June 3, 2003

Mr. Dave Parker
Community Government and Transportation
Government of Nunavut
Iqaluit, Nunavut
XOA OHO

RE: Cape Dorset Sewage Treatment Options

Dear Mr. Parker:

In response to your request, we are pleased to submit this proposal to summarize the sewage treatment practices and treatment options for the Hamlet of Cape Dorset. The work will build on previous studies and letter reports, including our recent letter comparing a mechanical treatment plant and a new sewage lagoon. The option of expanding the existing sewage lagoon will also be examined in this new study.

Our proposed work scope, budget, and schedule follows:

1) WORK SCOPE

The main components of the study will be as follows:

i) Introduction and Background:
- community info
- existing sewage disposal
- regulatory history

ii) Existing Sewage Practices:
- existing lagoon system
- lagoon deficiencies
- repairs and upgrades
- previous study recommendations

iii) Sewage Generation and Treatment:

Generation:
- population projections
- sewage generation
- sludge generation

Treatment
- review of previous studies
- options considered / rejected
- options for further study

iv) Evaluation of Treatment Options:

a) Mechanical Plant
- design criteria
- suppliers proposals (summary)
- capital costs
- operation and maintenance costs
- sludge disposal
- life cycle cost analysis

Note: The life cycle analysis will be to a 40 year horizon and will include replacement of major equipment, building upgrades, etc.

b) Sewage Lagoon Option
- design criteria
- access road and lagoon preliminary design
- capital costs
- operation and maintenance costs
- life cycle cost analysis

The report will close with a discussion of the treatment options, regulatory and community issues, and the most viable method(s) of sewage treatment. A draft report will be issued to the GN for comments, followed by the final report. The reports will include drawings illustrating site locations and key aspects of the treatment options.

3) FEE PROPOSAL

For this assignment, the following hourly charge-out rate structure will apply.

Personnel	Hourly Charge-Out Rate
G. Strong, P.Eng	$ 160
Derek Chubb, P.Eng.	$ 140
Colin Hansen, P.Eng.	$ 75
Jason Andrews, EIT	$ 65
CAD	$ 60
Word processing	$ 50

We fee for completing the above work scope, including preparation and distribution of a final report, will be $17,240 including disbursements at 8%. The total fee including G.S.T. will be $19,923. Invoices will be submitted monthly and will be calculated based on the percentage of work completed.

4) ADDITIONAL SERVICES

With delays in adopting a new sewage treatment system, regulatory expectations may become an issue. Dillon offers to assist the GN on an as-required basis to help manage the regulatory issues that may arise. We propose to provide the GN with a letter outlining the delay and the reasons for it. The letter would be prepared by Dillon but submitted by the GN. This assistance would be provided on a time disbursement basis.

As we discussed last week, we could look at the viability of interim actions to address the sewage disposal for the next year, such that the GN could be seen to be active. This would include developing the option to expand the existing lagoon into the road area, and re-route the road. This option is really only viable if the ultimate solution remains the secondary sewage treatment plant, since under that option, some road works would be needed. This option will be developed on a time and material basis, and would include;

- design criteria
- lagoon capacity / expansion options
- capital, operating, and life cycle costs

The additional cost to complete this option is estimated to be $3,500.00 plus GST.

5) SCHEDULE

Based on starting the work immediately, the final report will be completed no later than July 31st 2003.

Yours Sincerely
Dillon Consulting Limited

Gary Strong, P. Eng
Managing Partner

Appendix B
Sewage Generation Calculations

Appendix B
Sewage Characteristics – Calculations

Population

The Government of Nunavut Bureau of Statistics has developed population projections for Cape Dorset until the year 2020. These projections were used to calculate the sewage waste generation for this study. The projected population at the end of 20 years was extrapolated to be 2012 residents in 2024. See ***Table 1***.

Table 1
Cape Dorset Population and Projections, 2000-2024

Year	Population	Year	Population
2000	1213	2013	1600
2001	1240	2014	1632
2002	1268	2015	1662
2003	1298	2016	1692
2004	1327	2017	1726
2005	1354	2018	1757
2006	1382	2019	1793
2007	1412	2020	1829
2008	1441	2021[1]	1873
2009	1471	2022[1]	1919
2010	1501	2023[1]	1965
2011	1536	2024[1]	2012
2012	1570		

2000-2020 Projections: Government of Nunavut, Bureau of Statistics.

