Proposal for Engineering & Architectural Services
Water Supply Improvements
Grise Fiord, Nunavut

FSC
GROUP

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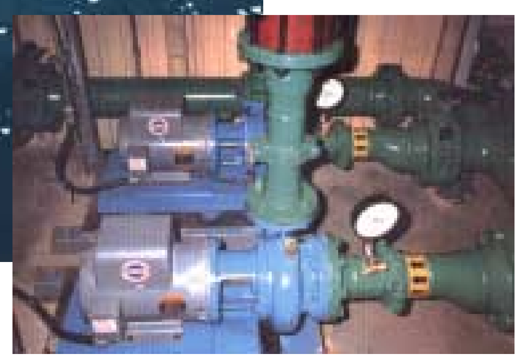

FSC Job # 2000-9993-011

January 28, 2000

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1. EXECUTIVE SUMMARY

We have assembled a highly qualified and experienced project team in the area of Municipal Planning & Design with a management and technical base in Iqaluit supported by our staff in Yellowknife. We further propose to include the technical support of AGRA Earth & Environmental for the geotechnical aspects of the project. We believe that the Project Team's technical experience and local knowledge will be assets in completing this project to the satisfaction of the residents of Grise Fiord and the Government of Nunavut.

Ferguson Simek Clark has the staff resources available to make an immediate start on this assignment.

A large portion of this project will be mechanical and electrical in nature. FSC is the only consulting firm in Nunavut with resident staff in the disciplines of electrical and mechanical engineering.

Our engineering and architectural group has ample capacity to complete this project on time and within the specified budget. We have current work commitments for only approximately 25% of our capacity for the period of the design and construction schedule.

As we understand it, the prime objective of this assignment is as follows:

> *To upgrade the existing water supply system for Grise Fiord to meet minimum flow and storage requirements. We will provide a simple, energy efficient, fail-safe, rugged and reliable water system meeting the standards and budget of the GN and which can successfully be operated and maintained by local staff.*

We have reviewed your request for proposals and have prepared the following proposal ensuring that all relevant items are considered. The following are highlights of our proposal:

1. We will make an immediate start on this assignment to ensure timely submissions of the Project Reports and Design Packages.

2. The Key Project Positions will be filled as follows:

Project Position	Personnel	Resident Office
Local Liaison	Raymond Mercredi	Grise Fiord
Assistant Resident Inspector		Grise Fiord
Project Manager,	Terry Gray, Arch. Tech.	Iqaluit
System Specialist (Mechanical),	Ross Abdurahman, P. Eng.	Iqaluit
System Specialist (Electrical),	Garry Karst, P. Eng.	Iqaluit
Resident Inspector	Michael Cunningham, CET	Iqaluit
Steel Tank Specialist	Walter Orr, P. Eng.	Yellowknife
System Specialist (Structural),	Pavol Kavicky, P. Eng.	Yellowknife
System Specialist (Municipal),	Kevin Hodgins, P. Eng.	Yellowknife
System Specialist (Water Quality/Treatment),	Ron Kent, P. Eng.	Yellowknife
Geotechnical Specialists	Agra Earth & Environmental.	Yellowknife

3. We will research the potential for conversion to heat recovery from the NWT Power Corporation generation facility that is immediately across the roadway from the water supply facility.

4. We propose to complete the tasks for this project for an estimated cost of $99,820.

5. We offer a $2,000 reduction if one of the project review submissions is deleted. Project submissions would therefore be at the schematic design, 65% and tender stage.

6. The Northern/Local Content of our Proposed Effort is as follows:

Project Effort & Expenses	
Local Involvement	16 %
Iqaluit Based	61 %
Yellowknife based	23 %
Non-Northern	0 %
Total	**100.0 %**

2. PROJECT UNDERSTANDING

2.1. GENERAL

We fully understand the requirements of this assignment as set forth in the Terms of Reference supplied to us by the Government of Nunavut, Department of Public Works and Housing.

The purpose of the study is to upgrade the existing community water supply and storage system for Grise Fiord.

If selected, Ferguson Simek Clark will take a fresh look at this project having not been specifically involved in the water supply system of Grise Fiord in recent years. Our key project team technical members all have intimate knowledge of the system having been through the facility while completing other work in the community.

It is reported that the community growth has resulted in the need for additional storage of 3,940 m^3. A portion of the system components are due to be replaced and the tank lining of the existing tanks is questionable and requires inspection and possibly recoating.

Our research shows that prior to 1978, ice blocks cut from icebergs frozen into the flow ice were the main source of water for most of the year. The ice blocks would be transported by Bombardier and trailer to residents' water tanks and left to melt. A reverse-osmosis plant for the desalinization of sea water was installed in the late 1980's but was decommissioned due to operational problems.

Water is now obtained from a small glacial runoff pond located in the centre of the community. The water is of good to excellent chemical quality for domestic use. The water is clear, very soft, poorly buffered, neutral, and low in dissolved solids. Treated water is below the recommended limit with respect to corrosiveness. Batch chlorination has been shown to have eliminated or greatly reduced most corrosion-intensifying bacteria.

The truckfill point and treatment facilities are located inside the Hamlet garage. Treatment facilities consist of two chemical solution mixing tanks (each 115 L capacity), a 1/2 hp mixer, and a hypochlorinator.

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Water shortage problems have been encountered in recent years and the community has reverted to collecting ice for supplementing the seasonal collection. These ice blocks have been placed into the storage tanks where the heat exchangers have melted the ice for treatment and delivery of the required water to the community holding tanks.

A boiler system is utilized in Grise Fiord to temper the storage water. The boilers and circulation pumps are manually started and run continuously with the boiler firing thermostatically by an integral temperature switch on the return hot water loop.

2.2. RESEARCH FOR PROPOSAL

In writing this proposal we conducted a great deal of research on the community, the water infrastructure and the project in general.

We researched past water quality, water supply and infrastructure studies; studies for the sewage system as they relate to the overall water requirements for the Community, and heat recovery potential from the power generation facility across the road for the water facility.

Our research included the following:

- Review of 1983 Study of Heat Recovery Potential from Diesel Electric Generating Plants in Grise Fiord authored by Ferguson Simek Clark.
- Review of 1985 Grise Fiord Water Supply Study authored by Timothy Smyth, Municipal Programs Engineer, Department of Local Government, GNWT Baffin Region.
- Review of 1985 Grise Fiord Water System Supplementary Predesign Report authored by M. M. Dillon of Edmonton, Alta.
- Review of 1986 Design Brief for the Installation of the Second Water Storage Tank authored by M. M. Dillon of Edmonton, Alta.

- Review of 1988 Operations & Maintenance Manual for the Grise Fiord Water Supply Facility.
- Review of 1993 Sewage Disposal Improvement Concept Report authored by UMA Engineering Ltd.
- Review of 1993 Inspection Report for the Sewage Lagoon authored by UMA Engineering Ltd.
- Review of 1994 geotechnical Investigation reports completed by Thurber Engineering for the new sewage lagoon.
- Review of 1998 Grise Fiord Water Supply Evaluation included with the RFP.
- Review of past inspection records and knowledge of the various engineers, technologist, and architects in the FSC group who have inspected this facility over the years.
- Telephone discussion with Mr. Peter Biggar, P. Eng., Northwest Territories Power Corporation to establish the potential for heat recovery from the Power Corporation power generation plant for use ion tempering the community water supply.
- Telephone conversation with Hamlet personnel including Levi Killiktee, SAO and Robert Sheaves, Assistant SAO.
- Telephone conversation with Mr. Louis Bourgeois, the GN Project Officer responsible for ensuring the satisfactory and timely completion of the infrastructure upgrade.

2.3. REVIEW OF 1998 PLANNING STUDY

A planning study was completed for this facility in 1998. The project included study of the demographics and water use for the community. It also included inspections of the water source, fill line, pumphouse, storage tanks, and various system components.

An evaluation of the system components was completed and reported in the 1998 Planning Study.

The identified components are as listed below:

- Heat exchangers and boilers
- Pumps
- Heating System Operation
- Seasonal Fill System
- General O & M Practices
- Recommendations for increased storage and system upgrades were made based upon this study.

