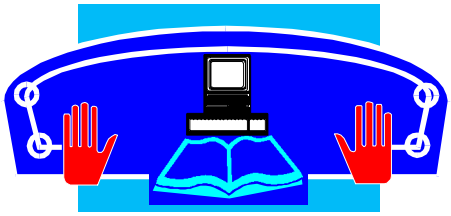

Study Of Vegetable Markets In Selected N.w.t. Communities

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APPENDICES

i. INTRODUCTION

The Department of Economic Development anu Tourism of the Northwest Territorial Government is interested in the prospects for developing anti improving agricultural capabilities in the territories. Agriculture in the north offers a number of potential advantages to residents. These include:

- opportunities for local employment;
- avoioance of high freight races;
- improved standaros of fresnness ana nutritional content; ana
- diversification and expansion of the regional economic ease ano ousiness sector.

Within the agricultural sector, one of the specific aras of opportunity relates to greennouse production anu it is this sub-sector which is addressed in this stuuy. Nichols Applied Management, in conjunction with Noval Enterprises, was commissioned to evaluate the market prospects for greennouse production in the corrmlunities of Inuvik, Yellowknife, Cambridge Bay, Rankin Inlet and Frobisher Bay. This report outlines the finaings of that study and recommends additional initiatives that may be pursued in developing northern greenhouse agriculture.

The stuuy undertakes to identify tne size of tne market for greenhouse production in eacn of tne communities reference earlier ana to identify tne potential opportunities and constraints that tnese individual markets may impose. To a large extent tne definition of "greennouse production" is market ariven. Fresh tomatoes, for example are readily

available from market gardens in California where they are grown outdoors ona year-round basis. In Alberta, however, greenhouse tomatoes are tne norm for local production. The price structure of' the market dictates that more costly production methods (greenhouse production) can replace iess costly outdoor growing methods when factors such as transportatim costs and in-transit quality deterioration are taken into consideration. What can be grown, in northern communities, is to a large extent not technologically determined but rather determined by the markets for the final products.

During the course of the stuay, the consultants defined potential greenhouse product profiies in wider terms than are tradiionally considered practical unaer commercial greenhouse standaras ana then examined the practicality of growing these crops having regard to the markets evaluated. Typical greenhouse crops in southern climates include tomatoes, long english cucumbers, peppers and musk melons. The hardiness of crops such as onions, potatoes, carrots and turnips have led to these crops being traditionally regarded as "field" crops. Accordingly, greenhouses tend to be reserved for tne more fragile crops. The advantages of northern production relate primarily to the freight benefits from producing closer to the market and freight rates are independent of tne type of product. The freight costs saved by growing 10 pounds of potatoes in tne north are identical to the freight saved Dy growing a similar poundage of tomatoes. As a result, crops that are not practical to grow in greenhouses in the soutn may be eligible for consideration as greenhouse crops in tne nortn.

For the purposes of this study, then, tne study team has included a broad range of craps encompassing tne traditional greenhouse crops but also including many otner vegetables sucn as potatoes, carrots, anu onions=

As a matter of convenience in aiscusslng tne market far vegetaoies, the potential proaucts have been aivided into four groups with like characteristics. These are:

- salaa vegetables such as lettuce, tomatoes, cucumbers, etc.;
- table vegetables such as onions, carrots, beans, turnips, etc.;
- potatoes; ana
- melons (honey dew ma musk).

Appenaix A to this report details the crops included in each of these groups ana presents the Canadian per capita consumptions of each crop.

Over tne course Of theproject,theconsultants visited each of the study area communities, including Inuvik, Yellowknife, Cambridge bay, Rankin Inlet, and Frobisher Bay. These visits were carried out during March, April anu May of 1966. The purposes of the visits were tnreefola, namely:

- to estimate the aemana for fresh vegetables in each community baseu on discussions witn local retailers, wholesalers, restauranteurs, anu operators of institutional kitchens, in oraer to estimate the potential sales fur local production and to understand tne competitive alternatives to locally-grown produce;

- to gauge the degree of community acceptance that could likely be achieved by a new local agricultural venture; and
- to unoertake sane preliminary assessment of potential sites within each comnunity giving consideration to terrain, availability of water, and proximity to an adequate source of waste neat.

The findings of these visits were integrate with our experience in other greenhouse operations, a literature review, statistical analysis and other research in order to develop the conclusions and recommendations presented in tnis report.

2. ESTIMATION OF DEMAND

The demand for fresh vegetables in each of the communities visited was determined primarily through discussions with local food retailers, wholesalers, restauranteurs and institutions. In most instances interviewees were very co-operative and often consulted historical records in order to estimate sales of various vegetable products. In some cases, though, there may have been a reluctance to provide complete disclosure for a number of reasons, including concerns about confidentiality, lack of readily available data, unwillingness to expend additional time to respond to our queries, etc. Therefore, it was necessary to make estimates of the sales of some products for certain outlets.

In order to estimate the sales of particular products for which information was not readily available, the consultants relied on the use of a number of statistical measures and indications. Per capita disappearance estimates by Agriculture Canada (see Appendix A) were used to determine the typical ratio of consumption of one vegetable to another. These ratios were then applied to the known sales levels for certain foodstuffs in order to estimate the volume of sales for other products. To use an example, Canadians consume on average four pounds of cauliflower and one pound of beets per year; expressed differently, the consumption of cauliflower is four times that of beets. If confronted with a particular outlet for which no information on beet sales was available, beet sales might be estimated on the basis of one-quarter of the sales of cauliflower, a commodity for which sales information might be documented. This estimating procedure was

repeated using as a base tne sales data of commodities for which we haci information. using this form of estimating, tne study team was aole to complete estimates of sales/usage by outlet for each product.

