necessary. Having a waste oil and recovery tank available at the site is also a good practice.
- The Town of Faro maintains and operates garbage collection services and provide “Haul All” bear proof containers for user drop off that are located throughout town. A possible consideration for other municipalities might be such strategically located containers for residents to drop off their wastes to make waste collection more viable, if considered.
- Teslin is one of few waste facilities that provide shelter for special wastes. At the very least, shelter should be provided for car batteries and household hazardous waste at all facilities. This concept is discussed further in Section 11.2.

10.13 COOPERATIVE SOLID WASTE MANAGEMENT

The possibility of a regionalized waste management approach to the Yukon is discussed later in Section 11.6.9. However, in efforts to provide an idea of the waste volumes to be expected in the various geographic areas in the Yukon, Figures 2 to 6 depict this information with respect to potential waste networks centered around incorporated communities in the territory.

It must be recognized though, that no decisions have been made regarding changes at the respective facilities and that the concept of a regional landfill could imply either the establishment of a new facility or the upgrade of an existing facility. The waste regions are identified by incorporated community names for illustrative purposes only and do not imply any commitments or responsibilities outside of those existing presently.

11.0 TASK 7 – UPDATING THE YUKON SOLID WASTE MANAGEMENT STRATEGY AND GUIDELINES

The following sections present a summary of the challenges faced with waste management in the Yukon, complete with a number of recommendations to address these challenges.

11.1 REVIEW OF EXISTING WASTE FACILITIES

Solid waste deposits in the Yukon can be divided into three broad categories:

- Domestic Waste (i.e. organics, garbage)
- Recyclables (i.e. glass, beverage containers, paper, etc.)
- Bulk (i.e. Construction and Demolition waste, scrap metal) or Special Wastes

The handling of domestic waste at Yukon waste facilities has been discussed in the sections above. Recycling capabilities in incorporated communities has been identified as well in Section 10.0, though recycling in unincorporated communities has received less discussion in this study. This is because recycling depots in most unincorporated communities are located in the communities rather than at the waste facilities (excluding Mt. Lorne and Marsh Lake).

Bulk wastes, meanwhile, are generally segregated at most waste facilities, with a number of designated areas available on site to allow for the separation of these materials. However, there is not always sufficient signage to direct these waste deposits, and there is usually a lack of supervision that would prevent site misuse.

The generation rates of the above noted waste streams can be classified into two categories:

- Frequent – Domestic Waste and Recyclables
- Infrequent – Bulk or Special Wastes

The objective of all waste facilities is to ensure that the waste streams are handled appropriately based on their generation rates. The following sections identify a number of challenges faced in this regard presently, and provide a number of recommendations for improvements where applicable.

Refer to Section 4.0 for additional discussion of current waste management practices in the Yukon.

11.1.1 Waste Diversion in the Yukon

Waste diversion in the Yukon is variable across the territory, and is largely dependent on the resources available in any given community. The following sections provide a brief description of the existing diversion initiatives in place at present time.

Recycling

Most communities throughout the Yukon have their own recycling societies that spearhead initiatives and manage their community's recyclables, though this is largely managed on a volunteer basis.

In addition, some facilities have a "Free Store" where users can take or leave items they feel are reusable (e.g. chairs, cd towers). In many cases though, these stores are underutilized, and do not necessarily address the materials normally considered as "recyclables".

Raven Recycling represents the largest organization for processing of recyclables in the Yukon. It collects, separates, bails, and hauls the majority of all potential recyclable materials (e.g. newsprint, paper, cardboard, plastics, aluminium, glass, metals) in the territory for shipment to southern processing facilities. Additionally, P&M Recycling (another depot and processing facility) accepts bottles, cans, and several other recyclable materials.

The beverage container recycling program in the Yukon has one of the highest user participation rates in Canada. Yukon Environment, and its Recycling Fund, sponsors a Recycling Club with participating businesses that encourages children to collect recyclables and turn them in at recycling depots for points that can be collected and later exchanged for prizes. This program captures the interest of Yukon residents at a young age and establishes a desirable behaviour that continues into the future.

Recommendation

In order for waste diversion to be successful, the infrastructure and programs must be in place to facilitate participation. In order to maximize participation, the system must be easy to access and utilize. Local waste disposal facilities offer a convenient location for recyclables to be deposited, but this type of infrastructure is lacking at most facilities. It is recommended that, in the absence of a separate community recycling depot, waste facilities should be equipped with containers capable of storing recyclables for collection. The size and type of these containers would be dependant on the surrounding community size, as well as the capabilities of the end destination (i.e. whether Raven Recycling and other recyclers able to accept un-segregated deposits).

Other potential programs that could increase waste diversion in the Yukon include:

- increasing environmental deposit refunds for materials such as beverage containers or implementing programs for other materials such as gas cylinders to provide further incentives and encourage participation; and
- increasing subsidies or implementing initiatives like tax credits to existing recyclers to combat lower commodity prices and prevent the closure of such facilities that provide a worthwhile service.

The success of existing programs is encouraging for the Yukon in looking to the future. The major obstacle outside of participation though, is having economically viable outlets for recycled products, which at present time may require government funding to subsidize potential losses to avoid the abandonment of worthwhile programs.

Backhauling

A prominent challenge with recycling in the Yukon is apparent when it comes to transportation costs. It is inherently expensive to ship collected recyclables out of the territory, and as such, many recycling options are limited in comparison to more southern jurisdictions. To this end, there is a common stream of thought that suggests backhauling (i.e. shipping of products or wastes through use of trucks that have deposited goods in the Yukon and are heading back to their place of origin) of recyclables should be an attainable goal in relation to the supply of materials that come from outside the territory. Raven Recycling has had success in this regard, negotiating a number of regular backhaul arrangements in addition to other transportation solutions, though not all recycling initiatives in the territory have the same capabilities or opportunities. Further, there are additional barriers to the backhauling of wastes within the territory. Whitehorse represents the major hub of shipping activity in the Yukon, and many communities outside the capital do not see the same level of trucking that would allow the opportunity for backhaul. As such, the costs and logistics of shipping waste present a challenge.

Recommendation

Two possible solutions to the obstacles faced with backhauling include:

1. A shipment exchange network could potentially be facilitated in the territory. Using signs posted at major roadways entering the territory and Whitehorse can advertise a telephone number to call where haulers can report their arrival and return destinations, schedule, load capacity size, and contact information. Interested Yukon parties can then phone this network and ask if there are any haulers available for backhaul at any given time, or request to be notified when certain destinations or schedules become available. The incentive for the haulers would be compensation from the shippers that would normally be missed out on if returning to their origin with an empty load.
2. A Materials Recycling Facility (MRF) can be established in the Yukon to limit and maximize the amount of shipping required out of the territory. It is understood that Raven Recycling is currently investigating the feasibility of such a facility in the near future, as discussed in Section 10.8.1.

It should be noted that Environment Yukon has recently requested bids for the transportation of recyclables from community depots to Whitehorse processors to help mitigate some of the challenges associated with the hauling of these materials within the territory (closing August 6, 2009). This support is offered through the Recycling Fund. It is

to be understood, however, that Environment Yukon's support to offset these costs does not extend beyond the delivery of these recyclables to the processors.

Composting

Composting is the aerobic process through which organic materials are biodegraded at an increased rate and mixed with soil to provide a nutrient rich topsoil. Compostable wastes include food wastes, "contaminated" paper products (i.e. paper towels), non-recyclable paper products, yard waste, hair, and wood shavings or sawdust. Oxygen and water are also important components in the composting process, which requires that compost be turned and watered regularly so that air and moisture are distributed throughout.

The City of Whitehorse encourages backyard composting as a means of reducing the amount of waste collected from curbside collection that enters the landfill. Recently, the City of Whitehorse has gone full-scale with a composting program that requests residents to separate their waste into two bins; a green, ventilated bin for compostables and a black bin for garbage. Waste trucks collect these bins and deposit the garbage into the landfill and the compostable wastes into large windrows (i.e. "log rolls" of compost that can be turned regularly by heavy equipment). The compost is screened using a 1/4" mesh, tested annually, and sold at Alberta Grade A quality to Yukon residents.

Rural Yukon, and even more urbanized areas such as Carmacks, that do not have curbside collection programs pose a challenge to this level of participation and waste capture. Nevertheless, compostable waste is still generated at similar rates and has the potential for capture. The challenges associated with remoteness of facilities are discussed further in Section 11.3.3.

Recommendation

Similar to recyclables, infrastructure to support the segregation of organics and other compostables is necessary for a program to be successful. This is typically more difficult with organics, however, due to concerns with odour and scavengers. Nevertheless, there is the potential to increase waste diversion in the Yukon through a compost program.

It is recommended that compost alternatives be investigated further after a decision has been made at each waste facility regarding its change in practices (i.e. from burning vessel to transfer station, landfill, or incinerator).

11.1.2 Waste Programs and Initiatives in the Yukon

Within Appendix D of this report, a number of waste programs available in the Yukon have been summarized. These initiatives include:

- beverage container recycling program;

- used tire management program;
- HHW collection; and,
- special waste collection.

These programs offer Yukon residents the opportunity to handle their wastes in an appropriate manner and effectively communicate their respective effects on the environment.

Noticeably absent from this list of programs in comparison to provincial Canada, however, includes:

- e-waste recycling program (in progress as per Section 7.3.2); and
- white goods program.

11.1.3 Budgets and Financing

The 2008/2009 budget for all 19 unincorporated solid waste sites operated by YG is \$1.2 M. This annual budget is directed at maintaining the contracts required for site maintenance, and covers staff salary (including Community Development staff salary) where applicable. The remainder then is put towards any facility upgrades that may be required. YG Community Services has observed that this budget is not sufficient to provide an appropriate level of service for all existing waste facilities in terms of meeting public demands and protecting the environment.

Only a select few municipalities with incorporated waste facilities collect additional taxes from Yukon residents that help fund local waste operations (i.e. Dawson City, Whitehorse), and in Whitehorse's case, the facility is further funded through tipping fees. Outside of these municipalities, the use of waste facilities is free of charge, with the onus for funding solid waste programs being on the YG. This disparity creates a situation where residents of a community with a tipping fee facility choose to utilize a "free" YG operated facility, which burdens the already limited capacities at the facilities even further (i.e. Deep Creek). Currently, this practice cannot be monitored or controlled, and as such, taxing and tipping fee regimes in the Yukon may have to be re-examined in the future.

11.2 "TROUBLESOME" WASTE MANAGEMENT

Household Hazardous Waste (HHW)

HHWs comprise a wide range of wastes. They include waste oil, antifreeze, aerosol cans, paints and thinners, solvents and cleaners, pesticides, car batteries, and medication. The Environment Yukon website describes the preferred handling and disposal for such wastes. These wastes are considered hazardous because of the adverse affects that they have on the environment if not disposed of properly, and require special handling above and beyond that required for regular household wastes.

Currently, Environment Yukon offers support to any community wishing to hold a HHW Collection Day, including staffing of the event with technical personnel, removal of the collected wastes and up to \$1000 funding towards advertising costs. Based on past participation, it is believed that most operators are aware of this program, but the onus lies with the facility operators to take advantage of it by contacting the department.

While these HHW collection days are available and receive participation, it is still apparent that in practice many of the waste sites still receive these materials without proper controls due to a lack of policing and continuous monitoring.

The reasons for this type of facility misuse are varied. The majority of instances amount to either uncertainty/unawareness as to what comprises HHW (not to mention the environmental risks or hazards) or general disinterest where users are not motivated to make a separate trip to dispose of the wastes properly. Finally, there may be a lack of awareness or desire to participate in the Yukon Environment's annual HHW roundup program.

Recommendation

While signage is effective in communicating messages to those willing to receive them, there will always be the risk of facility misuse. As such, a potential mitigation would involve either reducing the number of nearby facilities available (thereby forcing deposits in a properly managed facility) or improving existing facilities to ensure proper segregation and storage of materials. Such improvements might include controlled entry hours, designated storage areas, or security camera systems.

Site supervision through staffing is another alternative for the monitoring of waste disposal, but is available only at a considerable cost. Even with supervision though, it is difficult to police every deposit of waste to ensure the materials end up where they belong. To this end, public education programs targeted towards HHW may be considered in the future if its management continues to present challenges.

Litter (e.g. Plastic Bags, Packaging)

The transfer station facilities that are staffed are effective in managing the litter that accumulates at their sites. While the staff cannot supervise 100% of the waste loads deposited, they can direct a fair number of users appropriately, and are able to walk around regularly to pickup loose and windblown wastes.

A number of sites visited over the course of this study suffered from uncontrolled litter. Whether it was due to a lack of supervision or a lack of regular maintenance (above and beyond what is required or can be reasonably expected of a contractor), litter concerns were evident and need to be addressed. To this effect, supervision and limited access hours would provide some level of relief.

Recommendation

Some jurisdictions in North America have implemented bans on plastic bags. Recently, a number of businesses have also promoted use of reusable plastic bags (made from recycled materials) and bin carriers for groceries. Such an initiative could be implemented in the Yukon, and could prove successful given the small population base and limited number of bag producing businesses. Such a program has already been implemented to some success in Dawson, where their Reusable Bag Blitz program generated encouraging participation from the community.

White Goods

White goods refer to major appliances such as refrigerators, washing machines, etc., which are bulky and consist largely of metal and plastic that is not easily separated.

At nearly every facility visited, there was a considerable quantity of white goods deposited. The majority of these white goods included refrigerators, ovens, washers, and dryers.

While nearly every facility has a separate area designated for white good disposal, the bulk of these sorts of waste deposits are a burden on many of the facilities due to size limitations. The current practice for removal of such goods is on an “as-needed” basis, but it is difficult to predict and costly to manage.

Refrigerators must be drained of CFC/HFCs before they are recycled/disposed, and are currently flagged at their respective facilities to indicate whether or not this draining has taken place.

It is thought that one of the biggest reasons for the quantity of white goods being deposited is the relative cost of repair versus purchasing a new product. This concern is compounded by the fact that there is also a lack of repair capacity (i.e. lack of service technicians) in communities outside of Whitehorse.

Recommendation

In New Brunswick, a province that has eliminated its local “dump sites” in favour of a regionalized landfill approach, they have instituted a White Goods Recycling Pilot Program (Solid Waste & Recycling 2008). Through this program, there are a number of scheduled white good collection days over the course of six or seven months of the year, organized on a regionalized basis. A telephone number is available to residents of that province to sign up for a pickup during the window period for their scheduled route, and the residents leave their appliance at an accessible location for pickup.

This program ensures that the white goods are not dumped illegally, and that the condition of the appliances is improved through the professional handling services of the haulers. This allows for better scrap metal recovery and CFC/HFC capture. It is envisioned that a

similar program may be feasible in the Yukon, which could also be applied to other troublesome wastes such as auto hulks.

Additional strategies to help combat unmanageable or excess white goods deposits at YG operated waste facilities include:

- providing a tax incentive to appliance retailers that collect white goods as part of a trade in program;
- creating a government funded program where YG pays for transportation and lodging costs for a service technician to visit communities, with the cost of the repairs covered by the people utilizing the service; and,
- enacting a stewardship program for white goods where the industry applies a fee with purchases and coordinates a collection program.

Auto Body Hulks

Auto hulks were present at a number of facilities in varying degrees of salvage. Current British Columbia legislation (British Columbia being the end location for these wastes) dictates that all fluids must be drained from an auto hulk before it will be accepted in the province for salvaging and recycle.

Due to the infrequency of auto hulk deposits, it is not cost efficient to institute a regular collection of these wastes, and most facilities operate on an “as needed” basis for their removal. The trouble, however, is that auto hulks take up a lot of area, as they cannot be stacked, and a substantial amount of available land is lost, limiting the ability of a site to operate normally.

Banning the deposits of auto hulks at facilities can be implemented, but may be difficult to enforce. As such, it is recommended that the auto hulks be handled in a similar manner to the white goods program recommended in the section above.

Scrap Metal

During EBA’s site visit tour, there were considerably sized scrap metal piles (i.e. metals outside of auto hulks and white goods) deposited at many of the waste facilities. One of the biggest concerns with scrap metal is that it often requires further segregation into such categories as steel, aluminium, copper wire, etc. Scavenging of metal also creates a hazard and liability due to the size, weight, and rigidity of the material.

Scrap metal recycling can be a profitable endeavour, but due to the remoteness of the facilities, it is difficult to manage a feasible pickup schedule, and waste deposits are irregular and potentially unsustainable.

Recommendation

EBA noted that a large quantity of waste metals were generated by highway construction activities (i.e. mostly culvert replacements). Deposition of such metal wastes can be controlled by requiring highway construction contractors to enact their own metal salvaging programs as a requirement of their construction contracts. Additional alternatives are highlighted in the scrap metal study section below.

Scrap Metal Recovery Study

In a 2007 study conducted by the Recycling Council of British Columbia (RCBC), the scrap metal recovery industry was investigated in northern British Columbia and Yukon Territory (British Columbia 2007). The purpose of the study was to quantify the extent of metal stockpiles and investigate potential market solutions.

In northern British Columbia, there are a number of scrap metal markets available, and given the recent value increase of metals, there has been an increase in material recovery, though previously some regional districts provided subsidies for the transport and processing of these goods.

The study indicates that there are several companies in lower mainland British Columbia interested in recovering metals from northern communities. Additionally, there are a number of northern British Columbia businesses (in Prince George and Dawson Creek, particularly) that have market connections.

In general, northern British Columbia faces the same challenges with white goods and auto body hulks, and ensuring that fluids are drained and metal is appropriately recovered. Transportation costs are the primary barrier to recovering these materials.

A number of programs were investigated regarding increased metal recovery. The following summarizes some of the potential programs that could be implemented in a Yukon setting:

- A one-week roundup program. This program would operate similar to the Yukon's HHW collection days, except include white goods and/or auto hulks.
- A Car Heaven program. This program has been employed successfully in several cities throughout Canada. The basis of this program is that vehicles are towed to an auto-wreck yard where fluids are drained and the metal is properly salvaged. Vehicle donors receive a free tow, a charitable receipt, and in some instances, a gift certificate towards a new vehicle.
- Freight subsidies. Offering subsidies for scrap metal transportation is one way to improve recovery, though the solution can be costly and is likely only worthwhile when large stockpiles of scrap metal have been amassed.
- Extended producer responsibility. This type of producer responsibility has been successful in British Columbia in other industries. Such a program could put the onus

of the cost of recycling on the producer, or encourage better product design in the future that allows most efficient recovery. The RCBC study revealed existing programs in Sweden where there is a car scrapping law that requires disposal fees to be included with the purchase of new vehicles. Additionally, in Japan, there is a home appliance recycling law that requires appliance retailers to accept and recycle collected appliances.

- Freight piggybacking system. As discussed in Section 11.1.1, there is the potential to establish a network where cooperation within the industry for transportation costs can be facilitated. The RCBC suggests an internet site in addition to a telephone line for organization.

Tires

There currently exists a deposit charge in the Yukon for all new tires having a rim size of 24.5 inches or less at time of purchase, and disposal of tires at the Whitehorse landfill, and everywhere else in the territory, is free of charge.

Despite no longer charging a tipping fee for tire acceptance at the Whitehorse landfill, it has been observed that many residents still bypass this facility to deposit their tires at other nearby facilities that are not as well equipped to manage these wastes. Furthering the difficulty in handling such quantities is the requirement that the steel rims must be removed from the tires before they can be shipped and recycled.

Recommendation

One potential solution for encouraging proper tire disposal is to provide incentives similar to a bottle deposit program (i.e. a refundable deposit). While a deposit fee ensures that funds are available for the recycling of tires, users would likely feel more motivated to dispose of their tires in a more controlled fashion (i.e. at designated facilities capable of handling tires) if they were receiving money in exchange for their effort.

In British Columbia, certain types of tires can be exchanged for a cash refund through the regional districts, and some small businesses have developed that collect these tires free of charge so that these refunds can be collected. Tires that do not meet the refund requirements are often still collected, except at an additional cost. Such a program may warrant further investigation in the Yukon if funding becomes available (i.e. through an increased deposit on the purchase of new tires). It should be acknowledged, however, that there are certain obstacles associated with implementing such a program in the Yukon, including the large distances between communities, remoteness to southern markets, and the potential for residents from outside the Yukon utilizing these services.

As far as tire management is concerned once the tires have been collected, it is recommended a tire shredder be utilized to increase payload densities for shipments to Southern Canada. It is understood, however, that YG has investigated this possibility previously and encountered challenges with the specialized equipment required for

transport. Additionally, the possibility of in-territory recycling of tire materials could also be explored in the future, should tire volumes be feasible.

Construction and Demolition (C&D) Wastes

C&D Wastes are unique in the Yukon in that they are rare, unpredictable, and immense in size. The majority of the waste facilities in the Yukon would be hard pressed to make room for a large deposit of C&D wastes.

These wastes consist of such materials as asphalt shingles, concrete, wood (potentially treated), drywall, etc., and while each material can be collected and recycled in some capacity, the difficulty is that the wastes are commingled when deposited, making salvage of the material near impossible.

Recommendation

One strategy currently employed in some jurisdictions in North America is a deposit program instituted through the permitting of construction, renovation, and demolition projects (CRD) (EBA 2006). Through this process, users must obtain a permit prior to undertaking a CRD project and pay a deposit (i.e. \$100) that will be returned when a receipt is shown to indicate that the CRD waste has been handled in an appropriate manner (i.e. a receipt from the Whitehorse landfill must be produced for the deposit to be refunded).

Additionally, YG could require that contractors submit a “waste demolition plan” prior to demolitions, so YG can plan for acceptance of this waste and create a designated location ahead of time.

e-Waste

Electronic waste (e-waste) is waste consisting of any broken or unwanted electronic appliance. E-waste has concerned landfill operators, as many components of such equipment are toxic and non-biodegradable.

The Yukon Territory is currently without a year-round e-waste program. Instead, Yukoners have relied heavily on Computers for Schools (Yukon) to provide a disposal option during the HHW collection days hosted twice annually by the City of Whitehorse, and occasionally by other communities. The Computers for School program accepts unwanted computers for refurbishing and distribution to schools and non-profit organizations. However, this program does not accept e-waste from the public that is over and above the need for these refurbished electronics. This means that there is currently no program in place to divert unwanted e-waste from public waste disposal sites. A recent study has provided Yukon Environment with an outline of other e-waste programs in Canada, and the development of a Yukon based program is currently underway as a result.

The Mt. Lorne and Marsh Lake facilities do provide a separate area for e-waste products to be deposited, but outside of the Whitehorse area, e-waste handling is not managed as a special waste stream.

Across Canada, there are currently five e-waste programs in existence, enacted under various regulatory regimes governing the handling and disposal of e-waste. Each program was developed for a region after taking into account regional considerations such as the local economy, industry input, retailer participation, and convenience for the consumer; with the common goal being diverting e-waste from landfills. Programs currently in place in Canada follow a similar industry-based stewardship model with subtle differences. The Canadian Council of Ministers of the Environment's (CCME's) 12 principles for electronics product stewardship form the basis for the e-waste programs currently in existence in Canada. These programs are relatively new, and it is difficult to fully assess performance at this point.

Recommendation

Currently, the Yukon's waste tires are shipped to a private facility in Leduc, Alberta, which is located nearby the City of Edmonton. An Edmonton facility has the processing equipment necessary for e-waste, and so there is some potential for the "piggybacking" of these two waste streams. This system requires that the e-waste materials be shredded prior to acceptance, which can also be a shared process if the earlier suggestion of a tire shredder is adhered.

For e-waste collection, a "collection-day" program similar to the HHW program in place presently could be employed. Alternatively, waste facilities could be equipped with a container capable of storing e-waste. Such a container can store multiple waste types that also require sheltered storage. Please refer to Appendix E for a depiction of the kind of storage facility that could be considered for use in the Yukon. Such a facility is relatively expensive to have constructed out of territory, and so it would be recommended that Community Services investigate the feasibility of contracting the construction of similar units in the Yukon. Given a typical storage unit with five storage sections, EBA would recommend collecting batteries and propane tanks in the fenced compartments, and paints or other HHWs in the sheltered compartments.

It is to be recognized, however, that Environment Yukon is currently investigating an extended producer responsibility program targetted towards e-waste. As such, it is recommended that Community Services maintain regular communication with Environment Yukon when developing any e-waste related diversion or collection strategies.

Propane Tanks

There is an inherent danger in the disposal of propane tanks, and a further risk associated with the improper disposal of these wastes, both environmentally and with respect to human health and safety, as they could explode in a burning vessel.

Recommendation

It was noted in the previous Solid Waste Strategy (Gartner Lee, 2001) that a Carmacks waste facility employee was injured due to an explosion at the facility. This incident should be regarded as an extreme event, and while it is difficult to ensure that compressed gas canisters do not become mixed with other waste types, the hazard should be very clearly communicated to the public, and potential fines should be considered for offences. A deposit program for compressed gas canisters may be effective in this regard as well.

The storage unit discussed in the section above would also provide a suitable management practice for propane tanks if utilized.

Lead Acid Batteries

At most facilities, there is a pallet available for vehicle batteries. These pallets are only labelled in some instances, however, and they are exposed to the elements in nearly all cases.

Recommendation

It is considered a best practice that used car batteries are exchanged upon the purchase of new batteries as part of extended producer responsibility. Many businesses in the car battery industry are equipped to handle used car batteries that are disposed of appropriately. To encourage this exchange, a deposit return could be implemented, or an advertising campaign designed to raise awareness of the hazards associated with used car batteries.

As discussed in the sections above, a sheltered storage unit would also provide improved management practices for car batteries if utilized.

Please refer to Table 18 for a summary of preferred “Troublesome” Waste Management practices as outlined in the sections above.

11.3 WASTE MANAGEMENT CHALLENGES

11.3.1 Waste Segregation

The commingling of wastes is major challenge for waste management initiatives. Each waste type (e.g. plastics, glass, paper) requires separate handling for the various processes

that must be undertaken to reuse, recycle, or recover the materials, respectively. Commingling of wastes, such as a tin can in amongst food scraps, essentially contaminates a “clean” waste stream, and additional efforts are then needed to “purify” that stream. In order to avoid these efforts, it is necessary to facilitate waste segregation so that waste streams can be better encapsulated towards their own end.

At every waste facility currently in operation, there is some level of waste segregation taking place. The level of sorting varies significantly from site to site, however, and is often dependant on space availability and the size of the community served. The performance of the waste segregation program is also directly related to the level of public participation. Regardless of the barriers faced, waste segregation is imperative in capturing waste streams destined for whatever end they are designated.

Recommendation

It is recommended that every waste type accepted at a facility be clearly identified with appropriate signage in an area designated for that materials disposal. These areas include tires, white goods, glass, batteries, propane tanks, metals, plastics, food scraps and other organics, C&D wastes (e.g. concrete, wood with nails), e-waste, HHWs, and auto hulks. As discussed earlier in this report, the public may not necessarily adhere to the signage in place every time, but some level of improvement can be expected as a result of these measures.

Ideally, standardized signs would be employed throughout the territory for a level of consistency, and EBA would recommend signs similar to those in Carmacks where waste depictions are provided for additional clarification.

11.3.2 Inconsistency and Unpredictability of Waste Deposits

Due to the small size of the existing waste facilities, and the size of the community that each site serves, unpredictable spikes in the waste stream are more prevalent and difficult to handle than at a large scale landfill such as in Whitehorse. For example, a simple lodge renovation could more than double the waste stream at a remote facility for a given month.

Whether it is the demolition or renovation of a nearby house, or the passing of a resident that had amassed a large collection of materials not considered of use to the inheritor, a waste facility can be overloaded with waste, which limits its operational efficiency.

Recommendation

A “Waste Line” should be established for the territory, where users of a facility can report a large waste deposit or indicate that the facility must be checked or emptied by the contractor. This telephone line will help limit the uncertainty inherent in planning site pickups and contractor requirements. Other functions of the “Waste Line” could include

providing answers to user questions about waste segregation, information on waste collection schedules, etc. The City of Calgary currently provides a similar service, entitled 3-1-1. Here, residents can dial this number and speak to a City representative that will provide information on a wide variety of City related issued (i.e. parks and recreation activities, animal services, bylaws, etc.).

11.3.3 Remoteness of Facilities

The Old Crow solid waste facility amplifies the challenges associated with remoteness of facilities in the Yukon. This community is only accessible by air, and cannot be incorporated into regional waste plans due to this disconnect. In order to offer the same level of services to such facilities, the costs are directly proportional to the degree of remoteness. These costs add up significantly when considering the variety of waste services required, such as recycling, staffing, user costs, etc. For such remote facilities, it is appropriate to make them as self sustaining as possible.

The cost to transport waste is considerable in the Yukon as the current waste facilities are widely spread across the territory. Remoteness cannot be considered a limiting factor; however, as regardless of how remote a facility may be, if it is necessary to handle the wastes of the surrounding communities, it must be operated as effectively as possible.

While there are, at times, large distances between waste facilities, these distances are not so unreasonable that trips would be avoided. In Alaska and the Northwest Territories, there are siting regulations in place to avoid having more than one facility within a certain distance of another. That is to say, remoteness, to some degree, is actually encouraged within these jurisdictions. And while it may increase the cost of waste hauling operations, it also limits the redundancy of waste facilities and provides for better efficiency.

Recommendation

EBA recommends that backyard programs, such as composting, recycling, etc. be promoted and encouraged for residents in outlying communities to reduce the amount of waste going to local facilities. If the YG were to subsidize the purchase of a compost bin, for example, or blue bins for recyclables, it may encourage waste segregation and recycling, which could in turn reduce the number of facilities required, or the maintenance of existing facilities.

This being said, there exists a number of facilities at present time that EBA feels should be examined regarding closure. When considering site closure, the most important factors to examine are cost per user, distance to nearest other waste management facility, and public opinion or resistance to the closure. It is felt that a number of facilities can be closed, which would offer more operational funding for other nearby facilities and, in turn, allow for increased waste management efficiency. Additional discussion regarding site remoteness is provided below.

The following section presents a number of other potential waste practices for remote communities based on a report prepared by UMA Environmental.

Remote Community Case Study Report

In 1995, UMA Environmental produced a report entitled Small Scale Waste Management Models for Rural, Remote, and Isolated Communities in Canada for the Canadian Council of Ministers of the Environment (CCME) Solid Waste Management Task Group (UMA 1995).

This report highlights a number of case studies throughout Canada, North America, and Europe that have been successful in the following areas of waste management:

- Waste Reduction
- Reuse
- HHW Reduction, Reuse, recycling and Disposal
- Recycling Materials Collection, Processing , and Marketing
- Backyard and On-Site ICI Composting
- Collection and Centralized Composting of Leaf, Yard, and other Organic Waste
- Residual Waste Management
- Organizational Structure, Regulatory and/or Economic Instruments

The following presents a summary of the case studies that EBA feels may be suitable in the Yukon, arranged as per the categories outlined above, if applicable.

Waste Reduction

Home Waste Survey, *Moorhead and Minneapolis, Minnesota* – In this project, trained surveyors visited participating households to provide personalized training for better waste disposal and diversion practices. The surveyor would provide a number of recommendations to the home owners and weeks later check back for updates and to continue with encouragement.

Precycle, *Boulder, Colorado* – Precycle is a point of purchase awareness campaign primarily focused on grocery stores, but could definitely be expanded to other stores. In this program, there are reminders and “Did You Know?” facts located on the shelves and in the check-out aisles to encourage responsible behaviour with respect to buying in bulk to reduce packaging, identifying products that use recycled material in their packaging, re-using plastic bags or encouraging plastic tubs, etc.

HHW Reduction, Reuse, recycling and Disposal

Return to Point of Sale, *Region of Freisland, Germany* – A large number of retail outlets to volunteer to participate in this program that allows users of HHW to return their waste to the point of sale, targeting such items as used oil at gas stations and auto-shops, paints at

paint vendors, used or expired medication at pharmacies, household cleaners and batteries at supermarkets, etc.

Recycling Materials Collection, Processing, and Marketing

Pembina Valley Recycling Network, *Manitoba* – The Pembina Network is a cooperative effort between a number of communities in south-central Manitoba that manages recycling and composting programs. The network utilizes a centralized facility to process all collected materials through, while the participating municipalities organize their own collection programs. At the time of the UMA study, there were plans to establish a regional landfill facility as well.

Rural Deposits as an Alternative to Curbside Collection, *Pictou County, Nova Scotia* – This program is focused around one permanent recycling facility and a number of temporary collection points served by a mobile trailer system. This mobile unit travels to the different collection points on an established schedule and collects target materials (i.e. recyclables, e-waste, auto hulks, white goods) as necessary.

Backyard and On-Site ICI Composting

Backyard Composting Project, *Pickering, Ontario* – A composting team visited residents to explain the program and offer a composting bin for participation. Residents were also offered a bucket and scale to help with the monitoring process. The majority of residents accepted the composters and were happy with the program.

Community Composting, *Zurich, Switzerland* – In Zurich, larger scale composters, in comparison to personal-scale composters, were set up in small communities and in multi-family residential blocks. Here, users place their compostable waste in the composters in this shared resource, which is managed by either the community or condo association.

11.3.4 Public Involvement

Environmental Awareness

With an increasing focus on global climate change resulting from greenhouse gases, and general environmental wellbeing, the public is becoming increasingly educated and concerned about the potential effects of what is going on around them. As such, there is a growing resistance against waste management practices that are considered to be outdated, and the burning of waste, specifically, is being opposed across Canada and in the Yukon. With the Yukon Territory representing the only jurisdiction in Canada to officially permit burning, public pressure geared towards the cessation of this method of operations has only increased. This pressure has directly led to the recent permit requirements to end open burning practices by January 1, 2012.

User Experience

The conditions and appearance of a waste disposal site sets an expectation in the mind of a user. If a site is not very well kept, users, in general, will tend to be less careful in the

disposal of their waste. Conversely, if a site is well organized, users will tend to respect the tidiness of the facility and dispose of their waste more appropriately. The trouble, however, is that just one poor deposit can upset the site's appearance.

Furthermore, it is entirely common that when action is taken at one facility, other communities will anticipate that these steps will be undertaken in their community as well. This should be taken into consideration for all waste operation planning so as to avoid controversy. An illustration of such a scenario is the recent media attention to the disparity in funding between the Marsh Lake and Mt. Lorne facilities.