The study compares the age of the specified equipment to the expected life of each particular component. The major pieces of the equipment were found to be in relatively good condition. It was noted that the system pumps are reaching the end of their anticipated service life and that the seasonal fill system is at times problematic depending on the spring runoff rates.

We have studied the recommendations made within the 1998 planning study and present within this section our analysis of these recommendations.

Recommendation #1*. All pipe-mounted pumps are to have spares located on-site.*

FSC analysis

Given the remoteness of Grise Fiord, we recommend that not only the pipe-mounted pumps have spares but rather there should be spares on site for ***all*** system pumps. This is standard practice for all of the water systems that have been designed by Ferguson Simek Clark.

Recommendation #2*. Improvements in the keeping of records.*

FSC analysis

We support this recommendation. In the methodology section of this proposal we discuss procedures for handing over the facility to the staff of operators. At the commissioning stage, FSC standard procedures include a training session for the community operators, which emphasizes the importance of maintaining solid continuous system records.

Recommendation #3*. The 20 year planning water consumption be set at 9,193 m^3.*

FSC analysis

We have reviewed the analysis in the establishment of this value. The only component that we believe stands out for discussion is the volume recommended for fire protection (60,000 litres). In some communities that we have recently completed water storage system analysis and designs the Fire Marshall has accepted a lesser volume of stored water, that being, 30,000 litres. Given that the water source for Grise Fiord is the spring runoff and therefore resupply is difficult during freezing season, FSC supports the recommendation for fire storage as being 60,000 litres.

Recommendation #4. *Repairs be made to the internal tank paint system in conjunction with other required capital projects*

FSC analysis

We have given the entire system some consideration and while we recognize the possibility of deterioration of the tank lining resulting in corrosion of the steel storage tanks, we believe that the identificaton of iron in the water is more likely due to corrosion of the system piping. While we support the recommendation to repair the internal paint system of the tanks, we further recommend that the internal coatings of the entire system piping be either re-coated or replaced at the time of upgrading the system in 2000. With the development of modern epoxy coatings such as Valspar 78, this can easily be accomplished on-site.

Recommendation #5*. Water quality testing be completed monthly, with the results filed as part of the community annual report.*

FSC analysis

We support this recommendation. In writing this proposal we collected water quality data for the community. We summarize the findings from a sample tested on September 25, 1990 below:

Grise Fiord Water Quality

Legend	
MAC	Maximum Acceptable Concentration
AO	Aesthetic Objective
N/R	Not Required by Regulation

		Drinking Water Regulations		**September 25, 1990**
PARAMETER:		**MAC**	**AO**	
ROUTINE:	pH		6.5-8.5	7.1
	Sp. Conduct (mS/cm)	N/R		50
	Alkalinity mg/l as CaCO3	N/R		18
	Calcium (mg/l)	N/R		3.3
	Magnesium (mg/l)	N/R		0.2
	Sodium (mg/l)		<200	1
	Chloride (mg/l)		<250	1.7
	Calcium Hardness mg/l as CaCO3		N/R	11.0
	Total Hardness, mg/l as CaCO3		<120	11.8
OTHER PARAMETERS	Turbidity (NTU)	1	5	0.5
	Filter Residue (TDS) (mg/l)	N/R		<18
	Trihalomethane (mg/l)	100		0.002
	Dissolved Organic Carbon	N/R		<0.5
	Aggressive Index	**N/R**	**>12**	**9.40**
METALS	Total Aluminum (ug/l)	N/R		60
	Total Antimony (ug/l)	N/R		1.2
	Total Arsenic (ug/l)	25		0.04
	Total Barium (ug/l)	1000		12
	Total Cadmium (ug/l)	5		<3
	Total Chromium (ug/l)	50		<6
	Total Copper (ug/l)		<1000	710
	Total Iron (AA) (mg/l)		<0.3	<0.01
	Total Lead (ug/l)	10		<2
	Total Manganese (ug/l)		<50	<3
	Total Mercury (ug/l)			<0.1
	Total Selenium (ug/l)	10		0.3
	Total Silver (ug/l)	N/R		<50
	Total Zinc (ug/l)		<5000	165

Notes:

Trihalomethane is determined from a treated (chlorinated) water sample
Aggressive Index: <10 = very aggressive, 10-12 moderately, >12 not aggressive

Recommendation #6*. An additional tank with a total usable storage of 3,940 m^3 be installed at the existing system c/w additional boiler and heat exchanger.*

FSC analysis

This recommendation is as a result of recommendation #3, to provide a total storage capacity of 9,193 m^3 in the community. As noted in our analysis of #3 previously we support the addition of this volume. It is important to identify that the values noted are “useable” volumes. Dead storage will result in actual volumes being slightly larger than these. If FSC is selected for this project, we will ensure that the storage volumes designed allow for a reasonable sum for dead storage.

FSC will complete all of the mechanical study and design required for the tempering systems (boilers and heat exchanges) in our Iqaluit offices.

Recommendation #7*. A study to verify the commercial discharge volumes of the collection area should be undertaken. Annual monitoring of the total flow in this area should be completed.*

FSC analysis

Knowledge of the water source volume and quality is fundamental to the design of a system. Certainly, sufficient volume in the collection area is required annually to ensure a fail-safe system. Currently, an estimated 50% of the available water must be captured from the existing source without the aid of an engineered structure; an onerous task. Water quality is not well understood. The current source passed Dillon's requirement of meeting the 20 year demand. This is at best a qualified "pass".

The tiny water shed for the existing source means that the discharge peak will normally pass in days rather than weeks. Such a small window to capture the community’s entire annual water requirement could mean that if anything went wrong during the refill period, the winter water supply would be in jeopardy.

The alternate source (Planning Study Source #3) would have provided additional capture potential, however, this source failed Dillon's analysis on financial impact. Dillon's analysis should have included the cost to upgrade the existing site with an engineered structure to ensure adequate capture and volume measurement.

As part of our proposed scope, while on site in summer 2000, FSC will investigate the existing and alternate source streams and recommend where and how flow measuring equipment could be installed.

As an extra to the scope of this project, FSC could undertake a hydrological analysis of the two sources to determine available capture volumes.

As a further extra, FSC will design and cost an engineered system to improve the capture rate from the existing source.

Recommendation #8*. An additional steel tank is to be installed complete with heat exchanger and boiler to meet the 20 year water consumption needs of the community.*

FSC analysis

This is a complete repeat of recommendations #3 and #6 mentioned earlier. As noted in our analysis of each of these recommendations, we support the addition of 3,940 m^3 to meet the 20 year water needs for Grise Fiord.

2.4. POTENTIAL FOR HEAT RECOVERY FROM THE NWT POWER CORPORATION

Our group of engineers has significant experience in heat recovery analysis and design having worked across Northern Canada for 25 years and in Grise Fiord for 17 years.

In 1983, FSC completed an analysis of heat recovery potential from the Power Corporation in Grise Fiord. At that time it was found that there is potential to recover heat from the community generators for use in any of the adjacent community facilities including the community water storage facility.

In preparing this proposal we contacted Mr. Peter Biggar, P. Eng. of the Northwest Territories Power Corporation, the facility owners and operators of the power supply system in Grise Fiord. Mr. Biggar knows the Baffin and high arctic regions well, having acted as a Project Officer with the GNWT in Iqaluit in the mid 1990's. Mr. Biggar informed us that the peak load on the Grise Fiord power system is in the order of 200 kW. Based on this analysis, there is approximately 150 kW of potential heat recovery available from the jacket cooling systems and another 150 kW from the exhaust system.

Heat recovery from the jacket water can be accomplished with a relatively simple system upgrade including heat exchangers and transfer/recirculation pumps. Heat recovery from the exhaust requires a much more elaborate system that would likely not be justifiable for this community.

Modern pre-insulated piping systems could easily be installed to transfer this heat to the existing water plant. A detailed study and discussion with the Power Corporation would be required to assess the costs and benefits of such a system, however, at first glance it appears that this would significantly reduce the operating costs for this facility and would provide for an economically friendly approach to delivering the required services to the community of Grise Fiord.

We propose to study this further should we be selected for this assignment.

2.5. STEEL STORAGE TANKS

FSC staff has significant experience with vertical steel storage tanks across Nunavut and the NWT. We have been involved in inspection, design, and construction monitoring programs for large welded steel vertical and horizontal tanks in the following communities:

Nunavut

- Broughton Island, Cape Dorset, Gjoa Haven, Grise Fiord, Igloolik, Iqaluit, Kugluktuk, Pelly Bay, Rankin Inlet, and Sanikiluaq.

