Request for Proposals

The Government of Nunavut (GN), Department of **Community and Government Services** is requesting Proposals from qualified consultants experienced in the design of potable water systems in the Arctic. This is a request for the provisions of consulting and design services as outlined below.

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1. Standard Instructions to Proponents

1. Proposals must be received before *3.00 pm* local time on *May 2, 2007* at:

> Regional Director, Brent Boddy, Kitikmeot Region
> Government of Nunavut
> Community And Government Services
>
> Delivered to 2nd floor, Enokhok Building
> P.O. Bag 200, Cambridge Bay, NU, X0B 0C0
>
> In care of: Sudhir Jha, Project Officer
> Community and Government Services
> Telephone: ***(867)*** 983-4008 Fax: ***(867) 983-4124***

Proposals received after the exact time and date noted above will be rejected.

The original and **3** copies are to be submitted, quoting **"Kugluktuk Water System Upgrades: CGS Project No 04-4417 ."** on the outside of the envelope or package.

After the closing time, only the identity and addresses of the proponents will be posted.

2. The GN will not be responsible for any proposal that

- does not indicate the Request for Proposal reference, closing date and proposer's name;
- is delivered to any address other than that provided above.

3. Electronically-submitted proposals will be accepted under the following conditions:
   - the proposal is received before the submission at the e-mail address provided (note that the GN server transmits attachments 2 MB or less instantly, but all attachments greater than 2 MB are transmitted over night)
   - the GN will not accept liability for any claim, demand, or other actions for any reason should the e-mail transmission be returned, not received in its entirety (or at all), received after stated closing time and date, sent to a different address other than that stated herein, attachments contain corrupted information or viruses and are filtered out by the GN server, attachments are submitted in a format other than Adobe .pdf, or for any other reasons
   - the proposer shall submit an original proposal and **3 (three)** copies of the proposal to the address stated herein immediately following sending the e–mail transmission
   - the GN cannot guarantee the complete confidentiality of information contained in the proposal received by facsimile

4. Facsimile transmitted proposals will be accepted under the following conditions:

   - the proposal is received before the submission deadline at the facsimile number stated;
   - the GN will not accept liability for any claim, demand or other actions for any reason should a facsimile transmission be interrupted, not received in its entirety, received after stated closing time and date, received by any other facsimile unit other than that stated herein, or for any other reasons;
   - the GN cannot guarantee the complete confidentiality of information contained in the proposal received by facsimile;
   - it is understood that the GN is not allowed to comment on the completeness of the submission, or offer any other opinion other than to state, upon inquiry by the proposer, that a submission has been received
   - the proposer shall submit an original proposal and **3 (threes)** copies to the address stated herein immediately following the transmission of the facsimile.

5. All questions or enquiries concerning this Request for Proposals must be in writing and be submitted to the address provided above no later than five (**5**) calendar days prior to the proposal deadline. Verbal responses to any enquiry cannot be relied upon and are not binding on either party. The GN contact for this project is:

Sudhir Jha, M.Eng, Project Officer
Community and Government Services
Cambridge Bay, NU, X0B 0C0
Phone no: (867)983-4008
Fax no: (867)983-4123
E- mail: sjha@gov.nu.ca

6. This is not a Request for Tenders or otherwise an offer. The GN is not bound to accept either the proposal which provides for the lowest cost or price to the GN, or any proposal of those submitted.

7. If a contract is to be awarded as a result of this request for proposals, it will be awarded to the proposer who is responsible and whose proposal provides the best potential value to the GN. Responsible means the capability in all respects to perform fully the contract requirements and the integrity and reliability to assure performance of the contract obligations.

8. Notice in writing to a proposer and the subsequent execution of a written agreement shall constitute the making of a contract. No proposer will acquire any legal or equitable rights or privileges whatever until the contract is signed.

9. The contract will be in the form of the standard “GN Architectural/Engineering Services Agreement” and it will contain the relevant provisions of this Request for Proposals, the accepted proposal as well as such other terms as may be mutually agreed upon, whether arising from the accepted proposal or as a result of any negotiations prior or subsequent thereto. The GN reserves the right to negotiate modifications with any proposer who has submitted a proposal.

10. In the event of any inconsistency between this Request for Proposal, and the ensuing contract, the contract shall govern.

11. The GN has the right to cancel this Request for Proposals at any time and to reissue it for any reason whatsoever, without incurring any liability and no proposer will have any claim against the GN as a consequence.

12. Any amendments made by the GN to the Request for Proposals will be issued in writing and sent to all who have received the documents.

12. The GN is not liable for any costs of preparation or presentation of proposals.

13. An evaluation committee will review each proposal. The GN reserves the exclusive right to determine the qualitative aspects of all proposals relative to the evaluation criteria.

14. Proposers may not amend their proposal after the closing date and time but may withdraw their proposal at any time prior to acceptance.

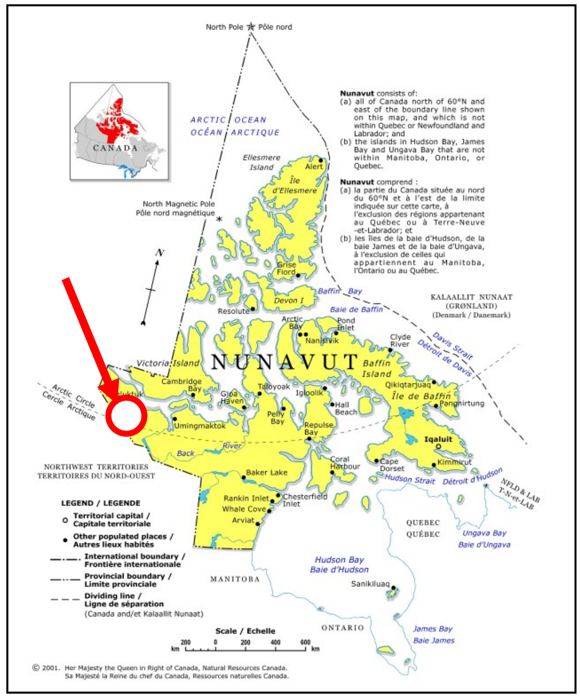
15. Proposals will be evaluated as soon as practicable after the closing time. No detail of any proposal will be made public except the names of all parties submitting proposals.

16. Provisions of the Government of Nunavut Nunavummi Nangminiqaqtunik Ikajuuti (NNI) Policy will be applied in the evaluation of all proposals.

17. The proposal and accompanying documentation submitted by the proposers are the property of the GN and will not be returned.

2. Terms of Reference

The consultant will work in collaboration with the Regional Municipal Planning Engineer and the Project Officer, who will together provide a range of design, engineering, and site management services for the Hamlet of Kugluktuk. In addition, the consultant will work closely with hamlet staff (in particular with the water treatment plant foreman and the SAO) and hamlet council, keeping them informed and part of the design team through strategic presentations, consultations, and communications.



The proposal must demonstrate that the design work will utilize appropriate technology and must be shown to provide simple, cost-effective solutions.

2.1 Introduction

Kugluktuk, meaning "the place of rapids", is located on the Arctic Coastline at 67° 50' N latitude and 115° 6' W longitude, about 450 km southwest of Cambridge Bay and approximately 1000 air kilometres north of Yellowknife. It gained hamlet status on April 1, 1981, changing its name from Coppermine in 1996. It is the second largest community in the Kitikmeot Region, with a population of approximately 1,400 (1349 from a 2004 census). The community is located on a silt plain, with Precambrian volcanic and sedimentary rock outcrop jutting further up-shore with much folding, faulting, and volcanic intrusions. Thus dolomite and shale, interspersed with volcanic rock, form steep outcrops near the community. The permafrost is continuous, with an active layer thickness varying between somewhat less than 0.5 m and just over one metre along the sandy waterfront. Vegetation is typical Arctic tundra, consisting of sedges, grasses, heather, lichens and mosses. Alder thickets and willows are common in damp low-lying areas.

Per capita water use by the community has steadily increased over the years. In 1993 the estimated use was 73 litres per capita per day (lpcd). Standard accepted daily residential water usage (RWU) is
90 x [1.0 + 0.00023 x (population)], where 90 is in litres per capita per day. Kugluktuk draws its water from the Coppermine River at a point where it has traditionally been topographically and proximally convenient to locate an intake pump-house. This point is fairly close to the ocean, being about 2.5 km upstream from the Coronation Gulf. Intake water temperatures are normally just above freezing for all but two or three months each year. Near the river mouth, most of the surficial material consists of marine sediments deposited during oceanic ingress prior to glaciation. The actual

river estuary extends approximately 7 to 10 km from its mouth to an area of rapids. It has an average width of 570 m and "depths that reach up to 8 m in isolated areas, but generally are less than 3 m."[1] Ice tends to form in early October, and vanishes in early June, though lately this pattern seems to be changing, with both later ice formation and earlier break-up. Oceanic tides are "mainly diurnal (one tide per day)…[2] Studies in the past have shown that the river has more than sufficient flow to meet the demands of the community long into the future, with a two-year return period daily discharge of 1340 m^3/s.[3] Even in March and April, flows have been recorded at 55 cubic metres per second (approximately 4.75 million litres per day.[4] In spite of this abundance, the Kugluktuk water system may present the most challenging set of problems that can confront an engineering design team in either the Northwest Territories or Nunavut. The successful engineering team must deal with several major and different issues: chronic excessive turbidity, seasonal salt water invasion, sand and silt build-up around the intake pipe, strategic horizontal and vertical locations of intake pumphouse and pipe, the need for a new intake pump house, and sufficient water storage requirements to meet demand over the next twenty years.

However, progress has been made. Within the past five years a new water treatment plant has been designed and constructed. This plant has partially dealt with many of these problems. Yet some work remains to be done in order to provide a continual and healthful supply of water for the community.

Many solutions to these problems have been suggested in the past. Although the purpose of this RFP is not to categorically close the door on any possibility, it is worthwhile keeping in mind that the budget is far from limitless, so location is one of the critical parameters. For example, the only other (nearest) body of viable potable water is "S Lake", which is a long distance from the community. This is not an economically feasible source of water. Nor is locating the intake pipes far up-river an acceptable solution, unless there is absolutely no other way to solve the present series of problems. Another near-by pond, Heart Lake, located on the outskirts of the hamlet, is a small pond not deep enough (or with sufficient quantities of water) to provide year-round potable water for the community. It is also a fairly stagnant lake (in addition, there are reports of snow-machines sunk in the lake, leading to concerns about hydrocarbon contamination).

Divers in Kugluktuk

It is the intent of CGS to build on the engineering successes accomplished in the past and to solve the remaining design challenges.

