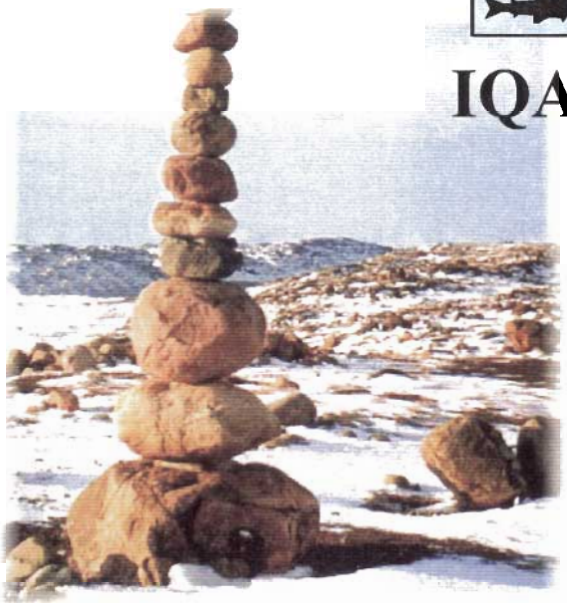
Solid Waste Management Planning Study Municipality of Iqaluit

IQALUIT



September 5, 2000

Golder Associates Ltd.

J. L. Richards & Associates Limited
Consulting Engineers, Architects & Planners

Solid Waste Management Planning Study Municipality of Iqaluit

IQALUIT

Prepared for
The Municipality of Iqaluit
Iqaluit, Nunavut
X0A 0H0

Prepared by
J.L. Richards & Associates Limited
11 Princess Street, Suite 301
Kingston, Ontario
K7L 1A1

JLR 17002
September 5, 2000

Golder Associates Ltd.

J. L. Richards & Associates Limited
Consulting Engineers, Architects & Planners

TABLE OF CONTENTS

TABLE OF CONTENTS (Continued)

PAGE

LIST OF TABLES & FIGURES

LIST OF APPENDICES

ABBREVIATIONS

C of A	Certificate of Approval
EA	Environmental Assessment
EFW	Energy From Waste
ha	Hectares
HHW	Household Hazardous Waste
ICI	Industrial, Commercial, and Institutional
m	Metres
m^3	Cubic Metres
MRF	Material Recovery Facility
MSW	Municipal Solid Waste
PCP	Public Consultation Plan
SWMPS	Solid Waste Management Planning Study
TC	Technical Committee
t/c/yr	Tonnes/capita/year
3Rs	Reduce, Reuse, Recycle
WCS	Waste Composition Study
WMS	Waste Management System
WMPS	Waste Management Planning Study
yd^3	Cubic Yards

1.0 INTRODUCTION

Iqaluit has experienced considerable growth in recent years, and this is expected to continue, particularly with the Town's new status as the Capital of Nunavut. Numerous challenges face the community as they plan for their orderly long-term growth. Development of a Solid Waste Management Plan (SWMP) is just one of these challenges.

In October 1999, the Municipality of Iqaluit engaged the Study Team of J.L. Richards & Associates Limited and Golder Associates Limited to undertake a Solid Waste Management Planning Study (SWMPS). The project was initiated the first week of November when the Study Team members visited the community for a series of meetings with Municipal officials and various stakeholders.

The Town initiated the study to address a number of waste management issues:

- the unstructured and unplanned waste management practices of the 1940's, 50's, and 60's have left a legacy of problems which the Town does not wish to repeat;
- three of the several known landfill sites are the responsibility of the Town. These sites have not been properly closed, and there is concern about their potential environmental impact;
- the existing landfill is expected to be at capacity by 2001 and there is no other planned or approved facility;
- open burning of refuse at the present landfill has been a source of complaint. Smoke from the site is clearly visible from the Town. Ash and soot from the landfill occasionally impact on the recreational lands to the south and west; and
- the Nunavut Water Board has directed the Town to develop a long term waste management plan.

The following report describes the waste management planning process which has resulted in the identification of two alternative SWMPs for Iqaluit. It also identifies candidate areas for the required disposal facility and presents a conceptual closure approach for the three Municipal landfill sites.

2.0 STUDY PURPOSE

The study purpose was developed in consultation with Municipal staff and was stated to the public at the public meetings and in study newsletters and/or announcements. The Study Purpose is:

> **To develop an environmentally responsible, socially acceptable, and cost effective Solid Waste Management Plan for the Municipality of Iqaluit for the next 20 years or more.**

In developing a SWMP, it is important to balance the potential impact of the plan on both the natural and human environment. The plan must also be supported by the majority of community members and be affordable and cost effective, lest it place an unreasonable financial burden on the community. The long-term planning horizon is desirable, particularly when contemplating potentially significant investment in community infrastructure.

3.0 PUBLIC CONSULTATION PLAN

3.1 Introduction

The successful implementation of a Solid Waste Management Plan is entirely dependant on its acceptance by the community. Very little in any community is more controversial than the development of a plan to deal with garbage and other wastes. Community attitudes and values regarding the environment, waste production and handling, the 3Rs (reduce, reuse, recycle), the location of waste handling facilities and the ability of the community to pay for the solution must be clearly understood. It is, therefore, obvious that a key element in the success of the evolution of a Solid Waste Management Plan is the formulation of a sound public consultation plan.

During the initial visit to Iqaluit in November 1999, the Study Team designed a Public Consultation Plan based upon the feedback received from various stakeholders. A copy of the Plan is presented in Table 3-1.

TABLE 3-1
PUBLIC CONSULTATION PLAN

STUDY STEPS	CONSULTATION METHODS
.1 Project Initiation	• Study Team in Iqaluit during week of November 1, 1999 • meetings held with the Elders, various agencies, business leaders, and Municipal representatives • public announcement in local papers made prior to Study Team visit • public announcement on CBC Radio made prior to Open House meeting • Open House meeting held on evening of November 4, 1999 • community interest group and agency mailing list prepared
.2 Prepare Public Consultation Programme .3 Characterization of the Study Area .4 Document Review .5 Review of Existing Solid Waste Management System .6 Consideration of Functionally Different Alternatives and Identify the Preferred Solid Waste Management System	• introductory letter to be sent to all community groups/agencies identified in mailing list • Newsletter No. 1 to be sent to all households, businesses, agencies, and community groups in Iqaluit to announce study startup • Study Team to return to Iqaluit in January (tentative date January 17, 2000) • distribute Newsletter No. 2 prior to January visit • include parties on mailing list in the Newsletter mailout • make public announcement in local paper and on local radio • post notices in Municipal buildings and other key locations • meet with various stakeholder groups/agencies in Iqaluit, as time permits • hold Open House to discuss study status and review waste management alternatives
.7 Consideration of Alternative Methods of Implementation .8 Implementation Strategy for the Preferred Solid Waste Management Plan	• distribute Newsletter No. 3 prior to March visit • include parties on mailing list in the Newsletter mailout • Study Team to return to Iqaluit in March • make public announcements in local paper and on local radio prior to visit • post notices in Municipal buildings and other key locations prior to visit • meet with various stakeholder groups/agencies in Town, as time permits • hold Open House to discuss Study status and review alternative waste management plans and evaluation criteria.

NOTES:

1. The Public Consultation Plan reflected in this table was based upon feedback received from various stakeholders during meetings held in Iqaluit during the week of November 1, 1999. The plan was issued to Municipal Staff in mid November.
2. Column 2 identifies various public consultation methods which the Study Team and the Town proposed to use to inform the stakeholders and to solicit their input during the study period.
3. The Open House originally scheduled in March was held in May.

The Plan indicates the activities which were undertaken by the Town's Study Team and identifies the opportunities for public consultation. Once again, one of the primary objectives of the process was to ensure that the views of the residents of Iqaluit were reflected in the Solid Waste Management Plan, the document which will ultimately define the way in which the Town's waste is handled.

3.2 Study Participants

Several key parties or groups were included in the Study. Mr. Matthew Hough, E.I.T., was the project's Study Coordinator. He was the principal contact for the general public, public agencies, Town Council, the Steering Committee, and the consultant Study Team.

In January 2000, Town Council established a Steering Committee composed of the following members: Deputy Mayor Ben Ell, Councillor Lynda Gunn, Clerk Ookalik Curly, Doug Sitland, P.Eng., Government of Nunavut, and ratepayers Janet Armstrong (alternate), Elsie Maltin, Marcel Mason, and Lynn Peplinski. Councillor Matthew Spence eventually replaced Lynda Gunn, and Janet Armstrong, who was originally identified as an alternate, became a regular member of the Committee.

The purpose of the Steering Committee was to provide the Project Coordinator and the Study Team with a sense of the issues relating to waste management in Iqaluit. The Committee met on several occasions to discuss the issues and they were available to the public for consultation purposes. They met with the Study Team on two occasions, and some members attended and participated in the public meetings in January and May 2000.

The consultant Study Team was responsible for conducting the Study, preparing discussion materials prior to the public meetings, and the preparation of the Study report. The Study Team members belonged to the Technical Committee, which included the following individuals:

Matthew Hough, E.I.T., Project Coordinator, Town of Iqaluit
Denis Bedard, P.Eng, Director of Engineering & Planning, Town of Iqaluit
Doug Sitland, P.Eng., Government of Nunavut
David Hunter, P. Eng., Lead Consultant, J.L. Richards & Associates Limited
Tom Kent, M.A., Senior Planner, J.L. Richards & Associates Limited
Robin Johnstone, Ph.D., Golder Associates Ltd.

Mr. Paul Fraser, Acting CAO for the Town of Iqaluit, replaced Mr. Bedard on the Technical Committee in April 2000.

Both the Town and GN members of the Technical Committee and the Steering Committee reviewed and commented on the materials prepared by the Study Team, prior to the meetings with the general public.

3.3 Public Agency Consultation

At the project outset, a public agency contact list was prepared. A letter was forwarded to each agency by the Town, advising them of the Study and seeking their input on waste management issues and their potential involvement in the approval process for any future waste management facilities. At the time of writing, the Town had received a response from only three agencies on the contact list. No comments of particular significance were received.

Appendix 'B' includes a copy of the form letter to the agencies, the agency contact list, and copies of the correspondence received.

3.4 Community Stakeholder Meetings

During the course of the Study, the Study Team met with a number of community stakeholders. The organizations contacted and the comments received are summarized herein.

Organization: Qikiqtaaluk Inuit Association

Contact: Tina Price

Date: November 1, 1999

Comments/Questions:

.1 Waste management site should not be located close to the community.

.2 No waste management facility should be located near water.

.3 Upper Base may be a suitable location for a waste management facility.

.4 The West 40 area is unsuitable for waste management because of its recreational value. The proximity of the Sylvia Grinnell Park and the use of the area by campers makes the continued use of the area for waste management unsuitable.

.5 There is a need for recycling. Presently, paper and some cans are collected for recycling, however, the system needs to be better organized. As an example, wood can be collected and reused.

.6 Community wants the old dump sites to be cleaned up.

Organization: Hunters & Trappers Association

Contact: Sytookie Joamie

Date: November 2, 1999

Comments/Questions:

.1 The HTA has concerns about the old landfill sites even if they are covered up specifically: the potential impact on the environment; seepage from the landfills into adjacent waterways and land areas down-gradient from the landfill.

.2 Waste management is a current problem, whereas previously, little waste was left on the land by hunters and most was biodegradable.

.3 Prepackaged food and supplies are problematic, creating a lot of non-biodegradable waste.

.4 An incinerator might be a good method of waste disposal.

.5 The cost of future waste management facilities will be a concern with cost-conscious people.

.6 The future waste disposal site should be less visible.

.7 The Mayor or Deputy Mayor should promote the next public meeting and encourage participation.

Organization: Chamber of Commerce

Date: November 2, 1999

Comments/Questions:

The Study Team advised the Chamber executive about the study purpose, schedule, tasks, and consultation opportunities. They were encouraged to inform their membership about the Open House later in the week, and to attend the meeting.

Organization: Nunavut Research Institute

Contact: Jamal Shirley, Lynn Peplinski

Date: November 3, 1999

Comments/Questions:

.1 The proposed consultation list is good but should also contact some others:

- *"Causeway Campers"* via Mary Wilman
- Community Lands & Resources Committee (QIA)
- Environmental Technology Program at Arctic College

.2 Present recycling program has problems - waste doesn't get shipped south. A more structured recycling program should be put into place, and people operating shipping may be willing to take recyclable material south.

.3 People are receptive to recycling. Children of the community are very important to recycling initiatives.

.4 There should be some requirement for product stewardship. For example, the Coca Cola plant produces a large volume of PET bottles which are a substantial contribution to the overall waste stream. Approval of business license should be conditional on identifying how generated waste will be handled.

.5 Who enforces legislation (City, Towns & Villages Act)? Recycler should be forced to do something with material collected.

.6 Why is it such a mess at the dump? Need a full-time person dealing with landfill waste.

.7 Construction waste is a problem. There is no incentive to reduce construction waste. Higher tipping fees may reduce amount of waste, especially from construction.

.8 Department of Sustainable Development needs to be involved so that things like bottling plant that aren't sustainable are closely regulated. When applying for a business license, Town should ask for a Waste Generation & Disposal Plan prior to issuing a license.

.9 Burning of waste at the landfill is completely unacceptable.

.10 Need to reduce volume of waste for landfill. Bag limits may be a good way to restrict residential refuse volumes.

.11 Consultants should work with key Departments to get good population projection estimates.

Organization: Elders' Social Centre

Contact: Elders

Date: November 3, 1999

Comments/Questions:

.1 The list of stakeholders identified for contact well represents the broad interests of the Inuit Community.

.2 The *"Iqaluit dump"* is well known in the Baffin Region. It is an eyesore and does not leave a very favourable impression for visitors.

.3 Many people are disrespectful of the community and they are throwing their litter on the street, instead of disposing of it properly.

.4 It is important for everyone in the community to be involved in solving the community's waste management problem. They must be supportive of each other.

.5 It would be helpful and useful to have a source separation program and a recycling program. They did express concern, however, that the Town administration may indicate they have insufficient funds to implement such a program.

.6 There should be more large garbage boxes throughout the community. There are too few at present.

.7 The North 40 may be a good location for a landfill.

.8 We are pleased to meet with the consultants and appreciate the opportunity to be involved.

Organization: Qikiqtaaluk Wildlife Board

Contact: Joanisie Akumalik

Date: November 4, 1999

Comments/Questions:

.1 QWB is a regional body providing support to Baffin Island HTAs. Consultation needs are taken care of if you consult with local HTA.

.2 QWB will be on reviewers list of any submission to NIRB.

Organization: Nunavut Wildlife Management Board

Contact: Ben Kovic

Date: November 5, 1999

Comments/Questions:

.1 Iqaluit is polluting more than helping the environment.

.2 Could facilitate North 40 into dumpsite and keep all contaminants on an already contaminated site.

.3 Present dump is not suitable: too visible, too close to camps.

.4 Town doesn't have reusable stuff separated out (first year it worked well because the guy worked so hard). People at landfill must be well trained and well motivated.

.5 Could have a small fee for material taken out of landfill e.g. 10 sheets of plywood for $10. (most people have $5 to pay for needed wood).

.6 Could separate waste wood (i.e. no good for construction) so people could burn it.

.7 Too much burning is done on Saturdays (as dump closed on Sun. & Mon.). This stops people from getting access to the reusable material during the weekend. Burn after weekend so that more material is re-used/diverted from dump.

.8 Consensus is never gained when individual organizations are consulted. Public meetings are best way to gain consensus.

Organization: Indian & Northern Affairs Canada

Contact: Paul Smith, Peter Kusagak, Philippe Lavallee

Date: January 18, 2000

Comments/Questions:

.1 Sites other than those acknowledged by the Town remain *"orphans."* Federal government has not assumed responsibility for any sites.

.2 Since all potential sites are located within the Municipal boundaries, NIRB does not have any jurisdiction on lands which are not Inuit owned, however, Indian and Northern Affairs may have to pick up the slack. Nunavut Water Board is responsible for approval, however there is some question about enforcement responsibilities.

.3 There is some question about matters of jurisdiction which will not be settled until the Federal government adopts new legislation.

.4 The most fundamental concern is that open burning be stopped. Iqaluit, as the Capital of Nunavut, should set the example. Most communities in the North have to resort to burning, however, they are all much smaller than Iqaluit.

.5 There seems to be difficulty implementing a recycling program in Iqaluit.

.6 Consideration should be given to an incinerator and to using waste heat.

.7 There is no place in the community where contaminated wastes can be dealt with.

.8 Provision must be made for land farming in any new system.

.9 Factors which should be taken into consideration at the site selection stage are: proximity to development and the road system. The Road to Nowhere may be a difficult area.

Organization: True North Properties Group

Contact: Alain Carrière

Date: January 18, 2000

Comments/Questions:

.1 Indicated that they are interested in the outcome of the study.

.2 They have looked at waste management services in Iqaluit, and they have an interest in providing a service.

.3 Landfilling will be the most economical option – even if the facility requires engineered liners.

.4 True North used to operate a portable incinerator in the North but found that the permitting process was too onerous. A new permit was required each time the equipment was relocated. Consequently, they no longer do it.

Organization: Department of Sustainable Development

Contact: Robert Eno

Date: January 19, 2000

Comments/Questions:

.1 Sustainable Development does not get involved in permitting, other than through the submission of comments to NWB, for example, if asked.

.2 Normally, they will defer to other agencies as far as enforcement is concerned. They will act if other agencies fail to do so.

.3 There is still confusion/disagreement between agencies as to their respective responsibilities and roles.

.4 Sustainable Development is responsible for enforcement within the Municipal boundaries. They could issue a stop order at the landfill for example.

.5 Thinks that the public is strongly opposed to open burning and will not likely support a landfill.

.6 An annual operating report must be a condition for any new facility. If an incinerator is proposed, heat recovery must be a component.

.7 Concerned about Municipal staff turnovers and the subsequent loss of continuity which can lead to operational problems.

.8 Municipal staff must be trained and motivated in the proper operation of future waste management services.

Organization: Elders Meeting, Elders Social Centre

Contact: Elders

Date: January 19, 2000

Comments/Questions:

.1 Would magazines and paper be separated at home?

.2 Could groups of people (e.g. families) place their separated stuff together?

.3 Many items are presently thrown away that could be recycled. A waste exchange would be a good idea.

.4 In the south, they recycle things separately - this is a good idea. Would it be done here?

.5 Concerned that garbage collectors might not know the difference between garbage and recyclable stuff.

.6 On a train trip through Ottawa, one Elder noted that the place was very tidy with little garbage and any garbage was neatly sorted and organized. Even the garbage looked good!

.7 There is a big difference in waste management between the south and the north. Animals are a problem here; ravens get into everything. Blue boxes wouldn't work because they are easy pickings for ravens. Blue bags would get ripped open. One end of present boxes could be painted blue and the recyclables could be placed there.

.8 If a landfill is needed, the best place to put it would be down wind of the community. Doesn't matter if landfill is upwind, however, provided there is no burning.

.9 It is difficult to pick a spot for a landfill as recreation areas are everywhere. Road to Nowhere is good but a heavy traffic area for hunters. The North 40, near the granular source, would be best as there is little traffic there and area is already disturbed.

Organization: Elders Meeting, Elders Social Centre

Contact: Elders

Date: May 17, 2000

Comments/Questions on the Alternative WMSs and Site Locations.

.1 The Elders would prefer an incinerator because it would reduce the quantity of waste.

.2 The Elders would like to see elimination of current landfill for many reasons, including the fact that families with kids shouldn't be exposed to health risks from the present dump, if they go camping in the area.

.3 It would be good for the community to see vegetation growing in the present landfill area after it has been closed.

.4 The cost of the identified alternatives is an issue. The Elders as a group are worried that the Municipality will claim that they don't have the money and will revert to the old style landfill.

.5 Elders are concerned that the Municipality will not listen to their opinion and will do what they want.

.6 Previous burning at the landfill has affected the area around the dump. The Elders want the consultants to pass the message to the Municipality that they want the job of managing waste done properly, even if it is expensive.

.7 If it is feasible, the Elders would choose an incinerator, stating that if we take our responsibility to the environment seriously, we should use the incinerator even if it is more expensive than landfilling.

.8 Elders were interested in whether the incinerator would eliminate the paper problem. The Town is messy with litter.

.9 In Pangnirtung, the incinerator is located away from the community. The garbage crew picks up garbage and litter from around the town, which makes it clean.

.10 At the end of the meeting, the Elders showed unanimous support for an incinerator.

3.5 Public Meetings

Three public meetings were held to advise the general public about the study and its progress. Prior to each meeting, the Town issued notices and public service announcements to advise people as to the meeting time, location, and subject matter. Newsletters were also issued during the study. A copy of each newsletter is contained for reference purposes in Appendix 'C'.

Open House No. 1 was held on the evening of November 4, 1999, at the Parish Hall. The Study Team introduced the study to the public, informed them of its purpose, the project tasks, schedule, and proposed future meetings and consultation opportunities. A question and answer period followed the introduction. The following comments and/or questions briefly identify the concerns of those people in attendance.

Person	Comments/Questions	
Individual 1	.1	Present site is not acceptable to Inuit who like to camp.
	.2	Have the consultants made any progress on the proposed landfill sites?
	.3	If the community decides on a location much further inland, the community would have to pay for a road to get there.
	.4	Would the consultants rely on information proposed by local people?
	.5	Will any new facility have to go through NIRB review? If so, the process may be very lengthy.
Individual 2	.1	Despite the importance of this decision, are you going to make a decision right here and now (regarding landfill site)?
Individual 3	.1	Too much waste is generated. Iqaluit should act like the Capital and take responsibility and reduce waste. Should look at reducing and recycling and significant public education process.
	.2	Will there be any monitoring of burning refuse at the landfill?
	.3	Iqaluit could become centre for Baffin Island waste management.
	.4	What is the economic viability of recycling?
Individual 4	.1	Ultimately, we (Town) will get a facility that Iqaluit can afford to buy. Do you know how much there is to spend?
	.2	Does that mean we have $4 million for the consultants to spend?

Person		Comments/Questions
Individual 5	.1	How committed is the Council to spending/buying the solution that the community wants? Things are expensive up here.
Individual 6	.1	What is the experience of other northern communities?
Individual 7	.1	Who is here tonight from Council and staff that will make the ultimate decision?
	.2	Issues of cost will surely mandate what recommendations the consultants make.
	.3	Is the town looking at how to generate money from industry, etc.?
Individual 8	.1	How closely is Solid Waste Planning linked with Town planning?
Individual 9	.1	Once a location for a new landfill site is identified, the current location must be properly taken care of.
Individual 10	.1	When can the community of Iqaluit possibly expect to hear: 1) Which site will be used? 2) When construction will begin?
Individual 11	.1	We need a dump that is not on the Road to Nowhere.
Individual 12	.1	It is very important that the consultants have an open mind and not make decisions based on comments from a few people.
	.2	The Road to Nowhere is the best place for the landfill.
Individual 13	.1	North 40 is not a suitable place for a new landfill. There is too much snow accumulation there in winter and too much ice in spring.
Individual 14	.1	Burning at the dump is bad, but an incinerator would be a good idea.

The second Open House was held at the Parish Hall on January 20, 2000. It was organized in two stages. The first stage included a presentation on potential waste management system components, a set of draft screening criteria to evaluate the components, and finally, an evaluation of the components. Draft versions of Table 8-1, 8-2, and 8-3 were used for this purpose.

The second stage of the meeting took the form of focus group sessions in which the public was invited to comment on which components should be considered for the future SWMP.

The following is a list of general comments/questions identified by the public:

Person		Comments/Questions
Individual 1	.1	Public Safety related to the transport of hazardous waste by sea and by air is an issue.
Individual 2	.1	The Plan must be easy to implement. The public must be able to follow this plan.
Individual 3	.1	The Plan must be adaptable in order to deal with possible changes in legislation and must be in keeping with current trends in other jurisdictions.
Individual 4	.1	Recycling must be legislated.
Individual 5	.1	Consideration must be given to: climate change, recycling, the location of Iqaluit and its weather, the geological characteristics of the terrain, wind direction, public education.
	.2	Stop archiving our waste.
Individual 6	.1	Establish a hazardous waste depot for hunters and trapper who use boats.
Individual 7	.1	Establish higher tipping fees.
Individual 8	.1	Review tipping fees.
Individual 9	.1	Review the possibility of private collection.
Individual 10	.1	Cost of building a road to a new landfill could be significant.
Individual 11	.1	Over the long term, consideration must be given to the types of waste generated, i.e., PET bottles for soft drinks. Material bans should be formulated.
Individual 12	.1	Establish separate areas for specific waste streams in a landfill site.
Individual 13	.1	Solution must be environmentally friendly to humans and to the natural environment.
Individual 14	.1	In addition to being proven on North America and North of 60, the technology should be proven in circumpolar regions.
Individual 15	.1	The solution must be accepted by the community and has to be affordable.

The focus group discussions centred on each of the components listed under the four categories of waste reduction and diversion; waste handling and collection; waste processing; and waste disposal. The following points summarize the public comments/questions on the components in each of these four areas.

Waste Reduction and Diversion

Public Education

1. Ease of Implementation - easy to start with and can be built upon.
2. Encouragement of traditional values.
3. Ideals used in Town should also be practiced on the land.
4. Communication is essential.
5. Students are critical to the program's success.

Composting

1. Use residual heat from the power plant to provide heat for the composting process.
2. Compost could be good as an end product - it is environmentally friendly.

Waste Handling Tax

1. Disposal fees should be levied on all vehicles brought to Iqaluit. The money raised must not go into general revenue in either the Town or the Government of Nunavut's coffers. It should be used for waste management purposes.
2. Legislative authority may be a problem.

Recycling

1. Paper and bottle days - charging less for sorted material may be proposed as an incentive. The issue is end management, for example, what would we do with the paper?
2. Recognize existing recycling activities.
3. Presently, there is little faith that recycling will work in Iqaluit, given past experience.

Reduction

1. User pay or penalty might be hard to institute.
2. Encourage waste exchanges.
3. Focus on industry - waste audits & waste management plans as conditions of business licenses.
4. Establishment of a place where waste is sorted which is easily accessible.

3Rs

1. Must be adopted by the whole community - industry as well as households.
2. Recycling bins must be made animal and weather proof.

General Comments

The Steering Committee must be used beyond the end of the study to provide critical guidance to Council with respect to the implementation of the preferred Solid Waste Management Plan. There should be a review of the Town's By-law pertaining to the management of waste.

Waste Handling and Collection

Door-to-Door Collection

1. If the frequency of collection is to be reduced, better containers are required. The dogs and ravens are very talented when it comes to picking garbage.
2. Garbage piles up very quickly, so maybe collection should be no less frequent even if the dog/raven problems are solved. The packaging of goods so that they survive transportation to the community increases the volume of waste.
3. Problems occur with the collection of garbage in the high rise buildings. Although garbage is collected every day, not all of it is picked up.
4. More frequent pick-ups are required in the summer to prevent the wind from blowing around the plastic bags.
5. Legislate the frequency of garbage pickup.
6. Weekly collection may be OK if the dog/raven/wind concerns can be addressed.

Direct Haul

1. Requires a method of separation - should be separated at the source and not at the dump.
2. With regulation and proper management, direct haul is workable. Separation requires education.

Depot

1. Household hazardous waste depot is a good idea. Iqaluit has had some experience with special collection events in the past and they have worked quite well.
2. A depot is required on the beach, so that hunters and trappers can dispose of hazardous waste when they return from their expeditions.

Transfer Station

1. There is no need for a transfer station in Iqaluit. The community is not big enough.

Source Separation

1. Separation at source is supported as is the concept of material bans.

Waste Processing

Material Recovery Facility

1. Since Iqaluit produces relatively small volumes of garbage, is a large scale Material Recovery Facility economically feasible?
2. There is a high level of interest in small scale MRFs, however, these types of facilities must have the support of the community. Must have shippers and companies on board if this type of facility is to work.
3. Clean PET fetches upwards of $400.00/tonne and since there is a lot of PET pop bottles in Town, the revenue could be used to support a MRF. There was some discussion about volunteer groups manning the MRF in exchange for support of community based, non-profit organizations.

Shredding and Baling

1. Should be considered, but only as part of another process such as the recycling of aluminum cans, paper etc.

Import of Waste

1. If an incinerator is established in Iqaluit, import of waste from other communities may be OK.
2. It is often cheaper to deal with waste where it is generated and not export it.
3. Import of waste may be considered at a future date only if a particular opportunity arises.

Waste Disposal

Landfill

1. No open burning should occur at any new facility.
2. Continuation of the practice of filling holes in the landscape is not desirable.
3. All waste disposal options will require a landfill component of some description.

Incineration

1. Disposal through incineration is a possible option, however the community is not receptive to hazardous waste incineration.

Export

1. The export of waste from the community can lead to serious problems if the importer changes the rules or decides not to continue the service.
2. Consider export only in the context of shipping recyclables out of the community.