NWT

- Colville Lake, Fort Resolution, Fort Simpson, Fort Simpson, Fort Smith, Frank Channel, Hay River, Sachs Harbour, Tsiigehtchic, Tulita, Lutsel K'e, Norman Wells, and Yellowknife.

These tanks are used for a variety of purposes including water and bulk fuel. Each of these tanks required study of the construction materials, coatings, foundations, and insulation (water tanks).

We have reviewed the present tankage arrangement and topography of area proposed for the expansion in Grise Fiord. The fundamental design philosophy is to provide a third steel water storage tank to meet the increased capacity requirements while ensuring that the top elevations of the tanks are equal. This will ensure that the pressures of the tanks are equal when in balance while eliminating the possibility of losing water through the vents of tanks with a lower top elevation. The base elevations are less critical.

Given that the area proposed for the new tank is higher than the existing two tanks, there are two options for this project. The first option is to excavate to establish a base elevation equal to the other two tanks and the second option is to construct a squatter tank with a base elevation higher while constructing the new tank top elevation equal to the exiting tankage. This will result in a larger tank diameter. The height of the two existing tanks is 10.97 m (36'). The diameter of existing tank number two is 21.3 m (70') and tank number one is approximately 7.7 m (25.3').

Below we present our analysis of the relationship between tank diameter and height for the required storage in Grise Fiord. Our analysis compares constructing a tank of identical height as the two existing tanks (10.97 m) to reduced height tanks that maintain the top elevation.

Useable Storage Volume			**3940 Cubic metres**		
Tank Height (m)	**Free Board & Dead Storage allowance (m)**	**Useable Tank Height (m)**	**Tank Diameter (m)**	**Area of Steel (square metres)**	**Percentage increase in steel**
10.97	0.525	10.45	21.92	1509.4	100%
10.47	0.525	9.95	22.46	1530.8	101%
9.97	0.525	9.45	23.05	1555.8	103%
9.47	0.525	8.95	23.68	1585.1	105%

Standard practice for earthworks construction in permafrost zones is to minimize cutting of existing grade to protect the ground equilibrium and permafrost regime. The analysis above finds that if the tank base for the new tank is to be placed above the base elevations of the existing two tanks while maintaining the top elevation, the steel requirement increases marginally. We believe that this marginal increase in steel should not deter from acceptance of this option necessarily. If FSC is selected for this project, we propose to discuss the foundation options with AGRA Earth & Environmental and present a technical and costing analysis to the GN for their consideration. The costing study will include costs for the tank, excavation, foundation granular materials and insulation.

2.6. WATER STORAGE AND DISTRIBUTION

Numerous steps have been taken to improve the water storage system. In 1978, a 1,393,000-L water tank was erected. The tank was sized for a population of 150 on the erroneous assumption that daily consumption would be 32 L per capita and that only 9 1/2 months storage was required. In 1988, another storage tank of 3,896,000 L capacity was constructed to meet the actual requirements. The total storage capacity of the truckfill point is presently 5,022,750 L.

Each summer the glacial runoff pond is drained by gravity feed into the two storage tanks. It requires 21 days to fill both tanks. The tanks are connected by a heated walkway. Valve pumps, hypochlorination equipment, and a control panel are located in the walkway.

The 1994 (4,546 L) water truck is filled through a chain-operated, quick-opening valve. When this valve is opened, a flow-switch is activated automatically starting the booster pump and the hypochlorinator. A 3 m truckfill arm extends from the roof of the building.

Water delivery is provided by the Hamlet five times per week or upon request. Most residential holding tanks have 227 L capacities. All water deliveries are metered.

3. KNOWLEDGE OF COMMUNITY AND INFRASTRUCTURE

3.1. GENERAL

Ferguson Simek Clark team members have direct experience with most major infrastructure items in Grise Fiord, something no other consulting team can claim.

In particular, we are proud of the work we have undertaken on a variety of projects in Grise Fiord.

Capital projects that our team members have completed, since 1983 are shown in the following list.

Project Year	Project Name
1983	NWTPC Heat Recovery Study
1985	J & R Mech.
	Arch. PCL Const.
	Elec. NW Electrical
	Multi-Purpose Hall - PCL
1987	Umimmak School
1988	Health Centre
1989	Health Centre - Services During Construction.
1989	Bulk Fuel Storage Facility design & construction monitoring
1990	Standard Electric F. A. Plan
1990	Umimmak School – Design and construction monitoring
1992	Two Bay Firehall - Design
	Two Bay Firehall - Additional Services
1992	Umimmak School - Electrical As Builts
1999	R.C.M.P. Building

The engineering and architectural staff included as our project team for this proposal have significant experience and interest with Northern community water supplies and municipal systems. As such, most of our projects team routinely tour municipal facilities in each of the communities in which we are working whether or not we are specifically working with the municipal system. The senior municipal, civil, electrical and mechanical engineers carried on our project team have all inspected the existing water system in Grise Fiord.

Based upon our knowledge of the Grise Fiord water supply system, the resources available to us in the community and the government libraries, we do not find a data collection trip necessary to complete this project.

Our treatment specialist, Mr. Ron Kent, P. Eng., regularly provides training in water systems management and has provided training through the NTWWA in the Introduction to Water and Sanitation to Grise Fiord municipal staff including: Levi Killiktee, SAO; Robert Sheaves, Ass't SAO ; and Akaskjuk Ningiuk, Hamlet Foreman.

3.2. LOCATION

Grise Fiord is located on the southern coast of Ellesmere Island at 76°25′ N and 83°01′ W. It is approximately 380 km north-east of Resolute and 1920 km north-east of Yellowknife.

3.3. GEOLOGY AND TERRAIN

The Community is situated on a narrow strip of beach near the mouth of Grise Fiord. From the beach, the land slopes back into a series of low benches for about 100 m until it reaches the foot of a steep rock-face. The surficial soils in the area consist of free draining gravel deposits. A major layer of silty sand with traces of gravel was identified over a large portion of the valley above the settlement. The depth of the permafrost table is approximately 0.6 m.

3.4. CLIMATE

A true arctic desert, Grise Fiord receives an average of 15.2 cm of snowfall each year. There is so little rainfall in the area that the mean annual precipitation totals near 0 cm. July mean high and low temperatures are 10° C and 2.2° C. January mean high and low temperatures are -27.2° C and -35° C. Winds are generally south-east and annually average 18.5 km/h.

Global warming is suspected in reducing the size of the glacier situated above the Hamlet. Although threatening, the danger to the community is not yet known.

3.5. COMMUNITY HISTORY AND ECONOMY

Grise Fiord is Canada's most northerly community. Permanent settlement began in 1953, when the RCMP relocated Inuit from Port Harrison (Quebec) and Pond Inlet to the area. The relocation continued into the 1960's when the RCMP brought their station from Craig Harbour (5 km east of Clyde River) and that community's residents with them. In 1962, a school was built and in the late 1960's, residents established a cooperative.

Grise Fiord, blessed with game resources, bases its economy on hunting, trapping and fishing. Tourists are drawn to Ellesmere Island National Park and to view local archaeological sites. Near the Hamlet are ruins of the once prosperous Thule people and evidence of European exploration during the late-nineteenth and early-twentieth centuries. Grise is one of the most traditional, rugged, and beautiful communities in the North.

Grise Fiord gained Hamlet status on October 7, 1987. The Hamlet's traditional name "Aujuittuq", means 'place that never melts'.

3.6. GENERAL DEMOGRAPHIC INFORMATION

The population of Grise Fiord, 156 (1996), is increasing at a rate of 2.24% per year. Projections estimate that the population will reach 196 in 2006.

3.7. TRANSPORTATION AND ACCESS

The Hamlet of Grise Fiord and the GN jointly operate a 610 m x 23 m unlicensed Arctic 'D' gravel runway. Runway lighting and Nav aid facilities are available. The runway has a difficult approach as it is surrounded on three sides by mountains; expansion at this location would be difficult.

Marine transportation is available from Eastern Arctic Sealift and Transport Canada (Montreal). Facilities include a beach landing and an offshore anchorage for POL tankers. Access into the fiord is possible from July to early-October.