The estimates of potential markets for greenhouse production is premised an the assumption that local production will be competitive with existing extra-regional sources of fresh produce in terms of both quality ana price. The extent to which indigenous production can exceed these expectations will depend on the additional penetration of the local market for frozen ano canned vegetable products or the expansion of the available fresh produce market because of improvements in proauct quality or availability. The methodology employed in this study focuses conservatively on the present consumption of fresh vegetables only. The substitution of fresh for frozen or canned products would serve to increase the aemand above the estimates developed in the report.

This procedure proouces estimates for total annual market demana. It is unlikely that local production coula service total annual demand for a numoer of reasons including:

- the high costs of growing unaer artificial light in the winter;
- perioaic 'specials" in southern markets that can compete with local production;
- 8 scheduling situations where crops have nat matured in time with market demand, ana
- e other competitive actions of southern wholesalers.

However, it is expecteo the local production coulu service a significant portion of the market. For our purposes, the total , annual demand determines the extent of the commercial opportunity in each ccmmunity. For the reasons cited above, actual levels of sales for a commercial greenhouse will oe less than the levels of oemand projected by this study.

It should be noted as well that the market estimates are derived from the experiences of the commercial service sector establishments in the specific communities; tney ao not include the proauce volumes shipped by inaividual households from southern communities. This form of 'hidden market" is especially significant in the more remote communities of Cambridge Bay, Kankin Inlet and Frobisher Bay, but may still exist to same extent in Yellowknife ano Inuvik. A number of interviewees mentionea that shopping services in southern communities, especially Montreal, accept orders from northern residents for foodstuffs and other personal items, assemble tne orders and ship tnem into northern communities. In addition, it is comnon practice among northern resiaents who nave occasion to visit southern locations on business or pleasure to return with a supply of fresh produce as checkeu baggage on tne aircraft. These alternative sources of fresh vegetables represent a hidden oemand for fresn vegetables, but, it is unclear whether local production couio displace these supply arrangements. The use of southern purchasing agents will retain its appeal oue to the requirement for personal goods not readily availabie in the north anu, travellers will in all likelihood continue to take advantage of the Cost savings oy bringing in fresh vegetables when tney travel. In developing the estimates of market demand, tne consultants nave not included a factor to allow for this "hidden oemand". While lt is conceivable that local production may oe able to reduce tne size of this "hidden" market, no provision has oeen made tor the greenhouse penetration of tnat market.

In the interest of protecting the confidentiality of the interviewees, sales information has oeen summarized into the major vegetable categories aiscussed earlier. The estimated market for fresh vegetable proaucts in eacn of the stuay area communities is discussed separately in the following sue-sections of the report.

2.1 MARKET DEMAND - FROBISHER BAY

The market demand for fresh vegetables in Frobisher Bay is projected as the summation of the sales or utilization of the following establishments:

- three retail grocers;
- three hotels;
- two restaurants; ancY
- three institutional users (jail, hospital anu school).

Utilizing the procedures outlined in the previous section, the market aemand for fresh vegetables in Frobisher Bay is estimated as fallows:

Current Annual Market Demand - Frobisher Bay

	Pounds	Pounds/Capita	% of Average Canadian Consumption
Potatoes	196,000	65	41%
Salad Vegetables	151,000	50	7>%
Table Vegetables	88,000	29	60%
Melons	7,000	2	28%
	442,000	146	

Other potential markets for greenhouse proaucts in the FroDisher Bay area include additional small settlements in the Baffin Region and, possibly, Greenland. Based on conversations with the regional airline servicing Greenland, upwards of 5,000 pounds per week of vegetables are shipped out of Montreal ana Ottawa to GreenLancl via Frobisher Bay. Clearly, if local greenhouse production can displace imports from southern centres in the Frobisher Bay market, the potential should exist for displacing sales out of Montreal ana Ottawa to **Greenlancl.** During the course of this stuuy tne consultants made no efforts to carry out market investigations in Greenlana; it was felt that some initial contact between the Government of the **N.W.T.** and Greenlana officials would be appropriate and that such market research, where necessary, should be carried out during a subsequent part of a fuli **feasibiiity** analysis.

The market for fresh vegetables in other Baffin region settlements represents another potential market for Frobisner Bay production aithough tne relative economics are less clear. Currently, there are favorable air cargo freight rates from Ottawa ana Montreal into many settlements, and tne added potential to use the postal service into eastern Arctic settlements out of Vai d'Ur, Quebec. Food products, including fresh vegetables, can be mailed out of Val d'Ur at the 4tn class postal rate and still receive tne special handling necessary for perishatrle products. The net result is that mailing fresh vegetables out of Val d'Ur or using through rates out of Ottawa and Montreal are often less expensive than air freight charges to some communities out of Frobisner bay. The freight advantage into the remaining communities is minimal. Given these rate comparisons, it is almost inconceivable that

Frabisher Bay proauctian could compete with southern production on a cost basis. Unless relief from postal rates anu more realistic air cargo rates out of Frobisher Bay can be negotiated, or a compensating subsiuy arranged, it is unlikely that the econcmics will allow for the servicing of settlements out of Frobisher Bay. A comparison of relative freight advantages is presented in the following chart.

Analysis of Freight Advantage - Frabisher Bay

	Air Cargo Via Ottawa/ Mtl.	(Postal) via Val d'Or	Least Cast Alter-native	Rate from Frobisher Bay	Freignt Advantage of Frobisner Bay Production	
	----------$/kg.----------				----------$/lb----------	
Frobisher Bay	1.34	2.43	1.34	-	1.34	.61
Arctic Bay/ Nanasivik	2.64	2.43	2.43′	2.36	.07	.03
Broughton Island	2.74	2.43	2.43	2.31	.12	.05
Cape Dorset	2.69	2.43	2.43	1.99	.44	.20
Clyde River	2.93	2.43	2.43	3.76	Nil	Nil
Grise Fiord	4.66	2.43	2.43	4.45	Nil	Nil
Hall Beach	1.83	2.43	1.83	1.80	.03	.01
Igloolik	2.60	2.43	2.43	2.37	Nil	Nil
Lake Harbour	2.65	2.43	2.43	.96	1.47	.67
Pangnirtung	2.58	2.43	2.43	1.63	.80	.36
Pond Inlet	3.09	2.43	2.43	4.28	Nil	Nil
Resolute	2.64	2.43	2.43	2.43	Nil	Nil

The market for fresh vegetables in other Baffin Region settlements was estimated using regression analysis. This procedure attempts to find the best predictor of demand through the analysis of a number of potential factors sucn as income, total population, population of natives, population of non-natives, price levels, and other indicators related to the estimates of demand for each vegetable group in the five study area centres. Overall, the population of non-natives in a community was determined to be the best overall predictor of demand for each vegetable group.

