ATTACHMENT A

PROJECT DESCRIPTION DETAILS ("DESIGN REPORT")

ARVIAT – EMERGENCY WATER SUPPLY AND TREATMENT PROJECT

DESIGN REPORT

Prepared for:

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NUNAMI STANTEC

EXECUTIVE SUMMARY

Stantec Consulting Ltd. (Stantec) was retained by the Nunavut Government to determine a solution that will ensure the Hamlet of Arviat, Nunavut has sufficient drinking water supply to last until the end of June 2011, at which time its traditional water source in WolfCreek becomes available.

Arviat currently has two water storage cells which are designed to store enough water for the town during the winter. Treated water (filtered and chlorination) is stored in the reservoirs, and pumped out on a daily basis supplying water to each user via a cistern tank.

Recently, damage to reservior cell #1 has significantly depleted the available water for the community, and there are valid concerns that the village may run out of water before the end of June, when local waterways become ice free and additional water can be obtained.

In response to this development, the Government of Nunavut has explored a number of potential water sources to augment water supply in the Hamlet and it was determined to pursue the option of providing an advanced water treatment (RO) system to treat saline water ranging from brackish to sea water conditions.

It must be emphasized that the unit must be procured by the supplier, tested, refurbished as may be necessary, and available for shipment to site by April 25, 2011. This date is non-negotiable.

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1 WATER SUPPLY AND TREATMENT PROCESS

The following summarizes Stantec's design of the Reverse Osmosis (RO) system to provide potable water to the Hamlet.

1.1 Scope of Work

The design of the water supply and treatment process includes all needed equipment to remove water from the Hudson's Bay and produce potable water for delivery to the Hamlet by transfer trucks. The treatment process is capable of treating raw water from the Hudson's Bay to meet potable water quality requirements specified by the *Canadian Drinking Water Quality Guidelines*.

1.2 Design Assumptions

The water quality of the Hudson's Bay was assumed to be a worst case scenario of saline sea water with the following characteristics:

- TDS: 35,000 mg/L
- Temperature: -2°C prior to the introduction to the RO system

A sample from the Hudson's Bay was taken on March 23, 2011, and was analyzed by Maxxim Analytics. The results of this testing will be used to refine the design as the project progresses.

From speaking to representatives of the Hamlet, it was determined that the Hamlet would require 220 m^3 of potable water a day. This water would be delivered to residents by transfer trucks, which would be able to operate throughout each day as required in this emergency situation.

The gathering of information required for design is an ongoing process, and in lieu of exact data professional judgment has been used for preliminary sizing to discuss availability of equipment with suppliers. Exact design parameters will be confirmed prior to procurement of equipment.

1.3 Systems Description

The water treatment system has been designed to ensure reliability from the RO units as well consistency in operation. A Process Flow Diagram can be found in Appendix A, which outlines the treatment process designed by Stantec. The following sections outline the design parameters of significant process components.

Raw Water Pump

A submersible turbine pump will be used to remove water from the Hudson's Bay and transport it to the water treatment system. The pump will be positioned in the water to minimize scour and any impacts on aquatic life. The pump will need to be compatible with sea water to limit corrosion of the equipment. It is expected for the pump to be run continuously to prevent freezing of the intake pipe, regardless of the operation of the RO unit. The design parameters of the pump are as follows:

- Flow: 1,600 L/min (2 RO trains in operation)
- Discharge Pressure: 590 kPa (85 psi)
- Materials: 316SS

- Discharge: 150mm
- Control: Variable Frequency Drive

The design of the pump takes into consideration the tidal variation (+/- 4m), grade of the warf relative to the water level and position of the water treatment system relative to the placement of the pump. Final position of all equipment will be confirmed in the final design.

Piping from the raw water pump to the water treatment system will be 150mm HDPE piping complete with insulation and heat tracing. Prior to the cartridge filters, a bypass line complete with isolation valves will be installed to divert pumped flow back to Hudson's Bay in the event any of the upstream process require shutdown for maintenance or repair. In addition, due to the position of the raw water pump in the ice on the bay, breakaway couplings will be incorporate to protect the system from sudden or unexpected ice movement that may impact the pump and discharge line.

Fish Screen

It will be necessary to incorporate a fish screen on the raw water pump suction to ensure fish are not suctioned into the intake line. Details on the requirements of the fish screen are provided through the Department of Fisheries & Oceans (DFO). The screen will be designed with specific pore sizing and fabricated from 316SS materials to reduce the impact of corrosion in the sea water.

Preliminary Design Characteristics:

- Materials: 316SS
- Screen Size

The final design of the screen will incorporate these details in conjunction with the final design and selection of the raw water pump.

Cartridge Filters

Cartridge filters will be used to remove particles from the pressurized influent raw water. The intent of the filter system is to maintain the integrity of the RO membranes. The filter models were chosen to replicate the filter system that is already in place at the Hamlet to filter reservoir water to simplify operations and maintenance for staff. The design parameters of the pump are as follows:

- Flow: 1,600 L/min (2 RO trains in operation)
- Two (2) cartridge filters
- One cartridge filter is to have remove particles larger than 20 microns. One cartridge filter is to remove particles larger than 5 microns
- Both cartridge filters must be manufactured to be compatible with raw water quality as specified above. This may include the application of coatings to protect from corrosion
- Both cartridge filters must be supplied with inlet and outlet fittings of 100mm
- 10 spare cartridges for each filter

Circulation Heater

A circulation heater will be used to increase the temperature of the influent raw water. The membranes of the RO units are sensitive to low temperatures, and cannot treat water below freezing temperatures. A pressure release valve will likely be needed upstream of the heater in order to

reduce the influent pressure to less than 96 kPa (14 psi) to avoid having to obtain a Canadian Registration Number for a pressurized vessel. The design parameters for the circulation heater are as follows:

- Flow: 1,600 L/min (2 RO trains in operation)
- Vessel must be compatible with sea water and corrosion resistant
- Influent temperature of -2 °C
- Must raise temperature to minimum 1 °C

Final selection of equipment is based on availability. The water heater may consist of an electric inline water heater or a boiler/heat exchanger system. Final details of the system will be confirmed with the detail design.

Raw Water Tank

A raw water tank will be used to equalize flow to the RO unit to help ensure consistent operation of the RO units. As well, the tank allows for a buffer volume for the RO feed pump to draw from during require maintenance of the cartridge filters. The tank will be fitted with an overflow outlet, which ultimately will discharge back into the Hudson's Bay. Water will overflow when the RO units are not in operation due to the continuous operation of the raw water pump. Water may also overflow during RO operation due to the slight over sizing of the raw water pump. From discussions with operational staff for the Hamlet, Stantec was informed that the Hamlet possessed a tank suitable for this application. Details of this tank as provided to Stantec by the Hamlet, include:

- Volume: 6,000L
- Diamater: 2.06m (81 inches)
- Height: 1.8m (estimated) (71 inches)
- Inlets/Outlets: To be determined

RO Units

The RO unit will treat water to remove salinity. The RO unit will be supplied from Canadian Water Technologies, as per the tender received by the Hamlet on April 5, 2011. The RO system is to have the following components:

- RO membranes
- Two trains
- RO feed pump c/w starters
- RO High pressure pumps c/w VFDs
- PLC c/w HMI
- Pre-filtration system
- Instrumentation including flow meters, pressure gauges, conductivity, etc.
- Antiscalant injection system c/w sufficient antiscalant for 3 months of operation
- Clean In Place (CIP) System

The RO system is capable of producing 720 L/min with both trains operating, assuming the water quality characteristics specified above. Exact operating parameters will be determined using water quality data provided by Maxxim and from testing of the units to be done once the units are procured.

As the equipment is considered a surplus unit and currently owned by a third party, details of the system are still outstanding. Once the system is purchased and transported to Calgary by Canadian

Water Technologies, all outstanding mechanical, hydraulic, electrical and control details will be made available.