Grise Fiord has no direct road access. Within the community there are 3.3 km of gravel surface roads. Calcium chloride is applied annually to the road to act as a dust suppressant and surface stabilizing agent.

3.8. HOUSING

The number of occupied private dwellings in Grise Fiord increased 11.1% between 1986 and 1991. As of 1994, the Housing Corporation owned twenty-six housing units. The Housing Assistance Program, the Alternative Housing Program and Government Lease-to-Own units have accounted for seven new homes in the community in 1995. In 1997, the total housing count for Grise Fiord was 44.

3.9. FIRE PROTECTION

A five-person volunteer fire brigade uses a 1992 Ford Model F-700 fire truck (4546 L capacity) is used for fighting fires. Telephone and siren alarm systems are in place for quickened response. The Hamlet has a firehall (142 m²) designed by Ferguson Simek Clark.

3.10. WATER SUPPLY AND TREATMENT

Prior to 1978, ice blocks cut from icebergs frozen into the flow ice were the main source for water for most of the year. The ice blocks would be transported by Bombardier and trailer to residents' water tanks and left to melt. A reverse-osmosis plant for the desalinization of sea water was installed in the late 1980's but was decommissioned due to operational problems.

Water is now obtained from a small glacial runoff pond located in the center of the community. The water is of good to excellent chemical quality for domestic use. The water is clear, very soft, poorly buffered, neutral, and low in dissolved solids. Treated water is below the recommended limit with respect to corrosiveness. Batch chlorination has been shown to have eliminated or greatly reduced most corrosion-intensifying bacteria.

The truckfill point and treatment facilities are located inside the Hamlet garage. Treatment facilities consist of two chemical solution mixing tanks (each 115 L capacity), a 1/2 hp mixer, and a hypochlorinator.

3.11. WATER STORAGE AND DISTRIBUTION

Numerous steps have been taken to improve the water storage system. In 1978, a 1,393,000 L water tank was erected. The tank was sized for a population of 150 on the erroneous assumption that daily consumption would be 32 L per capita and that only 9 1/2 months storage was required. In 1988, another storage tank of 3,896,000 L capacity was constructed to meet the actual requirements. The total storage capacity of the truckfill point is presently 5,022,750 L.

Each summer the glacial runoff pond is drained by gravity feed into the two storage tanks. It requires 21 days to fill both tanks. The tanks are connected by a heated walkway. Valve pumps, hypochlorination equipment, and a control panel are located in the walkway.

The 1994 (4546 L) water truck is filled through a chain-operated, quick-opening valve. When this valve is opened, a flow-switch is activated automatically starting the booster pump and the hypochlorinator. A 3 m truckfill arm extends from the roof of the building.

Water delivery is provided by the Hamlet five times per week or upon request. Most residential holding tanks have 227 L capacities. All water deliveries are metered.

3.12. SEWAGE COLLECTION AND DISPOSAL

Most buildings are equipped with pressurized water systems and sewage holding tanks. The sewage truck is a 1993 Ford F-350 (4546 L). Remaining buildings have honeybucket toilets and discharge their greywater on the ground beside the building.

Honeybags are collected and sewage tanks pumped out regularly. The waste is trucked 1.4 km to the waste management site adjacent to the airstrip, west of the community. The raw sewage is dumped into a 300 m^2 solid retention pond for primary treatment and honeybags are placed in a 160 m^2 pit. Sewage bags are collected daily using the garbage truck but not combined with the domestic garbage.

A newly-constructed sewage lagoon, near the airstrip, was commissioned in 1997.

3.13. SOLID WASTE COLLECTION AND DISPOSAL

Residents place solid waste outside the home in wooden boxes for collection. The wastes are not burned by the residents. The waste is collected twice per week using a Ford model F-350 pickup truck and hauled to the 125,000 m^2 solid waste management site. Wastes are burned twice weekly. An annual spring clean-up is organized by the Community.

A separate bulky waste site occupies an area of 7,500 m^2. Used oil is stored at this site.

4. METHODOLOGY

4.1. QUALITY MANAGEMENT

Ferguson Simek Clark is committed to quality management. This commitment is implemented at three levels according to the requirements of the project.

First is a system of self-checking in which each individual is expected to check his or her own work.

Second is a peer review process in which others involved in the project discuss aspects of the work on an on-going basis to minimise difficulties. Correspondence and documents are reviewed by a peer. All design documents are reviewed and approved by the project manager prior to issuance.

The third level is to have a senior member of the firm responsible for quality management. This person will either review or arrange for review of design documents. He will also ensure the first two levels are being implemented.

4.2. PROJECT MANAGEMENT

We believe that a successful project requires a team working in a co-ordinated manner towards well defined and understood goals. Ferguson Simek Clark will act as the prime consultant. Our Project Manager will be Mr. Terry Gray. Terry will be responsible for liaison with the client and ensuring the project schedule and budget are maintained.

Regular communication between the client and ourselves will occur to ensure the client is aware of the status of the project and any potential problems are addressed immediately. Specific actions we intend to take to ensure the client is kept fully aware of the project status in a timely manner include:

- Project Initiation Meeting upon contract award to determine administrative and technical requirements.
- Monthly Project Status Reports.
- Weekly telephone calls to Louis Bourgeois, the Project Officer for this assignment.
- Pre-tender construction estimates.
- On-going review meetings with the GN.
- Submission of all required deliverables as requested in the Project Request for Proposals including submissions of the project documentation at the specified stages of 25%, 50%, and 100% complete.
- Development and refinement of construction/tender cost estimates to be submitted along with the project documentation. Cost estimates to be developed as Class ‘D’, ‘C’, and ultimately ‘A’ as defined by the Federal Treasury Board and accepted by the GN.

4.3. LOCAL INVOLVEMENT

We believe that for the improvements to the Grise Fiord water supply system to be successful and provide lasting benefit to the community, locals must be involved in the project. As such we have included Mr. Raymond Mercredi of Grise Fiord to assist in the collection of existing conditions data.

Members of the FSC project team have worked with Mr. Mercredi when in the community for other project work. He is a talented, industrious man who has proven to be helpful in the collection/verification of system components. We will ask Mr. Mercredi to verify the model and serial numbers of the various system components prior to our design to ensure that minimal modifications have occurred throughout the life of the system.

We further propose to involve current or future potential water system operators in all key site and system inspections and during the construction of any improvements to the system. We suggest that the current or future potential operators be present during the commissioning stage in order to gain a thorough understanding of the objectives and operations of the system. If required, we will arrange for translation during these activities.

4.4. PRELIMINARY ENGINEERING (SCHEMATIC DESIGN SERVICES)

GENERAL

Preliminary engineering comprises project initiation, data collection, review and analysis, concept development and selection, and preparation of a Design Concept Brief. This Brief will be presented a letter style report. The purpose of this exercise is to establish the project parameters. The parameters will be essentially established based upon the recommendation of the Planning Study, however, this gives the project team one last change to agree on the project elements and make any necessary refinements prior to beginning the detailed design.

Due to the remoteness and high cost of travelling to Grise Fiord, we have developed an approach to the preliminary engineering stage of this project that does not require us to travel to Grise Fiord.

We have researched the available information for the project and find that there is sufficient information to establish much of the design parameters. We propose to further supplement this information with data collected by our Local Liaison, Mr. Raymond Mercredi. We propose that we can request specific system information from Raymond should we not be able to extract all of the required information from the vast data and reports that we have reviewed for this proposal.

Our Project Manager and/or Deputy Project manager is available, if requested, to attend a community consultation meeting in Grise Fiord.

OBJECTIVES

- Define components (concept development).
- Identify parameters and constraints that will affect design (spatial requirements).
- Recommend design details and construction techniques, (while construction techniques can be discussed, they are ultimately the selection of the Contractor).
- Provide cost estimates and schedules.

PROCEDURES

- Review available information held by client, and from other sources.
- Collect additional data.
- Develop concepts for decision by Client.
- Prepare preliminary engineering reports outlining results of preliminary engineering investigations.
- Finalize conceptual design and document decisions.
- Prepare Design Concept Briefs documenting system design parameters, criteria and assumptions, equipment standards of acceptance, design criteria and assumptions.