Note 1: Linear extrapolation from 20yr growth rate = [(2020 pop. – 2000 pop.)/ 2000 pop.] / 21 yrs * 100 = 2.4%

Sewage Generation

In trucked service communities, it can be assumed that the sewage generated is equal to the water consumption. Therefore, the daily and annual sewage generation rates for Cape Dorset are equal to water consumption rates.

The MACA general Terms of Reference include a standard for water consumption in communities of less than 2000 residents with trucked water can be estimated with the following formula:

Water Use (l/cd) = 90 l/cd x (1.0 + 0.00023 x population)

The factors of 0.00023 x population represents the commercial and industrial water use.

The projected sewage generation at the end of 10 years (2014) is 73,730m^3 and at the 20 year (2024) horizon was found to be 96,725m^3. ***Table 2*** shows the daily and annual sewage generation for the planning horizon.

Table 2
Annual Sewage Generation, Cape Dorset

Year	Population	Daily (M^3)	Annual (M^3)	Year	Population	Daily (M^3)	Annual (M^3)
2000	1213	140	50964	2013	1600	197	71902
2001	1240	143	52351	2014	1632	202	73735
2002	1268	147	53802	2015	1662	207	75467
2003	1298	152	55369	2016	1692	212	77213
2004	1327	156	56897	2017	1726	217	79208
2005	1354	160	58331	2018	1757	222	81042
2006	1382	164	59829	2019	1793	228	83190
2007	1412	168	61448	2020	1829	234	85358
2008	1441	173	63026	2021	1873	240	87545
2009	1471	177	64671	2022	1919	249	90885
2010	1501	182	66330	2023	1965	257	93805
2011	1536	187	68283	2024	2012	265	96725
2012	1570	192	70198				

Organic Mass and Suspended Solids Loading
To estimate loading, organic load per capita is 0.074 kg. The daily and annual organic mass loadings for the planning horizon are shown in ***Table 3***.

Table 3
Annual Organic Mass

Year	Population	Daily (kg)	Annual (kg)	Year	Population	Daily (kg)	Annual (kg)
2000	1213	90	32763	2013	1600	118	43216
2001	1240	92	33492	2014	1632	121	44080
2002	1268	94	34249	2015	1662	123	44891
2003	1298	96	35059	2016	1692	125	45701
2004	1327	98	35842	2017	1726	128	46619
2005	1354	100	36572	2018	1757	130	47457

Year	Population	Daily (kg)	Annual (kg)	Year	Population	Daily (kg)	Annual (kg)
2006	1382	102	37328	2019	1793	133	48429
2007	1412	104	38138	2020	1829	135	49401
2008	1441	107	38921	2021	1873	139	50590
2009	1471	109	39732	2022	1919	142	51832
2010	1501	111	40542	2023	1965	145	53075
2011	1536	114	41487	2024	2012	149	54344
2012	1570	116	42406				