Static Mixer

A static inline mixer will be used to provide adequate mixing for the permeate flow and injected chemicals. The design parameters for the mixer are as follows:

- Water at 720 L/min
- Pressure less than 140 kPa (20 psi)
- Uniform flow pattern
- Horizontal installation
- 100mm diameter
- NSF approved material
- G = 1000 s-1
- Mixer to include injection ports for post-treatment chemicals

Chemical Metering Pumps

RO permeate will require post chemical addition to increase the pH of the water and for disinfection. The pH of the permeate will be increased by the use of sodium carbonate (Na_2CO_3), which will also help to stabilize the alkalinity of the water. Sodium carbonate will be dosed to achieve a pH of 7. Sodium carbonate is supplied as powder, and will need to be made into a solution by staff.

Disinfection will be achieved by the addition of calcium hypochlorite (CaOCl). Calcium hypochlorite is supplied as powder, and will need to be made into a solution by staff. Codium hypochlorite will be dosed to achieve a chlorine concentration of 1 mg/L. The permeate flow is assumed to be 720 L/min.

Two peristaltic pumps will be used pump these chemicals into the permeate line through the inline static mixer.

Final details and selection of the pumps will be confirmed with the detail design and will be based on final chemical requirement calculations. The RO system may contain provisions for chemical addition and need to be further investigated prior to determine if a chemical feed system is required to be installed by the Owner.

Process Tanks

Two tanks will be used to provide enough retention for disinfection to occur. The tanks will be hydraulically linked to optimize mixing in the tanks as much as possible. Mixing will be based on the inclusion of the static inline mixer, tank (bulk) mixing, overflow to second tank as well as consideration of retention time in downstream storage tanks and water haulers.

- Volume: 9,500 L (each tank)
- Target CT: 12 mg/L/min
- Baffling Factor: 0.3
- Inlets/Outlets: To be determined

Based on these parameters, two tanks with a combined capacity of 19,000 L (17,100 L operating volume assumed) will provide a CT equal to or greater than 12 mg/L/min for flows through a single

train. Should flows be greater than one train (>800 L/min), the volume of the downstream storage tanks will provide the remaining retention time for complete disinfection of the treated water.

Storage Tanks

Two tanks will be used to provide enough storage for trucking operations. These tanks, in conjunction with the operation of the RO system will provide sufficient water to keep trucks moving at a rate of 3 trucks/90 minutes for single train operation and 3 trucks/60 minutes (or better) with two trains in full operation. The storage tanks will be hydraulically linked near the bases to allow single inlet/outlet flows.

- Volume: 9,500 L (each tank)
- Diameter: 2.41m (91 inches)
- Height: 2.77m (109 inches)
- Inlets/Outlets: To be determined

Final determination of storage tank volume will be determined based on discussions with GN CG&S personnel as well as final determination of the operation control system for the RO system.

Transfer Pumps

A small transfer pump will be installed at the base of one storage tanks to pump water from the storage tank into the transfer truck. The pumps will be sized for a flow of 1,200 L/min (10 minute truck fill).

- Flow: 1,200 L/min
- Discharge Pressure: 40 kPa (7 psi)
- Materials: 316SS
- Discharge: 100mm
- Control: Constant Speed

1.4 List of Materials

The following is a list of equipment that will be included in the treatment process. This list is not meant to be exhaustive, and will be refined during the design process.

- Fish screen
- Raw pump(s)
- Breakaway couplings
- Filters and cartridges
- Pressure release valve
- Circulation heater
- Raw water tank
- RO Unit
- Chemical feed system
- Inline static mixer
- Process storage tanks
- Storage tanks
- Transfer pump
- Piping (complete with insulation and heat trace), fittings and valves
- Spill containment

1.5 Budget Information

Stantec's opinion of probable cost for the treatment process can be found Appendix B. A Class 5 estimate type was completed based on supplier information, data from similar projects and professional judgment.

1.6 Schedule Information

Delivering of equipment is of critical importance and to the construction of the RO system, which must be operational by May 7, 2011. Delivery information for the treatment process components are briefly outlined in the following sections.

Raw Water Pump

Final selection of raw water pump to be completed. Projected delivery based on discussions with vendor is end of April.

Cartridge Filters

Delivery is 3-4 weeks once ordered, and must be built as they are not in stock.

Circulation Heater

Discussions with the regional representative of Chromalox indicate that the heater can be delivered within 2 weeks of ordering. Confirmation of details from vendor pending.

RO Units

According to the tender received by the Hamlet on April 5, 2011 the RO unit will be delivered to site on April 30, 2011. This date is subject to contract execution with Canadian Water Technologies.

Chemical Metering Pumps

Discussions with the supplier, Capital H20 Systems, indicate that these items are in stock in Calgary.

Static Mixer

Discussion with the supplier, Waste n Watertech indicate the item is in stock and available.

Process Tanks

Discussions with the supplier, Norwesco, indicate that tanks are available in stock depending on the size required. The addition of fittings may increase delivery time.

Storage Tanks

Discussions with the supplier, Norwesco, indicate that tanks are available in stock depending on the size required. The addition of fittings may increase delivery time.

Transfer Pumps

Final selection of raw water pump to be completed. Projected delivery based on discussions with vendor is end of April.

Project Information:

Case-specific:

System Details

Feed Flow to Stage 1	422.22 gpm	Pass 1 Permeate Flow	190.04 gpm	Osmotic Pressure:			
Raw Water Flow to System	422.22 gpm	Pass 1 Recovery	45.01 %	Feed	306.36 psig		
Feed Pressure	774.83 psig	Feed Temperature	1.0 C	Concentrate	566.52 psig		
Fouling Factor	0.85	Feed TDS	33127.25 mg/l	Average	436.44 psig		
Chem. Dose (100% H2SO4)	0.00 mg/l	Number of Elements	84	Average NDP	321.70 psig		
Total Active Area	33600.00 ft²	Average Pass 1 Flux	8.14 gfd	Power	177.92 kW		
Water Classification: Seawater (Open Intake) SDI < 5				Specific Energy	15.60	kWh /kgal	

Stage	Element	#PV	#Ele	Feed Flow (gpm)	Feed Press (psig)	Recirc Flow (gpm)	Conc Flow (gpm)	Conc Press (psig)	Perm Flow (gpm)	Avg Flux (gfd)	Perm Press (psig)	Boost Press (psig)	Perm TDS (mg/l)
1	SW30ULE-400i	12	7	422.22	769.83	0.00	232.19	744.56	190.04	8.14	0.00	0.00	86.28

Pass Streams (mg/l as Ion)					
Name	Feed	Adjusted Feed	Concentrate	Permeate	
			Stage 1	Stage 1	Total
NH4	0.00	0.00	0.00	0.00	0.00
K	394.00	394.00	715.34	1.38	1.38
Na	10100.00	10100.00	18340.95	31.14	31.14
Mg	1210.00	1210.00	2199.68	0.80	0.80
Ca	411.00	411.00	747.17	0.27	0.27
Sr	0.00	0.00	0.00	0.00	0.00
Ba	0.00	0.00	0.00	0.00	0.00
CO3	3.43	3.43	9.25	0.00	0.00
HCO3	160.00	160.00	284.34	0.75	0.75
NO3	0.04	0.04	0.07	0.00	0.00
Cl	15000.00	17947.86	32595.59	51.12	51.12
F	0.91	0.91	1.65	0.00	0.00
SO4	2900.00	2900.00	5272.86	0.82	0.82
SiO2	0.00	0.00	0.00	0.00	0.00
Boron	0.00	0.00	0.00	0.00	0.00
CO2	2.89	2.84	4.62	3.38	3.38
TDS	30179.39	33127.25	60166.91	86.28	86.28
pH	7.70	7.70	7.76	5.73	5.73

Design Warnings

-None-

Solubility Warnings

Langelier Saturation Index > 0

CaF2 (% Saturation) > 100%

Antiscalants may be required. Consult your antiscalant manufacturer for dosing and maximum allowable system recovery.