Plasma Technology

1. There is uncertainty because the technology has not been commercially applied to the destruction of Municipal Solid Waste. The consensus was to consider it further and reserve judgement until additional information is available.

Following the report from each focus group, meeting participants were asked to complete a survey ranking the components in order of preference. Only thirteen people responded to the survey, the results of which are summarized in Table 3-2.

TABLE 3-2
RANKING OF WASTE MANAGEMENT COMPONENTS

	RESPONDENT													
COMPONENT	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**RANKING**
Curbside Collection	1	1	2	1	1	0	0	1	1	0	1	1	1	11
HHW	2	1	0	0	0	1	1	1	1	1	1	1	2	12
Public Education	1	1	0	0	1	1	1	1	1	2	1	1	1	12
Source Separation	1	1	1	1	1	0	0	1	2	0	2	2	2	14
Reduction	1	2	1	0	1	2	2	2	1	2	1	2	1	18
Reuse	1	2	1	0	2	1	1	1	1	3	1	2	2	18
Direct Haul	2	3	2	1	2	0	0	3	1	0	2	2	0	18
Depot	1	4	1	1	3	0	0	2	1	0	3	1	1	18
Composting	2	1	0	0	3	1	1	1	1	4	2	3	0	19
Recycling	2	1	0	0	2	2	1	2	1	3	1	3	2	20
Landfill	2	2	3	1	3	3	0	3	1	0	2	1	0	21
Incineration	2	1	5	5	1	2	0	2	1	0	1	1	0	21
MRF	3	2	3	5	1	0	0	4	1	0	1	2	0	22
Shredding	3	2	4	1	4	0	0	3	3	0	2	3	0	25
Baling	3	3	4	3	4	0	0	4	1	0	2	3	0	27
Plasma Torch	3	0	1	5	4	2	0	4	3	0	3	4	0	29
Export	5	3	3	3	5	0	0	5	5	0	4	4	0	37
Import	5	5	5	5	5	0	0	5	5	0	0	4	0	39
Transfer Station	4	5	4	5	4	0	0	5	5	0	5	5	0	42
Rating System	0	No opinion expressed or not answered												
	1	Must have it												
	2	Preferably should have it												
	3	Could have it												
	4	Preferably should not have it												
	5	Must not have it												

The third public meeting occurred on May 18, 2000, at the Astro Theatre Board Room. A Drop-in-Centre was held in the afternoon, and an Open House was scheduled for the evening. The main objectives of these meetings were to introduce the alternative Waste Management Systems, the criteria to evaluate the WMSs, and the outcome of the evaluation. Draft versions of Tables 8-4 and 8-5 were used for this discussion.

Proposed screening criteria (refer to Table 9-1) were also introduced to identify those areas generally unsuitable for a landfill and/or an incinerator. The constraint areas were illustrated on aerial photographs of the community.

The following are the comments/questions posed by the audience:

Comments on the Alternative WMSs

.1 DFO, under the Fisheries Act, would prefer incineration as there is less opportunity for deleterious substances to impact fish and fish habitat.

.2 Incineration is the only option to consider. Could combine it with sewage treatment (to heat water) so that treatment of water is more efficient.

.3 Under General Sanitation Regulations, it is legislated that there must be 450 m between any occupied buildings and a disposal site. The boundaries for exclusion zones should be amended to reflect this.

.4 Can heat from incineration be used for heating or cost recovery?

.5 If incineration was used, would you still have to do a Household Hazardous Waste (HHW) separation? Also, what precautions would there be to prevent HHW being combusted?

.6 One benefit of incineration is the production of heat. Has potential cost-recovery from incineration been considered in the costing provided?

.7 It is noted that reduction/diversion is an important component of all plans, so should the process of reduction/diversion not be started immediately at the time of instituting other components (e.g. incinerator) so that there is no lag in the amount of material diverted?

.8 Will the process of education to achieve reduction/diversion be included in the report?

.9 What recent information is there on the composition of the waste stream? It will potentially affect which option will work best. You need recent information to know what you are going to reduce and what you are going to divert.

.10 With respect to eco-tourism, would it be good to do something about the placement of the landfill?

.11 A landfill on its own would be OK, if it was properly managed. At the Nanisivik Mine, landfilling is done properly. However, the Iqaluit landfill is too near the seashore and runoff goes into the sea. A new landfill should be located away from the shore.

.12 Composting would be the best option as a high proportion of the waste stream is compostable or recyclable, however, more information is needed on the composition of the waste stream.

.13 When you compost, you will end up with a substance. What will you do with it, as you will still have to deal with it?

.14 Since you will need a special building for composting, composting will be a waste of time and money.

.15 You could use waste heat created by composting to heat the composting building. Composting is a good idea. It is much better to deal with inert compost than something that will create leachate, etc.

.16 Are there territorial regulations about incineration, (with respect to air quality) that would apply?

.17 If all options are defendable environmentally, then we should go straight to considering cost of options. Each option will have a different lifetime so can you compare costings between options.

.18 The combination of landfill, incineration and reduction/diversion is ideal. A long-term plan is what is necessary. Composting is not viable. Must consider the growth of the population in the plan. Money needs to be well spent.

Comments on the Screening Criteria

.1 By applying federal regulations, you exclude a huge amount of disturbed ground and are forced to disturb undisturbed ground. It would be better to use a site for landfilling that has already been impacted.

.2 What are the different landfill sizes for each option? The smaller landfill associated with the incinerator is much better.

.3 Ocean dumping of waste is still approved by Federal Government and should be considered for disposal of metals. An incinerator is the best option. It should be centrally located with a tie-in to heating. The costs of building a road are huge.

.4 Agrees with the previous individual, incineration is the best option. There are no visible emissions, and it is clean. The current generation of incinerators is best.

.5 Don't want the landfill closer than 3 km to airport.

.6 The cost of options is very important. The study report should consider benefits of options and indicate them against the costs. There should be an emphasis in the reduction of waste volume and the report should consider the ramifications of global warming and the effect of leachate on permafrost.

.7 What is the final product of the management plan and when will it be delivered? There will have to be a decision by council, and ultimately, an EA.

3.6 Student Survey

This past February, the teacher of the Grade 8 class at Inukshuk High School contacted the Municipal office and expressed an interest in doing a school science project on waste management. Project Coordinator, Matthew Hough, met with the class, and together, they designed a survey. The objective of the survey was to poll a broad cross section of the Municipality to determine the public's views on waste management. Two hundred questionnaires were circulated, and 162 responses were received, for a participation level of 81%. The survey results are summarized in Table 3-3.

In spite of the fact that the survey sample was limited, there are some important observations which can be made. People value the convenience and service associated with the curbside collection of their waste. A HHW program to divert these wastes from landfilling and a public education program on waste management practices are also very important. Source separation, which in this instance may be associated with the separation of HHW from the regular refuse, is seen as an important activity.

On the other end of the scale, the components of Plasma Torch, export, import, and transfer station are identified as low priority or not desirable. Of the remaining components, it is clear there is an interest in reduction, reuse, and recycling.

Landfill and incineration received the same total score. However, a comparison of responses for each component indicates that in 5 cases incineration is preferred, in 3 instances (excluding those where no opinion was expressed) they are considered equally acceptable, and in 2 cases landfilling was preferred.

TABLE 3-3
STUDENT WASTE MANAGEMENT SURVEY (FEBRUARY 2000)

QUESTION	YES		NO		NO OPINION	
	No. of responses	%	No. of responses	%	No. of responses	%
.1 Do you know that the present dump will close in the summer of 2001?	28	17.28	132	81.48	2	1.23
.2 Do you know that the Municipality is preparing a Solid Waste Management Plan?	114	70.37	45	27.78	3	1.85
.3 Do you think that the Municipality should keep burning garbage at the dump?	16	9.88	141	87.04	5	3.09
.4 Do you think that the Municipality should organize a recycling program?	146	90.12	14	8.64	2	1.23
.5 Do you think that the Municipality should build another dump?	31	19.14	127	78.40	4	2.47
.6 Do you think that the Municipality should operate an incinerator?	139	85.80	15	9.26	8	4.94
.7 Do you think that the Municipality should compost?	126	77.78	30	18.52	6	3.70
.8 Do you think that the Municipality should operate a junk-yard?	124	76.54	26	16.05	12	7.41
.9 If the Municipality set up a recycling program would you be willing to recycle?	144	88.89	16	9.88	2	1.23
.10 If the Municipality set up a recycling program would you be willing to separate recyclable materials (e.g. paper & plastics) in your home?	139	85.80	20	12.35	3	1.85
.11 If the Municipality set up a recycling program would you be willing to take the material to a central depot?	143	88.27	16	9.88	3	1.85
.12 Would you support a ban on materials that are harmful to the environment?	116	71.60	40	24.69	6	3.70
.13 Would you support a tax on large items (e.g. vehicles) brought into the community?	101	62.35	53	32.72	8	4.94

TABLE 3-3 (Cont'd)
STUDENT WASTE MANAGEMENT SURVEY (FEBRUARY 2000)

QUESTION	NO OF RESPONSES	%
.14 If the Municipality were to build a new dump, where would you prefer it to be located?		
a) West 40	42	25.93
b) North 40	91	56.17
c) Upper Base	14	8.64
d) Road to Nowhere	13	8.25
e) If none of the above, where would you suggest a new dump be located?	2	1.23
.15 How many years have you lived in Iqaluit?		
a) 0-5	37	22.84
b) 5-10	22	13.58
c) 10 or more	103	63.58
.16 What is your age?		
a) 16-25	20	12.35
b) 26-35	91	56.17
c) 36-45	22	13.58
d) 45-55	12	7.41
e) 55-65	8	4.94
f) >65	9	5.56

An additional question was raised seeking any further comments or ideas, however, this information was not reported to the Study Team.

The survey did produce some interesting results, including:

.1 70% of the respondents were aware the Municipality was preparing a SWMP. Hence the notices, newsletters, public service announcements, and the news media coverage was serving to heighten public awareness.

.2 A significant number of respondents (87%) think waste burning at the landfill should cease.

.3 There is 89% support for a community recycling program with 88% of those polled indicating a willingness to take their recyclables to a central depot.

.4 78% of those polled thought the Municipality should not build another *"dump,"* whereas 86% supported the operation of an incinerator.

.5 The North 40 (56%) and the West 40 (26%) were the two most popular areas for a future landfill. The Upper Base (9%) and Road to Nowhere (8%) were the least favoured locations.

.6 Almost 64% of the respondents have lived in Iqaluit for more than 10 years. One might assume that the majority of respondents have a vested interest in the issues and the long-term disposition of waste in the community.

4.0 DEFINITION OF THE STUDY AREA

4.1 Study Area Location

Iqaluit, previously known as Frobisher Bay, is the Capital of the new Territory of Nunavut. Located at 63° 45' N latitude and 68° 32' W longitude, it is situated at the northeastern head of Frobisher Bay on the southeastern coast of Baffin Island.

The Municipal boundaries for Iqaluit incorporate a total area of approximately 225 square kilometers. The actual area of study is restricted to the town site proper, including those lands of planned development currently reflected in the draft General Plan.

4.2 Land Use Activities

4.2.1 Historical Context

Iqaluit, the site of a traditional Inuit fishing camp on southern Baffin Island, was first visited by Sir Martin Frobisher in 1576 during his search for the Northwest Passage. The eighteenth and nineteenth centuries was a time in which whaling was the predominant commercial activity. Development of the present Community did not begin until 1942 when the United States Air Force established an aircraft staging area very near the site of a traditional fishing camp. The base was used primarily by Ferry Command for the transport of aircraft built in North America to the European Theatre of Operations. After the Second World War, Frobisher Bay, as it was then known, became an important link in the Distant Early Warning System. As American interests associated with continental defence withdrew from the Community, the Canadian Government established regional facilities, providing the basis for a stable economy in Baffin. Iqaluit, now the Capital of Nunavut, boasts an airfield capable of landing the Space Shuttle, it has a hospital, educational facilities from primary school through to college, an

Arctic research station, as well as commercial and administrative functions serving the whole of the Region. It is now a Community of over 5,000 people.

4.2.2 General Plan

The General Plan, which will set out the Town's goals and objectives to foster the orderly development of the Community, is presently being updated. The current Plan (By-law No. 370) does address the issue of waste management. It recognizes in Section 2.4 that *"with the growth of Iqaluit, certain basic infrastructure challenges need to be addressed, including:*

> ***a long-term solution for solid waste management;***
> *a long-term stable and safe water supply;*
> *a cost-effective and environmentally safe sewage disposal system; and*
> *a safe and convenient system of roads, sidewalks, and snowmobile routes."*

Section 11.3.5 goes on to indicate that *"the Town shall continue to evaluate all possible options for an integrated waste management system, include the suitability of the new landfill suitable for long-term use and also considering complementary strategies such as source reduction, re-use, and re-cycling of waste materials."* Furthermore, Section 11.3.6 states that *"the Town shall continue to encourage the responsible federal, territorial and other agencies to assist in the clean-up and restoration of the six landfill sites which are the legacy of fifty years of indiscriminate waste disposal. The Town shall seek suitable end uses, such as recreational use, for these restored sites."*

While solid waste management is addressed in a general sense, no area, other than the existing site in the West 40 is identified for this activity. No policies regarding setbacks from built up areas or the establishment of buffers have been developed.

4.2.3 Zoning By-law

The Comprehensive Zoning By-law (By-law No. 368) contains no provisions for the establishment of a landfill site or other waste management facility. The present facility is located in the Transportation Zone. Among the uses permitted in that Zone are public utility structures which according to the definition contained in Section 9 includes a *"system, works, plant, equipment, or services whether*

owned or operated by or with or under a franchise from the Municipality or under a Federal or Territorial statute, which furnishes services and facilities available at approved rates to or for the use of all inhabitants of the Municipality, including but not limited to:

a) communication by way of telephone or telegraph;

b) public transportation by bus or other vehicle;

c) production, transmission, delivery or furnishing of water, gas, electricity or heating to the public at large;

d) collection and disposal of sewage, garbage and other waste;

e) collection, channelling and drainage of surface water."

The Zoning By-law is being revised in conjunction with the General Plan. A draft version presently exists, and the final version of both the General Plan and the Zoning By-law is expected to be adopted by Council later this year.

4.3 Transportation

There are no road or rail links to Iqaluit. The only access to the Community is by air and, during the summer, by sea.

During open water season, which generally extends from July to October, fuel and large quantities of dry goods, ranging from food to construction material and motor vehicles, arrive in the Community via the sealift. Generally, goods are marshalled and loaded on ships in Montréal or Québec City and sent directly to Iqaluit. Material is unloaded at low tide, at the sealift beach, located just to the south and east of runway 18. No passenger services are provided.

The Iqaluit Airport is the only year round link to and from the Community. The airport has a 9,000 foot asphalt runway capable of handling the Space Shuttle and any other large aircraft. Scheduled air service from the south is available through First Air and Canadian North. Iqaluit Airport serves as a portal to all of the Baffin Island communities and is the principal service point for Nunavut. It is also the gateway to Yellowknife, Ottawa, and Montréal.

During the winter, all material sent to Iqaluit must arrive by air.

4.4 Population

Iqaluit has experienced a steady growth in its population. In the thirty-five years between 1961 and 1996, the Community grew from 512 people to 4,220. Annual growth rates have varied between 43.7% (which represented a very rapid period of growth between 1961 and 1966 during the construction of the DEW Line) and less than 1% between 1976 and 1981. Table 4-1 illustrates the census data for Iqaluit from 1981 to 1996. The compounded annual growths rate between 1981 to 1996 and 1991 to 1996 were 4.03% and 3.51% respectively.

TABLE 4-1
POPULATION

	1981	1986	1991	1996
IQALUIT	2,332	2,947	3,552	4,220

The General Plan, which was developed for the Town of Iqaluit in 1996, predicted that the population would reach 5,000 by the year 2000, 7,500 by 2010, and 10,000 by 2020. These figures were developed in order to plan for the orderly growth of the Community and to provide a basis for the establishment of five-year capital plans to accommodate that growth. While the process of establishing the new Nunavut Territory was well in hand, as the Plan was written, no one could have predicted the impact on Iqaluit. Its new status as the Capital has resulted in a more rapid growth in population. A great deal of new infrastructure is being built and there is a significant influx of people, which is expected to continue in the short term. The population of Iqaluit was 5,279 as of April 1, 2000, based upon the number of Health Insurance Cards issued by the Government of Nunavut.

Population forecasts have been developed for the period from 2000 to 2020. Since the task of predicting future populations is more of an art than an exact science, three scenarios are presented in Table 4-2 representing low, medium, and high projections.

TABLE 4-2
POPULATION FORECASTS FOR IQALUIT
2000 TO 2020

Year	Low Growth	Medium Growth	High Growth
2000	4,654	4,880	5,279
2001	4,752	5,061	5,510
2002	4,842	5,228	5,750
2003	4,930	5,400	6,002
2004	5,002	5,578	6,264
2005	5,113	5,761	6,538
2006	5,203	5,951	6,823
2007	5,340	6,147	7,122
2008	5,481	6,350	7,433
2009	5,625	6,559	7,758
2010	5,773	6,775	8,097
2011	5,925	6,998	8,450
2012	6,082	7,229	8,820
2013	6,242	7,467	9,205
2014	6,406	7,713	9,607
2015	6,575	7,967	10,027
2016	6,748	8,229	10,465
2017	6,926	8,500	10,922
2018	7,104	8,771	11,400
2019	7,287	9,051	11,898
2020	7,474	9,339	12,418

The Low Growth figures were derived from population projections developed by the Government of the Northwest Territories. Figures to the year 2006 are taken directly from MACA data, beyond that the estimated populations were calculated using a compounded annual growth rate of approximately 2.62%.

The Medium Growth figures were obtained from the Municipality of Iqaluit which commissioned an analysis in order to estimate the design capacity of a new sewage treatment facility. Annual growth rates used in the calculations varied between 3.08% and 3.56%.

The High Growth projections are based on an average annual compounded growth rate of 4.37%, which is slightly less than the 4.50% growth rate between 1991 and 2000.

Discussions with the Municipality have led to the conclusion that given the Town's new political status and the actual demand for infrastructure related to the new government, the Low Growth projections are too low. Municipal officials are of the opinion that time will show that the population will fall somewhere between the Medium and High projections. They also expressed the view that the rate of growth will be quite rapid during the next three years as government positions are filled and families and support businesses move to Iqaluit.

4.5 Economic Base

Economic development in Nunavut, apart from mining operations on Cornwalis Island and in North Baffin, is largely the result of government activity; that is to say, the administration of the Territory. The creation of National and Territorial Parks have lead to the establishment of a fledgling tourist industry, however, the high cost of travel to the area presently limits the development of this sector of the economy.

The predominant economic activity in Iqaluit is the provision of government services. An analysis of 1994 data on the employment profile of the Community, shows that a very high percentage of those who are employed work in government jobs. Education and health services follow, as do retail, transportation, communications, and construction. Hospitality, business services, manufacturing, and fishing employment fall into last place.

While there is little data available, it is very clear that Iqaluit is experiencing an economic boom which is the direct result of the creation of the new Territory and the construction of the required infrastructure. The Municipality reported that in 1999, construction permits were issued which totalled in excess of $54,000,000. It is fully expected that 2000 will also be a busy construction year. A large number of housing units have been built, and there is relatively little serviced land available.

Retail activity is dominated by *North Mart* which provides a full range of goods to the Community. A smaller general retailer, *Arctic Ventures*, provides a similar service to Iqaluit and there are a number of convenience stores throughout the Community which serve the day to day needs of the neighbourhoods in which they are located. There are four hotels in the Community, all of which provide dining facilities.

As the population grows, there may be a need for expanded retail activity, however, the very high cost of land acquisition and construction may limit the number of operators to those presently established. Some thinking suggests that they are in the best position to expand their operations by doing so at their existing sites.

There is also some suggestion of expanded mineral exploration activity to the south of Iqaluit. While this activity may have some short-term implications with respect to airport operations, the long-term effect at the airport and on the economic development of the Town have not yet been evaluated.

4.6 Natural Environment

4.6.1 Climate

Iqaluit is located in the Arctic in that area often defined as that region where the average temperature for the warmest month is below 10°C. Environment Canada weather data for Iqaluit indicates a daily mean temperature range from -26.8°C in February to 7.7°C in July. Total annual rainfall is 193 mm and total annual snowfall is 257 cm. Total annual precipitation is 424 mm.

Table 4-3 summarizes key climatic information by month.

TABLE 4-3
TEMPERATURE, PRECIPITATION, WIND, AND SUNSHINE RECORDS
IQALUIT, NUNAVUT

	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Ann.
TEMPERATURE(°C)													
Maximum	-21.7	-22.5	-18.7	-9.9	-0.7	6.5	11.6	10.2	4.9	-2.1	-8.8	-18.1	-5.8
Minimum	-30.0	-31.2	-28.4	-19.6	-7.7	0.1	3.7	3.4	-0.4	-7.8	-16.7	-26.3	-13.4
Mean	-25.8	-26.8	-23.5	-14.7	-4.2	3.4	7.7	6.8	2.3	-4.9	-12.7	-22.1	-9.5
PRECIPITATION													
Rainfall (mm)	0.0	0.0	0.0	0.2	2.3	24.3	57.8	62.8	38.1	6.7	0.4	0.0	192.9
Snowfall (cm)	24.4	21.4	25.3	32.5	28.2	11.7	0.3	0.7	14.4	38.8	35.2	23.9	256.8
Total (mm)	21.8	19.0	22.0	28.4	29.6	36.5	58.2	63.5	51.9	42.4	30.9	19.8	424.1
WIND													
Prevailing Direction	NW	NW	NW	NW	NW	SE	SE	SE	NW	NW	NW	NW	NW
Speed (km/h)	16	16	14	17	18	16	13	14	16	18	18	15	16
Peak Wind (km/hr)	108	89	129	116	85	71	80	90	97	104	97	111	
SUNSHINE (hrs.)	38.3	96.0	171.6	225.4	199.0	188.8	214.4	160.4	89.5	56.9	45.9	22.2	1508.3

4.6.2 Geology

The study area is located within the Canadian Shield. The area is underlain by Precambrian rocks of the Cumberland batholith (St. Onge, Scott and Wodicka, 1999). The principal rock type mapped in the Cumberland batholith is a tan to pink weathering orthopyroxene-biotite monzogranite that is massive to weakly foliated. The strike of the bedrock foliation is typically north to northwesterly with a 35 to 60 degree dip to the east/northeast; this imparts a northwest to southeast grain to the landscape. Consequently, bedrock ridges trend in a northwest to southeast direction and this structural trend controls the local surface water drainage pattern on the glacially scoured terrain.

Two localized outcrops of the Lake Harbour Group are present on the West 40 peninsula. The rock types which comprise the Lake Harbour Group include pale grey to white marble and calc-silicate rocks. Shallow dipping (less than 10 degrees) middle Ordovician limestone (Blackadar, 1967) occurs as a series of northwest-trending erosional outliers to the northwest of Frobisher Bay some 350 kilometres northwest of Iqaluit.

The overburden consists of silty sand to sand, gravel, and boulders which varies in thickness from 0 to 18 metres (Golder Associates, 1973). The coastline is characterized by inlets of varying size and abrupt cliff faces with narrow beaches. Reworked marine sediments (remnants of past sea levels) occur along the present day shoreline of the Iqaluit area (Public Works Canada, 1992). Fluvial deposits occur along many of the streams and rivers which drain the interior and are characterized by point bar, river terrace landform and outwash plains. Some glaciofluvial deposits are present within the study area. They are distinguished by their irregular outline and apparent misfit location in the landscape within the valleys (Hardy BBT Ltd., 1991).

The Iqaluit area is located within the continuous permafrost zone (*"permanently frozen ground"*). Based on available ground temperature data from the Iqaluit area, the depth of the active permafrost layer is 1 to 1.5 metres (with some variability depending on the thickness of overburden over bedrock). The Royal Military College Environmental Science Group (1991) indicated that in areas with dry granular materials, the active permafrost layer extends to a depth of 2.7 metres below ground surface.

4.6.3 Ecology

Iqaluit has a low arctic eco-climate. Sea ice dominates Koojesse Inlet for eight to nine months of the year; break-up is not complete until around the middle of July (Peramaki 1995). Frobisher Bay is a macro-tidal environment; Iqaluit experience semi-diurnal tides with a mean tidal amplitude of 7.8 metres and tidal ranges as high as 11.6 metres (Samuelson 1997).

Ecologically, Iqaluit is described as lying within the Northern Arctic Ecozone and the Meta Incognita Peninsula Eco-region (Environment Canada 1997). Where they exist, soils are characteristically silty, and as a growth medium are nutrient-poor, cold, shallow, and saturated in low areas (Peramaki 1995). Vegetation cover is dominated by lichens and herbs. In some areas, the latter are often mixed with shrubs including dwarf birch, arctic willow, and northern Labrador tea. There are numerous species of lichen, moss, and grass. Wet sites are dominated by willow and sedge (Samuelson 1997, Environment Canada 1999). A wide variety of flowering species are found in the vicinity of Iqaluit including mountain avens, purple saxifrage, and arctic poppies (Rigby 1991). Vegetation within the Municipality is limited by large areas of disturbed ground and exposed bedrock. Terrestrial mammals in the surrounding area include caribou, wolf, arctic fox, arctic hare, and brown and collared lemmings. Marine mammals occurring within Frobisher Bay include polar bear, right whale, ring seal, harp seal, bearded seal, beluga, narwhal, walrus, and killer whale, but marine mammal sightings within Koojesse Inlet are generally restricted to seals (Environment Canada 1997, 1999). Bowhead whales are also occasionally sighted in Frobisher Bay. Polar bear are rarely seen in the vicinity of Town. Iqaluit has expansive sub-arctic tidal flats which are dominated by a variety of molluscs, gastropods, barnacles, and several species of polychaetes (Samuelson 1997). A wide variety of birds can be seen on the tidal flats during Spring and Fall migrations but breeding by shorebirds within the Town site will ultimately be heavily constrained by the availability of adjacent undisturbed shoreline habitat and disturbance by humans and/or dogs. The bird community is dominated year-round by ravens but seagulls are numerous during summer. Snow bunting and rock ptarmigan are frequently seen. During Community meetings, it was reported to Study Team members that peregrine falcons (*Falco peregrinus tundrius* or tundra peregrine falcon subspecies) have bred on the northern edges of the study area. Tundra peregrines are officially listed as a *"vulnerable species"* by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC).

5.0 EXISTING WASTE MANAGEMENT SYSTEM

5.1 Introduction

The Town's waste stream is comprised of refuse from the municipal and industrial, commercial, and institutional (ICI) sectors. There are no records indicating the volume or tonnage of refuse generated by the various sectors. The Municipality has recently started to track the number of loads received at the landfill site in an effort to help quantify waste materials. The only known reference to waste composition for Iqaluit appears in *"Guidelines for the Planning, Design, Operation and Maintenance of Solid Waste Modified Landfill Sites in the Northwest Territories,"* Volume 1, March 1990.

5.2 Waste Reduction and Diversion Programs

There are no territorial or municipal government programs promoting waste diversion or the 3 Rs: reduction, reuse, recycle. There are, however, two local initiatives that contribute to waste diversion in the Community, although the actual volumes of materials handled are unknown.

A local contractor collects aluminium cans for shipment to a recycler in the south. The cans are collected throughout the year from local bars. Each year a 'Kiddy Can Day' is held, during which residents are encouraged to turn in aluminium cans for a nickel a can. The contractor bales the cans and ships them out on the sealift. This recycling program is reportedly inconsistent in the availability of service. A significant volume of cans was *"temporarily"* placed at the landfill site this past fall, and no effort has been made to recover and process them.

Inmates from the Young Offenders Centre presently collect paper from commercial and institutional buildings in the Community. Participants interested in the program call the Centre to arrange regular pick-up. Collection occurs on Fridays, and the paper is taken to the Department of Public Works, Government of Nunavut, where it is shredded and baled. First Air takes the paper to Ottawa, where it is sent to a local recycler. Proceeds from the program go to the Iqaluit Rotary Club to support their charitable Community work.

Household Hazardous Waste (HHW) is accepted at the landfill site. Items include paint, solvents, and batteries. Batteries are neutralized and stored in a container which is shipped out on the sealift.

Household Hazardous Waste Days are held in spring and fall. At these times, the Municipality encourages residents to turn in any waste that is not permitted in weekly collections.

There is no specific education program in place to advise the public on waste management practices or initiatives in the community. Public announcements are made periodically by the Municipality, as required.

5.3 Waste Collection Practices

Residents store their refuse in closed wooden garbage boxes located outside the home. The boxes are essential to minimize scavenging by ravens and roaming dogs.

The Town provides twice-weekly refuse collection from individual residences and apartment complexes, utilizing a 20 yd^3 packer truck with a 3-person crew. The crew collects approximately 2 truck loads per day, 5 days per week, for a total of 160 to 200 yd^3/week.