Based on this finaing, and on estimates of the size of the non-native population prepared Dy the Nortnwest Territories Bureau of Statistics, the consultants assessed the demand far fresh proauce in other Baffin Region settlements as follows:

Estimates of Annual Market Demano in Baffin Region Settlements (Excluding Frobisher Bay)

	Puunas
Potatoes	70,000 - 115,000
Salad Vegetables	35,000 - 50,000
Table Vegetables	28,000 - 35,000
Melons	3,000 - 5,000
Total	133,000 - 205,000

To summarize, the potential market demand for products of a Frobisher Bay greenhouse could reach a high of 800,000 to 900,000 pounds per year calculated as follows:

Estimates of Total Potential Market From Frobisher Bay

	Frobisher Bay	Settlements	Greenland	Total
	Pounds Per Year			
potatoes	196,000	70,000 - 115,000 ?	266,000 - 311,000+	
Salad Vegetables	151,000	38,000 - 50,000 ?	189,000 - 201,000+	
Table Vegetables	88,000	28,000 - 35,000 ?	116,000 - 123,000	
Melons	7,000	3,000 - 5,000 ?	10,000 - 15,000	
Total	442,000	133,000 - 205,000	260,000	841,000 - 907,000

As indicated earlier, significant uncertainties are associated *with* these estimates in respect of 1) tne economics of shipping into the settlements from Frobisher Bay and 2) the size and characteristics of tne Greenlana market.

For the purposes of this stuay, the consultants nave reliea on a base market estimate of 442,000 pounds per year, while recognizing at the same time the possibility that favorable circumstances could virtually aouble the size of the potential market.

Expectations for this market over the next five years are for modest increases in volume tied primarily to increases in the non-native population projecteo for Frobisher bay. Projection of the Northwest Territories Bureau of Statistics call for an increase of only 28 people in the non-native population (2.5%). Based on the relationsnip between the non-native population ana total aemanu, a five year forecast for fresh vegetables was uevelopea and is presented below:

Projected Market Demand - Frobisner Bay
(000's pounds)

	1986	1987	1988	1989	1990
Potatoes	196	,197	198	200	202
Salad Vegetables	151	151	152	153	153
Table Vegetables	88	88	89	89	90
Melons	7	7	7	7	7
Total	442	443	446	449	452

In essence, the future growth in the market aemanu for fresh vegetables is expectea to be limited. During the discussions held in the northern communities, the retailers ano restauranteurs were asked as to whether there were discernible trenas in the consumption of vegetables among tne native comnunity. While it is generally believed that natives are eating more vegetables than previously, it was not felt that the trend would have a significant result on market volumes over the next five years.

It is possible, however, that local production could serve to increase levels of consumption as a result of a number of factors. The publicity, curiosity, and local interest associated with a greenhouse operation may serve to stimulate increased consumption. In addition, the potential for higher quality, possibly lower prices, and greater availability may all serve to stimulate demand. It is possible then, that the consumption estimates could expand with the introduction of locally-grown produce.

2.2 MARKET DEMAND - RANKIN INLET

The market demand for fresh vegetables in Rankin Inlet is projected as the summation of the demand by each of the following outlets:

- two retail grocers;
- one hotel (1); and
- one restaurant.

Utilizing the procedures outlined in the previous section, the market demand for fresh vegetables in Rankin Inlet is estimated as follows:

Current Annual Market Demand - Rankin Inlet

	Pounds	Pounds/Capita	% of Average Canadian Consumption
Potatoes	43,000	32	21%
Salad Vegetables	50,000	37	56%
Table Vegetables	22,000	16	33%
Melons	*	1	10%
		86	

1. Volumes related to institutional use are reflected in the estimates for the hotels, which cater the meals for the local school.

Other settlements in the Keewatin Region also represent a potential market for greenhouse production in Rankin Inlet and the consumption volumes for those centres have been estimatea utilizing the regression analyses described in the previous subsection. The estimates derivea for the various Keewatin Region settlements are as follows:

Estimates of Annual Market I,lemana in Keewatin Region Settlements (Excluding Rankin Inlet)

	Pounds
Potatoes	35,000 - 60,000
Salad Vegetables	20,000 - 25,000
Table Vegetables	14,000 - 19,000
Melons	1,000 - 2,000
Total	70,000 - 106,000

The inclusion of these settlements as potential markets is premised on an analysis of freight advantages. While in all instances it costs less to ship to tne settlements in the region from Rankin Inlet vis-a-vis southern communities such as Winnipeg, the differences in freight rates vary by commodity and destination. It is reasonable to assume that the production costs of a greenhouse in Rankin Iniet will be greater than wholesale prices in Winnipeg and that there will be a reliance on the freight differential to give an economic advantage to production in Rankin. The freight differential, and production costs, then become important factors in determining how much of the market can be competitively accessed. An analysis of freight rates indicates that a freight advantage from Rankin is possibie in respect of all tne settlements although, due to the possibilities for routing freight through Churchill or Thompson, the cost advantage is

not always equal to the Winnipeg/Rankin Inlet freight rate. in audition, rate differences apply to various commodities with the alternative of shipping hardy vegetable products such as potatoes, carrots and onions to Churchill, Manitoba via railway and from there into the settlements via air cargo. Shipping times and other uncertainties make the latter routing a practical alternative only for hardy proaucts. Salad vegetables, melons and most table vegetables generally must De transported by air cargo out of Winnipeg.