The current funding levels at each facility are limited to the total budget allotted to waste management for the entire territory annually. The budget is divided amongst the existing facilities according to the level of maintenance required at each, which is more or less proportional to the amount of waste deposited there and relates to the population of the surrounding area. Additional funding, in some cases, is granted to facilities that have acquired grants through volunteerism and separate government funding. This additional funding provides noticeable improvement to the waste facilities, which is observed by users and residents from outside the community who may not be aware of the additional funding source, which creates a perceived expectation for the same level of service elsewhere. As such, a public education program may be necessary to ensure that residents better understand why decisions are made and how funding is obtained and distributed throughout the territory. Refer to Section 11.4 for additional discussion regarding such community involvement and participation.

11.3.5 Environmental Concerns, Public Safety, and Liability

Most striking about the Yukon waste operations in comparison to southern Canada are the differences in liability concerns. Scavenging, for example, while not encouraged in the Yukon, is not discouraged either. In other jurisdictions throughout Canada there are strict regulations that prohibit scavenging of any kind. By disallowing scavenging, the liability of the governing jurisdiction for injuries incurred as a result of the activity is removed. However, a side effect of the rule is that waste separation is at times hindered, and some reusable or recyclables products are automatically considered irretrievable.

The burning vessels present another hazard where public safety and liability may become a concern. As the burning vessels are located at sites with unlimited and unsupervised access, there is the potential for injury at site due to the heat generated by the vessels, which slowly dissipates for several hours after the burning vessel is ignited (assuming that the vessel is only ignited by the appropriate contractor). While some sites post a sign indicating that the burning vessel is hot, these signs are generally afterthoughts that have been spray-painted in many cases and could go unobserved or ignored.

Also generating liability implications in the Yukon is the fact that environmental monitoring at unincorporated facilities is currently present at only three facilities (Carcross, Marsh Lake, and Upper Liard). Without environmental monitoring, there is no way to observe or be

aware of the environmental implications of a waste facility, and so no action can be triggered to correct a situation that may arise.

There may arise liability concerns in the future regarding air quality as a result of waste burning practices. Air emission modelling is currently being undertaken for the territory, and the results from this modelling will give an immediate indication of the associated hazards relative to both human and environmental exposure. These results should be examined carefully and be included in the decision making processes for changes considered at each respective facility.

Recommendation

It is recommended that:

- Legislation be re-evaluated to improve public safety and remove the YG's liability for a scavenging related incident, yet still allowing approved operators to separate waste as necessary.
- A physical barrier or other means of protection for the burning vessel doors should be installed to limit the potential for burn injuries to users. This measure is recommended in the interim as burning vessels are phased out towards the January 1, 2012 deadline.
- Environmental monitoring wells (groundwater monitoring wells) should be considered at every waste facility to harmonize Yukon waste standards with Southern Canada; one upgradient of groundwater flow direction, and two downgradient (at minimum). It is recognized that the recent permits issued for unincorporated facilities has begun this process with the requirement for a hydrogeological assessment plan (as discussed in Section 4.7.4).

11.3.6 Potential Implications of Climate Change

Climate change, in loose terms, refers to the increase of temperatures throughout the globe that presents adverse effects on the natural environment, such as increased flooding and more severe weather systems. Climate change is a controversial topic at present time, and the arguments involved are largely focussed around uncertainty as to what is causing the changes (e.g. natural climate cycles, emissions), and the effects and control of the situation.

With respect to the Yukon, increasing temperatures do have an effect on the waste stream, specifically how the environment will become more sensitive to the risks associated with wastes. The following list denotes a number of potential effects that should be taken into consideration when planning for the future of Yukon's waste management:

- Increased rate of production of methane gas from landfills as a result of increased rate of decomposition of wastes through temperature and moisture increases.

- Rising water tables, which will infiltrate landfills, particularly considering that existing landfills in the territory do not have engineered liner systems.
- Sloughing of wastes from melting permafrost.
- Wetter conditions that may affect operations

Conversely, with these potential challenges come opportunities, such as greater potential for composting, or methane gas collection from landfills, which in turn would reduce the carbon footprints associated with landfilling.

Recommendation

Moving forward, all landfills should be constructed with strict engineering controls, recognizing the potential implications of climate change (i.e. melting of permafrost, sloughing of liner material). Such controls are a potential legislative requirement currently under consideration with Yukon Environment, as evident in the recent permit requirements issued in April 2009 (see Section 4.7.4). Additionally, landfill gas collection and waste to energy systems should be considered in the future as technology advances and the need arises. Such options are discussed further in Section 11.7.3.

11.3.7 Potential Changes Affecting Waste Management Practices

The most discussed change affecting waste management in the Yukon at present is the potential of a ban on burning, which has recently been addressed as part of the permits issued to Yukon waste facilities (Section 4.7.4.3).

In most cases, a proposed change in waste management practices would require a change in facility operations, which would require additional capital and operational spending.

Potential changes, be they policy based, operational, or legislative, are difficult to anticipate, as they result from new scientific information and shifting public focus, but some potential scenarios may include:

- imposing mandatory environmental monitoring at all waste facilities (see Section 11.3.5);
- disallowing the establishment of any new waste facilities;
- developing stricter standards for buried waste, including barrier systems for both landfills and trenches constructed for the acceptance of ash (see Section 11.3.5);
- imposing strict controls on the management of special and/or HHW wastes;
- banning the use of plastic shopping bags;
- implementing emissions standards that would require air quality monitoring;
- instituting a carbon tax against emissions territory wide; and,

- making it mandatory to establish e-waste or hazardous waste storage areas at all waste facilities.

Please refer to Table 19 for a summary of mitigation recommendations for the waste management challenges presented in the sections above.

11.4 YUKON WASTE GROUP AND COMMUNITY ASSOCIATIONS

Recommendation

During the course of this study, an idea was put forth regarding the establishment of a group dedicated to waste management in the Yukon.

While the name of the group and its precise function is yet to be determined, the premise would be to have key representatives of waste management jurisdictions and organizations as part of this group that will inform and provide advice to the Yukon governments in its development of waste management programs and initiatives in the territory.

Potential objectives of the group could include establishing waste reduction and diversion initiatives, setting environmental goals, developing action plans to reach these targets, facilitating community participation and organizations, facilitating community applications for funding, and developing public education programs and campaigns. However, the exact role, responsibility, and authority of the group will require careful consideration and coordination.

It is proposed that this group be formed shortly after the issuance of the solid waste strategy so that improvements to the existing waste practices can be implemented in a timely and effective manner.

Further to the waste working group and the existing community associations in the Yukon that are dedicated to waste management and diversion, it would be beneficial that these associations expand and collaborate across the territory. These efforts would better involve the community at large and allow for information and resource sharing territory wide. While such community associations would largely be run on a volunteer basis, it is felt that this commitment would improve waste diversion practices significantly, which was a common theme in the public meetings for this study.

11.5 ADDITIONAL CONSIDERATIONS

When considering existing unincorporated waste facilities, which are primarily burn-based operations, the alternatives considered for a change in management practices within this study included:

- Transfer Stations
- Incinerators

- Regional Landfills

In addition to these alternatives, waste facility closures are also to be seriously considered in some cases.

Within each site, there are also a number of other measures to be considered that would improve the current operations, but not necessarily change the overall operating structure or operating cost. The following waste considerations further discuss possible actions that can be implemented in the Yukon to achieve the desired changes.

11.6 SHORT-TERM CONSIDERATIONS

The short-term waste considerations discussed in the following sections are focussed on feasible improvements and additions to the current waste system and examine better facility and material management. Additional short-term strategies include those recommendations that have been made throughout this report.

11.6.1 Changing Public Perceptions

The first step towards encouraging the public to handle their wastes more effectively is to change their perception when it comes to how they view their waste facilities. The following sections are based on this principle.

11.6.1.1 Signage

It is recommended that the YG change the signage of all their facilities from being labelled as a “Dump” to instead being called a “Public Waste Disposal Facility”. This seemingly insignificant move can go a long way to changing one’s perception of what the facility is meant for. Elsewhere in Canada, the term “dump” is generally avoided, replaced at minimum with “waste facility”.

Additionally, as discussed in Section 11.2, standardized signs for waste segregation similar to those in Carmacks are recommended for clarity.

11.6.1.2 Site Appearance

As discussed earlier in this report, it is important to maintain a professional appearance at each and every waste facility to facilitate respectful behavior from site visitors. This requires constant maintenance and upkeep of facilities, which means increased expense, though staffed facilities can accomplish this as part of daily duties versus additional contractor responsibilities.

11.6.1.3 Public Education Programs

In order to enforce some of the desired mentalities and actions to come out of the waste study, the public will need to be educated, informed, and reminded of how to handle their wastes differently to adapt to the forthcoming changes. This could involve newspaper ads

and radio campaigns to deliver the messages, and increased signage at the waste facilities themselves to ensure the message gets across before waste is deposited.

Additionally, waste knowledge can be adopted into school programs to educate children in how to properly dispose of their wastes, establishing positive life long behavior.

The Department of Environment and Raven Recycling have had an active role in such public education programs in the past, and it is recommended that the waste group discussed in Section 11.4 continue with or expand upon these programs in the future.

11.6.2 Waste Quality Tracking

In order to both calibrate the waste model and develop a complete understanding of each waste facility in the territory, it is necessary to know the quantity and composition of waste accepted.

While it would be time consuming and costly to conduct a waste audit at each facility, it would be worthwhile to hold an audit on a semi-regular basis (i.e. two to five years) at a representative facility for both an incorporated community (i.e. Whitehorse) and unincorporated community (i.e. Ross River) to observe changes in waste disposal practices and the effect that future waste diversion initiatives might be having in the territory.

As a regular practice at transfer station facilities, waste volumes should be tracked at the landfill scale (if available) where the wastes are being deposited.

11.6.3 Addressing Required Facility Changes

As discussed throughout this document, the majority of unincorporated waste facilities in the Yukon require a change in operating practices in order to improve the levels of service offered to users and address recent permit requirements for the cessation of burning.

The waste model developed for this study indicates that transfer stations are typically the most suitable alternative available at this time. These results are supported by public opinion and additional information compiled through this study. However, as there are 15 burn-based operations in the territory that will require a change in operating practices, it is likely that a staged approach will be taken to the conversion process leading up to January 1, 2012. It is recommended that the results of the waste model and the SENES air dispersion modeling report be considered when developing a prioritization plan for the required changes. Additionally, the recommendations discussed in the following sections provide further discussion on possible strategies for Community Services' consideration.

Given that the majority of unincorporated waste facilities will operate as burning vessel or transfer stations over the next three years, Figure 7 and Figure 8 present a recommended conceptual layout for both types of facilities, as based on the recommendations discussed in the sections above.

11.6.4 Facility Closure and Funding Distribution

Due to the proximity of a number of sites, as well as the baseline cost of any site's required operation and maintenance, it would be beneficial to consider a number of facility closures. By closing certain waste facilities or consolidating them with others, a cost associated with waste disposal will be incurred by some local residents (i.e. personal transport beyond current practices), but more funds will be made available for remaining facilities, which would improve the levels of service offered.

The facilities that EBA recommends should be considered for closure include:

- Canyon Creek – located approximately 25 km from Haines Junction and 37 km from Champagne. There are approximately 25 facility users at a cost of \$1,700 per user annually. Additionally, this facility is located on reserve land that is leased by Community Infrastructure, which is an added cost that could be avoided. If closed, residents of Canyon Creek can deposit their wastes at either Haines Junction or Champagne.
- Destruction Bay – located approximately 20 km from Burwash Landing, the Destruction Bay facility presently operates as a pseudo-transfer station accepting primarily construction and demolition debris and other bulk wastes (scrap metal, auto hulks). The cost to operate this facility is approximately \$10,000 annually. EBA recommends that this facility be closed when road construction projects in the area have been completed. The waste facility located in Burwash Landing would then accept wastes from both communities.

The closure of these facilities would result in over \$50,000 of operation and maintenance savings annually.

However, it is recommended that an environmental site assessment (ESA) be conducted on the facilities that are closed to determine if remediation is required, which will be determined under Yukon's Contaminated Sites Regulation

11.6.5 Unsupervised Transfer Stations

As discussed earlier in this study, unsupervised transfer stations are not ideal, as users often deposit their wastes differently when unsupervised. This is not to say that unsupervised transfer stations cannot be successful, however. Under certain circumstances, unsupervised transfer stations could actually offer the most cost effective and efficient facility alternative available. Such conditions that would lend to success include a small population base utilizing the facility, a tidy operation fully equipped with waste segregation areas (including bins and HHW storage) for all waste types, and sufficient capacity for wastes accumulating between regular pickup periods. The facilities discussed below are those that could be potential candidates for unsupervised transfer stations.

- Silver City – located approximately 58 km from Haines Junction, 67 km from Burwash Landing. There are approximately 20 regular facility users. Silver City represents one of

the smallest facilities evaluated and represents a scenario where an unmanned transfer station may be viable.

- Keno and Stewart Crossing – Each of these facilities are located approximately 60 km from the community of Mayo, which has sufficient landfill capacity for the foreseeable future (though an agreement would have to be worked out with Mayo to allow outside residents to deposit their wastes there). Keno services approximately 20 users, while Stewart Crossing services approximately 30 users. Costs are unknown for the community of Stewart Crossing, but in Keno, the cost per user is roughly \$215/year.
- Braeburn – Braeburn services a population of 15 people, and is located approximately 57 km from Deep Creek and 73 km from Carmacks. Given the small waste volumes anticipated, Braeburn could be operated as a small, unmanned transfer station that is visited periodically by waste trucks that would haul to Carmacks (given an agreement with the community), or in conjunction with the haul route associated with Deep Creek and Whitehorse.

11.6.6 Joint Ventures

There are a number of unincorporated waste facilities in the Yukon that are located in relatively short distances from one another that could potentially be reduced to a single facility to service multiple communities. As examples of such cooperation, EBA recommends the following possibilities:

- Carcross and Tagish – These two facilities should be considered for a joint facility. EBA would recommend that the Tagish facility be closed and that the Carcross facility be upgraded to a transfer station, as only 28 km separate the sites, and a higher level of service can be offered if only one facility requires maintenance and staffing.
- Mt. Lorne and Marsh Lake – Similar to Carcross and Tagish, these two facilities are located in relatively close proximity to one another (approximately 48 km). While it may not be politically viable to suggest that resident of either community travel an extra 48 km to dispose of their wastes, the option should be at least investigated, with potential consideration given to a central location between the two communities. It is suggested that an area by the Carcross cutoff be investigated for potential site locations. There has been perceived disparity in recent past between the funding levels received at each facility, and perhaps they could benefit from combining their resources.

11.6.7 Additional Site Specific Recommendations

Additional facility alterations to be considered include:

- Upper Liard – The Upper Liard facility is located approximately 15 km away from Watson Lake. The community of Watson Lake is currently investigating the establishment of a new landfill. Given these plans and the proximity of Upper Liard in relation to the incorporated municipality, there is a potential agreement to be reached

between YG and Watson Lake regarding the waste disposal of the approximate 250 site users the Upper Liard facility currently services.

- Johnson's Crossing – Johnson's Crossing is located outside of the road loop formed between other waste facilities in the area (Marsh Lake, Tagish, Carcross, and Mt. Lorne). This facility serves approximately 35 people. The community of Teslin recently acquired funding from the Gas Tax Fund to convert their burning vessel station into a transfer station. Teslin has since reached a deal with the Whitehorse landfill to transfer its wastes to this location. It is suggested that negotiations take place between YG, Teslin, and Whitehorse to incorporate Johnson's Crossing into this transfer agreement, as Johnson's Crossing is located en route to Whitehorse from Teslin. This would require that Johnson's Crossing be converted to a transfer station as well.
- Old Crow – This facility is subject to adverse and unique conditions that have led to a number of concerns that need to be addressed. Most noticeably, concerning site remoteness, Old Crow is only accessible via air, except on select occasions where temporary winter access roads are constructed. During these occasions, it is imperative that waste materials and recyclables located at the waste facility are fully evacuated to maintain capacity at the waste site. The waste model indicates that an incinerator would be the preferred waste management practice of the future in Old Crow, meaning that its use should be maximized regarding organics, paper products, and brush to limit the wastes for winter road transport. Further, it is recommended that the wastes not accepted in the incinerator be stored in a manner that promotes ease of transport. Potential solutions include PODS¹⁰, Sea Cans, or a used trailer home to be swapped out during collection periods. A compacter and bailer might also be worth investigating further to maximize shipment payloads. Meanwhile, materials such as Construction and Demolition Debris and Scrap Metal should be targeted for salvage within the community to ease the storage burden at the waste facility.

Additionally, the site is located in close proximity to a number of water bodies, which has resulted in surface water impacts due to flooding and runoff. As such, an environmental site assessment (ESA) is recommended at the facility to better understand the impact of these concerns and develop potential remediation steps to correct the situation, which may include relocation of the facility. It is understood that relocation of the waste facility has been discussed in the past and is presently under consideration.

11.6.8 Remote Facilities and Automated Access

Another option to consider for use in more remote facilities is an automated or monitored access system, where the users of each facility can be tracked to determine where the users are coming from, and the "average" volumes that are deposited. While there may be some

¹⁰ <http://www.pods.com/canada.aspx>

privacy issues to address with such a system, there is also the opportunity to monitor facility misuse.

There are a number of options for facilitating controlled access to remote facilities. These options include:

- pressure triggered cameras with solar cells and memory cards;
- gates activated by swiping cards; and,
- motion sensing cameras.

11.6.9 Regionalization Pilot

Regionalization refers to the establishment of a single, large facility capable of handling the wastes from the contributing region. Such a facility would be fed either by a series of transfer stations that transport the waste with haul trucks, or through direct user deposits, or a combination of both.

As the Yukon continues to grow in population, regionalization of waste facilities (to some degree) will become the most effective operating practice for the territory. As such, it is recommended that regionalization is explored in the short term as a pilot program for future endeavours.

Since the Mt. Lorne and Marsh Lake facilities are already operating as transfer stations, and the Carcross facility is eager to institute such an operation, there is the immediate potential to create a waste facility “circuit” that includes these three facilities, with the potential to incorporate additional facilities in the future. In addition, because Whitehorse is in such close proximity, and will act as the “end of the line” disposal center for the collected materials, there is also an opportunity to partner with Raven Recycling for the acceptance of recyclables.

11.6.10 Develop Environmental Targets

In order to help make consistent and allied decisions in waste management throughout the Yukon, it would be beneficial to develop environmental targets in line with the solid waste strategy prepared in conjunction with this document. These targets would provide the public with confidence that there is a firm direction in place and that progress is being made towards the Yukon’s overall waste management goals.

Example targets include those aimed toward waste diversion, policies against emissions, protection of environment, getting participation from every resident, etc.

It is important to ensure that any target considered should be both realistic and attainable. Also, it should be recognized that there are numerous levels at which environmental targets can be achieved, be it through waste reduction, waste diversion, or waste disposal

Many jurisdictions throughout Canada have focussed their attention on achieving greater waste diversion. These initiatives are proactive approaches to waste management, and it is

important to avoid reactive planning. It is envisioned that the waste group discussed in Section 11.4 will be tasked with this responsibility, its ongoing maintenance, and future goals.

11.7 LONG-TERM CONSIDERATIONS

The following sections discuss long term strategies will be targeted towards meeting the environmental vision to be outlined in the solid waste strategy prepared in conjunction with this study.

11.7.1 Waste Reduction

As mentioned earlier, the focus of this study has been primarily on waste disposal practices, with the occasional discussion of waste reduction and diversion. However, taking action to avoid waste generation in the first place is perhaps the most important aspect of waste management, which reduces the requirement for diversion and disposal practices. There are a number of potential alternatives to reducing wastes. These initiatives can be implemented a number of different levels, including:

- **Consumer Mentality** – As the Yukon becomes more progressive in terms of waste management, a more responsible waste culture will develop, which will lead to less waste being discarded, with greater focus placed on reduce, reuse, recycle, and recovery practices.
- **Extended Producer Responsibility** – This concept, which sees producers accept responsibility for their products at the end of usable service lives, is an effective source control measure that is being examined in the Yukon presently (i.e. e-waste).
- **Packaging** – The majority of products in the Yukon are imported, which results in large quantities of packaging wastes. General packaging reduction from producers would require support from federal governments and international consumer pressures. However, at the acceptance level, there is also the potential to promote or enforce packaging reduction prior to sale of the product.
- **Industrial/Commercial/Institutional (ICI) Controls** – As evident in Ontario, additional responsibilities or pressures can be placed on producers through policy or regulatory controls that require producers to meet select waste reduction targets (i.e. investigate ways of reducing packaging by 20%, increasing recyclable product content, etc.).

It is recommended that future examinations of Yukon's solid waste management practices focus on potential waste reduction initiatives available.

11.7.2 Zero Waste

According to the Zero Waste International Alliance, the concept behind zero waste is to “conserve and recover all resources and not burn or bury them.”

While many consider zero waste to be an unachievable goal, at the very least it provides a target to strive towards. There are always improvements that can be made with waste segregation, reuse, recycling, and recovery of materials, diversion, source policies, etc. Whenever a decision is made regarding the waste streams in the Yukon, they should be made as a step towards zero waste.

11.7.3 Regionalization

As the population of the Yukon continues to grow, and infrastructure development coincides with this growth, regionalization will become the most viable waste management strategy available.

Certainly, the sporadic and sparsely located residents in the Territory can make for difficult planning regarding regionalization, but concentration of efforts on fewer, more centralized waste facilities will eventually become the most effective management policy for the Yukon, as with any jurisdiction.

11.7.4 Fostering Grassroots Waste Management Initiatives

YG should investigate ways of assisting residents, particularly those in outside of a community setting, to manage their own wastes in the most efficient and effective ways possible.

Compost bins for organics, blue box recyclables, and safe burning practices for the heating of homes are all achievable initiatives today, but time is required to foster such ideas until they become common practice amongst all citizens. Pilot programs are ideal for growing these initiatives, which could involve selecting a particular community and supplying them with the necessary tools and know-how, and observing the effects over a number of years so that practices can be improved and perfected prior to expansion.

11.7.5 Waste to Energy

As technology progresses and associated costs become more feasible, waste to energy may become a strategy that is worth investigating. The City of Edmonton, for example, has recently invested in such an initiative, and there are a number of locations in Ontario also delving into this market that Europe has seen as an effective model for many years.

Given that the City of Whitehorse represents nearly 75% of the total Yukon population, it may be a potential candidate for a waste to energy program in the future.

The components of a waste to energy program include [HDR Corporation (HDR) 2008]:

- Site – There needs to be a location available that works.
- Waste – There needs to be enough waste generated after diversion to make the endeavour worthwhile.

- Permits – There are a number of permits that will need to be investigated and acquired prior to production.
- Energy Contract – There needs to be a need for the energy produced, and there needs to be a way of distributing it effectively.
- Ash/Bypass Disposal – There needs to be a plan for residue.
- Facility – There needs to be a facility constructed that will operate effectively with minimal maintenance and maximum public acceptance.

Risks to the program include (HDR 2008):

- Technology and Cost – The technology in this field is advancing and the price of this technology is decreasing. At present time, however, one or both may be limiting factors.
- Waste Supply and Output – An important consideration in considering waste to energy facilities, as well as incinerators, for that matter, is the effect waste diversion may have on the viability of the program. There are also concerns regarding the end of life disposal of residues that could inhibit the project's success.
- Legislation and Emissions – In relation to technology, the emissions released from such facilities must meet all of the applicable standards in place, exceeding them where capable.

Given that the Community Infrastructure Branch of the YG is also in charge of water for the territory, there is a potential overlap in services that could be further explored with respect to waste to energy, including the possibility of including sewage in such a program.

At present time, EBA feels that waste to energy in the Yukon is a very long-term option to consider rather than an immediate one.

11.7.6 Landfill and Methane Gas Recovery

Landfill gas, generated through the decomposition of wastes in place in a landfill, consists of 40% to 60% methane and 40% to 60% carbon dioxide. This composition results in a large carbon footprint for landfills, but also offers the potential for energy recovery through methane collection.

Factors contributing to landfill gas collection include:

- composition of waste (i.e. organics vs. non-organics);
- moisture content;
- age of waste deposits;
- presence of oxygen; and,
- temperature.

Given the cold temperatures in the Yukon, landfill gas will be generated at a slower rate than in more southern areas of Canada. The Yukon also has a relatively dry climate, which furthers this effect. Possible mitigation of these conditions may include seasonal methane collection in the summer.

Increasing temperatures in the Yukon as a result in climate change may change these conditions in the future, making landfill gas collection more viable.

11.7.7 Carbon Offset Revenue Potential

With both waste to energy and landfill collection programs, there are very large carbon credit offsets compared to current practices that could potentially yield carbon credits that could be sold.

There is an increasing awareness regarding carbon footprints and their impacts in industry, which can be offset by carbon credits. This awareness will continue to expand in coming years, and may make such endeavours a viable initiative in the near future.

11.7.8 The Future of Waste Management

There are a number of scenarios that may arise in the future that have the potential to alter the waste management practices in the Yukon.

Technology is constantly advancing and efficiencies are often found as industry adapts to these advancements. The Yukon will have to continuously monitor the waste management practices outside the territory to ensure it is up to date and operating as effectively as possible.

Indirect influences may also impact the Yukon's waste management practices. Should fuel prices rise, for example, the cost associated with the transportation of waste may call for a reduction in hauling. Implications of this scenario would include a need for increased storage capacity, better compaction of wastes, or localized disposal solutions. Alternatively, instead of transporting waste, transportation of the management system may become more practical (i.e. mobile incinerators).

Due to the uncertainty associated with such possibilities, it is recommended that waste practices be reviewed on a regular basis in the future (i.e. five to ten years).

12.0 SUMMARY OF RECOMMENDATIONS

A summary of recommendations made throughout this report is included in Table 20. This table has been divided into a number of categories for the type of recommendation made, and each recommendation has been assigned a relative impact on the overall waste stream.

The categories of recommendations made include:

- Yukon Wide Programs – These recommendations include those pertaining to those program recommendations that would be implemented territory wide, offering services to every resident.
- Government Policy or Legislation Changes – These recommendations are geared towards government-related initiatives that would require policy changes and new legislation.
- Waste Handling and Acceptance at Disposal Facilities – Refers to recommendations that should be taken into consideration at the unincorporated waste facilities themselves (i.e. facility upgrades, staffing).
- Specific Facility Actions – These recommendations are specific to individual facilities.
- Additional Strategies – Remaining recommendations that do not fall into the categories described above.

13.0 CLOSURE

This report and its contents are intended for the sole use of the Community Services and their agents. EBA does not accept any responsibility for the accuracy of any of the data, the analysis or the recommendations contained or referenced in the report when the report is used or relied upon by any Party other than Community Services, or for any Project other than the one herein. Any such unauthorized use of this report is at the sole risk of the user.

This Issued for Use report is provided solely for the purposes of client review and presents our findings and recommendations to date. Our findings and recommendations are related only through an “Issued for Use” report, which will be issued subsequent to this review. You should not rely on the interim recommendations made herein. Once our report is issued for use the “Issued for Review” report should be either returned to EBA or destroyed.

Should you have any questions or comments related to this study, please direct them to Mr. Paul Moore of the Government of Yukon at solidwastestudy@gov.yk.ca.

Respectfully submitted,
EBA Engineering Consultants Ltd.

ISSUED FOR USE

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TABLES



TABLE 1: TYPICAL ENVIRONMENTAL RISK CALCULATION SUMMARY

LOCATION: *Upper Liard*

		Burning Vessel Risk Ratings		Burn and Bury in Trench Risk Ratings		Transfer Station Risk Ratings		Incineration Risk Rating		Landfill Risk Rating	
		Risk	Points	Risk	Points	Risk	Points	Risk	Points	Risk	Points
Does the Facility Accept Domestic Waste?	Yes	Low Risk	1	Low Risk	1	Low Risk	0	Low Risk	0.5	Low Risk	0.5
Does the Facility Accept Metals?	Yes	Low Risk	1	Low Risk	1	Low Risk	0	Low Risk	1	Low Risk	1
Does the Facility Accept Brush & Construction Debris?	Yes	Low Risk	1	Low Risk	1	Low Risk	0	Low Risk	0.5	Low Risk	0.5
Does the Facility Accept Tires?	Yes	Low Risk	1	Low Risk	1	Low Risk	0	Low Risk	0.5	Low Risk	0.5
Does the Facility Accept Batteries?	Yes	Moderate Risk	5	Moderate Risk	5	Moderate Risk	2.5	Moderate Risk	5	Moderate Risk	5
Does the Facility Accept Waste Oil	Yes	Moderate Risk	5	Moderate Risk	5	Moderate Risk	2.5	Moderate Risk	5	Moderate Risk	5
Does the Facility Accept Household Hazardous Wastes?	Unknown	High Risk	0	High Risk	0	High Risk	0	High Risk	0	High Risk	0
Does the Facility Accept Appliances (White Goods)?	Unknown	Low Risk	0	Low Risk	0	Low Risk	0	Low Risk	0	Low Risk	0
Is the Facility a Burn Operation (domestic waste only)?	Yes	Moderate Risk	5	Moderate Risk	5	Moderate Risk	0	Moderate Risk	2.5	Moderate Risk	0
Is the Facility a No-Burn Operation?	No	Low Risk	0	Low Risk	0	Low Risk	0	Low Risk	0	Low Risk	0
Does the Facility Have a Burning Vessel in place?	Yes	Moderate Risk	5	Moderate Risk	0	Moderate Risk	0	Moderate Risk	0	Moderate Risk	0
Is there a Water Tank on-site?	Yes	High Risk	0	High Risk	0	High Risk	0	High Risk	0	High Risk	0
What is the site's Geology like?	Gravel Pit	Moderate Risk	5	Moderate Risk	5	Moderate Risk	0	Moderate Risk	5	Moderate Risk	5
Groundwater Monitoring	Yes	Moderate Risk	0	Moderate Risk	0	Moderate Risk	0	Moderate Risk	0	Moderate Risk	0
Air Quality Monitoring	No	Moderate Risk	5	Moderate Risk	5	Moderate Risk	0	Moderate Risk	2.5	Moderate Risk	2.5
Surface Water Monitoring	No	Moderate Risk	5	Moderate Risk	5	Moderate Risk	0	Moderate Risk	2.5	Moderate Risk	2.5
Electric Fence In Place	Yes	Moderate Risk	0	Moderate Risk	0	Moderate Risk	0	Moderate Risk	0	Moderate Risk	0
Controlled Access (i.e. Gates, Operating Hours)	No	Moderate Risk	5	Moderate Risk	5	Moderate Risk	5	Moderate Risk	5	Moderate Risk	5
Distance to Nearest Water Well (km)	Unknown	Auto-Calculation	0	Auto-Calculation	0	Auto-Calculation	0	Auto-Calculation	0	Auto-Calculation	0
Distance to Water Body (km)	3	Auto-Calculation	0	Auto-Calculation	0	Auto-Calculation	0	Auto-Calculation	0	Auto-Calculation	0
Distance to Closest Dwelling (km)	0.464	Auto-Calculation	7.5	Auto-Calculation	7.5	Auto-Calculation	3.75	Auto-Calculation	7.5	Auto-Calculation	7.5
Operational Costs (AVG 2003 - 2008)	\$8,335.00	Risk of Illegal Dumping	0	Risk of Illegal Dumping	0	Risk of Illegal Dumping	0	Risk of Illegal Dumping	0	Risk of Illegal Dumping	0
Staff Salary Cost (YG) (AVG 2003 - 2008)	\$1,368.80										
Total Cost per User	\$38.82										
Distance to Whitehorse or Other Incorporated Community (km)	15										
				Notes		Notes		Notes		Notes	
				Windblown litter/fire hazards only difference in comparison to burning vessel.		Limited Waste Acceptance Risk - Leaves Site		Waste Acceptance = Half Risk of Burning Vessel (for buried wastes). Ash is less volatile.		Waste Acceptance = Half Risk of Burning (for buried wastes). Clay Liner less permeable.	
						No setback concerns except noise for dwellings.		Environmental monitoring concerns halved as well		Monitoring and Setback Risks also Halved	
		Wastes Accepted - Risk Points	14	Wastes Accepted - Risk Points	14	Wastes Accepted - Risk Points	5	Wastes Accepted - Risk Points	12.5	Wastes Accepted - Risk Points	12.5
		Operational Practices - Risk Points	30	Operational Practices - Risk Points	25	Operational Practices - Risk Points	5	Operational Practices - Risk Points	17.5	Operational Practices - Risk Points	15
		Setback Risk Points	7.5	Setback Risk Points	7.5	Setback Risk Points	3.75	Setback Risk Points	7.5	Setback Risk Points	7.5
		Total Env. Risk Rating	51.5	Total Env. Risk Rating	46.5	Total Env. Risk Rating	13.75	Total Env. Risk Rating	37.5	Total Env. Risk Rating	35

Notes:
Unknown information to be updated by Community Services staff as available.
If information is unknown, a score of zero has been assessed.

TABLE 2: TYPICAL CARBON FOOTPRINT CALCULATION SUMMARY

Sample Location: Upper Liard					
CARBON FOOTPRINT CALCULATIONS (ANNUAL)	Burn and Bury in Trench	Burn in a Burning Facility and Bury in Trench	Sanitary Landfill Operations	Transfer Station and Regional Solid Waste Disposal Site	Incineration
Waste Acceptance (tonnes eCO ₂)	18.4	18.4	141.8	141.8	18.4
Energy Use (tonnes eCO ₂)	0.0	0.0	0.1	0.0	0.1
Waste Collection and Transportation (tonnes eCO ₂) - (assumed diesel 7 mpg)	0.3	0.3	0.0	0.7	0.3
Landfill Heavy Equipment (tonnes eCO ₂)	0.0	0.0	0.9	0.0	0.0
Average User Travel Distance (tonnes eCO ₂) - (assumed gasoline 14 mpg)	19.5	19.5	39.0	19.5	19.5
TOTAL CARBON FOOTPRINT (tonnes eCO₂)	38.2	38.2	181.9	162.0	38.4

Notes:

Carbon footprint calculations consider nearest landfill (i.e. closest incorporated community) as end of the line for transportation based carbon emissions (i.e., waste shipped beyond landfill sites to other locations for recycling, such as Whitehorse, is not considered).