A separate Municipal 2-person crew with a 24 yd^3 packer truck collects waste from the institutional and commercial sectors, plus office waste from industry. Collection occurs over 5 days per week. Approximate waste quantities are 2 loads per day, for a total of 200 to 250 yd^3/week. If commercial collection is not completed during the 5-day work week, then the crew works Saturday morning.

The Town also undertakes spring and fall special collection events to pick up large, bulky waste items. A 10 yd^3 dump truck and a 2-person crew provides the service. Each event takes approximately 1 week, and approximately 500 yd^3 of waste is collected annually through these special collections.

Iqaluit waste collection services utilize the following equipment:

- 1997 International 20 yd^3 packer
- 1995 Ford 24 yd^3 packer

The equipment is stored in Airbase Garage in the centre of Town. This warehouse is scheduled to be demolished and the equipment moved into a new garage in the North 40 area.

The 2000 operating budget is approximately $192,000, including salaries and benefits, operation and maintenance of equipment, and contract services. This amount includes the spring and fall cleanup, however, it includes no provision for future equipment replacement.

The industrial sector and the building industry are responsible for their own waste collection and transport (i.e. direct haul) to the Municipal landfill. Some industries/builders rent refuse containers from Baffin Building Services for this purpose. Tipping fees at the landfill are $25 per truck load or per container. Approximately $53,000 in tipping fees was collected in 1999.

5.4 Waste Processing

The Municipality of Iqaluit is not directly involved in any waste processing activities. As noted in Section 5.2, some minor processing is associated with the recycling of cans and the waste paper collected by other parties.

5.5 Waste Disposal

The Municipality's landfill site is located in the West 40 area, immediately south of the original Landfill Site #3, on the east side of the Causeway Access Road. Public Works Canada reported (*"Literature Review on Abandoned and Waste Disposal Sites in the Iqaluit Area, N.W.T.,"* November 1992) that the origin of Site 3 is unknown. The original site, which is inactive, is approximately 1.5 ha in area, and it appears to have served as a metal and domestic waste landfill.

The original site was expanded in 1996 to serve as an interim landfill until such time as a long-term facility could be established. The expansion area, which totals approximately 2.7 ha, is located immediately south of the former site and north of the tank farm.

The southerly portion of the site has separate storage areas for bulky recyclable and non-recyclable wastes. Residents of the community are allowed to take recyclable materials from the recyclable-materials area.

Storage areas have been established for paint and batteries entering the landfill site. The paints are opened and left to dry before being placed in the landfill. Batteries are neutralized and stored in an on-

site container, which will be shipped out when full. The batteries collected include those from vehicles, snowmobiles, and planes.

In the November 1991 UMA Engineering Ltd. report for the present site, UMA noted that the Town chose not to receive hazardous waste materials at the site. The Town has confirmed that apart from the batteries and paints, this continues to be their policy.

The northern portion of the expanded site is utilized for waste disposal. Open burning is practiced to reduce refuse volume and maximize site life. Municipal staff estimate that this interim facility will be full by June 2001, based upon the current level of activity and the present method of operation.

The expanded site has a chain link security fence around the property with a lockable gate. The site is open to the public from 09:00 to 18:00, Tuesday through Saturday. A site superintendent is present during normal hours to inspect incoming loads, direct the driver to the proper disposal area, and to issue statements for disposal fee purposes.

Resources at the Municipal landfill include:

- full-time site superintendent
- site office
- Cat 814 wheeled dozer

The 2000 operating budget for the landfill site is approximately $100,000, including wages and benefits, operation and maintenance costs, and contracted services. The budget amount does not include any allowances for future equipment purchases, landfill closure costs, or the development of new facilities.

5.6 Waste Quantities

There are no scales at the Iqaluit landfill site and hence there are no historical records which may be used to forecast waste quantities. However, the Department of Municipal and Community Affairs (MACA), Government of the Northwest Territories, developed a Program Management Handbook

(1986) which contains *a "General Terms of Reference for a Community Water and Sanitation Services Study."* The Terms of Reference indicate that for planning purposes, the average residential refuse generation rate is 0.010 m^3/person/day. The guide goes on to say that the total refuse generation rate for a population of 2,000 to 10,000 may be based on the formula:

Total generation rate = 0.010 x (.323 x ln (population) - 1) m^3/p/d

For a population over 10,000:

Total generation rate = 0.010 x 2.0 m^3/p/d

The foregoing formulae represent uncompacted volumes for residential, commercial, and construction waste. They do not include an allowance for bulky waste materials such as discarded vehicles, snowmobiles, appliances, oil drums, machinery, and furniture.

The projected uncompacted volumes of refuse generated for the planning horizon (i.e. 2001 - 2020) are presented in Table 5-1. It is noted that the tonnage estimates derived using the MACA formula and the conversion factor for cubic metres to tonnes results in equivalent per capita generation rates of 1.0 to 1.1 t/c/y. By comparison, studies elsewhere have reported generation rates of approximately 0.85 t/c/y for residential plus ICI waste.

In the absence of any site-specific data for Iqaluit, it is proposed the MACA based quantities be used for the purpose of this planning exercise. If indeed the MACA numbers are high, the disposal solution will simply have a life span in excess of the 20-year planning horizon. The projected waste quantities should be reassessed however, prior to designing and/or selecting equipment for any facility such as an incinerator, etc. In the interim, the Town should continue to monitor and quantify the volumes of waste being received at the present landfill site.

TABLE 5-1
PROJECTED WASTE QUANITIES

YEAR	POPULATION[1]	MACA GENERATION RATE (m^3/c/d)	WASTE QUANITIES[2]		
			ANNUAL VOLUME[3] (m^3)	CUMULATIVE VOLUME (m^3)	ANNUAL TONNES[4]
2001	5,510	0.018	36,000	36,000	5,400
2002	5,750	0.018	38,000	74,000	5,700
2003	6,002	0.018	39,000	113,000	5,850
2004	6,264	0.018	41,000	154,000	6,150
2005	6,538	0.018	43,000	197,000	6,450
2006	6,823	0.019	47,000	244,000	7,050
2007	7,122	0.019	49,000	293,000	7,350
2008	7,433	0.019	52,000	345,000	7,800
2009	7,758	0.019	54,000	399,000	8,100
2010	8,097	0.019	56,000	455,000	8,400
2011	8,450	0.019	59,000	514,000	8,850
2012	8,820	0.019	61,000	575,000	9,150
2013	9,205	0.020	67,000	642,000	10,050
2014	9,607	0.020	70,000	712,000	10,500
2015	10,027	0.020	73,000	785,000	10,950
2016	10,465	0.020	76,000	861,000	11,400
2017	10,922	0.020	80,000	941,000	12,000
2018	11,400	0.020	83,000	1,024,000	12,450
2019	11,898	0.020	87,000	1,111,000	13,050
2020	12,418	0.020	91,000	1,202,000	13,650

Notes:
1. Population reflects high growth rate forecast from Table 4-2.
2. Quantities exclude bulky wastes such as discarded vehicles, snowmobiles, appliances, oil drums, machinery, furniture, etc.
3. Uncompacted volume rounded to the nearest 1000 m^3.
4. Based upon a density of 150 kg/m^3 of uncompacted refuse.

NOTE: The waste tonnages equate to approximately 1.0 to 1.1 t/c/y. Comparable rates in the south for residential plus ICI waste are approximately 0.85 t/c/y.

5.7 Waste Composition

The Town has not commissioned a Waste Comparison Study (WCS) as part of this assignment. Hence, the only known reference is the 1990 MACA planning guideline, which presents a waste composition summary for three (3) northern communities. The Table 5-2 summarizes the information. Paper

products make up 37.9% of the Iqaluit waste stream, followed by food (21.%), plastic, rubber, and leather (13.3%), and metal (9.4%).

TABLE 5-2
WASTE COMPOSITION FOR NORTHERN COMMUNITIES

COMPONENT	PERCENTAGE BY WEIGHT		
	IQALUIT	PANGNIRTUNG	BROUGHTON ISLAND
Food	21.4	19.3	15.9
Cardboard	14.4	12.1	9.3
Newsprint	5.0	0.4	0.3
Other Paper Products	18.5	15.2	14.0
Cans	5.4	5.5	5.0
Other Metal Products	4.0	3.9	6.5
Plastic, Rubber, Leather	13.3	8.8	8.9
Glass, Ceramics	3.1	2.6	1.7
Textiles	3.5	4.1	3.3
Wood	4.5	13.4	20.0
Dirt	3.4	3.1	4.8
Diapers	3.5	11.6	10.3
Total	100.0	100.0	100.0

Table 5-3 presents a waste composition comparison for Iqaluit versus several other locations. As one might expect, there are differences from community to community. Results will vary depending upon the scope of the individual study, the length of the sampling period, the seasons covered, how representative the study is of the entire community, the actual makeup of the community, and the type and extent of ICI development, etc. The United States Environmental Protection Agency (USEPA) figures are based upon a national survey. Figures for Fergus, Ontario are from a WCS commissioned by the Ontario Ministry of the Environment, and the remaining figures are from studies for the particular municipalities. Subject to those notes referenced in the table, there are no significant differences between the MACA reported figures for Iqaluit versus those for other locations.

TABLE 5-3
WASTE COMPOSITION COMPARISON

COMPONENT	PERCENTAGE BY WEIGHT				
	USEPA	OTTAWA 1997	PEMBROKE & AREA RECYCLING BOARD	FERGUS	IQALUIT
Paper	38.12	21.22	20.24	32.39	37.9
Glass	5.89	2.58	5.16	7.58	3.1
Metal	7.66	2.57	4.14	5.71	9.4
Plastics	9.42	10.29	9.98	8.73	13.3
Organics	23.80	39.30[1]	45.59[1]	28.78	21.4
Other	15.10	24.04[2]	14.90[2]	15.00	14.9

Notes:
1. Includes kitchen organics and yard waste (Ottawa 9.56; PARB 24.15 yardwaste).
2. Includes disposable diapers, textiles, C&D waste, HHW & unclassified materials.

6.0 EXISTING MUNICIPAL LANDFILL SITES

There are at least six waste disposal sites within Iqaluit, three of which are the responsibility of the Municipality. The sites known as Sites 3, 4, and 5 (Apex) have been the subject of various studies. An overview of each site is provided below, based on information provided in the previous reports.

Site 3

Site 3 is located across Koojesse Inlet from the Town in the area known as the West 40. The site is on the east side of the Causeway Access Road, and is set back about 150 metres from the Inlet. The original site area is at the north limit of the site and measures about 200 metres north-south by 75 metres wide (1.5 hectare land area). It was used for the disposal of mostly metal wastes (including drums, batteries, cans) of unknown origin, although there is evidence of domestic waste materials. Site 3 was expanded to the south in 1996 to provide interim landfill capacity while the Town undertook the development of a long-range waste management plan. The landfill expansion had an estimated site life of 5 years. Municipal waste received at the landfill is burned in open fires to reduce waste volume and increase site capacity. Burning of the food wastes also reduces the site attraction for birds, which could pose a hazard to airport traffic. The total site area is about 3.6 hectares.

The ground surface slopes generally southward, with about a 5 to 6 % grade across the northern former disposal area and flatter gradients across the southern portion. The difference in elevation from north to south is about 9 metres. Bedrock outcrops across the northeastern and eastern side of the disposal area, as well as immediately to the west of it. Surface drainage is generally southward, leaving the site via a culvert below the Causeway Access Road and then to the southwest. More direct discharge from the northern former disposal area occurs locally eastward through the depressions between bedrock outcrops towards the flats of Koojesse Inlet.

Previous investigations in 1991 indicate that the subsurface conditions in the southern portion consist of silty sand and sandy silt. The thickness of similar soil materials adjacent to or underlying the waste in the northern portion is less than in the south part. The thickness of waste is estimated to typically be about 1 to 2.5 metres. The depth to bedrock is very variable across the site but is typically outcropping to 3 metres in the northern and central portions, to greater than 4.8 to 7.5 metres in the southern portion.

Chemical analysis on soil samples from the northern disposal area describes the presence of several elevated metals, PCBs and heavy oils. Subsurface materials in the southern portion, sampled prior to the site expansion, appeared unaffected by the disposal activities in the north.

The major environmental issues associated with Site 3 are the exposed waste materials and potential discharge of contaminants off the site via surface water drainage, either locally to the east through the bedrock depressions or with the main drainage to the southwest. Open burning at the present working area has been the cause of many complaints from Town residents.

Site 4

Site 4 is located about 600 metres north of Site 3, on the east side of the Causeway Access Road and immediately adjacent to the foreshore flats of Koojesse Inlet, directly opposite the Town. The site had been used as a *"honey bag"* disposal area until 1979, when disposal of Municipal waste commenced. It occupies an area of approximately 1.2 hectares. It is believed that Site 4 was used principally for Municipal waste disposal, whereas large scrap and bulky items were taken to the North 40 area. There are reports indicating that fuel contaminated soils were also disposed of at the site. Historically, the

refuse was burned and the residual ash was pushed over the slope face. The upper flat sections of the landfill area have been graded and covered with some gravel, but some waste is reportedly still exposed. The steep landfill face opposite the Inlet remains exposed.

Site 4 is in an area characterized by exposed bedrock, and an exposed ridge to the south physically separates the site from the West 40 area. The top of the site is moderately sloping towards the east and has been covered with some granular material. However the east side consists of a 12 to 14 metre high steep exposed landfill face (about 1.5 to 2H:1V) with an area at the toe where debris off the face has accumulated on the tidal flats. The accumulated material is reported to be just above the high tide level in the Inlet.

The steep east slope has been assessed as unstable, and may be adversely influenced by tidal action. Tension cracks have been observed at the crest of the slope. The top portion of the site is easily accessible to vehicles, however access to the toe area of the slope does not presently exist but may be possible through the tidal flats at low tide.

At the time of various studies, there was no reported evidence of leachate from Site 4. However surface runoff from the exposed landfill face is directly to Koojesse Inlet. These potential pathways for contaminant movement, together with the refuse exposure and marginal stability of the steep waste face, represent the main environmental issues at Site 4.

Site 5

Site 5, also known as the Apex waste disposal site, is located southeast of Iqaluit on Tarr Inlet. The site was used for Municipal waste disposal from the mid 1970's to 1979 when the site closed. Some site cleanup has occurred, including the placement of gravel cover material on the top portion of the landfill and removal of PCB-containing electrical equipment. Public Works Canada (1992) stated that 60 pieces of electrical equipment were removed to the PCB storage area at Iqaluit airport. This demonstrates that the site was also used for disposal of non-municipal wastes.

The site is approximately one hectare in size, bounded by bedrock to the north and northwest, a gravel deposit to the south, and the tidal flats of Tarr Inlet to the east. Refuse was deposited at the site and

pushed over the shoreline cliff towards Tarr Inlet. The height of the exposed waste face ranges from 20 to 27 metres and debris is scattered at the toe of the area along the tidal flats. The exposed face is very steep (1 to 1.5H:1V) and considered to be potentially unstable. There is evidence of toe erosion by tidal activities and ice scour. There is vehicle access to the toe area during low tide.

Surface water runoff is reported to enter the waste disposal area from the hill adjacent to the site and has been observed to exit from the waste at the toe area of the slope. The potential for seasonal leachate discharge from the waste has been identified as an environmental concern at this location. A 1995 report identified local contaminant inputs to the marine environment from the Apex site in terms of PAHs, certain metals, and pesticides.

The main environmental concerns are the release of environmental contaminants via leachate discharge or overland flow to Tarr Inlet and the stability of the high and steep exposed waste slope.

7.0 CONCEPTUAL CLOSURE PLANS FOR EXISTING MUNICIPAL LANDFILL SITES

7.1 Historical Approach To Landfill Closure Planning

The historical approach to closure planning presented in previous reports has envisaged *"remediation"* or *"clean-up"* of the landfill sites. This remediation approach considers the landfill sites to be *"contaminated sites"* and recommendations have been developed which involve remediation of these contaminated sites in accordance with various procedures and guidelines (e.g., CCME assessment and remediation criteria, various Canadian provincial guidelines, etc.) such that site re-development can occur.

It is acknowledged that there are waste materials (including hazardous wastes) within the Iqaluit sites (e.g., petroleum compounds, PCBs, solvents, etc.) that can result in adverse impacts on the environment. However, the remediation or clean-up (and subsequent re-development) approach of these Iqaluit sites is faced with several constraints and various issues to be considered as noted below:

- Physical constraint – if landfilled waste materials are removed from the Iqaluit sites, where will the material be placed?

- Processing or treatment constraint – if the waste materials are removed from the sites and processed/treated, this would be an expensive procedure to implement especially in a relatively remote location with a relatively small waste quantity.
- Health and safety constraint – there would be hazards associated with removing and handling the landfill waste materials and the separation of hazardous versus non-hazardous components of the waste.
- Cost/benefit considerations – is the *"remediation"* of these Iqaluit sites for re-development a cost effective means for managing the landfill sites, especially when these lands are not currently located within lands proposed for development?
- Timing/environmental considerations – the investigation of the Iqaluit sites, development and evaluation of remediation alternatives, and remediation planning and implementation is a costly and potentially lengthy process and, regardless of which remediation approach is selected, it would take several years to complete. Over this time period, the environmental impacts from the sites would continue. It would also be necessary for the Municipality to have the funding available and budgeted for the work.

7.2 Proposed Approach To Landfill Closure Planning

It is proposed that an alternative approach to landfill closure planning be considered for the Iqaluit sites. As opposed to site remediation and re-development, an alternative approach to managing these Iqaluit sites could involve proper site closure and management of environmental impacts. This approach to landfill management is consistent with that followed in other parts of Canada and the United States (including Alaska) where the long-term use of the landfill site area is for waste management. Re-development (in the short term) for other possible land uses is not considered a viable alternative. This approach involves the closure and post-closure care of the site as a *"landfill."* The closure and post-closure care phases of the landfill lifespan involves the proper physical closure of the site, followed by the post-closure care of the site which involves the monitoring and management of the environmental impacts from the facility. The intent of this proposed alternative approach is to isolate the waste materials for both aesthetic and health reasons, and to monitor and control adverse impacts beyond the limits of the landfill site.

This alternative approach to landfill management will require that the land be designated as closed landfill sites. This could be accomplished following consideration of a number of options for site closure including the following:

- Leave waste materials at the present three Iqaluit sites and develop site-specific closure plans.
- Relocate all or part of the waste materials from a more unsuitable existing site to a more suitable site/location (e.g., combine waste materials from one of the sites with waste materials at one of the other existing sites and focus closure on the larger combined site).
- Utilize a combination of engineered components and the natural hydrogeological/physical setting of the site (e.g., utilize the natural containment properties of permafrost to passively control landfill leachate impacts on surface water and groundwater beyond the defined boundaries of the closed landfill site).

The fundamental objective of site closure should be physical stability of the disposal areas and isolation of the waste materials. Water contact with the waste materials should be minimized to reduce the leaching of contaminants from the waste materials to the external environment.

In northern climates, where granular earth borrow materials are limited and low permeability soils (e.g., clay) are non-existent, it is not possible to construct a low permeability final cover system over the waste materials. As such, a final closure design which minimizes the use of valuable granular borrow materials and does not rely on low permeability soils, should be considered. If a low permeability cover is needed to reduce infiltration into the completed landfill, synthetic materials can be used.

The general trend in the management of closed landfills is to utilize the natural environment and natural processes to provide some degree of *"passive"* treatment, containment, and control of leachate-related impacts. Where possible, natural or *"passive"* systems are preferred over *"active"* engineered systems such as bottom liners, leachate collection, pumping, and treatment systems.

In southern climates, examples of components that can augment the natural environment and thus contribute to the passive control of environmental impacts could typically include the use of peat

filtration systems; use of iron filings to neutralize contaminants; and the use of nutrients and oxygen to promote bacterial action.

In northern climates, the cold temperatures and permafrost can be used to advantage and incorporated into the landfill closure planning to create the necessary containment features and thus control impacts on the environment. Based on a review of available information (including aerial photography, geological data, and ground temperature data), it appears that the permafrost conditions and the expected relatively low permeability of the Precambrian bedrock will minimize the mobility of any leachate-impacted groundwater. The primary concern will be potential leachate impact to surface water. This is consistent with observations at the three Iqaluit sites.

Much of the refuse will be placed during the winter months and will become frozen, thereby minimizing waste decomposition and leachate generation. As the fill height increases, the permafrost will move up through the waste. Once the waste reaches the final design elevation, a top cover closure layer would be placed. Thermal models would be worked to develop appropriate properties for various zones of the cover. Zones containing more moisture and finer grained soils that would remain frozen would be near the waste. The higher portions of the cover may be more granular and with lower moisture content.

7.3 Consultation with Regulatory Agencies

Prior to initiating any landfill closure planning activities, it is recommended that the Municipality of Iqaluit should consider landfill site closure in an environmentally acceptable manner, as the preferred method of managing the Iqaluit sites (as opposed to site remediation and re-development). This approach is consistent with the document entitled "*Guidelines for the Planning, Operation & Maintenance of Solid Waste Modified Landfill Sites in the Northwest Territories,*" Volume I: Planning & Design (Northwest Territories, December 1991) as evidenced by the following statement in Section 3.2.3 of the guidelines:

> *"When a disposal site has reached capacity, steps must be taken to ensure that the facility is properly closed and that the general aesthetics of the area are restored."*

It is recommended that the Municipality bring this approach forward to the regulatory agencies for their review and comment. It is expected that the agencies would include the Nunavut Water Board, Nunavut Impact Review Board, Department of Health, Department of Renewable Resources and Economic Development, and Department of Fisheries and Oceans.

7.4 Development of Site-Specific Closure Plans

Once feedback has been received from the regulatory agencies on the proposed approach to landfill closure, a work plan would be required to develop conceptual and then final site-specific closure plans for the Iqaluit sites in accordance with the above approach.

8.0 CONSIDER FUNCTIONALLY DIFFERENT ALTERNATIVES

8.1 Introduction

This stage of the WMPS involved the identification and evaluation of the functionally different alternatives to manage the waste quantities associated with the study area. The process involved the following 5 steps:

.1 Identify and describe potential system components or waste management practices;

.2 Identify screening criteria;

.3 Screen the system components and identify those suitable for further consideration;

.4 Combine the reasonable system components into system alternatives and evaluate the systems; and

.5 Identify the preferred waste management system.

Each of the preceding steps is discussed in the remainder of this section of the report.

8.2 Potential System Components

Table 8-1 summarizes a list of potential components arranged under the 4 classes of reduction and diversion, handling and collection, processing, and disposal. The individual components are identified with capitalized text. The points following the component identify some of the ways in which the particular component may be practiced. For example "*HOUSEHOLD HAZARDOUS WASTE*

MANAGEMENT" is a component. Some municipalities hold special HHW collection events during which the public is encouraged to bring their wastes to a central depot set up especially for the event. In other cases, a permanent depot may be established for HHW drop off during regular operating hours. Some municipalities provide collection service with specially equipped vehicles.

The glossary of terms in Appendix 'A' includes definitions for the various components.

TABLE 8-1
LIST OF POTENTIAL
WASTE MANAGEMENT SYSTEM COMPONENTS

Waste Reduction and Diversion	Waste Handling and Collection	Waste Processing	Waste Disposal
REDUCTION o user pay o bag limits o eliminating single use practices o replace disposables with recyclables o material bans from collection and/or disposal REUSE o waste exchanges o reusing products/ packaging o buy-back centres RECYCLING o Blue Box program o Material bans from disposal o Waste exchange HOUSEHOLD HAZARDOUS WASTE MANAGEMENT o HHW - special collection events at temporary depot o Permanent collection depot o Special collection vehicles COMPOSTING o Municipal & ICI compostables PUBLIC EDUCATION	CURBSIDE COLLECTION o Weekly pick-up of MSW o Blue Box pick-up o special events such as spring/fall clean-up DIRECT HAUL o ICI practice o special trips by public o used to deliver MSW, recyclables, compostables, HHW DEPOT o used to collect HHW o container station for recyclables o temporary depot for single-day events o permanent depot TRANSFER STATION o large central facility SOURCE SEPARATION o Blue Box o Material bans	MATERIALS RECOVERY FACILITY (MRF) o mixed materials recyclables recovery o source separated materials recovery SHREDDING BALING IMPORT	LANDFILL INCINERATION o energy from waste EXPORT PLASMA TORCH

ICI = Industrial, Commercial, Institutional
MSW = Municipal Solid Waste

8.3 Development and Application of the Screening Criteria

A draft list of screening criteria and corresponding rationale was developed to evaluate the list of potential waste-management system components. In addition, principles were established for the application of the screening criteria. The criteria, rationale, and principles are summarized in Table 8-2.

Each potential system component identified in Table 8-1 was evaluated utilizing the screening criteria presented in Table 8-2. Table 8-3 summarizes the screening results. Tables 8-1, 8-2, and 8-3 were presented to the Steering Committee and reviewed with both the Technical Committee and the public during the week of January 17 to 21, 2000. No comments or recommendations were received from the committee members or the public which lead to any changes to Tables 8-1 or 8-2. Table 8-3 reflects the comments received during the public meeting of January 20, 2000.

Column 1 of Table 8-3 lists each component and gives a corresponding definition. The next 5 columns reflect the assessment of the component against each of the 5 selected screening criterion. Column 2 (Proven Technology) also lists some examples of the component's current application elsewhere and within Iqaluit, if applicable. For example, on page 3 of the table under Curbside Collection, it is noted that the Town picks up residential, industrial, and commercial waste weekly, and that a special large-item collection occurs semi-annually.

The last line item under each screening criterion indicates whether the component satisfies or fails to satisfy the criterion. The last column of the table indicates whether the component should be considered further as a component in the WMS.

It is important to note that if a component failed to meet all of the criteria, it was not considered further as part of any WMS. Also, if there was some uncertainty as to whether a component met a particular criterion, it was not eliminated from further consideration on the basis of that one criterion. The principles governing the application of the screening criteria cover these 2 points.

TABLE 8-2
SCREENING CRITERIA & RATIONALE
FOR THE WMS COMPONENTS

CRITERIA	RATIONALE
.1 Proven Technology	○ Do not wish to employ experimental technology. ○ Must have proven success in North America and must be adaptable for the Iqaluit environment.
.2 Economic Feasibility	○ Cost/benefit of component must be reasonable. ○ Must be affordable to the Town. ○ Emphasis will be placed on most effective service for the least cost, including the capital and O&M cost.
.3 Compliance with Government Regulations, Policies, Guidelines and Initiatives	○ Components which do not comply will not be approved.
.4 Compatibility and Flexibility	○ Components must complement other system components and be flexible to accommodate potential changes in the quantity and composition of the future waste stream plus technological changes.
.5 Capable of Being Publicly Managed and/or Controlled	○ Greater certainty regarding long term WMS management. ○ It is not intended to exclude privately managed and/or controlled components.
.6 Other criteria? Any other ideas?	Why are they important?

PRINCIPLES GOVERNING THE APPLICATION
OF THE
SCREENING CRITERIA FOR WMS COMPONENTS

1. The study criteria shall be applied with the stated study purpose in mind.
2. Alternative components are to be judged based on the present state of knowledge (i.e. pertaining to technology, costs, legislation, etc.).
3. If there is any uncertainty about a component meeting one or more of the screening criteria, the component will be carried forward for subsequent evaluation.
4. It a component fails to meet all of the screening criteria, it will be excluded from further consideration.