The following table summarizes the freight cost advantages of producing in Rankin Inlet as opposed to snipping vegetables out of Winnipeg, assuming an air caryo load of 200 kilograms or more.

Analysis of Freight Advantage - Rankin Inlet (Air Cargo)

Destination	via wpg.- Thompson	via wpg.- Churchill	via wpg.- Rankin Inlet	Least Cast Alter- native	Rate Fram Kankin Inlet	Freight of Rankin Production	Adva Inl
	$/kg					$/10	
Rankin Inlet	$2.09	2.03	1.63	1.63		1.63	.74
Eskimo Point	1.60	1.63	2.37	1.60	.74	.86	.39
Whale Cove	1.81	1.89	2.13	1.81	.50	1.31	.59
Chesterfield Inlet	2.35	2.27	2.17	2.17	.54	1.63	.74
Baker Lake	2.25	2.43	2.49	2.25	.86	1.39	.63
Coral Harbour	3.(I7	3.15	2.80	2.80	1.17	1.63	.74
Repulse Bay	3.14	3.23	2.84	2.84	1.21	1.63	.74

The freight advantage is reaucea for vegetables that are hardy enough to withstand five to seven aays shipping time. The following table summarizes these costs.

Analysis of Freight Advantage - RanKin Inlet (Rail/Air Cargo)

Oest ination	via Rail Wpg.- Churchill	Rate from Rankin Inlet	Freight Advantage of Rankin Inlet Production	
	$/kg		$/lb	
Rankin Inlet	1.39		1.39	.61
Eskimo Point	.99	.74	.25	.11
Whale Cove	1."25	.50	.75	.34
Chesterfield Inlet	1.63	.54	1.09	.49
Baker Lake	1.79	.86	.93	.42
Coral Harbour	2.51	1.17	1.34	.61
Repulse Bay	2.59	1.21	1.38	.63

Clearly, there remains a freight advantage in terms of servicing these communities out of Rankin Inlet, although, the advantage is not equal in respect of all communities. The pricing of greenhouse products will largely determine wnetner tkse markets are accessible. For purposes of this stuay, it is assumed that these markets can be accessea in a competitive manner and that they will contribute to volumes of a greenhouse facility in Rankin Inlet, with the exception of hardy vegetables into Eskimo Point and Whale Cave.

Making the appropriate adjustments to reflect the relative economics of the various freight costs, the following summary of market demand is derived.

Estimates of Total Accessible Market - RanKin Inlet

	Rankin Inlet	Keewatin Settlements	(less) inaccessible market aue to limited freight Advantage	Total
	lbs./year			
Potatoes	43,000	35,U00 - 60,000	11,000 - 18,000	67,000-85,0
Salad Vegetables	50,000	20,000 - 25,000		***70,000 - 7>,0***
Table Vegetables	22,000	14,000 - 19,000	2,000 - 3,000	34,000 - 38,0
Melons	1,000	1,000 - 2,000		2,000 - 3,0
Total	116,000	70,000 - 106,000	13,000 - 21,000	173,000 - 201,0

NO significant volume changes are expectea in this market over the next five years. The NWT Bureau of .Statlstics estimates that the non-native population level in Rankin Inlet ' and elsewhere in tne region will be stable over the perioci 1986 to 1990. Based on the strong relationship between the non-native population and consumption, it is not realistic to expect significant consumption increases.

As discussed earlier in Section 2.2, small increases in the consumption of vegetables by natives, may be expected but cannot be quantified. In the interests of reflecting a conservative estimate of the market demand, then, no increase in vegetable consumption is assumed over the next five years. As mentioned earlier, however, local production of fresn produce may increase interest and awareness levels within the community and result in some increases in consumption. Any consumption increases of this nature are unlikely to spill over to the outlying settlements.

2.3 MARKET DEMAND - CAMBRIDGE BAY

The market aemand for fresn vegetables in Cambridge Bay is estimated on the basis of the current sales of the two retail outlets. The only other outlet for fresh vegetables in Cambridge Bay, the hotel restaurant, is ownea by the Co-op ano the consumption estimates for this outlet are captured in the estimates of retail volumes collected at the Co-op retail store.

To repect the confidentiality of the two retailers, demand estimates presented in this report incluae volume estimates for the corrununities of Spence Bay, Gjoa Haven, ano Pelly Bay, It should be noted that Coppermine is not incluoed as the freight advantage is so minimal that it is unlikely that

Cambridge 8ay production could economically be sold in Coppermine. lhe following table presents the anaiysis of relative freight costs.

Analysis of Freight Advantage - Camoridge bay

Destination	From Edmonton	From Cambridge Bay	Freight Advantage from Producing in Camoridge bay	
	$/kg.			$/lb.
Cambridge Bay	1.60		1.60	.73
Coppermine	1.80	1.70	.10	.05
Goa Haven	3.55	2.07	1.48	.67
Pelly Bay	5.19	2.75	2.44	1.11
Spence Bay	3*9U	2.44	1.46	.66

Estimates of consumption volumes for the expanded market as defined by areas of significant freight advantage are summarized below:

Estimates of Total Accessable Markets - Cambridge Bay

	Pounds	Pounds/Capita	% af Averaye Canadian Consumption
Potatoes	30,000 - 36,000	11.05 - 13.25	7% - 8.5%
Salad Vegetables	29,000 - 31,000	11.68 - 11.41	L6% - 17%
Table Vegetates	15,00(1 - 17,000	5.>2 - 6.26	11% - 13%
Melons	2,000 - 3,000	.74 - 1.10	9% - 13%
Total	76,000 - 87,000	27.99 - 32.02	

As with Frobisher Bay and Rankin Inlet, significant expansion of the market for fresh vegetables is. unlikely to occur without increases in the size of the nun-native population. Projections for the Kitikmeot Region call for a static non-native population over the next five years. Again, however, the interest anu awareness provided oy a community greenhouse may contribute to higher levels of local consumption, especially among natives.