YUKON WASTE COMPOSITION

Source: City of Whitehorse Residential (Urban and Rural Combined) 1994 SWAP Data	Percentage of Waste Stream	Waste Tonnage	Handling Practice
Newsprint	5.2%	11.2	Burn/Bury
Cardboard	1.8%	3.9	Burn/Bury
Other Paper	20.7%	44.5	Burn/Bury
Aluminum	0.9%	1.9	Recycled
Steel	3.0%	6.5	Recycled
Copper Wire	0.5%	1.1	Recycled
Glass	5.4%	11.6	Recycled
HDPE	1.1%	2.4	Burn/Bury
PET	0.5%	1.1	Burn/Bury
Other Plastic	7.1%	15.3	Burn/Bury
Food Scraps	27.8%	59.8	Burn/Bury
Yard Trimmings	10.2%	21.9	Burn/Bury
White Goods	0.1%	0.2	Recycled
Personal Computers (Estimated - No Data Available)	0.1%	0.2	Recycled
Televisions (Estimated - No Data Available)	0.1%	0.2	Recycled
Microwaves (Estimated - No Data Available)	0.1%	0.2	Recycled
VCRs (Estimated - No Data Available)	0.1%	0.2	Recycled
Tires (Estimated - No Data Available)	0.5%	1.1	Recycled

Plastics assumed burned to account for non-organic input.

Notes:

Carbon emission estimates not available for all waste types. Table above depicts only those wastes with a corresponding emission estimate (i.e. only 85.2% of the waste stream is represented).

EMISSION FACTORS

WASTE TYPE	Net Recycling Emissions (tonnes eCO ₂ /tonne of waste)	Net Composting Emissions (tonnes eCO ₂ /tonne of waste)	Landfill Without Landfill Gas Collection (tonnes eCO ₂ /tonne of waste)	Net Combustion Emissions (tonnes eCO ₂ /tonne of waste)
Newsprint	-0.3	0	0.32	-0.05
Fine Paper	-0.36	0	1.88	-0.04
Cardboard	-0.21	0	1.66	-0.04
Other Paper	-0.25	0	1.7	-0.04
Aluminum	-6.49	0	0.01	0.01
Steel	-1.18	0	0.01	-1.03
Copper Wire	-4.1	0	0.01	0.01
Glass	-0.1	0	0.01	0.01
HDPE	-2.27	0	0.01	2.89
PET	-3.63	0	0.01	2.17
Other Plastic	-1.8	0	0.01	2.67
Food Scraps	0	0.02	1.23	0.02
Yard Trimmings	0	0.02	0.59	0.01
White Goods	-1.46	0	0.01	-0.26
Personal Computers	-1.6	0	0.01	0.41
Televisions	-0.23	0	0.01	0.75
Microwaves	-1.27	0	0.01	-0.55
VCRs	-0.95	0	0.01	0.15
Tires	-3.29	0	0.01	-0.49

Notes:

Carbon "credits" associated with combustion can be attributed to energy generation (heat) from the burning of waste. This energy is currently not utilized at Yukon facilities.

TABLE 2A: EFFECT OF WASTE DIVERSION ON CARBON FOOTPRINT CALCULATIONS

MT LORNE SUMMARY

CARBON FOOTPRINT CALCULATIONS (ANNUAL)	Burn and Bury in Trench	Burn in a Burning Facility and Bury in Trench	Sanitary Landfill Operations	Transfer Station and Regional Solid Waste Disposal Site	Incineration	Burning Facility (Increased Diversion)	Transfer Station (Increased Diversion)
Waste Acceptance (tonnes eCO ₂)	12.0	12.0	92.4	92.4	12.0	-26.8	5.4
Energy Use (tonnes eCO ₂)	0.1	0.1	0.1	0.1	0.1	0.1	0.1
Waste Collection and Transportation (tonnes eCO ₂ - assumed diesel 7 mpg)	0.8	0.8	0.0	1.6	0.8	0.8	1.6
Landfill Heavy Equipment (tonnes eCO ₂)	0.0	0.0	0.6	0.0	0.0	0.0	0.0
Average User Travel Distance (tonnes eCO ₂ - assumed gasoline 14 mpg)	71.2	71.2	142.3	71.2	71.2	71.2	71.2
TOTAL CARBON FOOTPRINT (tonnes eCO₂)	84.0	84.0	235.4	165.2	84.0	45.2	78.2

Notes:

Burn-based operation carbon footprints demonstrative of theoretical values if facility were not presently a transfer station. It is no way suggested that operations be changed based on carbon footprint values.

MT LORNE BREAKDOWN

YUKON WASTE COMPOSITION	Percentage of Waste Stream	Waste Tonnage	Diverted Tonnage (60% Assumed)	Residual Tonnage	Notes
Newsprint	5.2%	7.3	4.4	2.9	Burn/Bury
Fine Paper	0.0%	0.0	0.0	0.0	Burn/Bury
Cardboard	1.8%	2.5	1.5	1.0	Burn/Bury
Other Paper	20.7%	29.0	17.4	11.6	Burn/Bury
Aluminum	0.9%	1.3	0.8	0.5	Recycled
Steel	3.0%	4.2		4.2	Recycled
Copper Wire	0.5%	0.7		0.7	Recycled
Glass	5.4%	7.6	4.5	3.0	Recycled
HDPE	1.1%	1.5	0.9	0.6	Burn/Bury
PET	0.5%	0.7	0.4	0.3	Burn/Bury
Other Plastic	7.1%	9.9	6.0	4.0	Burn/Bury
Food Scraps	27.8%	38.9	23.4	15.6	Burn/Bury
Yard Trimmings	10.2%	14.3	8.6	5.7	Burn/Bury
White Goods	0.1%	0.1		0.1	Recycled
Personal Computers (Estimated - No Data Available)	0.1%	0.1		0.1	Recycled
Televisions (Estimated - No Data Available)	0.1%	0.1		0.1	Recycled
Microwaves (Estimated - No Data Available)	0.1%	0.1		0.1	Recycled
VCRs (Estimated - No Data Available)	0.1%	0.1		0.1	Recycled
Tires (Estimated - No Data Available)	0.5%	0.7		0.7	Recycled

Notes:

Carbon emission estimates not available for all waste types. Table above depicts only those wastes with a corresponding emission estimate (i.e. only 85.2% of the waste stream is represented).

MARSH LAKE SUMMARY

CARBON FOOTPRINT CALCULATIONS (ANNUAL)	Burn and Bury in Trench	Burn in a Burning Facility and Bury in Trench	Sanitary Landfill Operations	Transfer Station and Regional Solid Waste Disposal Site	Incineration	Burning Facility (Increased Diversion)	Transfer Station (Increased Diversion)
Waste Acceptance (tonnes eCO ₂)	34.2	34.2	263.9	263.9	34.2	-76.6	15.3
Energy Use (tonnes eCO ₂)	0.0	0.0	0.2	0.0	0.3	0.0	0.0
Waste Collection and Transportation (tonnes eCO ₂ - assumed diesel 7 mpg)	1.2	1.2	0.0	2.4	1.2	1.2	2.4
Landfill Heavy Equipment (tonnes eCO ₂)	0.0	0.0	1.6	0.0	0.0	0.0	0.0
Average User Travel Distance (tonnes eCO ₂ - assumed gasoline 14 mpg)	249.7	249.7	561.9	249.7	249.7	249.7	249.7
TOTAL CARBON FOOTPRINT (tonnes eCO₂)	285.1	285.1	827.6	516.0	285.4	174.3	267.4

Notes:

Burn-based operation carbon footprints demonstrative of theoretical values if facility were not presently a transfer station. It is no way suggested that operations be changed based on carbon footprint values.

MARSH LAKE BREAKDOWN

YUKON WASTE COMPOSITION	Percentage of Waste Stream	Waste Tonnage	Diverted Tonnage (60% Assumed)	Residual Tonnage	Notes
Newsprint	5.2%	20.8	12.5	8.3	Burn/Bury
Fine Paper	0.0%	0.0	0.0	0.0	Burn/Bury
Cardboard	1.8%	7.2	4.3	2.9	Burn/Bury
Other Paper	20.7%	82.8	49.7	33.1	Burn/Bury
Aluminum	0.9%	3.6	2.2	1.4	Recycled
Steel	3.0%	12.0		12.0	Recycled
Copper Wire	0.5%	2.0		2.0	Recycled
Glass	5.4%	21.6	13.0	8.6	Recycled
HDPE	1.1%	4.4	2.6	1.8	Burn/Bury
PET	0.5%	2.0	1.2	0.8	Burn/Bury
Other Plastic	7.1%	28.4	17.0	11.4	Burn/Bury
Food Scraps	27.8%	111.2	66.7	44.5	Burn/Bury
Yard Trimmings	10.2%	40.8	24.5	16.3	Burn/Bury
White Goods	0.1%	0.4		0.4	Recycled
Personal Computers (Estimated - No Data Available)	0.1%	0.4		0.4	Recycled
Televisions (Estimated - No Data Available)	0.1%	0.4		0.4	Recycled
Microwaves (Estimated - No Data Available)	0.1%	0.4		0.4	Recycled
VCRs (Estimated - No Data Available)	0.1%	0.4		0.4	Recycled
Tires (Estimated - No Data Available)	0.5%	2.0		2.0	Recycled

Notes:

Carbon emission estimates not available for all waste types. Table above depicts only those wastes with a corresponding emission estimate (i.e. only 85.2% of the waste stream is represented).

TABLE 3: 2008 ANNUAL CONTRACTS FOR UNINCORPORATED WASTE FACILITIES

Fiscal Year	Area	Area by Name	Expenditures	Unallocated Portion	Total Expenditures	% Expenditures	Staff Salary Costs	Area Totals
2007/08	24	Champagne	\$40,870.76	\$209.94	\$41,080.70	7%	\$6,711.94	\$47,792.63
	25	Beaver Creek	\$10,341.95	\$53.12	\$10,395.07	2%	\$1,698.39	\$12,093.46
	27	Burwash Landing	\$19,740.00	\$101.40	\$19,841.40	3%	\$3,241.77	\$23,083.17
	28	Canyon	\$35,846.00	\$184.13	\$36,030.13	6%	\$5,886.75	\$41,916.88
	29	Cacross	\$39,299.61	\$201.87	\$39,501.48	6%	\$6,453.92	\$45,955.39
	30	Mt. Lorne	\$51,667.96	\$265.40	\$51,933.36	8%	\$8,485.09	\$60,418.45
	35	Destruction Bay	\$9,916.00	\$50.94	\$9,966.94	2%	\$1,628.44	\$11,595.37
	51	Keno City	\$3,626.00	\$18.63	\$3,644.63	1%	\$595.47	\$4,240.10
	57	Marsh Lake	\$118,994.21	\$611.23	\$119,605.44	20%	\$19,541.63	\$139,147.08
	63	Old Crow	\$12,897.50	\$66.25	\$12,963.75	2%	\$2,118.07	\$15,081.82
	65	Pelly Crossing	\$49,851.14	\$256.07	\$50,107.21	8%	\$8,186.72	\$58,293.93
	67	Ross River	\$27,842.64	\$143.02	\$27,985.66	5%	\$4,572.41	\$32,558.07
	71	Tagish	\$31,432.84	\$161.46	\$31,594.30	5%	\$5,162.01	\$36,756.31
	75	Upper Liard	\$8,335.00	\$42.81	\$8,377.81	1%	\$1,368.80	\$9,746.62
	88	Deep Creek	\$101,743.63	\$522.62	\$102,266.25	17%	\$16,708.69	\$118,974.94
99	Territory Wide	\$46,521.36	\$238.96	\$46,760.32	8%	\$7,639.90	\$54,400.22	
			\$608,926.60	\$3,127.85	\$612,054.45		\$100,000.00	\$712,054.45

LEGEND

Burn Facility
Manned Transfer Station
Unmanned Transfer Station

Notes:

"Territory Wide" encompasses smaller unincorporated waste facilities, including Johnson's Crossing, Braeburn, Stewart Crossing, and Silver City.



TABLE 4: NEW REGIONAL LANDFILL COST ESTIMATE

Task	Description	Assumption/Comment	Unit	Amount	Unit Rate	Cost Per Unit	Total Cost
LANDFILL CELL SIZE (m ³)		15,000					
CELL DEPTH (m)		4.5					
CELL LENGTH (m)		58.0					
CELL WIDTH (m)		58.0					
Site preparation							
Mobilization/Demobilization		Depends on contractors fleet location and availability (highly variable)		1	\$ 50,000.00	\$ 50,000.00	\$ 50,000.00
Sub Total							\$ 50,000
Earthworks							
Stripping and Clearing	Labour only	Assumed 300 mm over the footprint area, plus 5 m are beyond perimeter	m ³	1,190.70	\$ 3.50	\$ 4,167.45	\$ 8,334.90
Cut and Fill Requirements	Supply and labour	Excavation, transport, and placement of soil (10% extra volume to cell size)	m ³	16,500.00	\$ 9.00	\$ 148,500.00	\$ 148,500.00
Installation of Compacted Soil Liner	Labour only	Volume of soil from within footprint area (1 m thick)	m ³	3,969.00	\$ 13.50	\$ 53,581.50	\$ 53,581.50
Sub Total							\$ 210,416
Geomaterials							
Excavation of leakage drainage	Labour only		m	58.00	\$ 20.00	\$ 1,160.00	\$ 2,320.00
Geotextile wrapping for leakage pipes	Supply and labour	6 oz. geotextile	m ²	232.00	\$ 2.00	\$ 464.00	\$ 928.00
Pipe 150mm (w/ end caps)	Material only		m	58.00	\$ 5.00	\$ 580.00	\$ 1,160.00
Pipe 375mm (w/ end caps)	Material only		m	58.00	\$ 5.00	\$ 580.00	\$ 1,160.00
Backfill leakage drainage	Supply and labour		m	58.00	\$ 22.00	\$ 1,276.00	\$ 2,552.00
Anchor Trench excavation and backfill	Labour only	Perimeter of cell plus 2 m on each side	m	240.00	\$ 50.00	\$ 12,000.00	\$ 12,000.00
Supply and Installation of geo-composite	Supply and labour	1 sided, composed of geonet and geotextile	m ²	3,969.00	\$ 7.00	\$ 27,783.00	\$ 27,783.00
Supply and Installation of geomembrane	Supply and labour	60 mil HDPE	m ²	3,969.00	\$ 10.00	\$ 39,690.00	\$ 39,690.00
Supply and installation of geotextile	Supply and labour	6 oz. geotextile	m ²	3,969.00	\$ 2.00	\$ 7,938.00	\$ 7,938.00
Sandbags (filling and supplying sand)		For liner ballasting	lump	1.00	\$ 6,000.00	\$ 6,000.00	\$ 6,000.00
Sub Total							\$ 101,531
Surface improvements							
Drainage Improvements	Labour only	Assumed to be required for landfill cell perimeter plus internal roads	m	348	\$ 25.00	\$ 8,700.00	\$ 8,700.00
Subtotal							\$ 8,700
MISCELLANEOUS							
Site Investigation and Approval Preparation		Siting, drilling, results analysis, approval prep. and regulatory liaison	lump	1	\$ 150,000.00	\$ 150,000.00	\$ 150,000.00
Engineering Fees		Engineering Design	lump	1	\$ 50,000.00	\$ 50,000.00	\$ 50,000.00
Groundwater Monitoring Wells	Labour and material	Assumed 8 required	unit	8	\$ 3,000.00	\$ 24,000.00	\$ 24,000.00
Surface Water Pond	Labour and material	Assumed 35% of cell capacity	m ³	5,250	\$ 13.50	\$ 70,875.00	\$ 70,875.00
Fencing	Labour and material	Assumed perimeter of cell x 8	m	1,856	\$ 21.00	\$ 38,976.00	\$ 38,976.00
Road Construction	Labour and material	Assumed perimeter of landfill cell x 2.	m	116	\$ 45.00	\$ 5,220.00	\$ 5,220.00
Weigh Scales	Supply and install	70 ft truck scale	lump	1	\$ 75,000.00	\$ 75,000.00	\$ 75,000.00
Scalehouse	Supply and install	100 sqft	lump	1	\$ 10,000.00	\$ 10,000.00	\$ 10,000.00
Office Building	Supply and install	1000 sqft	lump	1	\$ 100,000.00	\$ 100,000.00	\$ 100,000.00
Maintenance Building	Supply and install	2500 sqft	lump	1	\$ 180,000.00	\$ 180,000.00	\$ 180,000.00
Signage	Material		lump sum	1.00	\$ 2,500.00	\$ 2,500.00	\$ 2,500.00
Lighting	Power supply and lighting		lump sum	\$1.00	\$ 35,000.00	\$ 35,000.00	\$ 35,000.00
Line location	Labour	1 day assumed	lump	1	\$ 2,000.00	\$ 2,000.00	\$ 2,000.00
As-Built Survey	Labour	As built survey and construction surveying	lump	1	\$ 2,500.00	\$ 2,500.00	\$ 2,500.00
Note:							
Construction costs are highly variable and may differ significantly in any given year.							
Subtotal							\$ 746,071
SUBTOTAL							\$ 1,116,718
Contingency (20%)							\$ 223,344
TOTAL COST							\$ 1,340,062

TABLE 5: NEW LANDFILL CELL CONSTRUCTION COST ESTIMATE

Task	Description	Assumption/Comment	Unit	Amount	Unit Rate	Cost per unit	Total cost
LANDFILL CELL SIZE (m³) 8,000							
CELL DEPTH (m) 4.5							
CELL LENGTH (m) 43.0							
CELL WIDTH (m) 43.0							
Site preparation							
Mobilization/Demobilization		Depends on contractors fleet location and availability		1	\$ 50,000.00	\$ 50,000.00	\$ 50,000.00
Sub Total							\$ 50,000
Earthworks							
Stripping and Clearing	Labour only	Assumed 300 mm over the footprint area, plus 5 m area beyond perimeter	m ³	691.20	\$ 3.50	\$ 2,419.20	\$ 4,838.40
Cut and Fill Requirements	Supply + labour	Excavation, transport, and placement of soil (10% extra volume to cell size)	m ³	8,800.00	\$ 9.00	\$ 79,200.00	\$ 79,200.00
Installation of Compacted Soil Liner	Labour only	Volume of soil from within footprint area (1 m thick)	m ³	2,304.00	\$ 13.50	\$ 31,104.00	\$ 31,104.00
Closure of Previous Cell	Labour only	Assumed same size as current cell, 1 m cap of fill	m ²	2,304.00	\$ 7.50	\$ 17,280.00	\$ 17,280.00
Topsoil for Capped Cell	Supply + labour	Assumed 150 mm on surface	m ²	345.60	\$ 2.50	\$ 864.00	
Vegetation of Capped Cell	Supply + labour	Hydroseeding	m ²	2,304.00	\$ 0.45	\$ 1,036.80	\$ 1,036.80
Sub Total							\$ 133,459
Surface improvements							
Drainage Improvements	Labour only	Assumed as perimeter of landfill cell	m	172	\$ 25.00	\$ 4,300.00	\$ 4,300.00
Subtotal							\$ 4,300
MISCELLANEOUS							
Engineering Fees		Cell design	lump	1	\$ 20,000.00	\$ 20,000.00	\$ 20,000.00
Additional Expansion Factor		Includes fencing alterations, road expansion, monitoring well reclamation and re-drilling, etc. (Assumed 15% of earthworks, surface improvements, mobilization)	lump	1	\$ 28,163.88	\$ 28,163.88	\$ 28,163.88
As -Built Survey		As built survey and construction surveying	lump	1	\$ 2,500.00	\$ 2,500.00	\$ 2,500.00
Note:							Subtotal
Construction costs are highly variable and may differ significantly in any given year.							\$ 50,664
SUBTOTAL							\$ 238,423
Contingency (20%)							\$ 47,685
TOTAL COST							\$ 286,108

TABLE 6: ANNUAL OPERATIONS AND MAINTENANCE COST ESTIMATE FOR A REGIONAL LANDFILL

EXISTING INCORPORATED LANDFILL OPERATION AND MAINTENANCE COSTS												
LOCATION:	Site Location	Land Zoning	Maintained by Municipal Staff	Maintained by Contractor	Areas/Communities Serviced	Approx. No. of Regular Users	Quantity of Solid Waste (A) (tonnes/yr)	Environmental Monitoring	Electric Fence In Place	Annual O&M Budget	Budget per User	Budget per Tonne
Carmacks	1.2 km southwest of Village, east side of highway.	Solid Waste Site	Yes		Carmacks and surrounding area.	490	343	No	No	\$10,000	\$20.41	\$29.15
Dawson City	A few km south of Town, west side of Klondike Hwy.	YTG Reserve No. MI - Industrial Business	Yes		Dawson City, Klondike Valley and surrounding area.	3,000	2,550	Yes	Yes	\$80,000	\$3.33	\$3.92
Faro		Lot 1027	Yes		Faro and surrounding area.	400	350	No	Yes		\$25.00	\$28.57
Haines Junction	Near km 1630 Alaska Hwy. East side.	YTG Reserve No. 023 PD - community use	Yes		Haines Junction and surrounding area.	200	140	No	Yes	\$25,450	\$50.00	\$71.23
Mayo	km 49.6 Silver Trail	Federal Reserve 105M12/38 NOZ (no zoning)	Yes		Mayo and surrounding area.	600	365	No	Yes	\$2,500	\$16.67	\$27.40
Teslin	1 km south east of Nisutlin River Bridge	Federal Reserve 105C02/29	Yes		Teslin and surrounding area.	600	510	No	Yes	\$10,000	\$16.67	\$19.61
Watson Lake	Near km 1022 Alaska Hwy north side (Auburn Drive)	Federal Reserve 105A02/42	Yes		Watson Lake and surrounding area.	1,800	1,600	No	No	\$45,000	\$5.56	\$6.25
Whitehorse	North on Alaska Hwy, first left after Fish Lake Road	Lot 1166 105D/11 Public Utility zoning		Yes	City of Whitehorse	21,000	22,500	Yes	Yes	\$590,000	\$0.48	\$0.44

Notes:

^(A) As provided by municipalities in Solid Waste Permit Applications and converted using 135 kg/m³. Or, where unknown, based on a generation rate of 0.85 tonnes per person per year (E&DB Internal Report on Ban on Burning, May 1997).

Solid Waste Permits are pending - applications were submitted in April 2000.

Table supplied by Community Services (2008). Blank cells represent missing or unknown information.

			AVG TONNES/YR	AVERAGE COST/YR	
AVG.	\$25.75	\$35.19	341.68	\$12,024.14	YEAR 2000
	\$31.00	\$42.37	341.68	\$14,477.06	YEAR 2008

COMPARATIVE ESTIMATE

Source: Appendix A - Guidelines for Establishing Transfer Stations for Municipal Solid Waste, Government of BC, Ministry of Environment, February 1996, Updated 2005

1,000 TPY (Tonnes Per Year) Engineered Landfill

	1996	2008	
Staffing and Equipment	\$ 34,300.00 /yr	\$ 44,538.55 /yr	Assumed to be equal to O&M cost highlighted in table above
Assumes compaction equipment at \$90/hr, one hour per day, 3 days per week.			
Inspection and maintenance six hours per week at \$20/hr.			

\$44,538.55 / 1000 tonnes
\$ 44.54

ADDITIONAL LANDFILL COSTS (FOR AN ENGINEERED LANDFILL)

	1996	2008
Cover Materials	\$ 2,200.00 /yr	\$ 2,856.70 /yr
Environmental Monitoring Program	\$ 4,000.00 /yr	\$ 5,194.00 /yr
Annual Report	\$ 5,000.00 /yr	\$ 6,492.50 /yr
Litter Control Fencing	\$ 300.00 /yr	\$ 389.55 /yr
Closure Fund	\$ 4,500.00 /yr	\$ 5,843.25 /yr
Post Closure Fund	\$ 900.00 /yr	\$ 1,168.65 /yr
General Site Maintenance	\$ 600.00 /yr	\$ 779.10 /yr
TOTAL	\$ 53,796.00 /yr	\$ 69,270.30 /yr

PLUS

Considering additional costs, this amount totals:
\$ 69.27 This cost is used for estimating within the model.
\$ 60,000.00 Year-round staffing for scalehouse.

MISSING COST - SCALE OPERATOR/SITE SUPERVISOR

\$ 60,000.00 /yr Assumed salaried cost. Fixed for all landfills.

TOTAL O+M

\$ 129,270.30 /yr Per Regional Landfill, Assuming 1,000 tonnes per year.

Annual Operating Costs

\$ 69.27 /tonne plus \$ 60,000.00 /yr salary

Comparable

TABLE 7: NEW TRANSFER STATION COST ESTIMATE

ESTIMATE NUMBER 1

<u>Open Top Container</u>	
Site Development at Existing Site	
Site Grading	\$ 2,500.00
Access Road	\$ 5,500.00
Fencing	\$ -
Retaining Structure (2-40yd bin system)	
Granular Base	\$ 7,300.00
Concrete Slabs	\$ 10,000.00
Concrete Footings	\$ 4,700.00
Concrete Retaining Wall	\$ 20,000.00
Supply and Place Fill	\$ 13,500.00
Safety Railings	\$ 2,000.00
Utilities	
110 v Power Supply (accessible from road)	\$ 7,300.00
Site Finishes	
Perimeter Fence	\$ -
Landscaping	\$ 2,000.00
Signs	\$ 500.00

Operation and Maintenance

Haul Costs	
Hours per Week	2
Number of Weeks	52
Haul Cost	\$ 90.00
Total	\$ 9,360.00
Maintenance	
Hours per Week	1
Number of Weeks	52
Labour Cost	\$ 25.00
Total	\$ 1,300.00

	2001 Cost	2008 Cost
TOTAL CAPITAL	\$ 75,300.00	\$ 88,357.02
TOTAL O&M	\$ 10,660.00	\$ 12,508.44

ESTIMATE NUMBER 2

February 1996 -- Update to 2008 With Bank of Canada Inflation Calculator
100 TPY Rolloff Station

Capital		1996	2008
Site Preparation	\$ 5,000.00	\$	6,492.50
Access Road and Ramp	\$ 3,600.00	\$	4,674.60
Retaining Wall	\$ 7,000.00	\$	9,089.50
Concrete Pad	\$ 5,600.00	\$	7,271.60
Rolloff Bins (Two 50 yd3)	\$ 11,000.00	\$	14,283.50
Rolloff Bin Covers	\$ 10,200.00	\$	13,244.70
Purchase Effort + Taxes	\$ 16,000.00	\$	20,776.00
Signs	\$ 200.00	\$	259.70
Subtotal	\$ 58,600.00	\$	76,092.10
Contingency	10%	\$ 5,860.00	\$ 7,609.21
Engineering	15%	\$ 9,669.00	\$ 12,555.20
TOTAL	\$	\$ 68,269.00	\$ 88,647.30

	1996 Cost	2008 Cost
TOTAL CAPITAL	\$ 68,269.00	\$ 88,647.30

Source: Solid Waste Strategy, Gartner Lee Limited, September 2001

Source: Appendix B - Guidelines for Establishing Transfer Stations for Municipal Solid Waste, Government of BC, Ministry of Environment, February 1996, Updated 2005

TABLE 8: INCINERATOR FACILITY COST ESTIMATE

ESTIMATE NUMBER 1 - 3.2 TONNE CAPACITY

Source: Burning Garbage and Land Disposal in Rural Alaska, Alaska Energy Authority, May 2004

<u>Incineration System</u>		<u>Operation and Maintenance</u>	
BOS Fabrication and Freight	\$207,400.00	Fuel	
Metal Building, complete	\$325,400.00	Burns per Year	140.00
Fire Suppression System	\$41,000.00	Gallons per Burn	34.00
Water, Sewer, and Fuel Storage	\$20,700.00	Cost per Gallon	\$1.35
Conveyor System	\$18,700.00	Total	\$6,426.00
Operator Training	\$1,500.00	Labour	
TOTAL CAPITAL	\$614,700.00	Burns per Year	140.00
<u>Other Solid Waste System Items (Optional)</u>		Hours per Burn	5.00
Landfill Engineering and Permitting	\$60,000.00	Dollars per Hour	\$25.00
Landfill Site Control	\$81,300.00	Total	\$17,500.00
Landfill Construction	\$75,000.00	Electricity	\$2,500.00
Dump Closure and Ash Monofill	\$34,400.00	Materials and Supplies	\$3,000.00
Waste Collection Equipment	\$55,400.00	Training	\$500.00
Waste Oil Burner	\$12,700.00	TOTAL O&M	\$29,926.00

ESTIMATE NUMBER 2 - 1.0 TONNE CAPACITY

Quote from Eco Waste Solutions (October 20, 2008):	\$457,300.00
Additional Comments	100 gallons diesel required per burn. Alternatively, 24 kWh per burn electricity required.

ADJUSTED COST ESTIMATE BASED ON BLEND OF ABOVE SOURCES

<u>Incineration System</u>		<u>Operation and Maintenance</u>	
Unit Cost	\$536,000.00	Fuel	
		Burns per Year	91.98
		Gallons per Burn	100.00
		Cost per Gallon	\$3.37
		Total	\$30,984.84
		Labour	
		Burns per Year	91.98
		Hours per Burn	5.00
		Dollars per Hour	\$25.00
		Total	\$11,497.50
		Training	\$500.00
TOTAL CAPITAL	\$536,000.00	TOTAL O&M	\$42,982.34



TABLE 9: FUTURE COST PROJECTIONS FOR CURRENT FACILITIES

	Annual	2008 to 2013	2008 to 2018	2008 to 2023	2008 to 2028
<i>Stats Canada Industrial Product Price Index (IPPI)</i>	<i>0.021</i>	<i>0.11</i>	<i>0.231</i>	<i>0.366</i>	<i>0.515</i>
Burning Vessel/Trench Model	2008	2013	2018	2023	2028
Average Total Cost (Based on 12 sites)	\$ 28,259.48	\$ 31,368.02	\$ 34,787.42	\$ 38,602.45	\$ 42,813.11
Cost Per User		\$ 13.32	\$ 14.18	\$ 15.12	\$ 16.19
Cost Per Tonne		\$ 11.99	\$ 12.76	\$ 13.61	\$ 14.57
Manned Transfer Station Model	2008	2013	2018	2023	2028
Average Total Cost (Based on Marsh Lake and Mt. Lorne)	\$ 99,782.76	\$ 110,758.87	\$ 122,832.58	\$ 136,303.25	\$ 151,170.89
Cost Per User		\$ 81.77	\$ 87.03	\$ 92.83	\$ 99.37
Cost Per Tonne		\$ 73.60	\$ 78.33	\$ 83.55	\$ 89.44
Unmanned Transfer Station Model	2008	2013	2018	2023	2028
Average Total Cost (Based on Deep Creek)	\$ 118,974.94	\$ 132,062.18	\$ 146,458.15	\$ 162,519.77	\$ 180,247.03
Cost Per User		\$ 336.38	\$ 358.00	\$ 381.85	\$ 408.78
Cost Per Tonne		\$ 302.74	\$ 322.20	\$ 343.67	\$ 367.91

Notes:

Information based on existing contracts for unincorporated waste facilities (Community Infrastructure Branch 2008).

TABLE 10: FUTURE COST PROJECTIONS FOR WASTE FACILITY ALTERNATIVES

	Annual	2008 to 2013	2008 to 2018	2008 to 2023	2008 to 2028
<i>Stats Canada Industrial Product Price Index (IPPI)</i>	0.021	0.11	0.231	0.366	0.515
Landfill Cell Construction (8,000 m³)	2008	2013	2018	2023	2028
Capital Cost	\$ 286,107.70	\$ 317,579.54	\$ 352,198.57	\$ 390,823.11	\$ 433,453.16
Annual O&M (Based on Haines Junction Budget)	\$ 25,450.00	\$ 28,249.50	\$ 31,328.95	\$ 34,764.70	\$ 38,556.75
Incinerator Facility	2008	2013	2018	2023	2028
Capital Cost	\$ 536,000.00	\$ 594,960.00	\$ 659,816.00	\$ 732,176.00	\$ 812,040.00
Annual O&M	\$ 42,358.78	\$ 47,018.25	\$ 52,143.66	\$ 57,862.10	\$ 64,173.56
New Transfer Station Establishment	2008	2013	2018	2023	2028
Capital Cost	\$ 88,647.30	\$ 98,398.50	\$ 109,124.82	\$ 121,092.21	\$ 134,300.65
Annual O&M	\$ 99,782.76	\$ 110,758.87	\$ 122,832.58	\$ 136,303.25	\$ 151,170.89

TABLE 11: EQUIVALENT CARBON EMISSION COMPARISONS ON A PER TONNE OF WASTE BASIS

Tonnes eCO ₂ / Tonne of waste	Net Recycling Emissions	Net Composting Emissions	Net Anaerobic Digestion Emissions	Net Combustion Emissions	Net Landfilling Emissions (NLE) National Average	NLE Without Landfill Gas Collection	NLE With Landfill Gas Collection	NLE With Landfill Gas Collection and Energy Recovery
Newsprint	-0.3	0	-0.38	-0.05	0.23	0.32	0.09	0.08
Fine Paper	-0.36	0	-0.22	-0.04	1.35	1.88	0.48	0.45
Cardboard	-0.21	0	-0.2	-0.04	1.19	1.66	0.43	0.4
Other Paper	-0.25	0	-0.12	-0.04	1.22	1.7	0.44	0.4
Aluminum	-6.49	0	0.13	0.01	0.01	0.01	0.01	0.01
Steel	-1.18	0	0.13	-1.03	0.01	0.01	0.01	0.01
Copper Wire	-4.1	0	0.13	0.01	0.01	0.01	0.01	0.01
Glass	-0.1	0	0.13	0.01	0.01	0.01	0.01	0.01
HDPE	-2.27	0	0.13	2.89	0.01	0.01	0.01	0.01
PET	-3.63	0	0.13	2.17	0.01	0.01	0.01	0.01
Other Plastic	-1.8	0	0.13	2.67	0.01	0.01	0.01	0.01
Food Scraps	0	0.02	0.02	0.02	0.89	1.23	0.32	0.3
Yard Trimmings	0	0.02	-0.04	0.01	0.43	0.59	0.16	0.15
White Goods	-1.46	0	0.13	-0.26	0.01	0.01	0.01	0.01
Personal Computers	-1.6	0	0.13	0.41	0.01	0.01	0.01	0.01
Televisions	-0.23	0	0.13	0.75	0.01	0.01	0.01	0.01
Microwaves	-1.27	0	0.13	-0.55	0.01	0.01	0.01	0.01
VCRs	-0.95	0	0.13	0.15	0.01	0.01	0.01	0.01
Tires	-3.29	0	0.13	-0.49	0.01	0.01	0.01	0.01

TABLE 12: TYPICAL MODEL INPUT SUMMARY

YUKON GOVERNMENT
DEPARTMENT OF COMMUNITY SERVICES



WASTE ALTERNATIVE EVALUATION MODEL

**Note: This model is only to be used in conjunction with the Comprehensive Solid Waste Study (EBA 2009) and knowledge of the findings, methods, and assumptions within.