Stage Details

Stage 1 Element	Recovery	Perm Flow (gpm)	Perm TDS (mg/l)	Feed Flow (gpm)	Feed TDS (mg/l)	Feed Press (psig)
1	0.09	3.31	46.14	35.19	33127.25	769.83
2	0.09	2.96	56.29	31.88	36557.53	764.70
3	0.09	2.60	69.64	28.92	40292.94	760.23
4	0.09	2.24	87.37	26.32	44269.87	756.32
5	0.08	1.89	111.07	24.07	48386.02	752.87
6	0.07	1.56	143.05	22.18	52507.30	749.81
7	0.06	1.27	186.21	20.62	56480.64	747.06

Scaling Calculations

	Raw Water	Adjusted Feed	Concentrate
pH	7.70	7.70	7.76
Langelier Saturation Index	0.25	0.25	0.80
Stiff & Davis Stability Index	-0.58	-0.58	-0.27
Ionic Strength (Molal)	0.64	0.68	1.28
TDS (mg/l)	30179.39	33127.25	60166.91
HCO3	160.00	160.00	284.34
CO2	2.89	2.89	4.62
CO3	3.43	3.43	9.25
CaSO4 (% Saturation)	23.47	23.47	45.81
BaSO4 (% Saturation)	0.00	0.00	0.00
SrSO4 (% Saturation)	0.00	0.00	0.00
CaF2 (% Saturation)	45.24	45.24	271.00
SiO2 (% Saturation)	0.00	0.00	0.00
Mg(OH)2 (% Saturation)	0.10	0.10	0.25

To balance: 2947.86 mg/l Cl added to feed.

2 STRUCTURAL SYSTEM

2.1 Introduction

Due to time constraints and our unique situation, to date three suppliers were able to meet most if not all of the requirements; “All Weather Shelters”, “Sprung” and “G & B Portable” (partnered with LX construction). More information about these three suppliers can be found in the “Description of Systems” section below.

2.2 Design Assumptions

The design assumptions for this temporary structure are listed below.

- 20’x100’ building foot print
- 8’x8’ (or larger) roll up fabric door
- Two man doors (one at each end)
- Structure expected to be in place for 3-12 months
- High wind loads based on National Building Code
- Insulated structure with an R-value of 10 or greater

Please refer to the performance specification on tensioned fabric structures for additional requirements.

2.3 Systems Description

2.3.1 Prefabricated Structure

There were numerous systems that were looked at when trying to find a temporary structure for this application. The systems that were looked at include:

- Module Wood framed structure
- Mobile, multipurpose expandable trailer and power supply
- Tensioned fabric membrane with engineered steel frames
- Engineered steel frames with metal corrugated roof

The recommended system is tension fabric membrane with engineered steel frames.

2.3.2 Ancorhage of Prefabricated Structure

The other major structural component of this project is how the prefabricated structure is tied down to the existing Wharf. There are two potential options that are still being looked into.

- Ground Anchors (Rock/Earth anchors)
- Ballast (various configurations, various material)

Option one – Ground Anchors

There are several types of anchors available to tie the prefabricated structure to the ground. Suppliers have used wedge anchors, earth anchors, ground stakes, duckbills and other types of anchors that will resist loading that is put on the prefabricated structure. A geotechnical report is required to design this anchorage system. No geotechnical information is currently available though we continue to investigate.

Option two – Ballast System

Heavy material is used to weigh down both sides of the prefabricated structure. The concern with this option is getting suitable ballast material to site. Ballast can come in several forms, as long as it has the weight capacity to withstand the overturning caused by potential strong winds. Gabions filled with rock, ballast boxes filled with gravel and containers filled with water are some options. There is however a limited amount of gravel available on site during the expected erection period as well as limited space in the Hercules aircraft to transport ballast material to site.

More information is required to carry through with either of these options as we continue to investigate. Information about the geotechnical conditions of the Wharf, the availability of gravel, or the availability of ballast containers that can be filled with local material or water is necessary to come to a final conclusion.

2.3.3 Feasible Options

2.3.3.1 All Weather Shelter

Here are preliminary details regarding what this supplier indicates they can provide:

- 20’x100’ foot print structure made up of white poly fabric supported on an engineered frame
- Engineering design and seal of the prefabricated structure
- Engineering design and seal of the connection between the anchor and structure
- NOTE: Engineering design and seal of the connection between the anchor and ground CANNOT BE DONE WITHOUT MORE INFORMATION ON SOIL CONDITIONS
- Supply of own crew to erect the building
- Shipment of material to nearest international airport
- Erection done by the 29th of April
- Flexible to work with anchors or ballast.

This supplier has given us the most confidence to date based on our initial investigation.

2.3.3.2 Sprung

Here are preliminary details regarding what Sprung has indicated they can provide:

- 20’x100’ foot print structure made up of white poly fabric supported on an engineered frame
- Engineering design and seal of the prefabricated structure
- Engineering design and seal of the connection between the anchor and structure

- NOTE: Engineering design and seal of anchors to ground CANNOT BE DONE WITHOUT MORE INFORMATION ON SOIL CONDITIONS
- Local crew for labor force with a supplied Foreman
- Shipment of material to nearest international airport
- Erection done by the 29th of April
- Flexible to work with anchors or ballast.

2.3.3.3 G & B Portables (Partnered with LX Construction)

Here are preliminary details regarding what G & B Portables has indicated they can provide:

- 24'x 96' foot print structure made up of white poly fabric supported on an engineered frame
- Engineering design and seal of the prefabricated structure
- Engineering design and seal of the connection between the anchor and structure
- NOTE: Engineering design and seal of anchors to ground CANNOT BE DONE WITHOUT MORE INFORMATION ON SOIL CONDITIONS
- Will provide own crew or use local crew
- Erection done by the 29th of April
- Quoted for a ballast container fill with local gravel for an anchorage system

2.4 List of Materials

Here is a list of material that will be required to supply, deliver, erect, and tie down the prefabricated structure.

Supplied by Prefabricator

- Prefabricated Structure
  - Membrane
  - Engineered Frame
  - Doors & Door Hardware
  - Patch/opening/sleeve kits
- Anchorage material
  - Ground anchors or,
  - Ballast containers and Ballast material
- Appropriate fall protection
- Insulation
- Possible equipment
  - Jack hammer for anchorage
  - Drill machine

Supplied by Owner

- Scissor lift or Scaffolding for erection of structure
- Transportation to and from site for Prefabricated personnel
- Erection Crew (local labour)

- Electrical power on site

2.5 Budget Information

Attached to this report are four preliminary quotations. The four suppliers are listed below:

- G & B Portable (LX Construction)
- Future Steel
- All Weather Shelters
- Sprung

Only three out of these four quotations are of interest. Future Steel uses a corrugated deck membrane instead of a fabric membrane. The attached quotes are substantially different and require further attention by the bidder as information, site specific requirements and conditions have continued to evolve.

2.6 Critical Schedule

Suppliers indicated they can meet the deadlines laid out for them. Suppliers can have the temporary structure shipped to the nearest International Airport for pick up via Hercules Aircraft by April 19th, 2011. It was assured with the man power and equipment listed above that the structure can be erected by April 29th.

2.7 List of Suppliers Contacted

Weatherhaven*

Mike Ball (1 604 451 8900)

Tami Mackenzie (1 604 636 1305)

Dome Shelter Systems

Manny (1 416 614 9167 ext. 222)

Cover Tech

Sales Rep (1 506 325 2968)

Big Top Manufacturing

Sales Rep (1 850 584 7786)

Star Building Supplies

Rob Horwood (204 233-8687)

McDiarmid Lumber Farm & Commercial Buildings

Jeremy (1 204 667 4737)

G & B Portable (LX Construction)

Alex (1 204 803 0887)

Future Steel

Gregg Hann (1 800 668 5111 ext. 241)

Sprung

Bart Ellis (1 403 601 2292)

All Weather Shelters

Craig Sims cell (1 780 669 9181) work (780 930 1551)

Norseman**

Dave Moffat (1 403 543 3366)

*In addition to the suppliers mentioned Weatherhaven was called numerous times with no answer.

**Norseman does not have an engineered structure with the width required. Only non-engineered structures.

3 MECHANICAL SYSTEM

3.1 Scope of Work

Provide coordination installation of existing heating furnaces for heating and ventilation, to maintain adequate services temperature levels for the building, once information is provided as per discussion in meeting April 07, 2011. Size of units (two according discussion) will be reviewed for suitability based on revised heat loss calculation for the building, as per new information received at said meeting.