1 "A Study of Salinity in the Vicinity of the Coppermine Water Intake Structure, by A.F.Babb of Northwest Hydraulic Consultants Ltd, August, 1982, p. 2

2 *Coppermine Water System Modifications Final Planning Report*, by Stanley Associates Engineering Ltd, May, 1995, p.6.5

3 *Kugluktuk Water System Modifications: Water Intake Design, River Engineering Study*, AGRA Earth & Environmental Ltd., May 1997, p.7

4 *Coppermine Water System Modifications Final Planning Report*, by Stanley Associates Engineering Ltd, May, 1995, p.4.5

2.1 Background and Discussion

2.1.1 Description of the system as it exists now

The water treatment plant in present operation was designed by FSC Architects and Engineers in 2002 to meet the requirements of the GN at the time. FSC was aware of the challenges confronting them, and addressed them by designing, in various stages, the holding pond, new realigned insulated water line from the IPH to the water treatment plant, and a new water treatment plant with new water tanks. They recommended the installation of the existing package cartridge filtration system as well. However, no funds were available at the time for a new pumphouse or relocated intake pipes.

- **2.1.1.1** Intake lines: these are located in the nearest of three (possibly four) channels in the river bed. "The existing intake is sited in the western sub-channel of the river. At low river levels, a sand bar can isolate this channel from the main flow, turning the channel into a backwater, which promotes sedimentation."[5] Historically, divers have had to be engaged once every two years at a minimum to clear sediment away from the fast-clogging intakes. Recently it has been determined that, in order to keep the lines running properly, divers will have to be called in at least once a year. The best time for the divers is during cold weather, when they can work from a natural platform – the ice-covered river.[6] At present, the intake pipe opening is located about 1.5 to 2 m above the river bed and approximately 35 m from shore.[7] The pump flow rate us usually around 600 to 675 litres per minute, according to the water treatment foreman. This is accomplished via a multi-stage intake pump, with anywhere from five to eight stages. As this RFP is being written, only one intake pump is functioning. The other is jammed somewhere down the pipe.

"New" IPH

- **2.1.1.2** Intake pumphouses (IPH): The "new" IPH is over 25 years old (built around 1980), and has been placed where it is due to the relative ease of access by road vehicles. It has two intake pumps (standard practice is to provide for system redundancy) and a salinity sensor that automatically shuts off flow if salt water levels reach a certain pre-determined amount (operators also routinely taste the water, since in the past this sensor has failed, resulting in filling the surge tank with non-potable water). The system is designed to backwash the intake lines with water from the storage tank in order to remove silt and salt water before the pumps fill the tanks in the water treatment

"Old " IPH

5 *Data Gap Analysis: Kugluktuk Potable Water Intake"DRAFT, by AD Williams Engineering, April 2006, p. 10*
6 Ice thickness can vary between a maximum of 2 m and 2.4 m according to earlier studies.
7 *Kugluktuk Water System Modifications: Water Intake Design, River Engineering Study*, AGRA Earth & Environmental Ltd., May 1997, p. 1

plant. This building is old, and is in need of replacement. According to a report dated August, 1997, "excessive settlement was observed on the building".[8]

Note that there is an older IPH (still in reasonable condition) which in this report will be referred to as the "old IPH". This "old" IPH, a wooden shell on skids, is presently located about 15 m from shore. It is still serviced with a 600 V Tec cable. There is an overland utilidor connecting the two IPHs. The Tech cable is routed along this utilidor. As this RFP is going out, a contract is being given to a local Kitikmeot contractor to install a separate pump that will utilize this voltage and utilidor to bring water from the river's surface. This work is described below:

Work in Progress (Auxiliary System):

- New auxiliary intake pump through a hole in the ice (with a plywood shack over it), or floating when ice is gone. Note that the fresh water layer, regardless of its thickness, will be located just below the lower surface of the ice, and will rise up to the ice surface once a hole has been drilled.
- Approximately 15.25 m (50 ft) of 3" insulated heat-traced pipe to the "old" IPH, which still has 600 V power to it, as well as a decent Teck cable connecting the two IPHs
- 26 m (86 ft) of the same pipe from the "old" IPH to the "new" IPH, which would rest in the existing utilidor between the two IPHs
- Connection inside the current IPH to the existing 6" pipe
- Work is also being performed on the flange at the IPH for the intake line that contains the only working intake pump. This flange is failing due to ground settlement and tension in the casing.

Note that this secondary system will be retained as part of the new modified system, unless it can be demonstrated that this is unnecessary. The advantage of this third seasonal intake is that it can be used in times of excessive sand build-up around the two main intakes, as well as at times when the salt water wedge rises above these primary intakes. In fact, this solution, though independently arrived at by the Regional Engineer only recently due to an inordinately long period of salt water invasion, is not new. A 1982 report written by A.F. Babb recommended combining "both submerged and overhead systems."[9]

Figure 7: Lined holding pond

- **2.1.1.3** New 150 mm (6") HDPE insulated water

8 *Water System Modifications, Kugluktuk, NWT: Intake Structure Design Concept Brief – 60% Draft,* FSC Architects & Engineers, *p. 29*

9 "A Study of Salinity in the Vicinity of the Coppermine Water Intake Structure, by A.F.Babb of Northwest Hydraulic Consultants Ltd, August, 1982, p. IV

transmission line (2004, overland) from the "new" intake pumphouse to the surge tank at the WTP. The approximate length of this line is 335 m (1,100 ft), and contains four gentle bends, each 45 degrees or less. Since then, the heat trace performance has been improved by replacing the old breaker with a new power breaker of 40 Amps current rating. The previous breaker was 30 Amps rating and heat trace was withdrawing about 32 Amps, causing the breaker to continually tripping. Two limit controllers for heat trace and the auto-dialer have also been replaced.

- **2.1.1.4** Lined holding pond, which is filled via the overland line during the warm months. Its original purpose was to be filled in anticipation of times of excessive salinity. A diesel pump is used to fill the water tanks in the WTP from the holding pond. The capacity of this pond is approximately 800,000 to 1,000,000 litres. It is designed to hold up to about seven days of water use.
- **2.1.1.5** Water Treatment Plant (2003), equipped with two nominal 200 m^3 holding tanks (6.1 m high and 6.57 m, diameter (designed to hold a maximum of 198,750 litres each*), one 6,500 L raw water surge tank, and a staged cartridge filtration system (cartridges housed in vertical steel canisters) that, according to the WTP foreman George Egotak, typically uses filters in a series of pore sizes (in microns) that differ from summer operation to winter:

Summer	20	10	5	1
Winter	10	5	1	0.35

"Water is pumped in to the cartridge housing and a centrifugal force separates dense particles that wind up at the bottom of the housing and can be removed…Remaining liquids are forced into an inner chamber of the cartridge filter and filtered water is forced out."[10] To enable one set of filters to be shut down for cleaning, the WTP is equipped with two parallel filter trains. Cartridges are cleaned using a pressure washer, but can withstand a maximum of two cleanings before they are destroyed by the washing process. Usually only one wash per filter is performed. After a second pressure-wash, the filter often becomes clogged too quickly. Each replacement cartridge costs approximately $300 landed in Kugluktuk. Chlorination is added, and a log of residual free chlorine is kept daily. The purpose of the surge tank (sized for ten minutes raw water inflow) is to provide a constant source of raw water for the filters, regardless of incoming pressure. *Although the theoretical maximum tank storage is 198,750 litres each, a float is set to shut off tank flow when it reaches only 164,000 L. Total tank storage at present is thus 328,000 L (this is their regular storage, not counting their fire reserves, according to the water system foreman). Fire reserves are set at 45,000 litres per tank. This is governed by a shut-off valve that will not permit water being pumped below that point. This brings the effective total water storage down to 238,000 L. Note that there are no sewers to accept treatment process wastes. The capacity of water production is limited by the maximum flow the filters will permit: 9.46 litres per second at 345 kPa.

Cartridge Filters in WTP

10 *Hamlet of Kugluktuk, Nunavut: Water System Improvements Final Design Brief*, Ferguson, Simek Clark, Engineers & Architects, Dec. 16, 1999

- **2.1.1.6** A truck-fill arm at the WTP fills the water distribution trucks at the WTP. Water use varies according to season. Summer months (June through August) requires the highest usage. According to the water system foreman George Egotak summer usage is as follows:
  - Monday's delivery load is usually about 360,000 litres
  - Wednesday and Friday about 220,000 litres pre day
  - Tuesday and Thursday about 160,000 Lpd
  - Saturday about 360,000 litres

It is clear by these figures that there is not sufficient tank capacity to meet summer peak day demand without relying on continuing pumping from the river. Other months demand are reduced by approximately 20 to 30%

The annual water use is 46,390,922.60 litres for the year 2006. This is up from a yearly use of 29,794,995 litres for the year 1993.[11]

2.1.1.7 Water is trucked from the WTP to residences, each with a tank that is usually capable of holding 1,135 litres (based on a 1997 report).

The total elevation head is approximately 106 ft (32.3 m) from sea level to the top of the water tank. For preliminary design purposes a conservative figure of 120 ft (36.6 m) may be used, with fitting and friction losses still to be added.

2.1.2 Background to Some of the Areas of Concern that must be Addressed:

1. **Turbidity**[12:] A series of cartridge filters was designed by FSC around 2002 that was expected to reduce the amount of turbidity in the water to acceptable levels. In addition, an artificial storage pond was designed and constructed. The intent was to store water prior to times of highest salinity so that this source could be tapped until salt water levels in the Coppermine decreased. Unbeknownst to the design team, the water treatment plant operators have been using the pond as a settling pond throughout the year – a function for which it was not designed, for there is no sump from which to remove the settled particles. Due to the high turbidity levels at times other than spring breakup, however, this cartridge filtration system is handling excessive turbidity loads throughout the entire year. Filters are costly, and seldom last three cycles, due in part to the destructiveness of the high-pressure washers used. According to an FSC report (2003), with raw water turbidity between 99 and 130 NTU, the 1 micrometer and 0.35 micrometer filters "lasted approximately 15 minutes before being clogged and replaced. The treated water turbidity averaged 51.9 NTU."[13] Further in the

11 *Coppermine Water System Modifications Final Planning Report*, by Stanley Associates Engineering Ltd, May, 1995, p.2.1

12 Turbidity and suspended solids are not the same. The former is defined as particles (in mg/L) less than 1.2 microns, where as the latter are suspended particles in excess of 1.2 microns. The majority of particles that have been found to have settled out in the reservoir are smaller than 1.2 microns (i.e.: in the clay and silt range). Data from *Kugluktuk Water Treatment Plant Spring Freshet Plant Performance Review*: FSC Architects & Engineers, 9/15/2003, p.10

13 *Draft Report: Kugluktuk Water Treatment Plant Spring Freshet Plant Performance Review, Ferguson Simek Clark Architects & Engineers, 8/8/2003, p.4*

report, the authors state, "Large porosity filters clean more readily than 1μm and 0.35 μm filters. The latter tend to retain solids more readily and washing provides only partial rejuvenation."[14]

As it stands now, turbidity levels in the treatment plant "range from an average monthly low of 4 NTU (nephelometric turbidity units) to an average monthly high of 26 NTU"[15]. Raw river water turbidity levels in the spring have been known to vary from a high of 130 NTU to a low of 99 NTU, with filtration bringing down these very levels to only approximately 52 and 37 NTU respectively.[16] Water with greater than 5 ntu may have bacteriological problems, though, according to the Environment Health Officer, so far there have been no reports of any water-borne disease in the community, so the free residual chlorination that is currently being practiced must be effective.