INSTRUCTIONS

1. Complete all the information highlighted in green within this spreadsheet.
2. Ensure all information on the "Site Summaries" tab is up to date and accurate.
3. View "Results" tab for model output summary.

FACILITY INFORMATION

FACILITY TO BE EVALUATED	Upper Liard
CURRENT FACILITY TYPE	Burn in a Burning Facility and Bury in Trench

Is the facility to be evaluated as part of a circuit (see table below)?	Watson Lake
How many facilities in the network?	1
Number of hauls per year?	12
Current Price of Gas (\$/L)	\$ 1.00

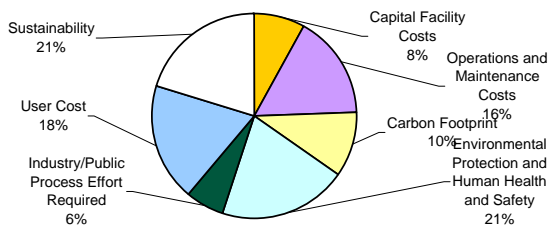
CIRCUIT INFORMATION

Waste Circuit Table -- 2008			
	Circuit	Facilities Included	Current Type of Facility
<p>See "Waste Sites Map" tab for larger depiction.</p> <ul style="list-style-type: none"> ● Unincorporated Waste Facilities. ● Incorporated Communities. 	Whitehorse	Deep Creek Mt. Lorne Marsh Lake Carcross Tagish Johnson's Crossing	Supervised Transfer Station Supervised Transfer Station Supervised Transfer Station Burn and Bury in Trench Burning Vessel Burning Vessel
	Haines Junction	Beaver Creek Burwash Landing Destruction Bay Silver City Canyon Creek Champagne	Burning Vessel Burning Vessel Unsupervised Transfer Station Burning Vessel Burning Vessel Burning Vessel
	Carmacks	Braeburn Pelly Crossing	Burning Vessel Burning Vessel
	Mayo	Keno City Stewart Crossing	Burning Vessel Burning Vessel
	Faro	Ross River	Burning Vessel
	Watson Lake	Upper Liard	Burning Vessel
	Other	Old Crow	Burning Vessel

MODEL WEIGHTING FACTORS

Please rank the following according to importance (1 to 10, each):

CONSIDERATION	WEIGHT
Capital Facility Costs	4
Operations and Maintenance Costs	8
Carbon Footprint	5
Environmental Protection and Human Health and Safety	10
Industry/Public Process Effort Required	3
User Cost	9
Sustainability	10



WASTE ALTERNATIVE CHARACTERISTICS EVALUATION

Please score the following categories for each waste alternative:

	Burn and Bury in Trench	Burn in a Burning Facility and Bury in Trench	Sanitary Landfill Operations	Transfer Station and Regional Solid Waste Disposal Site	Incineration
Is the facility able to accommodate expected waste volumes? (YES or NO)	YES	YES	YES	YES	YES
Is the facility capable of implementing change? (YES or NO)	YES	YES	YES	YES	YES
Does the facility meet regulatory standards in the Yukon? (YES or NO)	YES	YES	YES	YES	YES
How does the respective facility alternative score with respect to the Industry/Public Process Effort Required? (1 to 10, 1 = Easy, 10 = Difficult)	8	8	5	2	6

TABLE 12: TYPICAL MODEL INPUT SUMMARY

YUKON GOVERNMENT
DEPARTMENT OF COMMUNITY SERVICES



WASTE ALTERNATIVE EVALUATION MODEL

WASTE COMPOSITIONS

Please provide the waste composition distribution below:

Current Source: City of Whitehorse, Residential (Urban and Rural Combined) SWAP Data, 1994

Newsprint	5.2%
Fine Paper	0.0%
Cardboard	1.8%
Other Paper	20.7%
Aluminum	0.9%
Steel	3.0%
Copper Wire	0.5%
Glass	5.4%
HDPE	1.1%
PET	0.5%
Other Plastic	7.1%
Food Scraps	27.8%
Yard Trimmings	10.2%
White Goods	0.1%
Personal Computers (Estimated - No Data Available)	0.1%
Televisions (Estimated - No Data Available)	0.1%
Microwaves (Estimated - No Data Available)	0.1%
VCRs (Estimated - No Data Available)	0.1%
Tires (Estimated - No Data Available)	0.5%

Note:

Table above depicts only those wastes with a corresponding emission estimate. Carbon emission estimates not available for all waste types.

ESTABLISHMENT OF RISK RATINGS

Please rate the following hazards in terms of risk:

Waste Acceptance Risks	
What level of risk is associated with the acceptance of Domestic Waste at a facility?	Low Risk
What level of risk is associated with the acceptance of Metals at a facility?	Low Risk
What level of risk is associated with the acceptance of Construction Debris at a facility?	Low Risk
What level of risk is associated with the acceptance of Tires at a facility?	Low Risk
What level of risk is associated with the acceptance of Batteries at a facility?	Moderate Risk
What level of risk is associated with the acceptance of Waste Oil at a facility?	Moderate Risk
What level of risk is associated with the acceptance of Household Hazardous Waste?	High Risk
What level of risk is associated with the acceptance White Goods (Appliances)?	Low Risk
Operational Risks	
Risk associated with the burning of wastes at a facility?	Moderate Risk
Risk associated with NOT burning wastes at a facility? (i.e. risk of waste operations outside the burning of waste)	Low Risk
Risk associated with having a burning vessel at a facility? (i.e. the risk of the burning vessel itself, beyond risks associated with burning waste)	Moderate Risk
Risk associated with NOT having a water tank at a burning facility?	High Risk
Risk associated with having poor geology at a facility?	Moderate Risk
Risk associated with NOT having groundwater monitoring controls in place?	Moderate Risk
Risk associated with NOT having air quality monitoring controls in place?	Moderate Risk
Risk associated with NOT having surface water quality monitoring controls in place?	Moderate Risk
Risk associated with NOT having an electric fence in place at a facility?	Moderate Risk
Risk associated with NOT having controlled access hours at a facility?	Moderate Risk
Other risks	
Risk of illegal dumping if regional landfill is too far from community?	High Risk

SCORING SUMMARY	
Low Risk	1
Risk	5
High Risk	10



TABLE 13: SUSTAINABILITY SUMMARY FOR WASTE MODEL

Summary for All Community Locations

SUSTAINABILITY TABULATION	Burn and Bury in Trench	Burn in a Burning Facility and Bury in Trench	Sanitary Landfill Operations	Transfer Station and Regional Solid Waste Disposal Site	Incineration
Financial Sustainability	Medium	Medium	Medium	Medium	Medium
Environmental Sustainability	Low	Low	Medium	High	Medium
User Viability	Low	Low	Medium	High	Medium
Flexibility	Medium	Medium	Medium	High	Low
Total Env. Sustainability Rating	12	12	20	35	16

SCORING LEGEND

High	10
Medium	5
Low	1

LEGEND

User Input

TABLE 14: TYPICAL MODEL OUTPUT SUMMARY

FACILITY: **Upper Liard** Current Number of Facility Users 250
Model Output Information Summary Current Cost per User \$ 38.82

		Burn and Bury in Trench	Burn in a Burning Facility and Bury in Trench	Sanitary Landfill Operations	Transfer Station and Regional Solid Waste Disposal Site	Incineration	
RANK		N/A	4	3	1	2	
SUMMARY INFORMATION	Expense	Capital Operations TOTAL	N/A N/A N/A	\$ - \$ 9,704 \$ 9,704	\$ 1,340,062 \$ 80,276 \$ 1,420,338	\$ 198,944 \$ 106,450 \$ 305,394	\$ 536,000 \$ 76,744 \$ 612,744
	Full Regional Cost	Capital Operations TOTAL		\$ 1,340,062 \$ 79,522 \$ 1,419,584			
	Carbon Footprint	Waste Acceptance (tonnes eCO ₂ /tonne) Energy Use (tonnes eCO ₂ /tonne) Waste Collection and Transportation (tonnes eCO ₂ /tonne) Landfill Heavy Equipment (tonnes eCO ₂ /tonne) Average User Travel Distance (tonnes eCO ₂ /km) TOTAL (tonnes eCO₂)	N/A N/A N/A N/A N/A N/A	18.4 0.0 0.3 0.0 19.5 38.2	141.8 0.1 0.0 0.9 39.0 181.9	141.8 0.0 0.7 0.0 19.5 162.0	18.4 0.1 0.3 0.0 19.5 38.4
	Environmental and Human Safety Risk Rating	Wastes Accepted - Hazard Points Operational Practices - Hazard Points Setback Hazard Points Total	N/A N/A N/A N/A	14 25 7.5 46.5	13 15 7.5 35.5	12 5 3.75 20.75	12.5 17.5 7.5 37.5

DETAILED SCORING SUMMARY FOR FACILITY ALTERNATIVE RANKINGS

Alternative	Burn and Bury in Trench		Burn in a Burning Facility and Bury in Trench		Sanitary Landfill Operations		Transfer Station and Regional Solid Waste Disposal Site		Incineration	
	Score	Total	Score	Total	Score	Total	Score	Total	Score	Total
Musts										
Facility must be able to accommodate expected waste volumes.	N/A	-	YES	-	YES	-	YES	-	YES	-
Facility must be capable of implementing change.	N/A	-	YES	-	YES	-	YES	-	YES	-
Facility must meet regulatory standards in the Yukon	N/A	-	YES	-	YES	-	YES	-	YES	-
Wants - Facility Rankings										
Facility Costs	N/A	N/A	10.0	40.0	2.5	10.0	7.5	30.0	5.0	20.0
Annual Facility Costs (Operations and Maintenance)	N/A	N/A	10.0	80.0	5.0	40.0	2.5	20.0	7.5	60.0
Carbon Footprint	N/A	N/A	10.0	50.0	2.5	12.5	5.0	25.0	7.5	37.5
Environmental Health and Safety	N/A	N/A	2.5	25.0	7.5	75.0	10.0	100.0	5.0	50.0
Sustainability	N/A	N/A	0.0	0.0	7.5	75.0	10.0	100.0	5.0	50.0
Limits										
User Cost	N/A	N/A	0.0	0.0	2.0	-18.0	0.0	0.0	0.0	0.0
Industry/Public Process Effort	N/A	N/A	-8.0	-24.0	-5.0	-15.0	-2.0	-6.0	-6.0	-18.0
Total Points (for Developing Rank)		N/A		171.0		179.5		269.0		199.5

Indicates existing facility type.

TABLE 15: WASTE MODEL RESULTS SUMMARY

LOCATION:	Beaver Creek	Braeburn	Burwash Landing	Canyon Creek	Carcross	Champagne	Deep Creek	Destruction Bay Metals	Johnson's Crossing	Keno City
Current Facility Type	Burn in a Burning Facility and Bury in Trench	Burn in a Burning Facility and Bury in Trench	Burn in a Burning Facility and Bury in Trench	Burn in a Burning Facility and Bury in Trench	Burn and Bury in Trench	Burn in a Burning Facility and Bury in Trench	Transfer Station and Regional Solid Waste Disposal Site	Transfer Station and Regional Solid Waste Disposal Site	Burn in a Burning Facility and Bury in Trench	Burn in a Burning Facility and Bury in Trench
Number of Users	130	15	127	25	430	50	400	127	35	20
Cost per User	\$ 92.62	\$ -	\$ 180.96	\$ 1,669.31	\$ 106.40	\$ 951.65	\$ 296.13	\$ 90.90	\$ -	\$ 211.07
Number 1 Ranked Alternative	Transfer Station and Regional Solid Waste Disposal Site	Transfer Station and Regional Solid Waste Disposal Site	Transfer Station and Regional Solid Waste Disposal Site	Transfer Station and Regional Solid Waste Disposal Site	Transfer Station and Regional Solid Waste Disposal Site	Transfer Station and Regional Solid Waste Disposal Site	Transfer Station and Regional Solid Waste Disposal Site	Transfer Station and Regional Solid Waste Disposal Site	Transfer Station and Regional Solid Waste Disposal Site	Transfer Station and Regional Solid Waste Disposal Site
Alternative Score	269	259	269	259	236.5	269	311.5	351.5	259	259
Capital Cost	\$ 123,643.99	\$ 88,647.30	\$ 123,643.99	\$ 88,647.30	\$ 306,516.08	\$ 88,647.30	\$ -	\$ -	\$ 88,647.30	\$ 88,647.30
Operation Cost	\$ 111,382.15	\$ 107,494.15	\$ 108,430.15	\$ 106,630.15	\$ 107,620.15	\$ 107,476.15	\$ 119,262.32	\$ 13,434.44	\$ 108,520.15	\$ 107,260.15
User Cost	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -
Carbon Footprint	203.73	16.26	91.32	20.85	306.99	42.50	227.59	185.44	38.84	20.12
Environmental Risk Score	12.5	13.5	14.5	12	18.5	17	20.75	17	12.5	15.75
Number 2 Ranked Alternative	Incineration	Incineration	Incineration	Sanitary Landfill Operations	Burn and Bury in Trench	Incineration	Sanitary Landfill Operations	Sanitary Landfill Operations	Incineration	Sanitary Landfill Operations
Alternative Score	194.5	194.5	194.5	239.5	171	189.5	216	153	194.5	195.5
Capital Cost	\$ 536,000.00	\$ 536,000.00	\$ 536,000.00	\$ 44,549.94	\$ -	\$ 536,000.00	\$ 212,287.06	\$ 226,313.68	\$ 536,000.00	\$ -
Operation Cost	\$ 48,110.12	\$ 6,114.39	\$ 50,628.83	\$ 5,316.20	\$ 45,753.53	\$ 40,473.33	\$ 27,588.22	\$ 54,012.57	\$ 12,763.99	\$ 1,275.00
User Cost	\$ -	\$ -	\$ -	\$ 8.40	\$ -	\$ -	\$ 15.13	\$ 35.29	\$ -	\$ 20.17
Carbon Footprint	134.24	7.19	25.46	23.11	95.63	15.10	320.16	307.50	18.76	23.78
Environmental Risk Score	31.5	31.5	37.5	27	49.5	35.5	34.5	37.5	33.5	39.75
Number 3 Ranked Alternative	Burn in a Burning Facility and Bury in Trench	Burn in a Burning Facility and Bury in Trench	Burn in a Burning Facility and Bury in Trench	Incineration	Sanitary Landfill Operations	Sanitary Landfill Operations	Incineration	N/A	Burn in a Burning Facility and Bury in Trench	Incineration
Alternative Score	171	171	171	189.5	143	175.5	212	N/A	171	169.5
Capital Cost	\$ -	\$ -	\$ -	\$ 536,000.00	\$ 228,208.59	\$ 89,099.87	\$ 536,000.00	\$ -	\$ -	\$ 536,000.00
Operation Cost	\$ 12,040.34	\$ -	\$ 22,981.77	\$ 30,086.36	\$ 50,348.50	\$ 9,569.16	\$ 98,415.55	\$ -	\$ -	\$ 9,314.33
User Cost	\$ -	\$ -	\$ -	\$ -	\$ 26.89	\$ 24.20	\$ -	\$ -	\$ -	\$ -
Carbon Footprint	134.17	7.18	25.39	5.96	600.42	67.35	111.88	N/A	18.74	9.04
Environmental Risk Score	43	42	49	30.5	37.75	35	36.5	N/A	44	42.5
Number 4 Ranked Alternative	Sanitary Landfill Operations	Sanitary Landfill Operations	Sanitary Landfill Operations	Burn in a Burning Facility and Bury in Trench	Burn in a Burning Facility and Bury in Trench	Burn in a Burning Facility and Bury in Trench	N/A	N/A	Sanitary Landfill Operations	Burn in a Burning Facility and Bury in Trench
Alternative Score	112.5	140.5	130.5	131	121	131	N/A	N/A	140.5	151
Capital Cost	\$ 231,659.67	\$ 63,812.48	\$ 226,313.68	\$ -	\$ 10,000.00	\$ -	\$ -	\$ -	\$ 18,575.12	\$ -
Operation Cost	\$ 23,391.27	\$ 4,083.10	\$ 23,391.27	\$ 41,732.75	\$ 66,533.15	\$ 47,582.70	\$ -	\$ -	\$ 4,138.23	\$ 4,221.47
User Cost	\$ 97.14	\$ 24.54	\$ 42.02	\$ -	\$ -	\$ -	\$ -	\$ -	\$ 43.70	\$ -
Carbon Footprint	464.00	20.03	238.26	5.94	95.63	15.07	N/A	N/A	67.27	9.03
Environmental Risk Score	38	32	38	42	49.5	47	N/A	N/A	34.5	54
Number 5 Ranked Alternative	N/A	N/A	N/A	N/A	Incineration	N/A	N/A	N/A	N/A	N/A
Alternative Score	N/A	N/A	N/A	N/A	107	N/A	N/A	N/A	N/A	N/A
Capital Cost	N/A	N/A	N/A	N/A	\$ 536,000.00	N/A	N/A	N/A	N/A	N/A
Operation Cost	N/A	N/A	N/A	N/A	\$ 155,948.39	N/A	N/A	N/A	N/A	N/A
User Cost	N/A	N/A	N/A	N/A	\$ -	N/A	N/A	N/A	N/A	N/A
Carbon Footprint	N/A	N/A	N/A	N/A	95.87	N/A	N/A	N/A	N/A	N/A
Environmental Risk Score	N/A	N/A	N/A	N/A	40.5	N/A	N/A	N/A	N/A	N/A
	Beaver Creek is located furthest away from the closest incorporated community (Haines Junction) than any other respective community in the Yukon (barring Old Crow). The model indicates that a transfer station is the preferred waste management practice at this facility based on the weightings presently assigned. However, this particular facility may also require additional examination regarding the establishment of an incinerator dependant on the actual cost of transport, as well as the fact that a transfer station would require regular border crossings with the United States, as Beaver Creek is only accessible by road via Alaska.	Braeburn is one of the smaller facilities analyzed in this study, and a large portion of the waste accepted at the facility is generated by a local food establishment. The model indicates a transfer station would be the most suitable alternative for this facility, though whether this waste is transferred to Carmacks or the City of Whitehorse is another discussion point worth addressing. Within the Comprehensive Solid Waste Study this facility is singled out as a potential candidate for an unsupervised transfer station because of the low population base.	Burwash Landing, like Beaver Creek, is located a relatively great distance from the nearest incorporated community. This distance is more reasonable than the comparison, however, which indicates that the preferred alternative of a transfer station is a more supported recommendation. As Destruction Bay currently receives more of the bulk wastes in this geographic region, it is recommended that consideration be given to Burwash Landing space limitations (if applicable) should a change in practices at Destruction Bay be implemented (i.e. site closure).	Canyon Creek is located in close proximity to Haines Junction and Champagne. While the model indicates that a transfer station is the preferred waste handling practice for this facility, the option of a regional landfill also scores highly. As such, consideration should be given to Canyon Creek regarding site closure in favour of having residents deposit their waste in Haines Junction, or alternatively in Champagne.	The Carcross facility is the only "burn and bury in trench" facility remaining in the Yukon, though for some time it has been known that the residents of this community would prefer a transfer station. The waste model supports this preference, which indicates this alternative would be suitable. Within the Comprehensive Solid Waste Study, it is recommended that the Carcross facility be amalgamated with the Tagish facility as a single transfer station due to the proximity of the two communities, which would provide cost savings to Community Services and allow a higher level of service to facility users.	The Champagne facility, much like Canyon Creek, services a small number of users at a high per user cost. This facility is located slightly further from Haines Junction, but still within relative proximity. Additionally, Champagne is a likely destination for waste from Canyon Creek if that facility is closed. These factors combine to indicate that a transfer station would likely be the most viable facility alternative available.	The Deep Creek facility preference is clearly identified as a transfer station, which is the current practice in place. It is not recommended that a change in practice be considered at this time.	The Destruction Bay facility is unique in that it is not quite a transfer station, but currently accepts major construction and demolition projects. This facility is within 15 km of the Burwash Landing facility. In the Comprehensive Solid Waste Study, it is recommended that this facility be closed once construction activities in the area are complete.	The model indicates that a transfer station is preferred at Johnson's Crossing. Within the Comprehensive Solid Waste Study, it is suggested that Johnson's Crossing be converted to an unsupervised transfer station (because of the small contributing population), provided that a deal can be negotiated with the community of Teslin and the City of Whitehorse regarding the collection and disposal of wastes in Whitehorse.	For Keno City, it was assumed that the municipal landfill in Mayo would be willing to accept the wastes from Keno residents in a regional landfill scenario (due to the small number of facility users). Within the comprehensive solid waste study, EBA has recommended that the Keno facility be converted to an unsupervised transfer station, with wastes to be deposited in Mayo for a negotiated tipping fee (paid by Community Services). The same recommendation has been made for Stewart Crossing.

TABLE 15: WASTE MODEL RESULTS SUMMARY

LOCATION:	Marsh Lake	Mt. Lorne	Old Crow	Pelly Crossing	Ross River	Silver City	Stewart Crossing	Tagish	Upper Liard
Current Facility Type	Transfer Station and Regional Solid Waste Disposal Site	Transfer Station and Regional Solid Waste Disposal Site	Burn in a Burning Facility and Bury in Trench	Burn in a Burning Facility and Bury in Trench	Burn in a Burning Facility and Bury in Trench	Burn in a Burning Facility and Bury in Trench	Burn in a Burning Facility and Bury in Trench	Burn in a Burning Facility and Bury in Trench	Burn in a Burning Facility and Bury in Trench
Number of Users	1000	380	280	300	380	20	30	280	250
Cost per User	\$ 138.54	\$ 158.30	\$ 53.63	\$ 193.46	\$ 85.30	\$ -	\$ -	\$ 130.70	\$ 38.82
Number 1	Transfer Station and Regional Solid Waste Disposal Site	Transfer Station and Regional Solid Waste Disposal Site	Incineration	Transfer Station and Regional Solid Waste Disposal Site	Transfer Station and Regional Solid Waste Disposal Site	Transfer Station and Regional Solid Waste Disposal Site	Transfer Station and Regional Solid Waste Disposal Site	Transfer Station and Regional Solid Waste Disposal Site	Transfer Station and Regional Solid Waste Disposal Site
Ranked Alternative									
Alternative Score	331.5	331.5	204.5	289	289	259	259	259	269
Capital Cost	\$ -	\$ -	\$ 536,000.00	\$ 231,215.81	\$ 274,244.53	\$ 88,647.30	\$ 88,647.30	\$ 216,872.90	\$ 198,944.26
Operation Cost	\$ 139,507.84	\$ 60,801.05	\$ 105,399.67	\$ 108,106.15	\$ 107,548.15	\$ 107,224.15	\$ 107,170.15	\$ 108,160.15	\$ 106,450.15
User Cost	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -
Carbon Footprint	516.01	165.21	64.72	290.21	364.73	18.67	27.51	204.00	162.02
Environmental Risk Score	14.5	8.75	45	17	17	5	12	18.5	20.75
Number 2	Sanitary Landfill Operations	Sanitary Landfill Operations	Burn in a Burning Facility and Bury in Trench	Burn in a Burning Facility and Bury in Trench	Incineration	Incineration	Incineration	Incineration	Incineration
Ranked Alternative									
Alternative Score	216	234	171	171	184.5	194.5	194.5	194.5	199.5
Capital Cost	\$ 530,717.66	\$ 201,672.71	\$ -	\$ -	\$ 536,000.00	\$ 536,000.00	\$ 536,000.00	\$ 536,000.00	\$ 536,000.00
Operation Cost	\$ 55,176.43	\$ 19,311.75	\$ 15,015.57	\$ 58,037.86	\$ 123,931.37	\$ 7,167.59	\$ 9,759.99	\$ 100,169.30	\$ 76,743.79
User Cost	\$ 18.15	\$ 12.10	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -
Carbon Footprint	827.62	235.35	64.56	138.54	179.52	7.64	11.96	63.91	38.37
Environmental Risk Score	34.75	26	56.5	51.5	32.5	20.5	27.5	40.5	37.5
Number 3	Incineration	Incineration	Sanitary Landfill Operations	Incineration	Burn in a Burning Facility and Bury in Trench	Burn in a Burning Facility and Bury in Trench	Burn in a Burning Facility and Bury in Trench	Sanitary Landfill Operations	Sanitary Landfill Operations
Ranked Alternative									
Alternative Score	192	192	102.5	159.5	171	171	171	160.5	179.5
Capital Cost	\$ 536,000.00	\$ 536,000.00	\$ 1,340,062.08	\$ 536,000.00	\$ -	\$ -	\$ -	\$ 148,600.94	\$ 1,340,062.08
Operation Cost	\$ 211,155.93	\$ 76,858.30	\$ 82,633.13	\$ 117,452.80	\$ 32,415.05	\$ -	\$ -	\$ 33,105.86	\$ 80,275.52
User Cost	\$ -	\$ -	\$ 336.13	\$ -	\$ -	\$ -	\$ -	\$ 36.97	\$ 5.04
Carbon Footprint	285.40	84.03	203.14	138.72	179.30	7.63	11.94	479.92	181.85
Environmental Risk Score	36	27.5	48	40	44	31	39	41	35.5
Number 4	N/A	N/A	N/A	Sanitary Landfill Operations	Sanitary Landfill Operations	Sanitary Landfill Operations	Sanitary Landfill Operations	Burn in a Burning Facility and Bury in Trench	Burn in a Burning Facility and Bury in Trench
Ranked Alternative									
Alternative Score	N/A	N/A	N/A	145.5	120.5	158.5	168.5	151	171
Capital Cost	N/A	N/A	N/A	\$ 1,276,249.60	\$ 1,340,062.08	\$ 35,639.95	\$ -	\$ -	\$ -
Operation Cost	N/A	N/A	N/A	\$ 81,662.09	\$ 90,177.51	\$ 3,615.01	\$ 1,875.00	\$ 36,594.85	\$ 9,703.80
User Cost	N/A	N/A	N/A	\$ 35.97	\$ 25.55	\$ 19.50	\$ 18.49	\$ -	\$ -
Carbon Footprint	N/A	N/A	N/A	506.74	513.09	23.36	33.78	63.75	38.23
Environmental Risk Score	N/A	N/A	N/A	39.25	33.5	21	28.5	52	46.5
Number 5	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Ranked Alternative									
Alternative Score	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Capital Cost	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Operation Cost	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
User Cost	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Carbon Footprint	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Environmental Risk Score	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	The Marsh Lake facility, similar to Mt. Lorne, is clearly identified in the model to prefer its current operation as a transfer station, and as both facilities operate effectively, there is no need to consider further alternatives. Within the Comprehensive Solid Waste Study, the possibility is put forth that the Mt. Lorne and Marsh Lake facilities combine their resources (in a new, centrally located facility) due to their proximity and like-minded waste management ambitions. The populations of both communities are small enough that their combined total should not make this possibility unreasonable.	See Marsh Lake for similar comments.	Since Old Crow is completely isolated from a road network, a transfer station is not a possibility at this location. As such, Old Crow may be an ideal candidate for an incinerator, though residual wastes (i.e. those not acceptable in an incinerator) will require additional consideration as discussed in the Comprehensive Solid Waste Study.	Pelly Crossing is located approximately midway between Mayo and Carmacks, but for the purposes of this evaluation, the facility was considered as part of the Carmacks Circuit. There is a relatively large population of 300 people utilizing this facility. Interestingly, the current operations of a burning vessel scores second highest in the model, which could indicate that the Pelly facility should be considered a lower priority in the process of eliminating burning towards January 1, 2012.	The Ross River facility is one of the more outlying facilities evaluated. The transfer station and landfill alternatives assume that the community of Faro would be willing to cooperate with Community infrastructure to accept Ross River's waste, but should this not be possible, further haul distances may be considered for a transfer station, or a landfill could be established within Ross River directly.	The Silver City facility serves only 20 people. Within the Comprehensive Solid Waste Study, it is recommended that the Silver City facility be converted to an unsupervised transfer station because of this low population base.	See Keno City for similar comments.	The community of Tagish is in relatively close proximity to Whitehorse, though closer to the Carcross facility, which yielded similar results in the model to those found here. Within the comprehensive solid waste study it is recommended that the Carcross and Tagish facilities be combined into a single transfer station location for the purposes of cost savings and an increased level of service to facility users. This facility would most likely be located in Carcross.	The model indicates a clear preference for a transfer station facility in Upper Liard. However, since Upper Liard is located approximately 15 km from Watson Lake, it is recommended in the Comprehensive Solid Waste Study that thought be put towards closure of the Upper Liard facility in favour of having residents deposit their wastes in Watson Lake, though this is contingent on Community Services and Watson Lake reaching an agreement to this effect.

TABLE 16: ENVIRONMENTAL RISK CALCULATION SUMMARY FOR INCORPORATED COMMUNITIES

	LOCATION:	Carmacks	Dawson City	Faro	Haines Junction	Mayo	Teslin	Watson Lake	Whitehorse
	Facility Type	Landfill	Landfill	Landfill	Landfill	Landfill	Transfer Station	Landfill	Landfill
	Areas / Communities Served	Carmacks and surrounding area.	Dawson City, Klondike Valley and surrounding area.	Faro and surrounding area.	Haines Junction and surrounding area.	Mayo and surrounding area.	Teslin and surrounding area.	Watson Lake and surrounding area.	City of Whitehorse
	Approx. # of Regular Users	490	3,000	400	1,000	600	600	1,800	21,000
	Quantity of Solid Waste (tonnes/yr)	343	2,550	350	850	365	510	1,600	22,500
RISK RATING									
Low Risk	Domestic	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Low Risk	Metals	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Low Risk	Brush & Construction Debris	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Low Risk	Tires	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Moderate Risk	Batteries	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Moderate Risk	Waste Oil	No	Yes	No	No	No	Unknown	Yes	Yes
High Risk	Household Hazardous Waste	Yes	Yes	No	Yes	Yes	Yes	Yes	Yes
Low Risk	White Goods	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Moderate Risk	Burn Operation	Yes	Limited	Yes	No	Yes	No	Yes	No
Moderate Risk	Burning Vessel On-Site	Unknown	Yes	No	No	Yes	No	Yes	No
High Risk	Water Tank on-site (by Fall 2000)	Unknown	Yes	No	No	Unknown	No	Yes	No
Moderate Risk	Environmental Monitoring - Groundwater	No	Yes	No	No	No	No	No	Yes
Moderate Risk	Environmental Monitoring - Air Quality	No	No	No	No	No	No	No	No
Moderate Risk	Environmental Monitoring - Surface Water	No	No	No	No	No	No	No	No
Moderate Risk	Electric Fence In Place	No	Yes	Yes	Yes	Yes	Yes	No	Yes
Moderate Risk	Controlled Access (i.e. Gates, Operating Hours)	No	Yes	No	Yes	No	Yes	Yes	Yes
No Risk	Does the Site Have Electricity?	No	No	No	No	No	No	No	Yes
Distant Dependant	Distance to Nearest Water Well (km)	Unknown	Unknown	Unknown	Unknown	Unknown	Unknown	Unknown	Unknown
Distant Dependant	Distance to Water Body (km)	0.5	1.6	2	1.5	1	6	Unknown	Unknown
Distant Dependant	Distance to Closest Dwelling (km)	0.75	1.3	Unknown	Unknown	0	Unknown	Unknown	Unknown
TOTAL	Waste Acceptance Risk Score	10	12.5	5	12.5	10	4	10	10
	Operational Risk Score	30	10	35	10	30	0	30	5
	Distance to Sensitive Receptor Score	24	6	4	6	7	0	0	0
	TOTAL RISK SCORE	54	28.5	44	22.5	46	4	40	15

Notes:
Risk Ratings assigned follow user assigned values as per Table 1.
Unknown values have been assessed a score of zero.