DATA COLLECTION & PROJECT FAMILIARIZATION

This task consists of the collection and preliminary review of any reports, plans, and other documents relevant to the project. Much of the required information should be available from the Client and from information within FSC's libraries, such as the preliminary engineering assessments and geotechnical information. We will also review topographic mapping and aerial photography.

In writing this proposal, we collected a great deal of information from the government libraries and the community to assist us with the project study. We intend to extract the necessary design information form this collection of data and supplement it as necessary with field collected data.

INITIATION MEETING

We propose to meet with the client project representatives to determine administrative procedures and discuss the technical requirements of the project. We propose that this meeting be held after we have reviewed the available data.

For the purpose of this proposal, we have assumed that this meeting will be held in Iqaluit.

We propose that our Project Manager (Mr. Terry Gray), and Deputy Project Manger (Mr. Ross Abdurahman) attend this meeting in person and that other project staff attend via teleconference from their respective offices

PROJECT SYSTEM ANALYSIS

Following the collection of project data, and the project initiation meeting, the Project Team will complete a thorough analysis of the existing system. The Project System Analysis will include reviewing the present operation & maintenance requirements & practices as well as a thorough condition assessment of the project systems. We propose to complete this based upon teleconferences with the hamlet staff and with the vast materials that we have collected for this project.

The Project System Assessment will include the following:

- Economic and technical analysis of the system,
- Establishment of facility component sizes, capacities, locations, methods of operation, and other principal features.
- Review of the project budget and schedule.
- Formulation of recommendations for system modifications as required.

The results of the Project System Analysis will satisfy the objectives of the Predesign Services and "General Terms of Reference for a Community Water & Sanitation Services Study".

SCHEMATIC DESIGN CONCEPT BRIEF

After completion of the Data Collection and Project System Analysis, concept development will commence. Selected concepts will be more fully developed in consultation with the client and considering information gathered earlier.

The Schematic Design Concept Report will present the concepts to be investigated. Sizes and capacities will be determined.

Life cycle cost estimates will be prepared (using net present value analysis). These estimates will be presented in a report, which will be suitable for decision making, by the Client. The planning horizon used will be twenty years with an 8% discount rate.

The format will assist in the decision making process. Assumptions, objectives, and criteria will be set forth in tabular form. Where required for a decision making process, priorities or weights will be assigned to objectives and criteria. These will be discussed with the Client.

Known risks will be identified and discussed, and consideration will be given to means to alleviate risks, within project budget and schedule constraints. Where alleviation is not possible within these constraints discussion of possible future remedial measures will be discussed.

We believe that in analyses of this type, it is important to eliminate alternate concepts as soon as they fail to meet critical criteria. The final analysis should address as few alternatives as possible, in order to keep the process from becoming more important than the result.

This report will contain a review of the project budget and schedule. Recommendations will be provided as appropriate. For the most part, recommendations will be based on the analysis described above. However, good engineering judgement will be exercised and will influence the recommendations.

We understand that, upon review of the draft concept report, decisions will be taken by the Client as to the concepts to be developed.

DELIVERABLES

- Project Initiation Meeting (in Iqaluit).
- Draft Schematic Design Concept Report (6 copies with review in Iqaluit).
- Final Schematic Design Concept Report (10 copies).

4.5. DESIGN SERVICES

GENERAL

As we understand it, the prime objective of this assignment is as follows:

> *To upgrade the existing water supply system for Grise Fiord to meet minimum flow and storage requirements. We will provide a simple, energy efficient, fail-safe, rugged and reliable water system meeting the standards and budget of the GN and which can successfully be operated and maintained by local staff.*

The design will build on the concepts put forth in the Design Concept Brief, and on the decisions arrived at in producing that report.

Design reviews will be held in Iqaluit and Ferguson Simek Clark will arrange for reproduction of the tender documents.

OBJECTIVES

- Produce design documents (25%, 50%, and 100%).
- Prepare Tender Call documents (20 sets).
- Prepare pre-tender cost estimates.
- Prepare Pre-purchase List of Materials (if required).
- Assist in answering inquiries during tender period.
- Assist in evaluation of tenders.

DESIGN DOCUMENTS

25% DESIGN DOCUMENTS

Drawings will be adequate to provide a meaningful review. Specifications will be in an outline form.

We intend to provide drawings in plan and elevation views, double line mechanical drawings in plan and elevation views, and industrial type electrical drawings (line finders, contact numbers).

After Client review we will attend a review meeting. It is intended that our Project Manager and various Specialist Engineers attend this meeting. Class 'D' costs estimates will be presented.

TENDER CALL DOCUMENTS

Comments and Changes from the 50% review will be incorporated in the final documents and they will be prepared for Tender call. As requested, we will provide 20 sets of drawings and specifications to the GN for distribution. Cost estimates will be advance to a Class 'C' level.

PRE-TENDER (CLASS 'A') COST ESTIMATES

After completion of the tender Documents we will prepare a pre-tender (Class 'A') cost estimate for submission to the Client.

PRE-PURCHASE LIST-OF-MATERIALS

If the Client wishes to pre-purchase materials, we will assist by preparing a List of Materials. This list will be based on the requirements of the specification.

DELIVERABLES

- 25% documents and review meeting.
- 50% documents and review meeting.
- Tender documents
- Pre-tender cost estimate.
- Pre-purchase List of Materials (if required).

4.6. TENDER SERVICES

We will assist the Client in answering any queries which arise during the Tender Period regarding interpretation of the documents, or materials and equipment.

TENDER EVALUATION

After the close of Tenders, we will assist in the tender evaluation (if requested). This could include assessing similar contract experience or financial capability of the Bidders.

DELIVERABLES

- 20 sets of tender documents.
- Tender recommendation (if requested).

4.7. GENERAL ENGINEERING SERVICE DURING CONSTRUCTION

General engineering services during construction will be provided to assist in the administration of the construction contract.

MATERIAL PROCUREMENT

This task consists primarily of the review of shop drawings provided by the Contractor to assist in fulfilling the intent of the contract. Inspecting material and equipment prior to shipping may also be desirable.

If the GN pre-purchases material we are prepared to assist by preparing a list of materials (as noted under design services) or inspecting material and equipment prior to shipping.

Since travel and time requirements for pre-shipping cannot be established at this time, these activities have not been included in the project budget.

CONSTRUCTION ADMINISTRATION

This service consists of assisting the Client in evaluating changes in the work, providing interpretations of the Contract Documents as directed by the GN, reporting on the progress and quality of the work and examining progress claims and recommending payment as appropriate.

We anticipate all survey requirements, besides verification surveys, after initial layout of reference lines and benchmarks at commencement of construction will be the Contractor's responsibility.

INTERIM AND/OR FINAL INSPECTION

When the Contractor advises that the project is ready for interim and final completion inspection, we will travel to Grise Fiord to inspect the facility, prepare deficiency lists and assist in the preparation of the Interim and Final Completion Certificate.

DELIVERABLES

- Shop drawing reviews (to Contractor).
- List of Materials (if required).
- Pre-shipping inspection reports (if required).
- Progress claim recommendations.
- Deficiency list.

4.8. RESIDENT ENGINEERING SERVICES

Resident engineering services are intended to ensure that the work meets the intent of the Contract Documents.

Our Resident Inspector will be assigned to the project for the duration of construction of the foundation/siteworks. We propose to also be on site for inspection of the insulation and painting of the tanks. We do not necessarily have to be on site for the entire period of construction of the steel tank.

The Inspector will monitor the progress of the project and ensure completion of the work, as specified, and document the construction progress and quality of workmanship through surveys and testing procedures as required. Our Resident Inspector will provide an initial layout survey consisting of reference points, lines and benchmarks. While on site, he may also assist the Contractor in performing any further surveys.

We propose to locally hire an assistant resident inspector during the construction of the project to assist with the survey requirements and to become familiar with the facility.

Our Inspector will:

- Maintain a complete photographic record of the project, particularly of any work which will later be concealed, while he is on site.
- Maintain a daily record of work done and prepare weekly summaries of work to be submitted to the GN as the work progresses.
- Maintain regular contact with the GN project officer and senior engineer responsible for the construction of this project and Ferguson Simek Clark's project manager and project engineer.
- Maintain records of compaction, piping, pressure testing, underground construction, insulation or any other work not visible after completion, while he is on site.
- Conduct inspections of the quality and thickness of coatings on the tankage and piping.