Water Quality: Aside from excessive turbidity, raw water quality is consistently within Canadian Drinking Water Guidelines for potable water, both chemically and bacteriologically. The water is soft, slightly alkaline, weakly buffered, and low in dissolved solids.[17] According to a 1991 report, "The supply water's total hardness, as tested, was 16.6 mg/L as CaCo3 to indicate the water is soft. A soft, poorly buffered, neutral pH water can be potentially very corrosive when in contact with metallic materials…The pH of Coppermine's raw and treated water, as tested, was 7.4 and 7.3…Total alkalinity, as tested, was 27 mg/L…"[18] "Microbiological analysis of Coppermine's raw water supply indicates the presence of low concentrations of corrosion causing and corrosion intensifying bacteria. Corrosion causing microorganisms include thiosulfate reducing bacteria. Corrosion intensifying bacteria include iron oxidizing bacteria. The predominant bacteria in the new water sample were the bacterial species: thiosulfate reducing and iron oxidizing bacteria. The most probable number of each of these organisms pwr mL, after 14 days of incubation, was equal to 240 organisms/mL.[19]

- Note that previous guidelines for Canadian drinking water quality give a turbidity of 1 NTU or less (unless it can be demonstrated that consistently good micro-biological quality can be maintained. If that is so, 5 NTU is acceptable). Surface waters that use chemically-assisted filtration require 0.3 NTU, and those that are filtered through diatomaceous earth require 1 NTU, and those that use membrane filtration require 0.1 NTU.[20] Note that the raw river water is of "good bacteriological quality for indicator bacteria."[21]

14 *Draft Report: Kugluktuk Water Treatment Plant Spring Freshet Plant Performance Review, Ferguson Simek Clark Architects & Engineers, 8/8/2003, p.7*

15 *Data Gap Analysis: Kugluktuk Potable Water Intake" DRAFT, by AD Williams Engineering, April 2006, p. 1*

16 *Kugluktuk Water Treatment Plant Spring Freshet Plant Performance Review*: FSC Architects & Engineers, 9/15/2003, p. 4 & 5

17 *Second Submission: Water Treatment Plant Pre-Design Report: Kugluktuk, Northwest Territories, , by FSC Architects & Engineers, August 11, 1997, p.4*

18 *Northwest Territories Water Quality Study: Coppermine, N.W.T. Kitikmeot Region*, by Roderick M. Facey and Daniel W. Smith & Associates Ltd, Edmonton, Alberta, July, 1991, p. 6-7

19 *Northwest Territories Water Quality Study: Coppermine, N.W.T. Kitikmeot Region*, by Roderick M. Facey and Daniel W. Smith & Associates Ltd, Edmonton, Alberta, July, 1991, p. 12

20 *Data Gap Analysis: Kugluktuk Potable Water Intake, Kugluktuk, Nunavut, DRAFT*, by A.D. Williams Engineering Inc. April 2006, p. 1

21 *Kugluktuk Water Treatment Plant Spring Freshet Plant Performance Review*: FSC Architects & Engineers, 9/15/2003, p. 13

2. **Salt Water Wedge Invasion:** According to a 1981 report, "The Coppermine River is a classic example of a stratified estuary. Small tidal fluctuations combine with the relatively narrow estuary to provide minimal tidal exchange volumes. The river flow rates are large compared with the inflow from tidal action…"[22] The Coppermine experiences a small vertical tidal surge (approximately 0.2 m at the intake – Babb, 1982). Thus the height of the water at the intake would fluctuate only 0.1 m above and below mean sea level. Up-river south winds can add from 0.3 to 0.4 m to the sea level, but reports of 0.6 m rise also exist. Thus, at certain times of the year (especially during the Autumn when the river flow has decreased from its July maximum, a salt water "wedge" (varying little across the estuary[23]) from the ocean surges up-river, invading as far as the intake pipes. Stanley Associates (1995) estimated that the salt water wedge could reach as far as Bloody Falls, "as the river bottom profile is still below the mean sea level elevation", but in all likelihood reaches only to km 6.[24] This wedge is felt to be well-defined, with salt water and fresh water generally remaining stratified.[25] Since salt water is more dense than fresh water, it settles to the river bed, and presents a variable column of saltwater to the fixed intake pipes. According to Babb, "Because much of the estuary is less than 2 m in depth, ice growth can greatly reduce the effective flow area of the estuary in lateral as well as vertical directions. Thick ice cover will reduce the tendency for salt wedge penetration because of reduced effective depth and also because of the removal of the shallow areas of the outward movement of fresh water."[26] According to earlier studies, in the winter "the layer of fresh water under the ice has been observed to be as little as 0.5 m thick".[27] There has been mention of concerns that "saline water could be trapped in deeper sections near the intake before freezeup. It would tak some time for it to clear."[28] Although there is an automatic sensor whereby the intake pipe would shut down if the salt content of the water exceeded a certain level, the number of times this occurs is not only unpredictable, but may be increasing. Certainly, each year the water crew can count on a period of two to three weeks where the intakes are not usable due to excessive salinity. From previous literature and this year's experience, it appears as if there is a chance that once every ten years this saltwater wedge predominates for one to two months.[29] For example, during the year 1994 the salt

22 *Study of Salinity in the Vicinity of the Coppermine water intake structure*, Report No. 1 & 2, by Northwest Hydraulic Consultants, 1981, p. i

23 However, other studies seem to point to another conclusion: that in the shallower channels there was no detectable salt water because "salt water, moving beneath the fresh water, would need greater depths in order to penetrate into the river". (from *A Study of Salinity in the Vicinity of the Coppermine water intake structure*, Report No. 1 & 2, by Northwest Hydraulic Consultants, 1981, p. 3)

24 *Coppermine Water System Modifications Final Planning Report*, by Stanley Associates Engineering Ltd, May, 1995, p.6.8, 6.9

25 "A Study of Salinity in the Vicinity of the Coppermine Water Intake Structure, by A.F.Babb of Northwest Hydraulic Consultants Ltd, August, 1982, p. 3

26 "A Study of Salinity in the Vicinity of the Coppermine Water Intake Structure, by A.F.Babb of Northwest Hydraulic Consultants Ltd, August, 1982, p. 4

27 Qualitative data reported in "A Study of Salinity in the Vicinity of the Coppermine Water Intake Structure, by A.F.Babb of Northwest Hydraulic Consultants Ltd, August, 1982, p. IV

28 *Kugluktuk Water Supply Improvements Report Review*, A.D. Williams Engineering, 2006. Reporting on Northwest Hydraulic Consultants (1982), p. 2

29 This year (2006) a combination of weather events conspired to create a near-crisis situation for the hamlet. For approximately six to eight weeks the salinity sensors (and crew tasters) prevented water from being pumped into the surge tank from the intakes. This was due to a long, hot summer (thus low river flow in the autumn), up-river winds pushing ocean water up to the intakes, normal high autumn tides, and a late winter freeze (delayed ice forming on the river).

problem occurred throughout most of the summer,[30] and from the end of October, 1980 to the end of January, 1981, the intake was not operable for the same reason.[31] During these times, the community has no back-up water capacity, and often faces the choice of either running out of water or of using water with unacceptable levels of salt. Factors determining saltwater invasion range from high winds blowing ocean saltwater upriver to high ocean tides. The worst time of the year is the Fall, when a confluence of factors conspire: up-river winds, low river flows, and high tides. Traditionally, the only factor giving relief is the on-set of river freeze-up, which protects the river from the up-river winds (occurring at the same time that monthly high tides are lower). When a long, dry summer precedes this, inordinately long periods of salinity are inevitable, leading to extreme duress for the hamlet. Note that at one time (around 1990) a variable-height intake was designed and built so that intake heights could be aligned with fresh water heights, but this was disabled one year later due to excessive sediment build-up. At that time, fixed intakes were reinstalled.

3. **Sand and Debris Build-up around the Intake Pipe:** The bed of the Coppermine River is comprised mostly of sand. According to a 1997 report,[32] "sand grain sizes have been reported for the government dock area about 1.5 km downstream of the intake as D_{90}=1.2 mm, D_{50}=0.5 mm, D_{35}=0.4 mm". Due to shifting river currents and to eddies caused by the existence of the intake pipe itself sand is continually building up around the intake. There have been concerns that since "the existing intake is sited in the western sub-channel of the river, at low flows a sand bar can isolate this channel from the main flow, turning the channel into a backwater, which promotes sedimentation."[33] Traditionally, divers are hired at least once every two years (usually in February or March, when the ice cover is still thick enough to provide a stable platform) to clear away sand and accumulated debris from around the intake and screen. In fact, this should be done once each year automatically, as part of routine maintenance. In 1997, AGRA Earth & Environmental Ltd (Yellowknife) undertook a study of the sediment approximately 50 m downstream of the existing water intake. The results of the grain size test indicate that the sediments are relatively uniformly graded. "The maximum size of the sand grains…was reported as .36 mm. Most of the sample material ranged in size from 1.18 mm and 0.3 mm. There was only about one percent silt sized material…[and] a noticeable lack of fines…[indicating] a persistent current at this location."[34] Around 1985 the intake system was modified so that swivelling intake arms were added (activated by air filling a flotation tank located at the end of each intake arm), in the expectation that the intake could be adjusted to rise above the saltwater wedge. However, that same year excessive siltation rendered the swivel mechanism inoperable, and this system was replaced by the current fixed intakes in 1991. To illustrate how serious a problem this is, Arctic Divers prepared a report in

30 *Coppermine Water System Modifications Final Planning Report*, by Stanley Associates Engineering Ltd, May, 1995, p.6.2