TABLE 17: CARBON FOOTPRINT ESTIMATE SUMMARY FOR INCORPORATED COMMUNITIES

LOCATION:	Haines Junction		Carmacks		Whitehorse		Teslin		Mayo		Faro		Watson Lake		Dawson City	
Population	848		472		25,403		458		466		395		1,594		1,923	
Approx. # of Regular Users	1,000		490		23,000		600		600		400		1,800		3,000	
Quantity of Solid Waste (tonnes/yr)	850		343		22,500		510		365		350		1,600		2,550	
	Tonnes	Carbon Footprint	Tonnes	Carbon Footprint	Tonnes	Carbon Footprint	Tonnes	Carbon Footprint	Tonnes	Carbon Footprint	Tonnes	Carbon Footprint	Tonnes	Carbon Footprint	Tonnes	Carbon Footprint
PAPER																
Newsprint	44.2	-13.26	17.8	5.7	1,170.0	374.4	26.5	-8.0	19.0	-0.9	18.2	5.8	83.2	-4.2	132.6	-6.6
Corrugated/Kraft	15.3	-3.21	6.2	10.2	405.0	672.3	9.2	-1.9	6.6	-0.3	6.3	10.5	28.8	-1.2	45.9	-1.8
OTHER PAPER	176.0	299.12	71.0	120.7	4,657.5	7,917.8	105.6	179.5	75.6	-3.0	72.5	123.2	331.2	-13.2	527.9	-21.1
GLASS																
TOTAL GLASS	45.9	-4.59	18.5	-1.9	1,215.0	-121.5	27.5	-2.8	19.7	-2.0	18.9	-1.9	86.4	-8.6	137.7	-13.8
PLASTIC																
PET#1	4.3	-15.43	1.7	0.0	112.5	1.1	2.6	-9.3	1.8	2.2	1.8	0.0	8.0	17.4	12.8	-46.3
HDPE #2	9.4	-21.22	3.8	0.0	247.5	2.5	5.6	-12.7	4.0	11.6	3.9	0.0	17.6	50.9	28.1	-63.7
OTHER PLASTICS	60.4	0.60	24.4	0.2	1,597.5	16.0	36.2	0.4	25.9	69.2	24.9	0.2	113.6	303.3	181.1	1.8
FERROUS METAL																
TOTAL FERROUS METAL (STEEL)	25.5	-30.09	10.3	-12.1	675.0	-796.5	15.3	-18.1	11.0	-12.9	10.5	-12.4	48.0	-56.6	76.5	-90.3
NON-FERROUS METAL																
Aluminum Cans	7.7	-49.65	3.1	-20.0	202.5	-1,314.2	4.6	-29.8	3.3	-21.3	3.2	-20.4	14.4	-93.5	23.0	-148.9
Other Non-Ferrous - Copper Wire	4.3	-17.43	1.7	-7.0	112.5	-461.3	2.6	-10.5	1.8	-7.5	1.8	-7.2	8.0	-32.8	12.8	-52.3
ORGANICS																
Food Scraps	236.3	290.65	95.4	117.3	6,255.0	125.1	141.8	174.4	101.5	2.0	97.3	119.7	444.8	8.9	708.9	871.9
Yard Trimmings	86.7	0.87	35.0	0.3	2,295.0	1,354.1	52.0	30.7	37.2	0.4	35.7	21.1	163.2	1.6	260.1	2.6
OTHER WASTES																
Appliances	0.9	-1.24	0.3	-0.5	22.5	-32.9	0.5	-0.7	0.4	-0.5	0.4	-0.5	1.6	-2.3	2.6	-3.7
Personal Computers (Estimated - No Data Available)	0.9	-1.36	0.3	-0.55	22.5	-36.0	0.5	-0.8	0.4	-0.6	0.4	-0.6	1.6	-2.6	2.6	-4.1
Televisions (Estimated - No Data Available)	0.9	-0.20	0.3	-0.08	22.5	-5.2	0.5	-0.1	0.4	-0.1	0.4	-0.1	1.6	-0.4	2.6	-0.6
Microwaves (Estimated - No Data Available)	0.9	-1.08	0.3	-0.44	22.5	-28.6	0.5	-0.6	0.4	-0.5	0.4	-0.4	1.6	-2.0	2.6	-3.2
VCRs (Estimated - No Data Available)	0.9	-0.81	0.3	-0.33	22.5	-21.4	0.5	-0.5	0.4	-0.3	0.4	-0.3	1.6	-1.5	2.6	-2.4
Tires (Estimated - No Data Available)	4.3	-13.98	1.7	-5.64	112.5	-370.1	2.6	-8.4	1.8	-6.0	1.8	-5.8	8.0	-26.3	12.8	-41.9
TOTAL (Tonnes eCO₂)		417.7		206.0		7,275.6		280.8		29.4		230.9		136.8		375.6
Tonnes eCO₂ per Person (Avg)		0.42		0.42		0.32		0.47		0.05		0.58		0.08		0.13

Notes:
Waste composition depicted above includes only those waste types for which a carbon emission estimate is available.

LEGEND

LANDFILL
COMPOST
RECYCLE
COMBUSTION

TABLE 18: BEST MANAGEMENT PRACTICES FOR "TROUBLESOME WASTES"			
Material Type	Current Disposal Practice	Ideal Disposal Practice	Mitigation Recommendations
Household Hazardous Waste	The majority of the sites likely do accept these materials in some capacity or another, due to either uncertainty/unawareness as to what household hazardous waste is or general disinterest in proper disposal practices. The Department of Environment ships special wastes out of the Yukon once a year. The Department pays for collecting and transporting the wastes, while the generator of the wastes is responsible for the disposal costs. This service is available to special waste generators in all Yukon communities.	HHW should only be accepted in a controlled fashion. Storage should provide adequate protection to the environment. Hazardous waste should not find itself mingled with regular waste stream.	Reduce the number of nearby facilities available (thereby forcing deposits in a properly managed facility) or create a "full package" site out of existing facilities, which would involve considerable capital costs to ensure proper segregation and storage of materials. Site supervision through staffing is another alternative for the monitoring of waste disposal.
Litter	The transfer station facilities that are staffed do a good job in managing the litter that accumulates at their sites and are able to walk around regularly to pickup loose and windblown wastes. At the Deep Creek transfer station, however, litter is rampant. The burning vessel sites are tidy. The burning vessels contain the waste deposited within them, and are not susceptible to wind concerns. The open trench burning facility was fairly litter blown, and many scavenger birds were present there in comparison to other sites. Wind fences are in place at most facilities and contain the windblown waste well.	Windblown litter should be kept to a minimum, and collected regularly. Ideally, wind fences are installed to prevent the litter from escaping the waste sites.	Open trench burning and unsupervised transfer stations are not ideal for litter management, and these operating practices should be avoided. Additionally, bans on plastic bags can be considered to encourage reusable bags and plastic bins.
White Goods	At nearly every facility, there was a surprising quantity of white goods deposited. The majority of these white goods included refrigerators, ovens, washers, and dryers. The bulk of these sorts of waste deposits are a burden on many of the facilities due to space limitations. The current practice for removal of such goods is on an "as-needed" basis, but it is difficult to predict and costly to manage. Refrigerators must be drained of Freon before they are recycled/disposed, and are currently flagged at their respective facilities to indicate whether or not this draining has taken place.	White goods should be deposited or transported to a facility capable of handling them properly, including the removal of any environmentally hazardous fluids, and the recycling/salvaging of parts.	In New Brunswick, there exists a White Goods Recycling Pilot Program. Through this program, there are a number of scheduled white good collection days over the course of six or seven months of the year, organized on a regionalized basis. A telephone number is available to residents of the province to sign up for a pickup during the window period for their scheduled route, and the residents leave their appliance at an accessible location for pickup. This program ensures that the white goods are not dumped illegally, and that the condition of the appliances is improved through the professional handling services of the haulers, which allows for better scrap metal recovery and Freon capture. It is envisioned that a similar program may be feasible in the Yukon, which could also be applied to other troublesome wastes such as auto hulks.
Scrap Metal	During EBA's site visit tour, there were considerably sized scrap metal deposited at many of the waste facilities. One of the biggest concerns with scrap metal is that it often requires further segregation into such categories as steel, aluminum, copper wire, etc. Scavenging of metal also creates a hazard and liability due to the size, weight, and rigidity of the material. Scrap metal recycling can be a profitable endeavor, but due to the remoteness of the facilities, it is difficult to manage a feasible pickup schedule, and waste deposits are irregular and potentially unsustainable.	There should be sufficient space available at every site to accommodate scrap metal, ideally a number of types of scrap metal (e.g., steel, copper wire). Scavenging should be prohibited due to the liability concerns should an injury be incurred.	Require that large scale projects (i.e., highway culvert replacements, construction and demolition of metal structures) have their own waste management plans. Consideration could also be given to providing freight subsidies to haulers for the collection and transport of metal when stockpiles are large enough to warrant collection.
Auto Hulks	Auto hulks were present at a number of facilities in varying degrees of salvage. Current British Columbia legislation (British Columbia being the end location for these wastes) dictates that all fluids must be drained from an auto hulk before it will be accepted in the province for salvaging and recycle. Due to the infrequency of auto hulk deposits, it is not cost efficient to institute a regular collection of these wastes, and most facilities operate on an "as needed" basis for their removal. The trouble, however, is that auto hulks take up a lot of area, as they cannot be stacked, and a substantial amount of land area is lost, limiting the ability of a site to operate normally.	Auto hulks should be drained of all fluids prior to being deposited at the waste facilities to minimize the efforts from YG to properly handle the waste. Instructions for how to deposit auto hulks should be posted at the waste facilities (i.e., informing the resident that the fluids must be drained prior to disposal and where on site the hulk can be placed on site).	Because auto hulks can be traced to the last known owner through vehicle registration numbers, there is an enforcement potential lacking with other waste types. One alternative to consider is a "Car Heaven" program whereby charitable receipts and a free tow to an auto wreck yard is provided to participants who "donate" their used vehicles to the program so that they can be drained of fluids and salvaged. Alternatively, a collection program similar to the New Brunswick white goods recommendation above may prove successful.
Tires	There currently exists a deposit charge in the Yukon for all new tires at time of purchase, and disposal of tires at the Whitehorse landfill, and everywhere else in the territory, is free of charge. Despite no longer charging a tipping fee for tire acceptance at the Whitehorse landfill, it has been observed that many residents still bypass this facility to deposit their tires at other nearby facilities that are not as well equipped to manage these wastes.	Tires should be segregated from the waste stream. As tire piles can be a fire hazard, they should be removed from the storage area for recycling on a regular basis. Steel rims should be removed from the tires prior to storage.	The Yukon has already implemented a tire recycling fee on the purchase of all new tires. A potential consideration may be offering a deposit return to provide further incentive for proper tire disposal.
Construction and Demolition Waste	Construction and demolition wastes are unpredictable and immense in size. The majority of the waste facilities in the Yukon would be hard pressed to make room for a large deposit of construction and demolition wastes.	Ideally, construction wastes should be separated by material type so that recycling and reuse of materials can be facilitated. As these wastes are bulky and potentially hazardous (as a result of unsupervised scavenging), they should only be deposited at facilities capable of supporting their size.	One strategy currently employed in some jurisdictions in North America is a deposit program instituted through the permitting of construction, renovation, and demolition projects. Through this process, users must obtain a permit prior to undertaking a construction, renovation, or demolition (CRD) project and pay a deposit (e.g., \$100) that will be returned when a receipt is shown to indicate that the CRD waste has been handled in an appropriate manner (i.e., a receipt from the Whitehorse landfill must be produced for the deposit to be refunded).
e-Waste	The Yukon Territory is currently without a year-round e-Waste program. Environment Yukon is currently undertaking a comprehensive review of its existing recycling programs and is in the preliminary stages of research to support the development of an "Extended Producer Responsibility" (EPR) framework that can be applied to a number of product categories, including e-waste. The Mount Lorne and Marsh Lake facilities do provide a separate area for e-waste products to be deposited, but outside of the Whitehorse area, e-waste handling is not managed as a special waste stream.	e-Wastes should not end up in a landfill or burning facility, but collected and recycled appropriately.	There are a number of different options available to facilitate e-Waste recycling. A recycling fee at the time of purchase as part of an extended producer responsibility program is one of these options that has worked in other jurisdictions in Canada. Should e-waste not be returned to point of sale, collection of the materials should be provided at waste facilities equipped with sheltered storage areas.
Propane Tanks (Gas Canisters)	Propane tanks are generally segregated at the different waste facilities, but the odd tank is improperly disposed of, with one tank observed to have gone in a burning vessel.	It is of the utmost importance that propane tanks be handled safely due to the potentially fatal risk of an explosion. They must be kept outside of the normal waste stream.	To ensure that compressed gas canisters do not become mixed with other waste types, the hazards associated with them should be very clearly communicated to the public, and potential fines should be considered for offences. A deposit program for compressed gas canisters may be effective in this regard as well.
Lead Acid Batteries	Vehicle batteries are typically deposited on a pallet that is available at most facilities, though only in some cases is this pallet clearly marked to accept these wastes.	Batteries should be stored in their own clearly labeled location and should be sheltered from the elements.	A storage vault with a number of separate compartments could be installed at every facility so that batteries, propane tanks, e-waste and HHW can be handled appropriately.

TABLE 19: BEST MANAGEMENT PRACTICES FOR WASTE MANAGEMENT CHALLENGES			
Waste Management Issue	Current Practice	Ideal Practice	Mitigation Recommendations
Waste Segregation	At every waste facility currently in operation, there is some level of waste segregation taking place. This level varies significantly from site to site, however, and is often dependant on space availability and the size of the community serviced.	Ideally, every type of waste should be segregated to allow for maximum landfill diversion and recycling.	It is recommended that every waste accepted at a facility be labeled in an area designated for that material's disposal. While the signage will not be adhered to every time, it will at least improve current waste disposal practices to some degree.
Inconsistency and Unpredictability of Waste Deposits	Due to the small size of the existing waste facilities, and the size of the community that each site serves, spikes in the waste stream are more difficult to handle than at a large scale landfill such as in Whitehorse. Whether it is the demolition or renovation of a nearby house, or the passing of a resident that had amassed a large collection of materials not considered of use to the inheritor, a waste facility can be overloaded with waste, which limits its operation efficiency.	Facilities should be able to accommodate the volumes of waste that can reasonably be expected for the size of the community served.	A "Waste Line" should be established for the territory, where users of a facility can report a large waste deposit or indicate that the facility must be checked on or emptied by the contractor. This telephone line will remove the "guessing game" that comes with planning site pickups and contractor requirements.
Remoteness of Facilities	The cost to transport waste is considerable in the Yukon as the current waste facilities are thinly spread across the territory. Bulk materials tend to be stockpiled for significant lengths of time due to unfeasibility of collection and transport.	Remoteness can not be considered a limiting factor. Regardless of how remote a facility may be it must be operated as effectively as possible. In Alaska and the Northwest Territories, there are siting regulations in place to avoid having more than one facility within a certain distance of another. That is to say, remoteness, to some degree, is actually encouraged within these jurisdictions.	A number of facilities should be examined regarding closure. The factors to consider most are cost per user, distance to nearest other waste management facility, and public opinion or resistance to the closure. It is felt that a number of facilities can be closed, which would offer more operational funding for other nearby facilities and, in turn, allow for increased waste management efficiency.
Public Pressures and Perceptions	The public is becoming increasingly educated and concerned about the potential effects of what is going on around them. As such, there is a growing resistance to waste management practices that are considered to be outdated, and the burning of waste, specifically, is opposed. At any site, there is a perceived mentality that the site should be treated as the site is viewed. If a site is not very well kept, the public, in general, will dispose of their waste in an untidy fashion. Conversely, if a site is well organized, the general public will respect the tidiness of the facility and dispose of their waste more appropriately. If action is taken at one facility, other communities will anticipate that these steps will be undertaken in their community as well.	The public should be kept abreast of all initiatives being undertaken by the government and should be free to express their opinions and give their suggestions.	It is recommended that an environmental targets (i.e. "80% waste diversion by 2030") be created by the government so that they can cooperate with the public in reaching their goals together. Additionally, information regarding proposed facility upgrades and waste initiatives should be regularly communicated to the public, with regular consultation to address any suggestions, concerns, comments, or questions.
Environmental Concerns, Public Safety and Liability	Scavenging, while not encouraged in the Yukon, is not discouraged either, which presents a safety hazard. The burning vessels present another hazard where liability may become a concern. As the burning vessels are located at sites with unlimited and unsupervised access, there is the potential for injury at site due to the heat generated by the vessels, which slowly dissipates for several hours after the burning vessel is ignited (assuming that the vessel is only ignited by the appropriate contractor). While some sites post a sign indicating that the burning vessel is hot, these signs are generally afterthoughts that have been spray-painted in many cases and could go unobserved or ignored. Environmental monitoring at unincorporated facilities is currently present at only three facilities. Without environmental monitoring, there is no way to observe or be aware of the environmental implications of a waste facility, and so no action can be triggered to correct a situation that may arise.	Each waste facility should be as safe as reasonably possible for both environmental health and human safety.	It is recommended that: · Scavenging legislation be re-evaluated to remove the Yukon Government's liability for a scavenging related incident, yet still allowing approved operators to separate waste as necessary. · A physical barrier or other means of protection for the burning vessel doors should be installed to avoid a burn related accident. · Environmental monitoring wells (groundwater monitoring wells) should be installed at every waste facility; one upgradient of groundwater flow direction, and two downgradient.
Funding	With limited and fixed funding currently received for waste management in the Yukon, not every waste solution is necessarily feasible.	There should always be funding available for necessary improvements to a waste facility where environmental health and human safety is benefited.	There are a number of additional funding resources available in the Yukon that can help to offset Community Service's expenses. These funding alternatives include: · Gas Tax Fund (GTF) · The Green Municipal Fund · Infrastructure Canada Program · First Nation Infrastructure Fund (FNIF) These programs should be investigated in greater detail to identify their applicability and degree of funding available. Once a thorough understanding of these funds is gained, communities can be encouraged to apply for this assistance.
Legislation Changes on the Horizon	No current legislation changes in effect. The most discussed legislation with respect to waste management in the Yukon at present and in the near future is a ban on burning (effective January 1, 2012). Other potential legislation changes may include: · imposing mandatory environmental monitoring at all waste facilities; · disallowing the establishment of any new waste facilities; · developing hard standards for buried waste, including barrier systems for both landfills and trenches constructed for the acceptance of ash; · imposing strict controls on the management of special and hazardous wastes; or · imposing environmental monitoring requirements at all waste facilities.	Waste facilities in the Yukon should be able to adapt to whatever waste legislation may be implemented in the future. These changes should be communicated between the branches of government affected with suitable notice so that the change can be properly planned for.	Any potential legislation change should be kept in mind when considering existing waste practices, as well as any changes that may be contemplated. It is recommended that the Community Services maintain regular communication with Environment Yukon in this regard.

TABLE 20: SUMMARY OF RECOMMENDATIONS

Recommendation	Relative Cost to Community Services		Impact on Waste Management Operations	Impact on Environment, Human Health and Safety	Barriers
	Expense	Effort			
Yukon-Wide Programs					
Establish a working group dedicated to waste management in the Yukon.	Low	High	Would provide forum for waste management stakeholders to communicate and cooperate in improving Yukon solid waste management practices.	N/A	Need to carefully define role of group and its membership.
Establish a backhaul exchange program with a hauler network of schedules and destinations, organized through local businesses and shippers.	Medium	High	Accommodates maximization of backhaul potential.	N/A	Will require cooperation with industry and other government departments. Organizational efforts require further investigation.
For auto hulks and white goods, initiate a roundup program similar to the HHW collection days. Establish temporary collection points for targets materials throughout Yukon communities as needed throughout the year (i.e. two weeks roundup of white goods in Keno, followed by Stewart Crossing, etc.)	Medium	Medium	Ensures auto hulks and white goods are properly handled (i.e., liquids are drained) and parts are salvageable.	Eliminates liquid-related environmental concerns.	Organizational efforts and logistics require further investigation.
Increase environmental deposits and refunds for beverage containers.	Low	Low	Should result in greater capture of beverage containers.	N/A	Yukon currently ranks amongst the highest in Canada for beverage container return. Public may not be enthusiastic about higher deposits on purchases.
Establish a deposit program for compressed gas (i.e., propane tanks). Include advertising program to reinforce risks of improper disposal.	Low	Medium	Will ensure proper disposal of propane tanks.	Will ensure that propane tanks do not become a hazard to site users.	May face resistance from public due to deposit expense.
Develop a government funded program for white good repair (i.e. residents pay for repair services, YG pays for lodging and transportation of repair man during repair windows in an outlying community).	Low	Medium	Will reduce number of white goods being deposited at remote facilities.	N/A	Organizational efforts and logistics require further investigation.
Establish a Car Heaven program - provide charitable receipts and a free tow to a auto-wreck yard where fluids are drained and metal is salvaged	Medium	Medium	Will ensure auto-hulks are properly handled.	Will prevent capacity reducing deposits at small waste facilities. Will ensure proper capture of liquids.	Will provide incentive to users, but requires start-up efforts and long term feasibility study.
Implement education programs at school and in communities.	Low	High	Encourages desirable behavior of residents at a young age.	Participation should better resident mindsets and facilitate better environmental care.	Curriculum inclusion requires school support and potential government participation and funding.
Encourage "backyard" programs such as composting and bluebox recycling for remote residents. This could include the subsidized distribution of different waste bins to encourage waste segregation	Medium	Medium	Higher waste diversion equates to less stress on existing waste facilities.	Better environmental management.	Participation is not always guaranteed.
Investigate options for increased organic diversion, composting, once facility alternatives have been established (i.e. prior to January 1, 2012)	Low	Low	Can be significant if logistical barriers can be overcome.	Will reduce methane generation from organics in landfill.	Remote communities, wildlife concerns, and colder temperatures present challenges that need to be addressed.
Hold semi-regular waste audits (i.e. every two to five years) at representative waste facilities (incorporated and unincorporated).	Medium	Medium	Will provide current and historical trends in waste deposits in the respective communities and provide an indication of the effect of waste diversion initiatives in place.	N/A	Requires numerous audits over a long period of time. May require volunteer support.
Establish a "Waste Line" telephone reporting system where large waste deposits can be reported (and combined with other waste related questions, services).	Medium	Medium	Provides information source to public for waste-related questions, which should result in better waste disposal practices. Also provides a notification system for pick-up requirements when sites become overloaded.	N/A	Will require a full time staff member. Organization and logistics to be further investigated.
Government Policy or Legislation Changes					
Require highway developments to have their own waste management plans in place.	Low	Low	Will ensure large scale construction and demolition debris from roads is deposited appropriately.	N/A	Will require legislative support. May encounter industry resistance.
Consider implementing a ban on plastic bags. Encourage reusable bags and plastic bins at local businesses.	Low	Medium	Could make composting more efficient and feasible.	Should result in less litter, cleaner burning of wastes in burning vessels.	Requires industry buy-in and resident support.
Provide tax incentives for retailers to participate in point of sale return or Extended Producer Responsibility Programs. Program could be funded through deposit fees. Target materials to include white goods, gas canisters, lead acid batteries, HHW.	Low	High	Ensures proper disposal and management of these wastes.	Ensured Freon capture.	Requires industry support.
Establish permit and deposit program for construction, renovation, and demolition activities. Return deposit when proof of proper disposal of wastes is provided.	Low	Medium	Should eliminate the overloading of facilities with C&D waste.	These bulk wastes could be hazardous to safety if scavenging is permitted. Their removal would avoid this risk.	Will require legislative support from other government departments.
Require demolition plans and reporting to better prepare for large deposits at remote facilities.	Low	Medium	Should make large waste deposits more manageable at remote facilities.	N/A	Requires industry and resident support and education.
For tires, increase deposits and provide refunds to encourage increased or altered participation.	Low	Medium	Increased tire diversion and less deposits at remote facilities incapable of managing these wastes.	N/A	Logistics require further investigation.
Prohibit unsupervised public scavenging.	Low	Low	N/A	Should eliminate the risk and liability associated with scavenging.	Requires legislative support, site supervision.
Waste Handling and Acceptance at Disposal Facilities					
Establish a materials recycling facility in Whitehorse.	High	High	Provides a Yukon-based resource for recycled goods.	Increased waste diversion.	Volatility of commodity prices for recycled goods.
Ensure that every facility can accept any type of waste (i.e., every facility is a "full service facility").	Medium	Medium	Consistency amongst waste facilities will be established which should provide for more standardized management approaches.	Ensures the proper disposal of potentially hazardous materials mixing with non-hazardous wastes.	May increase staffing and maintenance requirements.
Provide separate and sheltered storage for e-waste, propane tanks, HHW, and batteries.	Medium	Medium	Provides clearly segregated areas for select waste types which should facilitate more efficient handling of these materials.	Ensures household hazardous waste, waste oil, propane tanks, and batteries do not present environmental or safety risks.	Dependant on users utilizing this facility should it be installed.
Provide staffing at larger facilities and establish controlled access hours at all facilities.	High	Medium	Will ensure better waste disposal practices from residents, less maintenance from contractors for upkeep.	Fewer hazardous deposits will find their way into the normal waste stream.	The cost of staffing is a significant barrier considering the number of facilities present in the Yukon.
Provide a recycling depot at those waste facilities whose communities are presently without one.	Medium	Medium	Should provide higher recycling rates and public participation.	Increased waste diversion.	Commingled recyclables may present operational challenges. Could be addressed through materials recycling/processing facility.
Establish clear and standardized signage for every type of waste accepted at facility.	Low	Low	Will provide a clear indication of where select waste types should be deposited, which should encourage better disposal habits.	N/A	N/A
Utilize tire shredder to increase payload densities when shipping tires out of territory.	Medium	Medium	Will reduce costs associated with tire transport.	N/A	Logistical complexities with special hauling requirements of tire shreds vs. whole tires.
Ship e-waste to Edmonton in conjunction with tire shipments to Leduc.	Low	Medium	Will reduce costs associated with e-waste and tire transport.	N/A	Logistical complexities with special hauling requirements of tire shreds vs. whole tires. Will require cooperation with hauler. Need to investigate willingness of Edmonton to accept Yukon's e-waste.
Provide safety protection for burning vessels.	Medium	Medium	Will reduce liability for the potential that a user could burn themselves on a burning vessel's doors.	Will provide protection against injury for users.	May be difficult to install due to warping of burning vessels as a result of intense heat.
Install environmental monitoring wells at every waste facility that buries waste (including ash).	Medium	Medium	Will require annual monitoring and potential remediation requirements should contamination be detected.	Will provide an indication of environmental hazards and allow action to be taken to reduce hazardous effects.	Will result in an additional annual cost and may indicate that some facilities require extensive remediation programs.
Label facilities as "Public Waste Disposal Facility" rather than "Dump".	Low	Low	Should improve user mentality and encourage more appropriate disposals.	N/A	N/A
Maintain a professional, tidy appearance at all waste facilities.	Medium	Medium	Will require more effort from contractors and staff, likely increasing Community Infrastructure expenses.	N/A	Upkeep at some facilities may become unreasonable.
Construct new regional landfills with strict engineering controls, as well as leachate and landfill gas collection systems.	High	Medium	Will require increased costs for construction and staffing, but provide complete waste management controls for all waste types.	Strict engineering controls will provide increased environmental protection.	Siting of a landfill may be difficult in some areas do to geology, resident concerns, distance to sensitive receptors, etc.

TABLE 20: SUMMARY OF RECOMMENDATIONS

Recommendation	Relative Cost to Community Services		Impact on Waste Management Operations	Impact on Environment, Human Health and Safety	Barriers
	Expense	Effort			
Specific Facility Actions					
Closure of the Canyon Creek facility including an ESA	Low	Low	Will provide more budget to be distributed across fewer facilities.	Site remediation will return area to natural state. The absence of a facility removes environmental risks.	Possible political barriers to site closure.
Closure of the Destruction Bay facility including an ESA	Medium	Low	Will provide more budget to be distributed across fewer facilities.	Site remediation will return area to natural state. The absence of a facility removes environmental risks.	Possible political barriers to site closure.
Convert the Silver City facility to an unsupervised transfer station.	High	Medium	Beyond the capital costs, operational costs should be relatively similar to present costs. Should facilitate more efficient maintenance and hauling due to segregation of wastes in bins.	Environmental risks reduced at site due to temporary storage of wastes only. Better disposal practices at a regional landfill provide more environmental protection.	Residents mustn't abuse unsupervised nature of the facility.
Closure of the Upper Liard facility.	Low	Low	Will provide more budget to be distributed across fewer facilities.	Site remediation will return area to natural state. The absence of a facility removes environmental risks.	Possible political barriers to site closure.
Convert the existing Keno facility to an unsupervised transfer station.	High	Medium	Beyond the capital costs, operational costs should be relatively similar to present costs. Should facilitate more efficient maintenance and hauling due to segregation of wastes in bins.	Environmental risks reduced at site due to temporary storage of wastes only. Better disposal practices at a regional landfill provide more environmental protection.	Residents mustn't abuse unsupervised nature of the facility.
Convert the existing Stewart Crossing facility to an unsupervised transfer station.	High	Medium	Beyond the capital costs, operational costs should be relatively similar to present costs. Should facilitate more efficient maintenance and hauling due to segregation of wastes in bins.	Environmental risks reduced at site due to temporary storage of wastes only. Better disposal practices at a regional landfill provide more environmental protection.	Residents mustn't abuse unsupervised nature of the facility.
Convert the existing Braeburn facility to an unsupervised transfer station.	High	Medium	Beyond the capital costs, operational costs should be relatively similar to present costs. Should facilitate more efficient maintenance and hauling due to segregation of wastes in bins.	Environmental risks reduced at site due to temporary storage of wastes only. Better disposal practices at a regional landfill provide more environmental protection.	Residents mustn't abuse unsupervised nature of the facility.
Amalgamate the Carcross and Tagish waste facilities into a single transfer station facility.	High	High	Single facility between the two communities will provide a higher level of service to residents of both communities at a reduced cost in comparison to operating two facilities.	Environmental risks reduced at site due to temporary storage of wastes only. Better disposal practices at a regional landfill provide more environmental protection.	May encounter resistance from residents as the change would require additional user travel in some cases.
Amalgamate the Mt. Lorne and Marsh Lake waste facilities into a single transfer station facility.	High	High	Single facility between the two communities will provide a higher level of service to residents of both communities at a reduced cost in comparison to operating two facilities.	Increased volunteerism and staffing as a result of combining resources should further enhance desirable user behavior and better environmental management.	May encounter resistance from residents as the change would require additional user travel in some cases.
Beyond potential site relocation, convert Old Crow into an incinerator facility and focus on fully utilizing winter access roads for transporting residual wastes out of the community. Efficient means of transporting waste could include PODS, Sea Cans, or other cargo-based temporary storage units.	High	Medium	Old Crow's remote location presents unique challenges. These recommendations attempt to make the most of limited resources and available alternatives.	Improved environmental protection from current practices.	Costs are significant due to remoteness of location. Cooperation required with community to develop best solution.
Develop an agreement with Teslin and Whitehorse to allow Johnson's Crossing to be included in a transfer station route.	Medium	High	Beyond the capital costs, operational costs should be relatively similar to present costs. Should facilitate more efficient maintenance and hauling due to segregation of wastes in bins.	Environmental hazards reduced at site due to temporary storage of wastes only. Better disposal practices at a regional landfill provide more environmental protection.	Dependant on cooperation of Teslin and the City of Whitehorse. Residents mustn't abuse unsupervised nature of the facility.
Additional Strategies					
Establish waste quantity records from future tracking.	Low	Medium	Understanding waste quantities and general composition estimates will help Community Infrastructure better manage their facilities.	N/A	Voluntary auditing may be fruitless. Contractor may need incentive to put extra effort into the reporting process.
Consider remote access systems for remote waste facilities with the potential for user tracking.	Medium	High	Automated access may reduce abuse of facilities and may also provide a policing system.	N/A	Potential logistic issues with controlled use. Potential privacy concerns with policing component.
Provide freight subsidies for scrap metal transportation when large stockpiles have amassed.	Medium	Medium	Will maximize scrap metal recovery, reduce burden on smaller waste facilities.	Reduce potential for scavenging related incidents.	Logistics require further investigation.
Establish cooperation between smaller communities to share waste disposal and recycling programs.	Low	Medium	Will provide additional resources to communities with limited resources.	N/A	Logistics require further investigation.
Establish large-scale community composters for smaller communities to utilize as a shared resource.	Medium	Medium	Will reduce amount of waste going to landfill, transfer stations.	N/A	Logistics require further investigation.
Identify waste reduction opportunities in future waste studies in the territory.	Medium	Medium	Will reduce amount of waste going to landfill, transfer stations.	N/A	Logistics require further investigation.
Introduce Home Waste Surveys to train households on better waste disposal and diversion practices.	Medium	Medium	Will reduce amount of waste going to landfill, transfer stations.	N/A	Logistics require further investigation.
Provide personal-sized composting bins and scales to residents for monitoring household compost initiatives.	Medium	Medium	Will reduce amount of waste going to landfill, transfer stations.	N/A	Wildlife may pose a challenge to backyard composting in some areas.
Consider moving towards regionalization as waste management strategy, beginning with a Whitehorse area based pilot program.	High	High	Regionalization programs will reduce the number of facilities required in the Yukon and allow more standardized management approaches.	Single location for waste deposits provides increased environmental control.	Residents may be opposed to extra costs to deposit wastes elsewhere.
Consider Waste to Energy as a long term strategy for the City of Whitehorse	Medium	Medium	Provides usable energy from waste materials.	Will reduce natural resource based energy consumption.	Current waste generation volumes and future focus on increased waste diversion makes waste to energy unfeasible at present time.
Develop an environmental targets (i.e., "80% Waste Diversion by 2030")	Low	Low	Environmental vision will help to guide decisions.	Environmental goals, when reached, will enrich the facility environments.	N/A

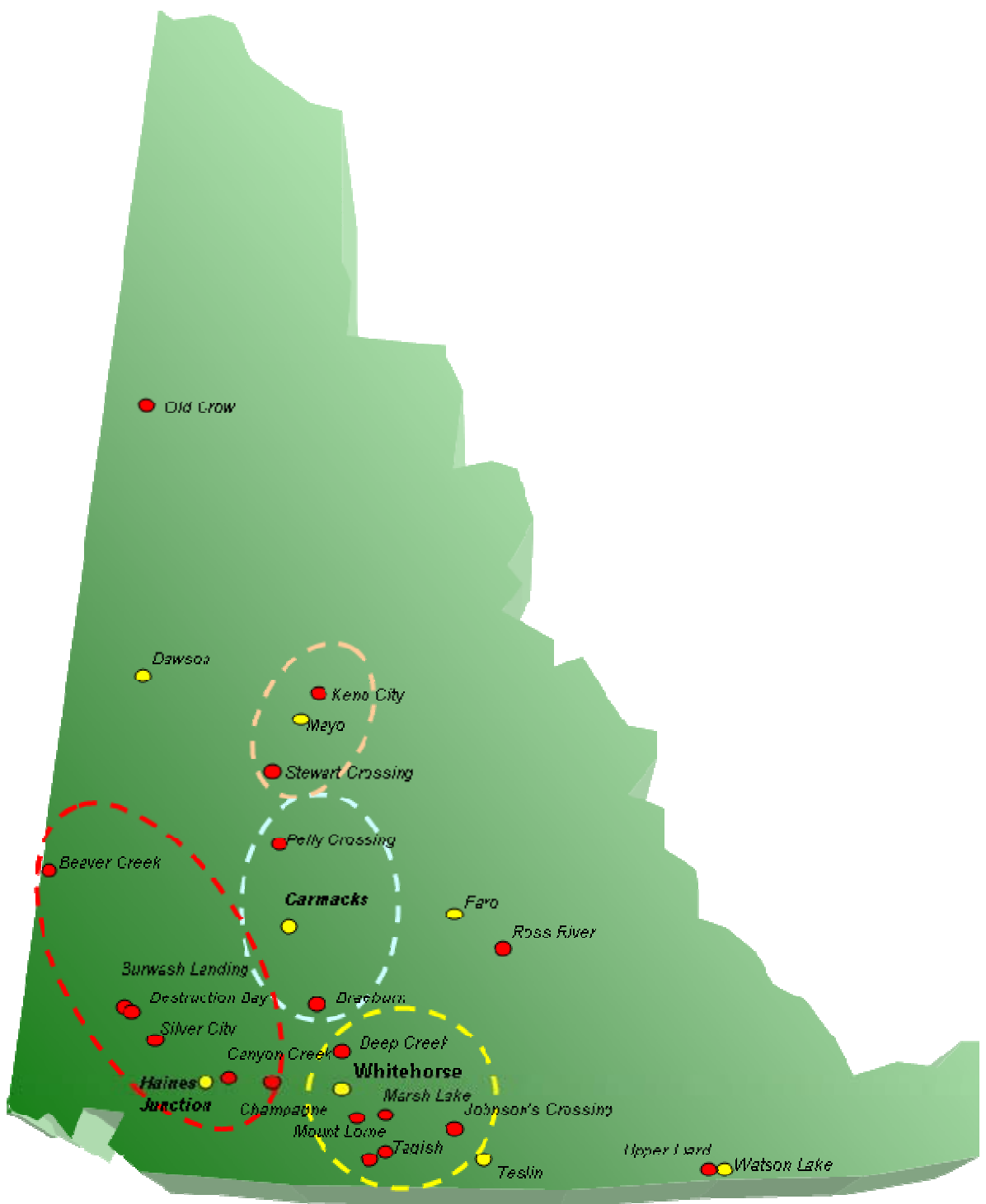
Notes:

Cost Legend (Approximate):
 Low = Less than \$10,000.
 Medium = Between \$10,000 and \$50,000.
 High = Greater than \$50,000.