TABLE 8-3
APPLICATION OF THE SCREENING CRITERIA TO THE WASTE MANAGEMENT SYSTEM COMPONENT LIST

COMPONENT	CRITERIA					
	PROVEN TECHNOLOGY	ECONOMIC FEASIBILITY	COMPLIANCE WITH GOVERNMENT REGULATIONS, POLICIES, GUIDELINES AND INITIATIVES	COMPATIBILITY AND FLEXIBILITY	CAPABLE OF BEING PUBLICLY MANAGED AND/OR CONTROLLED	SHOULD THE COMPONENT BE CONSIDERED AS A POTENTIAL COMPONENT IN THE WMS?
WASTE REDUCTION AND DIVERSION COMPONENTS						
REDUCTION The avoidance or prevention of waste production through measures or efforts designed to reduce the quantities of waste requiring disposal.	○ component in limited use in the study area, used extensively elsewhere ○ no formal program is in place in the study area ○ user pay and disposal fees encourage reduction ○ examples of reduction include purchasing decisions for less packaging; reusable vs. single use goods (e.g. cloth diapers); donating clothing, furniture and appliances to charity; using refillable containers; stopping junk mail; purchasing more durable goods ○ success a function of consumer awareness and attitude ✔ criterion satisfied	○ cost borne by the waste generator, not the Municipality ○ leads to reduced collection and disposal costs for the Municipality ✔ criterion satisfied	○ no regulations, policies, guidelines, or initiatives presently exist ✔ criterion satisfied	○ compatible with other components ○ can introduce a material ban list prohibiting certain items from landfill ○ user pay programs can be introduced to encourage reduction ✔ criterion satisfied	○ reduction program is not structured at this time, however, Municipality can manage any improvements or enhancements ✔ criterion satisfied	✔ yes, all criteria satisfied
REUSE The return of a product or material to reuse for its original purpose or by finding a new use for it without modifying it.	○ component in limited use in the study area, used extensively elsewhere ○ no formal program is in place in the study area ○ user pay and disposal fees encourage reuse ○ examples of reuse include cloth vs. disposable diapers; bottle returns; used clothing, furniture, and appliance donations to charities, etc. ○ ICI sector may reuse some waste materials ○ establishment of waste exchanges ○ function of awareness and attitude ✔ criterion satisfied	○ cost related to the initiative undertaken ○ cost absorbed by the generator ○ leads to reduced collection and disposal costs in the Municipality because less waste is produced ✔ criterion satisfied	○ no regulations, policies, guidelines or initiatives presently exist ✔ criterion satisfied	○ compatible with other components ✔ criterion satisfied	○ Municipal policies could have a positive impact ✔ criterion satisfied	✔ yes, all criteria satisfied

3Rs - Reduce, Reuse, Recycle
EFW - Energy from Waste
HHW - Household Hazardous Waste
ICI - Industrial, Commercial, Institutional
MSW - Municipal Solid Waste
MRF - Material Recovery Facility
O&M - Operation and Maintenance
WM - Waste Management
WMS - Waste Management System

TABLE 8-3
APPLICATION OF THE SCREENING CRITERIA TO THE WASTE MANAGEMENT SYSTEM COMPONENT LIST

COMPONENT	CRITERIA					
	PROVEN TECHNOLOGY	ECONOMIC FEASIBILITY	COMPLIANCE WITH GOVERNMENT REGULATIONS, POLICIES, GUIDELINES AND INITIATIVES	COMPATIBILITY AND FLEXIBILITY	CAPABLE OF BEING PUBLICLY MANAGED AND/OR CONTROLLED	SHOULD THE COMPONENT BE CONSIDERED AS A POTENTIAL COMPONENT IN THE WMS?
RECYCLING The sorting, collecting and processing of a waste material or product so that it can be used for a similar or new purpose	◦ residential recycling is in use throughout North America ◦ no formal municipal programs are in place in the study area ◦ local business collects cans, Baffin Correctional Centre collects paper from commercial sector ◦ examples include recycling plastic pet pop bottles to make clothing; waste paper and cardboard to make paper ◦ user pay for collection and disposal fees encourage recycling ◦ function of awareness and attitude ✔ criterion satisfied	◦ cost can vary significantly depending upon the program ◦ ICI sector generators absorb their costs ◦ continued feasibility of recycling initiatives depends on availability of markets ✔ criterion may be satisfied depending upon program and market conditions	◦ no regulations, policies, guidelines, or initiatives presently exist ✔ criterion satisfied	◦ compatible with other components ◦ can expand or restrict the program to meet market requirements ✔ criterion satisfied	◦ can be publicly managed ✔ criterion satisfied	✔ yes, whether the Municipality should become more actively involved in recycling is dependent upon continued economic viability
HOUSEHOLD HAZARDOUS WASTE (HHW) MANAGEMENT The management of wastes resulting from the use of common household products which can be hazardous to the environment. The objective is to minimize the quantity of HHW going to inappropriate disposal	◦ component in use throughout North America and elsewhere ◦ no formal program in use in the study area ◦ paints and batteries presently managed at landfill site ◦ involves personal decisions on use and disposal of oil and water based paints, pesticides, cleaning agents, batteries, etc. ◦ function of awareness and attitude ◦ requires public and/or private sector involvement ✔ criterion satisfied	◦ cost of program can be significant ◦ door-to-door collection is very expensive for most communities ◦ source separation with delivery to HHW Depot is quite common and may be most suitable for Iqaluit ◦ failure to manage HHW could result in very significant social, natural, and financial costs ◦ no disposal facility exists in the north ✔ economic viability uncertain	◦ no regulations, policies, guidelines, or initiatives presently exist ◦ reduces volume of hazardous waste materials going to inappropriate disposal ◦ reduces impact on disposal facilities and the greater environment ✔ criterion satisfied	◦ compatible with other components ◦ can be amended to meet community and regulatory needs ✔ criterion satisfied	◦ can be publicly managed ✔ criterion satisfied	✔ yes, Town must act to minimize potential impact on environment. Disposal options must be considered

3Rs - Reduce, Reuse, Recycle
EFW - Energy from Waste
HHW - Household Hazardous Waste
ICI - Industrial, Commercial, Institutional
MSW - Municipal Solid Waste
MRF - Material Recovery Facility
O&M - Operation and Maintenance
WM - Waste Management
WMS - Waste Management System

TABLE 8-3
APPLICATION OF THE SCREENING CRITERIA TO THE WASTE MANAGEMENT SYSTEM COMPONENT LIST

COMPONENT	CRITERIA					
	PROVEN TECHNOLOGY	ECONOMIC FEASIBILITY	COMPLIANCE WITH GOVERNMENT REGULATIONS, POLICIES, GUIDELINES AND INITIATIVES	COMPATIBILITY AND FLEXIBILITY	CAPABLE OF BEING PUBLICLY MANAGED AND/OR CONTROLLED	SHOULD THE COMPONENT BE CONSIDERED AS A POTENTIAL COMPONENT IN THE WMS?
COMPOSTING Composting is the controlled microbiological decomposition of the organic fraction of a solid waste material, resulting in a humus-like end product which is primarily used for soil conditioning. The composting of organic wastes from several generators at a central location is referred to as centralized composting	○ composting facilities exist throughout North America and elsewhere ○ some larger municipalities in North America have or are planning facilities for municipal, wood and papermill wastes, animal manure, and sewage sludge; in some instances, the composting occurs within a climate-controlled building ○ backyard composting used in many southern locations where weather conditions are more suitable; limited value in northern climates ○ no program in place in the study area ✔ criterion satisfied	○ costs vary depending upon the type and size of facility ○ windrow composting of leaf and yard wastes tends to be least costly, in-vessel composting tends to be most costly ○ a large building would be required to accommodate equipment and raw and finished product ○ compost contamination will impact on marketability ○ marketability will impact on economic feasibility ✔ economic viability uncertain	○ no regulations, policies, guidelines, or initiatives presently exist ✔ criterion satisfied	○ composting wastes is compatible with other components ○ systems can be expanded to meet increases in the waste stream ✔ criterion satisfied	○ centralized facilities can be publicly managed/controlled ✔ criterion satisfied	✔ yes, subject to verification of the economic viability
PUBLIC EDUCATION The process of informing the public at large and the ICI sector about how they may contribute to wise waste and resource management practices including waste reduction, reuse, and recycling	○ component in limited use in the study area ○ used throughout North America and elsewhere ○ the objective is to maximize community awareness of waste and resource management ✔ criterion satisfied	○ costs borne by the Municipality ○ costs vary depending upon the media used, the frequency of use, and the information format ✔ criterion satisfied	○ no regulations, policies, guidelines, or initiatives presently exist ✔ criterion satisfied	○ key element to any WMS ○ can be modified to address new WM initiatives/programs ✔ criterion satisfied	○ Municipality can manage their education programs ✔ criterion satisfied	✔ yes, all criteria satisfied
WASTE HANDLING AND COLLECTION COMPONENTS						
CURBSIDE COLLECTION The pick-up and movement of recyclables, compostables, and wastes from individual residences and ICI establishments to the place of processing and/or disposal. Methods of collection may vary from being labour intensive to mechanized	○ component in use in the study area and throughout North America ○ Town picks up residential waste and Industrial/commercial waste weekly ○ special large item collection occurs twice/year ✔ criterion satisfied	○ residential costs borne by homeowner through separate tax assessment or direct payment ○ curbside pick-up in remote or sparsely populated areas tends to be more expensive ○ cost of service to ICI sector usually paid by the generator ○ frequency of collection impacts on service cost ✔ criterion satisfied	○ no regulations, policies, guidelines, or initiatives presently exist ✔ criterion satisfied	○ additional collection trucks can be added to meet changes in the waste stream ✔ criterion satisfied	○ Municipality can manage curbside collection of residential and ICI waste streams ✔ criterion satisfied	✔ yes, all criteria satisfied

3Rs - Reduce, Reuse, Recycle
EFW - Energy from Waste
HHW - Household Hazardous Waste
ICI - Industrial, Commercial, Institutional
MSW - Municipal Solid Waste
MRF - Material Recovery Facility
O&M - Operation and Maintenance
WM - Waste Management
WMS - Waste Management System

TABLE 8-3
APPLICATION OF THE SCREENING CRITERIA TO THE WASTE MANAGEMENT SYSTEM COMPONENT LIST

COMPONENT	CRITERIA					
	PROVEN TECHNOLOGY	ECONOMIC FEASIBILITY	COMPLIANCE WITH GOVERNMENT REGULATIONS, POLICIES, GUIDELINES AND INITIATIVES	COMPATIBILITY AND FLEXIBILITY	CAPABLE OF BEING PUBLICLY MANAGED AND/OR CONTROLLED	SHOULD THE COMPONENT BE CONSIDERED AS A POTENTIAL COMPONENT IN THE WMS?
DIRECT HAUL The transporting of recyclables, compostables, or wastes directly to a waste diversion facility, depot, transfer station, processing facility, or disposal facility by the waste generator	◦ component in use in the study area and throughout North America ◦ residential generators sometimes haul bulky materials to WM facilities ◦ industrial and some commercial and institutional generators use direct haul since Municipal curbside collection is limited ✔ criterion satisfied	◦ costs borne by the generator ◦ tipping fee may apply ✔ criterion satisfied	◦ no regulations, policies, guidelines, or initiatives presently exist ✔ criterion satisfied	◦ compatible with waste diversion components ◦ site facilities can be modified to accommodate changes in the waste stream ✔ criterion satisfied	◦ materials hauled by the generator ◦ facilities can be publicly managed ✔ criterion satisfied	✔ criterion satisfied
DEPOT A centrally located facility which is used to collect waste materials directly from the waste generator for reuse or recycling	◦ component in use throughout North America and elsewhere ◦ no formal facilities in use in the study area, separate outside storage area for paints and batteries provided at landfill ✔ criterion satisfied	◦ local unmanned depots tend to be economical ◦ HHW Depot costs will vary depending upon facilities and program ✔ criterion satisfied	◦ no regulations, policies, guidelines, or initiatives presently exist ✔ criterion satisfied	◦ facilities compliment other components, can be modified to suit changes in the waste stream ✔ criterion satisfied	◦ facilities can be publicly managed and/or controlled ✔ criterion satisfied	✔ criterion satisfied
TRANSFER STATION A facility where wastes are transferred from small waste collection vehicles to larger waste hauling vehicles for transportation to a waste diversion, processing, or disposal facility	◦ used throughout North America ✔ criterion satisfied	◦ large central transfer stations primarily used when the WM facility is a long distance from the generators; capital & O&M costs vary and may be significant ◦ large central station for MSW is not economically suited to study area size and population ✘ criterion not satisfied	◦ no regulations, policies, guidelines, or initiatives presently exist ✔ criterion satisfied	◦ compatible with other components, can be modified to suit changes in the waste stream ✔ criterion satisfied	◦ facilities can be publicly managed and/or controlled ✔ criterion satisfied	✘ no, criteria not satisfied, large central facility within study area is not essential ◦ haul distances are not long enough to justify a transfer station
SOURCE SEPARATION The separation of specific materials from the waste stream at their point of generation for the purposes of reuse, recycling, or further processing	◦ component in limited use in the study area, used throughout North America ◦ no formal program is in place in the study area ◦ some commercial generators separate fine paper ◦ function of awareness and attitude ✔ criterion satisfied	◦ costs borne by the generator ◦ generators' efforts may reduce waste collection and disposal costs ◦ generators' efforts also impact on the volume of recyclables available for the resale market ✔ criterion satisfied	◦ no regulations, policies, guidelines, or initiatives presently exist ✔ criterion satisfied	◦ compatible with many of the other components ◦ program can be modified to suit changes in the waste stream ✔ criterion satisfied	◦ can be publicly managed/controlled ✔ criterion satisfied	✔ yes, criterion satisfied in association with a 3 Rs program

3Rs - Reduce, Reuse, Recycle
EFW - Energy from Waste
HHW - Household Hazardous Waste
ICI - Industrial, Commercial, Institutional
MSW - Municipal Solid Waste
MRF - Material Recovery Facility
O&M - Operation and Maintenance
WM - Waste Management
WMS - Waste Management System

TABLE 8-3
APPLICATION OF THE SCREENING CRITERIA TO THE WASTE MANAGEMENT SYSTEM COMPONENT LIST

COMPONENT	CRITERIA					
	PROVEN TECHNOLOGY	ECONOMIC FEASIBILITY	COMPLIANCE WITH GOVERNMENT REGULATIONS, POLICIES, GUIDELINES AND INITIATIVES	COMPATIBILITY AND FLEXIBILITY	CAPABLE OF BEING PUBLICLY MANAGED AND/OR CONTROLLED	SHOULD THE COMPONENT BE CONSIDERED AS A POTENTIAL COMPONENT IN THE WMS?
WASTE PROCESSING COMPONENTS						
MATERIAL RECOVERY FACILITY (MRF) A facility where wastes are separated to recover recyclable and compostable materials from the residual materials in the waste stream, or a facility where source separated recyclable materials are processed for markets	○ in use throughout North America ○ no facility in use in the study area ✔ criterion satisfied	○ costs can vary significantly ○ feasibility depends on availability of markets for recovered materials ○ high cost of collection, processing, and shipping vs. product value will impact on viability ✔ viability uncertain	○ no regulations, policies, guidelines, or initiatives presently exist ✔ criterion satisfied	○ compatible with many of the other components ○ can be modified to suit changes in the waste stream and/or collection methods ✔ criterion satisfied	○ can be publicly managed/controlled ✔ criterion satisfied	✔ yes, subject to confirming the economic viability; a large scale MRF is not supportable at this time, however, a small scale facility may be feasible
SHREDDING The mechanical size reduction of solid wastes resulting in a final product that has reasonably uniform particle size, but not necessarily of a reduced volume	○ component in use throughout North America ○ applications include shredding of waste for fuel in an incineration facility where applicable ○ shredding prior to landfilling not common practice ○ not used in the study area ✔ criterion satisfied	○ shredding as an independent process is of limited value and therefore is not considered economically viable ✘ criterion is not satisfied	○ no regulations, policies, guidelines, or initiatives presently exist ✔ criterion satisfied	○ not compatible with landfilling due to explosion hazard and presence of other unknown materials ✔ criterion is satisfied for composting, incineration, and a MRF	○ can be publicly managed/controlled ✔ criterion satisfied	○ consider shredding as part of composting, incineration, or a MRF component ○ consider participation in any government or private sector initiative to reduce the volume of metal waste in the community ✘ do not consider shredding as a separate, Municipally-financed component
BALING The process of compacting solid wastes to form a compressed block or bale	○ sometimes used to prepare wastes and recyclables for transit ○ baled waste operations do exist at some North American landfills ✔ criterion satisfied	○ baling recyclables is essential in support of a recycling program ○ baling of wastes for disposal would be relatively expensive and of questionable benefit ✔ criterion satisfied for recycling only	○ no regulations, policies, guidelines, or initiatives presently exist ✔ criterion satisfied	○ compliments a recycling program and a MRF operation, can be modified to suit changes in the waste stream ✔ criterion satisfied	○ can be publicly managed/controlled ✔ criterion satisfied	○ consider baling only as part of a MRF or recycling operation ✘ do not consider baling as a separate component
IMPORT The import of waste materials from beyond the service or study area	○ waste import is a common technology in North America ○ applications include import of recyclables and waste for EFW and landfill disposal ✔ criterion satisfied	○ import of refuse is a revenue generator, but facilities may have to be expanded to accommodate additional volumes ○ hauling and tipping fees paid by the generator ○ there are no generators within a reasonable distance of the study area, therefore import is highly unlikely ✘ economic viability doubtful	○ no regulations, policies, guidelines, or initiatives presently exist ✔ criterion satisfied	○ may help finance the operation of other components ○ flexibility can be maintained by imposing limits on material types, quantities, and quality ✔ criterion satisfied	○ can be publicly managed/controlled ✔ criterion satisfied	✘ no, do not consider further; economic viability of import of waste or recyclables is doubtful; reconsider component at a future date if an opportunity arises

3Rs - Reduce, Reuse, Recycle
EFW - Energy from Waste
HHW - Household Hazardous Waste
ICI - Industrial, Commercial, Institutional
MSW - Municipal Solid Waste
MRF - Material Recovery Facility
O&M - Operation and Maintenance
WM - Waste Management
WMS - Waste Management System

TABLE 8-3
APPLICTION OF THE SCREENING CRITERIA TO THE WASTE MANAGEMENT SYSTEM COMPONENT LIST

COMPONENT	CRITERIA					
	PROVEN TECHNOLOGY	ECONOMIC FEASIBILITY	COMPLIANCE WITH GOVERNMENT REGULATIONS, POLICIES, GUIDELINES AND INITIATIVES	COMPATIBILITY AND FLEXIBILITY	CAPABLE OF BEING PUBLICLY MANAGED AND/OR CONTROLLED	SHOULD THE COMPONENT BE CONSIDERED AS A POTENTIAL COMPONENT IN THE WMS?
WASTE DISPOSAL COMPONENT						
LANDFILL The disposal of solid wastes on land, under controlled conditions, by spreading the waste in layers, compacting, and then covering the wastes with soil or other suitable materials	○ the most common form of solid waste disposal in North America and elsewhere ○ Town already operates a landfill site ✔ criterion satisfied	○ capital and O&M costs can vary depending upon size and site conditions ○ properly designed and operated landfill may be a cost-effective disposal option ✔ criterion satisfied	○ no regulations, policies, guidelines, or initiatives presently exist ○ landfilling is an accepted means of disposal ✔ criterion satisfied	○ compatible with other components ○ can be modified to suit changes in the waste stream ✔ criterion satisfied	○ can be publicly managed/controlled ✔ criterion satisfied	✔ yes, criterion satisfied
INCINERATION The burning of wastes sometimes with the purpose of generating steam and/or electricity	○ waste incinerators exist in North America and elsewhere ○ Energy from Waste (EFW) facilities exist in North America and elsewhere ✔ criterion satisfied	○ high capital and O&M costs make feasibility uncertain for the study area ○ costs frequently exceed the cost of landfilling, cost difference may be offset if energy is produced and sold to other parties ✔ economic viability uncertain	○ no regulations, policies, guidelines, or initiatives presently exist ✔ criterion satisfied	○ not compatible with 3Rs components, particularly the recycling of combustible materials ○ operating periods may be modified to suit changes in the waste stream quantities ✔ compatibility and flexibility are limited	○ can be publicly managed/controlled ✔ criterion satisfied	✔ yes, although economic viability uncertain and not compatible with many waste diversion initiatives which may be undertaken ○ consider only in conjunction with a limited waste diversion program
EXPORT The shipping of the waste materials, including MSW, HHW, and recyclables beyond the service or study area	○ waste export is practiced throughout North America and elsewhere ○ some export of recyclables happens presently ✔ criterion satisfied	○ export of recyclables is essential to generate revenues ○ MSW export uncertain since tipping fees at receiving site dictated by others ○ shipping cost makes MSW export questionable ○ costs borne by exporter ✘ MSW export is considered non-viable	○ no regulations, policies, guidelines, or initiatives currently exist ✔ criterion satisfied	○ flexibility lost if receiving facility no longer available, may not be able to easily find an alternate facility ✘ criterion is <u>not</u> fully satisfied	○ Town sacrifices control of long-term management of WMS ○ receiver could raise tipping fees significantly or run out of capacity ✘ criterion is <u>not satisfied</u> for MSW ✔ criterion may be satisfied for certain recyclables	✘ do <u>not</u> consider export of waste as a separate component; consider export only in conjunction with HHW and/or recycling programs
PLASMA TORCH The thermal destruction of waste materials using energetically charged gas at very high temperatures	○ disposal of MSW utilizing plasma technology is in the development stage at this time ✘ criterion is not satisfied	○ technology is in the development stage for MSW disposal, therefore costs are not well known; expect relatively high capital and O&M costs ✘ criterion is not satisfied	○ no regulations, policies, guidelines, or initiatives currently exist ✔ criterion satisfied	○ waste diversion programs compete for same waste stream ○ flexibility may be accomplished through extended operating hours ✔ compatibility and flexibility may be limited	○ can be publicly managed/controlled ✔ criterion satisfied	✘ do <u>not</u> consider technology further

3Rs - Reduce, Reuse, Recycle
EFW - Energy from Waste
HHW - Household Hazardous Waste
ICI - Industrial, Commercial, Institutional
MSW - Municipal Solid Waste
MRF - Material Recovery Facility
O&M - Operation and Maintenance
WM - Waste Management
WMS - Waste Management System

The recommendation for further consideration in the WMS (last column of Table 8-3) has been qualified in the case of several components.

One important point to note is plasma torch technology, which has been identified as unsuitable for further consideration. At the January 20 public meeting, we indicated that we would look into the plasma technology component further. We have spoken with an Ottawa area firm which promotes plasma technology for waste management purposes. This firm is not aware of any plasma application for MSW disposal within North America and hence, the component fails to satisfy the *"Proven Technology"* criterion. The fact that the technology is in the development stages for MSW, suggests that costs for the facilities are not well known. The proponent has acknowledged that a plasma plant of the size required for Iqaluit is not economically competitive, compared to landfilling or incineration. The firm has projected preliminary capital and annual operation and maintenance costs of $7,500,000 and $940,000 respectively. A building to house the equipment, site-servicing costs, land costs, and engineering fees would be additional. A further $2,000,000 would be required within 5 to 10 years to retrofit the plasma torch to increase capacity to meet the longer-term capacity. Plasma torch technology is not the most cost-effective option and hence, it fails to satisfy the *"Economic Feasibility"* criterion as well. These findings confirm the initial assessment of this component and therefore, plasma technology will not be considered further.

The components identified for possible consideration in the future WMS for the Municipality of Iqaluit are listed below. Comments regarding their application in the future WMS are also noted.

- reduction
- reuse
- recycling
- HHW Management
- public education

  - common elements in an expanded waste reduction and diversion program

- composting

  - a possible component to reduce the volume of organic materials and sewage sludge going to landfill

○	curbside collection	○	for weekly collection of Municipal refuse and for special collection events
○	direct haul	○	ICI sector and residents may sometimes haul waste direct to the disposal facility
○	depot	○	drop-off depots may be introduced to support expanded waste diversion program
		○	HHW depot(s) (temporary and/or permanent) will be required to support HHW diversion
○	source separation	○	materials separated at source to support recycling and HHW initiatives
		○	will also be required if composting is selected
○	material recovery facility	○	a small scale MRF will be required to support recycling initiatives
○	landfill	○	may be selected to receive all solid waste from the community
		○	size would be reduced if composting or incineration is selected
○	incineration	○	alternative waste disposal option; landfill still required for disposal of incineration ash and other MSW

8.4 Identification and Evaluation of the Alternative Waste Management Systems

Comments received from the public during the planning period indicated general support for greater waste reduction and diversion initiatives in the community. However, it is also recognized that the success of such a program will be dependent upon a number of factors, including:

- public education program to raise community awareness about waste reduction and diversion;
- availability of waste diversion alternatives;
- level of public support;
- cost of services and facilities;
- isolation of the community relative to waste diversion markets;
- net revenue from the sale of recycled products; and
- government initiatives which may be introduced at some future date.

Considering the foregoing, it is anticipated that the waste reduction and diversion program will be developed gradually. Initial capital and operation and maintenance costs are expected to be relatively modest, as the Town administration and community support groups endeavour to develop the optimum program for the Town.

The concept of an evolving waste reduction and diversion program is in keeping with the *"Compatibility and Flexibility"* criterion for component selection. Because of the public support for such an initiative, expansion of the reduction and diversion program, including the components of reduction, reuse, recycling, HHW management, and public education, has been included as a common element in the Alternative WMSs 2, 3, and 4. It is assumed that each Alternative offers the same type and level of service, with the exception of the disposal components. The composting diversion component is dealt with as part of Alternative 3.

The components which passed the screening process described above were combined to form four (4) alternative waste management systems. A description of each system follows:

.1 System No. 1 - Existing WMS - The *"Do Nothing"* Alternative

The existing WMS is the one presently in place. As described in Section 5.0, it includes the following components: recycling initiatives for cans and paper; HHW diversion of paint and vehicle batteries at the landfill; weekly curbside collection of refuse plus semi-annual special event collections; direct haul; source separation for cans and paper; and landfilling.

.2 System No. 2 - Expanded Reduction and Diversion Program with Increased Landfill Capacity

System No. 2 includes an expanded waste reduction and diversion program, incorporating services and facilities which are expected to evolve with time. The size and nature of the depots, source separation, and MRF components will be influenced by the development of the diversion program.

Curbside collection and direct haul will continue to exist. A new landfill with sufficient capacity to meet the projected waste volumes for the 20-year planning horizon will be required. Sufficient area should also be provided to accommodate the disposal/storage of the non-hazardous solid wastes including vehicles, white goods, demolition wastes, and salvageable materials.

.3 System No. 3 – Expanded Reduction and Diversion Program with Centralized Composting and Increased Landfill Capacity

System No. 3 is the same as System No. 2, except for the incorporation of a centralized composting facility. The organic materials in the waste stream would be separated at source, collected independently, and taken to a centralized composting facility. The organics and sludge from the new sewage plant would be composted, thus reducing the volume of waste to landfill. Some of the compost could be used to enrich native soils to aid in beautification/revegetation projects in the community. If compost volumes eventually exceed local needs, it could possibly be packaged and marketed in the south, although shipping costs may be prohibitive. A landfill is still required for the balance of the waste stream.

.4 System No. 4 – Expanded Reduction and Diversion Program with Incinerator and Increased Landfill Capacity

System No. 4 is like System No. 2, except an incinerator will be used to burn the MSW. Incineration may result in a waste reduction of 80 to 90%, leaving metals, glass, and a non-toxic, inert ash. The glass and metals can be recycled or landfilled along with the ash. A landfill for ash and other non-combustible wastes, plus storage for those items noted for System No. 2, will still be required.

The four (4) alternative WMSs were subjected to a qualitative descriptive review utilizing the methodology presented in Table 8-4. Table 8-5 summarizes the environmental effects, mitigation/enhancement, net effects, and advantages and disadvantages associated with each alternative under the headings of social/cultural environment, natural environment, service provided, and cost.

TABLE 8-4
METHODOLOGY FOR EVALUATION OF ALTERNATIVE WASTE MANAGEMENT SYSTEMS

1. The evaluation of the alternative WMSs involved a qualitative descriptive review.
2. Evaluation criteria for the assessment of the alternative WMSs included the following:

Environmental Effects	Criteria
Social/Cultural Environment	On and off-site effects
Natural Environment	On and off-site effects
Service Provided	Reliability and Flexibility
Cost	Capital Costs and Operating Costs

3. The rationale for each of the criterion are:

Social/Cultural Environment On and off-site effects	Allow the proponent to strive to: o Maximize community awareness of natural resource management. o Minimize negative impacts to social/cultural environment (including nuisance effects of odour, dust, noise and visual intrusion). o Minimize negative impact to land use.
Natural Environment On and off-site effects	Allow the proponent to strive to: o Minimize depletion of natural resources. o Minimize negative impacts to natural environment. o Minimize negative impacts to surface water. o Minimize negative impacts to ground water. o Minimize negative impacts to air quality.
Service Provided Reliability and Flexibility	Allow the proponent to strive to: o Reduce wastes requiring disposal o Provide adequate disposal capacity
Costs Capital and Operating	Allow the proponent to strive to: o Minimize cost of waste management

4. Each alternative WMS was subjected to an assessment and the results tabulated. The four environmental effects noted above were assessed under the headings: mitigation/enhancement, net effects, and advantages/disadvantages.