2.4 MARKET DEMAND - INUVIK

me market demand for vegetables in Inuvik is based , largely an discussions with two wholesalers, ana a retailer of vegetable products. One of the wholesalers alsa operated a retail outlet but subsequent to the field visits nas ceased operations. It has been determined that virtually all of the vegetables consumed in Inuvik, including institutional anu restaurant valumes, were captured by the operators interviewed.

Estimates of consumption in Inuvik for eacn of the groups of vegetable products are presented below.

Current Annual Market Demand - Inuvik

	Pounds	Pounds/Capita	% of Average Canadian Consumption
Potatoes	480,000	148	95%
Salad Vegetables	180,000	57	86%
Table Vegetables	140,000	45	93%
Melons	25,000	8	92%
	825,000	258	

Consumption volumes on a per capita oasis are very similar to Canadian averages, ana the factors contrioutiny to this are discussed below:

- the availability of road transportation into Inuvik for most of the year allows for vegetables to be brought in at a much lower price than in the other Arctic communities aiscussea so far;
- the comparatively high percentage of non-native population (approximately 60%) influences the consumption of vegetables upwards;

- some industrial camps are serviced out of Inuvik with fooa products; nowever, tneir employment figures have not been included in the population estimates used to derive per capita consumption; ana
- the Canadian average per capita consumption as estimated by Agriculture Canada likely understates true Canadian consumption as it does not include the consumption of crops from personal gardens. Given that consumption from personal gardens is minimal in Inuvik, but much more prevalent in more densely populated southern regions, it is likely that Inuvik consumption corresponds less closely to the Canadian average than is suggestea by the market estimates.

A numoer of communities surrounding Inuvik would also offer potential markets for locally-produced vegetables. However, the limited freight advantage offered from an Inuvik basing-point infers that production costs in Inuvik woula nave to resemble those in southern climates and, particularly for non-typical greenhouse crops, this is unrealistic. Tne freight advantage into all of the settlements from Inuvik (except tnose on the highway into Inuvik) is estimated at $.i8 per pound, wnich corresponds to the truckload rate far produce out of Edmonton. Proauce for communities such as Tuktoyaktuk, Aklavik, Paulatuk, Sachs Harbour anu Holman is currently trucked to Inuvik and re-shipped via air (or winter road). Tne cost from Inuvik ta the communities would ae the same whether the produce originate in Inuvik or Edmonton, anu therefore, a freight aavantage of $.18 per pound for tne outlying communities is estimated.

A good deal of uncertainty is associated with the short-term prospects for economic activity in the Inuvik region. Historically, drilling rigs in the Beaufort Sea have been major consumers of vegetables. The recent downturn in oil prices nas had a devastating impact on exploration activity in the region and tne prospects for recovery are unclear. In the long term it is realistic to expect that exploration ana increased economic activity will take place, but the three-to five-year horizon cannot be predicted with any degree of certainty due to the potential for various energy-related market influences.

In the context of this market analysis, then, no provision is included for the consumption of fresh proauce by industrial camps. The market estimates derived from the the methodology described earlier predicts consumption in the surrounding communities of Arctic Red River, Fort McPherson, Aklavik, Tuktoyuktuk, t-blman, Sachs Harbour, Fort Franklin, Fort Norman, Norman Wells, Fort Gooa Hope and Paulatuk. These estimates are provided below.

	Annual Consumption (lbs.)
Potatoes	150,000- 250,000
Salad Vegetables	80,000 - 108,000
Table Vegetables	50,000 - 75,000
Melons	5;000 - 10,000
Total	285.000 - 440.000

In summary, the total annual demand for fresh vegetables in the Inuvik region is estimated at 1,110,000 pounds to 1,265,000 pounas. These volumes 00 not incluae tne consumption attributable to resource camps in the area.

A projection of voiumes for the next five years suggests that only modest increases in voiumes can be expected, based on the population estimates of the NWT Bureau of Statistics. Due to the dependence on oil activity for a significant portion of the economic activity in the region, a great deal of volatility in consumption is possible. If the present downturn in ail prices is viewed as temporary, the current population ana consumption levels will likely prevail over the next few years. However, under a scenario of continuing energy price weakness, the regional population could drop significantly and consumption of vegetables would be adversely affected. A return to higher oil prices could lead to a new "boom" and further increases in population ana consumption. Any predictions of tne outcome of the oil price debate can only be speculative. For the purposes of this report, it is assumed that present levels of population ana consumption will remain unchanged aver the next five years.

2.5 MARKET DEMAND - YELLOWKNIFE

The market aemand for fresh produce in YellowKnife has been assessed on the basis of discussions with t'our retailers, which also aperate as wholesalers to tne hotels, restaurants, institutions and camp outfitters in the area.

Estimates of local consumption developea using the methodology discussed earlier are presentea in tne table below:

Current Annual Market Demand - YellowKnife

	Pounds	Pounds/Capita	% of Average Canadian Consumption
Potatoes	1,450,000	130	83%
Salad Vegetables	775,000	69	105%
Table Vegetables	525,000	47	47%
Melons	60,000	6	64%
	2,810,OU(I	251	

Consumption patterns in Yellowknife resemble closely those of most other cities in Canaua. The apparently nigh level of consumption of salad vegetables probably is attributable to some of the same reasons aiscussea in relation to the Inuvik analysis.

No estimates have been maae of proauce consumption in other corrrnunities in the region. Due to the potential for field agriculture south of Great Slave Lake, the terms of reference for this study were restricted to the Yellowknife market only. Accordingly, the market estimates are based only on the demand served by Yellowknife wholesalers.