FIGURES





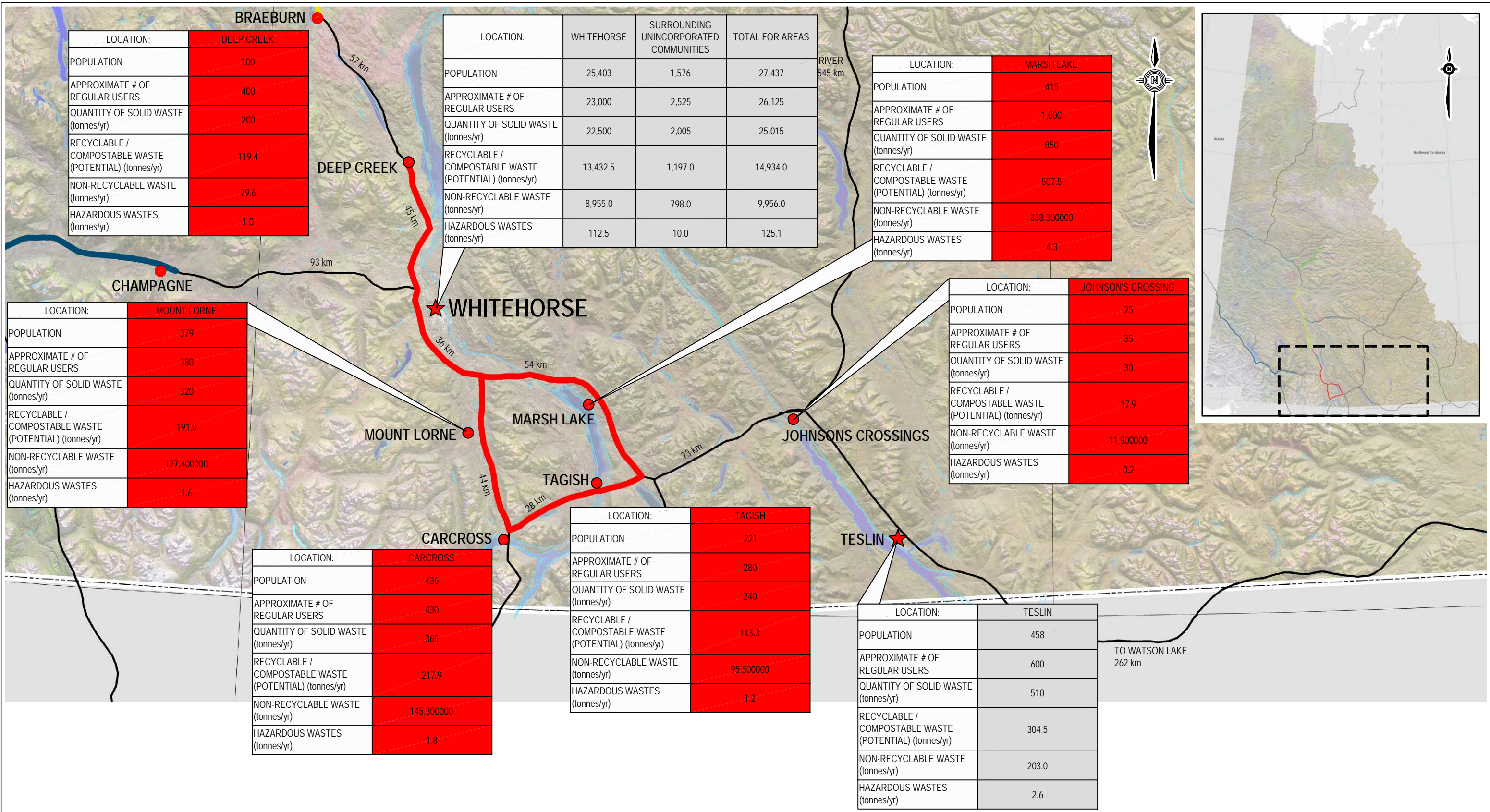
LEGEND:

- Haines Junction
- Whitehorse
- Carmacks
- Mayo

**YUKON TERRITORY
COMPREHENSIVE SOLID WASTE STUDY**

**FIGURE 1
YUKON
WASTE CIRCUITS**

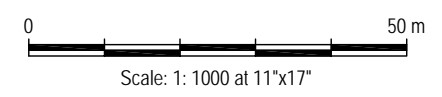




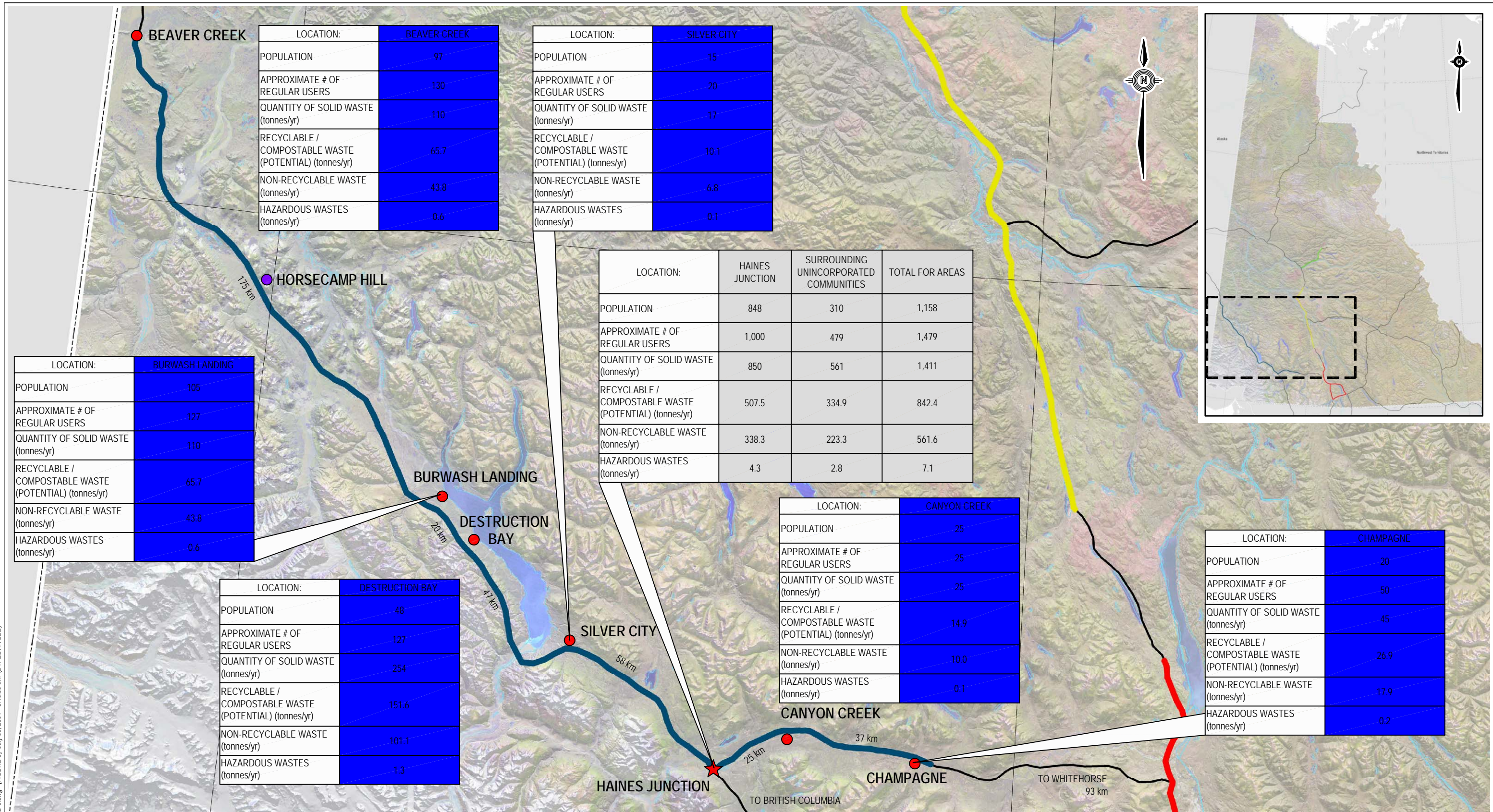
G:\W231\W23101149\AUTOCAD\DWG\W23101149_Fig2.dwg [FIGURE 2] July 30, 2009 - 8:44:31 am (BY: ELVIN LEE)

LEGEND

- - DESIGNATED GOVERNMENT USE SOLID WASTE FACILITIES
- - FACILITY CLOSURE
- ★ - MAJOR TOWNS
- - POPULATED PLACES
- - CARMACKS CIRCUIT
- - HAINES JUNCTION CIRCUIT
- - MAYO CIRCUIT
- - WHITEHORSE CIRCUIT



CLIENT		YUKON WIDE SOLID WASTE STRATEGY			
Yukon Government		WHITEHORSE WASTE CIRCUIT			
EBA Engineering Consultants Ltd. 	PROJECT NO. W23101149	DWN EL	CKD SM	REV 0	Figure 2
	OFFICE EBA-RIV	DATE July 29, 2009			



LOCATION:	BEAVER CREEK
POPULATION	97
APPROXIMATE # OF REGULAR USERS	130
QUANTITY OF SOLID WASTE (tonnes/yr)	110
RECYCLABLE / COMPOSTABLE WASTE (POTENTIAL) (tonnes/yr)	65.7
NON-RECYCLABLE WASTE (tonnes/yr)	43.8
HAZARDOUS WASTES (tonnes/yr)	0.6

LOCATION:	SILVER CITY
POPULATION	15
APPROXIMATE # OF REGULAR USERS	20
QUANTITY OF SOLID WASTE (tonnes/yr)	17
RECYCLABLE / COMPOSTABLE WASTE (POTENTIAL) (tonnes/yr)	10.1
NON-RECYCLABLE WASTE (tonnes/yr)	6.8
HAZARDOUS WASTES (tonnes/yr)	0.1

LOCATION:	HAINES JUNCTION	SURROUNDING UNINCORPORATED COMMUNITIES	TOTAL FOR AREAS
POPULATION	848	310	1,158
APPROXIMATE # OF REGULAR USERS	1,000	479	1,479
QUANTITY OF SOLID WASTE (tonnes/yr)	850	561	1,411
RECYCLABLE / COMPOSTABLE WASTE (POTENTIAL) (tonnes/yr)	507.5	334.9	842.4
NON-RECYCLABLE WASTE (tonnes/yr)	338.3	223.3	561.6
HAZARDOUS WASTES (tonnes/yr)	4.3	2.8	7.1

LOCATION:	BURWASH LANDING
POPULATION	105
APPROXIMATE # OF REGULAR USERS	127
QUANTITY OF SOLID WASTE (tonnes/yr)	110
RECYCLABLE / COMPOSTABLE WASTE (POTENTIAL) (tonnes/yr)	65.7
NON-RECYCLABLE WASTE (tonnes/yr)	43.8
HAZARDOUS WASTES (tonnes/yr)	0.6

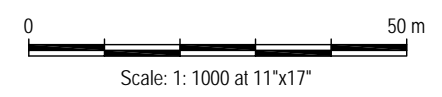
LOCATION:	DESTRUCTION BAY
POPULATION	48
APPROXIMATE # OF REGULAR USERS	127
QUANTITY OF SOLID WASTE (tonnes/yr)	254
RECYCLABLE / COMPOSTABLE WASTE (POTENTIAL) (tonnes/yr)	151.6
NON-RECYCLABLE WASTE (tonnes/yr)	101.1
HAZARDOUS WASTES (tonnes/yr)	1.3

LOCATION:	CANYON CREEK
POPULATION	25
APPROXIMATE # OF REGULAR USERS	25
QUANTITY OF SOLID WASTE (tonnes/yr)	25
RECYCLABLE / COMPOSTABLE WASTE (POTENTIAL) (tonnes/yr)	14.9
NON-RECYCLABLE WASTE (tonnes/yr)	10.0
HAZARDOUS WASTES (tonnes/yr)	0.1

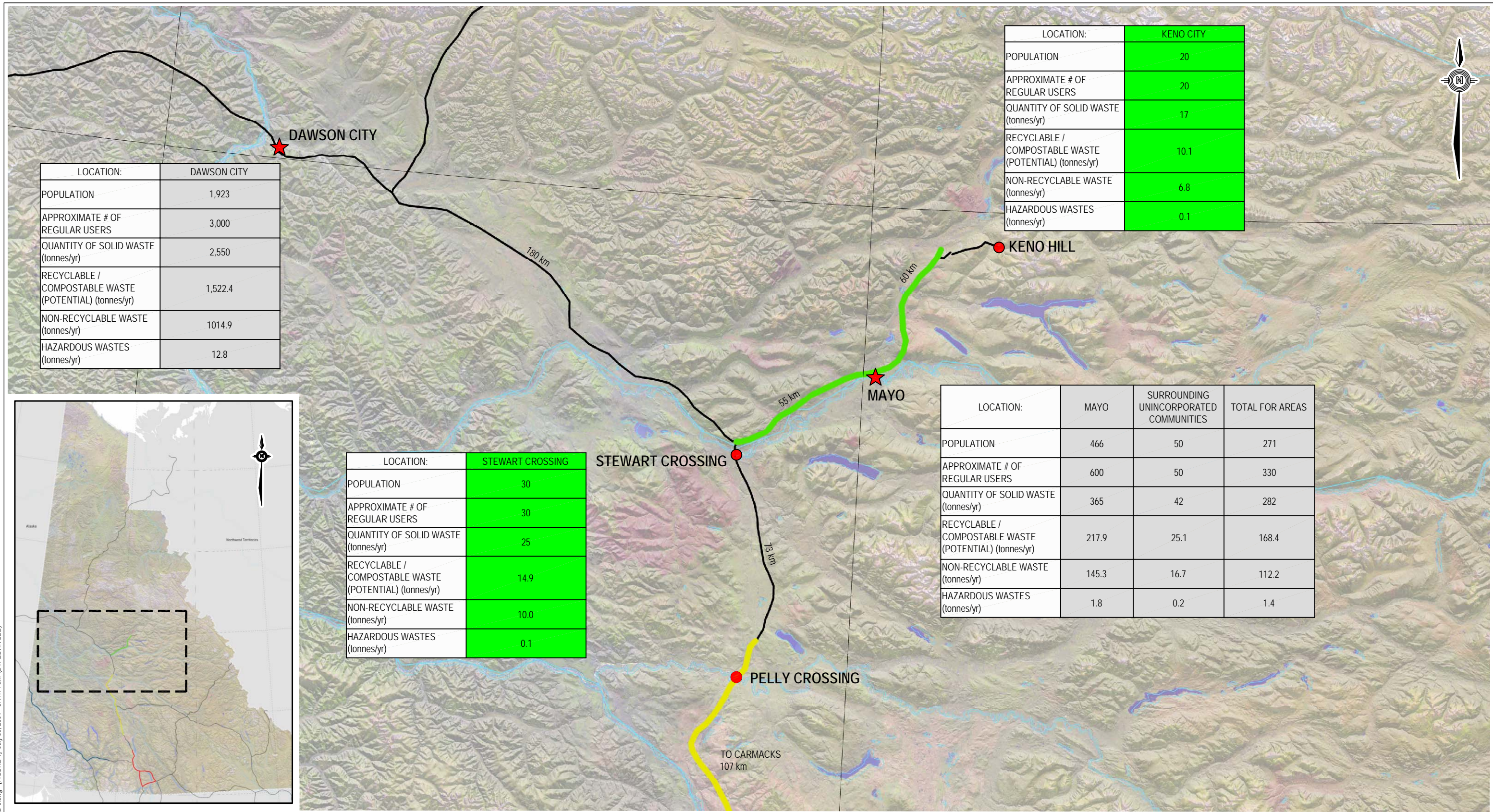
LOCATION:	CHAMPAGNE
POPULATION	20
APPROXIMATE # OF REGULAR USERS	50
QUANTITY OF SOLID WASTE (tonnes/yr)	45
RECYCLABLE / COMPOSTABLE WASTE (POTENTIAL) (tonnes/yr)	26.9
NON-RECYCLABLE WASTE (tonnes/yr)	17.9
HAZARDOUS WASTES (tonnes/yr)	0.2

G:\W231\W23101149\AUTOCAD\DWG\W23101149_Fig2.dwg [FIGURE 3] July 30, 2009 - 8:46:35 am (BY: ELVIN LEE)

- LEGEND**
- - DESIGNATED GOVERNMENT USE SOLID WASTE FACILITIES
 - - FACILITY CLOSURE
 - ★ - MAJOR TOWNS
 - - POPULATED PLACES
 - - CARMACKS CIRCUIT
 - - HAINES JUNCTION CIRCUIT
 - - MAYO CIRCUIT
 - - WHITEHORSE CIRCUIT



CLIENT		YUKON WIDE SOLID WASTE STRATEGY			
Yukon Government		HAINES JUNCTION CIRCUIT			
EBA Engineering Consultants Ltd. 	PROJECT NO. W23101149	DWN EL	CKD SM	REV 0	Figure 3
	OFFICE EBA-RIV	DATE July 29, 2009			

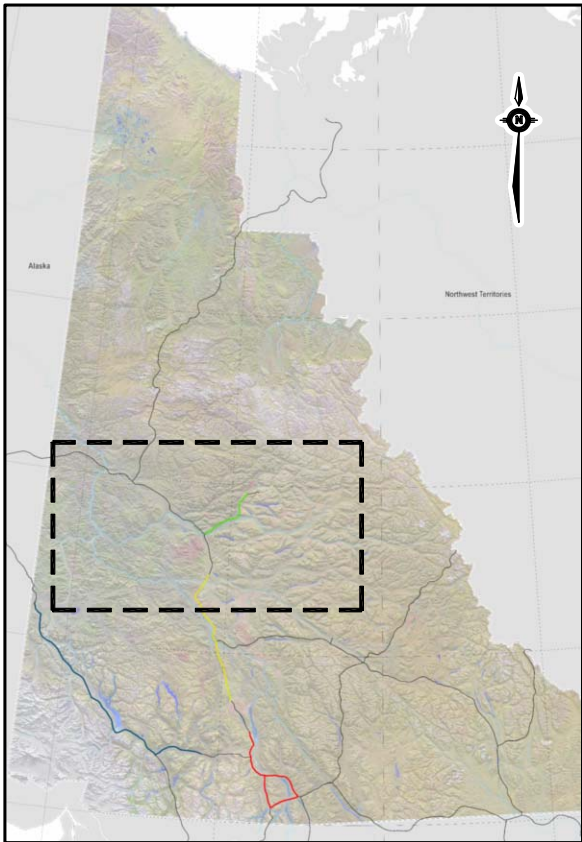


LOCATION:	DAWSON CITY
POPULATION	1,923
APPROXIMATE # OF REGULAR USERS	3,000
QUANTITY OF SOLID WASTE (tonnes/yr)	2,550
RECYCLABLE / COMPOSTABLE WASTE (POTENTIAL) (tonnes/yr)	1,522.4
NON-RECYCLABLE WASTE (tonnes/yr)	1014.9
HAZARDOUS WASTES (tonnes/yr)	12.8

LOCATION:	KENO CITY
POPULATION	20
APPROXIMATE # OF REGULAR USERS	20
QUANTITY OF SOLID WASTE (tonnes/yr)	17
RECYCLABLE / COMPOSTABLE WASTE (POTENTIAL) (tonnes/yr)	10.1
NON-RECYCLABLE WASTE (tonnes/yr)	6.8
HAZARDOUS WASTES (tonnes/yr)	0.1

LOCATION:	STEWART CROSSING
POPULATION	30
APPROXIMATE # OF REGULAR USERS	30
QUANTITY OF SOLID WASTE (tonnes/yr)	25
RECYCLABLE / COMPOSTABLE WASTE (POTENTIAL) (tonnes/yr)	14.9
NON-RECYCLABLE WASTE (tonnes/yr)	10.0
HAZARDOUS WASTES (tonnes/yr)	0.1

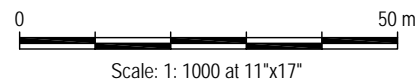
LOCATION:	MAYO	SURROUNDING UNINCORPORATED COMMUNITIES	TOTAL FOR AREAS
POPULATION	466	50	271
APPROXIMATE # OF REGULAR USERS	600	50	330
QUANTITY OF SOLID WASTE (tonnes/yr)	365	42	282
RECYCLABLE / COMPOSTABLE WASTE (POTENTIAL) (tonnes/yr)	217.9	25.1	168.4
NON-RECYCLABLE WASTE (tonnes/yr)	145.3	16.7	112.2
HAZARDOUS WASTES (tonnes/yr)	1.8	0.2	1.4



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LEGEND

- - DESIGNATED GOVERNMENT USE SOLID WASTE FACILITIES
- - FACILITY CLOSURE
- ★ - MAJOR TOWNS
- - POPULATED PLACES
- - CARMACKS CIRCUIT
- - HAINES JUNCTION CIRCUIT
- - MAYO CIRCUIT
- - WHITEHORSE CIRCUIT



CLIENT		YUKON WIDE SOLID WASTE STRATEGY			
Yukon Government		MAYO WASTE CIRCUIT			
EBA Engineering Consultants Ltd. 	PROJECT NO. W23101149	DWN EL	CKD SM	REV 0	Figure 4
	OFFICE EBA-RIV	DATE July 29, 2009			

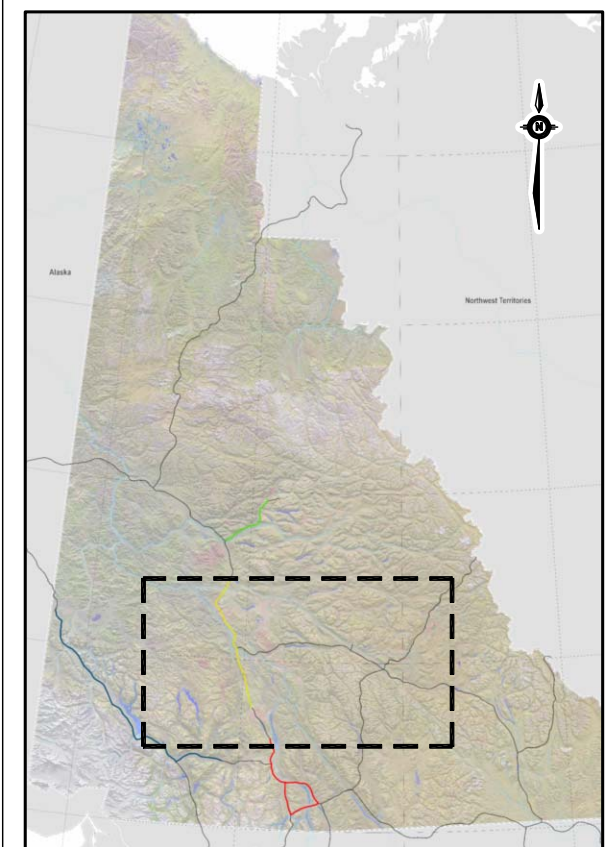
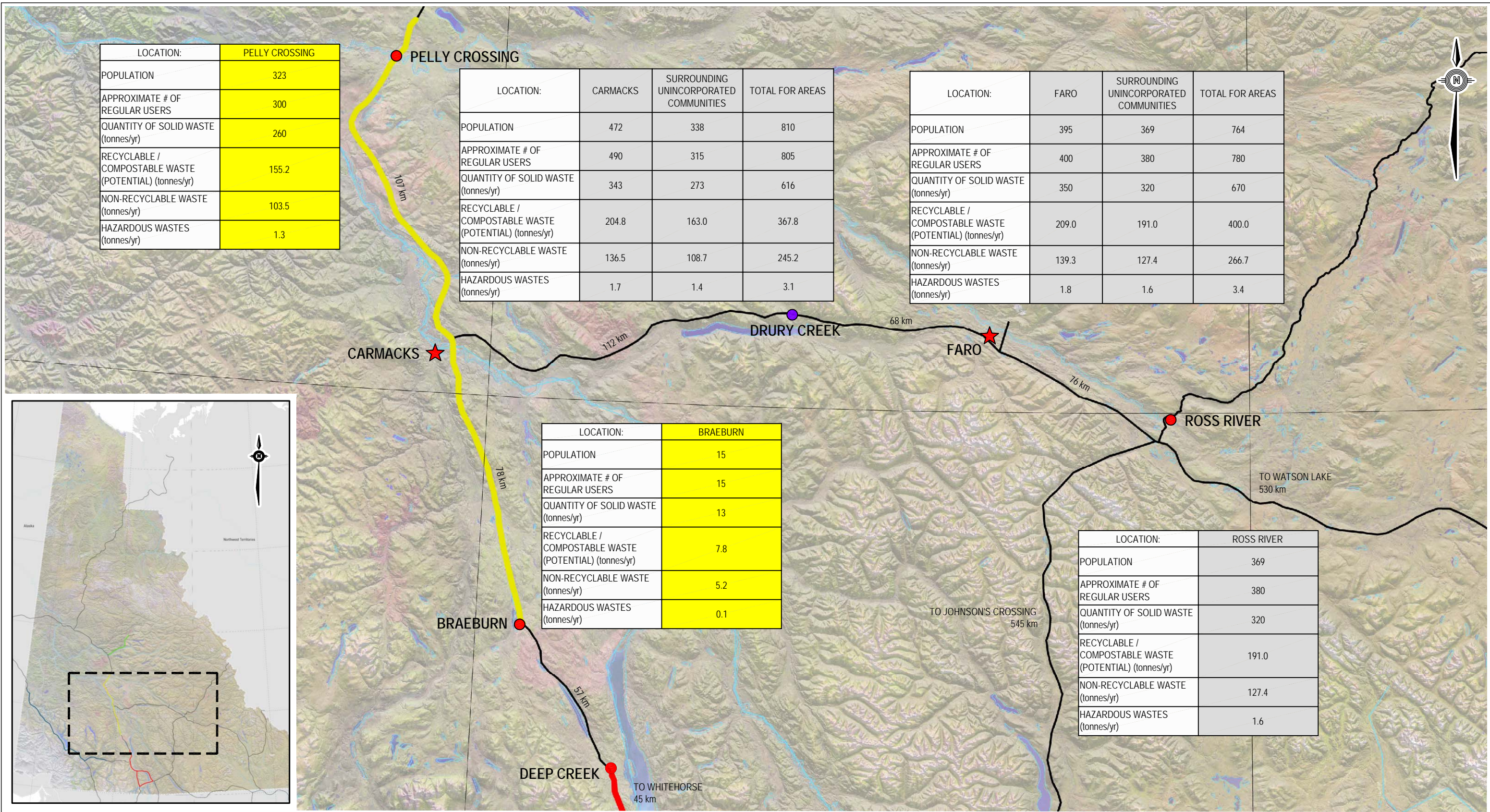
LOCATION:	PELLY CROSSING
POPULATION	323
APPROXIMATE # OF REGULAR USERS	300
QUANTITY OF SOLID WASTE (tonnes/yr)	260
RECYCLABLE / COMPOSTABLE WASTE (POTENTIAL) (tonnes/yr)	155.2
NON-RECYCLABLE WASTE (tonnes/yr)	103.5
HAZARDOUS WASTES (tonnes/yr)	1.3

LOCATION:	CARMACKS	SURROUNDING UNINCORPORATED COMMUNITIES	TOTAL FOR AREAS
POPULATION	472	338	810
APPROXIMATE # OF REGULAR USERS	490	315	805
QUANTITY OF SOLID WASTE (tonnes/yr)	343	273	616
RECYCLABLE / COMPOSTABLE WASTE (POTENTIAL) (tonnes/yr)	204.8	163.0	367.8
NON-RECYCLABLE WASTE (tonnes/yr)	136.5	108.7	245.2
HAZARDOUS WASTES (tonnes/yr)	1.7	1.4	3.1

LOCATION:	FARO	SURROUNDING UNINCORPORATED COMMUNITIES	TOTAL FOR AREAS
POPULATION	395	369	764
APPROXIMATE # OF REGULAR USERS	400	380	780
QUANTITY OF SOLID WASTE (tonnes/yr)	350	320	670
RECYCLABLE / COMPOSTABLE WASTE (POTENTIAL) (tonnes/yr)	209.0	191.0	400.0
NON-RECYCLABLE WASTE (tonnes/yr)	139.3	127.4	266.7
HAZARDOUS WASTES (tonnes/yr)	1.8	1.6	3.4

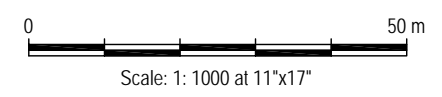
LOCATION:	BRAEBURN
POPULATION	15
APPROXIMATE # OF REGULAR USERS	15
QUANTITY OF SOLID WASTE (tonnes/yr)	13
RECYCLABLE / COMPOSTABLE WASTE (POTENTIAL) (tonnes/yr)	7.8
NON-RECYCLABLE WASTE (tonnes/yr)	5.2
HAZARDOUS WASTES (tonnes/yr)	0.1

LOCATION:	ROSS RIVER
POPULATION	369
APPROXIMATE # OF REGULAR USERS	380
QUANTITY OF SOLID WASTE (tonnes/yr)	320
RECYCLABLE / COMPOSTABLE WASTE (POTENTIAL) (tonnes/yr)	191.0
NON-RECYCLABLE WASTE (tonnes/yr)	127.4
HAZARDOUS WASTES (tonnes/yr)	1.6



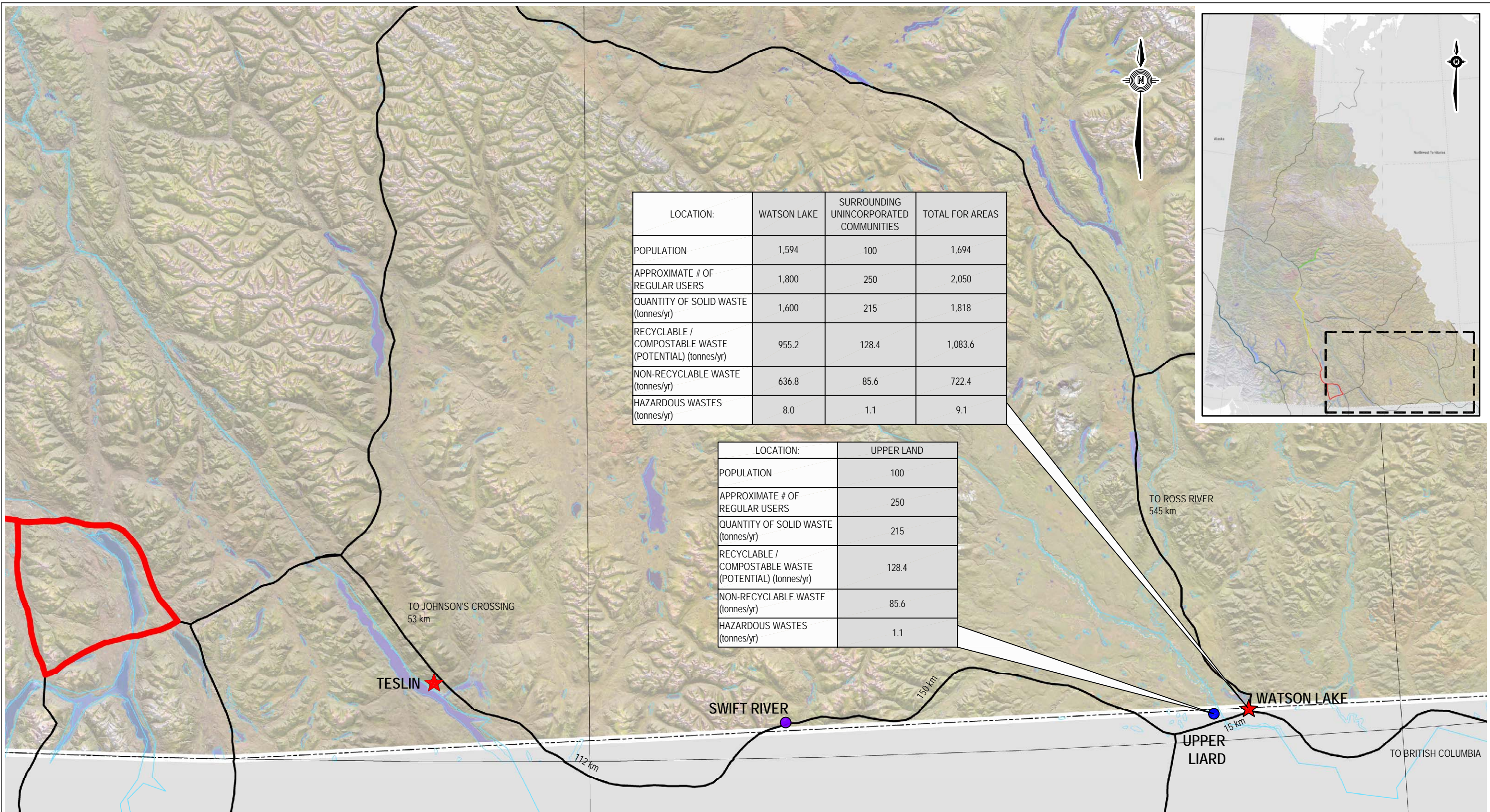
LEGEND

- - DESIGNATED GOVERNMENT USE SOLID WASTE FACILITIES
- - FACILITY CLOSURE
- ★ - MAJOR TOWNS
- - POPULATED PLACES
- - CARMACKS CIRCUIT
- - HAINES JUNCTION CIRCUIT
- - MAYO CIRCUIT
- - WHITEHORSE CIRCUIT