TABLE 8-5
EVALUATION OF ALTERNATIVE WASTE MANAGEMENT SYSTEMS

SYSTEM NO.	ENVIRONMENTAL EFFECTS	MITIGATION ENHANCEMENT	NET EFFECTS	ADVANTAGES/DISADVANTAGES
1.0 EXISTING WMS – THE "DO NOTHING" ALTERNATIVE o limited recycling of cans & paper o HHW management of paint & vehicle batteries at landfill o curbside collection o direct haul o source separation of cans & paper o landfill	**SOCIAL/CULTURAL ENVIRONMENT**			**ADVANTAGES** o refuse burning maximizes life of existing landfill o curbside collection reduces illegal dumping and littering o curbside collection reduces the need for direct haul and thus reduces traffic volumes o public has the opportunity to haul wastes if required
	o requires the waste generator to be responsible for making decisions o curbside collection of regular wastes and special collection events may sometimes increase noise levels and traffic conflicts in residential neighbourhoods o beneficial impact due to proper management of HHW (paints & batteries) o direct haul provides public with the option to haul additional wastes to the appropriate facility o landfill may be incompatible with neighbouring land uses o negative effects from truck traffic, noise, dust, odour; visual impact associated with landfill and refuse burning	o education programs must be designed so that all waste generators receive and understand information on the available waste management services o to minimize impact of vehicle traffic in neighbourhoods and along haul routes, schedule collection during normal work hours, use efficient routing, and use high density, high volume vehicles to minimize number of vehicle trips o to maximize participation, schedule special events at convenient times and locations o schedule hours of operation at waste management facilities to accommodate the customers o proper site selecting, buffering, facility design, and operational features will reduce impacts of waste management facilities o could restrict burning at existing landfill to reduce impact on neighbouring land uses	o positive effects from educating the public and ICI sectors about how they can contribute to waste diversion and minimize environmental impacts o noise levels and traffic conflicts by collection trucks will be minimized through scheduling, routing, vehicle selection, and maintenance o direct haul has positive effect since it provides residents & ICI the option to deliver wastes to facilities as needed o waste management facilities' effects can be minimized through proper site selection, design, and operation o restricting burning will reduce landfill capacity which is already inadequate	
	NATURAL ENVIRONMENT			**DISADVANTAGES** o significant financial costs for HHW management, but there is a potentially significant impact on the environment for failure to manage HHW properly o noise levels and traffic conflicts with collection trucks may be considered an inconvenience o landfill requires regular monitoring and post-closure care o existing landfill is not well screened and many people consider it unacceptable o open burning at the landfill is a source of complaints o **existing landfill will not meet the Town's long-term waste management planning objectives**
	o recycling results in the use of fewer natural resources o reduction in the volume of HHW (paint & batteries) disposed of in traditional methods reduces the impact on the natural environment o curbside collection potentially increases proportion of wastes receiving proper management, thereby reducing negative effects caused by littering and improper disposal o direct haul may result in nuisance impacts associated with littering if loads are not properly covered o landfill may result in displacement of natural features, potential contamination of surface and groundwater, and the attraction of nuisance vermin	o provide and deliver public education programs to increase public awareness and participation in diversion programs o collect and manage run-off from waste management facilities o enforce laws against illegal disposal and littering along roadsides and at waste management facilities o encourage haulers to cover or tie down their loads to reduce litter o regular maintenance, clean-up, and collection will discourage vector visitations to waste management facilities o maintain security at waste management facilities to discourage illegal dumping o prepare site development and operations plan including contingency, monitoring, and post-closure plans for waste management facilities	o recycling program assists in the conservation of natural resources o diversion of HHW reduces impact on the natural environment o good resource management through the promotion of recycling o facilities' impacts can be minimized by proper siting, management, and operation o curbside collection decreases illegal dumping and littering o litter nuisance impacts reduced with co-operation of haulers and the general public	

3Rs - Reduce, Reuse, Recycle
MSW - Municipal Solid Waste
HHW - Household Hazardous Waste
ICI - Industrial, Commercial, Institutional
O&M - Operation and Maintenance
MRF - Material Recovery Facility
WMS - Waste Management System

TABLE 8-5
EVALUATION OF ALTERNATIVE WASTE MANAGEMENT SYSTEMS

SYSTEM NO.	ENVIRONMENTAL EFFECTS	MITIGATION ENHANCEMENT	NET EFFECTS	ADVANTAGES/DISADVANTAGES
1.0 EXISTING WMS – THE "DO NOTHING" ALTERNATIVE (continued) o limited recycling of cans & paper o HHW management of paint & vehicle batteries at landfill o curbside collection o direct haul o source separation of cans & paper o landfill	**SERVICE PROVIDED**			
	o positive contribution towards maximizing waste diversion through existing diversion opportunities o some of the potentially most harmful wastes (HHW) diverted for proper waste management o semi-weekly curbside collection of wastes provides high level of service. o direct haul represents a low level of service o existing landfill capacity does not satisfy the long-term needs of the Town	o provide and deliver public education programs to increase public awareness and participation in diversion opportunities o maximize diversion to maximize service life of existing landfill o examine alternatives to providing long-term waste disposal	o diversion opportunities help reduce refuse disposal volumes o the number of potentially harmful materials (HHW) are reduced/diverted from disposal o positive effect due to reduction in wastes requiring disposal o curbside collection is convenient for the residents o direct haul is convenient for generators who choose to or are required to haul their own wastes o the recycling opportunities and curbside collection help reduce traffic to the waste management facilities o limited landfill capacity adversely impacts on the Town's ability to identify a long-term waste management plan	
	COST			
	o costs for present HHW program are modest o recycling opportunities reduce volumes and cost of waste collection and disposal o curbside collection of wastes and special items requires capital and O&M investment in vehicles o direct haul cost borne by the generator o semi-weekly collection of residential waste is relatively expensive o the limited capacity at the existing landfill site creates uncertainty with respect to future waste disposal costs o refuse burning at landfill reduces O&M costs associated with regular and final cover as well as site-development costs	o conduct market surveys and develop a recycling program to suit market demands o develop an education program to promote new initiatives o encourage use of fewer and less toxic materials o promote waste diversion to reduce waste volumes and the number of vehicle trips o maximize diversion to maximize service life of existing landfill	o reduction of wastes may result in lower WM costs o bag limits and disposal fees result in better waste management decisions by the public and ICI o education costs minimized by using most effective means of reaching the service area o continued feasibility of recycling will be dependent upon market availability o sale of recyclables reduces recycling program costs o costs for present HHW management is relatively inexpensive o maximized diversion will reduce collection and disposal costs for the Town and extend landfill site life o costs for direct haul borne by generator o relatively inexpensive to operate present landfill site o weekly collection of residential waste would reduce total cost of WMS o refuse storage boxes may have to be larger to accommodate less frequent pick-up	

3Rs - Reduce, Reuse, Recycle
MSW - Municipal Solid Waste
HHW - Household Hazardous Waste
ICI - Industrial, Commercial, Institutional
O&M - Operation and Maintenance
MRF - Material Recovery Facility
WMS - Waste Management System

TABLE 8-5
EVALUATION OF ALTERNATIVE WASTE MANAGEMENT SYSTEMS

SYSTEM NO.	ENVIRONMENTAL EFFECTS	MITIGATION ENHANCEMENT	NET EFFECTS	ADVANTAGES/DISADVANTAGES
2.0 EXPANDED REDUCTION AND DIVERSION PROGRAM WITH INCREASED LANDFILL CAPACITY o reduction o reuse o recycling o HHW management o public education o curbside collection o direct haul o depot o source separation o MRF o landfill	**SOCIAL/CULTURAL ENVIRONMENT**			**ADVANTAGES**
	o beneficial impact due to emphasis on 3Rs and waste diversion o requires the generator to be responsible for making decisions o increase in community awareness of waste and resource management and increased community goal sharing o curbside collection of regular wastes and special collection events may sometimes increase noise levels and traffic conflicts in residential neighbourhoods o beneficial impact due to proper management of HHW o direct haul provides public with the option to haul additional wastes to the appropriate facility o depots for recyclables drop-off and HHW provide the generator with the opportunity to divert wastes from disposal o landfill may be incompatible with existing land uses o potential negative effects from truck traffic, noise, dust, odour; visual impact associated with landfilling o increased landfill capacity essential for long-term disposal requirements	o provide and deliver public education programs to increase public awareness and participation in the diversion programs o education programs must be designed so that all waste generators receive and understand the information o to minimize impact of vehicle traffic in neighbourhoods and along haul routes, schedule collection during normal work hours, use efficient routing, and use high density, high volume vehicles to minimize number of vehicle trips o to maximize participation, schedule special events at convenient times and locations o to minimize the impact of depots, pick up wastes frequently, keep areas neat, and screen the sites if necessary o schedule hours of operation at waste management facilities to accommodate the customers o proper site selecting, buffering, facility design, and operational features will reduce impacts of waste management facilities	o the following components have positive effects due to the involvement of the public, thus creating improvements to society and the environment - 3Rs component - HHW reduction and diversion - public education - depot - source separation o positive effects from educating the public and ICI sectors about how they can contribute to waste diversion and minimize environmental impacts o noise levels and traffic conflicts by collection trucks will be minimized through scheduling, routing, vehicle selection, and maintenance o direct haul has positive effect since it provides residents & ICI the option to deliver wastes to facilities as needed o waste management facilities' effects can be minimized through proper site selection, design, and operation o increased landfill capacity will enable the Town to define long-term WMP	o involves the public in environmental improvements o assists in conserving natural resources o contributes to maximizing waste diversion and minimizing waste for disposal o leads to reduced impact on the natural environment o reduces capacity requirements for future landfill o increased community involvement through effective conservation strategies o curbside collection reduces illegal dumping and littering o curbside collection reduces the need for direct haul and thus reduces traffic volumes o public has the opportunity to haul wastes if required o curbside collection increases level of service over direct haul o increased landfill capacity will enable Town to provide long-term WMS
	NATURAL ENVIRONMENT			**DISADVANTAGES**
	o 3Rs program and associated components result in the use of fewer natural resources o reduction in the use of HHW and the volume disposed of in traditional methods reduces the impact on the natural environment o curbside collection potentially increases proportion of wastes receiving proper management thereby reducing negative effects caused by littering and improper disposal o direct haul may result in nuisance impacts associated with littering if loads are not properly covered o landfill may result in displacement of natural features, potential contamination of surface and groundwater, and the attraction of nuisance vermin	o provide and deliver public education programs to increase public awareness and participation in diversion programs o collect and manage run-off from waste management facilities o enforce laws against illegal disposal and littering along roadsides and at waste management facilities o encourage haulers to cover or tie down their loads to reduce litter o regular maintenance, clean-up, and collection will discourage animal visitations to waste management facilities o site landfill to minimize potential impacts o maintain security at waste management facilities to discourage illegal dumping o prepare site development and operations plan including contingency, monitoring, and post-closure plans for waste management facilities to minimize potential impact	o 3Rs program assists in the conservation of natural resources o reduced use of HHW and the diversion of HHW reduces impact on the natural environment o good resource management through the promotion of 3Rs initiatives o facilities' impacts can be minimized by proper siting, management, and operation o curbside collection decreases illegal dumping and littering o litter nuisance impacts reduced with co-operation of haulers and the general public o regular collection and maintenance will reduce impacts of drop-off depots o effects of landfilling will be minimized through proper site selection, design, development, operation, and management	o feasibility of recycling and MRF is dependent upon market availability o significant financial costs for HHW management but there is a potentially significant impact on the environment for failure to manage HHW properly o noise levels and traffic conflicts with collection trucks may be considered an inconvenience o nuisance effects associated with recycling depots may include visual impacts o landfill requires regular monitoring and post-closure care o potential negative social/cultural impact due to potential size of facilities o potential negative impact due to loss of natural setting and greater potential for ground and surface water impact due to larger landfill

3Rs - Reduce, Reuse, Recycle
MSW - Municipal Solid Waste
HHW - Household Hazardous Waste
ICI - Industrial, Commercial, Institutional
O&M - Operation and Maintenance
MRF - Material Recovery Facility
WMS - Waste Management System

TABLE 8-5
EVALUATION OF ALTERNATIVE WASTE MANAGEMENT SYSTEMS

SYSTEM NO.	ENVIRONMENTAL EFFECTS	MITIGATION ENHANCEMENT	NET EFFECTS	ADVANTAGES/DISADVANTAGES
2.0 EXPANDED REDUCTION AND DIVERSION PROGRAM WITH INCREASED LANDFILL CAPACITY (continued) o reduction o reuse o recycling o HHW management o public education o curbside collection o direct haul o depot o source separation o MRF o landfill	**SERVICE PROVIDED**			
	o positive contribution towards maximizing waste diversion o potentially most harmful wastes (HHW) diverted for proper waste management o public education leads to maximization of waste diversion and proper waste management o curbside collection of wastes provides high level of service o direct haul represents a low level of service o recycle depots and HHW special event depots will not result in the highest level of participation o source separation is achieved through recycle and HHW depots and curbside collection o MRF helps maximize waste diversion o increased landfill capacity provides long-term disposal component which is essential to long-term WMP	o provide and deliver public education programs to increase public awareness and participation in diversion opportunities o inform the public of the benefits of participation in the 3Rs programs o special event advertising increases participation rates for HHW special events o ensure markets exist for the recyclables o maximize diversion to maximize service life of new landfill o enhance landfill site through design and operational features, convenient hours of operation, site security, and operation	o 3Rs program and associated components help maximize waste diversion o the number of potentially harmful materials (HHW) are reduced/diverted from disposal o positive effect due to reduction in wastes requiring disposal o increases participation levels and wise waste management o curbside collection is convenient for the residents o direct haul is convenient for generators who choose to or have to haul their own wastes o recycling depots and special event HHW depots help optimize waste diversion o the 3Rs program, curbside collection, and recycling depots all reduce traffic to the waste management facilities o diversion is facilitated by the convenience of the 3Rs programs o provide essential disposal facility for the long-term WMS	
	COST			
	o reduce and reuse components result in less waste and lower waste management costs o Town incurs cost of education programs o disposal fees generate revenues o recycling program and MRF are dependent upon available markets o costs for HHW program may be significant o reduction, reuse, and HHW programs reduce volumes and cost of waste collection and disposal o curbside collection of wastes and special items requires capital and O&M investment in vehicles o direct haul cost borne by the generator o recycling depots relatively inexpensive to establish, operate, and maintain o cost of increased landfill capacity will depend primarily on site features, size, and location of the preferred site	o develop an education program to try and improve waste diversion and promote new initiatives o conduct market surveys and develop a recycling program to suit market demands o encourage use of fewer and less toxic materials o promote waste diversion to reduce waste volumes and the number of vehicle trips o size and related cost of landfill may be reduced through maximizing diversion and maximizing site life of landfill	o reduction of wastes may result in lower WM costs o bag limits and disposal fees result in better waste management decisions by the public and ICI o education costs minimized by using most effective means of reaching the service area o continued feasibility of recycling will be dependent upon market availability o sale of recyclables reduces recycling program costs o costs for HHW management will become more significant o maximized diversion will reduce collection and disposal costs for the Town and extend landfill site life o costs for direct haul borne by generator o generally inexpensive to operate recycling depots o landfill cost will be reduced through maximization of diversion and site life	

3Rs - Reduce, Reuse, Recycle
MSW - Municipal Solid Waste
HHW - Household Hazardous Waste
ICI - Industrial, Commercial, Institutional
O&M - Operation and Maintenance
MRF - Material Recovery Facility
WMS - Waste Management System

TABLE 8-5
EVALUATION OF ALTERNATIVE WASTE MANAGEMENT SYSTEMS

SYSTEM NO.	ENVIRONMENTAL EFFECTS	MITIGATION ENHANCEMENT	NET EFFECTS	ADVANTAGES/DISADVANTAGES
3.0 EXPANDED REDUCTION AND DIVERSION PROGRAM WITH CENTRALIZED COMPOSTING AND INCREASED LANDFILL CAPACITY o reduction o reuse o recycling o HHW management o centralized composting o public education o curbside collection o direct haul o depot o source separation o MRF o landfill	**SOCIAL/CULTURAL ENVIRONMENT**			**ADVANTAGES**
	o System No. 2 comments apply o centralized composting helps maximize diversion o centralized compost facility and/or increased landfill capacity may be incompatible with existing land uses o potential negative effects from vehicle traffic, noise, dust, odour, and visual impact o separate collection or collection with special or modified trucks will be required to manage organic and non-organic waste streams o additional source separation effort required to separate waste streams o compost may be used to aid in beautification/revegetation projects o increased capacity enables Town to fulfil long-term disposal requirements	o System No. 2 comments generally apply o site compost facility and landfill in compatible land use area o proper site selection, design, and operational features will reduce potential adverse impacts o select haul routes to minimize traffic related impacts	o System No. 2 comments generally apply o diversion enhanced through composting o site impacts will be minimized through proper site selection, design, and operation o haul route impacts will be minimized through route selection and roadway improvements as required o increased landfill capacity will enable Town to define a long-term waste management plan	o System No. 2 comments generally apply o composting will help maximize waste diversion, reduce volume of waste to landfill, reduce leachate generation and potential impact on the environment o may reduce the demand on cover material o compost may be used to enhance native soils o increased landfill capacity will enable the Town to provide long-term WMS
	NATURAL ENVIRONMENT			**DISADVANTAGES**
	o System No. 2 comments generally apply o composting of organics will reduce refuse volume to landfill (by up to 20%) and the volume of leachate generated thus reducing potential impact on natural environment o compost may be used to enrich soil to aid in revegetation projects o reduction in organics to landfill may contribute to a smaller landfill and a reduced need for granular cover materials o increased landfill capacity may result in the displacement of natural features, potential contamination of surface water and groundwater, adverse impact on air quality, and the attraction of nuisance vermin	o System No. 2 comments generally apply o site compost facility and landfill to minimize potential impacts o prepare development and operations plan, including monitoring, contingency, and closure plans to minimize potential impact of landfill o maintain site security to minimize adverse impact	o System No. 2 comments generally apply o reduced leachate generation and reduced refuse volume due to composting o potentially reduced volume of cover material required therefore less demand on valuable granular materials o compost may enrich native soils, assist in vegetation and enhancement of natural environment o effects of compost facility and landfilling will be minimized through proper site selection, design, development, operation, and management	o System No. 2 comments generally apply o potential negative social/cultural impact due to potential size of facilities o potential negative impact due to loss of natural setting and greater potential for ground and surface water impact due to larger landfill o greater demand for cover materials due to larger landfill
	SERVICE PROVIDED			
	o System No. 2 comments generally apply o separate collection or collection with special or modified trucks will be required to manage organic and non-organic waste streams o additional source separation effort required to separate waste streams o increased disposal capacity provides Town with a long-term disposal component, which is essential to fulfilling the long-term waste management objective	o System No. 2 comments generally apply o enhance composting and landfill sites through design and operational features, convenient hours of operation, site security, and access	o System No. 2 comments generally apply o provides source of compost for soil enrichment o provides an essential disposal facility for the long-term WMS	
	COST			
	o System No. 2 comments generally apply o separate collection of organics will increase collection costs o composting facility will increase capital plus O&M costs o cost of increased landfill capacity will depend primarily upon site features, size, and location of the selected site	o System No. 2 comments generally apply o collection costs may be minimized by providing separate and once weekly collection for compostables and non-compostables o size requirements and related cost may be minimized through maximizing diversion and maximizing life of existing landfill	o System No. 2 comments generally apply o cost will be minimized through maximization of diversion and site life o use of modified trucks to allow 2-stream pick-up (i.e. organics plus other waste) will minimize collection costs o locating composting and landfill facilities in common location may minimize additional cost	

3Rs - Reduce, Reuse, Recycle
O&M - Operation and Maintenance
ICI - Industrial, Commercial, Institutional
WMS - Waste Management System
MRF - Material Recovery Facility
HHW - Household Hazardous Waste
MSW - Municipal Solid Waste

TABLE 8-5
EVALUATION OF ALTERNATIVE WASTE MANAGEMENT SYSTEMS

SYSTEM NO.	ENVIRONMENTAL EFFECTS	MITIGATION ENHANCEMENT	NET EFFECTS	ADVANTAGES/DISADVANTAGES
4.0 EXPANDED REDUCTION AND DIVERSION PROGRAM WITH INCINERATOR AND INCREASED LANDFILL CAPACITY o reduction o reuse o recycling o HHW management o public education o curbside collection o direct haul o depot o source separation o MRF o incinerator o landfill	**SOCIAL/CULTURAL ENVIRONMENT**			**ADVANTAGES**
	o System No. 2 comments apply o incinerator and/or increased landfill capacity may be incompatible with existing land uses o potential negative effects from vehicle traffic, noise, dust, odour, and visual impact o incinerator plus increased landfill capacity enables Town to fulfil long-term disposal requirements	o System No. 2 comments generally apply o site incinerator facility and landfill in compatible land use area o proper site selection, design, and operational features will reduce potential adverse impacts o select haul routes to minimize traffic related impacts	o System No. 2 comments generally apply o site impacts will be minimized through proper site selection, design, and operation o haul route impacts will be minimized through route selection and roadway improvements as required o incinerator plus increased landfill capacity will enable Town to define a long-term waste management plan	o System No. 2 comments generally apply o incinerator will reduce volume of waste to landfill, reduce leachate generation and potential impact on the environment o will reduce the demand on cover material due to smaller landfill area o incinerator and increased landfill capacity will enable the Town to provide a long-term WMS
	NATURAL ENVIRONMENT			
	o System No. 2 comments generally apply o incinerator will reduce refuse volume to landfill and the volume of leachate generated thus reducing potential impact on natural environment o incinerator will reduce refuse volume by 80 to 90%, resulting in a smaller landfill area and reduced volume of cover material o energy recovery from the incinerator may be used to generate heat and/or electricity and reduce demand for oil o improperly operated incinerator may have adverse impacts o increased landfill capacity may result in the displacement of natural features, potential contamination of surface water and groundwater, adverse impact on air quality, and the attraction of nuisance vermin	o System No. 2 comments generally apply o site incinerator facility and landfill to minimize potential impacts o prepare development and operations plan, including monitoring, contingency, and closure plans to minimize potential impact of landfill o prepare site operating and monitoring protocol to ensure efficient operation of incinerator to minimize potential impact o maintain site security to minimize adverse impact	o System No. 2 comments generally apply o reduced leachate generation and reduced refuse volume due to incineration o reduced volume of cover material required therefore less demand on valuable granular materials o energy recovery from incinerator may reduce oil demand o effects of incinerator and landfill facility will be minimized through proper site selection, design, development, operation, and management	**DISADVANTAGES** o System No. 2 comments generally apply o potential negative social/cultural impact due to potential size and location of facilities
	SERVICE PROVIDED			
	o System No. 2 comments generally apply o curbside collection and direct haul practices will remain essentially unchanged o incinerator plus increased landfill capacity provides Town with a long-term disposal component, which is essential to fulfilling the long-term waste management objective	o System No. 2 comments generally apply o enhance incinerator and landfill sites through design and operational features, convenient hours of operation, site security, and access	o System No. 2 comments generally apply o provides an essential disposal option for the long-term WMS	
	COST			
	o System No. 2 comments generally apply o incinerator facility is typically more expensive than landfilling o energy recovery from incinerator may be used to offset O&M costs o cost of increased landfill capacity will depend primarily upon site features, size, and location of the selected site o landfill costs will be reduced due to smaller area	o System No. 2 comments generally apply o size requirements and related cost of incinerator and landfill may be minimized through maximizing diversion	o System No. 2 comments generally apply o cost will be minimized through maximization of diversion o locating incinerator and landfill facilities in common location may minimize cost	

3Rs - Reduce, Reuse, Recycle
MSW - Municipal Solid Waste
HHW - Household Hazardous Waste
ICI - Industrial, Commercial, Institutional
O&M - Operation and Maintenance
MRF - Material Recovery Facility
WMS - Waste Management System

The Alternative WMSs evaluation presented in Table 8-5 was the subject of discussions with the Steering Committee on May 16, the Elders on May 17, and the public at the Drop-in-Centre and an Open House on May 18, 2000. The systems, their relative advantages and disadvantages, and their approximate costs were discussed.

It is clear that System No. 1 is not acceptable due to the fact that there is insufficient capacity at the existing landfill. Also, the existing WMS does not address the public's preference for expanded waste reduction and diversion initiatives.

System No. 3 was not widely supported by those in attendance at the meetings. While it was generally agreed that the diversion of organic wastes from landfill was beneficial, it was recognized that there are significant disadvantages to centralized composting in Iqaluit:

.1 The harsh climate would necessitate the construction of a composting building to accommodate the associated equipment;

.2 Construction and operation and maintenance costs for the composting facility would result in this alternative costing considerably more than conventional landfilling (i.e.: System No. 2);

.3 The landfill disposal area would still be relatively large;

.4 There is very limited use for compost in the north and hence it may become another *"waste"* material; and

.5 The shipping cost to distant compost markets and the relatively low market value would yield little, if any, revenue.

System No. 2, which includes expanded landfill capacity, and System No. 4, with incineration plus expanded landfill capacity, were the two alternatives of most interest to those in attendance at the meetings. From a cost perspective, System No. 2 is preferable. However, in spite of the cost savings, the public did not express a strong preference for either alternative.

The possible location of a future landfill and/or an incinerator, which is discussed in Section 9.0, may have a bearing on Council's selection of the preferred alternative. Further discussion of Alternatives 2 and 4 appear in Section 10.0.

9.0 IDENTIFICATION OF CANDIDATE AREAS FOR POTENTIAL DISPOSAL SITES

9.1 Introduction

During the week of May 15, 2000, the Steering Committee, the Elders, and the general public were introduced to the draft set of screening criteria which would be used to identify those areas within the Municipality which would generally be unsuitable for siting a landfill or an incinerator. The remaining areas, which are often referred to as the *"Candidate Areas,"* would subsequently be subjected to further study for the purpose of identifying candidate landfill sites and/or candidate incinerator sites. Candidate sites would normally be subjected to rigorous evaluation based on site-specific investigations and an assessment of their net environmental impact.

9.2 Screening Criteria

The screening criteria presented to the public are reflected in Table 9-1. One notable change in the table since the public meeting on May 18, is that the separation between a waste disposal site and any occupied buildings has been increased from 250 to 450 metres. This requirement is in keeping with comments received from Baffin Regional Health Services during the May 18 Drop-in-Centre.

A discussion of each of the five criterion follows.

9.2.1 Aviation

There is a concern that food waste landfills will attract birds, which may pose a hazard to air safety. Transport Canada guideline TP 1247E recommends an 8 kilometre exclusionary zone around airports, unless a bird hazard specialist identifies that a lesser zone will not pose a risk to aviation traffic.

TABLE 9-1
PROPOSED SCREENING CRITERIA FOR LANDFILL AND/OR INCINERATOR SITE IDENTIFICATION

CRITERIA/INDICATORS	DEFINITION	RATIONALE	DATA SOURCE
AVIATION			
1. Screen out any lands within the setback area proposed in MACA's interim guidelines. ○ Avoid placing a food waste landfill within the recommended setback distance from airports. Other waste-management facilities may be located within this setback area. ○ Provide 3.0 km buffer.	The guideline proposes a 3.0 km setback from the airport. This setback has been applied to the centreline of the airport runway.	Food waste landfill may be an attraction to birds. Bird strikes are a serious threat to aircraft safety.	○ MACA 1990 Guideline ○ National Topographic Maps 1:50,000 ○ Town Maps
BIOLOGY			
1. Avoid significant aquatic habitats along with an appropriate buffer ○ Provide 100 m buffer from major aquatic habitat.	Major aquatic habitat shall be defined as named water bodies or double-lined streams on standard 1:50,000 scale topographic maps.	Harmful disruption of fish habitat is prohibited and related aquatic systems are important as water sources and corridors for adjacent terrestrial habitats.	○ National Topographic Maps 1:50,000
2. Avoid other important natural habitat and natural environment designations.	Areas of important natural habitat identified by the Town and government agencies.	Such areas are intended for environmental protection.	○ General Plan ○ Government Officials
GEOLOGY/HYDROGEOLOGY			
1. For an engineered or natural attenuation landfill or an incinerator site, minimize potential impacts to off-site groundwater resources.	Groundwater resources are present within the active layer of the permafrost (1 to 3 m depth).	Although these groundwater resources are not, and will not, themselves be exploited for water supply or other uses, the flow systems eventually discharge to surface water bodies. The intent is to size and design the facility to accommodate waste-management activities and limit environmental impacts on water resources to the landfill property itself.	○ Natural Topographic Maps 1:50,000 ○ Geological Maps ○ Aerial Photography
2. For an engineered or a natural attenuation landfill or incinerator site, avoid granular resource areas.	Granular resources are areas of granular soils suitable for construction purposes. Granular borrow pits which have been exhausted are no longer granular resource areas.	Granular resources are limited in the study area, are valuable, and should be reserved for general construction purposes. Although cover for the disposed waste will be needed, it is preferable to consider importing the granular material as needed or using alternative cover materials rather than situating the facility in the granular resource itself.	○ Natural Topographic Maps 1:50,000 ○ Geological Maps ○ Aerial Photography ○ Aggregate Resource Studies

Note: All buffer distances are to be measured from the constraint to the waste fill area.