The local market for vegetables is projected to grow over the next five years as a result of population increases. The Northwest Territories Bureau of Statistics projects that the Yellowknife population will increase from 11,214 in 1986 to 11,703 in 1990, an increase of aoout 4% over that time perioa. Consumption patterns are expectea to remain similar to tnose at present. Projections for consumption growth are presented in the following table.

Projected Market Demano - Yellowknife

	1985	1986	1987	1988	1989	199(J
	(000 lDs.)					
Potatoes	1,450	1,468	1,486	1,504	l,5i9	1,532
Salaa Vegetables	775	785	7Y4	8(J4	812	8i9
Table Vegetables	525	531	538	845	55Ll	555
Melons	60	61	62	62	65	63
Total	2,810	2,845	2,880	2,915	2,945	2,969

2.6 SUMMARY - MARKET DEMAND

The available market for fresh produce in each of tne ' communities examined is summarized below.

Estimated Annual Market Value

	Frobisher Bay	Rankin Inlet	Cambridge	InuviK	Yellowknife
Potatoes	196	67- 85	30 -36	63(1 - 730	1,4X
Salad Vegetables	151	70- 75	2Y -31	260 - 285	77>
Table Vegetables	88	34 - 38	15 - 17	19U - 215	525
Melons	7	2- 3	2- 3	30- 35	bo
Total	442	173 - 201	76 -87	1,110 - 1,265	2,810

The market volume available to a greenhouse operation is an important factor in ascertaining commercial feasibility. It is important, however, to weigh those potential volumes against the revenues necessary to achieve a profitable level of operations.

Market forecasts can be analyzed jointly with freight advantages in order to measure the potential for a proposed greenhouse operation to achieve a profit-making level of operation. In simplistic terms, northern production can be sold at a price as high as tne landed cost of southern production but if prices exceed the costs of soutnern proaucts sales of local proaucts cannot be assured. As a measure of tne potential for profitability one can multiply volumes by tne estimated freight advantage in order to determine tne amount of freight that would be savecl by prouucing in the north. This becomes a good indication of profitability potential.

Freight advantage does not represent the only savings associate with production in the north. Savings can result from streamlining of the distribution process, because the greenhouse will be able to sell directly to the retailers, restaurants, and institutions. In addition, there is also likely to be some savings in terms of reauced spoilage, particularly in centres relying on air transportation. The value of these two advantages is difficult to quantify and will vary substantially for each product. For the purposes of this preliminary study, it is assumed that these advantages serve to partially offset the higher operatiny costs of growing in a greenhouse as compared to the costs of growing in outdoor fields in the south.

In order for a greenhouse to operate successfully, however, the freight advantage will nave to oe sufficient to compensate for the remaining cost differentials between growing field crops in the south and greenhouse craps in the north. Volume estimates and freight advantages are presented in the following table.

	Volume (000's lbs.)	Freight Advantage ($/lb.)	Total Maximum Freight Advantage ($)
Frobisher Bay	442	.61	$270, 000
Rankin Inlet	173 - 201	.70 (avg.)	121,000 - 141,000
Cambridge Bay	76 - 87	.70 (avg.)	53,000 - 61,000
Inuvik	1,110 - 1,265	.18	200,000 - 228,000
Yellowknife	2,810	.18	225,000

Using this form of analysis, it is clear that Frobisher Bay is a preferred location to uoth Inuvik anu Yellowknife because the total freight advantage is niyner ana

required volumes are lower. In selecting a preferred location from among the remaining three alternatives, it is necessary to examine the minimum size of a greenhouse that could be operated effectively.

It is expected that an efficient northern greenhouse will require the services of a competent horticulturalist. Based on our understanaing of typical salaries, northern and hausing allowances and relocation costs, a horticulturalist willing to relocate could cost $80,000 - $100,000 per year. This is $40,000 - $60,000 more than would be incurred in a southern community. Clearly this indicates that the prospects for developing a profitable greenhouse in Cambridge Bay, are slim, as the total freight advantage may only just cover tne added cost associated with retaining a qualified manager. (Over time, it may be possible to train a local resident to fill the managerial position, and thereby reducing this cost somewhat.)

Rankin Inlet and Frobisner Bay appear to be corrrnunities most capable of supporting a greenhouse operation. However, a more detailed feasibility stuay is required to place the market conditions into the context of a realistic operating approach and business plan.

3. OTHER ISSUES CONCERNING NORTHERN GREENHOUSES

In aodition to the dominant question of market demand, there are a numoer of other issues of critical concern that require a thorough review prior to any final decision to build and operate a greenhouse operation in the north. These issues are presented in this section and their implications are discussed.

The commissioning of tnis study nas been premised on waste heat being available fran tne Northern Canada Power Commission. It is understood that NCPC nas a policy of making waste heat available to the territorial government providing that the capital costs of the collection and distribution systems are not borne by NCPC. As a result, one of the overriding considerations in the siting of a waste heat-based greenhouse facility is tne proximity to the local NCPC piant.

Other issues to consider in determining an appropriate site are related to the terrain and to tne availability of water on a year-round basis. A greenhouse operation consunes large amounts of water ana it woula be essential that it be available on a year-round basis.

Oecisions related to location, building materials selection, and greenhouse design shoula aiso give consideration to protection from vandalism. It was volunteereo oy a numoer of the peopie interviewed that the inciaence of vandalism in the communities is quite nigh and that glass buildings may become an inviting target. The implication of undetecteo damage under conditions of severe cola could very quickly destroy an entire crop.

Northern waste heat greenhouses will nave a number of requirements in aadition to a waste heat recovery system. These include:

- a complete back-up heating system that can replace the heat normally obtained from the waste neat source;
- an alarm warning system to aiert officials of heat losses due to vandalism, storm damage, waste heat malfunctions or other causes; aria,
- supplementary lighting for extending the growing season.