CLIENT		YUKON WIDE SOLID WASTE STRATEGY			
Yukon Government		CARMACKS WASTE CIRCUIT			
EBA Engineering Consultants Ltd. 	PROJECT NO. W23101149	DWN EL	CKD SM	REV 0	Figure 5
	OFFICE EBA-RIV	DATE July 29, 2009			

G:\W231\W23101149\AUTOCAD\2009\W23101149_Fig2-a.dwg [FIGURE 5] July 30, 2009 - 8:47:52 am (BY: ELVIN LEE)

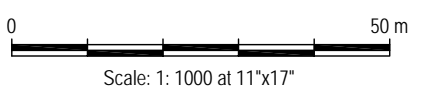


LOCATION:	WATSON LAKE	SURROUNDING UNINCORPORATED COMMUNITIES	TOTAL FOR AREAS
POPULATION	1,594	100	1,694
APPROXIMATE # OF REGULAR USERS	1,800	250	2,050
QUANTITY OF SOLID WASTE (tonnes/yr)	1,600	215	1,818
RECYCLABLE / COMPOSTABLE WASTE (POTENTIAL) (tonnes/yr)	955.2	128.4	1,083.6
NON-RECYCLABLE WASTE (tonnes/yr)	636.8	85.6	722.4
HAZARDOUS WASTES (tonnes/yr)	8.0	1.1	9.1

LOCATION:	UPPER LAND
POPULATION	100
APPROXIMATE # OF REGULAR USERS	250
QUANTITY OF SOLID WASTE (tonnes/yr)	215
RECYCLABLE / COMPOSTABLE WASTE (POTENTIAL) (tonnes/yr)	128.4
NON-RECYCLABLE WASTE (tonnes/yr)	85.6
HAZARDOUS WASTES (tonnes/yr)	1.1

G:\W231\W23101149\AUTOCAD\2009\W23101149_Fig2.dwg [FIGURE 6] July 30, 2009 - 8:46:32 am (BY: ELVIN LEE)

- LEGEND**
- - DESIGNATED GOVERNMENT USE SOLID WASTE FACILITIES
 - - FACILITY CLOSURE
 - ★ - MAJOR TOWNS
 - - POPULATED PLACES
 - - CARMACKS CIRCUIT
 - - HAINES JUNCTION CIRCUIT
 - - MAYO CIRCUIT
 - - WHITEHORSE CIRCUIT



CLIENT		YUKON WIDE SOLID WASTE STRATEGY			
Yukon Government		WATSON LAKE WASTE CIRCUIT			
EBA Engineering Consultants Ltd.	PROJECT NO. W23101149	DWN EL	CKD SM	REV 0	Figure 6
	OFFICE EBA-RIV	DATE July 29, 2009			

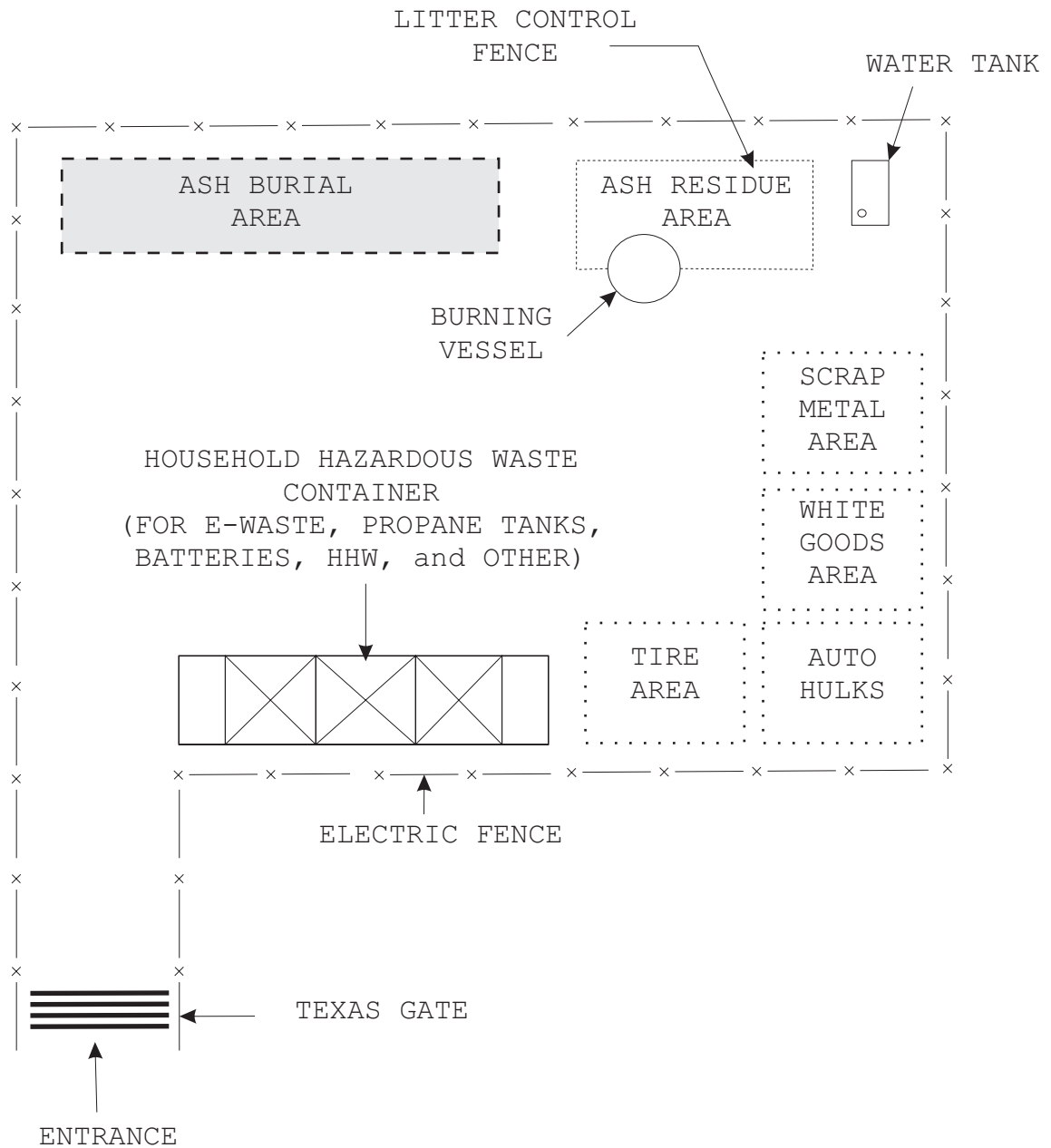


Figure not to scale.

CLIENT



EBA Engineering
Consultants Ltd.



YUKON SOLID WASTE STRATEGY

**RECOMMENDED CONCEPTUAL LAYOUT
TYPICAL BURNING VESSEL FACILITY**

PROJECT NO./FILE NO.
W23101149

DWN
SM

CKD
SW

REV
0

OFFICE
EBA-RIV

DATE
January 2009

Figure 7

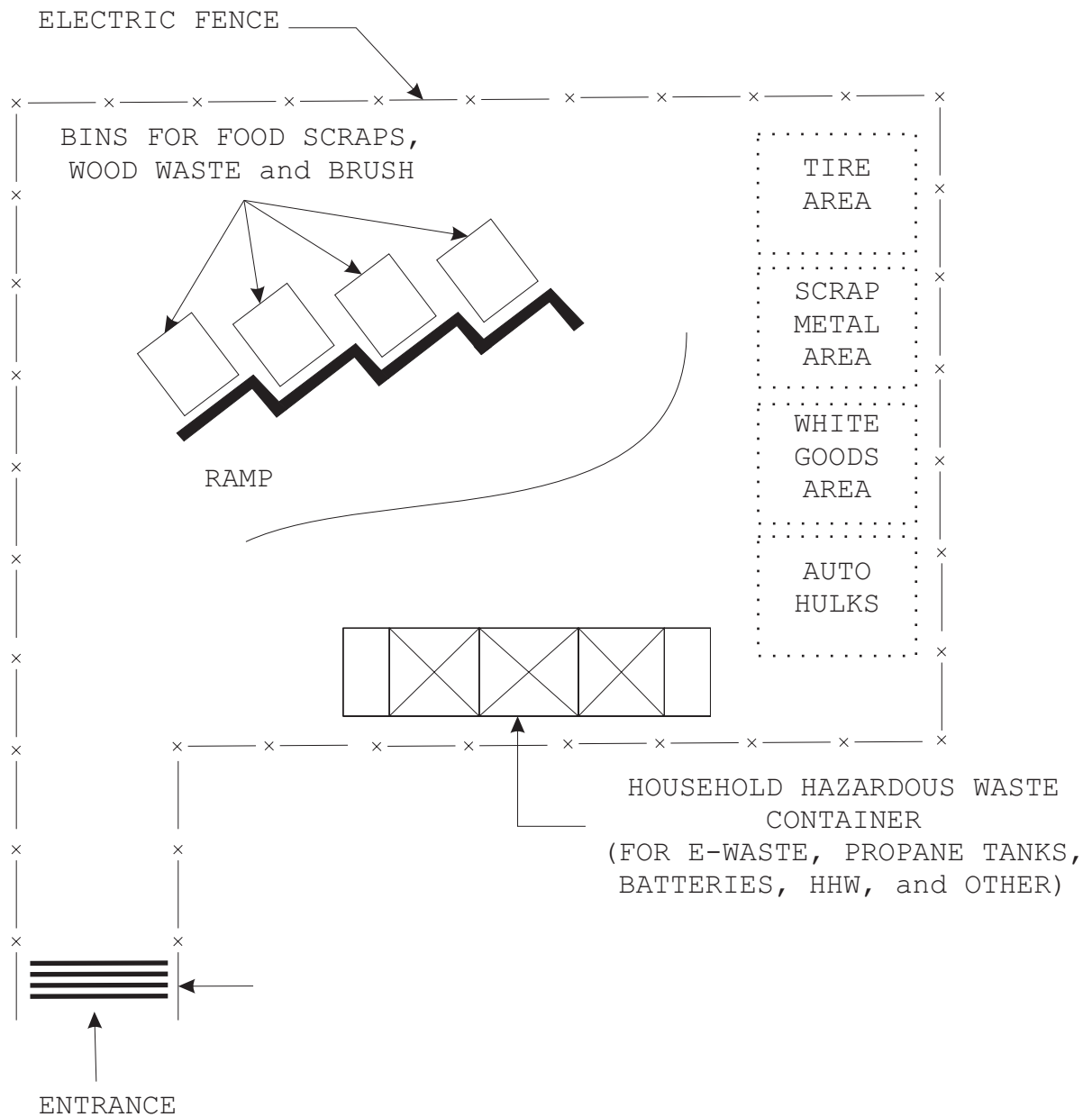


Figure not to scale.

CLIENT

Yukon

EBA Engineering
Consultants Ltd.



YUKON SOLID WASTE STRATEGY

**RECOMMENDED CONCEPTUAL LAYOUT
TYPICAL TRANSFER STATION FACILITY**

PROJECT NO./FILE NO.
W23101149

DWN
SM

CKD
SW

REV
0

OFFICE
EBA-RIV

DATE
January 2009

Figure 8



APPENDIX A

APPENDIX A FEEDBACK RECEIVED FROM PUBLIC AND STAKEHOLDER MEETINGS

Government of Yukon Solid Waste Disposal Review



The Government of Yukon welcomes your views on solid waste disposal in the Yukon.

1. Do you have any comments on the current solid waste disposal methods?

*- make it easier for salvage - keeps it out of
Landfill.*

2. Do you have any comments on the four identified solid waste disposal options?
(burning vessels; regional landfill only; incineration; regional landfill with transfer stations)

3. What waste management related services would you like to see in your community?

4. Which community do you live in or closest to?

Thank you.

Please return this information to a Government of Yukon representative at the meeting or send it to the address below (by May 22, 2009). Please contact us if you have further questions or comments:

Mail:

Community Services
Government of Yukon (Community Infrastructure)
Box 2703
Whitehorse, Yukon
Y1A 2C6

E-mail: buildingcanada@gov.yk.ca

Fax: 867-393-6216

Phone: 867-667-5707

*Could offset cost new dump facility by operating
gravel pit first.*

Government of Yukon Solid Waste Disposal Review



The Government of Yukon welcomes your views on solid waste disposal in the Yukon.

1. Do you have any comments on the current solid waste disposal methods?

- more education on recycling of non-refundables
- composting
- no garbage burning
- recycle building materials

2. Do you have any comments on the four identified solid waste disposal options?
(burning vessels; regional landfill only; incineration; regional landfill with transfer stations)

preferences
Yukon wide } incineration, using the heat generated
as a by product to create energy?
or regional landfills as second choice.

3. What waste management related services would you like to see in your community?

4. Which community do you live in or closest to?

Thank you.

Please return this information to a Government of Yukon representative at the meeting or send it to the address below (by May 22, 2009). Please contact us if you have further questions or comments:

Mail:

Kriss Sarson
Community Services (Community Infrastructure)
Government of Yukon
Box 2703
Whitehorse, Yukon
Y1A 2C6

E-mail: buildingcanada@gov.yk.ca

Fax: 867-393-6216

Phone: 867-895-5425

Government of Yukon Solid Waste Management Review



The Government of Yukon welcomes your views on solid waste management in the Yukon.

1. Do you have any waste management suggestions for your local solid waste facility or for the Yukon as a whole?

I am aware that emissions & carbon footprint are the current buzz words for panic however with geographical logistics & population I still believe there is a place for burning within the communities. However we need to upgrade to a cleaner form of incineration.

2. Do you have any comments regarding the current solid waste management arrangements for the Yukon?

perhaps the unincorporated communities need to adopt a program not unlike those of the municipalities.

3. Do you have any comments on the proposed waste management options (please see presentation)?

not currently

4. Do you have a vision for waste management in the Yukon?

not currently

Thank you.

Please return this information to a Government of Yukon representative at the meeting or send it to the address below (by May 20, 2009). Please contact us if you have further questions or comments:

Mail:
Community Services
Government of Yukon (Community Infrastructure)
Box 2703
Whitehorse, Yukon
Y1A 2C6

E-mail: buildingcanada@gov.yk.ca

Fax: 867-393-6216

Phone: 867-667-5707

Burwash/DBay

Government of Yukon Solid Waste Management Review



The Government of Yukon welcomes your views on solid waste management in the Yukon.

1. Do you have any waste management suggestions for your local solid waste facility or for the Yukon as a whole?

- cleaner, more efficient disposal units
- funding to operate recycling / compost / etc

2. Do you have any comments regarding the current solid waste management arrangements for the Yukon?

- not living up to expectations of rural residents

3. Do you have any comments on the proposed waste management options (please see presentation)?

For our community of less than 100 people the options with the lowest emissions are the better option.

4. Do you have a vision for waste management in the Yukon?

Solid waste is at a minimum, compost, recycling reducing is a normal practice and is supported by YG.

Thank you.

Please return this information to a Government of Yukon representative at the meeting or send it to the address below (by May 20, 2009). Please contact us if you have further questions or comments:

Mail:
Community Services
Government of Yukon (Community Infrastructure)
Box 2703
Whitehorse, Yukon
Y1A 2C6

E-mail: buildingcanada@gov.yk.ca

Fax: 867-393-6216

Phone: 867-667-5707

Borwash/DBay.

Government of Yukon Solid Waste Management Review



The Government of Yukon welcomes your views on solid waste management in the Yukon.

1. Do you have any waste management suggestions for your local solid waste facility or for the Yukon as a whole?

We need more diversion - more recycling - either by paying more money for non-refundables or forcing people to recycle.

2. Do you have any comments regarding the current solid waste management arrangements for the Yukon?

3. Do you have any comments on the proposed waste management options (please see presentation)?

We need to work towards replacing burning vessels -

4. Do you have a vision for waste management in the Yukon?

more recycling - government needs to support this more

Thank you.

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Community Services
Government of Yukon (Community
Infrastructure)
Box 2703
Whitehorse, Yukon
Y1A 2C6

E-mail: buildingcanada@gov.yk.ca

Fax: 867-393-6216

Phone: 867-667-5707

Burwash/DBay

Government of Yukon Solid Waste Management Review



The Government of Yukon welcomes your views on solid waste management in the Yukon.

1. Do you have any waste management suggestions for your local solid waste facility or for the Yukon as a whole?

- stop burning!
- old dump reclamation
- metal/industrial materials dump located in managed areas only.

2. Do you have any comments regarding the current solid waste management arrangements for the Yukon?

3. Do you have any comments on the proposed waste management options (please see presentation)?

What is important to me is to reduce emissions! A number of good ideas and discussion

4. Do you have a vision for waste management in the Yukon?

more recycling & recycling incentives, less disposal + burning.

Thank you.

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Borwash/DBay

Government of Yukon Solid Waste Management Review



The Government of Yukon welcomes your views on solid waste management in the Yukon.

1. Do you have any waste management suggestions for your local solid waste facility or for the Yukon as a whole?

STOP burning the garbage at the dump.
The effects are well-known - toxic.
Health effects then tax the health care
system so the gov't pays one way or another.

2. Do you have any comments regarding the current solid waste management arrangements for the Yukon?

3. Do you have any comments on the proposed waste management options (please see presentation)?

4. Do you have a vision for waste management in the Yukon?

Reduce the air emissions & harmful smoke.

Thank you.

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Burwash/D Bay

Government of Yukon Solid Waste Management Review



The Government of Yukon welcomes your views on solid waste management in the Yukon.

1. Do you have any waste management suggestions for your local solid waste facility or for the Yukon as a whole?

We need to quit burning because of the air emissions.

- better system for when the facility is burning

2. Do you have any comments regarding the current solid waste management arrangements for the Yukon?

See our comments to the recent YESAA application process.

3. Do you have any comments on the proposed waste management options (please see presentation)?

- Transfer Stations & reg. landfills

- Incineration & emission controls

4. Do you have a vision for waste management in the Yukon?

- more recycling being done, - more incentive. (Fully supported by YT6)

Thank you.

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Burwash/DBay

Government of Yukon Solid Waste Disposal Review



The Government of Yukon welcomes your views on solid waste disposal in the Yukon.

1. Do you have any comments on the current solid waste disposal methods?

WE MUST MOVE AWAY FROM OUR CURRENT
TRENCH + BURIAL APPROACH, TOO UNHEALTHY
FOR US AND THE ENVIRONMENT.

2. Do you have any comments on the four identified solid waste disposal options?
(burning vessels; regional landfill only; incineration; regional landfill with transfer stations)

- ~~BE~~ SEGREGATE + RE-CYCLE MORE
 - MULCH + SPREAD GREEN WOOD
 - COMPACT + TRANSFER REMAINDER
TO WHITEHORSE LANDFILL
- ENCOURAGE SALVAGE + COMPOST

3. What waste management related services would you like to see in your community?

LET'S RE-OPEN RECYCLING DEPOT !!

4. Which community do you live in or closest to?

CARIBOU CROSSING

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Government of Yukon Solid Waste Disposal Review



The Government of Yukon welcomes your views on solid waste disposal in the Yukon.

1. Do you have any comments on the current solid waste disposal methods?

OUT MODER/Backward

IRRESPONSIBLE/Dangerous!

2. Do you have any comments on the four identified solid waste disposal options?
(burning vessels; regional landfill only; incineration; regional landfill with transfer stations)

In terms of the health & well being of people and environment the best would be regional landfill/transfer stations
It must be manned & gated. Vigorously promote 0 waste

3. What waste management related services would you like to see in your community?

Transfer Station Loop (Southern Lakes)

An all out effort to effectively reduce, reuse & recycle

4. Which community do you live in or closest to?

Thank you.

CARCROSS

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Government of Yukon Solid Waste Disposal Review



The Government of Yukon welcomes your views on solid waste disposal in the Yukon.

1. Do you have any comments on the current solid waste disposal methods?

Archaic & unethical &
unhealthy !!!

2. Do you have any comments on the four identified solid waste disposal options?
(burning vessels; regional landfill only; incineration; regional landfill with transfer stations)

landfill site & existing
transfer station very low
capital cost & with 0 waste
goals Very viable

3. What waste management related services would you like to see in your community?

transfer-station & 0 waste
goals,

4. Which community do you live in or closest to?

Carcross.

Thank you.

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Government of Yukon Solid Waste Disposal Review



The Government of Yukon welcomes your views on solid waste disposal in the Yukon.

1. Do you have any comments on the current solid waste disposal methods?

Present Methods of burning are archaic

2. Do you have any comments on the four identified solid waste disposal options?
(burning vessels; regional landfill only; incineration; regional landfill with transfer stations)

*Transfer station combined with recycling is the preferred method in Carcross.
Incineration is not an option as it produces toxic emissions both air & ash.*

3. What waste management related services would you like to see in your community?

Transfer Station combined with recycle/reuse.

4. Which community do you live in or closest to? *Carcross.*

Thank you.

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Government of Yukon Solid Waste Disposal Review



The Government of Yukon welcomes your views on solid waste disposal in the Yukon.

1. Do you have any comments on the current solid waste disposal methods?

No burning, allowing transfer stations

2. Do you have any comments on the four identified solid waste disposal options?
(burning vessels; regional landfill only; incineration; regional landfill with transfer stations)

transfer stations - Landfill

3. What waste management related services would you like to see in your community?

Educate and implement Composting

4. Which community do you live in or closest to?

CARCR0SS

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Government of Yukon Solid Waste Disposal Review



The Government of Yukon welcomes your views on solid waste disposal in the Yukon.

1. Do you have any comments on the current solid waste disposal methods?

Cease burning, increase recycling

2. Do you have any comments on the four identified solid waste disposal options?
(burning vessels; regional landfill only; incineration; regional landfill with transfer stations)

3. What waste management related services would you like to see in your community?

improved recycling options

4. Which community do you live in or closest to? *Carcross*

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Government of Yukon Solid Waste Disposal Review



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1. Do you have any comments on the current solid waste disposal methods?

Stop Burning

2. Do you have any comments on the four identified solid waste disposal options?
(burning vessels; regional landfill only; incineration; regional landfill with transfer stations)

i would like to have regional landfill with a transfer station in my community

3. What waste management related services would you like to see in your community?

Full time staff @ the transfer station with a recycling and reuse area.

4. Which community do you live in or closest to? Carcross

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Government of Yukon Solid Waste Disposal Review



The Government of Yukon welcomes your views on solid waste disposal in the Yukon.

1. Do you have any comments on the current solid waste disposal methods?

- NO BURNING
- CURRENT DUMP MANAGEMENT IS PRETTY GOOD RELATIVE TO SOME TIMES IN THE PAST

2. Do you have any comments on the four identified solid waste disposal options?
(burning vessels; regional landfill only; incineration; regional landfill with transfer stations)

- FAVOR REGIONAL LANDFILL + TRANSFER.
- EDUCATION - IS WHAT HAPPENS TO THE DIFFERENT WASTES
- EMPHASIS ON REDUCTION / RECYCLING

3. What waste management related services would you like to see in your community?

- RECYCLE CENTRE
- POSSIBLE USER PAY ON NON RECYCLABLE WASTE DUMPING. (REDUCTION INCENTIVE)

4. Which community do you live in or closest to?

CHARCROSS

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The Government of Yukon welcomes your views on solid waste disposal in the Yukon.

1. Do you have any comments on the current solid waste disposal methods?

We dispose of too much! Unmonitored, undesignated dumping (metal in domestic pit ect. better than before!)
We must reduce our waste. Reuse our stuff

2. Do you have any comments on the four identified solid waste disposal options?
(burning vessels; regional landfill only; incineration; regional landfill with transfer stations)

The last line makes sense if we can sustain it. I like the 0-garbage thing, we have to do it.

3. What waste management related services would you like to see in your community?

Monitored dumping, transfer station.
Community garbage reduction + collaborated reduction effort by YTB-CTFN-LAC-SCHOOL-businesses.

4. Which community do you live in or closest to?

Carcross.
Live close to Tagish & Whits.

Thank you.

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Government of Yukon Solid Waste Disposal Review



The Government of Yukon welcomes your views on solid waste disposal in the Yukon.

1. Do you have any comments on the current solid waste disposal methods?

No

2. Do you have any comments on the four identified solid waste disposal options?
(burning vessels; regional landfill only; incineration; regional landfill with transfer stations)

Move the dump.

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3. What waste management related services would you like to see in your community?

none

4. Which community do you live in or closest to?

Thank you.

Carmacks

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Government of Yukon Solid Waste Disposal Review



The Government of Yukon welcomes your views on solid waste disposal in the Yukon.

1. Do you have any comments on the current solid waste disposal methods?

GOOD IN DAWSON - CONCERNED FOR LEAKAGE
STOP BURNING

2. Do you have any comments on the four identified solid waste disposal options?
(burning vessels; regional landfill only; incineration; regional landfill with transfer stations) *N/A*

↳ better than open pits ↳ yes ↳ only if oem affordable

3. What waste management related services would you like to see in your community?

curbside recycling & compost pickup
no plastic bags - compostable only
education for the public
non toxic product incentives

4. Which community do you live in or closest to?

Dawson City

Thank you.

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Government of Yukon Solid Waste Disposal Review



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1. Do you have any comments on the current solid waste disposal methods?

INADEQUATE - SITES ARE POORLY MAINTAINED.

2. Do you have any comments on the four identified solid waste disposal options?
(burning vessels; regional landfill only; incineration; regional landfill with transfer stations)

REGIONAL LANDFILLS + INCINERATION
TO BRING UP VOLUMES.

3. What waste management related services would you like to see in your community?

INCINERATION - NOT CURRENTLY COST EFFECTIVE
BECAUSE OF LOW VOLUMES.

4. Which community do you live in or closest to?

FARO

Thank you.

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Fax: 867-393-6216
Phone: 867-896-5425

Government of Yukon Solid Waste Disposal Review



The Government of Yukon welcomes your views on solid waste disposal in the Yukon.

1. Do you have any comments on the current solid waste disposal methods?

DIVERSION PRIORITY
SUBSIDIZE TO OFFSET COSTS,

2. Do you have any comments on the four identified solid waste disposal options?
(burning vessels; regional landfill only; incineration; regional landfill with transfer stations)

Regional CW transfer stations +
incorporate diversion + burning

3. What waste management related services would you like to see in your community?

subsidize diversion - high temp
incineration

4. Which community do you live in or closest to?

FARO

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Government of Yukon Solid Waste Disposal Review



The Government of Yukon welcomes your views on solid waste disposal in the Yukon.

1. Do you have any comments on the current solid waste disposal methods?

CONTROLLED BURNING - EXISTING METHODS NOT ACCEPTABLE

2. Do you have any comments on the four identified solid waste disposal options?
(burning vessels; regional landfill only; incineration; regional landfill with transfer stations)

COMBINATION OF TRANSFER STATIONS + REGIONAL LANDFILLS WITH INCINERATORS.
- DIVERSION -
- EDUCATION -

3. What waste management related services would you like to see in your community?

MORE DIVERSION, \$ FOR RECYCLING.

4. Which community do you live in or closest to?

FARLO.

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Government of Yukon Solid Waste Disposal Review



The Government of Yukon welcomes your views on solid waste disposal in the Yukon.

1. Do you have any comments on the current solid waste disposal methods?

Yukon's system appears to work well

2. Do you have any comments on the four identified solid waste disposal options?
(burning vessels; regional landfill only; incineration; regional landfill with transfer stations)

None

3. What waste management related services would you like to see in your community?

4. Which community do you live in or closest to? *Yukon*

Thank you.

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Government of Yukon Solid Waste Disposal Review



The Government of Yukon welcomes your views on solid waste disposal in the Yukon.

1. Do you have any comments on the current solid waste disposal methods?

- Very inconsistent from site to site
- burning is not something that should be supported

2. Do you have any comments on the four identified solid waste disposal options?
(burning vessels; regional landfill only; incineration; regional landfill with transfer stations)

- invest in waste diversion
- I might support a mobile incinerator

3. What waste management related services would you like to see in your community?

- waste diversion/recycling

4. Which community do you live in or closest to?

Faro

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Government of Yukon Solid Waste Disposal Review



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1. Do you have any comments on the current solid waste disposal methods?

YES IT IS A JOKE LOOK AT HAINES JET DUMP.
WE ARE WASTING LAND LIKE CRAZY. HOLE AFTER
HOLE. COMPACTOR 1/2 ASSED SET UP.

2. Do you have any comments on the four identified solid waste disposal options?
(burning vessels; regional landfill only; incineration; regional landfill with transfer stations)

USE INCINERATION IT IS PROVEN USE LESS LAND
WAY CLEANER. DO NOT LET YOUR AND OUR LOCAL
POLATITIONS LISTEN TO GREENIES AND Y.T.G. ON
HOW OUR DUMP SHOULD BE. LOOK AT OURS IT
IS A DISASTER

3. What waste management related services would you like to see in your community?

50% of Recycling JUST GETS SHIPPED SOUTH
AND PUT IN LAND FILLS.

4. Which community do you live in or closest to?

Thank you. HAINES JUNCTION.

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Government of Yukon Solid Waste Disposal Review



The Government of Yukon welcomes your views on solid waste disposal in the Yukon.

1. Do you have any comments on the current solid waste disposal methods?

TO MUCH BURNING
TO TOXIC
TO MANY EXCUSSES

2. Do you have any comments on the four identified solid waste disposal options?
(burning vessels; regional landfill only; incineration; regional landfill with transfer stations)

!! NO burning !!!!!!
transfer Stations only !!

3. What waste management related services would you like to see in your community?

Regulated
no burning
metal, garbage dumps are burnt 2 times
every year as soon as the no burn
periods are lifted.

4. Which community do you live in or closest to?

Haines Junction

Thank you.

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Government of Yukon Solid Waste Disposal Review



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1. Do you have any comments on the current solid waste disposal methods?

I believe it is criminal to be burying our garbage. It will never deteriorate.

2. Do you have any comments on the four identified solid waste disposal options?
(burning vessels; regional landfill only; incineration; regional landfill with transfer stations)

I believe incineration is the way to go.

3. What waste management related services would you like to see in your community?

Move the dump.

4. Which community do you live in or closest to?

Haines Jct.

Thank you.

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Government of Yukon Solid Waste Disposal Review



The Government of Yukon welcomes your views on solid waste disposal in the Yukon.

1. Do you have any comments on the current solid waste disposal methods?

IT WORKS but is not ideal with this Federal Funding take the opportunity to relocate the dump to plan for next 100 yrs

2. Do you have any comments on the four identified solid waste disposal options?
(burning vessels; regional landfill only; incineration; regional landfill with transfer stations)

Properly built land fill but would prefer transfer.

3. What waste management related services would you like to see in your community?

Manned station @ transfer station

4. Which community do you live in or closest to? *Heines Got*

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Government of Yukon Solid Waste Disposal Review



The Government of Yukon welcomes your views on solid waste disposal in the Yukon.

1. Do you have any comments on the current solid waste disposal methods?

SUPPORT DIVERSION

WANT TO LIMIT BURNING IN SOUTHERN LAKES AREA
OR ELIMINATE

2. Do you have any comments on the four identified solid waste disposal options?
(burning vessels; regional landfill only; incineration; regional landfill with transfer stations)

- Regardless of emission studies, Quality of life issues need to be held up higher. Burning is unpleasant for people living in close proximity to it.
- Explore potential cost savings of integrated Southern Lakes Strategy with regards to trucking waste + diverted recyclables

3. What waste management related services would you like to see in your community?

- RV SANIT DUMP NEEDED
- Maintain Transfer Station + diversion capacity.

4. Which community do you live in or closest to?

MANISH LAKE

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Government of Yukon Solid Waste Disposal Review

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1. Do you have any comments on the current solid waste disposal methods?

MARSH LK DUMP WORKING GOOD.

2. Do you have any comments on the four identified solid waste disposal options?
(burning vessels; regional landfill only; incineration; regional landfill with transfer stations)

- HIGH TEMP BURN ONLY*
- Region Land fill + transfer the best.*

3. What waste management related services would you like to see in your community?

4. Which community do you live in or closest to? *ARMY BRANCH.*

Thank you.

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Fax: 867-393-6216

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Government of Yukon Solid Waste Disposal Review



The Government of Yukon welcomes your views on solid waste disposal in the Yukon.

1. Do you have any comments on the current solid waste disposal methods?

Do not allow open burning or burning in vessels

2. Do you have any comments on the four identified solid waste disposal options?
(burning vessels; regional landfill only; incineration; regional landfill with transfer stations)

Diversion/recycling/reduce followed by regional landfill with transfer stations

3. What waste management related services would you like to see in your community?

*Reduce
Reuse
Recycle*

4. Which community do you live in or closest to?

Mt. Lorne

Thank you.

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Government of Yukon Solid Waste Disposal Review



The Government of Yukon welcomes your views on solid waste disposal in the Yukon.

1. Do you have any comments on the current solid waste disposal methods?

DO NOT BURN! DO NOT BURN! DO NOT BURN!
MORE REDUCTION / REUSE / RECYCLE NECESSARY
HIGH COST TO HEALTH!

2. Do you have any comments on the four identified solid waste disposal options?
(burning vessels; regional landfill only; incineration; regional landfill with transfer stations)

DATA ON CARBON FOOTPRINT POSSIBLY MISLEADING
DATA ON COSTS MISLEADING / SKEWED
CHEAPEST OPTION NOT BEST!!
INCINERATION DONE IMPROPERLY IS UNHEALTHY

3. What waste management related services would you like to see in your community?

INCINERATION REDUCTION / REUSE / RECYCLE

4. Which community do you live in or closest to?

WUNT LORNS

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Government of Yukon Solid Waste Disposal Review



The Government of Yukon welcomes your views on solid waste disposal in the Yukon.

1. Do you have any comments on the current solid waste disposal methods?

Too many paper + bags around the site.

2. Do you have any comments on the four identified solid waste disposal options?
(burning vessels; regional landfill only; incineration; regional landfill with transfer stations)

Burning is better.