31 *Study of Salinity in the Vicinity of the Coppermine water intake structure*, Report No. 1 & 2, by Northwest Hydraulic Consultants, 1981, p. 5

32 *Kugluktuk Water System Modifications: Water Intake Design, River Engineering Study*, AGRA Earth & Environmental Ltd., May 1997, p.15

33 *Kugluktuk Water Supply Improvements Report Review*, A.D. Williams Engineering, 2006. Reporting on FSC Design Concept Brief (1998), p. 8

34 Letter from AGRA Earth & Environmental to FSC dated June 20, 1997 (from *Water System Modifications, Kugluktuk, NWT: Intake Structure Design Concept Brief – 60% Draft*, FSC Architects & Engineers, 1997)

2002 listing a history of their past dives over only a one and a half year period. This report has been summarized by A.D. Williams:[35]

- *August 1998 – excavation of sand from around screens. Sand had completely covered one screen. Two pipe supports had broken off.*
- *September 1998 – return to repair pipe supports*
- *July 1999 – excavate sand from around intakes. Install culvert around two intake screens c/w screen over top of culvert to keep trash out.*
- *April 2000 – system had not operated over the winter. Intake lines were pigged. Intakes were raised. Culvert was removed and sand excavated from around intakes. Culvert was reinstalled.*

4. Strategic Locations of the intake pumphouse and pipe:

The intake lines are locate in the nearest of three (possibly four) sub-channels in the river bed. This location, as section 2.1.2 indicates, has led to yearly problems of sedimentation. According to a 1997 report these channels appear to be semi-permanent,[36] although this is clearly not an established fact, and will require further exploration. From a 1995 report:

> "Sand bars and extensive shoal areas exist throughout the lower reach of the river, from km 0 to km 7…The river maintains a deeper main channel (thalweg) which, from km 3.2 to km 7, is relatively fixed along the right bank…This section of the right bank is being eroded and contributes sediment to the river…Downstream of km 3.2 the main channel position can fluctuate from year to year…"[37]
>
> "The adjacent sand bar to the east of this sub-channel is the tip of a very large permanent bar extending hundreds of metres upstream, which at low flows becomes exposed and cuts of the river flow from this west sub-channel. Therefore, the sub-channel containing the existing intake conveys flow only at higher river stages; at low stage it tends to become a backwater area with low velocities, which promotes sediment deposition.
>
> "The centre sub-channels appear to convey the majority of the river flow and are oriented so that flows tend to be directed partly towards the rock face on the left bank starting some 50 metres downstream of the intake. These flows, combined with that of the wet sub-channel appear to maintain a deeper sub-channel from 4 metres to 8 metres deep just off the rock face. Note that the location of the main flow channel as

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35 *Kugluktuk Water Supply Improvements Report Review*, A.D. Williams Engineering, 2006. Reporting on Arctic Divers (2002), p. 12

36 "i.e., they shift somewhat from year to year, especially in the location of the downstream face or edge, in response to varying flow conditions, but tend to remain tin approximately the same general position within the channel." (*Water System Modifications, Kugluktuk, NWT: Intake Structure Design Concept Brief – 60% Draft*, FSC Architects & Engineers, 1997, *p. 15)*

37 *Coppermine Water System Modifications Final Planning Report*, by Stanley Associates Engineering Ltd, May, 1995, p.6.2

shown in the Stanley report (1995) may have to be revised as shown in the attached mark-up of Figure 1."[38] [See Page 31]

5. **New Intake Pumphouse:**

The existing IPH is over 25 years old, is wracking, and at is the last component aside from the intakes that has not been upgraded or re-designed within the past five years.

6. **Water Capacity of the System for the future:**

Water Treatment Plant

According to the usage figures presented in section 2.1.1, Monday and Saturday deliveries amount to about 360,000 litres in the summer, which exceeds the total available storage (from Section 2.1.1.5, the WTP foreman's figures show that the tanks are capable of storing only 238,000 L, if we do not count the 90,000 L that must be kept in reserve to fight fires). After that, truck fill rates must be met directly by the pump. However, as was shown, the capacity of water production is limited by the maximum flow the filters will permit: 9.46 litres per second at 345 kPa. Assuming non-stop pumping and filtering, with maximum daily demand at 360,000 L, it will take over three hours to catch up on those days:

$$360{,}000\text{ L} - 238{,}000\text{ L} = 122{,}000\text{ L shortfall}$$
$$(9.46\text{ L/s})(60s/m)(60m/h) = 34{,}056\text{ L/h}$$
$$122{,}000\text{ L} \div 34{,}056\text{ L/h} \cong 3.6\text{ h}$$

Although raising the float switch to cut off at 180,000 L on each tank (instead of the existing 164,000L) will solve this for the short-term, tank capacity is an issue that must be faced immediately if the community is to continue to meet water demands.

2.1.3 Past Studies and Engineering Reports: During the past several years, numerous attempts have been made to solve the various issues that plague the water system in Kugluktuk. Many studies have been undertaken, and reports generated. CGS Kitikmeot Projects Division has had the most relevant of these reports and studies digitized to Adobe™ .pdf format, and is making them available on CD to all engineering firms who are interested in bidding on this design project. As can be seen, many of these works have been referenced in this RFP. Although much of what CGS feels is relevant in each of the references has been mentioned herein, all proposers are encouraged to become familiar with the material within the texts prior to writing a proposal. In addition, all water quality reports that are available to Projects Division are reproduced in .pdf format on this same CD.

2.1.4 Need for more Information or Data Collection: There is a need for more information before solutions to these issues can be determined, and a good design can be undertaken. This information

38 *Water System Modifications, Kugluktuk, NWT: Intake Structure Design Concept Brief – 60% Draft*, FSC Architects & Engineers, 1997, *p. 17*

includes, but is not limited to the following:

- River bed cross-sections and thalweg profile to provide bathymetry at the most likely locations for the intakes.
- Current flow measurements at these locations
- An analysis of ice conditions at break-up to determine the danger to intake structures.
- Up-to-date water quality analyses – both raw river water and post-filtered (pre-chlorinated) water. In addition, full water quality report for Heart Lake, and another location in the river where, in the past, hamlet crews have been known to draw water in times of water system shut-down.

<u>2.1.5 SCOPE OF WORK: Preliminary approach by the GN:</u> Although we expect that the following approaches will be modified through discussions with the successful consultant using the introduction of new data or innovative technological advancements, the GN's present approach to a solution of the various problems presented here has, and will remain to have, three key philosophies:

a) to build upon the existing 2002 WTP system rather than to design a new one. For this reason alone, such approaches as reverse osmosis or desalination plants are not at this time considered cost-effective or appropriate.

b) to deal with each of the problems on a piecemeal basis (in other words, the solution for seasonal salinity may or may not have anything to do with the solution for the turbidity problems).

c) to use appropriate engineering and relatively simple technologies – technologies that are capable of being operated easily (without the need for a great deal of training or certification[39]) and that do not require either expensive or hard-to-acquire components or replacement parts. Durability is also essential, as is being able to function in the harsh environment of the arctic.

Thus, our thinking ***at this stage of analysis*** is leaning towards the following approaches:

1. **Turbidity:**

   Explore options for reducing the levels of turbidity before the raw water enters the cartridge filters. Examples of this may be:

   - Coagulation, using various chemicals such as alum, ferric chloride, ferric sulphate, etc, to

39 Although for the foreseeable future there is no certification program for water treatment plant operators in Nunavut, it is imperative that hamlet personnel receive the appropriate training for the kind of facility they are hired to operate. If it is necessary to design a WTP that in other jurisdictions is a Class 2 plant, then an appropriate training program must be designed to upgrade the WTP operators so they are able to successfully and properly operate the plant. The consultant will, as part of this proposal, provide the necessary training.

be chosen according to an analysis of the kind of turbidity to be removed. Whether or not clarification is part of the system, consideration should also be given to the quantity and logistics of sludge removal (and whether the solids removal is primarily manual or mechanical). An analysis of the sludge may indicate that it is a useful by-product (can it be used with local aggregate sources to produce a better road or airport runway surface material, for instance?).[40] If coagulation is the chosen option, the primary criteria for choosing the type of system (various configurations of mechanical coagulation, in-line, air-mixing, etc), as in all systems in the Arctic, will be simplicity of operation, maintenance, and parts availability.

- Flocculation (hydraulic or mechanical) may be considered as an aid to the coagulation process, using such post-coagulation additives as bentonite or activated silica. It is important to note that detention time is increased in cold water, and settling of the floc may be affected by the denser cold water (thus tube settlers may be an option to aid in the sedimentation process). There are other considerations with flocculation and small WTPs that must be understood.

- Pre-ozination may be an option to augment (or, in some cases preclude) the coagulation process. "Ozone may significantly reduce coagulant requirements to the point where low residual solids (or filtration efficiency) make direct filtration feasible."[41]

- Clarification, including high-rate clarification such as plate settlers or tube settlers, may be a desired option before the water goes through the existing cartridge filtration. Traditionally, clarification is recommended before high-rate granular filtration when s exceeded roughly 10 NTU. However, other filtration methods may allow higher turbidity concentrations.

- Granular media filtration, such as natural silica sand, diatomaceous earth, granular activated carbon, crushed anthracite, etc., may be a viable option as a primary filtration approach prior to the existing cartridge filtration. Since there is already in place a cartridge filtration system it is possible that granular filtration may be feasible without any coagulation, flocculation, or clarification. However, it is likely that a fast granular filtration system is preferred over a slow system, since the raw water has an inordinately high level of turbidity.

- Recent advances have been made in low pressure membrane filtration. This, and microfiltration may also be worth while methods to explore.

Note that these added systems will require a location, additional shelter, power, and light. These factors as well must be considered and designed accordingly as part of the engineering contract.

40 Note that a current geotechnical study is underway to ascertain various sources and uses for local aggregate bodies. The information in this report will be made available to the successful engineering firm.
41 *Water Treatment Plant Design*, Third Edition, American Water Works Association, McGraw-Hill, Toronto, 1990, p. 89.

- In addition, the existing artificial storage pond, originally designed to store water in anticipation of times of high salinity in the river (late summer, early autumn) might be improved by the addition of a settling sump and provision for annual sludge clean-out. Presently, the hamlet water staff are using it as a settling pond as well as for its original purpose. But with no allowance in the design for solids removal, its use in this capacity is limited in duration.

- One recent report mentioned that the in-line turbidimeter in the WTP needs calibrating. This will be a requirement of the winning engineering team.

- Due to the excessive amount of turbidity, annual and semi-annual cleaning of tanks and storage pond is required. A full description of this procedure, as well as the frequency of cleaning will be presented in the revised O&M manual (see below).