Skills in marketing, shipping ana customer service, in addition to those of a horticulturalist will also be important components of a successful northern greenhouse. While it may be realistic to expect to capture a significant portion of the market with local production, it will require service, responsiveness anu an efficient Dusiness-oriented operation to be able to retain market share aria, in some instances, to expand into other geographic areas.

4. CONCLUSIONS

lhis study identifies tne market ana market potential for local production of vegetables in selected northern communities. In simplest terms, the greatest market potential is hela Dy those communities which are isolated from highway linkages to the south. me high cost of freight into isolated communities provides the opportunity for local productonto compete even though it will undoubtedly be more expensive to grow produce in the north than in the south.

While this stuay identifies the potential for waste heat greenhouse production, it does not fully aadress numerous technical issues concerning tne growing of.vegetables in the north. Existing technologies and growing techniques have been developed in greenhouses around the woria for growing crops such as tomatoes, iong english cucumoers, ana other more fragile vegetables ana plants. Until recently, however, limited attention has been paid to growing more haroy field craps such as potatoes, carrots ana onions in greenhouses as field production is inexpensive and efficient in southern climates. The research efforts of a numuer of scientific projects in Rankin Inlet, Sanikiluaq, Ellsmere Island, and Pond Inlet have and are continuing to explore alternatives for northern vegetable production using combinations of inuoar, Outaoor and cold frame growing environments.

It is expectea that the results of these projects will aid in the development of an operating configuration fur northern waste heat commercial greenhouses. Development of an operating configuration will require the exploration of a number of alternatives for various crops including:

- timing of the growing season for various crops;

- alternatives for indoor germination ana outaoor ana/ar cold frame growing environments;
- optimal utilization of space, heat and lights with concern for operating costs; ana,
- possibilities for underground heating of an outdoor growing environment.

In summary, an adequate market likely exists in Frobisher Bay and perhaps Rankin Inlet for furtner consideration of a commercial waste heat yreennouse. A series of technical questions remain as to now to efficiently yrow certain crops in northern conditions. Some of tnese questions of efficient growing techniques can be addresseo during the development of a feasibility study and business plan, but it is expected that there will still be a need for experimentation and development work auring the first few years of operation.

5. RECCMMENOATIONS

Given the potential requirement for on-going experimentation and development auring the first few years of operation of a nortnern greenhouse, it is recommenaed tnat efforts be concentrated on the investigation and possible construction of one pilot waste heat greennause in tne most promising of the locations investigated. The greenhouse concept can be ultimately expanded to other communities if experience warrants this.

Basea on market investigations to aate, it is recamnended that Frobisher Bay be seiected for comprehensive evaluation as a potential site fOr a commercial waste heat greenhouse. This recarmnenaation is based on the strengtn of the available market and the freight aavantage afforoeu Dy tne isolation of the community. The present market, as identified in tnis study, is estimated to be in the oraer of 442,000 pounds per annum and offers the greatest potential ot tne communities evaluated. In addition, the Frobisner Bay Location offers opportunities for expansion including:

- Possibilities for negotiating more favorable air cargo rates into the surrounding settlements in order to improve regional freight advantages anu thereby expand the potential market;
- the potential for penetrating markets in Greenland; anu,
- anticipated consumption increases based on population projections.

Components of a comprehensive evacuation of Frobisher Bay as a potential waste heat greenhouse site snoula include:

- an evaluation of alternative sites;
- analysis of Frobisher Bay climatic conditions;
- development ofan operating plan;
- capitai cost estimation;
- operating cost estimation; ana

a overail feasibility assessment.

With respect to site evaluation, the Northern Canada Power Commission currently operates twa plants in different parts of Frobisher Bay; neither of these plants operates on a full-time basis. Site selection should consider whether waste heat might be gatherea from one or both plants or whether there are alternatives for negotiating an agreement with NCPC to keep one plant in use at all times. Other site selection criteria would include consideration of topography, soil/gravel conditions, year round availability of fresh water, ana sufficient acreage to satisfy production requirements.

The analysis of Frobisher Bay climatic conditions should include the following factors: average wind speed and direction, hours of sunlight, average temperatures, and numoers of frost free days. A comprehensive weather analysis will be critical to the configuration of cost efficient indoor/outaoor/colo frame growing strategies.

An operating plan based on site and weather analysis and addressing issues of square footage, type of construction , crop requirements, inaoor/outdoor/cold frame combinations, will be critical to tne success of tne venture. It is expected that alternatives that invoi.ve indoor germination in tne spring ano outdoor or cola frame growing in tne summer will aoa to tne

Appendix A

Summary of Canadian per Capita Consumption

Salad Vegetables	lbs/capita/year
Cabbage	14.2
Celery	9.4
Cucumber	4.0
Lettuce	20.5
Peppers	3.4
Radish	1.5
Tomato	12.8
	65.8

Table Vegetables	
Beans	1.5
Beets	1.0
Broccoli	2.2
Brussel Sprouts	.2
Carrots	18.5
Cauliflower	4.0
Onion	14.5
Parsnip	.3
Peas	.1
Rutabagos	6.1
	48.4

Potatoes	
All varieties	156.2

Melons	
Muskana honey dew	8.7
Grand Total	279.1

Source: Agriculture Canada

APPENDIX B

-TO FOLLOW-

- transportation costs, in relation to the delivery of construction materials and operating supplies;
- weather and other data relevant to possibilities of maturation of plants outdoors;
- year round water supplies and quality;
- local soil and gravel characteristics for determination of appropriate growing mediuns;
- labour supply and costs - construction anti operating phases; ana
- utility costs of backup heating system ana electrical requirements.

Based on the forgoing analyses and the findings of the market study, the study team will be in a positian to prepare a conceptual model of development for the Frobisher Bay greenhouse, encompassing;

- a description of the proposed facilities ana ancillary services;
- size of facility;
- outdoor acreage requirements;
- proposea sites;
- proposed production model recognizing operating considerations, crop characteristics, climate and market conditions; and
- operational requirements.