3.2 Design Assumptions

The systems provided are based on existing equipment available on site, as per discussion in meeting April 07, 2011. According to discussion in this meeting two (2) furnaces will be adequate for the heating and ventilation of the RO building and equipment. Building design criteria is based on a outdoor air temperature of -50F and a indoor temperature of +40F (according discussion in meeting, the building only has to be maintained at just above freezing). Based on heat loss calculation, total heat required is 67.9 kw (231,620 BTUH).

No building automation system is being provided as part of the overall control of the associated equipment being provided for the building heating and ventilation, as this is considered a short term emergency facility.

No costs have been provided for the owner supplied equipment (furnaces, fuel oil tank and piping for the furnaces, and fire extinguishers).

The life expectancy of the systems provided is based on 12 months, as a temporary facility until the original water reservoir is repaired for the Hamlets potable water service.

3.3 Systems Description

Heating Systems:

Building heat loss requirements are to be covered, utilizing oil fired residential type furnaces, with self contained line voltage thermostats for control, as a source of heat for the building. Total number of furnace and size of the furnaces is to reviewed once information is received from the Hamlet, based on discussion in meeting April 07, 2011. Confirmation of control is also required.

Ventilation Systems:

Ventilation of the building will be through the furnaces with a couple of exhaust opening with back draft dampers, with snow traps, for relief of ventilation air. Requirements will be confirmed once information is received on the owner supplied furnaces, is received.

Fire Protection:

Fire protection for the building will be in the form of hand held fire extinguishers. According to discussion in the April 07, 2011 meeting, the Owner has fire extinguishers in stock and will provided

them for the project. Confirm is required on the type and size for the record, as part of the building layout drawings.

3.4 List of Materials

Heating Systems

Total of two (2) oil fired residential type furnaces; Make = _____, Model = _____, two-stage heating (high/low) capacity ___ kw (_____ MBH)/ ___ kw (____ MBH), ____ L/S (____ CFM), _____C (__F) temperature rise, Motor ___ HP ____ volt, __ phase, ____ amps/___ amps , totally enclosed permanent split capacitor, ball type bearings, unit mounted line voltage 2-stage thermostat, and summer/winter switch **?** .

Ventilation Systems

Ventilation will be through the two (2) owner supplied furnace units.

Supply air ducting should be provided for supply air through to the far end of the building, with supply air openings along the length of this duct complete with balancing dampers. As part of this installation an exhaust fans should be considered with outdoor and intake openings (mm x mm or " x ")

Fire Protection

Fire extinguishers will be provided for each exit and over head door. Additional fire extinguishers will be placed strategically to ensure proper access to fire extinguishers in an emergency condition.

3.5 Budget Information

Heating Systems

Furnaces are to be supplied by the Hamlet. Fuel oil tank and piping will also be required for the installation of the furnaces, which would be covered by the Hamlet.

If electric unit heaters are considered as additional heating and as back-up to the furnaces (ie. two heaters = to 135 MBH output, estimated cost per heater only is $2200.00).

Ventilation Systems

Estimate of probable cost for labour and material for the installation of the distribution ductwork, supply air grilles, balancing dampers and duct insulation = $30,000.00.

Balancing of the furnaces $4,000.00 for labour and report not including travel and accommodations.

Fire Protection

Fire extinguishers are to be supplied and installed by the Hamlet.

3.6 Schedule Information

Heating Systems

Delivery of electric unit heaters from time of order is about three weeks to Winnipeg as part of an emergency purchase order for Modine PTE400, 2 stage heaters.

Ventilation Systems

Duct work, duct accessories (take-offs, balancing dampers and grilles) and supply air insulation is about two weeks from time of order. Balancing of the distribution ductwork may be considered to ensure air flow through all of the supply air grilles.

4 ELECTRICAL SYSTEM

4.1 Scope of Work

The scope of work entails the installation of the water system and making all required connections to the service entrance switchboard (SES), motor control center (MCC), Distribution panelboards, generator distribution, HVAC equipment, heat tracing, RO systems controllers, and miscellaneous equipment. The generator and transfer system is required to be tendered and purchased for the installation once all the loads are identified and the system modeled. Also transformers for reducing the voltage from 480V to 120/208V, 3 phase, 4 wire including required panelboards for branch circuits will also be sized and tendered after the loads are identified and calculated. The Electrical Contractor shall also be required to coordinate his work with the other trades and systems providers.

4.2 Design Assumptions

The electrical assumptions will be that the entire electrical system will be designed around a 277/480V, 3 phase, 4 wire system and where required transformers and distribution required to step down the voltage and be sized based on the selection of the equipment. There will be no 600V system designed. Also a generator will be the primary power source for the new RO unit. If the unit is to be powered for an extended period of time a determination of providing utility grid normal power may be considered. Off the shelf equipment, to the extent possible, will be specified for readily available purchase and shipment to the site.

4.3 Systems Description

The electrical system will consist of a service entrance switchboard (SES), motor control center (MCC) and distribution equipment purchased with the RO system. The existing electrical service is a 1200A, 277/480V, 3 phase, 4 wire system. A new or used generator and transfer system will be required to power the RO system, building lighting, HVAC and other miscellaneous loads. The size of the generator is still to be determined due to lack of information on the RO system and sizing of other equipment. Preliminary sizing of the generator indicates that a 740KW generator will be required. All cabling will be Teck 90 cabling and sized for the loads and the Canadian Electrical Code (CEC). The Teck 90 cabling will be supported from the building or routed on the ground and protected with sand bags as required

4.4 List of Materials

Generator - Minimum of a 740KW generator or combination of multiple generators in parallel will be required. Sizing will be verified once all loads are accounted for.

Manual Transfer Switch – Sized according to the loads to be served and the Canadian Electrical Code.

Step Down Transformers – Nominal 30 KVA to 75KVA, 480-120/208V transformers will be specified as required.

Teck 90 Cabling – Sizes ranging from #12 AWG to #500 kcmil will be required. Where parallel runs of smaller conductors can be used to minimize cable sizes, it will be allowed or specified.

Panelboards – Branch Circuit panelboards with circuit breakers will be specified as required. Panels fed from step-down transformers will be specified with main circuit breakers.

4.5 Budget Information

Once the selection of equipment is made the final selection of the electrical equipment can be determined. At this time there is insufficient information to make any assumptions on the electrical budget.

4.6 Schedule Information

The schedule of deliverables is dependent on the size of the generator and availability of a unit. Once the final load study is completed, the search for a unit will commence.

Respectfully submitted,

Nunami Stantec Limited

Reviewed by:

Original signed by:

Jason Street, P.Eng.
Environmental Engineer

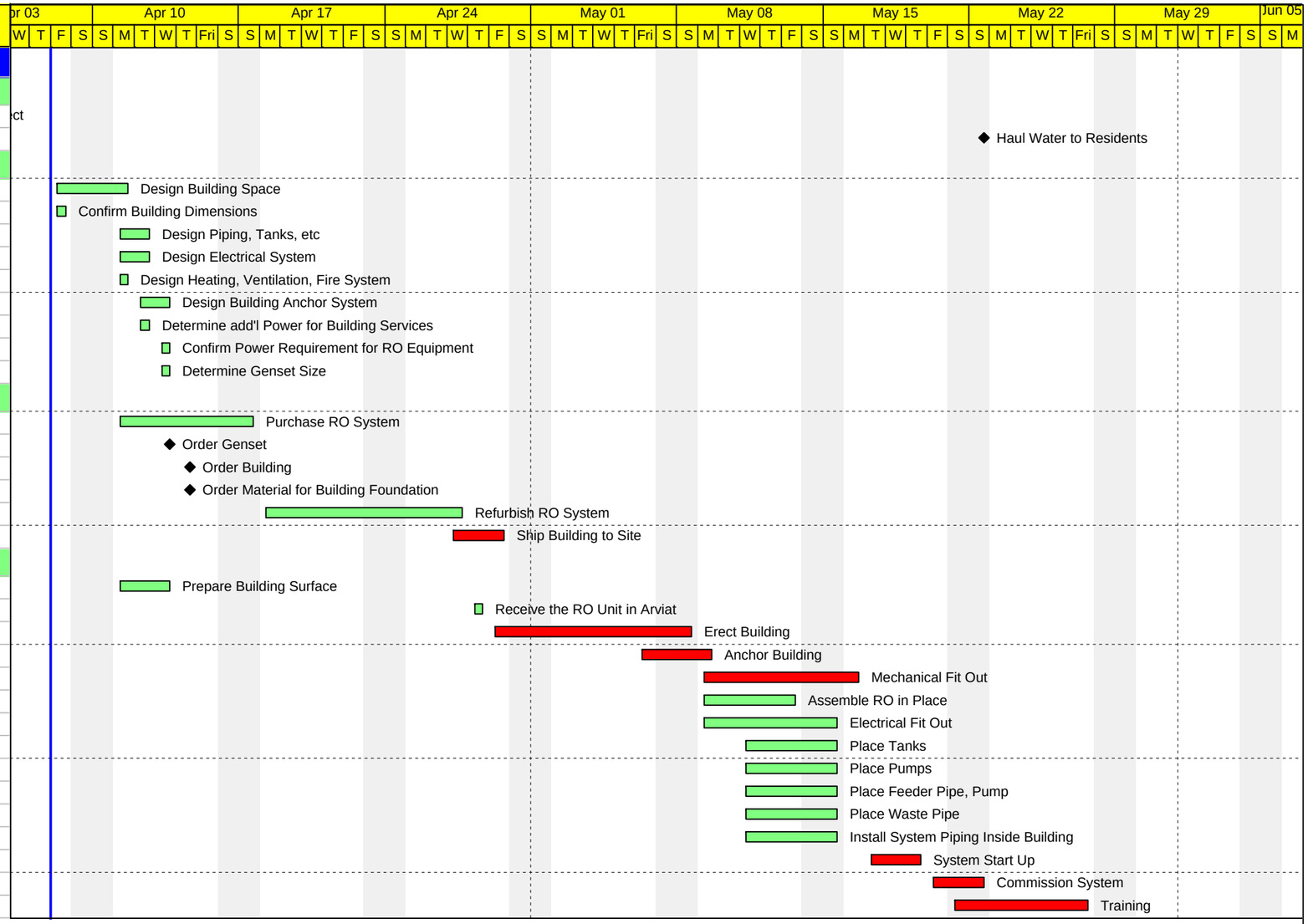
Original signed by:

Gerry Devine, MBA, P.Eng.
Project Manager

APPENDIX A

Tentative Schedule

Activity ID	Activity Name	Original Duration	Start	Finish
Arviat Emergency Water Project		36	24-Mar-11 A	27-May-11
Key Project Milestones		45	24-Mar-11 A	22-May-11
M0000	Commence Arviat Emergency Water Project	0	24-Mar-11 A	
M0010	Haul Water to Residents	0		22-May-11
Design		4	08-Apr-11	13-Apr-11
D0000	Design Building Space	2	08-Apr-11	11-Apr-11
D0010	Confirm Building Dimensions	1	08-Apr-11	08-Apr-11
D0020	Design Piping, Tanks, etc	2	11-Apr-11	12-Apr-11
D0030	Design Electrical System	2	11-Apr-11	12-Apr-11
D0040	Design Heating, Ventilation, Fire System	1	11-Apr-11	11-Apr-11
D0050	Design Building Anchor System	2	12-Apr-11	13-Apr-11
D0060	Determine add'l Power for Building Services	1	12-Apr-11	12-Apr-11
D0070	Confirm Power Requirement for RO Equip...	1	13-Apr-11	13-Apr-11
D0080	Determine Genset Size	1	13-Apr-11	13-Apr-11
Procurement		15	11-Apr-11	29-Apr-11
P0000	Purchase RO System	7	11-Apr-11	17-Apr-11
P0040	Order Genset	0		13-Apr-11
P0010	Order Building	0		14-Apr-11*
P0020	Order Material for Building Foundation	0		14-Apr-11
P0050	Refurbish RO System	8	18-Apr-11	27-Apr-11
P0030	Ship Building to Site	3	27-Apr-11*	29-Apr-11
Construction		47	11-Apr-11	27-May-11
C0000	Prepare Building Surface	3	11-Apr-11	13-Apr-11
C0040	Receive the RO Unit in Arviat	1	28-Apr-11	28-Apr-11
C0010	Erect Building	10	29-Apr-11	08-May-11
C0020	Anchor Building	4	06-May-11	09-May-11
C0030	Mechanical Fit Out	8	09-May-11	16-May-11
C0050	Assemble RO in Place	5	09-May-11	13-May-11
C0140	Electrical Fit Out	7	09-May-11	15-May-11
C0090	Place Tanks	5	11-May-11	15-May-11
C0060	Place Pumps	5	11-May-11	15-May-11
C0070	Place Feeder Pipe, Pump	5	11-May-11	15-May-11
C0080	Place Waste Pipe	5	11-May-11	15-May-11
C0100	Install System Piping Inside Building	5	11-May-11	15-May-11
C0110	System Start Up	3	17-May-11	19-May-11
C0120	Commission System	3	20-May-11	22-May-11
C0130	Training	7	21-May-11	27-May-11



Actual Work
Remaining Work
Critical Remaining Work
Milestone

Stantec

Data Date: 08-Apr-11

Arviat Emergency Water Supply & Treatment Project

Rev 1

Stantec # 149239001

Date	Revision	Checked	Approved
08-Apr-...	Initial Schedule	PJB	BJ
13-Apr-...	Updated Deliverables	PJB	BJ

APPENDIX B

Capital Cost Estimate

OPINION OF PROBABLE COST SUMMARY

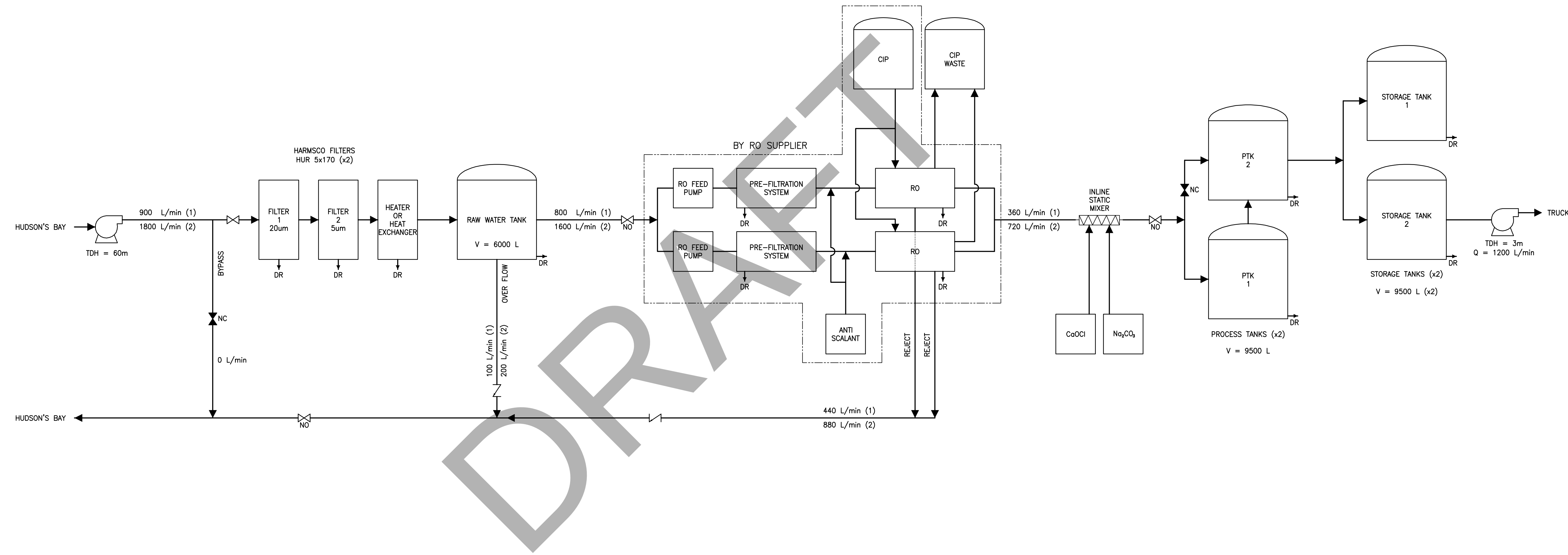
Hamlet of Arviat
RO WTP
Estimate Type: Class 5