- It is a requirement of most construction contracts that the contractor maintain as-built records for inclusion in record drawings. While not relieving the contractor of that responsibility, our resident inspector will keep records to assist in preparation of record drawings while he is on site.
- Assist in the verification of progress claims by examining and commenting on work completed, while he is on site.

DELIVERABLES

- Photographic record.
- Weekly work summaries.
- Initial survey.
- Testing and inspection records.
- Progress claim evaluations.
- Record information.

4.9. POST-CONSTRUCTION SERVICES

COMMISSIONING/TRAINING

As noted in the Resident Engineering Services Section, we propose to locally hire an assistant resident inspector during the construction of the project to assist with the survey requirements and to become familiar with the facility. We propose to hire an individual who may be involved in the operation of the future facility. We propose that this involvement throughout the construction will significantly add to the understanding and interest in the facility.

Commissioning of the facility will consist of inspection, review of test records, start-up and testing of all systems to determine if the facility is acceptable for turnover to the Client.

We also propose that it be a requirement of the construction contract that the facility be operated by the Contractor for a minimum of five days trial before commissioning.

It is a normal requirement of the construction contract that the Contractor provide five days of instruction to the operator during the trial operation. We will prepare a 2-3 day seminar for operating personnel. We will ensure compatibility with, and incorporate fundamental maintenance procedures into, the community's maintenance management program. This seminar plus the involvement throughout the construction will foster interest in the facility and will provide the necessary background for proper operations and maintenance of the facility.

It should be noted that our budget is based on commissioning at the time of the Final Inspection. There would be no change in the budget totals if commissioning takes place at the time of the Interim Inspection. However, if a separate trip is required for commissioning, the budget would require adjustment.

OPERATIONS AND MAINTENANCE MANUALS

If requested, we will update the O & M Manuals for the facility to include information on the project improvements.

If requested, a draft O & M Manual will be prepared for commissioning. It will describe start-up, operations procedures and emergency responses as fully as permitted by the material received from the Contractor.

RECORD DRAWINGS

Construction issue drawings will be updated to reflect actual construction details based on information supplied by the Contractor and supplemented by records kept by our Resident Inspector. A full size set of a half size of reproducible record drawings will be provided to the Client.

WARRANTY SERVICES

We will inspect the facility just prior to the end of the warranty period and produce a short report listing any deficiencies which should be addressed by the contractor.

DELIVERABLES

- Commissioning report.
- Record drawings (full size and half size reproducible sets).
- Update to O & M Manuals (six copies) (if requested).

5. VALUE ENGINEERING - TOTAL QUALITY MANAGEMENT

5.1. VALUE ENGINEERING

Our Project Team employs Value Engineering (VE) in the design and execution of projects and in the analysis of existing systems and structures.

System and structures are regarded from a functional viewpoint, with the objective of identifying essential features, while eliminating non-essential components. The cost of each feature is evaluated and lowest costs are assigned. The resulting system, structure or product has minimal essential function at the lowest cost attainable. Lowest costs are attained without compromising regulatory, performance, quality, reliability or safety standards and requirements.

This process is non-isolated and involves a team of engineers, and technical specialists. This Group Method is used to identify and determine viable alternatives and innovations relative to standard design and analysis methods.

5.2. TOTAL QUALITY MANAGEMENT

All proposals, project designs and executed work are directed under a Total Quality Management (TQM) framework.

The TQM framework ensures that all work is subject to an internal checks and balances system. The objective of this system is to eliminate error or poor quality in finished products. Work tasks are assigned for each project and design. Each task is monitored and checked relative to its acceptability and accuracy. When problems or errors have occurred relative to a task, the root causes of such shortcomings are identified and corrected. Time and cost efficiency as well as client and user expectations are regarded under the TQM framework.

In this way, we are able to provide a quality product, that meets the client and user requirements and that is also provided in accordance with time and cost objectives.

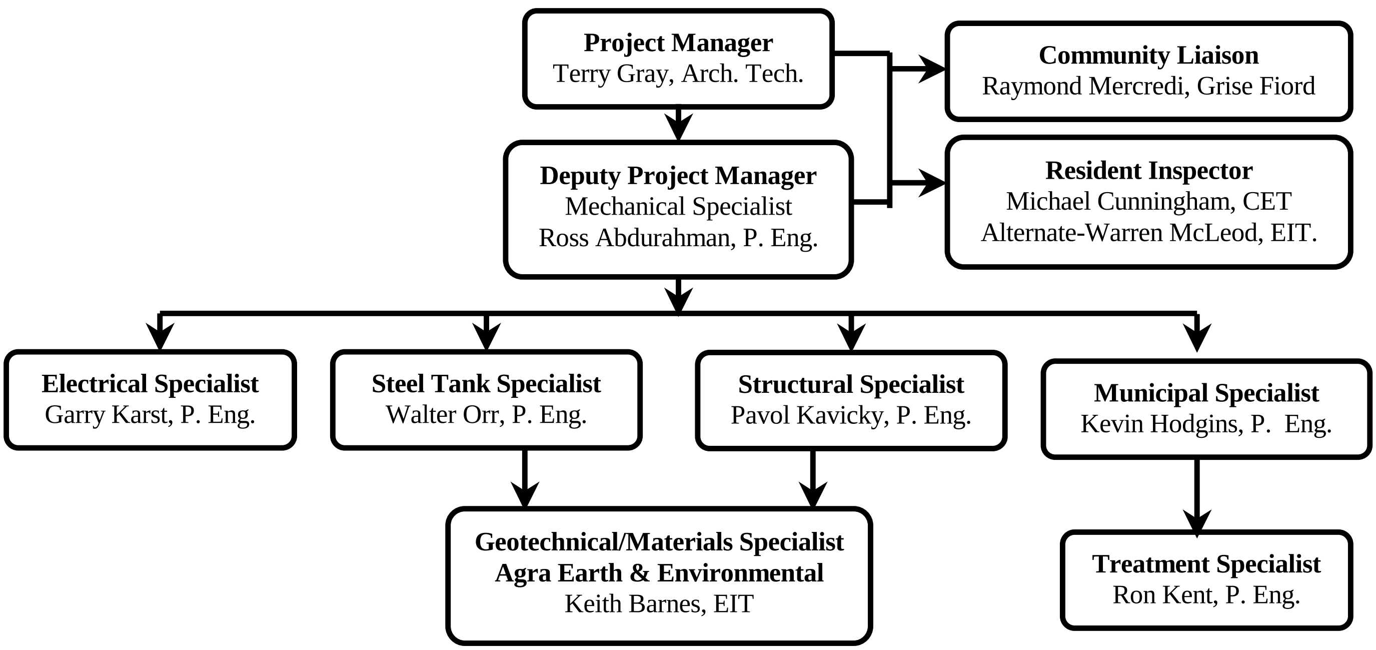
6. PROJECT TEAM

The team we propose has considerable experience related to this type of project. Team members have participated in the planning, design and construction of similar projects throughout Nunavut and the NWT.

A large portion of this project will be mechanical and electrical in nature. FSC is the only consulting firm in Nunavut with resident staff in the disciplines of electrical and mechanical engineering.

Our engineering and architectural group has ample capacity to complete this project on time and within the specified budget. We have current work commitments for only approximately 25% of our capacity for the period of the design and construction schedule.

The following chart summarizes the primary personnel that we propose for our Project Team. Summaries of each of these individuals is included on the following pages.



Terry Gray, Arch. Tech., Project Manager – Iqaluit Office

Mr. Gray represents FSC as Manager of Nunavut Operations. For this project we propose that Mr. Gray act of overall Project Manager. We propose that this is most efficient as he has regular contact with the GN on many projects. FSC's engineering staff will work under the project guidance of Mr. Gray. Mr. Ross Abdurahman, P. Eng., head of FSC's mechanical engineering division, will act as Deputy Project Manager to Mr. Gray.

Terry's involvement in this project will be completed from FSC's offices in Iqaluit

Ross Abdurahman, P. Eng. (Mechanical) Deputy Project Manager /System Specialist

Ross is a mechanical engineer and partner in the firm of Ferguson Simek Clark. He has considerable experience in municipal systems, and heat transfer and has worked on several municipal projects for FSC.