2. Salt Water Wedge Invasion:

- Either of two possible auxiliary system approaches are desirable at this stage of analysis, each involving the retention of a permanently-installed auxiliary intake system that would be used when the saline sensors in the primary IPH indicate excessive salt water invasion:

  A. Retaining the auxiliary system that is currently being put in place (see 2.1.1.2 “Work in Progress”), or some sort of improvement on it. This may imply keeping the present location of the main intake as it is.

  B. Moving the intake laterally to a deeper channel, and longitudinally further downstream. The advantage of this option would be that it should be designed to address the sand build-up issue as well. Whether or not the (new) IPH itself is moved is another design consideration, of course. For further discussion on this topic, see 4 below (“New Locations of the Intake Pumphouse and Pipe”). If this option is proven to be desirable, it will not preclude the continued implementation of a version of option ‘A’ above – at least until this configuration has stood the test of time.

There is at least a third option that may be worthwhile to explore that may address the salt water wedge at certain times, and provide some redundancy in times of high salinity:

- Design an intake with a vertical pipe at the end of the horizontal run. This intake pipe would have two of three intake ports located along the height, enabling selective closure according to the height of the saltwater wedge. The vertical intake pipe should not extend into the layer of maximum ice thickness that is expected. Note that an intake that was capable of being raised and lowered has already been tried and proven to be impossible to operate due to sand build-up (though this idea may yet have merit in a new, scoured channel located downstream).

This option also would not preclude the necessity of the auxiliary system discussed in *A* above.

3. **Sand build-up around the Intake Pipe:**

- A hydraulics engineer is needed on the team of the successful applicant in order to study flows of sand build-up around the intake.
- Moving the intake laterally to a deeper channel, and longitudinally further downstream. However, the site should be analysed for ice break-up forces.
- An underwater steel or concrete jetty may be required to deflect currents around the intake and thus preclude (or at least delay) sand build-up. Alternatively, baffles over the intakes may work. Sufficient modelling must be undertaken (either computer or water tank model) if this option is to be pursued.
- If these or other measures are not effective at taking care of the sand build-up problem, it may be necessary to write into the O&M manual the annual (or bi-annual) scheduling and contracting of a diving team to clear the sand from around the intake pipe.

4. **New Locations of the Intake Pumphouse and Pipe:**

IPH: Choosing a new location for the new IPH may have merit, depending on costs, including an analysis of head losses due to a new intake location and other factors such as cost.

Intake: A 1997 report recommended that the optimum location for the intake would be between 50 and 150 metres downstream of the present intake (p. 2), however it must be noted that there is the danger that the salt wedge may be somewhat more pronounced further downstream.

> "Analysis of the available data suggests that the river flow dynamics maintains a significantly deeper sub-channel or depression in the area off the rock face, starting some 50 metres to 100 metres downstream of the existing location. The principal mechanism for this appears to be the concentration of flow due to the channel narrowing in this reach, specifically the projection of the rock bluff along the west bank into the channel…The Coppermine…shows soundings of 7.3 metres and 8.5 metres in this location (Figure 2, from Stanley, 1995)."[42]

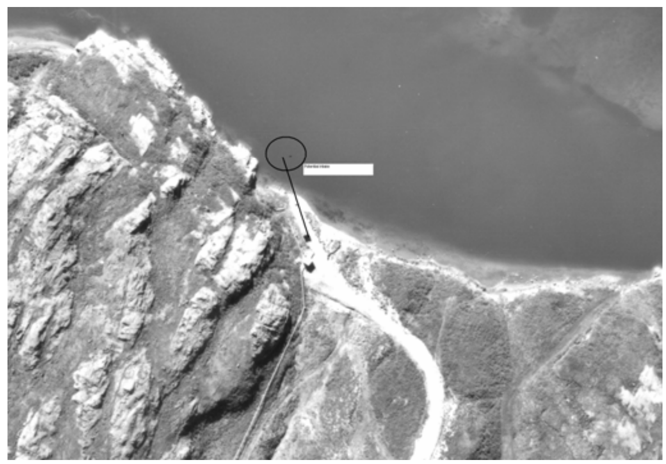
Rock Face

Bathymetric Survey: Towards further understanding of the river bottom profile in this vicinity, **the successful consultant will undertake, in the summer of 2007, to make soundings along a stretch of the Coppermine River.** This stretch commences at the present intake pipe and extends longitudinally 200 m down-stream. The data will

42 *Water System Modifications, Kugluktuk, NWT: Intake Structure Design Concept Brief – 60% Draft*, FSC Architects & Engineers, 1997, *p. 17*

also extend laterally 50 m from shore. Depth measurements will be taken in a longitudinal and latitudinal direction, with a grid of 5 m increments. From these measurements (and intermediate points if necessary), thalwegs will be drawn so that the channel bottoms are also plotted. The bathymetric data points will be plotted using either GPS coordinates and/or coordinates from a well-known and permanent bench mark on the shore. The consultant will then compare these new points with similar points gathered in previous years to ascertain relative channel stability.

Of particular interest is an apparently permanent and deep channel or depression, with a depth of between 3 and 5 m, dropping off quite near the shore (approximately 10 m out from the rock face) – one that seems deep enough and is scoured enough by the river current to present a good potential for the location of new intakes that may not be subject to sand build-up to the same extent as are the existing intakes.



Air Photo – location of deeper channel

The best time to parform bathymetric surveys is in the summer, by simply dropping a weighted line from a boat, plotting the x-y coordinates, and recording the depth. This would be far less expensive than doing it from the ice surface and with divers.

Another option for the successful consultant to consider is a cantilevered arm extending from the rock face (a 45^{o} to 60^{o} angle): Although this idea seems to be less cost-effective than using a version of the auxiliary system, it may be worth while to briefly explore the possibility of using the rock face at this place as the location for a cantilevered and braced steel arm that would extend permanently out over the river, and could be used at all times except possibly during break-up, when floating ice cakes may cause damage. This arm would be capable of raising and lowering a pump, depending on salt and turbidity conditions and ice thickness. Interestingly, a similar idea was discussed in the Stanley report (1995).[43] FSC undertook a very preliminary cost estimate of several variations in their 1999 “Final Design Brief”[44] reproduced on the accompanying CD. A synopsis of the alternatives was prepared by A.D. Williams, and is available on the CD as well.

Intake lines must be self-draining.

43 *Coppermine Water System Modifications Final Planning Report*, by Stanley Associates Engineering Ltd, May, 1995, p.7.9

44 Hamlet *of Kugluktuk, Nunavut: Water System Improvements Final Design Brief*, Ferguson Simek Clark Architects & Engineers, 1999, pages 2, 16, 25, & 31

Ice conditions and local river currents, including velocity measurements around the new proposed intake site should be studied, and the results accounted for in any design.[45]

Note that a contract is being awarded in April, 2007 for professional divers to clear the sand once again from the intakes and provide the GN with bathymetric data (including thalwegs) for river channels to 200 m downstream of the existing intakes, and 50 m out from shore, in 10 m incremental sounding points. This information will be available.

5. **New Intake Pumphouse:**

The existing IPH is over 25 years old, is wracking, and at any rate is the last component aside from the intakes that has not been upgraded or re-designed within the past five years. A new IPH is needed, and will incorporate at least the following characteristics

- Walls, floor, and ceiling that are built to high modern standards of energy efficiency that are the norm for arctic conditions. Such features as super-insulation, air-tightness, and natural light are essential. Heating the building is required, of course, but its size will be minimal if the building is sufficiently energy-efficient.

- Heating system to be electric heaters. With an extremely energy-efficient building, the amount of heat will be minimal. Electric heaters are also low-maintenance.

- Redundancy in intake pumps, as is currently the situation (i.e.: two intakes and two pumps), each automatically draining back to the river at the end of their pumping cycle (no check valves).

- Intake casing must be a minimum of 12” to 14” diameter so the pumps do not become stuck in any bends or dips that may develop. Optimum insulation on the pipes is somewhere around 2”.

- Backwash system capable of providing high flow for periodic removal of sediments from the line.

- A salinity sensor designed to detect pre-selected low limits of salinity, and to automatically shut off flow if these limits have been exceeded. These detection limits must be adjustable. Furthermore, it is imperative that actual tasting of the raw water by the hamlet crew be easily done. This is a necessary back-up precaution should the sensor fail (as it has in the past). In addition, process controls to safeguard salt water from being pumped into the system must be designed and specified.

- Digital Data Control (DDC) system that will sense, monitor, trend, and operate control points as may be required. This system must be Siemens-compatible and have remote monitoring and control capability through a standard IBM- compatible computer.

45 Recommendation contained in the letter from AGRA Earth & Environmental to FSC dated June 20, 1997 (from *Water System Modifications, Kugluktuk, NWT: Intake Structure Design Concept Brief – 60% Draft*, FSC Architects & Engineers, 1997)

Provision for a second CPU will be made in case the primary CPU is sent out for repairs.

- Connection to the auxiliary pump line.
- Controllers for electrical heat trace cables, and alarms should the heat trace fail. Capability of remote monitoring is desirable.
- Phone (or effective mobile radio) connecting it to the WTP.
- Exterior light sufficient for truck filling.
- If turbidity issues do not preclude this, a secondary fill arm, pump, and chlorinator pump to be used in case the fill arm at the WTP is out of order. This option should be considered if only for the possibility of access to fire trucks. Required truck fill pumping rate is a minimum of 910 litres per minute.
- Adequate power supply and back-up generator with its own dedicated fuel supply (tanks with double walls and proper isolation from the main part of the building).
- Sufficient room to store a spare pump, as well as a spare pump for the auxiliary system, chlorine, cleaning supplies, and other essential spares.
- Access road with turn-around area for hamlet water trucks, fire trucks (pumpers) and fuel delivery vehicles.
- Note that the building must be laterally braced against wracking due to tension from the intake line. This problem is currently plaguing the existing "new" IPH, and has required the retrofitting of rock-sockeded cable stays for each pump line. When designing the intakes, it is important to take into consideration the temperature-correlated density of water, which is most dense at 4 degrees C.

6. **Auxiliary Intake Pump:**

Referring to Section 2.1.1.2 ("Work in Progress"), it can be seen that there is a new auxiliary intake pump being installed. This will be operable through a in the ice, and housed by a plywood shack on skids resting on the ice surface. This system is not only being installed to provide fresh water in times of high salinity, but will also provide further system redundancy should the pumps from the IPH fail. However, at present this is not designed to work during months of thaw when the ice surface is too broken up (or non-existent). If this auxiliary system remains as part of the new system (current CGS thinking), provision will have to be made to enable the 74 kg pump itself to be supported by a flotation device that is anchored to the shore via a combination of cable-stays and a compression boom.