TABLE 9-1
PROPOSED SCREENING CRITERIA FOR LANDFILL AND/OR INCINERATOR SITE IDENTIFICATION

CRITERIA/INDICATORS	DEFINITION	RATIONALE	DATA SOURCE
LAND USE AND SOCIAL/CULTURAL ENVIRONMENT			
1. Avoid removal and/or disruption of existing, committed, and future residential areas, community, and recreation features, institutions, or businesses and areas of archaeological significance.	The following are definitions of the types of facilities that can be considered for various land uses and are meant for illustration purposes only: Community and Recreation Features: Parks/conservation areas, skating rinks, outdoor recreation facilities, community halls/centres, libraries, hiking trails, shopping centres, historic sites, wildlife centres, public buildings, air fields Institutions: Schools, churches, correction facilities, day care centres, hospitals, senior residences, health clubs, cemeteries.	Areas of concentrated human settlement represent significant financial and social investment in the form of building infrastructure and planning.	○ General Plan ○ National Topographic Maps 1:50,000 ○ Archaeological Reports
○ provide 450 m buffer between landfill and built-up areas	The built-up areas are defined as those residential and industrial development lands illustrated in the draft General Plan.	The General Sanitation Regulations under the Public Health Act require a 450 m separation between a landfill and any occupied building.	○ General Plan ○ National Topographic Maps 1:50,000 ○ Air Photos
○ provide 70 m buffer between incinerator and/or non-food waste storage area (i.e. for derelict vehicles, white goods, construction demolition materials, tires, and HHW) and residential areas.	Residential development areas are those areas designated in the General Plan.	A buffer between industrial and residential land uses is often proposed to mitigate the potential impacts of noise, odour, dust, and/or vibration.	
2. Avoid areas with important unextracted aggregate resources.	Areas of important unextracted resources identified by the Town.	Mineral aggregate resources are limited.	○ General Plan ○ Town Reports
3. Avoid removal/disruption of other lands: ○ avoid major communication, facilities, and energy utilities.	Microwave towers, television stations, radio towers, transformer stations, and generating stations.	Financial costs and environmental impacts associated with relocation.	○ National Topographic Maps 1:50,000
SURFACE WATER/HYDROLOGY			
1. Avoid the tidal flats and areas prone to flooding.	Lands which are susceptible to flooding and tidal submergence.	Lands subject to flooding or submergence are unsuitable for a landfill.	○ Town Records ○ National Topographic Maps 1:50,000
2. Avoid placing municipal landfill within the catchment area of Town's water supply.	Catchment area of the water supply reservoir.	Locating landfill outside the water supply catchment area will minimize the potential impact.	○ National Topographic Maps 1:50,000 ○ General Plan ○ Air Photos

Note: All buffer distances are to be measured from the constraint to the waste fill area.

The Municipal and Community Affairs (MACA) Department of the Northwest Territories 1990 guideline recommends a minimum setback of 3.0 kilometres. Their guideline was developed in recognition of the economic implications of meeting the Federal guidelines in communities with limited road networks and land suitable for landfill disposal.

A 3.0 kilometre buffer zone measured from the centreline of the airport runway to any food waste landfill is proposed for Iqaluit. Other waste management facilities could, however, be located within this buffer area.

9.2.2 Biology

There is no legislative requirement stating the required separation distance between a landfill and a water body. For initial screening purposes, a 100 metre buffer has been proposed between any landfill and any named water body or double-lined stream shown on a 1:50,000 scale topographical map.

Areas of important natural habitat should also be avoided. In this instance, neither Town nor Government staff identified any areas of particular significance.

9.2.3 Geology/Hydrogeology

In the siting of any waste management facility, the potential impact on off-site groundwater resources must be considered. The groundwater associated with the active zone of the permafrost eventually discharges to surface water bodies. Therefore, the siting and design of any facility should endeavour to limit environmental impacts to the property itself.

Granular resources in the study area are rare and valuable. It is proposed that any waste disposal facility not be placed over a granular resource area. The granular resources in the North 40 and along the Road to Nowhere have been identified by the Town.

9.2.4 Land Use and Social/Cultural Environment

In order to minimize the impact on the social/cultural environment, it is essential to recognize sensitive and/or important features of the community. The MACA *"Program Management Handbook"* suggests that a 500 metre separation be maintained between dwellings and a landfill where open burning does

not occur. Based on previous experience where successful mitigation measures have resulted in a reduced buffer, we had proposed a 250 metre buffer.

Staff at Baffin Regional Health Services (BRHS), advised that the General Sanitation Regulations under the Public Health Act require a 450 metre separation between any building used for human occupancy and a *"waste disposal ground."* This separation applies to industrial, commercial, and institutional buildings as well as dwellings. BRHS also advised that this separation would apply to an incinerator ash disposal site. Table 9-1 has been amended to reflect this requirement.

No specific recommendations have been identified by any of the agencies, or others, regarding the location of other waste management facilities relative to the community. The proposed screening criterion suggested a 70 metre separation be maintained between residential areas and any facilities such as an incinerator, storage for derelict vehicles, reusable construction materials, tires, and HHW. The buffer is proposed to help mitigate the potential impacts of noise, dust, odour, and/or vibration.

The criterion also proposes the avoidance of important aggregate resources and major infrastructure such as power and communication facilities, etc. The cost of relocating such facilities should be avoided if at all possible.

9.2.5 Surface Water/Hydrology

The proposed recommendations include the avoidance of placing any landfill or any waste management facility in areas subject to flooding or tidal submergence. Among other things, this will reduce the potential impact on surface water bodies.

Secondly, it is recommended that any future landfill not be located within the catchment area for the Town's water supply. This requirement will minimize any potential impact on this valuable resource.

9.3 Application of the Criteria

The Town's draft General Plan was used to map the projected limits of residential and industrial development on an aerial photograph of Iqaluit. Each screening criterion was also mapped and the results are reflected in Figures 9-1 and 9-2.

Figure 9-1 illustrates the constraint areas associated with siting a food-waste landfill. All those areas which fall within the hatched area of the plan are generally unacceptable for landfill development. In the case of a non-food-waste landfill, all but the 3.0 kilometre aviation criterion would apply.

Figure 9-2 presents the constraint mapping for the siting of an incinerator or other WM facilities (excluding landfill). The map illustrates that these facilities should be located at least 70 metres beyond the residential development areas and beyond any granular resources.

NOTES:

1. The Residential/Commercial, Transportation and Industrial areas are based upon the Draft General Plan. The Residential/Commercial Zone boundary incorporates an additional area for potential future development.

LEGEND:

Constraint Areas

RESERVOIR

APEX

CREEK

APEX

IQALUIT

AIRPORT

KOOJESSE INLET

SYLVIA GRINNELL RIVER

FROBISHER BAY

LEGEND

EXISTING LANDFILL SITES

RESIDENTIAL/COMMERCIAL ZONE

RESIDENTIAL/COMMERCIAL BUFFER ZONE – 450m (FROM LANDFILL) – 450m (1,476ft)

INDUSTRIAL ZONE

INDUSTRIAL BUFFER ZONE – 450m (FROM LANDFILL) – 450m (1,476ft)

TRANSPORTATION ZONE

TRANSPORTATION BUFFER ZONE – 450m (FROM LANDFILL) – 450m (1,476ft)

AGGREGATE RESOURCE AREA

MAJOR AQUATIC HABITAT BUFFER ZONE – 100m – 100m (328ft)

AIRPORT BUFFER ZONE – 3.0km – 3.0 nm

TOWN RESERVOIR CATCHMENT AREA

PROJECT:

SOLID WASTE MANAGEMENT PLANNING STUDY

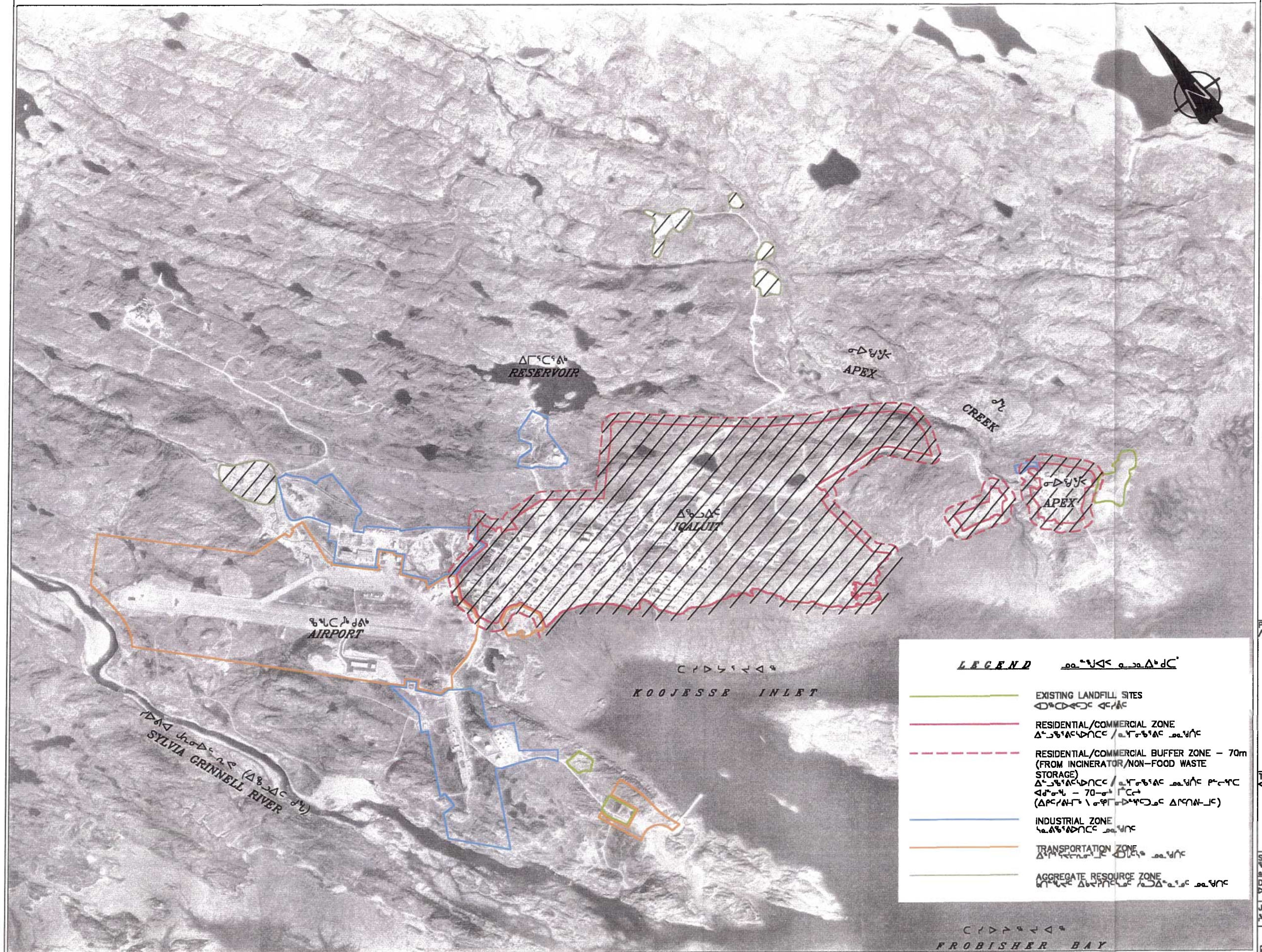
MUNICIPALITY OF IQALUIT

TITLE:

LANDFILL LOCATION CONSTRAINT MAP

SCALE:	1:30000
DATE:	28/06/00
J.L.R. NO.	17002
FIGURE:	9-1

J.L.Richards & Associates Limited
Consulting Engineers, Architects & Planners
Ottawa, Kingston, Sudbury, Canada



NOTES:

1. The Residential/Commercial, Transportation and Industrial areas are based upon the Draft General Plan. The Residential/Commercial Zone boundary incorporates an additional area for potential future development.

LEGEND:

Constraint Areas

PROJECT:

SOLID WASTE MANAGEMENT PLANNING STUDY

MUNICIPALITY OF IQALUIT

TITLE:

INCINERATOR LOCATION CONSTRAINT MAP

SCALE:	1:30000
DATE:	28/08/00
J.L.R. NO.	17002
FIGURE:	9-2

J.L.Richards & Associates Limited
Consulting Engineers, Architects & Planners
Ottawa, Kingston, Sudbury, Canada

10.0 COMPARISON OF LANDFILL VERSUS INCINERATOR PLUS LANDFILL DISPOSAL

10.1 Introduction

Generally speaking, landfilling and incineration are both suitable forms of waste disposal. This belief is reflected in the Ontario Ministry of the Environment July 1999 document, *"Environmental Risks of Municipal Non-Hazardous Waste Landfilling and Incineration, Technical Report Summary."* The Ministry conducted a series of technical risk assessments of two generic large-scale disposal facilities (incineration and modern landfill) for a 20 year service period. They concluded that there would be negligible effects associated for either facility, provided they meet stringent requirements and standards for design, operation, and pollution control. They state that *"concerns for human health and the environment should not limit the selection and approval of incinerators or landfills."*

System No. 2 - Expanded Reduction and Diversion Program with Increased Landfill Capacity and System No. 4 - Expanded Reduction and Diversion Program with Incinerator and Increased Landfill Capacity, will both provide the Town of Iqaluit with a long-term solution to the community's waste management needs. The following section outlines the system description for the two disposal options, provides associated preliminary cost estimates, and identifies the issues to be considered in selecting the preferred SWMS.

10.2 Landfill Disposal

10.2.1 System Description

The expectation is that any future landfill for the Municipality of Iqaluit would be designed and operated with all the necessary control and management features necessary to ensure minimal environmental impact. It is assumed the landfill will have sufficient capacity to accommodate the projected refuse demands for the 20-year planning horizon. Refuse will be unloaded at the working face, spread, compacted, and covered to minimize blowing debris. Once the landfill reaches capacity, the disposal area will be closed and capped.

It is also assumed that the landfill site will have sufficient room to accommodate the storage of derelict vehicles, reusable construction debris, white goods, tires, and HHW. All fluids would be drained from the vehicles and the batteries removed, prior to their being placed in the storage area. The public would have access to these areas and waste salvage would be encouraged. Vehicle parts, used appliances, scrap wood, hardware, tires, and other materials could be reused. Periodically the vehicles and white goods could possibly be crushed to reduce volume and/or possibly shipped as ballast on the sealift to scrap metal yards in the south. Used tires and wood could possibly be shredded and used as daily cover material at the landfill.

Based upon the screening criteria presented in Section 9.0, the landfill site will most likely be located out the Road to Nowhere, 450 metres or more beyond the limits of planned development.

The various design and feature assumptions used to estimate facility costs and area requirements are as follows:

○	Design life	20 years (2001 – 2020)
○	Total refuse volume	1,200,000 m^3 (uncompacted: 180,000 tonnes)
○	Compacted refuse volume	450,000 m^3 (based on moderate compaction: 400 kg/m^3)
○	Total daily cover material	80,000 m^3
○	Approximate fill area	200 m x 265 m (assume 10 m depth)
○	Total final cover	53,000 m^3 (assume 1.0 m deep)
○	Buffer width	30 m (from landfill to site boundary)
○	Buildings	200 m^2 office and 2 bay garage
○	Other features	Storage for white goods, tires, reusable construction materials, HHW, and approximately 150 vehicles
○	Total site area	10 hectares (approximately)

It is noted that the site area could vary significantly depending upon topographical features and the depth of refuse placed. The construction costs could similarly vary depending on site location, accessibility, and on-site development constraints.

10.2.2 Cost Estimates

Preliminary estimates of site development, annual operating, and closure costs were prepared, based upon various assumptions. A summary of the costs for each category follows.

Site Development Cost

.1	Land purchase (assume no cost)		N/A
.2	Site office & garage (200 m^2)		$250,000
.3	Landfill compactor (reconditioned machine)		150,000
.4	Site access road (assume 500 m long)		150,000
.5	Hydro service		20,000
.6	Site preparation (ditching, grading, signage, etc.)		150,000
.7	HHW storage area (allowance)		50,000
.8	Site fencing (assume none required)		N/A
.9	Litter fencing		30,000
		Subtotal	$800,000
		Contingency Allowance 30%	240,000
		Estimated Capital Cost	$1,040,000

Annual Operating Costs

.1	Salaries & benefits (assume 2 full-time staff)		$100,000
.2	Equipment rental (allowance for miscellaneous site work)		30,000
.3	Site monitoring (allowance for annual monitoring program)		30,000
.4	Miscellaneous expenses (allowance)		20,000
.5	Cover materials (average of 4,000 m^3/yr)		100,000
		Subtotal	$280,000
		Contingency Allowance 30%	84,000
		Estimated Annual Operating Cost	$364,000

Site Closure Cost

It is assumed site closure will principally relate to the construction of a top cover system over the completed landfill, plus some miscellaneous grading works. The approximate cost is $2.5 M.

10.3 Incinerator Plus Landfill Disposal

10.3.1 System Description

The incinerator could be used to burn all of Iqaluit's combustible municipal solid waste, apart from any paper products diverted through a recycling program, and any HHW. Depending upon the equipment selected, the following wastes could be incinerated: mattresses, combustible building materials, treated lumber, medical wastes, animal carcasses, expired drugs, furniture, tires, used oil, restaurant food wastes, cardboard, and other municipal solid waste. Refuse volumes would be reduced by approximately 90%. The resulting ash would be landfilled along with other non-combustible materials.

The incinerator would be located outside the residential area, presumably in the industrial lands. The landfill would have to be located 450 metres beyond the limits of planned development. It is assumed that the storage of derelict vehicles, etc. would be located at the landfill, although alternate locations within or adjacent to the industrial lands would also be available.

○	Design life	20 years (2001 - 2020)
○	Total refuse volume	1,200,000 m^3 (180,000 tonnes)
○	Volume to incinerator[1]	1,000,000 m^3 (150,000 tonnes)
○	Volume to landfill	200,000 m^3 (30,000 tonnes)
○	Compacted refuse volume	175,000 m^3 (including 100,000 m^3 of incinerator ash)
○	Total daily cover material	30,000 m^3
○	Approximate fill area	175 m x 100 m (assume 10 m depth)
○	Total final cover material	18,000 m^3 (assume 1.0 m deep)
○	Buffer area width	30 m (from landfill to site boundary)
○	Landfill site building	100 m^2 office and single bay garage
○	Other site features	storage at landfill for about 150 derelict vehicles, white goods, wood, tires, HHW
○	Total landfill site area	5 hectares (approximately)
○	Incinerator[2]	located in building in industrial park

Notes:

.1 From Table 5-2, approximately 84% of the waste stream is combustible. Cans, other metal, glass, ceramics, and dirt make up the balance.

.2 Average volume of waste incinerated during 20-year operating period - 7,500 t/a; 22.7 t/d based on 330 day/yr operation. Demand at year 2020 is approximately 11,500 t/a or 34 tonnes/d based on 330 day/yr operation.

10.3.2 Cost Estimates

The estimated costs of the incinerator option with landfill is based upon the assumptions outlined in the balance of this section.

Landfill Site Development Cost

.1	Land purchase		N/A
.2	Site office & garage (100 m²)		$130,000
.3	Landfill compactor (use existing municipal equipment)		N/A
.4	Site access road (assume 500 m)		150,000
.7	Hydro service		20,000
.8	Site preparation (allowance for ditching, grading, signage, etc.)		80,000
.7	HHW storage area (allowance)		50,000
.8	Site fencing (assume none required)		N/A
.9	Litter fencing		20,000
		Subtotal	$450,000
		Contingency Allowance 30%	140,000
		Estimated Capital Cost	$590,000

Incinerator Cost

The approximate cost of a 25 ton per day incinerator (assuming a single shift per day) is $2.2 M without an air emissions scrubber. The standard equipment of some manufacturers meets federal government air emission standards for MSW incineration without the need for a scrubber. However, should additional air pollution control equipment be required or desirable, the additional cost is about $1.9 M. Building and site servicing costs would be approximately $1.5 M additional.

Annual Operating Cost (Landfill)

.1	Salaries & benefits (1 full-time staff)	$50,000
.2	Equipment rental (allowance for miscellaneous site work)	15,000
.3	Site monitoring (allowance for annual monitoring program)	20,000
.4	Miscellaneous expenses (allowance)	10,000
.5	Cover materials (average of 4,000 m^3/yr)	40,000
	Subtotal	$135,000
	Contingency Allowance 30%	40,000
	Estimated Annual Operating Cost	$175,000

The annual operating cost for incineration is estimated at $30 to $60/ton or $250,000 to $500,000 over the 20-year planning horizon.

Landfill Site Closure Cost

Closure of the landfill site is estimated at $820,000 for a top cover and some minor site grading.

10.4 Summary

The selection of the preferred waste disposal option for the Town's long term Waste Management Plan involves the consideration of a number of factors. Theoretically, neither landfilling nor incineration will present any concerns for human health or the environment. Therefore, the question comes down to which of the alternatives best reflects the balance between community values and affordability. Landfilling is the most economical of the alternatives. Other somewhat intangible considerations include:

.1 The landfill disposal area associated with incineration is approximately 67% smaller (i.e.: 17,500 m^3 vs. 53,000 m^3 based on an assumed 10 m fill depth);

.2 The total waste disposal/storage site area is smaller for incineration (5 vs. 10 hectares excluding the incinerator building site);

.3 A smaller landfill site has less impact on the natural setting;

.4 Diversion of the organic components to incineration significantly reduces the leachate source and correspondingly reduces the potential impact on the environment;

.5 Smaller landfill will require less granular for daily and final cover operations. More of this valuable resource will be available for other applications;

.6 A heat recovery system could be incorporated in the incinerator design to reduce the heating costs for adjacent buildings like the water or sewage treatment plants; and

.7 The incinerator could also be designed to treat other wastes such as used oils, medical wastes, tires, etc.

11.0 SUMMARY AND RECOMMENDATIONS

This report summarizes the activities and findings associated with the Municipality of Iqaluit's solid Waste Management Planning Study. Three public meetings and a number of stakeholder meetings were held during the study period. The public's comments have been reflected in this report.

Total annual refuse volumes and tonnages have been estimated based upon a projected population and the MACA waste generation formula. The total tonnage requiring disposal during the 20 year planning period is approximately 180,000 tonnes, less any materials which may otherwise be diverted.

Public meetings in January and May of this year provided the public the opportunity to participate in the discussion and evaluation of alternative waste management components and four alternative Waste Management Systems. Two alternatives - System No. 2 with Expanded Reduction and Diversion Program and Increased Landfill Capacity, and System No. 4 with Expanded Reduction and Diversion Program with Incinerator and Increased Landfill Capacity, were identified as suitable. System No. 2 is the more economical, but System No. 4 also has a number of distinct advantages.

The public also had the opportunity to review and comment on the proposed screening criteria used to identify those areas of the community which would be unsuitable for a landfill or an incinerator. The remaining areas, which are referred to as the *"Candidate Areas,"* would normally be subjected to site-specific studies to ultimately identify the preferred site for the proposed facilities.

RECOMMENDATIONS REQUIRING IMMEDIATE ACTION:

.1 Select the Preferred Solid Waste Management System (SWMS)

Municipal staff estimate that the existing landfill site will be at capacity by June 2001. This leaves very little time for the completion of site-specific studies, detailed design, approvals, project tendering, and the construction of the proposed facilities.

IT IS CRITICAL THAT COUNCIL SELECT THE PREFERRED SWMS AND PROCEED WITH THE ASSOCIATED FOLLOW-UP WORK IN THE IMMEDIATE FUTURE.

.2 Develop a Contingency Plan

A serious crisis could arise if the existing landfill runs out of capacity before the new facility is approved and developed. This is a very real possibility, based on the projected completion date for the existing site and the work necessary to bring the new facility (i.e. landfill and/or incinerator) on line.

The capacity of the existing site should be verified, and if necessary, steps should be taken to extend its life. If sufficient additional capacity can not be obtained or developed at the present site, an alternative solution must be identified.

DEVELOPMENT OF A CONTINGENCY PLAN SHOULD BE GIVEN IMMEDIATE PRIORITY.

.3 Initiate Additional Studies

Additional studies are required prior to the implementation of the preferred SWMS. A landfill site is required regardless of the alternative selected. The next step typically involves selection of a number of potential landfill sites from within the Candidate Area. Each site would be subjected to detailed field investigations to determine the potential environmental impact of the proposed landfill on the subject property and adjacent lands. The site which best meets the requirements for capacity and associated facilities, and which has the lowest potential for environmental impact, would be identified as the preferred site.

If an incinerator is to be built, a feasibility or pre-design study should be undertaken. The study should identify potential sites and examine potential heat recovery opportunities. Heat from incineration might possibly be used to significantly reduce the heating cost of a Municipal building such as the water or wastewater treatment plant. This would reduce overall operating costs for the Municipality.

During the public meetings, it was noted that the hospital is considering a new incinerator as part of their expansion plans. The possibility of the Municipality incinerating hospital waste should be reviewed. Such a review should include an assessment of the impact on equipment size, air emissions, equipment selection, operation conditions/procedures, and capital and O&M costs.

Projected waste quantities and composition should be assessed. This information will impact on air emissions and equipment selection. A conceptual plan of the site facilities, a description of the site operating plan, and an updated cost estimate should be prepared.

THESE STUDIES SHOULD BE GIVEN A VERY HIGH PRIORITY. IT IS ESSENTIAL THAT FIELD WORK PROCEED THIS SUMMER, WHEN SITE CONDITIONS CAN BE MORE READILY ASSESSED.

OTHER RECOMMENDATIONS:

.4 Establish a Waste Management Committee

Members of the Steering Committee made a valuable contribution to this planning study. Council may wish to consider extending their mandate to assist the Municipality in ongoing waste management policy and program review/development.

.5 Expand HHW Program

Council should consider expanding and redefining the present HHW program. Regular scheduled events should be held at least once per year, where the public can drop off their household hazardous wastes at a centrally located depot. For example, a temporary one-day setup at a public works garage could serve this purpose.

The event should be staffed with trained personnel. Materials collected should be sorted, classified, and properly stored for eventual shipment to licenced disposal facilities.

A HHW storage facility should be established. This could be as simple as a number of secure container vessels dedicated for the temporary storage of specific materials such as batteries, paints, pesticides, waste oil, chemicals, prescription medications, propane cylinders, and PCB-contaminated materials.

.6 Hazardous Waste Survey

The present study was limited to the development of a SWMP for municipal solid waste. As such, it did not address hazardous waste (other than HHW) or liquid industrial or gaseous waste. It has been the policy of the Municipality that the disposal of hazardous industrial and commercial waste is the responsibility of the generator. These wastes are not permitted at the landfill. Municipal staff are not certain how these wastes are managed.

Staff should consult with Government of Nunavut personnel to confirm who has jurisdiction over hazardous waste management. Steps should be taken to identify the generators and ensure their industrial wastes are not inadvertently ending up in the Municipal landfill or being discharged into the sewer system.

A recommendation which originated during the public discussions was that each business, as a condition of their business licence, should be required to file a waste management plan. The plan should describe the nature of the business and identify the type and quantity of waste which will be generated. Among other things, this data could help to identify potential sources

of hazardous waste. The Municipality and other regulatory agencies could then ensure that the generators have a proper disposal program in place.

.7 Monitor Waste Quantities

Municipal staff should continue to monitor the volume and source of waste received at the landfill site. This information will help confirm the volume estimates based upon the MACA formula. It will also prove helpful in confirming the remaining site capacity and developing the contingency plan proposed in item .2 of this section.

.8 Develop Closure Plans for the Existing Municipal Landfills

The three existing Municipal landfills have not been properly closed and continue to pose a potential environmental risk. A study should be initiated to confirm the extent and nature of the fill materials and their potential impact on the environment. Alternative closure plans should be considered and a solution identified for each of the properties. As noted in Section 7.0 of this report, it may be preferable to designate the sites as landfills, and design a closure plan which would limit their potential impact to the site. The plan may incorporate a combination of technologies such as permafrost engineering, low permeability geosynthetic materials, and fine grained local soils as a cover material.

.9 Develop an Expanded Waste Reduction and Diversion Program

The public clearly expressed their interest and support for waste diversion and the 3 Rs - reduce, reuse, and recycle. This objective is reflected in the two recommended alternative SWMSs, Systems No. 2 and No. 4.

It has been recognized that the Municipality's waste reduction and diversion program will develop over a period of time. This is one area where the Steering Committee, or some such group, could be particularly helpful. Table 8-1 identifies a number of waste reduction and diversion opportunities under each of the system components. Some of the options to consider are noted below.

Reduce

Waste reduction is the top priority in the 3 Rs hierarchy. It is preferable to reduce waste quantities and thereby reduce the volume of waste which would otherwise require management. Alternatives which could be considered include:

- user pay – this could mean that individuals have to pay for every bag of refuse they put out for collection;
- tipping fees – higher fees for those who haul their waste to the landfill will make them more aware of waste generation. A rate schedule could be developed based on the type and volume of waste received;
- bag limits – residents may be restricted in terms of the number of bags they put out for weekly collection. Additional bags could be subject to a surcharge;
- material bans – certain MSW materials could be banned from collection. Before this was done, an alternative option would have to exist within the community;
- import tax – the public has suggested that consideration be given to assessing a tax or duty on vehicles brought into the community. This may help slow down the number of vehicles coming into Town. If nothing else, the fees could be applied to managing the derelict vehicles.