Ross was involved in various components of the mechanical planning and/or design (tempering, pumping, HVAC and fuel handling) for the Cambridge Bay, Ft. McPherson, Ft. Simpson, Igloolik, Iqaluit, Kimmirut, Kugluktuk, Paulatuk, Rae, Rae Lakes, Tulita, Whale Cove, Yakutsk and Yellowknife water supply systems.

Ross will be responsible for the mechanical portions of the system and will act as Deputy Project Manager.

Ross's involvement in this project will be completed from FSC's offices in Iqaluit.

Garry Karst, P. Eng. System Specialist (Electrical)

Garry is a partner and an electrical engineer with FSC, he has been with Ferguson Simek Clark since 1984.

In that time Garry has worked on the electrical design, site inspections and contract administration of numerous municipal facilities, schools and other institutional buildings, commercial buildings and industrial buildings.

Garry was responsible for various components of the electrical planning and/or design of the Cambridge Bay, Ft. McPherson, Ft. Simpson, Igloolik, Iqaluit, Kimmirut, Kugluktuk, Paulatuk, Rae, Rae Lakes, Tulita, Whale Cove, Yakutsk and Yellowknife water supply systems.

Garry will be responsible for the design of the electrical components of this project including the power reviews system controls; alarm systems and electric freeze protection.

Garry's involvement in this project will be completed from FSC's offices in Iqaluit

Walter Orr, P. Eng. System Specialist (Steel Tanks Specialist)

Mr. Orr is a Senior Engineer in the Civil Engineering Department of Ferguson Simek Clark. He has 12 years experience in northern civil, municipal, environmental and petroleum engineering throughout the Northwest Territories.

His responsibilities involve project management, design and design co-ordination, project personnel co-ordination and control, contract administration and client relations. Projects he has completed include water storage, delivery and treatment; fuel storage and pipelines; environmental assessment; land development; airports and highways; sewage and solid waste disposal; roadwork construction; building structural and mechanical works.

He has 11 years background with the GN and GNWT fuel storage projects, with direct involvement in design and construction of 20 separate fuel dispensing facilities in 11 different Nunavut and NWT communities. All of these facilities included upgrades/rehabilitation or new steel tankage. Mr. Orr is one of the most experienced engineers in the study and delivery of steel tanks in Canada's North.

Walter will be responsible for the study and design of the steel water storage tank for this project including the insulation and cladding component of the system.

Kevin Hodgins, P. Eng. System Specialist (Municipal)

Mr. Hodgins is a partner and Senior Civil Engineer in charge of the civil engineering department of Ferguson Simek Clark and has been a resident of the Northwest Territories since 1987. During that time a large portion of his work has been related to municipal systems assessments and design.

Kevin's experience includes the planning, designing, tendering, construction and commissioning of many projects throughout the Northwest Territories, Nunavut, the Yukon and Russia. The projects for which Kevin has been responsible or involved include the following:

- Water supply projects in Cambridge Bay, Edzo, Ft. McPherson, Ft. Simpson, Gjoa Haven, Hay River, Igloolik, Iqaluit, Kugluktuk, Lake Harbour, Norman Wells, Paulatuk, Rae, Rae Lakes, Snare Lake, Tuktoyaktuk, Tulita, Whale Cove, Whitehorse, Yakutsk and Yellowknife.

Kevin will provide the municipal engineering input into this project.

Pavol Kavicky, P. Eng. System Specialist (Structural)

Pavol is a structural engineer with design experience in commercial and industrial facilities. Pavol manages our structural group. He has been responsible for all of the structural engineering efforts completed by FSC over the past number of years.

Pavol will be responsible for all structural components of this assignment expect the steel tank design. His involvement will include modification to the building(s), foundation designs and structural steel components.

Ron Kent, P. Eng. Treatment Specialist

Ron is an associate and Senior Environmental Engineer in charge of FSC's Environment Department. Ron has been in the north since 1978. He has significant experience in water systems and municipal compliance with legislation and regulations. Ron also authored the Community Works Management System used by CG&T.

Ron provides training in water systems management and provided training through the NTWWA in the Introduction to Water and Sanitation to Grise Fiord municipal staff including: Levi Killiktee, SAO; Robert Sheaves, Ass't SAO; and Akaskjuk Ningiuk, Hamlet Foreman.

Ron will review available water quality data, ensure coatings are approved by the GN Health department, and provide input to maintenance management training.

Michael Cunningham, C.E.T. Project Technologist/Resident Inspector

Michael is a civil engineering technologist with extensive construction management, supervision, and survey experience complimented by technical training in related fields on a continuing basis.

Michael resided in various communities in the NWT between 1987 and 1999 during which time he travelled extensively across the NWT and Nunavut.

Michael's experience includes working with a variety of consultants, contractors and government agencies during his tenure in the North. His latest project position was acting as resident inspector for the construction of the water supply improvements in Hall beach in 1999.

Michael will serve as the resident inspector for the project installations.

Warren McLeod, E.I.T. Intermediate Civil Engineer/Alternate Resident Inspector

Mr. McLeod is a graduate of Civil Engineering from the University of Alberta and is a lifelong resident of Yellowknife. Warren has well-developed surveying and design skills. He has detailed experience in project inspections, project drawings, specification writing, project co-ordination and project drawings.

Warren experience includes site inspections for steel tank installations in Cape Dorset and Sachs Harbour as well as site development/civil programs in over 20 different communities in Nunavut and the NWT.

Warren was the recipient of many scholarships while attending university. He worked for Ferguson Simek Clark as a student in the summer of 1996 and accepted a permanent position as Engineer in Training beginning in May 1997. He has attended primary and high school in Yellowknife and is one of the first graduates to work in the engineering field in the north.

Warren is proposed to be an alternate to Michael for the inspection services for this project.

Raymond Mercredi, Local Project Assistant

We believe that for the improvements to the Grise Fiord water supply system to be successful and provide lasting benefit to the community, locals must be involved in the project. As such we have included Mr. Raymond Mercredi of Grise Fiord to assist in the collection of existing conditions data.

Members of the FSC project team have worked with Mr. Mercredi when in the community for other project work. He is a talented, industrious man who has proven to be helpful in the collection/verification of system components. We will ask Mr. Mercredi to verify the model and serial numbers of the various system components prior to our design to ensure that minimal modifications have occurred throughout the life of the system.

AGRA Earth & Environmental, Expert Geotechnical/Materials Engineering

We propose to use the firm of AGRA Earth & Environmental to carry out the geotechnical investigation and materials testing program for this project. FSC and AGRA have worked extensively together in the past on numerous cold regions projects.

We dot not foresee a requirement for Agra to visit the site prior to the design phase of this project. We believe that they can provide the necessary geotechnical advice based on their previous project work in the Community and high arctic.

7. RELATED PROJECT EXPERIENCE

Ferguson Simek Clark is an established northern engineering and architecture firm that has been in business since 1976. Ferguson Simek Clark presently has offices in Iqaluit, Yellowknife, and Whitehorse.

Ferguson Simek Clark has a staff complement of some sixty personnel resident in Canada's three Northern Territories including architects and architectural technologists, professional engineers, engineering technologists and environmental staff. With our four northern offices, Ferguson Simek Clark contributes significantly to the northern economy.

The project management philosophy of Ferguson Simek Clark means assembling a team of experienced engineers and technologists with designated project member assuming corporate responsibility for each project. In addition to our design and construction experience, all senior and intermediate engineers, technologists, and architects have extensive experience in project management.