Critical to the development of a production model will be the thorough analysis of climatic comitians. If proaucts can be grown outside, it will De necessary to have a

thorough understanding of average temperatures, precipitation, frost-free days and sunlight. Alternatives such as under soil heating and/or removable covers may also be considered as a means of extending the outdoor growing season.

Task 2. Financial Feasibility

On the basis of the market, engineering, and technical analysis, the study team will be able to evaluate the financial feasibility of the proposed operations in Frobisher Bay.

The capital and operating costs of the facilities should be estimated by engineers convergent with waste heat greenhouses. These data can then be incorporate with the revenue estimates based on the market analysis to derive proforma profit and loss accounts covering the first five years of operation of the greenhouse.

Various sensitivity analyses are required in order to ascertain:

- the financial effects of changes in the production profile (i.e. changes in the product mix, capacity, and output);
- effects of pricing variations on profitability;
- effects of changes in market penetration or volume of output on financial performance;
- breakeven levels of activity;
- effects on profitability of different capital financing alternatives; and,
- implications of changes in key operating parameters and costs.


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MANAGEMENT

The study team should then prepare a sununary of the apparent financial feasibility of the greenhmse operations, the levels of risk attached to the development of the project, and the key variables on which the financial viability will rest. This summary report should be submitted for review by Economic Development and Tcurism, Renewable Resources.

Task 3. Operational and Financial Plan

Assuming that the findings of the financial feasibility analysis are positive, an operational and financial plan will be required.

The operational plan should include:

- a recommended organizational framework and structure for the greenhmse operations, recognizing the operational requirements of the facilities and the unique characteristics of the host community;
- a manpower plan, with related job descriptions and required qualifications.

Hands-on operating experience with waste heat greenhouses will be extremely useful in developing the project operational plan.

The financial feasibility of the proposed project should be prepared on the basis of the most likely market, financial, and operating conditions, i.e., the 'base case". Various government and financial assistance programs (e.g.

E.D.A. , energy conservation programs, etc.) shoulci be investigated and in the preparation of an appropriate financing plan for the greenhouse. me deliverables of this task incluoe:

- profit and loss projections;
- pro forma balance sheets; and,
- source and application of funo statements, including the capital financing plan.

Task 4. Implementation Strategy

A business plan and implementation strategy will be required to serve as a guide to bringing the project to fruition. The plan should describe:

- the relative roles ana responsibilities of the public anu private sectors, including the local community, necessary to enhance the potentiai success of the greenhouse. It will be necessary to investigate the applicability of relevant government programs in other areas of Canaoa in terms of potential greenhouse developments in tne N.W.T. Recommenoations regarding similar initiatives that might be undertaken to support these projects in the north shouio be formulate;
- a sequential scheouie of activities to project start-up, including areas of further research anu analysis, negotiations for waste heat use, lano acquisition, training and hiring, etc.

Task5. Reporting

The findings from this program of study should be incorporated with the market research assessment into a draft report and presented to Economic Development and Tourism for review. The feedback from the Department will be considered in terms of revising the draft report and filling any gaps in the analysis.

Task 6. Public Consultation and Review

Subject to approval of the Department and its review of draft findings, the study team may be required to meet with comnunity representatives in Frobisher Bay to:

- discuss the key findings of the report;
- assess the level of local interest in pursuing the greenhouse opportunity;
- identify connnunity concerns and issues related to the potential development of the project;
- identify potential individuals, firms, or organizations that might become involved in the operation of a greenhouse.

Following from these meetings, the study team should undertake the necessary revisions to the draft report for submission to the Department.

The firms of Nichols Applied Management and Noval Enterprises Limited would be prepared to undertake this work plan as a joint venture. Based on the above-outlined work plan, it is estimated that activities could be completed for an approximate cost of $50,000 comprised of $40,000 professional

fees and $10,000 expenses. Precise cost estimates could be established following agreement on specific requirements in the areas of reporting, presentation of results and liaison with interested parties in Frobisher Bay.

It should be stressed that it is essential that the initial visit to Frobisher Bay take place prior to the first snow fall in order that geophysical assessments of site alternatives can be conticted.

APPENDIX 6

Required Program of Study

In order to implement the recommendations containeo in this report it will ue necessary to assess the overall technical and financiai feasibility of tne praposea greenhouse and prepare a recomnendeci implementation and business plan to guide the development of the project in Frobisher bay. This Appendix details a program of study designed to accomplish these objectives.

Task 1. Development of Physical and Production Parameters

This task should commence with a field trip to Frobisher Bay by engineering specialists skilled in the areas of waste heat systems and greenhouse requirements. Over the course of the fieid trip the study team should examine alternative sites with respect to their suitability as a greenhouse site. Water availability, proximity to waste heat sources, adequacy of acreage and protection from vandalism will all be key parameters in site selection. (It is understood that FroDisher Bay is considering the construction of a new garbage incinerator. This may offer an alternative source of waste heat.)

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NICHOLS APPLIED MANAGEMENT

1100 A. E. LePage Building, 10130 - 103 Street, Edmonton, Alberta T5J 3N9 Telephone (403) 424-0091 Telex 037-2966

August 25, 1986

Our File #85-583

Mr. Syd Kirwan
Head, Renewable Resources
Economic Development and Tourism
Government of the Northwest Territories
Yellowknife, N.W. T. XIA 2L9

COMMERCE DIVISION
AUG 27 1986

Dear Mr. Kirwan:

Re: N.W. T. Greenhouse Project

As discussed in our telephone conversation on Friday, enclosed are two copies of Appendix B to our draft report.

If you have any questions or concerns please do not hesitate to call.

Yours truly,

Louise a Lainer

Steve A. Adams
Senior Consultant

SA/ll

Encs.

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