Reuse

Number 2 in the 3 Rs hierarchy, reuse involves the return or reuse of a product or material for its original purpose or alternatively, finding a new use without modifying the original item. Reuse practices include:

- waste exchange – charities, service clubs, and/or municipalities sometimes establish exchanges where residents can drop off clothing, small appliances, furniture, and other items which can be reused by others. Often these materials are made available at a nominal charge. Paint collected through the HHW depot could be mixed and distributed through a waste exchange.
- bottle deposit – some provinces have introduced legislation governing bottle deposits as a way of encouraging the reuse of bottles.

Recycle

The third priority in the 3 Rs hierarchy is the sorting, collecting, and processing of a waste material or product so that it can be used for a similar or new purpose.

Examples of recycling include waste exchanges and the collection and processing of a broad range of products. The market price for recycled materials can vary significantly, so much so that the generator may have to pay to get rid of certain products. Aluminium is the most valued commodity and has historically been several times more valuable than other recycled products. It has ranged in value from $758 to $2,045/tonne between 1990 and 1999.

Iqaluit may wish to consider initiating a smaller scale recycling program based upon the collection of aluminium cans, for example. The program should monitor public participation, project costs, and overall success. A local service club, sporting association, or other non-profit organization might be interested in providing much of the sweat equity in return for a share of the proceeds from the product sale.

Public Education

If the Municipality intends to reduce and divert waste from disposal, they must develop an effective public education program. Public acceptance and participation is essential to the success of these programs. It is therefore imperative to educate the public about the importance of the program and how they can make a meaningful contribution. The public education program will also serve to identify the Town's waste management services and policies to the public.

.10 Review Waste Management Program Services and Budget Policy

Presently the Municipality of Iqaluit operates a relatively small, open burn landfill. Annual operating budgets for collection and disposal are largely based upon the estimated cost of labour, equipment operation and maintenance, and some miscellaneous services and expenses. There is no budget provision for capital expenditures such as equipment replacement, site closure, development of the future site, etc.

Iqaluit is about to make a significant decision in terms of their future waste management system. In order to ensure the Municipality has sufficient funds to finance the ongoing operation of the new facilities, and to minimize the impact of future expenditures, a long-term budget forecast should be developed and a reserve fund established.

The financial model will identify the actual cost of waste collection and disposal services, and it could be used to develop a user pay program. As noted earlier, the user pay initiative will increase public awareness of personal waste management practices and contribute to the waste reduction and diversion.

Residential and ICI collection practices should also be evaluated. Many municipalities provide weekly versus semi-weekly collection of residential waste. Many others offer limited, if any collection, from properties in the ICI sectors. In many instances, businesses are responsible for getting their wastes to the disposal facility.

The services offered by the Municipality will impact on the budgets established for the financial model and any user pay program which might be introduced. They will also impact on the municipal tax assessment.

REFERENCE LIST

1. ARGA Earth & Environmental Limited, "Foundation Soils Investigation Proposed Commenuty Hall, Apex, NWT," 1997.

2. Blackadar, R.G., "Geological Reconnaissance, Southern Baffin Island, District of Franklin, Geological Survey of Canada, Paper 66-47, 32 p," 1967.

3. Bryant Environmental Consultants & Acres Associated, "Generic Plans and Operating Procedures of a Remediation Facility for Contaminated Hydro Carbon Materials in the NWT," 1994.

4. Bryant, W.J., "A Hazardous Waste Management Strategy for NWT Communities," Prepared for Government of NWT, 1991.

5. Community Works and Capital Planning Division, Department of Municipal and Community Affairs, Government of the Northwest Territories, "General Terms of Reference for a Community Water and Sanitation Services Study, Part 3, Section 1," 1986.

6. Department of Indian Affairs and Northern Development, "Environmental Site Assessment and Remediation Options of an Abandoned U.S. Air Force Base and Five Waste Sites in Iqaluit, NWT," June 1993.

7. Department of Indian Affairs and Northern Development, "Environmental Site Assessment of an Abandoned U.S. Air Force Base and Five Waste Sites in Iqaluit, NWT," August 1993.

8. Environment Canada, Conservation & Protection Branch, Yellowknife; Department of National Defence, Environment Sciences Group; and Natural Resources Canada, Geological Survey of Canada, Atlantic Geoscience Centre; "Baffin Region Ocean Disposal Investigation: Seabed Debris and Contaminant Inputs Near Iqaluit, Resolution Island, Cape Dyer and Kivitoo," Department of National Defence, April, 1995.

9. Ferguson Simek Clark, "Wetlands and Snowfluent Study Town of Iqaluit, Northwest Territories," 1997.

10. Ferguson, Simek, Clark Limited, "Soils Report for Proposed Roads in Happy Valley Subdivision, Frobisher Bay, NWT," 1983.

11. Ferguson, Simek, Clark Limited, "Soils Report for Proposed Lots in Happy Valley Subdivision, Frobisher Bay, NWT," 1983.

12. Golder Associates, "Subsurface Investigation, Underground Services and Treatment Facilities, Frobisher Bay, NWT, Golder Associates File No. 73758," 1973.

13. Hardy BBT Limited, "Environmental and Geotechnical Investigation Proposed Solid Waste Site, Iqaluit, NWT," Prepared for UMA Engineering Ltd., 1991.

REFERENCES (Continued)

14. Hardy BBT Limited, "Iqaluit 20-Year Granular Management Plan, Preliminary Investigation, Report No. CEO1122," 1991.

15. Heinke, G.W., and J. Wong, "Guidelines for the Planning, Design, Operation, and Maintenance of Solid Waste Modified Landfill Sites in the Northwest Territories, Volume 1: Planning and Design," Department of Municipal and Community Affairs, Government of NWT, 1990.

16. Johnson, Ken, "Report on the Design and Construction of a Sanitary Landfill," 1980.

17. MACA Program Management Handbook, "General Terms of Reference for a Study, Guidelines for Evaluation of Reports," 1986.

18. Oliver, Mangione, McCalla, & Associates Limited, "Municipality of Iqaluit Solid Waste Management Study," 1998.

19. Oliver, Mangione, McCalla, & Associates Limited, "Abandonment and Restoration Plan Apex Landfill Site, Iqaluit, NWT, Drainage Plan," 1997.

20. Oliver, Mangione, McCalla, & Associates Limited, "Abandonment and Restoration Plan Iqaluit Landfill Site, Iqaluit, NWT," 1997.

21. Oliver, Mangione, McCalla, & Associates Limited, "Remediation Plan, Iqaluit Landfill & Apex Dump, Iqaluit, NWT," 1997.

22. Oliver, Mangione, McCalla, & Associates Limited, "Drainage Plan, Iqaluit Landfill Site West 40, Site #4, Iqaluit, Northwest Territories," 1997.

23. Oliver, Mangione, McCalla, & Associates Limited, "Drainage Plan, Apex Dump Site, Iqaluit, Northwest Territories," 1997.

24. Oliver, Mangione, McCalla, & Associates Limited, "Evaluation of Solid Waste Disposal Town of Frobisher Bay," 1983.

25. Public Works Canada, Environmental Services, "Literature Review on Abandoned and Waste Disposal Sites in the Iqaluit Area, Northwest Territories," 1992.

26. Queen's University, Analytical Services Unit, "Cleanup of the Upper Base at Iqaluit, NWT," 1995.

27. Reid, Crother, and Partners Limited, "Planning and Engineering Report on Hamlet of Frobisher Bay," 1972.

REFERENCES (Continued)

28. Royal Military college Environmental Science Group, "North Warning System Environmental Study, Issued at the authority of the Director North Warning System Office, DND, 3 Volumes, Victoria, B.C.," 1991.

29. St. Onge, M.R., Scott, D.J., and Wodicka, N., "Geology, Frobisher Bay, Nunavut; Geological Survey of Canada, May 1979A, Scale 1:100,000," 1999.

30. Soberman, Lovicsek, and Heinke, "Guidelines for the Siting of Solid Waste Disposal Sites in the Vicinity of Community Airports in the Northwest Territories," 1990.

31. TimeScapes Heritage Resource Consulting, "Archaeological Site Assessment Sewage Treatment Facility Municipality of Iqaluit."

32. TimeScapes Heritage Resource Consulting, "Archaeological Site Assessment "'Road to Nowhere' Housing Development Municipality of Iqaluit."

33. Town of Iqaluit, "Proposal to Indian Affairs and Northern Development for Preliminary Stage of Cleanup of Waste Sites in Iqaluit, NWT," 1992.

34. UMA Engineering Ltd., "Contract Documents for Municipality of Iqaluit, NWT New Landfill Construction," 1994.

35. UMA Engineering Ltd., "Preliminary Report on the Cleanup of Waste Disposal Sites Near the Town of Iqaluit," 1994.

36. UMA Engineering Ltd., "Preliminary Report, Iqaluit Solid Waste Disposal Site," 1991.

37. UMA Engineering Ltd., "Town of Iqaluit Landfill Operation & Maintenance Manual for Site 3 in West 40," 1994.

38. UMA Engineering Ltd., "Preliminary Engineering Report Iqaluit Solid Waste Disposal Site," 1991.

APPENDIX 'A'

GLOSSARY OF TERMS

GLOSSARY OF TERMS[1]

These definitions are provided to assist the reader.

ADVERSE ENVIRONMENTAL IMPACT	Any direct or indirect undesirable effect on the environment resulting from an emission or discharge, which is caused or likely to be caused by humans.
AEROBIC	The biological state of living and growing in the presence of oxygen. Requiring the presence of free oxygen.
AEROBIC CONDITIONS	The biological state of living and growing in the absence of oxygen available (i.e., a compost heap that is aerated, mixed, or turned over regularly).
ANAEROBIC	The biological state of living and growing in the presence of oxygen.
ANAEROBIC CONDITIONS	A situation in which there is an absence of oxygen available (i.e., within the well compacted waste of a landfill site).
APPROVED SITE OR FACILITY	A landfill site/facility for which there is a current certificate of approval.
AQUIFER	A saturated permeable geologic unit that can yield economic quantities of water to wells.
ATTENUATION	Natural process of compacting mixed solid wastes to form a compressed block or bale.
BALING (OF WASTE)	The process of compacting mixed solid wastes to form a compressed block or bale.

[1]Glossary of Terms compiled from:
"Guide to Municipal Waste Planning in Ontario", Waste Reduction Office, April 1993; and
"Environmental Assessment Proposal: A Guideline for Public Sector Waste Management Planning", Environmental Assessment Branch, Ministry of Environment and Energy, February 1993.

BIODEGRADATION	Breaking down, decomposing, decaying or rotting, by natural biological processes. The processes may take a very long time. If the processes occur in bodies of water, they use up valuable oxygen which is needed by the aquatic organisms and often release nutrients which increase the rate of eutrophication.
BLUE BOX	A blue plastic box used by residents of many municipalities and rural areas to collect and store recyclable items and to carry these items to the curbside/roadside for collection.
BORE HOLE	A hole in a geological formation which has been drilled, jetted, driven or made by other similar techniques. It is used to determine soil and rock characteristics and also permits the installation of a water well or an observation well for groundwater monitoring purposes.
BUFFER AREA (ZONE)	An area of land situated within the peripheral area surrounding an active filling area, but limited in extent to the property boundary, assigned to provide space for remedial measures, contaminant control measures, and for the reduction or elimination of adverse environmental impacts caused by migrating contaminants.
BURIAL GROUND	Are any lands which contain or consists of human burials.
CANDIDATE AREAS	Areas identiifed as being generally suitable for conisderation as potential areas for siting a waste management facility/ies based on preliminary screening of constraints and secondary screening based on an analysis of published data.
CELL	A space or contained area within the active fill area identified and prepared for receiving waste during nay stage of landfilling, and subsequently compacted, enclosed by soil or other cover material.
COMPOSTING	Composting is the controlled microbiological decomposition of the organic fraction of solid waste material, resulting in humus-like end product which is primarily used for soil conditioning. The composting of organic wastes from several generators at a central location is referred to as centralized composting.

CONSTRAINT MAPPING	A method of overlaying inventory maps using the established exclusion criteria to assess the availability and suitability of candidate areas.
CONTAMINANT	A compound, element or physical parameter, usually resulting from human activity, or found at elevated concentrations, that has or may have a harmful effect on public health or the environment.
CONTINGENCY PLAN	A document plan detailing a coordinated course of action to be followed to control and remediate occurrences such as a fire, explosion or release of contaminants in an uncontrolled manner that could threaten the environment and public health.
COVER MATERIAL	Material approved to cover compacted solid waste. Usually, a soil with suitable characteristics for specific end-use.
CRITERIA	Consideration or factors which assist in the elimination or composition of options such as alternative components or sites.
CURBSIDE COLLECTION	The pick-up and movement of recyclables, compostables and wastes from individual residences and ICI establishments to the place of processing and/or disposal. Methods of collection may vary from being labour intensive to mechanized.
CURBSIDE RECYCLING	A recycling program in which people separate recyclable materials from general waste and place them at the curbside/roadside for collection.
D & O PLAN (REPORT)	Design and Operations Plan or Report, is a document detailing the planned sequence of activities through a landfill site's active life, the control systems, site facilities and monitoring systems, that are necessary.
DECOMPOSER	Microscopic organisms (e.g., bacteria and fungi) or small animals (e.g., worms and insect larvae) which digest or eat organic materials and produce a nutrient-rich material suitable for compost.

DEPOT	A centrally located facility which is used to collect waste materials directly from the waste generator for reuse or recycling.
DEPOT RECYCLING	A facility, large or small, for the temporary storage of recyclable materials; in some areas, used as drop off locations by the public; in other areas, used only by municipalities to store materials collected by trucks.
DESIGN CAPACITY	The maximum amount of waste that is planned to be disposed of at a landfill site.
DIRECT HAUL	The transporting of recyclables, compostables or wastes directly to a waste diversion facility, depot, transfer station, processing facility or disposal facility by the waste generator.
ECOSYSTEM	Any given area of the earth where living organisms (the "biotic components") interact with non-living things (the "abiotic components") in a cyclic exchange of matter and energy (e.g., oxygen, nitrogen, water, carbon dioxide, etc.). The basic unit of ecology. Ecosystems range in size form very small to very large. Examples include a pond, forest, lake, desert, etc. An ecosystem consists of four types of organisms: plants, herbivores, carnivores, omnivores and decomposers. Depending on how an ecosystem is defined, many organisms can be part of more than one ecosystem.
EFFLUENT	Any liquid and associated material discharged into a surface watercourse or discharged on land as a means of final disposal.
ENERGY FROM WASTE (EFW)	The process of converting used or waste products into fuel or any form of energy.
ENVIRONMENT	The definition of "environment" often includes the technical, natural, social, economic, and cultural factors, and their interrelationships.

ENVIRONMENTAL ASSESSMENT	A detailed environmental assessment study of a proposed project. The study includes an assessment of the need for the project, various alternatives to the project, potential environmental impacts (including social impacts), methods to reduce the potential for any negative effects, methods to remediate any problems which do occur, and monitoring techniques frequency.
ENVIRONMENTALLY SENSITIVE AREA (ESA)	Natural ecosystems or landforms considered either to be sensitive to human activities or unique thus requiring protection.
EVALUATION	The process of applying criteria and eliminating or comparing options.
EVALUATION CRITERIA	A set of broad factors (covering the natural, social, economic, financial, cultural, technical and land-use (planning environments) used to determine the suitability of two or more waste management system alternatives and facility/site alternatives on the basis of common method of comparison.
EXCLUSION CRITERIA	Criteria used to identify areas that are not suitable for the establishment of a waste management facility/site. Exclusion criteria are used to narrow down areas for consideration, and to develop information for consideration in subsequent levels of the site selection process.
EXPORT	The shipping of waste materials beyond the service or study area.
FILL AREA	The area of a landfill site designed and designated for the disposal of waste.
FLOODPLAIN	The area, usually lowlands, adjoining a watercourse which has been or which may be covered by flood water.
GARBAGE	A used material people no longer want and for which they can find no further uses. Also called: rubbish, refuse, residential (waste) and trash. (See Municipal Solid Wastes).

GROUNDWATER	Subsurface water that occurs beneath the water table in soils and rocks that are fully saturated.
HOUSEHOLD HAZARDOUS WASTE (HHW) MANAGEMENT	The management of wastes resulting from the use of common household products which may be hazardous to the environment.
IMPORT	The import of waste materials from beyond the service or study area.
ICI WASTE (Industrial, Commercial & Institutional Waste)	Solid waste generated by industries and businesses of all types, including manufacturing, construction and demolition sites, shopping stores, restaurants, hotel/motel establishments and offices; institutional types of establishments such as schools, hospitals, government offices, and universities. IC&I waste makes up about 60 per cent of Ontario's total municipal solid waste stream.
INCINERATION	Controlled burning of solid waste for the purpose of achieving volume and weight reduction.
INDUSTRIAL WASTE	Any process waste that is the direct or indirect by-product of the manufacturing of a product or the performance of a service.
LANDFILL	The disposal of solid wastes on land, under controlled conditions, by spreading the waste in layers, compacting and then covering the wastes with soil.
IN-VESSEL	A method of composting in which the compost is mechanically mixed and aerated in a container or enclosed building.
LANDFILL MINING	The excavation of previously buried waste to reclaim recyclable and organic soil for cover.

LANDFILL SITE	An area of land used for the burial of wastes under controlled conditions. Often called a "sanitary landfill site". Landfilling involves the compaction of waste in sections, called "cells". The cells of waste are covered with soil at regular intervals. A properly designed landfill site includes plans for site preparation, leachate and bio-gas control, final capping, site rehabilitation, final use, and perpetual monitoring.
LEACHATE	The liquid which results when rain or melting snow percolates through a material and carries with it dissolved materials picked up as it moves. Depending on the location, leachate may contain hazardous materials which could contaminate groundwater or surface water. Leachate has more heavy metals if the rain or snow is acidic.
LEACHATE COLLECTION AND/OR TREATMENT SYSTEM	A system where landfill produced leachate is collected and treated to remove contaminants prior to its release to the environment.
LEACHATE MONITORING SYSTEM	A system of strategically placed wells or other measuring devices for scrutinizing and assessing qualitatively the movement of leachate off-site and its effect on adjacent ground and surface water resources.
LINER	A constructed continuous layer of reworked natural soil (usually clay), or artificial materials placed beneath and on the sides of a landfill or waste cell that restricts the downward or lateral migration of leachate or landfill gas.
MATERIALS RECOVERY FACILITY (MRF)	A facility where wastes are separated to recover recyclable and compostable materials from the residual materials in the waste stream, or a facility where source separated recyclable materials are processed for markets.
METHANE GAS	An odourless, colourless, non-poisonous gas. It is explosive when mixed with air or oxygen in certain proportions. One source is from landfill sites undergoing anaerobic microbial decomposition.
MITIGATION	Techniques for preventing, avoiding or reducing the impact of an environmental problem, such as water pollution caused by the movement of leachate from a landfill site.

MONITORING	Regular or spontaneous procedures used to methodically inspect and collect data on the performance of a landfill site relating to environmental quality (i.e., air, leachate, gas, ground or surface water, unsaturated soils, etc.).
MONITORING WELL	A water well used for the purpose of monitoring ground water conditions.
MUNICIPAL SOLID WASTE (MSW)	Municipal solid waste is everything that is not hazardous waste, liquid industrial or gaseous waste. It includes two main types of solid waste: residential (domestic) waste; and industrial, commercial and institutional (IC&I) waste. (See also Residential Waste).
NATURAL ATTENUATION	Where contaminants are reduced to acceptable concentration levels by natural mechanisms (dilution, adsorption onto the soil matrix, etc.), biological action, and chemical interaction.
NET EFFECTS ANALYSIS	The residential environmental effects remaining following the consideration of mitigative and enhancement measures of potential effects.
OFF-SITE	Areas outside of the site considered to be potentially influenced by any effects from a proposed facility.
ON-SITE	Areas within which features will be displaced or lost by property purchase and facility development.
OFFICIAL PLAN	Is a policy document of a local government that sets out the Municipality's view of how land should be used.
PERCOLATION	The movement of infiltrating water through soil.
PERMEABILITY	Often used interchangeably with hydraulic conductivity, but not strictly correct. Permeability is a property of the porous media only. Dependent upon media properties that affect flow, diameter, sphericity, roundness and packing of the grains.

PERMEABLE MATERIAL	A porous substance which allows the passage, or movement of materials through it (e.g., sandy soil).
PLANNED LAND USE	The future intended use of any land area usually described in an Official Plan.
POINT-OF-IMPINGEMENT	The location where a pollutant first comes in contact with a receptor (e.g., an individual or private property).
POLLUTION	The release of contaminants into the environment. Pollution abatement is the removal of contaminants from emissions or effluent before they are released into the environment. Even better than pollution abatement is pollution prevention which involves changing industrial processes/activities to ensure that they do not create contaminants in the first place.
PRELIMINARY FIELD CHECK	A preliminary field check involves on-site field investigations.
PROCESSING FACILITY	A solid waste facility at which solid waste is shredded, baled, pulverized, composted, separated, combusted or otherwise treated, or altered by some means to facilitate further transfer, processing, utilization or disposal.
PUBLIC EDUCATION	The process of informing the public at large and the ICI sector about how they may contribute to waste reduction, reuse and recycling.
RECYCLABLE MATERIAL	A material that is used in place of a primary, raw, or virgin material in manufacturing a product and consists of materials derived form post consumer waste, industrial scrap, and material derived from agricultural wastes and other items, all of which can be used in the manufacture of new products.
RECYCLING	The sorting, collecting and processing of a waste material or product so it can be used for a similar or new purpose. For example, the "Blue Box" system, in-plant scrap handling, or raw material recovery systems. Recycling is also the marketing of products made from recycled or recyclable materials. This is the third of the 3Rs.

RECYCLING DEPOT	A facility used for the temporary storage of recyclable materials; in some areas, used as drop-off locations by the public; in other areas, used only by municipalities to store materials collected by trucks.
RECYCLING FACILITY OR PLANT	A facility where recycling of used or waste products is carried out.
REDUCTION	The avoidance or prevention of waste production through measures or efforts designed to reduce the quantities of waste requiring disposal.
REMEDIAL ACTION	Corrective action taken to clean-up or remedy a spill, an uncontrolled discharge of a contaminant, or a breach in a facility or its operations, in order to minimize the consequent threat to public health and the environment.
RESIDENTIAL WASTE	Waste produced by all types of households, including detached dwellings, row housing, condominiums and apartments. In Ontario, residential waste makes up about 40 per cent of the total municipal solid waste stream. (See also Municipal Solid Waste).
RESIDUAL WASTE	The materials remaining after all effects have been made to reduce, reuse and recycle. Usually, these materials have to be put in approved landfill sites. Only residual waste is properly referred to as 'garbage'.
REUSE	The return of a product or material to use either by reusing it for its original purpose or by finding a new use for it without modifying it.
RISK ASSESSMENT	When applied to waste management; a way of measuring the significance of a waste problem for its impact on the environment or human health.
RUN-OFF	The part of precipitation (rainwater, snowmelt) that flows overland and does not infiltrate the surface material (soil or rock).

SECONDARY RECYCLING	Recycling which makes different products out of the reprocessed materials (e.g. making egg cartons from used newspaper; making a filler for asphalt from glass bottles).
SENSITIVE LAND USE	A land use where humans or the natural environment may experience an adverse impact.
SHREDDING	The mechanical size reduction of solid wastes resulting in a final product that has reasonably uniform particle size, but not necessarily of a reduced volume.
SITE CLOSURE	The planned and approved cessation or termination of landfilling activities at a landfill site upon reaching its site capacity.
SITE LIFE	This is the number of years a site can accept waste until the site reaches site capacity and ceases to receive any further waste.
SITE CAPACITY	The maximum amount of waste that is planned to be disposed (design capacity) or that has been disposed of at a landfill site.
SITE SELECTION	The process of locating and obtaining the use of suitable land; it is an important activity in the pre-operation steps in establishing a waste management facility.
SOLID WASTE	Non-hazardous, unwanted, discarded material (see also Municipal Solid Waste).
SOLID WASTE DISPOSAL SITE OR FACILITY	A site or facility such as a landfill site where solid waste is disposed.
SOLID WASTE MANAGEMENT	The systematic control of the storage, collection, transportation, processing and disposal of solid waste.

SOURCE REDUCTION	The avoidance or prevention of waste production through measures or efforts designed to reduce the quantities of waste requiring disposal. A reduction in the quantity of waste produced is achieved through modified consumer practices and changes in industrial production to generate fewer useless by-products. The minimization and prevention of waste through changes in lifestyle habits, product design, procedures, purchasing decisions, etc., is the first priority of the 3Rs.
SOURCE SEPARATION	The separation of specific materials from the waste stream at their point of generation for the purposes of reuse, recycling or further processing.
STORM WATER	Run-off that occurs as a direct result of a storm or thaw.
STUDY AREA	The geographic area which is examined in the search for the Preferred Site for a Waste Management facility.
3Rs of WASTE MANAGEMENT	A hierarchy of waste diversion in the following order: 1) Reduce; 2) Reuse; and 3) Recycle.
THREE STREAM COLLECTION	Refers to a waste collection system where waste is separated at source into wet compostables (possibly food waste), dry recyclable (blue box materials), and waste. The remaining solid waste is landfilled.
TIPPING FEE	The amount of money charged by the operator of an approved waste management facility for receiving and managing waste. The charge is based on either the weight or volume of the waste. The cost is calculated as a percentage of or equal to the total cost (capital and operating) of the facility.
TRANSFER STATION	A facility where wastes are transferred from small waste collection vehicles to larger waste hauling vehicles for transportation to a waste diversion, processing or disposal facility.

TWO STREAM COLLECTION/WET DRY PROGRAM	A waste collection system where waste is separated at source into wet compostables and the remainder which is then sorted for recyclable materials at a Materials Recovery Facility (MRF).
USER FEES	Charges for the usage of solid waste management facilities; usually assessed by weight and category of waste material.
WASTE	Ashes, garbage, refuse, domestic waste, industrial waste, or municipal refuse and other used products.
WASTE AUDIT	A study of the generation and management of waste.
WASTE DISPOSAL	Placing waste for long-term or permanent storage in a landfill or waste disposal site. Landfill and waste disposal sites must be certified for use.
WASTE DISPOSAL SITE (FACILITY)	Any land upon, into, in or through which, or building or structure in which, waste is deposited or processed and any machinery or equipment or operation required for the treatment of disposal of waste.
WASTE DIVERSION	Using the 3Rs of waste management as part of a strategy to keep used materials from going to disposal (See 3Rs of Waste Management).
WASTE EXCHANGE	A placement service where one company's waste becomes another's secondary source.
WASTE EXPORT	Refers to shipment by truck or rail of mixed waste from one municipality/province/country to another municipality/ province/country.

APPENDIX 'B'

FORM LETTERS TO AGENCY
AGENCY CONTACT LIST
AGENCY RESPONSES

November 24, 1999

Mr. Jamai Shirley
Nunavut Research Institute
P.O. Box 1720
Iqaluit, Nunavut
X0A-0H0

VIA: Fax (867) 979-4618

Dear Mr. Shirley:

Re: Solid Waste Management Planning Study - Town of Iqaluit

As you may have heard, the team of J.L. Richards & Associates Limited and Golder Associates Ltd. has been commissioned by the Town of Iqaluit to develop a solid waste management plan for the Community. One of the key steps of this assignment is to undertake a public consultation program. We have prepared a list of agencies and community interest groups (copy attached) whom we will endeavor to contact during the course of the study. Our intent is to inform the stakeholders about the study and to seek their input regarding areas of interest and concern. By copy of this letter, regulatory agencies are also being asked to identify their future role in the approval process of any waste management facilities and the project related legislation, regulations and guidelines which they administer.

During the week of November 1, 1999, the study team was in Iqaluit to start the project. During their visit, they met with Community interest groups including the Elders, various agencies, business leaders, and municipal representatives. The team also attended the first of three public meetings in which they explained the process to the participants and asked for their assistance throughout the project. Attached is the information handout provided to each of the participants. It outlines the study steps and tasks, presents a draft outline for public consultation, and a general questionnaire. The team was particularly interested in hearing how they could keep the public informed throughout the study period.

The purpose of the study is to develop an environmentally responsible, socially acceptable, and cost effective waste management plan which will meet the needs of Iqaluit for at least the next 20 years.

During the course of the study, two discussion papers will be produced. The first will identify a number of waste management alternatives which will include a description of their application and merits in the Iqaluit environment. Draft evaluation criteria will also be presented to help determine the suitability of each alternative. Stakeholder input with respect to the evaluation criteria will be obtained so as to ensure that community values are indeed reflected. The alternatives worthy of continued consideration will be identified.

A similar discussion paper and review process will be undertaken in early March when several alternative long-term waste management plans are presented. Draft evaluation criteria and stakeholder input will be used to identify the preferred plan.