Job No: 149239001
Prepared By: Stantec
Revision No: 2
Date: 8-Apr-11

Item	Description	Unit	Qty	Unit Cost	Total Cost	Notes
	MATERIAL COST					
1.0	**Raw Water Intake Pump**					
	Raw Water Pump (2 supplied/1 installed), c/w VFD	ea	2	$ 20,000.00	$ 40,000.00	Pump details/pricing to be confirmed by vendor (estimate)
	Fish Screen	ls	1	$ 4,500.00	$ 4,500.00	Fish screen fabrication to be sourced (estimate)
	Breakaway couplings	ea	2	$ 7,500.00	$ 15,000.00	
	Interconnecting Piping to pre-filtration system c/w heat tracing and insultation	m	40	$ 160.00	$ 6,400.00	Final placement of pumps to be confirmed with GN
2.0	**Pre-Filtration System**					
	Harmsco filtration system (2 filters) c/w 20 spare filter cartridges	ls	1	$ 38,000.00	$ 38,000.00	two filters (25 and 5 microns with 10 cartridges of each)
	Thermal blanket	m2	10	$ 120.00	$ 1,200.00	
	Interconnecting Piping to RO System c/w heat tracing and insultation	m2	15	$ 160.00	$ 2,400.00	
	Heater/Boiler	ea	1	$ 75,000.00	$ 75,000.00	Subject to equipment selection, availability and vendor confirmation
	Heat Exchanger	ea	2	$ 10,100.00	$ 20,200.00	
3.0	**RO System**					
	Pre-storage tank (6,000L)	ea			$ -	Provided by GN
	Feed Pump (duplex)	ea		$ -	$ -	Included in RO System
	RO System	ls	1	$ 1,255,000.00	$ 1,255,000.00	RO System to be determined through RFQ
	Chemicals - antiscalant, NaOCl, anticorrosion inhibitor	ls	1	$ 15,000.00	$ 15,000.00	Estimate - details to be confirmed once RO system selected
	Chemicals - CIP system	ls	1	$ 5,000.00	$ 5,000.00	Estimate - details to be confirmed once RO system selected
	Onsite chemical containment	ls	1	$ 6,200.00	$ 6,200.00	
	Chemical Metering Pump	ea	2	$ 4,000.00	$ 8,000.00	Estimate - details to be confirmed once RO system selected
	Warranty	ea	1	$ 200,000.00	$ 200,000.00	
	Installation Services	ea	14	$ 950.00	$ 13,300.00	2 people, 4 days on site, 2 days travel each (plus travel expenses)
	Commissioning Services	ea	8	$ 950.00	$ 7,600.00	1 person on site, 4 days on site, 2 days travel (plus travel expenses)
	Training Services	ea	12	$ 950.00	$ 11,400.00	1 person on site, 5 days on site, 2 days travel (plus travel expenses)
						*** Number of days to be confirmed
4.0	**Post-Treatment System**					
	Inline static mixer	ls	1	$ 3,500.00	$ 3,500.00	Vendor to confirm pricing
	Process Storage	ea	2	$ 1,800.00	$ 3,600.00	9500L (2500 Usgal)
	Thermal blanket	m2	50	$ 80.00	$ 4,000.00	
	Interconnecting Piping to RO System c/w heat tracing and insultation	m	15	$ 160.00	$ 2,400.00	
5.0	**Storage**					
	Storage Tanks c/w gooseneck vent and birdscreen	ea	2	$ 1,800.00	$ 3,600.00	9500L (2500 Usgal)
	Pump for truck fill	ea	2	$ 5,000.00	$ 10,000.00	Pump details/pricing to be confirmed by vendor (estimate)
	Interconnecting Piping w/ heat tracing and insultation	m	10	$ 160.00	$ 1,600.00	
6.0	**Heating**					
	Fuel Oil Storage Tank	ea	1	$ -	$ -	Available on site - details to be confirmed
	Furnaces / Unit Heaters, ducting	ls	1	$ 45,000.00	$ 45,000.00	Final HVAC design to be completed
7.0	**Electrical**					
	Starter/Control Panel for raw water and truck fill pumps c/w on/off switch, alarm, transformer(s), power distribution panel, power supply and cabling	ls	1	$ 30,000.00	$ 30,000.00	
	750kW Diesel Generator	ea	1	$ 250,000.00	$ 250,000.00	Generator size/source to be confirmed upon selection of RO system
8.0	**Building**					
	Supply of building structure	ls	1	$ 70,000.00	$ 70,000.00	Pricing and scope to be confirmed by vendor; installation by local labor
	Anchor/Base	ls	1	$ 15,000.00	$ 15,000.00	Design of building anchor to be completed, cost is estimate only
	Civil/Site	ls	1	$ 20,000.00	$ 20,000.00	Estimate - site preparation for building, truck access, etc.
	TOTAL MATERIAL COST				**$ 2,182,900.00**	
	Installation				$ 37,500.00	Estimate of labour costs; based on 5 people/10 hours per day/10 days/$75 per hour.
	Freight				$ 275,000.00	Dependent upon location of material and transportation requirements - estimate only
	Indirect Capital Cost				$ 75,000.00	Including mod/demob, tools and equipment and third party testing
	SUBTOTAL				**$ 2,570,400.00**	
	Contingency					
	TOTAL				**$ 2,570,400.00**	

APPENDIX C

Process Engineering



(1) ONE RO TRAIN IN OPERATION (@ 100%)
(2) TWO RO TRAINS IN OPERATION (@ 100%)
DR – DRAIN LINE

Revision	By	Appd.	YY.MM.DD
Issued	By	Appd.	YY.MM.DD

Consultants

PRELIMINARY
NOT TO BE USED FOR CONSTRUCTION

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Client/Project
GOVERNMENT OF NUNAVUT

EMERGENCY WATER TREATMENT & SUPPLY SYSTEM
Arviat, Nunavut

File Name: P001.dwg	L.G	J.S	J.S	11.04.06
	Dwn.	Chkd.	Dsgn.	YY.MM.DD

Title
PROCESS FLOW DIAGRAM

Project No. 149239001
Scale
Drawing No. P001
Sheet of
Issue / Revision A/0

ORIGINAL SHEET – ISO A1

APPENDIX D

Structural Engineering

PART 1 PERFORMANCE SPECIFICATION

1.1 SUMMARY

.1 THE TENSIONED FABRIC STRUCTURE MANUFACTURER (HEREAFTER REFERRED TO AS "TFS MANUFACTURER") SHALL BE RESPONSIBLE FOR THE DESIGN, ENGINEERING, FABRICATION, SUPPLY AND INSTALLATION OF THE WORK SPECIFIED HEREIN. THE INTENT OF THIS SPECIFICATION IS TO HAVE SINGLE SOURCE RESPONSIBILITY FOR THE ABOVE FUNCTIONS.

.2 PERFORMANCE REQUIREMENTS: THE TFS MANUFACTURER SHALL BE RESPONSIBLE FOR THE CONFIGURATION, FABRICATION AND ERECTION OF THE TENSIONED MEMBRANE STRUCTURE. ALL MATERIALS PROVIDED SHALL BE NEW AND UNUSED.

.3 ERECTION OF THE COMPLETE SYSTEM SHALL BE THE RESPONSIBILITY OF THE SAME FIRM DESIGNING AND MANUFACTURING THE BUILDING.

.4 THE FABRIC STRUCTURE SHALL BE A FRAME SUPPORTED TENSIONED MEMBRANE STRUCTURE. THE FABRIC SHALL HAVE LOW ELONGATION CHARACTERISTICS UNDER TENSION AND SHALL ASSUME AN ANTICLASTIC CONFIGURATION. STRUCTURES THAT HAVE DESIGNS INCORPORATING FABRIC IN A FLAT OR MONO-AXIALLY CURVED CONFIGURATION AT ANY LOCATION IN THE ROOF WILL NOT BE ACCEPTABLE. LATERAL RESTRAINT TO THE STRUCTURAL MEMBERS MUST BE PROVIDED BY BRACING INDEPENDENT OF THE TENSIONED FABRIC.