3. What waste management related services would you like to see in your community?

- enclosed fencing around / over. to catch the paper / bags

4. Which community do you live in or closest to?

Ross River

Thank you.

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change

The Government of Yukon welcomes your views on solid waste disposal in the Yukon.

1. Do you have any comments on the current solid waste disposal methods?

I do not agree with the burning of household garbage. I would like to see recycling depots in our communities. People need to be educated on what they can do to reduce garbage and therefore garbage disposal.

2. Do you have any comments on the four identified solid waste disposal options? (burning vessels; regional landfill only; incineration; regional landfill with transfer stations)

We have limited information on the emissions that burning garbage puts into the air we breathe, either open pit or vessels. Incineration with filters and scrubbers would be an option if garbage was collected and then transported to a few central incinerators.

3. What waste management related services would you like to see in your community? with a regional landfill transfer station.

- recycling
- education on the goals, reasons and methods for changes in waste management methods and changes.

4. Which community do you live in or closest to?

Tagish

Thank you.

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Government of Yukon Solid Waste Disposal Review



The Government of Yukon welcomes your views on solid waste disposal in the Yukon.

1. Do you have any comments on the current solid waste disposal methods?

Changes are urgently necessary because solid waste disposal at ~~the~~ the Tagish/Carcross dumps and other communities are unacceptable the way they are. I don't see organized disposal. What happens is unorganized pollution.

2. Do you have any comments on the four identified solid waste disposal options? (burning vessels; regional landfill only; incineration; regional landfill with transfer stations)

Burning material like plastic without any filter system nearly 24 hours seven days a week isn't a good idea. It's unhealthy in many ways. Every new car leaves the factory with an catalytic converter, for example. Incineration, if this means high-temperature-burning is a better solution. Where ever that could be done.

3. What waste management related services would you like to see in your community?

The pile of batteries, oil-, brakefluid-, paintcontainers looks is a disaster zone. All those liquids are getting into the soil already for over two decades. The drinking water well is just one mile away from that zone. There are people in Tagish which are not drinking this water. Somebody should be hired to check

4. Which community do you live in or closest to? - Tagish -

and select whatever goes to the dump, like at Marsh-Lake and Robinson dumps. Real recycling is possible then.
Thank you.

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Government of Yukon Solid Waste Disposal Review

The Government of Yukon welcomes your views on solid waste disposal in the Yukon.

1. Do you have any comments on the current solid waste disposal methods?

We have a burning vessel and it's an absolute disgrace - shameful!

2. Do you have any comments on the four identified solid waste disposal options?
(burning vessels; regional landfill only; incineration; regional landfill with transfer stations)

the best option is the regional landfill with transfer stations
the worst option is the burning vessel

3. What waste management related services would you like to see in your community?

a regional landfill with transfer station

4. Which community do you live in or closest to?

Tagish

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Government of Yukon Solid Waste Disposal Review

The Government of Yukon welcomes your views on solid waste disposal in the Yukon.

1. Do you have any comments on the current solid waste disposal methods?

Criminal!

Stop burning now!

2. Do you have any comments on the four identified solid waste disposal options?
 (~~burning vessels; regional landfill only; incineration; regional landfill with transfer stations~~)



3. What waste management related services would you like to see in your community?

Recycling station + transfer station or landfill

4. Which community do you live in or closest to?

Tegish

Thank you.

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Government of Yukon Solid Waste Disposal Review



The Government of Yukon welcomes your views on solid waste disposal in the Yukon.

1. Do you have any comments on the current solid waste disposal methods?

Currently unacceptable

2. Do you have any comments on the four identified solid waste disposal options?
(burning vessels; regional landfill only; incineration; regional landfill with transfer stations)

No Burning - neither open burning nor incineration

3. What waste management related services would you like to see in your community?

Comprehensive Solid Waste management - i.e. education
in 3Rs - Transfer station

4. Which community do you live in or closest to?

Tegish

Thank you.

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Government of Yukon Solid Waste Disposal Review



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1. Do you have any comments on the current solid waste disposal methods?

A joke when we were promised bins for re-cycling last Sept (2008)

2. Do you have any comments on the four identified solid waste disposal options?
(burning vessels; regional landfill only; incineration; regional landfill with transfer stations)

3. What waste management related services would you like to see in your community?

A better system than a burner that is smoldering all the time.

4. Which community do you live in or closest to?

Tagish

Thank you.

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Government of Yukon Solid Waste Disposal Review



The Government of Yukon welcomes your views on solid waste disposal in the Yukon.

1. Do you have any comments on the current solid waste disposal methods?

It must be changed!

2. Do you have any comments on the four identified solid waste disposal options?
(burning vessels; regional landfill only; incineration; regional landfill with transfer stations)

Southern Lakes Loop
TRANSFER STATIONS

3. What waste management related services would you like to see in your community?

Waste reduction strategy
& TRANSFER STATION

4. Which community do you live in or closest to?

Thank you. Tagish

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Government of Yukon Solid Waste Disposal Review



The Government of Yukon welcomes your views on solid waste disposal in the Yukon.

1. Do you have any comments on the current solid waste disposal methods?

Current methods = liability. Poisoning people and the environment.
STOP BURNING GARBAGE! Because it's unsupervised 24-7, we get waste from Whitehorse, Marsh Lake, and Mt. Lorne. Then it's burned here. That SUCKS!
Burning vessel is a DIRTY band-aid solution.
DOES NOT ADDRESS recyclable + hazardous material are **BURNED** all the time. the Burning vessel pumps out toxic smoke or is smouldering All the time. DANGEROUS!

2. Do you have any comments on the four identified solid waste disposal options?

(burning vessels; regional landfill only; incineration; regional landfill with transfer stations)

NO! to incinerators — Waste of energy, undermines recycling and other diversion

NO! to burning vessels = toxic smoke factories.
for Tagish, we need a staffed transfer station and recycling depot.

Each community should discuss its own solutions. What does each community want and need? What is important to them?

3. What waste management related services would you like to see in your community?

At the dump **STOP BURNING GARBAGE!** I've said this for 5 years already. It's making me SICK.

Set up transfer bins for domestic garbage, covered bins for recyclables, STAFF for public education and refunds, HOURS of OPERATION, gates that lock outside those hours, FENCED compost area. Hire Anne M. to work there.

4. Which community do you live in or closest to?

Tagish

Thank you.

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TAGISH

Government of Yukon Solid Waste Disposal Review



The Government of Yukon welcomes your views on solid waste disposal in the Yukon.

1. Do you have any comments on the current solid waste disposal methods?

They suck.

2. Do you have any comments on the four identified solid waste disposal options?
(burning vessels; regional landfill only; incineration; regional landfill with transfer stations)

We need a transfer station.

3. What waste management related services would you like to see in your community?

4. Which community do you live in or closest to?

TAGISH

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Government of Yukon Solid Waste Disposal Review



The Government of Yukon welcomes your views on solid waste disposal in the Yukon.

1. Do you have any comments on the current solid waste disposal methods?

Burning garbage must
be stopped.

2. Do you have any comments on the four identified solid waste disposal options?
(burning vessels; regional landfill only; incineration; regional landfill with transfer stations)

Transfer stations & No Burning

3. What waste management related services would you like to see in your community?

Shut down burning vessel
Recycling Bins &
Transfer station

4. Which community do you live in or closest to?

Tagish

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Government of Yukon Solid Waste Disposal Review



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1. Do you have any comments on the current solid waste disposal methods?

UNSAFE, TOXIC

2. Do you have any comments on the four identified solid waste disposal options?
(burning vessels; regional landfill only; incineration; regional landfill with transfer stations)

NO BURNING!

regional landfill with transfer station

3. What waste management related services would you like to see in your community?

supervised transfer of garbage
recycle garbage
composting

4. Which community do you live in or closest to? TAGISH

Thank you.

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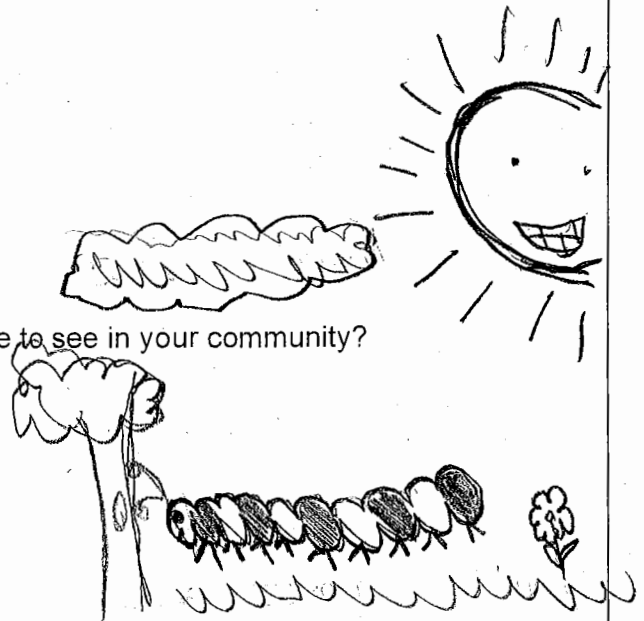
Government of Yukon Solid Waste Disposal Review



The Government of Yukon welcomes your views on solid waste disposal in the Yukon.

1. Do you have any comments on the current solid waste disposal methods?
2. Do you have any comments on the four identified solid waste disposal options?
(burning vessels; regional landfill only; incineration; regional landfill with transfer stations)

3. What waste management related services would you like to see in your community?



4. Which community do you live in or closest to?

Watson Lake

Thank you.

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Government of Yukon Solid Waste Disposal Review



The Government of Yukon welcomes your views on solid waste disposal in the Yukon.

1. Do you have any comments on the current solid waste disposal methods?
2. Do you have any comments on the four identified solid waste disposal options?
(burning vessels; regional landfill only; incineration; regional landfill with transfer stations)

3. What waste management related services would you like to see in your community?

4. Which community do you live in or closest to?

Watson Lake

Thank you.

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Government of Yukon Solid Waste Disposal Review



The Government of Yukon welcomes your views on solid waste disposal in the Yukon.

1. Do you have any comments on the current solid waste disposal methods?

Yes, why are we still burning garbage?!

2. Do you have any comments on the four identified solid waste disposal options?
(burning vessels; regional landfill only; incineration; regional landfill with transfer stations)

*no burning. maybe regional landfill. (?)
educate public to reduce & recycle so not so
much garbage is produced. maybe charge \$
for garbage, but then they throw it in the
bush, creating another problem,*

3. What waste management related services would you like to see in your community?

*curbside pick-up recycling (where)
no burning or dumps (outside where)*

4. Which community do you live in or closest to?

Whitehorse

Thank you.

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Government of Yukon Solid Waste Disposal Review



The Government of Yukon welcomes your views on solid waste disposal in the Yukon.

1. Do you have any comments on the current solid waste disposal methods?

- TOO EXPENSIVE IF USING TOWN
- Full transfer Station at times @ sleep back

2. Do you have any comments on the four identified solid waste disposal options?
(burning vessels; regional landfill only; incineration; regional landfill with transfer stations)

Burn what can be burned, and transfer what can't be burned.

Maybe moving grate, Power Vented burner
could burn cleanly (almost) INCINERATION

TWO OR 3 per site - ONE burner, one being loaded, one cooling

3. What waste management related services would you like to see in your community?

- at least unrestricted access to the (my) local dumps
- The government benefits from taxes on the trucks of the product, the sales facility, the job generated open base is a by product of our society.

4. Which community do you live in or closest to? WHITEHORSE DEER CREEK

Thank you.

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Government of Yukon Solid Waste Disposal Review



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1. Do you have any comments on the current solid waste disposal methods?

Carcross should follow Mt. Lorne system. Labour costs might be lessened by some reliance on volunteers w stipend

2. Do you have any comments on the four identified solid waste disposal options?
(burning vessels; regional landfill only; incineration; regional landfill with transfer stations)

Prefer reg. landfill with transfer stations

Whitehorse may not be best location for waste transfer, as this may be time limited.

3. What waste management related services would you like to see in your community?

4. Which community do you live in or closest to?

Whitehorse, I have residence in Carcross as well

Thank you.

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RECOMMENDATIONS FROM DAWSON SOLID WASTE MANAGEMENT COMMITTEE REGARDING YUKON SOLID WASTE STRATEGY

The Dawson City Solid Waste Management Committee (SWMC) consists of members of the Dawson community, members from administrative staff and elected representatives from the City of Dawson and representation from the Conservation Klondike Society.

SUMMARY:

Focussing on “waste disposal” rather than “waste diversion” is the wrong priority when devising a Yukon Solid Waste Strategy. If waste diversion were prioritized, many of the problems with waste disposal would automatically be solved.

Based on the Yukon Environment Waste Management Report (1995), Yukon domestic waste is comprised of the following (by weight):

- 50% compostables;
- 25% recyclable metal, glass, plastic;
- 20% recyclable paper; and
- 5% actual garbage.

If compostables, recyclables, hazardous waste, and e-waste were kept out of the waste disposal site:

- burial and transfer stations would suffice for the 5% ‘waste’ that remained;
- methane production from landfills would be minimal (as anaerobic composting would be minimized);
- heavy metal leachate into the ground water would be minimal (as anaerobic composting and heavy metal waste would be minimized);
- dioxin contamination would be eliminated (as open pit and vessel burning would be eliminated); and
- the life of each landfill would be greatly prolonged (as up to 95% of solid waste would be diverted).

Switching the focus and financial resources to waste reduction and diversion is investing in the future. If YTG Community Services continues to focus on waste disposal, there will be huge costs to pay down the road: huge costs to relocate and replace landfills as well as huge environmental and health costs. It will be our children who will bear the cost of the decisions made today. Solid waste management needs to be dealt with proactively now, not reactively in the future.

Successful waste diversion requires:

- recognition that all aspects of waste management are a YTG responsibility;
- co-ordination of goals between YTG's Department of Community Services and YTG's Department of the Environment;
- coordinated effort between YTG, municipal governments, recycling and conservation organizations; and,
- allocation of financial resources to provide infrastructure and programmes for waste reduction and diversion as well as subsidies to municipalities and recycling centers to help offset the O&M costs associated with waste diversion.

Therefore:

- Implement, now, the infrastructure to divert recyclables (incl. paper and cardboard), hazardous waste and e-waste out of the landfill so that open burning and burning vessels can be discontinued as soon as possible. With the possible exception of allowing the burning of untreated wood. Consider certified incineration (very expensive) only for communities with no road access (i.e. Old Crow).
- For Dawson and other communities concentrate on diversion:
 - **Provide support to set-up and maintain municipal composts in all communities.** This involves education to communities on how to set up a municipal compost (Dawson can provide a template) as well as subsidies/incentives to municipalities for compost collection.
 - **Maximize support for diverting all recyclables (not just the refundables), including paper and cardboard, out of the landfills.** This involves promotion, education as well as financial support for storage facilities and support for back-hauls.
 - **Purchase a mobile shredder and bailer that can travel to each community, with trained operator, to shred, bail and back-haul recyclables, incl. paper and cardboard, to Raven Recycling from the communities**
 - **Maximize support for keeping hazardous waste and e-waste out of the landfills.** This involves promotion, education as well as financial support for storage facilities and support for back-hauls.
 - **Lead by example** by implementing full recycling (including paper and cardboard), compost collection, hazardous waste and e-waste diversion at all YTG affiliated offices/buildings across the Yukon. Lead by example by implementing the use of recycled products (ie paper products), degradable plastic (i.e., degradable garbage bags) and minimizing hazardous waste (i.e., using environmentally friendly cleaning products) at all YTG affiliated offices/buildings across the Yukon.

- **Support initiatives for sustainable packaging and reduction of packaging**, i.e. the sustainable packing initiatives of the Canadian Council of Ministers of the Environment (CCME) http://www.ccme.ca/ourwork/waste.html?category_id=18.

Specific to Dawson:

- Replacing the Dawson's landfill will be a challenging and costly proposition. A new landfill would probably need to be located off of the Dempster Highway. Transporting waste such a distance from Dawson would result in a considerable carbon footprint and cost.
- Dawson already has some of the infrastructure in place to divert compostables and some recyclables. However, the following are required:
 - financial support to enable collection, storage, bailing and backhauling of paper and cardboard so that burning can be discontinued;
 - financial support to help offset costs of compost collection so that household compost collection can commence;
 - financial support for a storage facility at Quigley for e-waste and hazardous waste as well as increasing support to back-haul these items; and,
 - access to a shredder and bailer to enable more cost effective back-hauling of recyclables.

APPENDIX

THE DETAILS:

DIVERTING COMPOST IS THE EASIEST AND MOST COST EFFECTIVE DIVERSION STRATEGY AS IT CAN BE DONE LOCALLY AND REQUIRES MINIMAL INTERVENTION.

- Environmental and Health Advantages:
 - Decrease methane production from landfills (methane is produced when compost degrades anaerobically, buried in a landfill. It is not produced when compost is aerobically composted.)
 - Decrease heavy metal leaching from landfill into ground water (anaerobic break down of compostables in landfill causes increased acidity in the landfill which causes a marked increase in heavy metal leachate).
 - Provides a valuable resource that can be used locally, rather than wasting such a resource by burying it in the landfill
 - Ease of use:
 - Whitehorse has been collecting domestic compostables for 15 years (including all food products raw or cooked plus food soiled paper and wax paper and box board) and produces Grade A compost on testing. Windrow method. Problem: has accepted biodegradable bags, rather than certified compostable bags, and therefore bag debris hinders screening and found in compost.
 - Dawson can provide a template for smaller communities. Collecting local restaurant and grocery store compost since last July, extending to all commercial facilities and to some households (voluntary). Certified compost bags only (composted within a few months). Raven proof structure.
 - Ways in which YTG could assist:
 - promotion, education and support for communities to set up their own municipal composts;
 - financial assistance for O&M of compost curbside pick-up in communities with curbside garbage pick-up; and,
 - once municipal composts are in place, implement full composting practices in all YTG affiliated buildings throughout the Yukon.

DIVERTING RECYCLABLE METALS, GLASS, AND PLASTIC:

Environmental and health advantages:

- ‘Cradle to cradle’ vs. ‘cradle to grave’ concept, i.e. decreasing use of non-renewable resources to manufacture disposable packaging.
- Less energy required, and less pollution produced when packaging is made out of recycled material as opposed to making it from raw material.
 - Ways in which YTG could assist:
 - financial support, promotion and education for diverting **all** recyclables, not just the refundables;
 - support Raven Recycling and community recycling depots that feed into Raven Recycling. Raven has found recycling plants for almost all plastic (hard plastic and plastic film), steel and aluminum;
 - financial assistance to communities to build adequate storage facilities for recyclables;
 - purchase a mobile shredder and bailer that can travel to each community, with trained operator, to shred, bail and back-haul recyclables to Raven Recycling from the communities;
 - financial assistance to Raven to back-haul recyclables south, **including glass** (currently Yukon glass is not recycled as it is too heavy to back-haul);
 - lead by example by implementing **full** recycling practices in all YTG affiliated buildings throughout the Yukon;
 - educate and promote the use of degradable garbage bags and lead by example by implementing this in all YTG affiliated buildings throughout the Yukon;
 - promote the use of compostable take-out containers in the Yukon; and,
 - support initiatives in sustainable packaging such as that from the Canadian Council of Ministers of the Environment
http://www.ccme.ca/ourwork/waste.html?category_id=18

DIVERTING RECYCLABLE PAPER/CARDBOARD:

Environmental and health advantages:

- It saves up to 40% in energy to make products out of recycled paper rather than virgin fiber. It reduces air pollution by 74% and reduces water pollution by 34% to make products out of recycled paper rather than virgin fiber.
- Prevent the production of dioxins which results from the burning of paper, cardboard, box board, particle board, plywood and any treated, painted or coated wood.
 - Once formed, dioxins never break down. They are transferred from the air and the fire ash to soil, water and vegetation. They then accumulate up the food chain and ultimately end up concentrated in us where they continue to accumulate in our fat stores over time. They are also transferred through the placenta to developing fetuses and through breast milk to infants. Dioxins have been associated in humans with cancer, diabetes, birth and developmental defects, learning disabilities, decreased fertility, and suppression of our immune system. (Health Canada 2006. www.hc-sc.gc.ca/iyh-vsv/environ/dioxin_e.html) In the United States, some research suggests most adults have already accumulated detectable levels of dioxin in their bodies which are near the levels known to cause health problems (United States Environmental Protection Agency, January 2008, www.epa.gov/pbt/pubs/dioxins.htm)
- According to Raven Recycling in Whitehorse, Yukon is the only jurisdiction in Canada that still allows garbage burning at municipal landfills (www.ravenrecycling.org/garbageburning/garbageburning.htm).
 - Ways in which YTG could assist:
 - provide financial assistance to communities to build a structure to store paper and cardboard;
 - purchase a mobile shredder and bailer and have it travel to each community, with trained operator, to shred, bail and back-haul paper and cardboard to Raven Recycling from the communities;
 - discontinue all burning of garbage/ paper, cardboard, box board, particle board, plywood and any treated, painted or coated wood a.s.a.p. N.B. Must have the infrastructure to divert paper and cardboard in place first ;
 - continue to support Raven Recycling to back-haul paper, box board and cardboard to paper recycling plants in the south; and,
 - lead by example by implementing the use of 100% post consumer recycled and processed chlorine free office paper, paper towels, toilet paper, facial tissues in all YTG affiliated offices/buildings. Start by stocking the above at Central Stores.

DIVERTING HAZARDOUS WASTE

Ways in which YTG could assist:

- promote and educate Yukoners regarding hazardous waste items;
- disallow hazardous waste from the domestic pile after providing financial support to provide a safe storage facility to house hazardous waste until YTG pick-up;
- consider options for hazardous waste which has no option except the landfill i.e. motor oil containers, alkaline batteries;
- increase the frequency of hazardous waste pick-up in the communities to twice per year; and,
- lead by example by avoiding hazardous waste products (i.e., non environmentally friendly cleaning products) in all YTG affiliated offices/buildings.

DIVERTING E-WASTE

Ways in which YTG could assist:

- promote and educate Yukoners regarding e-waste;
- disallow e-waste from the domestic pile after providing financial support to provide a safe storage facility for e-waste until it can be back-hauled;
- support Computers for Schools to increase their ability to handle the increasing volume of e-waste; and,
- provide financial assistance for communities to back-haul e-waste to Computers for Schools in Whitehorse.



APPENDIX B

APPENDIX B FUNDING PROGRAMS AVAILABLE IN THE YUKON

EXISTING FUNDING PROGRAMS IN THE YUKON

1.0 GAS TAX FUND (GTF)

The Gas Tax Fund (GTF), a key component of the Building Canada infrastructure plan, is helping to build Canada's communities by providing predictable and long-term funding in support of municipal infrastructure that contributes to cleaner air, cleaner water, and reduced greenhouse gas emissions.

The GTF supports environmentally sustainable municipal infrastructure, such as:

- public transit;
- drinking water;
- wastewater infrastructure;
- green energy;
- solid waste management; and,
- local roads and bridges.

In addition, it benefits communities by providing funding to increase the capacity of communities to undertake long-term planning.

Municipalities can pool, bank, and borrow against this funding, providing significant additional financial flexibility. To ensure accountability to Canadians, communities report on their use of the funds on an annual basis.

Investment: The Building Canada plan is delivering \$8 billion (\$2 billion per year) in new predictable funding for sustainable infrastructure in our cities and communities. From 2007 to 2008 to 2013 to 2014, municipalities will receive a total of \$11.8 billion in gas tax funding.

In response to ongoing requests for stable, long-term funding, Budget 2008 announced that the GTF will be extended at \$2 billion per year beyond 2013 to 2014 and become a permanent measure. This will allow all municipalities, both large and small, to better plan and finance their long-term infrastructure needs.

2.0 THE GREEN MUNICIPAL FUND

Federation of Canadian Municipalities' (FCM's) Green Municipal Fund (GMF) provides loans and grants, builds capacity, and shares knowledge to support municipal governments and their partners in developing communities that are more environmentally, socially, and economically sustainable.

The Government of Canada endowed FCM with \$550 million to establish GMF to provide a long-term, sustainable source of financing for municipal governments and their partners. To ensure the greatest possible impact, FCM uses GMF to invest in plans, studies, and projects that provide the best examples of municipal leadership in sustainable development and that can be replicated in other communities. FCM develops case studies and other tools to support municipal governments that are prepared to follow these examples.

FCM offers low-interest GMF loans or low-interest loans combined with grants to implement leading examples of sustainable development projects. GMF can offer financing for up to 80% of the eligible costs of some capital projects. GMF interest rates for municipal governments are Government of Canada bond rate for the equivalent term minus 1.5%.

Potential applicants can apply at any time for low interest loans to support brownfield remediation, beginning in July 2008.

Potential applicants can apply only in response to specific targeted calls for applications in four sectors: energy, transportation, waste, and water. Specific prerequisites and criteria are set through each call for applications. In most cases, applicants must have already completed a feasibility study or field test.

3.0 INFRASTRUCTURE CANADA PROGRAM

The Infrastructure Canada Program (ICP) has been helping to renew and build infrastructure in rural and urban municipalities across Canada.

The ICP has focussed on green municipal infrastructure – projects that improve the quality of our environment and contribute to clean air and water.

Program Details

The goal of the ICP has been to enhance municipal infrastructure in urban and rural communities across the country, and improve Canadians' quality of life through investments that protect our environment and support long-term economic growth.

Green municipal infrastructure has been the program's first priority. Examples of eligible projects included:

- water and wastewater systems;
- water management;
- solid waste management and recycling; and,
- capital expenditures to retrofit or improve the energy efficiency of buildings and facilities owned by local governments.

4.0 FIRST NATION INFRASTRUCTURE FUND (FNIF)

The objective of the First Nations Infrastructure Fund (FNIF) is to improve the quality of life and the environment for First Nation communities by assisting First Nations in the provinces to improve and increase public infrastructure on reserves, Crown Land, land set aside for the use and benefit of a First Nation, or off-reserve in the case of cost-shared projects with non-First Nation partners, such as neighbouring municipalities.

Four categories of projects are eligible for funding under the program, each with several subcategories. All projects must fall within one or more of the eligible subcategories:

- Planning and skills development:
 - Comprehensive community planning.
 - Capital/infrastructure planning.
 - Community infrastructure awareness and maintenance capacity.
 - Training related to supporting community infrastructure.
- Solid waste management:
 - Waste disposal site construction.
 - Waste diversion projects.
 - Transfer stations.
 - Recycling.
- Roads and bridges:
 - Local roads.
 - Access roads.
 - Cost sharing with provincial/municipal roads projects.
 - Bridges.
- Energy systems:
 - Grid hook-up projects.
 - Sustainable energy systems for facilities – solar walls, ground-source heat pumps, wind power, etc.

5.0 BUILDING CANADA

The Building Canada Fund (BCF) is a Government of Canada funded infrastructure program focused on a number of national priorities: a stronger economy, a cleaner environment, and better communities, while addressing local and regional infrastructure needs.

Funding will be allocated for projects in the provinces and territories based on their population and all major projects will be selected through federal-provincial/territorial negotiations.

The program will operate through two components¹:

- The Major Infrastructure Component (MIC) will target larger, strategic projects of national and regional significance.
- The Communities Component (CC) will focus on projects in communities with populations of less than 100,000 – helping these smaller communities face their unique challenges.

The Government of Yukon has identified five key areas for the application of funding and include 1) Solid Waste 2) Drinking Water 3) Roads 4) Wastewater 5) Green Energy. As addressed in conjunction with the public meetings held as part of this comprehensive solid waste study, the government has now collected community input into their priorities under these categories and further they have inventoried the potential projects for each category both at a community level as well as Yukon wide. During the Building Canada presentations held in the spring of 2009, emphasis was placed on the fact that any solid waste funding would have to focus on the reduction/recycling aspects of solid waste and not on the development of new facilities.

6.0 GREEN INFRASTRUCTURE FUND

The Green Infrastructure Fund (GIF) is related to Building Canada and is a part of Canada's Economic Action Plan. This Fund, through which \$1 billion is available to eligible project over five years, supports sustainable energy generation and transmission, along with municipal wastewater and solid waste management infrastructure². Eligible projects are those that promote cleaner air, reduced greenhouse gas emissions, and cleaner water.

The new \$1 billion Green Infrastructure Fund will be allocated based on merit to support green infrastructure projects on a cost-shared basis (i.e. the federal government is to share the project costs with the local municipal or provincial/territorial governments). The merit

1 <http://www.buildingcanada-chantierscanada.gc.ca/funprog-progfin/target-viser/bcf-fcc/bcf-fcc-eng.html>

2 <http://www.buildingcanada-chantierscanada.gc.ca/media/news-nouvelles/2009/gif-fiv-eng.html>

of the projects will be based on assessment criteria such as eligibility, leveraging financial investments and project benefits.

Eligible recipients include provinces, territories, local or regional governments, public sector bodies, non-profit organizations and private companies, either alone or in partnership with a province, territory or a government. Proponents are encouraged to summarize their project in a letter to gauge interest from the federal government, and if this interest is received proponents will be invited to submit a more detailed proposal that describes the project and its components, cost estimates, expected results and benefits.

The Yukon has already accessed a portion of these funds, receiving up to \$71 million towards the enhancement of existing hydro power infrastructure at the Mayo hydro facility along with Phase 2 of the Carmacks-Stewart transmission line.



APPENDIX C

APPENDIX C WASTE MODEL (CD)



APPENDIX D

APPENDIX D WASTE PROGRAMS IN THE YUKON

EXISTING WASTE PROGRAMS IN THE YUKON

1.0 BEVERAGE CONTAINER RECYCLING PROGRAM

1.1 SUMMARY OF INITIATIVE

The program began in 1992 and is administered through the territorial government. The Department of Environment supports regulations, administers refund payments, pays depots handling fees, and is responsible for promotional/educational initiatives. Depots are operated by non-profit organizations or private businesses. The consumers bring in their used beverage containers and other recyclables to one of approximately 24 depots.

1.2 OBJECTIVES

The purpose of the expanded deposit return program is to divert waste material away from landfills and reduce roadside litter. Besides this, generating a stable and sustainable recycling fund is an ongoing goal.

1.3 DESIGNATED PRODUCTS

Schedule A under the Regulation outlines the following designated products: Beverage containers intended to contain any non-dairy, non-liquor beverage with a capacity of 1,000 mL or less a refundable deposit of \$0.05, and a recycling fund fee \$0.05; with a capacity of greater than 1,000 mL a refundable deposit of \$0.25 and a recycling fund fee of \$0.10. For beverage containers intended to contain liquor, aluminium cans have a refundable deposit of \$0.05 and a recycling fund fee of \$0.05; refillable glass containers have a refundable deposit of \$0.10 and no recycling fund fee; non-refillable containers with a capacity of 200 mL to 499 mL have a refundable deposit of \$0.10 and a recycling fund fee of \$0.05; non-refillable containers with a capacity of 500 mL or greater have a refundable deposit of \$0.25 and a recycling fund fee of \$0.10.

1.4 END-OF-LIFE PRODUCT ISSUES

The waste management concerns associated with this product relate to the volume of waste generated at local dumps or landfills.

2.0 USED TIRE MANAGEMENT PROGRAM

2.1 SUMMARY OF INITIATIVE

The Designated Materials Regulation establishes an advance disposal surcharge to be paid by consumers at the time of acquisition of specific new tires. It also establishes retailer permits governing the sale of new tires and depot permits for the handling of used tires.

Retailers who supply new tires within the Yukon are required to collect this surcharge from consumers, and remit it to the government.

2.2 OBJECTIVES

The primary goal of the regulation is to create a self-sustaining management program for all used tires in the territory.

2.3 DESIGNATED PRODUCTS

All new tires with an inner diameter of 24.5 inches (622.3 mm) or less that will be used on a motorized vehicle or a conveyance powered by a motorized vehicle, and that have not been retreaded or used.

2.4 END-OF-LIFE PRODUCT ISSUES

Used tires present a significant disposal challenge. They do not break down in the natural environment and will accumulate indefinitely unless they are processed in some way. They take up valuable landfill space when stored in piles above ground, provide a perfect breeding ground for mosquitoes, and pose a fire hazard.

3.0 HOUSEHOLD HAZARDOUS WASTE COLLECTION

The Monitoring and Inspections section of the Yukon Government's Department of Environment assists communities or interested groups in conducting household hazardous waste collections.

The section provides limited funding to offset some of the costs of the event: technical assistance; a safety orientation for event volunteers; and disposal of all wastes collected. The hazardous waste collection days usually run over two days and are scheduled separately in each community.

4.0 SPECIAL WASTE COLLECTION

Since 1993, Environment Yukon has administered an annual collection of "special wastes" from Yukon industries and ships them out of the Yukon for recycling or disposal. Special wastes include used oil, antifreeze, solvents, vehicle batteries, and other wastes with hazardous properties.

The department pays for all transportation and administration costs. Industry members pay the cost of treatment only. An average of 45,000 kg of special wastes are collected annually.

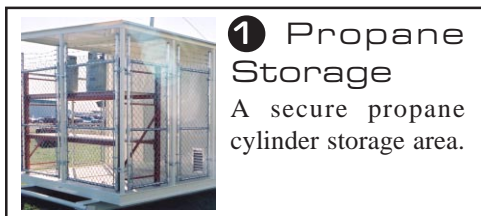


APPENDIX E

APPENDIX E SAMPLE STORAGE UNITS FOR SHELTERED WASTE

Community Household Hazardous Waste Facility

Permanent HHW programs have the ability to enhance community awareness and reduce collection and operations costs. Over the last decade PRO-TEC prefabricated Hazmat Storage Buildings have been installed at a number of municipal HHW storage facilities across the US and Canada. These facilities provide increased safety and community awareness while lowering costs compared to conventional methods such as hazmat collection days.



*Isolated Storage Room Uses: storage/dispensing/transfer of used oils, aerosol cans, oil based paints, varsol, water based paints, fluorescent light tubes/ballasts and more.

Common HHW Storage Requirements

- A storage facility with no less than three rooms to isolate incompatible products.
- A secure propane cylinder storage area and a secure battery storage area
- An area or small tank for collection of used oils.
- An area for bulking oil based paints and varsol into drums.
- An area for bulking water based paints or a paint exchange program.
- An area for fluorescent light tubes and light ballasts, which contain PBC liquid.
- An area for aerosol cans spent and unspent.
- An area for the spill response kit, personnel safety/drum handling equipment and to complete manifest forms.