7. **Water Capacity and Location of Tanks:**

It seems clear from the discussion in Section 2.1.2 that there is already a storage capacity problem. Firstly, the successful proposer will verify these figures presented in Sections

2.1.1.5 and 2.1.2 and will work with the hamlet and CGS team to arrive at some immediate solutions. The second question that must be answered is, "Is there sufficient capacity to meet near-future needs of the community?" Kugluktuk's population has grown surprisingly fast during the past two decades. The table below shows the population increase (and the percentage for five year increments between 1981 and 1996.[46]

Year	Population	Percent increase
1981	809	/
1986	888	10
1991	1,059	19
1996	1,201	14

The successful engineering firm will provide a reasoned population growth projection for the hamlet over two time periods: the next ten years (until 2017), and the next twenty five years (to 2032). As this is done, three trends and several design considerations must be borne in mind that will affect population growth in the community.

- The first trend is that Nunavut's growth rate is the highest in Canada, and that there is a large disproportion of young residents (see table below, taken from the 2001 census, which shows that over 50% of the population was under the age of 24 at that time), which will greatly accelerate the growth as these children come of age. If these facts are not taken in to consideration, any projections will fall short of future reality. Recommendations for increased water storage requirements at these two times must be made, as well as design recommendations and Class C cost estimates for system expansion and location of tank(s). See the table below, showing Kugluktuk population below the age of 24 (2001 Canadian census)

	Males	Females
Total number (all ages)	625	590
Percent between ages of 0-4	12%	9%
5-14	23%	24%
15-19	10%	11%
20-24	6%	8%

- The second trend is the expected increase in population due to the accelerated expansion of mineral exploration in the area. As this expansion of both exploration

46 *Second Submission: Water Treatment Plant Pre-Design Report: Kugluktuk, Northwest Territories, , by FSC Architects & Engineers, August 11, 1997, p.7*

and ultimately mining increases, the hamlet will become a natural base of jump-off operations for companies working in the vicinity.

- The third trend is the expected continued increase in tourism. Both hunting and ecotourism are important factors in the economy of the Region. Bloody Falls Park and trail have recently been developed, and will be used increasingly.
- One design consideration to system size will be the anticipated periodic amount of back-wash water required if granular media filtration is a chosen option.
- Another consideration in sizing the water requirements is to account for dead storage (water that is inaccessible). A figure of 5% is considered reasonable.
- Equalization storage, too, may be a necessary component in calculating storage if it is determined that it is not necessary to meet peak demand.

GNWT MACA standard is based on an 8-hour water plant operation, 5 days per week.
The equation is:
$EV_{design\ year} = PDD_{design\ year}$ – Avg system production in an 8-hr day
Where:
$EV_{design\ year}$= Equalization Volume in the design year horizon
$PDD_{design\ year} = PDF \times TDF \times ADD_{design\ year}$
$PDD_{design\ yhear}$=Peak Day Demand in the design year
PDF = Peak Day Factor = 1.5
TDF = Truck Delivery Factor = 7/5 based on water delivery 5 days per week
$ADD_{design\ year}$= Average Daily Demand in the design year

- A further consideration is the amount of fire-fighting water that must be kept on reserve at all times. At present, the hamlet maintains 90,000 litres in reserve exclusively for fire fighting purposes. The successful consultant will determine through consultations with the Nunavut Fire Marshall's office, and by good engineering practice how much water must be held in reserve at the 10 and 25 year design horizon.

The successful consultant will take these issues and trends into consideration and will recommend design changes if necessary to the storage capacity of the water system. These recommendations will include all design work, geotechnical studies, and a chosen location for new storage tanks, related insulated buildings and appurtenances, if necessary. One immediate change is to adjust the float switch at each tank and raise the level from 164,000 L to closer to their design maximum.

8. **Water Transmission Lines:** All parts of the transmission line system must be checked for settlement. Low points where water may freeze due to lack of natural drainage must be identified and subsequently rectified during the construction process. Included in this transmission line system is the overland line from the IPH to the WTP, the vault and lines to the storage pond. Also, solenoids and relief valves must be installed where needed at parts of the line so that it is self-draining.

9. Other Areas of concern that must be addressed by the successful engineering firm:

- Review historical water quality analyses (CD provided) and compare with current Canadian water quality standards. Take new samples, and have lab analyse all standard parameters for comparison. In particular, this will be analysed in the light of: pH adjustment, THM formation potential, and oxidation if iron and manganese must be removed. According to a 1997 report, THMs do not appear to be above the acceptable limit.[47]

  Note that pH may also be a vital parameter in the coagulation process. For example, the optimum pH for alum coagulation is between 5.5 and 7.0.[48] A pH re-adjustment may also be required prior to final potable water distribution so that the water is less corrosive. If this is the case, the system may well be too convoluted for the demands outlined in the first part of Section 2.1.5.

  Note also that a report from 1999 contains a caution that iron particles may be present to the point of exceeding Canadian standards for aesthetics. However, the report strongly suggests that the particles may come from piping or pumps.[49] This will be investigated by the successful engineering firm.

  In addition, the aesthetic parameter of colour (< 15 TCU) is apparently frequently exceeded during the summer. According to a 1997 FSC report, "summer concentrations are reported to reach 20 CTU while winter concentrations reach 10 CTU."[50]

  Filters, depending on the flow rates and the time they spend idle, may become fouled with bacteria or fungus. This may lead to issues of taste or odour. The successful engineering firm will ascertain if this is the case, and, if so, make recommendations to remedy the problem.

  According to an FSC 1997 report, trihalomethanes (THMs) were within acceptable limits, however a new analysis will be undertaken, and a new look at the efficacy of the current practice of chlorination will be taken.[51]

- Water quality analyses will be performed of near-by Heart Lake for all standard parameters – especially hydrocarbons. It is rumoured that several snowmobiles (at the least) are submerged in the bottom of this small, fairly stagnant lake. However, it is desirable to locate another water source near town so that, in times of need, the hamlet has reliable options.

47 *Second Submission: Water Treatment Plant Pre-Design Report: Kugluktuk, Northwest Territories, , by FSC Architects &Engineers, 1997, p.24*
48 *Water Treatment Plant Design,* Third Edition, American Water Works Association, McGraw-Hill, Toronto, 1990, p. 90.
49 *Hamlet of Kugluktuk, Nunavut Water System Improvements Final Design Brief*, Ferguson, Simek, Clark Engineers and Architects, December 16, 1999, p. 24
50 *Second Submission: Water Treatment Plant Pre-Design Report: Kugluktuk, Northwest Territories, , by FSC Architects & Engineers, August 11, 1997, p.2*
51 *Second Submission: Water Treatment Plant Pre-Design Report: Kugluktuk, Northwest Territories, DRAFT, Ferguson Simek Clark Architects & Engineers, Aug. 11, 1997, p. 30*

- Re-design the truck-fill pumping system so fill times are reduced. This will involve first contacting George Egotak, the WTP foreman. Presently, if the water tanks are low, it takes 15 to 20 minutes to fill up a water truck.
- Review the procedures and equipment used to pump water from the storage pond to the surge tank in the WTP. Presently this is done via a 3" flexible hose and diesel pump that is moved to the shore of the pond. This has the potential for oil contamination. The successful consultant will explore options for an in-line electric pump as part of a more permanent overland line. Self-drainage is required.
- Back-up power: At present there is no back-up power generator at the WTP. This must be addressed through design and implementation.
- Updating the O&M manuals: The successful engineering company will work with the Regional Engineer, the Project Officer, and the hamlet WTP staff to go through the existing O&M manuals and improve and update them. In addition, new O&M manuals will be created for any new systems that are being designed as a result of this RFP, or have been built during the last four to five years, since the WTP was built. Note that much of this must wait until after construction when as-built drawings and information are complete. These manuals will, in addition to containing up-to-date technical literature produced by component manufacturers, contain the following:
    - Complete schematic drawings of the WTP, IPH, and any other systems that are deemed useful to understanding how the system works. These drawings will be completely labelled with numbers/letters correlating to tags on the actual component..
    - A plain-language introduction to the operations of each of these systems. Included in this introduction will be a discussion of the flow the water takes from its source in the Coppermine through to its ultimate delivery by the water trucks.
    - A series of tables showing vital system checks – checks that are necessary to keep all aspects of the water system from failure. Included in this will be information on the correct temperatures and pressures at various points in the system, along with specific procedures to take in case of emergencies.
    - A series of Maintenance Schedule tables organized by: daily maintenance, weekly maintenance, monthly, semi-annually, annually, and other times as needed. These, too, will have reference to the label letter/numbers as needed. These tables will be able to be photocopied and will contain columns for maintainers' initials and dates of maintenance, plus a place for comments.
    - A series of Component Testing Schedule tables, whereby each component that is subject to wear-and-tear can be isolated and tested on a regular basis. For example, a relief valve should be tested for proper operation periodically or there is a great risk it will fail to open when it is required.

- Corresponding to the Maintenance Schedule tables and Component Testing Schedule tables will be specific methodologies on how to maintain and test each component.

- Label with either brass or durable plastic each component (pump, valve, etc). The label numbers/letters will correspond to those on the schematic drawings.

- The schematic drawings will be reproduced in large format and will be mounted behind plexiglass in the WTP, IPH, and any other place that is appropriate.

- Water Treatment Plant classification: With the possible addition of other filtration or coagulation components, is the Class of the WTP changed from Class 1 to higher? The successful consultant will advise the GN on what are the implications of this with regard to water treatment plant operator training. Note that at present there is no Operator certification mechanism in Nunavut.

- On-going training for WTP operators: With the possible augmentation of the WTP system, further training may be necessary. The successful consultant will advise the GN on training options. This may include on-site presence for periods of one or two weeks per month for the first six months to one year of operation of the new system.

The successful engineering company will perform all necessary designs, drawings, and specifications to enable one or more requests for construction tenders (RFT) to be issued for the issues discussed above. Furthermore, the successful firm will write the RFT(s), to be reviewed by the CGS team and subsequently delivered to hamlet staff for further possible input. Included in each RFT will be a **detailed, clearly written description (plain language) of the work required**, as well as detailed drawings and the usual contract sections. In addition, it must be made absolutely clear that at no time will it be allowed to jeopardize the continued supply of adequate and safe drinking water (as well as fire water reserves) to the community. The engineering design must reflect this basic requirement, as must the construction specification, drawings and RFT.