.5 PROVIDE A STRUCTURE AS SHOWN IN THE DRAWINGS AND DESCRIBED IN THIS SPECIFICATION. ANCHORING FOR THE STRUCTURE SHALL BE THE RESPONSIBILITY OF THE TFS MANUFACTURER.

1.2 REFERENCE STANDARDS

.1 NATIONAL RESEARCH COUNCIL OF CANADA (NRCC)

.1 NBC 2005, "NATIONAL BUILDING CODE OF CANADA."

.2 USER'S GUIDE – NBC 2005 STRUCTURAL COMMENTARIES.

.2 CANADIAN STANDARDS ASSOCIATION (CSA)

.1 CAN/CSA-G40.20/G40.21-04, "GENERAL REQUIREMENTS FOR ROLLED OR WELDED STRUCTURAL QUALITY STEEL/STRUCTURAL QUALITY STEEL."

.3 AMERICAN SOCIETY FOR TESTING AND MATERIALS INTERNATIONAL (ASTM)

.1 ASTM A36/A36M-08, "STANDARD SPECIFICATION FOR CARBON STRUCTURAL STEEL."

.4 PROVINCIAL SAFETY STANDARDS WHERE APPLICABLE.

1.3 REGULATIONS

.1 ABIDE BY THE CURRENT BYLAWS AND REGULATIONS OF THE TERRITORY AND/OR MUNICIPALITY IN WHICH THE WORK IS LOCATED, AND ABIDE BY THE CURRENT LAWS AND REGULATIONS WITH REGARD TO PUBLIC SAFETY.

.2 THE REGULATIONS OF THE MINISTER OF LABOUR, OCCUPATIONAL HEALTH AND SAFETY ACT, THE WORKERS' COMPENSATION BOARD AND OTHER APPLICABLE ACTS ADMINISTERED BY THE AUTHORITY HAVING JURISDICTION OF THE TERRITORY APPLY TO THE WORK OF THIS SECTION.

1.4 SAFETY

.1 CARRY OUT WORK IN ACCORDANCE WITH THE CURRENT OCCUPATIONAL HEALTH AND SAFETY ACT AND CONSTRUCTION SAFETY REGULATIONS.

1.5 QUALIFICATIONS

.1 ENGAGE A PROFESSIONAL STRUCTURAL ENGINEER REGISTERED IN THE TERRITORY OF NUNAVUT, FULLY QUALIFIED AND EXPERIENCED IN THE DESIGN OF TENSIONED FABRIC STRUCTURES, TO BE RESPONSIBLE FOR THE DESIGN OF THE TENSIONED FABRIC STRUCTURE.

1.6 DESIGN

.1 THE TFS MANUFACTURER'S ENGINEER IS RESPONSIBLE FOR ALL ASPECTS OF THE TENSIONS FABRIC STRUCTURE INCLUDING BUT NOT LIMITED TO THE MEMBRANE, STEEL FRAME, ALL CONNECTIONS, AND ANCHORAGE.

.2 THE STRUCTURAL DESIGN SHALL COMPLY WITH APPLICABLE CODES AND REGULATIONS. SPECIFICATIONS FOR THE FABRIC STRUCTURE SHALL INCLUDE:

.1 LARGE DEFLECTION NUMERICAL SHAPE GENERATION THAT WILL INSURE A STABLE, UNIFORMLY STRESSED, THREE DIMENSIONALLY CURVED SHAPE THAT IS IN STATIC EQUILIBRIUM WITH THE INTERNAL PRESTRESS FORCES AND IS SUITABLE TO RESIST ALL APPLIED LOADS.

.2 LARGE DEFLECTION FINITE ELEMENT METHOD STRUCTURAL ANALYSIS OF THE MEMBRANE SYSTEM UNDER ALL APPLICABLE WIND, SEISMIC AND SNOW LOADS.

.3 FINITE ELEMENT METHOD STRUCTURAL ANALYSIS OF THE SUPPORT FRAME SYSTEM.

.4 BASED ON THE STRUCTURAL CALCULATIONS AS DEFINED IN THIS SECTION, PREPARE STRUCTURAL DESIGN DRAWINGS DEFINING THE COMPLETE STRUCTURE, PRECISE INTERFACE GEOMETRY DETERMINATION, REACTION LOADS IMPOSED ON FOUNDATIONS, ANCHORING LOADS, CONNECTION DETAILS, INTERFACES AND SEAM LAYOUTS.

.3 STRUCTURAL CALCULATIONS FOR THE FABRIC STRUCTURE SHALL INCLUDE:

.1 LARGE DEFLECTION NUMERICAL SHAPE GENERATION THAT WILL INSURE A STABLE, UNIFORMLY STRESSED, THREE DIMENSIONALLY CURVED SHAPE THAT IS IN STATIC EQUILIBRIUM WITH THE INTERNAL PRESTRESS FORCES AND IS SUITABLE TO RESIST ALL APPLIED LOADS.

.2 LARGE DEFLECTION FINITE ELEMENT METHOD STRUCTURAL ANALYSIS OF THE MEMBRANE SYSTEM UNDER ALL APPLICABLE WIND, SEISMIC AND SNOW LOADS.

.3 FINITE ELEMENT METHOD STRUCTURAL ANALYSIS OF THE SUPPORT FRAME SYSTEM.

.4 MEMBER SIZING CALCULATIONS OF ALL PRIMARY STRUCTURAL MEMBERS.

.5 CONNECTION DESIGN INCLUDING BOLT, WELD AND ANCILLARY MEMBER SIZING.

1.7 SUBMITTALS

.1 DATA: MANUFACTURER PRODUCT DATA, INCLUDING SPECIFICATIONS AND INSTALLATION INSTRUCTIONS FOR EACH COMPONENT OF THE TENSIONED FABRIC STRUCTURE. INCLUDE LABORATORY TEST REPORTS AND OTHER DATA, WHERE APPLICABLE.

.2 ENGINEERING DRAWINGS: 11" X 17", DIMENSIONED DRAWINGS FOR THE TENSIONED FABRIC STRUCTURE SIGNED AND SEALED BY A PROFESSIONAL ENGINEER REGISTERED IN THE TERRITORY OF NUNAVUT AND RESPONSIBLE FOR THE DESIGN. INCLUDE PLAN VIEW, ELEVATIONS, DETAILS, SECTIONS, CONNECTIONS, AND ANCHORAGE.

.3 STRUCTURAL CALCULATIONS: SIGNED AND SEALED BY A PROFESSIONAL ENGINEER REGISTERED IN THE TERRITORY OF NUNAVUT AND RESPONSIBLE FOR THE DESIGN.

.4 REVIEW OF THE SHOP DRAWINGS BY THE CONSULTING ENGINEER IS INTENDED TO ASSIST THE TFS MANUFACTURER AND DOES NOT RELIEVE THE TFS MANUFACTURER OF RESPONSIBILITY FOR THE COMPLETENESS AND ACCURACY OF THE WORK AND ITS CONFORMANCE WITH THE CONTRACT DRAWINGS AND SPECIFICATIONS.

.5 FABRICATION THAT COMMENCES PRIOR TO SHOP DRAWING REVIEW BY THE ENGINEER IS AT THE RISK OF THE TFS MANUFACTURER.

1.8 DELIVERY, STORAGE AND HANDLING

.1 DELIVER ALL MATERIALS TO THE SITE IN BUNDLES EASILY IDENTIFIED AND PROPERLY MARKED.

.2 STORE AND HANDLE ALL MATERIAL ON SITE IN A MANNER TO PREVENT DAMAGE AND CONTAMINATION.

.3 TFS MANUFACTURER TO PROVIDE FOREMAN TO ATTEND ON SITE FOR DURATION OF TFS ERECTION (EXCLUDING SOUTH END WALL AS NOTED ON 3/S002).

.4 OWNER TO PROVIDE LOCL LABOR AND LIFTING EQUIPMENT.