Past relevant municipal and civil projects include:

- Hamlet of Kugluktuk Water Intake and System Improvements.
- City of Yellowknife, numerous municipal system extensions and upgrades.
- Village of Ft. Simpson, numerous municipal system extensions and upgrades.
- Hamlet of Cambridge Bay Water System Review and Planning Study.
- Treated Water Storage Reservoir, Ft. Simpson.
- Rae Lakes truckfill station. This single intake truckfill station is the first of the present type of truckfill stations to be stick-built. The intake was installed in the winter through the ice. This innovation was successful. The project was completed in 1993.
- Kimmirut (Lake Harbour) truckfill station. This single intake truckfill station is similar to that in Rae Lakes and involved autonomous power generation.
- Whale Cove truckfill station. This is a single intake truckfill station completed in 1992. It uses a modular panel type building. The alarm system uses an autodialer.
- Paulatuk truckfill station. This is a single intake truckfill station completed in 1992. It uses a modular panel type building. The alarm system uses a radio paging system.
- Snowdrift water supply truckfill station. This facility comprises an inclined shaft intake into Great Slave Lake and a truckfill station with standby generation capability.
- Sakha Village water supply and treatment system. This system, which uses a 450 metre deep well source, comprises treatment for hydrogen sulphide, fluoride and sodium removal. A reverse osmosis treatment system with potassium permanganate feed, manganese greensand filters and softening pre-treatment was selected. Water delivery is by means of a truckfill station.
- Water supply projects in Cambridge Bay, Edzo, Ft. McPherson, Ft. Simpson, Gjoa Haven, Hay River, Igloolik, Iqaluit, Kugluktuk, Lake Harbour, Norman Wells, Paulatuk, Rae, Rae Lakes, Snare Lake, Tuktoyaktuk, Tulita, Whale Cove, Whitehorse, Yakutsk and Yellowknife.
- Emergency remedial measures for inclined shaft water intakes at Aklavik.

Ferguson Simek Clark is proud of the knowledge of northern engineering gained from these and other projects. FSC has been innovative in northern engineering design and construction and has an excellent record of bringing in projects on schedule and budget.

8. FEES & EXPENSES

A detailed time and fee budget is presented on the attached page of this proposal.

We foresee opportunities to reduce the overall budget for this project and welcome the chance to discuss these with the Client.

One such opportunity would be to reduce the number of project submissions.

We believe that the simplicity of this project will allow the reduction of one such submission. The RFP request submissions at the schematic design, 25%, 50% and tender stages. We propose that submissions at the schematic design, 65% and tender stage would be adequate.

The lump sum fixed fees shown are based on the scope of work outlined in the Terms of Reference and this proposal. Changes to the scope of work will require adjustment to the fixed fee.

8.1. SUMMARY OF FEES & EXPENSES.

Phase	Service	Fee basis	Fee	Disbursements
Schematic Design	Tank/Mechanical Component	Fixed Fee	$ 9,040	$ 1,550
	Internal Painting Component		$ 1,000	$ 300
Design Services	Tank/Mechanical Component	Fixed Fee	$ 28,050	$ 800
	Internal Painting Component		$ 2,000	$ 200
Tender services	Complete Project	Fixed Fee	$ 1,560	$ 200
General Engineering	Tank/Mechanical Component	Time basis	$ 14,410	$ 4,840
	Internal Painting Component		$ 4,000	$ 2,420
Resident Engineering	Complete Project	Time basis	$ 15,000	$ 8,100
Post-construction Services	Complete Project	Fixed Fee	$ 5,450	$ 300

Estimated Project Total: $ 99,840

We offer a $2,000 reduction if one of the project review submissions is deleted. Project submissions would therefore be at the schematic design, 65% and tender stage.

Disbursements are an estimate only. Actual disbursements will be invoiced based upon receipts of expenditures. Estimated disbursements presented are based on airfares, airline schedules and accommodation and meal charges current at the time the proposal was prepared.

Disbursement estimates for resident inspections include airfare for return sched service YFB - YGZ.

Disbursement estimates for the interim and final inspection trips include airfare for return sched service YFB-YRB and YZF-YRB only.

Since YRB-YGZ charters will be shared with the GN, we have not included any costs for this leg of the inspection trips.

Travel delays caused by weather and other causes beyond our control are not included in our fee. Actual costs will be invoiced.

8.2. HOURLY CHARGEOUT RATES

We propose that the following time-based fees will be used for time-based portions of the work and for changes in scope unless revised fees are negotiated for the change. We will maintain these rates for the duration of this project.

Hourly rates for key project team members are listed below. FSC will maintain these rates for the duration of the project.

Raymond Mercredi	Grise Fiord	Local Liaison	$ 40
Local Project Assistant	Grise Fiord		$ 40
Terry Gray, Arch. Tech.	Iqaluit	Project Manager	$80
Ross Abdurahman	Iqaluit	System Specialist (Mechanical)	$ 140
Garry Karst	Iqaluit	System Specialist (Electrical)	$ 140
Michael Cunningham	Iqaluit	Resident Inspections	$ 65
Design Technologist	Iqaluit		$ 65
Kevin Hodgins	Yellowknife	System Specialist (Municipal)	$120
Walter Orr	Yellowknife	System Specialist (Tankage)	$ 90
Ron Kent	Yellowknife	System Specialist (Treatment)	$ 120
Pavol Kavicky	Yellowknife	System specialist (Structural)	$ 110
Warren McLeod	Yellowknife	Alternate/Resident Inspections	$ 65

A 5% administrative surcharge will be expected for Subconsultants Fees and disbursement. Prime Consultants Disbursements will be invoiced at cost plus 5%.

9. PROJECT SCHEDULE

We have considered the schedule for this project and present it below. One key date to be considered is the anticipated arrival of the Coat Guard sealift into Grise Fiord. The arrival date in 1999 was August 28. The Coast Guard has not yet schueded the shipping to Grise Fiord for 2000, however we anticiapte the delviery date to be very near the historic date.

We propose the following project milestones for the schedule of this project:

❑ Proposals Received	January 28, 2000.
❑ Project awarded by	February 4, 1999.
❑ Initiation Meeting	February 9, 2000
❑ Submission of Draft Schematic Design Brief	February 18, 2000
❑ Presentation of Final Schematic Design Brief	February 21, 2000
❑ Submission of 25% Design Drawings (with Class ‘D’ costing)	February 28, 2000
❑ Review of 25% Design Complete	March 3, 2000
❑ Submission of 50% Design Drawings (with Class ’C’ costing)	March 14, 2000
❑ Review of 50% Design Complete	March 10, 2000
❑ Submission Tender Documents and Class ‘A’ Cost Estimates	March 17, 2000
❑ Tender Period and Contract Award:	April 1 – May 15, 2000
❑ Siteworks Construction	July 15 – August 15, 2000
❑ Sea Lift expected into Grise Fiord	August 28, 2000
❑ Tank/Mechanical Construction/Painting	Sept 1, 2000 – July 15, 2001
❑ End of Construction Period	July 15, 2001
❑ Warranty Inspection	July 15, 2002

10. LOCATION/NORTHERN CONTENT

Ferguson Simek Clark is a northern-owned and operated company incorporated in the Northwest Territories with headquarters in Yellowknife and branch offices in Iqaluit and Whitehorse.

100% of Ferguson Simek Clark's work will be completed by permanent residents of Nunavut and the Northwest Territories.

The distribution of content of our proposed effort & expenses is as follows:

Project Effort & Expenses	
Local Involvement	16 %
Iqaluit Based	61 %
Yellowknife based	23 %
Non-Northern	0 %
Total	**100.0 %**

This distribution has been calculated as follows:

LOCAL INVOLVEMENT (GRISE FIORD)

Ferguson Simek Clark proposes to utilise Mr. Raymond Mercredi to assist in much of the existing conditions data collection and field inspections.

Raymond has been a resident of Grise Fiord for better than 10 years. He is a talented industrious type who makes himself available on a contract basis. I addition to Raymond, we prose to locally hire an assistant resident inspector for some of the time that the project is being constructed. The purpose of this position will be two-fold. Firstly it will be to provide the necessary assistance for the inspections, and secondly will provide an opportunity to educate a member of the community in the construction and operation of the improvements to the water supply system.

IQALUIT INVOLVEMENT

The portion of the work distribution allotted for Iqaluit is for labour and expenses. We expect such expenditures to be made at local businesses for airfare, accommodations, meals, reproduction, general office supplies, communication expenses, courier charges, etc.

Our intention is to hire a civil engineering technologist or engineer for a permanent position in Iqaluit. As such we have calculated the revenue from the resident inspections as being spent in Iqaluit.

YELLOWKNIFE INVOLVEMENT

The portion of the work distribution allotted for Yellowknife is primarily for labour in that community. Minimal disbursements have been allowed for expenditure in Yellowknife.

NON-NORTHERN INVOLVEMENT

The proposed consulting team members are all resident in Grise Fiord, Iqaluit, or Yellowknife. No non-northern expenditures are anticipated for this project.