2.2 Project Identification:

Name: Kugluktuk Water System Upgrades
Project Number 04-4417
Location: Kugluktuk, Nunavut
Client: Department of Community and Government Services (CGS)

2.3 Project Personnel:

The primary contacts for this project are:

Sudhir Jha, M.Eng, Project Officer
Community and Government Services
Cambridge Bay, Nunavut, X0B 0C0
Phone: 867-983-4008
Fax: 867-983-4123
e-mail: sjha@gov.nu.ca

- **Thomas G. Livingston**, P.Eng
  Regional Municipal Planning Engineer
  Community and Government Services
  Cambridge Bay, Nunavut, X0B 0C0eP

Phone: 867-983-4156
Fax: 867-983-4123
e-mail: tlivingston@gov.nu.ca

2.4 : Project Schedule and Deliverables

2.4.1 The Architectural and Engineering Services shall be delivered as described in Section E of the Standard GN Architectural / Engineering Services Agreement and modified as follows. The consultant shall provide the GN with:

- three electronic copies (CD) of all drawings (AutoCAD 2005) and specifications (MS Word format), with complete read/write access. (The GN will provide those topographical AutoCAD community maps in the possession of the Regional Engineer. However, if better maps are required, the consultant will be required to provide updated contour maps.)
- all submissions also in Adobe .pdf format for review by CGS Technical Services Division
- "as-built" electronic drawings (AutoCAD 2005) from marked up white prints produced by the construction contractor.
- commissioning services as follows:
    1. Hydrostatic
    2. Mechanical
    3. Electrical
    4. Instrumentation and Digital Control
- site survey as required for considerations of layout and design, including soil mechanics lab analyses, geo-technical investigation as required for structural and civil works, and topographical surveys, if required.
- documents labeled "**Issued for Tender, Not for Construction**", at the tender stage.
- after Tender Close, and prior to contract award, modified tender documents incorporating all addenda, labeling the documents "**Issued for Construction**".
- aall details shown on project documents cross-referenced to note detail number, originating location and location shown.
- all tender documents for Phase 1 construction, completed and available for tender on the 21st of January, 2008, and 19th January, 2009 for Phase 2 construction.
- Environmental Assessment studies or reports, as required
- brief report regarding options explored, along with Class D estimates for each
- all engineering services necessary to determine viable solutions to the issues discussed in the Terms of Reference and Scope of Work above. All relevant calculations, spreadsheets (in MS Excel format), and equations supporting these proposed solutions and designs will also be provided to the GN so that the CGS Project team is fully informed.
- clear information about which authorities having jurisdiction should be approached for permits or approval for any of the work entailed. These will consist of, but not be limited to, the hamlet council, Nunavut Environment Impact Review Board (NIRB), Nunavut Water Board (NWB), Nunavut Planning Commission, GN Environmental Protection, Canadian Department of Fisheries and Oceans (DFO), and Indian and Northern Affairs Canada. Furthermore, the consultant will be responsible for all regulatory submissions and compliance to accepted standards and practices, including new standards that are expected to be applied.

In addition, the consultant will be responsible for making presentations to hamlet councils, mayors, and staff regarding the various options being considered, on an as-needed basis.

2.4.2 Existing studies and investigations:

- All proposers will be given electronic copies of existing studies presently known to the Regional Engineer of CGS. Much of this is important information with which the proposers are expected to become familiar, and will become the back-ground for further investigations by the successful consultant.
- In addition, all proposers will be given electronic copies of all water quality analyses available

2.4.3 Local employment and training potential:

The consultant and contractor(s) will be encouraged to use local labour as much as possible. Where training opportunities for Nunavummiut exist, these too will be pursued. NNI minimum standards will be referenced.

2.4.4 Water License through the Nunavut Water Board

The successful consultant will be responsible for applying for the water license. To aid this process, CGS will obtain a letter from the hamlet of Kugluktuk giving permission for CGS to act on the Hamlet’s behalf in matters pertaining to the NWB. All correspondence to the NWB will subsequently originate with CGS. The successful consultant will be responsible for doing all that is required to apply for a new water license, and will devote whatever time is necessary to carry the application through to a successful conclusion. Although this may include several iterations and a series of long questions to be answered for the NWB, the consultant will provide sufficient budget for this process. The NWB will require one submission with any back-up documentation and studies that may be necessary. This submission must contain no inconsistencies, gaps, or contradictions. It must also be written in such a way as to make it clear to any member of the public who reads it during the review process that the applied science behind the designs is both comprehensible and comprehensive. This implies that the consultant will provide a full engineering rationale for each issue, including citing relevant engineering precedents, models, equations, or studies by acknowledged experts.

Note that work is currently underway to upgrade the hamlet’s sewage lagoon and wetland system. The consultant’s report projects sewage volumes of 126,113 cu. m by the year 2026.[52] This exceeds the current water intake capacity (64,000 cu. m) as shown in the water license by approximately 100%. This must be addressed by the successful consultant.

2.4.5 Site Visits,:

The successful consultant will provide sufficient time and budget to carry out all necessary site investigations, including airfare, room and board, geotechnical, river bathymetric cross-sectional analyses, salinity data collection, ice and wind studies, reading of available studies and will provide other on-site analyses as needed, equipment rental, and ancillary expenses including. The consultant will also be aware of the following needs.

52 *Detailed Design Report for the Improvement to the Sewage Lagoon and Solid Waste Disposal Facility: the Hamlet of Kugluktuk, Nunavut,* Nuna Burnside Engineering and Environmental Ltd, June, 2006, p. 12

- On-going discussions with RMPE and hamlet mayor, Council, SAO, and hamlet staff
- Rental of necessary equipment
- Sample jars to for analyses via air freight
- Thalweg lines, geotechnical, and water quality studies deemed necessary

2.4.6 Project Delivery:

It is expected that this project will be delivered through the standard tendering procedure. The Project Officer of Community Government and Services will be responsible for managing the project through the stages of the investigation. CGS Technical Services in Iqaluit may provide assistance. The Project Officer will be the lead contact within the GN, and it is to him that the consultant reports. The RMPE is responsible for providing over-all program information and direction, and taking part in design and subsequent review of all design submissions. The RMPE must approve any modifications to the program contained within this Request for Proposal prior to implementation of these changes.

2.4.7 Past Relevant Experience and Methodology:

Provide a short list of projects in which the Consultant and Sub-Consultant have performed similar work. The outline of experience should indicate how schedules were met and how final costs compared with estimates. References for substantiation are to be provided. The successful proposer must provide information showing all areas of required expertise are present on the engineering team.

In addition, all proposers will provide a clear outline of their ideas and methodologies proposed to provide solutions for each of the issues discussed in the Terms of Reference and Scope of Work above.

2.4.8 Target Schedule:

The engineering design and subsequent construction contracts will be broken up into two phases (refer to Section 2.1.5: Scope of Work):

- Phase 1 will involve primarily design work around the WTP and transmission line:
  1. Turbidity
  6. Auxiliary Intake Pump
  7. Water Capacity and Location of Tanks
  8. Water Transmission Lines
  9. Other Areas of Concern
     - Note that it may also be necessary to continue the work described in Section 2.1.1.2 (Work in Progress) if either the flange of the functioning intake line still needs repair, or if the second intake pump is still not functioning. And more bathymetric data may be required.
     - Bathymetric data as described in Section 2.1.5 (Scope of Work), No. 4 (p. 18)
- Phase 2 will involve primarily design work around the intake pumphouse and intake pipes
  2. Salt Water Wedge Invasion
  3. Sand Build-up around Intake Pipe
  4. New Location of Intake Pumphouse and Pipe
  5. New Intake Pumphouse

The discussion in Section 2.1.5 on updating the O&M manuals pertains to relevant aspects of both phases. It is expected that the final revision to the O&M manual will be delivered after Phase 2 completion.
Note: Periodic review meetings will be held, with the Consultant and GN representatives present. Location of meeting will be dependent on the phase, and will be either in Cambridge bay, on site, the consultant's offices, or via teleconference.

May 2, 2007 RFP close
May 24, 2007 Consultant Contract award

<u>Phase 1</u>

May 28, 2007 Start-up teleconference
July 3, 2007 Preliminary Report outlining design directions, providing recommendations and proposed design parameters.
July 10, 2007 The GN will review and amend the Preliminary Report as required, will make recommendations for change, and will authorize the Consultant to proceed to Design Development Phase
July, 2007 Site visits, investigations, water analyses, bathymetric survey, other surveys, etc.
August, September, 2007 Further on-site investigations as needed, consultations with Hamlet staff, CGS team
September 24, 2007 Development of design, including a class "C" estimate submitted by the consultant
October 1, 2007 GN review of design development complete
November 12, 2007 50% construction tender specifications and drawings including submission of a class "A" estimate.
December 10, 2007 90% construction tender specifications and drawings
January 21, 2008 Phase 1 Tender documents ready to be sent to contractors
May 2, 2008 Phase 1 construction tender award
Summer, 2008 On-site project services
Fall, Winter, Spring, 2008 On-going training of staff at WTP

<u>Phase 2</u>

May 12, 2008 Start-up teleconference with consultant
June 16, 2008 Preliminary Report outlining design directions, as revised from the report from June 18, 2007
June 23, 2008 The GN will review and amend the Preliminary Report as required, will make recommendations for change, and will authorize the Consultant to proceed to Design Development Phase
July, 2008 Site visits, investigations, surveys, etc
August, September, 2008 Further on-site investigations as needed, consultations with Hamlet staff, CGS team
September 22, 2008 Development of design, including a class "C" estimate submitted by the consultant

September 29, 2008	GN review of design development completes
November 10, 2008	50% construction tender specifications and drawings including submission of a class "A" estimate.
December 8, 2008	90% construction tender specifications and drawings
January 19, 2009	Phase 2 Tender documents ready to be sent to contractors
May 1, 2009	Phase 2 construction tender award
Summer, 2009	On-site project services