We would also be pleased to receive any information which you may have regarding the legislative and regulatory framework within which the Town must act regarding the approval process.

Yours very truly,

Denis Bedard, P. Eng.
Director of Engineering & Planning

Attachments

cc: David R. Hunter, P.Eng., J.L. Richards & Associates Limited
Robin Johnstone, Golder Associates Ltd.
Tom Kent, J.L. Richards & Associates Limited

Stakeholder Contact List

	Contact Person	Phone #	Fax #	Mail #	Community
Qikiqtaaluk Wildlife Board	Joanasie Akumalik	979-1560	979-1491	478	Iqaluit
Dept. of Sustainable Dev.	Earle Beddaloo	979-5119	979-5920	1340	Iqaluit
Nunavut Water Board	Phillipe di Pizzo	360-6338	360-6369	119 X0E-1J0	Gjoa Haven
Nunavut Tunngavik Inc.	Terry Forth	979-6320	979-3240	628	Iqaluit
Qikiqtani Inuit Assoc.	Oleepeeka Ikidluak	979-5391	979-3238	219	Iqaluit
Hunters & Trappers	Sytookie Joamie	979-6848		629	Iqaluit
Nu. Impact Review Board	Thomas Kalluk	979-2140			Iqaluit
Nu. Wildlife Man. Board	Ben Kovik	979-6962		1739	Iqaluit
DIAND	Peter Kusugak	979-6274	979-8309	358	Iqaluit
BRH & SS Board	Bonnie Segal	979-7656	979-7659	Bag 200	Iqaluit
Natural Resources Canada	David Scott	979-3339 (?)	979-0708	2319	Iqaluit
Nunavut Research Institut	Jamai Shirley	979-4105	979-4681	1720	Iqaluit
Dept. of the Environ. (Fed)	Anne Wilson	669-4735		5204-50th Ave	Yellowknife, NT
C.G.T.	Doug Sitland	979-5020	979-4779	Bag 800	Iqaluit
Nunanet	Marcel Mason	979-2772	979-1513		Iqaluit

Iqaluit Beautification. Soc.	Janice Braden	979-3232	979-3240	C/o NTI	Iqaluit
Environ. Tech. Program. A.C	Lin Maus	979-4421	979-5793	600	Iqaluit
Fisheries and Oceans	Margeret Keist	979-6274	979-4539	358	Iqaluit
Environment Canada	Francois Rainville	979-3660		607	Iqaluit

facsimile TRANSMITTAL

Nunavummi Qaujisaqtulirijikkut Nunavut Research Institute

To:	**Mathew Hough**
	979-5910
Fax:	
Phone:	
Date:	
Pages:	

From: Mary Ellen Thomas
Manager, Research Liaison
Nunavut Research Institute
Box 1720, Iqaluit
Nunavut, X0A 0H0
Phone: (867) 979-4108
Fax: (867) 979-4681
e-mail: slcnri@nunanet.com

The Solid Waste Management Planning Study does not fit within our definitions of research which I have attached for your future consideration. As you will see public consultations and internal planning documents are not generally licensed.

We thank you for keeping us informed on this interesting and much needed project.

Mary Ellen Thomas
Manager, Research Liaison

Current Working Research Definition:

"The Study and Investigation in some field of knowledge which uses scientific methods to discover or establish principles. Research projects have the following features:

- *The purpose is to increase knowledge of phenomena, events and/or relationships in the physical and social disciplines;*
- *Objectives are well defined and methodology is documented;*
- *Data Collection & Analysis;*
- *Analysis and interpretation of data follows scientific methods.*

Environment Canada / Environnement Canada

Solid Waste

Environmental Protection Branch
Suite 301, 5204 - 50th Ave.
Yellowknife, NT
X1A 1E2
Ph. (867) 669-4700

Dec. 24th, 1999

Our file: 4782-012

Denis Bedard
Director of Engineering and Planning
Municipality of Iqaluit
Box 460,
Iqaluit. NT X0A 0H0

By Facsimile: (867) 979-5922

Re: Solid Waste Management Planning Study - Town of Iqaluit

Thank you for your letter of Nov. 24th, which provided an update of the progress taken on this study so far.

You had asked that regulatory agencies identify their roles in the approval processes for any waste management facilities. Environment Canada (EC) does not administer any permits in respect of waste management facilities. Our role is based in the *Department of Environment Act*, which gives jurisdiction for the preservation and enhancement of the quality of the natural environment, including water, air, and soil quality. Additionally, should the waste facility have the potential to contribute deleterious substances to waters frequented by fish (both marine and fresh waters), EC has jurisdiction under Section 36 of the *Fisheries Act*, which prohibits such deposit. EC's role of a specialist department providing input to the Nunavut Water Board is carried out under the mandates of these pieces of legislation.

With respect to your question on communication, we will be pleased to review any drafts which are produced under the study, and provide input on the preferred plan, as described in point 6 of the Work Program.

Please do not hesitate to contact me at (867) 669-4735 or by email at anne.wilson@ec.gc.ca with any questions.

Yours truly,

A. Wilson

Anne Wilson
Water Pollution Specialist

cc: Steve Harbicht (Head, Assessment & Monitoring, EPB
Ed Collins (Chief, Environmental Engineering, EPB)

Canada

[illegible]/NUNAVUT IMPACT REVIEW BOARD/NUNAVUTMI KANOGILIVALIANIKOT ELITTOHAIYEOPLOTIK KATIMAYIIT

Fax: (867) 983-2594   Phone: (867) 983-2593

Date: FEBRUARY 9, 2000

To: Matthew

Fax #: (867) 979-5910

From:

____ Joe Ahmad
Executive Director
e-mail: jahmad@polarnet.ca

____ Linda Dyer
Executive Secretary

____ Gladys Joudrey
Environmental Assess. Officer
e-mail: gladys@polarnet.ca

____ Jorgen Komak
Environmental Technologist
jorgank@polarnet.ca

____ Alexandra Thomson
Senior Researcher/Trainer
e-mail: alext@polarnet.ca

_✓_ Rey Chaudhary
Environmental Assess. Officer
rchaudha@polarnet.ca

____ Millie Evalik
Finance/Administrative Officer
e-mail: evikhoak@polarnet.ca

____ Vacant
Interpreter/Translator

____ Vacant
Public Relations Officer

Total # of Pages including this page: 7

( ) Urgent ( ) Reply ASAP ( ) Please Comment ( ) Please Review ( ) For Your Info

Comments: If you require any further information, feel free to call/email me. I have included a general summary that we give out to the public in pamphlet form.
R. C.

[illegible]/P.O. Box 2379 Cambridge Bay, NT/EKALUKTUTIAK, NUNATIAKI X0E 0C0 • [illegible]/Phone/HIVAYAOTA: (867) 983-2593 • [illegible]/Fax/FAX-KOT: (867) 983-2594

Mission Statement

The MANDATE OF THE NUNAVUT IMPACT REVIEW BOARD is to use both traditional knowledge and recognized scientific methods in an ecosystem analysis to assess and monitor on a site specific and regional basis the environmental, cultural and socio-economic impacts of those proposals for which it has responsibility, bearing in mind that the task of the Board pursuant to the Nunavut Land Claim Agreement is to determine whether proposals should proceed, and if so, under what conditions.

In making these decisions, reports and recommendations, the Board shall act fairly and carry out its responsibilities in such a way that at all times the integrity of the ecosystem of the Nunavut Settlement Area is protected so as to always promote the future and well-being of the residents of Nunavut.

For a proponent to develop a project in Nunavut, certain authorizations are required for the use land and water. However, before an agency can authorize the use of land or water in the Nunavut Settlement Area (NSA), the Nunavut Impact Review Board (NIRB) may be required to assess the ecosystemic and socio-economic impacts of the project proposal, to determine whether the project should proceed to development, and if so, under what conditions.

Introduction

WHAT IS THE NUNAVUT IMPACT REVIEW BOARD (NIRB)?

The Nunavut Impact Review Board (NIRB) was established on July 09, 1996 as an institution of public government with responsibilities for the environmental assessment of projects in the NSA as described in Article 12 of the Nunavut Land Claim Agreement (NLCA).

WHAT ARE THE MAIN FUNCTIONS OF NIRB?

The functions of the Nunavut Impact Review Board are:

(a) to screen project proposals in order to determine whether or not a review is required;
(b) to gauge and define the extent of the regional impacts of a project;
(c) to review the ecosystemic and socio-economic impacts of project proposals;
(d) to determine, on the basis of its review, whether project proposals should proceed and under what terms and conditions, and then report its determination to the Minister; and
(e) to monitor projects in accordance with the provisions of Part 7 of Article 12 of the NLCA.

WHAT ARE THE OBJECTIVES?

In carrying out its functions the primary objectives of NIRB are at all times:

- to protect and promote the existing and future well being of the residents and communities of Nunavut
- to protect the ecosystemic integrity of the Nunavut Settlement Area; and
- to take into account the well being of Canadians outside of Nunavut.

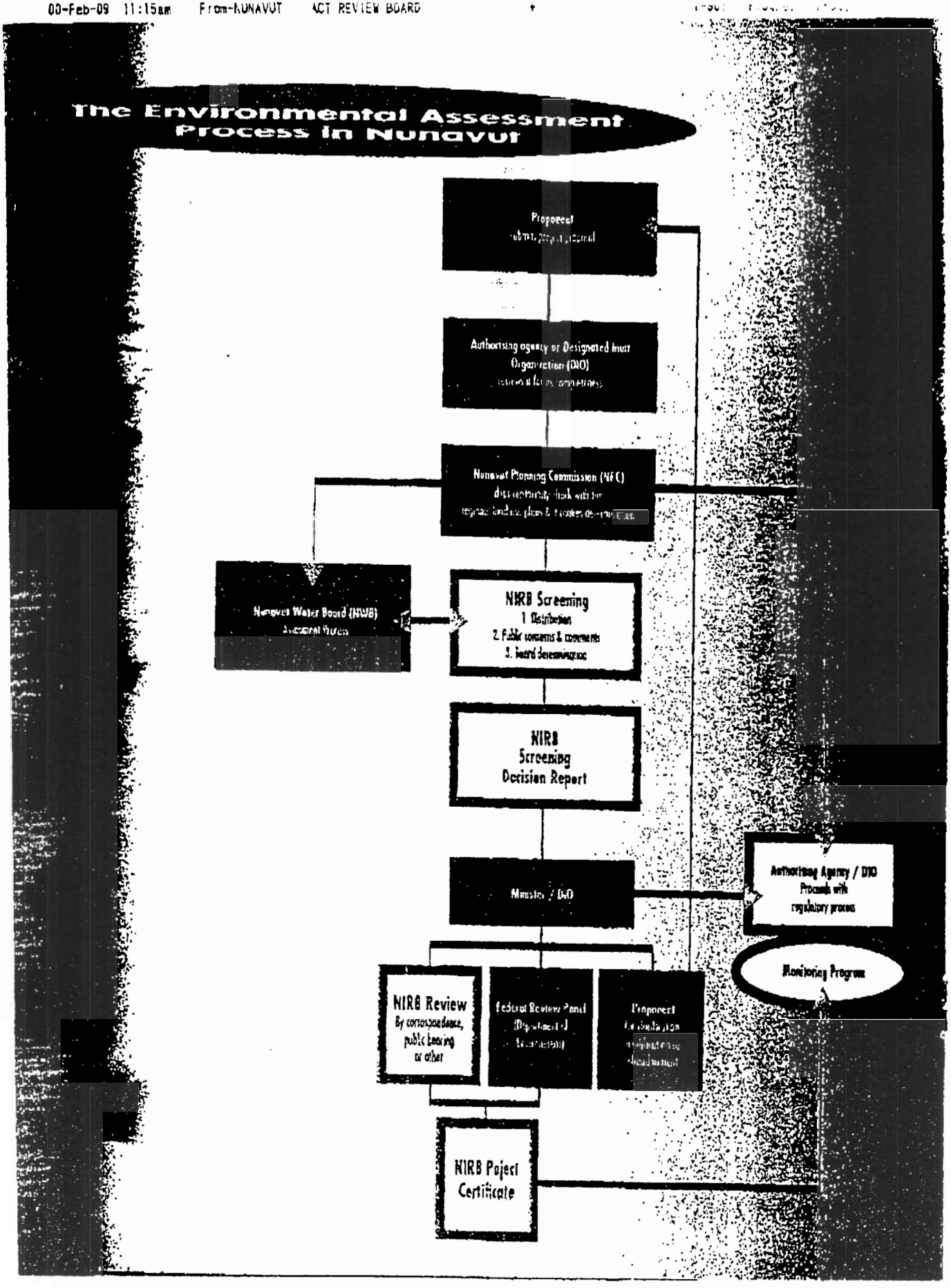
WHAT IS AN ENVIRONMENTAL ASSESSMENT?

Environmental Assessment is a systematic method of identifying potentially adverse environmental, social, cultural, economic and cumulative effects of a proposed project

Projects can have adverse effects on:

- Land • People • Water Quality • Fish • Air Quality • Wildlife • Archaeology
- Traditional Land Use • Marine areas • Marine mammals

If adverse environmental and/or socio-economic effects are identified, plans must be altered so that problems are avoided and minimized.


The Environmental Assessment Process in Nunavut
Proponent
Authorising agency or Designated Inuit Organization (DIO)
Nunavut Planning Commission (NPC)
Nunavut Water Board (NWB)
NIRB Screening
1. Distribution
2. Public concerns & comments
3. Board determination
NIRB Screening Decision Report
Minister / DIO
Authorizing Agency / DIO
Proceeds with regulatory process
Monitoring Program
NIRB Review
By correspondence, public hearing or other
Federal Review Panel
Proponent
NIRB Project Certificate

WHAT IS THE PROCEDURE FOR ASSESSMENT OF PROJECT PROPOSALS?

What is a project proposal?

A "project proposal" is a physical work that a proponent proposes to construct, operate, modify, decommission, abandon or otherwise carry out, or a physical activity that a proponent proposes to undertake or otherwise carry out.

Step 1

The initial responsibility for receiving and processing project proposals rests with the authorizing agency responsible for issuing the permit, licence, lease or approval. A project may require more than one authorization based on land (IOL, crown or commissioner) and water (marine or fresh water) jurisdictional responsibilities. The authorizing agency must ensure all the screening information is properly included with the project application and the necessary administrative details are complete.

What is an authorizing agency?

An authorizing agency is a government department, a Designated Inuit Organization (DIO) or regulatory board (e.g. federal and territorial government departments, Regional Inuit Associations, Nunavut Water Board, Community Councils, etc.) that have a regulatory responsibility or are the land owners in the Nunavut Settlement Area and are responsible for issuing a permit, lease, licence or other authorizations.

Step 2

If regional land use plans are in place, the project application is forwarded to the Nunavut Planning Commission (NPC).

Where NPC determines that a project proposal is in conformity with approved land use plans, or a variance has been approved, NPC forwards the proposal to NIRB for screening.

In the absence of an approved land use plan, all project proposals, other than those that fall within Schedule 12-1 of the NLCA are referred directly to NIRB by the authorizing agencies for screening.

What project proposals are not required to be screened by NIRB?

Project proposals are not forwarded to NIRB:

- if they are exempt from screening under Schedule 12-1 of the Nunavut Land Claims Agreement, unless NPC has concerns about the cumulative impact of that project proposal in relation to other development in a planning region.

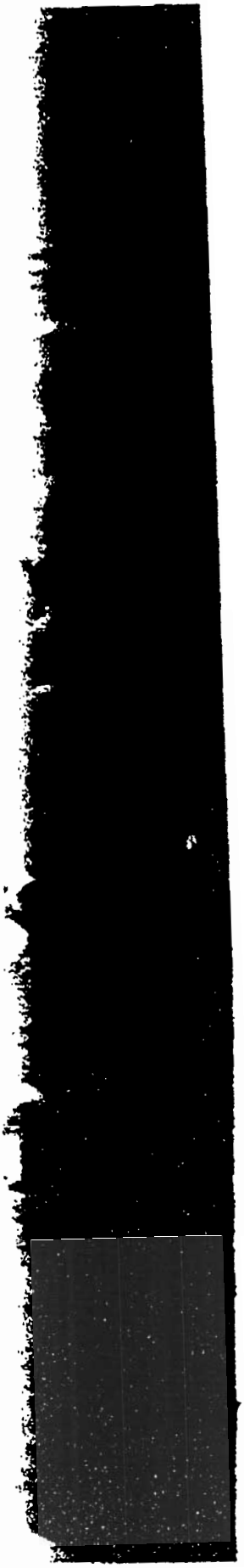
Step 3

Receipt of an Application

Once an application has been received and accepted, NIRB will:

1. notify the proponent and the appropriate authorizing agencies that the screening has begun and will assign a deadline for a NIRB screening decision; and
2. refer the project proposal to a distribution list comprised of representatives from communities, co-management boards, Designated Inuit Organizations, Community Land and Resource Committees, Hunters and Trappers Organizations, Community Councils, federal and territorial government departments, relevant wildlife management boards as well as, other individuals that the Board feels are appropriate.

The individuals on the distribution list are asked to comment on the proposal from the perspective of their knowledge of the area or respective expertise within a stated time frame, usually three (3) weeks.



Step 4

NIRB screens proposal to determine whether it has significant impact potential, and therefore whether it requires review under Part 5 or 6 of Article 12 of the NLCA.

What effects are screened?

In conducting its screening NIRB considers Inuit traditional knowledge, scientific information and all comments received from the distribution list and the public, knowledge of Board Members and recommendations of NIRB staff.

NIRB examines the effects upon the physical, biological and socio-cultural and economic environments, including any cumulative effects.

1. **Physical effects** can include impacts upon the air, the land, the surface water, ground water, permafrost, marine waters and climate.
2. **Biological effects** can include impacts upon terrestrial and aquatic plants and animals and their habitats.
3. **Socio-economic effects** can include regional benefits and impacts on human health, economics and community well-being, upon archaeological, heritage, recreational or aesthetic values or upon current and traditional use of land and resources.
4. **Cumulative effects** can include any effect which results from effects of a project when combined with those of other past, existing and future projects and activities.

NIRB also gives consideration to other relevant matters such as:

- the potential effects of accidents and malfunctions or acts of nature;
- conflict with established or proposed protected areas;
- conflicts with priority areas identified by the communities,
- conflicts with traditional use areas and Inuit lifestyle identified by CLARC, HTO, NWMB, NPC or others;
- potential to exceed air and water quality standards;
- proposed development in, or impact on surrounding land whether Inuit Owned Lands, DND, municipal or marine areas;
- benefits to local communities (e.g. IIBA, employment, training initiatives or contracts with local businesses); and
- the level of public concern and support for the project.

HOW IS INFORMATION OBTAINED?

The proponent is responsible for supplying information which adequately describes: the project proposal, any alternatives considered, its potential impacts, possible mitigation of adverse ecosystemic, socio-economic and cumulative effects, and details of the public consultation done by the proponent. More information on screening requirements can be obtained from NIRB.

Step 5

Screening Determination

Once a screening has been completed, NIRB will make one of the following determinations to the Minister and include them in the NIRB Screening Decision Report:

(a) the proposal be processed without a review, under Part 5 or 6; NIRB may recommend specific terms and conditions be attached to any approval;

(b) the proposal requires review under Part 5 or 6; NIRB shall identify particular issues or concerns which should be considered in such a review;

(c) the proposal is insufficiently developed to permit proper screening and should be returned to the proponent for clarification; or

(d) the potential adverse impacts of the proposal are so unacceptable that it should be modified or abandoned.

WHAT IS A SCREENING DECISION REPORT?

The Screening Decision Report is prepared by NIRB and submitted to the Minister with NIRB's screening determination. In the majority of cases, it is found that the proposal can be processed without a review.

NIRB shall determine a review is not required when:

(i) the project is unlikely to arouse significant public concern;

(ii) the adverse ecosystemic and socio-economic effects are not likely to be significant; or

(iii) the project is of a type where the potential adverse effects are highly predicable and are mitigable with known technology.

NIRB will then include terms and conditions in their Screening Decision Report that are to be attached to the permit, licence, lease or approval to ensure the impacts of the project are controlled or mitigated. The terms and conditions are developed based upon traditional, expert and technical knowledge as well as comments received from the distribution list.

WHEN IS A REVIEW REQUIRED?

A review is required when in NIRB's judgment:

(i) the project may have significant adverse effects on the ecosystem, wildlife habitat or Inuit harvesting activities;

(ii) the project may have significant adverse socio-economic effects on northerners;

(iii) the project will cause significant public concern; or

(iv) the project involves technological innovations for which the effects are unknown.

For the procedures of a NIRB review please contact the Nunavut Impact Review Board.

HOW LONG WILL A SCREENING TAKE?

NIRB will complete its screening responsibilities and make its indication to the Minister in writing within an acceptable time frame to allow authorizing agencies to follow any legal requirements to issue the authorization within a certain time period. However if the authorizing agency has no legal time period requirement, NIRB will make its determination within 45 days of receiving the project proposal at NIRB. NIRB may also with the approval of the Minister, exceed the 45 day time period.

WHAT IS THE PUBLIC'S ROLE?

The "public" includes individuals, groups, organizations or communities that have an interest in or could be affect by a proposed project.

The NIRB screening process presents the public with a variety of opportunities for review and comment on project proposals.

Project proposals are distributed to Community Councils, Hunters and Trappers Organizations (HTO), Community Land and Resource Committees (CLARC) and those requesting information regarding the project, and are given up to three (3) weeks to submit comments or concerns.

Project proponents are advised to consult with affected communities prior to submitting any new project proposals or amendment requests. Identifying key issues of public concern early in the planning stages has proven to be more efficient and effective means of project management and avoiding potential conflict.

All project information is filed in the Cambridge Bay office and is available for public review. Comments or concerns on a project proposal can be directed to the NIRB office in Cambridge Bay, or through a NIRB Board Member.

APPENDIX 'C'

NEWSLETTERS

TOWN OF IQALUIT SOLID WASTE MANAGEMENT PLANNING STUDY

Issue 1

December 14th, 1999

THIS NEWSLETTER....

Is the first in series concerning the Solid Waste Management Planning Study. Its purpose is to keep you informed about the study and to encourage public involvement through active participation. It is being distributed to all households and businesses in the Town of Iqaluit.

THE PURPOSE OF THE STUDY IS:

To develop an environmentally responsible, socially acceptable and cost effective Solid Waste Management Plan for the Town of Iqaluit for the next 20 years.

STEERING COMMITTEE

The Municipal Council will be creating a Solid Waste Steering Committee to provide feedback to the Technical Committee on the development of the plan. The Steering Committee will consist of:

3 councillors

1 administrative staff &

3 public members

INTRODUCTION

The Town of Iqaluit has been experiencing waste management related problems for several months. A number of residents, community interests groups, and government agencies have expressed concern about such issues as the large volumes of plastic bottles and cans in the community, litter on the streets, the burning of refuse at the landfill site, the impact of smoke from burning on the summer camp areas and the general aesthetics associated with the waste system.

Rapid growth in the community has contributed significantly to current problems. The Town's landfill site is quickly nearing capacity. It is projected to remain in service until June 2001, based upon the current method of operation.

The Town of Iqaluit, with financial assistance from the Government of Nunavut, Department of Community Government and Transportation, has initiated a Solid Waste Management Planning Study to address the municipality's long term needs. The Study Team Technical Committee will undertake a review of the Town's present waste management practices and the current and projected refuse generation rates.

Alternative waste management components for waste reduction and diversion, waste handling and collection, waste processing, and waste disposal will be identified and their applicability to Iqaluit evaluated.

The outcome of the study will be a long-term plan reflecting community values and is specific to the Town's long-term needs.

TECHNICAL COMMITTEE

Lead Consultant

J.L. Richards & Associates Limited

Sub-Consultant

Golder Associates Ltd.

Denis Bedard

Director, Engineering & Planning

Matthew Hough

Project Co-ordinator

Golder Associates

J.L. Richards & Associates Limited
Consulting Engineers, Architects & Planners

PROJECT INITIATION AND PUBLIC CONSULTATION

Iqaluit's planning study commenced in the first week of November. Study Team members were in town to identify and meet with individuals, community agencies and organizations to learn of the waste management issues the Iqaluit is facing. The Purpose of the public consultation plan is to ensure all stakeholders have an opportunity to express their views.

While many different views and concerns were expressed during the meetings, everyone agreed that there is a substantial problem with present waste management methods in Iqaluit and that a long-term plan is necessary. Concern was expressed that the Town may lack the financial commitment to implement a long-term plan or that the waste management options available to the community might be severely limited by money.

There was also great interest in where a new dump may be located. Suggested areas included the North 40 and beyond the end of the Road to Nowhere, in a place where it would not interfere with people going out on the land. There was also great interest in methods of reducing the amount of solid waste going into landfill, especially the waste generated by the construction industry. While the need for recycling programs was recognized throughout the community, concern was expressed over the long-term viability of recycling programs. The need for the proper cleanup of former landfill sites was emphasized. Everyone who was consulted is looking forward to discussing waste management options at future meetings. The study team is thrilled and grateful with the participation and interest shown by the community. With Everyone's input, a solution can be found. Qujannamiik! (Thank you!)

"It is important for everyone in the community to be involved in solving the community's waste management problem."

FUTURE PUBLIC CONSULTATION

The Study Team will return to Iqaluit during the week of January 17th to meet with the community interest groups and agencies. A public Open House and Workshop will be held. The purpose of the meetings will be to discuss waste management alternatives and to seek community feedback on their applicability to Iqaluit.

Newsletter No. 2 will be issued in January, prior to the Study Teams next visit. It will provide additional details about the study status and the proposed Open House and Workshop. In the interim, if you have any questions or comments, please contact the Engineering Department:

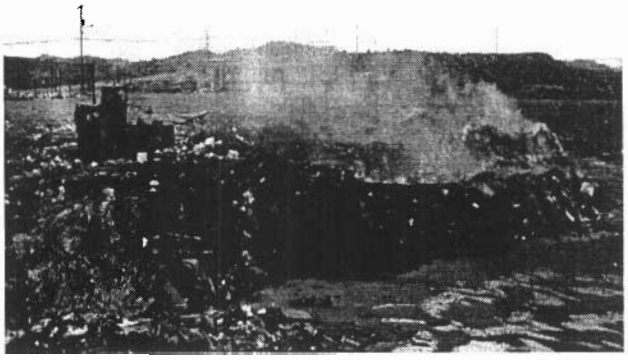
Denis Bedard @ 979-5636 or

dbedard@nunanet.com

Matthew Hough @ 979-5600 or

hough@connect.ab.ca

BURNING AT THE PRESENT LANDFILL SITE



TOWN OF IQALUIT SOLID WASTE MANAGEMENT PLANNING STUDY

Issue 2

January 5, 2000

THIS NEWSLETTER....

Is the second in a series concerning the Solid Waste Management Planning Study. Its purpose is to keep you informed about the study and to encourage public involvement through active participation. It is being distributed to all households and businesses in the Town of Iqaluit.

THE PURPOSE OF THIS NEWSLETTER IS...

To develop an environmentally responsible, socially acceptable and cost effective Solid Waste Management Plan for the Town of Iqaluit.

STEERING COMMITTEE

The Municipal Council has selected a Solid Waste Steering Committee to provide feedback to the Technical Committee on the development of the plan. The Steering Committee consists of:

Ben Ell	*Councillor*
Lynda Gunn	*Councillor*
Jushua Kango	*Councillor*
Ookalik Curley	*Staff*
Doug Sitland	*C.G.T.*
Elise Malton	*Public*
Marcel Mason	*Public*
Lynn Peplinski	*Public*
Janet Armstrong	*Alternate*

The Steering Committee will be meeting on January 18 at 7:00 p.m. in the Municipal Chambers.

PUBLIC MEETING AND WORKSHOP

Date: January 20, 2000

Time: 7:00– 10:00 p.m.

Location: Parish Hall

Contact: 979-5600

Town residents and members of the business community are invited to attend the public meeting and workshop on January 20, 2000. The purpose of the meeting/workshop is to update the public on the status of the Waste Management Planning Study and to seek input on the development of a preferred long-term Waste Management System for the Town. Information presented will include a list of potential Waste Management System components; and screening criteria and corresponding rational to assess the suitability of the components.

A workshop is proposed to apply the screening criteria to the component list. The outcome will be a list of waste management components or features, which could possibly be reflected in the Town's long-term plan.

Opportunities will be provided for questions and answers and general comments. Public input throughout the Study period is critical to the successful completion of the study and the municipality's long-term plan. This is your opportunity to provide a valuable input.

TECHNICAL COMMITTEE

Lead Consultant

J.L. Richards & Associates Limited

Sub-Consultant

Golder Associates Ltd.

Denis Bedard

Director, Engineering & Planning

Matthew Hough

Project Co-ordinator

Golder Associates

J.L. Richards & Associates Limited
Consulting Engineers, Architects & Planners