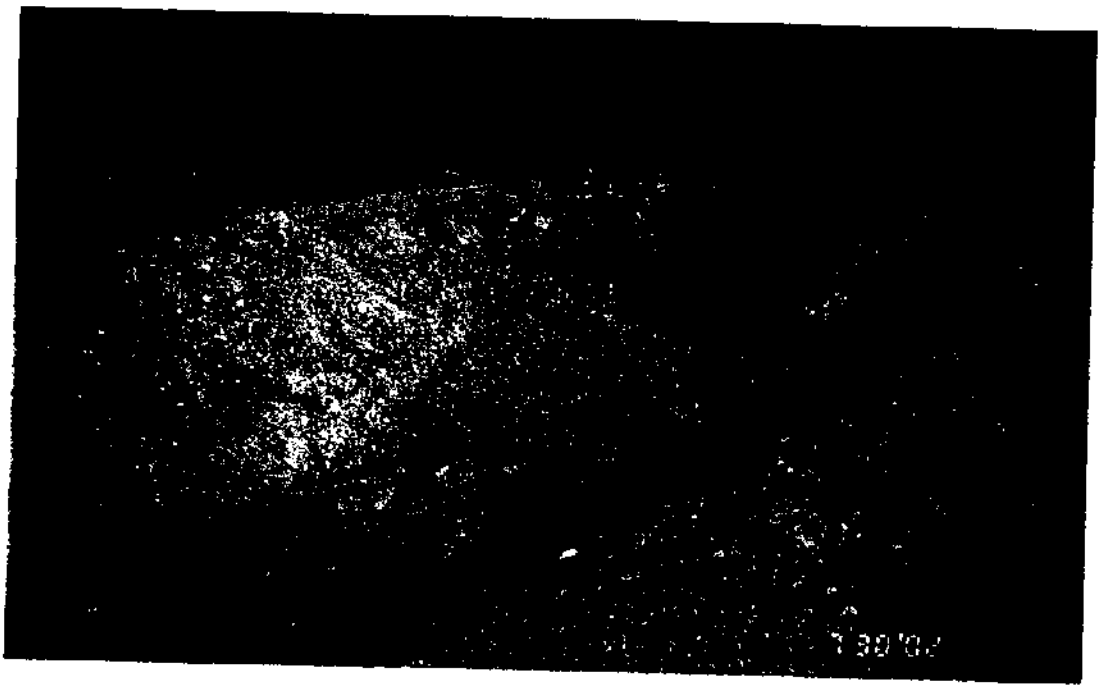
Suspended Solid Mass Loading

To estimate loading, suspended solid load per capita is 0.111 kg. The daily and annual suspended solid mass loadings for the planning horizon are shown in ***Table 4***.

Table 4
Annual Suspended Solid Mass

Year	Population	Daily (kg)	Annual (kg)	Year	Population	Daily (kg)	Annual (kg)
2000	1213	135	49145	2013	1600	178	64824
2001	1240	138	50239	2014	1632	181	66120
2002	1268	141	51373	2015	1662	184	67336
2003	1298	144	52588	2016	1692	188	68551
2004	1327	147	53763	2017	1726	192	69929
2005	1354	150	54857	2018	1757	195	71185
2006	1382	153	55992	2019	1793	199	72643
2007	1412	157	57207	2020	1829	203	74102
2008	1441	160	58382	2021	1873	208	75885
2009	1471	163	59598	2022	1919	213	77748
2010	1501	167	60813	2023	1965	218	79612
2011	1536	170	62231	2024	2012	223	81516
2012	1570	174	63609				

Appendix C
Existing Lagoon Photographs



View of Cell #1 Truck Delivery Point and Splash Pad (July 2002)

View of Cell #1 From Truck Delivery Site (July 2002)

DILLON CONSULTING	PROJECT: Cape Dorset Sewage Management Review	PROJECT NO.: 031943-1000
	TITLE:	DATE: July 2003
		FIGURE NO:

View of Cell #1. Overflow Culvert Visible Center Left (July 2002)

View of Cells #2 and #3 Failed Berms (July 2002)

DILLON CONSULTING	PROJECT: Cape Dorset Sewage Management Review	PROJECT NO: 031943-1000
		DATE: July 2003
	TITLE:	FIGURE NO:

View of Cell #3 Breached Berm (July 2002)