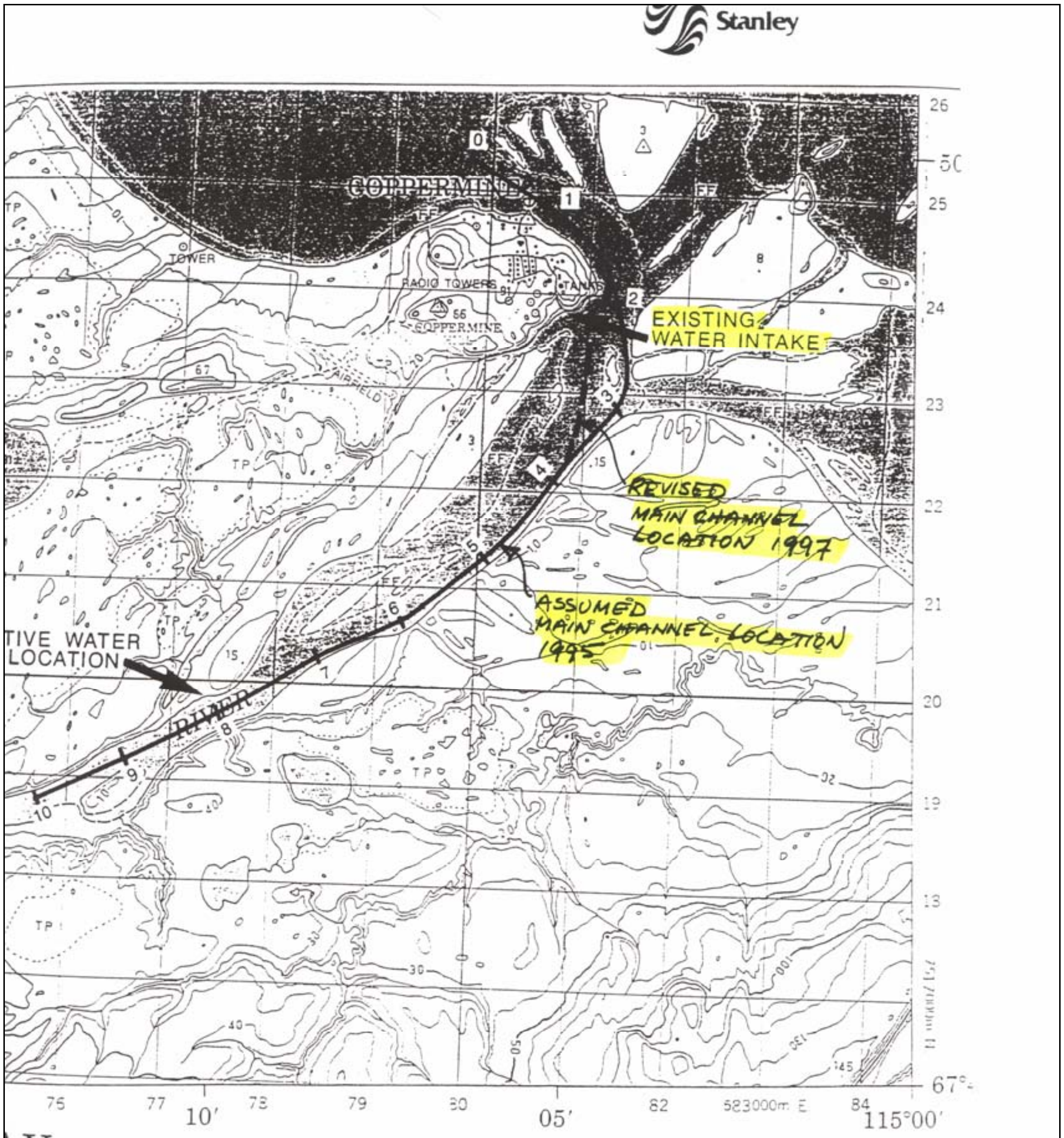


Figure 1 (from Stanley 1995 Report)
COPPERMINE RIVER
AND ESTUARY

3. Proposal Evaluation

3.1 Selection Methods

When an alternative is proposed regarding any specific requirement, it will be evaluated to ensure that the desired results will be achieved.

Proposers should be aware that certain mandatory requirements may have been set out in the Terms of Reference. Proposals that fail to provide these requirements will be deemed not responsive and will not be evaluated.

3.2 Rating

- The evaluation team will utilize specific criteria to rate each proposal. Ratings will be confidential and no details will be released to any of the other proposers.
- Each proposal will be evaluated using the standard "Architecture/Engineering Consultant Proposal Rating Schedule included as part of this proposal request." See Appendix "C"

3.3 Proposal Content

The following information should be provided in the proposal. This information will be utilised in evaluating each proposal submitted.

3.3.1 Project Team (Proposed Personnel)

- The proposer is to describe the capability of the resources proposed to meet the requirements described in the terms of reference.
- The proposal shall include brief resumes for the proposed sub consultants and project team members with a description indicating how, and in what ways the proposed resource satisfies the needs identified in the Request for Proposal.
- The proposer must demonstrate that the assembled team comprises, at the least, a qualified (experienced in Arctic water systems) hydraulics engineer, a soil mechanics engineer, a water quality expert, a structural engineer, an experienced water treatment engineer, a civil engineer qualified in Arctic water delivery systems, and an expert in river flow and river channel modelling.

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3.3.2 Methodology

Describe how the proposer intends to achieve the project's objectives. Demonstrate understanding of the work involved, design collaboration with the RMPE and PO, as well as with hamlet administration and Council, community input, budget schedule and other significant factors to be considered. It is expected that the methodology and schedule will demonstrate how the proponent will proceed and how much time each stage is expected to take.

3.3.4 Past Relevant Company Experience

Provide a list of projects in which the Consultant and Sub consultants have performed similar work.

3.3.5 Schedule

Indicate how closely the proponent's schedule meets the project requirements in a logical manner delivering a quality service.

3.3.6 Fees and Expenses

Prices bid must be stated in actual dollars and cents expressed in Canadian funds. The proposal must include cost information as follows (broken down according to each facility):

- A lump sum fee for preliminary design, design development, construction documents, bidding
- A lump sum for each of the following Construction Phase requirements (include an estimate for disbursements):

1. 30 days resident engineer services
2. 60 days discipline engineers / technicians / 3rd party inspectors for commissioning of project.
3. 10 site inspection trips, from the consultants designated home office, for structural, mechanical, electrical, geotechnical, survey, instrumentation and civil sections.
4. A minimum of 6 months training time for new water treatment systems, on the basis of one week on site per month, and on-call for the remainder of the month to answer operator questions

   Note: The number of days and trips listed above are an estimate based on our experience with similar projects and are meant to provide a consistent measure across all proposals. The actual numbers may differ and will be amended based on the Consultants published rates and per diems.

- The Consultant is to provide cost details, daily rate schedule and per diem rates for project team members for in and out of office services.
- Prices must be stated in actual dollars and cents expressed in Canadian funds.
- The Government of Nunavut will pay the Goods and Services Tax (GST); however, do not include GST in your proposed pricing.
- The proposal must include a total contract amount and a total estimated disbursement cost.
- An estimate of disbursements of non–field expenses such as telephones, facsimile, courier, copy, photographic, postage, computer and tender document printing costs. Assume 25 sets of tender documents for each tender.
- A lump sum for each of the Construction phase requirements (include an estimate for disbursements) as outlined above
- Cost details, daily rate schedule and per diem rates for project team members for in and out of office services.
- An estimated total contract amount
- Do not include GST in your proposed pricing. The Government of Nunavut will pay the Goods and Services Tax (GST).

Note: The number of days and trips listed above are an estimate based on our experience with similar projects and are meant to provide a consistent measure across all proposals. The actual numbers may be different and will be amended based on information as it becomes known.

3.3.7 Local and Nunavut Content
Identify the place of residence of each member of the team, his or her home office location and provide an estimate of the percentage of work that will be performed in Nunavut and the communities. Provide an estimate of the percentage of the total work for the project that will be completed by Nunavut businesses and businesses local in the subject community for the project.

3.3.8 Inuit Content
In compliance with Article 24 of the Nunavut Land Claim Agreement, the Government of Nunavut will provide consideration for the use of Inuit goods and services and labour. Proponents should describe fully the proposed Inuit content. This Inuit content will be the percentage of work for this

project to be completed by Inuit firms listed on the registry of Inuit firms maintained by Nunavut Tunngavik (NTI), and the amount of Inuit employment created related to this project.

ACRONYMS and TERMS used in this RFP

C/BA	Cost-Benefit Analysis
CGS	Community and Government Services
CPU	Central Processing Unit (of a computer)
DDC	Digital Data Control
DFO	Department of Fisheries and Oceans (Federal)
DIAND	Department of Indian and Northern Development (part of INAC)
GTI	Gas Tax Initiative
INAC	Indian and Northern Affairs Canada
IPH	Intake Pump House
lpcd	Litres per capita per day
NIRB	Nunavut Impact Review Board
NWB	Nunavut Water Board
ntu	nephelometric turbidity unit
PO	Project Officer
RFP	Request for Proposals
RFT	Request for Tenders
RMPE	Regional Municipal Planning Engineer
RWU	Residential Water Use
SAO	Senior Administrative Officer of the hamlet
WPT	Water Treatment Plant

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auxiliary system	The third intake pump system designed to address specifically salinity issues
“old IPH”	The IPH built prior to 1980
“new IPH”	The IPH built around 1980
new IPH	The IPH to be designed by the successful consultant responding to this RFP

Appendix A: ARCHITECTURAL/ENGINEERINGCONSULTANT PROPOSAL RATING SCHEDULE

Item	Rating Criteria		Unit Points Awarded (A)	Assigned Weight (B)	Total Points (A) x (B) = (C)
1	Project Team – personnel Assigned/made available to project			20	
2	Methodology or approach proposed by the consultant			20	
3	Past Relevant Company Experience			10	
4	Project Schedule			10	
5	Project Budget Fees and Expenses			10	
6	Past Performance References/ Appraisals			10	
7	Location of Company and Team Relative to Project Site			5	
8	Inuit Content	Inuit Labour		10	
		Inuit Firms		5	
SUB-TOTAL WEIGHTED SCORE (C):					

LOCAL/NUNAVUT BONUS POINTS

Nunavut
Businesses (C) __________ x (D) _________ x 7 % = _____________
Labour (C) __________ x (E) _________ x 7 % = _____________

Add the results of the above calculations for the **TOTAL NUNAVUT BONUS PONTS:**

Local
Businesses (C) _________ x (F)___________ x 1. 5 % = ___________
Labour (C) _________ x (G) __________ x 1. 5 % = ___________

Add the results of the above calculations for the **TOTAL LOCAL BONUS POINTS:**

PROPOSER ________ **TOTAL:**

Comments: ____.

Committee Member:__________________________________. **Date:**____________________.

LEGEND:
A – Evaluation Points Awarded
B – Weighting Factor
C – Sub-Total Weighted Score (A times B)
D - % of Work to be done be Registered Nunavut Businesses including Local
E - % of Work to be done by Nunavut Residents including Local Residents
F - % of Work to be done by Nunavut Businesses or Inuit Firms Local to the subject community
G - % of Work to be done by Local Residents of the Subject Community
Note: for Definitions of terms used in the Legend refer to the NNI Policy Definitions section.

RATING POINTS:

Poor 1 - 3 points
Fair 4 - 6 points
Good 7 - 8 points
Excellent 9 - 10 points