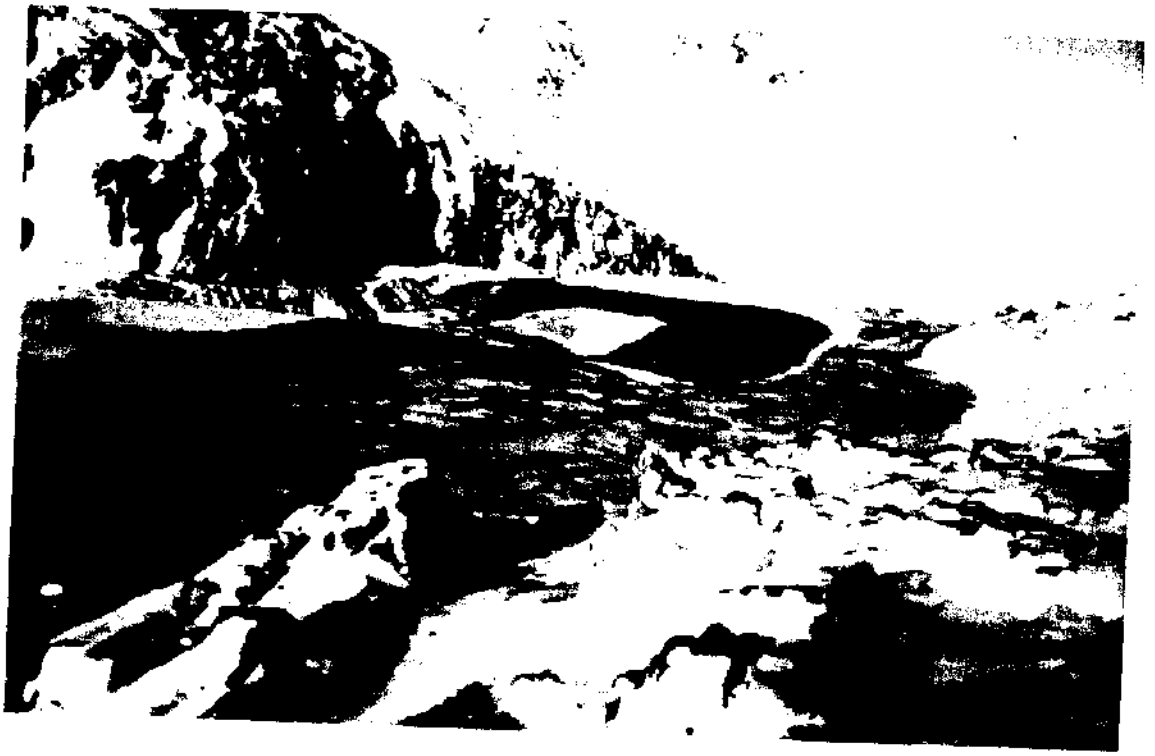
View Downstream of Cell #3 (July 2002)

DILLON CONSULTING	PROJECT: Cape Dorset Sewage Management Review	PROJECT NO: 031943-1000
		DATE: July 2003
	TITLE:	FIGURE NO:

Overview of Cell #1. Mech. Plant Proposed For Centre-Right Area (April 2003)

View of Cell #1 with Ice Cover (April 2003)

DILLON CONSULTING	PROJECT: Cape Dorset Sewage Management Review	PROJECT NO: 031943-1000
		DATE: July 2003
	TITLE:	FIGURE NO:



View of Cells #2 and #3 with Sewage Running Over Ice Cover (April 2003)

View of Cell #1 From Truck Dump Site (June 2003)

DILLON CONSULTING	PROJECT: Cape Dorset Sewage Management Review	PROJECT NO: 031943-1000
	TITLE:	DATE: July 2003
		FIGURE NO.

View of Old Single Cell Lagoon (June 2003)

View of Overflow Path From Single Cell Lagoon (June 2003)

DILLON CONSULTING	PROJECT: Cape Dorset Sewage Management Review	PROJECT NO: 031943-1000
		DATE: July 2003
	TITLE:	FIGURE NO:

View of Cell #1 Lower Berm and Overflow Culvert (June 2003)

View Downstream at Breached Cell #3 (June 2003)

DILLON CONSULTING	PROJECT: Cape Dorset Sewage Management Review	PROJECT NO: 031943-1000
		DATE: July 2003
	TITLE:	FIGURE NO:

View Looking Upstream at Breached Cell #3 (June 2003)

View of Overland Flow to Telik Inlet (June 2003)

DILLON CONSULTING	PROJECT: Cape Dorset Sewage Management Review	PROJECT NO.: 031943-1000
		DATE: July 2003
	TITLE:	FIGURE NO:

Appendix D
Regulatory Background

Affairs Canada et du Nord Canada

CANADA REMEMBERS
LE CANADA SE SOUV

INAC, Nunavut District
P.O. Box 100
Iqaluit, NU
X0A 0H0

tel.: (867) 975-4275
fax.: (867) 979-6445
Your file / Votre référence
Our file / Notre référence
(unlicenced)

January 15, 2001.

Hayward Sims
Senior Administrative Officer
Municipality of Cape Dorset
P.O. Box 30
Cape Dorset, NU X0A 0C0

September 5, 2000 Municipal Water Use Inspection - Report

Firstly, I wish to thank Dan Holmes for the much appreciated time and assistance provided during the tour of the Municipality's water use and waste disposal facilities. Attached for your records is the Municipal Water Use Inspection Report pertaining to the September 5, 2000 inspection; although the water and waste operations appear generally well managed, definite concern stems from the state of the facilities themselves. As such, the following considerations were noted, and will need to be addressed:

- **Sewage waste disposal:** At the time of the inspection, the uppermost cell of the new sewage disposal facility was filled to capacity (figure 1), and effluent was decanting downslope (figure 2). As extensive spring runoff essentially rendered the second cell useless by washing out its berms (figure 3), sewage effluent from the first cell of the new sewage disposal facility (figure 4) basically flowed unhindered through the breached lower cell (figure 5), into receiving waters (figure 6). Nevertheless, the attached analytical results relating to the discharge from the new sewage disposal facility reveal relatively acceptable concentrations of tested parameters. However, due to the excessive springtime erosion along the current sewage and solid waste disposal valley, the Municipality had to temporarily revert to the old, undersized sewage lagoon (figure 7) although it admittedly provides very minimal effluent treatment prior to discharge (figure 8).

This being said, the Inspector strongly questions the viability of the new sewage disposal facility. Indeed, the recurring nature of runoff-related damage undeniably jeopardizes the effectiveness of the facility. Accordingly, it is the Inspector's belief that resources annually directed to patch up work might be more suitably allocated to the investigation of alternate long-term locations, or perhaps even technologies, of sewage treatment facilities appropriate for the Municipality. Thus, by copy of this letter to Community Government and Transportation (GC&T), the Inspector trusts that this avenue will at least be considered.

Canada

- **Solid waste disposal:** Much of the above erosion and runoff issues equally apply to the solid waste disposal facility situated within the same drainage valley. Although the wastepile is well compacted and covered, and household combustible waste appears to be burned on a regular basis (figure 9), concerns remain over the quantity of runoff flowing through the site and its implications in regards to leachate production (figure 10). However, the attached analytical results indicate that the sampled leachate from the solid waste disposal facility was, at the time of the inspection, relatively benign. On a side note, should erosion be successfully controlled, the instalment of a perimeter fence would further contain the waste within the facility, and likely minimize complications related to wildlife attraction.

In parallel, both condition and location of the bulky metal wastes disposal site are causes for concern, although the attached analytical results are not disturbing. Indeed, an impressive volume of bulky wastes, the toe of which lies below the high tide mark, is accumulated along a section of shoreline (figures 11-12). Further, hazardous material is simply discarded at the site, since no specific form of containment is provided. Consequently, the inspector commends the Municipality for recognizing the need to cleanup the site, and for taking appropriate steps in this direction; such as contacting the EcoAction community program towards the restoration of this and other waste disposal sites within municipal boundaries, and investigating with the Canadian Coast Guards the possibility of shipping out bulky metal wastes on sealift backhauls.

- **Non-compliance of Act:** During the inspection, the importance of a Water licence was discussed, and the Inspector was under the impression that the Municipality would follow through by submitting an application to the Nunavut Water Board (NWB). However, to the Inspector's knowledge, the NWB has yet to receive such a document. Therefore, the Inspector wishes to reiterate that a Water licence is not a mere paperwork formality, but constitutes a legal requirement under both the *Northwest Territories Waters Act* and the *Nunavut Land Claims Agreement*. INAC and/or other implicated agencies can, if required, provide assistance for the completion of this process.

Please feel free to contact me at (867) 975-4298 or lavalleep@inac.gc.ca should any questions/comments arise.

Sincerely,

Philippe Lavallée
Water Resources Officer
INAC, Nunavut District

c.c. - Nunavut Water Board, Gjoa Haven
- CG&T, Iqaluit (Doug Sitland)
- Baffin Health & Social Services, Iqaluit (Bonnie Segal)
- EC Environmental Protection, Yellowknife (Anne Wilson)