.5 TFS TO BE DELIVERED TO 'FIRST AIR' SERVICED AIRPORT (EDMONTON INTERNATIONAL [YEG] OR WINNIPEG [YWG]) NO LATER THAN APRIL 19, 2011

.6 TFS TO BE PACKAGED AND CRATED TO SUIT AIR TRANSPORT REQUIREMENTS OF FIRST AIR HERCULES AIRCRAFT

.7 TFS TO BE PACKAGED AND CRATED TO FIT C-CAN STORAGE CONTAINER

.8 OWNER TO PROVIDE TRANSPORT FROM TFS DELIVERY LOCATION TO ARVIAT [YEK] AIRPORT

1.9 QUALITY ASSURANCE

.1 THE TFS MANUFACTURER SHALL PROVIDE DOCUMENTATION FOR THE FOLLOWING:

.1 HAVE BEEN IN CONTINUOUS OPERATION AS A PROFESSIONAL TENSION FABRIC STRUCTURE MANUFACTURER FOR A MINIMUM OF FIVE YEARS PRIOR TO THIS CONTRACT.

.2 HOLD A VALID GENERAL CONTRACTOR'S LICENSE FOR A MINIMUM OF TWO YEARS.

.3 WELDER QUALIFICATIONS: THE PERSONNEL MANUFACTURING THE METAL AWNING FRAMES MUST BE CERTIFIED WELDERS.

.4 PROVIDE WRITTEN WELDING PROCEDURE SPECIFICATIONS.

.5 HOLD DAILY SAFETY TAIL GATE MEETINGS BEFORE START OF INSTALLATION WORK.

.6 WHEN FORKLIFTS ARE USED AT THE JOB SITE, THE OPERATOR MUST BE FORK LIFT OPERATION TRAINED.

.7 PROOF OF FULL-TIME QUALITY ASSURANCE MANAGER.

.8 PROOF OF WORKERS COMPENSATION INSURANCE COVERAGE.

1.10 QUALITY CONTROL

.1 THE TFS MANUFACTURER'S PROFESSIONAL ENGINEER RESPONSIBLE FOR THE DESIGN OF THE TENSIONED FABRIC STRUCTURE IS TO INSPECT THE FABRICATION AND ERECTION.

.2 THE TFS MANUFACTURER IS NOT TO ASSIGN THE RESPONSIBILITY OF COORDINATION OF ERECTION. ENSURE A FULL-TIME QUALIFIED SUPERINTENDENT REPRESENTING THE TFS MANUFACTURER IS IN ATTENDANCE TO INSPECT AND CHECK ALL PHASES OF THIS WORK.

1.11 WARRANTY

.1 WARRANT FRAME MATERIALS AND WORKMANSHIP AGAINST DEFECTS FOR A PERIOD OF 1 YEAR FROM DATE OF SUBSTANTIAL COMPLETION OF THE WORK.

.2 MEMBRANE STRUCTURE WILL MEET ALL APPLICABLE CODES.

.3 WARRANT FABRIC MATERIALS AND WORKMANSHIP AGAINST DEFECTS FOR A PERIOD OF 4 TO 7 YEARS (DEPENDING ON SELECTED AND APPROVED FABRIC), ON A PRORATED BASIS, FROM THE DATE OF SUBSTANTIAL COMPLETION OF THE WORK AND/OR OFFER THE SAME WARRANTY OFFERED BY THE FABRIC MILL THAT MANUFACTURED OR SUPPLIED THE FABRIC.

PART 2 PRODUCTS

2.1 MATERIALS

.1 FABRIC MEMBRANE MATERIALS

.1 POLYVINYL CHLORIDE (PVC)

.1 RAW MATERIAL: POLYESTER

.2 CONSTRUCTION: PVC/PVDF COATED POLYESTER

.3 TENSILE STRENGTH: TO MEET REQUIREMENTS OF ENGINEER

.4 LIGHT TRANSMISSION: 8% – 14%, DEPENDING ON REQUIRED STRENGTH

.5 COLOUR: WHITE

.6 EXPECTED SERVICE LIFE: 10 YEARS (WARRANTY IS 5 YEARS)

.2 HIGH DENSITY POLYETHYLENE (HDPE)

.1 MESH FABRIC MADE FROM UV STABILIZED HDPE

.2 FIRE RETARDANCY: NFPA 701

.3 SEWN WITH PTFE THREAD IN A ZIG-ZAG STITCH TO PREVENT FAILURE UNDER TENSION

.4 COLOUR: AS APPROVED BY ARCHITECT/OWNER FROM AVAILABLE SELECTION

.5 EXPECTED SERVICE LIFE: 10 YEARS (WARRANTY 5 YEARS)

.2 STRUCTURAL STEEL FRAMING

.1 STRUCTURAL FRAME SHALL BE FABRICATED FROM STRUCTURAL STEEL USING STANDARD SHAPES. THE STEEL SHALL BE MINIMUM ASTM A36 FOR STANDARD PROFILES AND CSA G40.21 GRADE 350W FOR STRUCTURAL TUBES.

.2 THE FABRICATION OF THE STEEL SHALL BE IN ACCORDANCE WITH GUIDELINES SET FORTH IN THE CISC STEEL DESIGN MANUAL AND THE AWS CODE OF STRUCTURAL WELDING. ALL WELDS SHALL BE IN ACCORDANCE WITH MANUFACTURERS DESIGN AND PERFORMED PRIOR TO SHIPPING. NO WELDING SHALL BE PERFORMED IN THE FIELD UNLESS AUTHORIZED IN WRITING.

.3 THE STRUCTURAL MEMBERS SHALL BE FABRICATED IN AS LARGE SEGMENTS AS POSSIBLE TO MINIMIZE FIELD JOINTS.

.4 ALL SEGMENTS OF THE ASSEMBLY WILL BE WELDED OR STAMPED WITH THE APPROPRIATE PART NUMBER IN A MANNER THAT WILL STILL BE VISIBLE AFTER POWDER COATING IS APPLIED.

.5 GRIND ALL CORNERS AND SHARP EDGES.

.6 THE STEEL SHALL BE POLYESTER POWDER PAINTED TO A MINIMUM OF 3 MILS.

.7 STEEL WILL REQUIRE ABRASIVE BLASTING AND PRIMER BEFORE APPLICATION OF THE POLYESTER POWDER PAINT FINISH.

.8 TFS TO BE INSULATED TO R10 MINIMUM, R20 PREFFERED.

.9 PROVIDE AN APPROPRIATE PACKAGE OF ADDITIONAL FABRIC, FABRIC CONNECTORS, AND INSULATION TO ALLOW OWNER TO OPEN, CLOSE AND SEAL UTILITY AND MECHANICAL AND ELECTRICAL MEMBRANE PENETRATIONS (PATCH KIT).

PART 3 EXECUTION

3.1 DESIGN

.1 THE FRAMED-FABRIC STRUCTURE SHALL FULLY COMPLY WITH THE GENERAL REQUIREMENTS SPECIFIED IN THIS SECTION.

.2 ALL FRAMED FABRIC STRUCTURES ARE REQUIRED TO BE DESIGNED TO NBC 2005.

.3 CLIMATIC DATA:

.1 HOURLY WIND PRESSURE (1/10): 0.49 KPA

.2 HOURLY WIND PRESSURE (1/50): 0.64 KPA

.3 SNOW LOAD (1/50), SS: 2.9 KPA

.4 SNOW LOAD (1/50), SR: 0.2 KPA

.5 SEISMIC RESPONSE, SA(0.2): 0.12

.6 SEISMIC RESPONSE, SA(0.5): 0.056

.7 SEISMIC RESPONSE, SA(1.0): 0.023

.8 SEISMIC RESPONSE, SA(2.0): 0.006

.9 SEISMIC RESPONSE, PGA: 0.059

.10 ONE DAY RAIN (1/50): 65 MM

.11 IMPORTANCE CATEGORY: POST-DISASTER

.12 WIND EXPOSURE TYPE: OPEN TERRAIN

.13 INTERNAL PRESSURE CATEGORY: 3

.14 FOUNDATION SITE CLASS: E

.4 STRUCTURAL FRAMES AND SYSTEMS

.1 THE DESIGN OF THE MAIN STRUCTURAL ELEMENTS SHALL BE IN ACCORDANCE WITH THE RELEVANT STANDARDS. WHERE SUITABLE STANDARDS OR CRITERIA DO NOT EXIST, THE SUPPLIER SHALL PROPOSE DETAILED CRITERIA FOR THE DESIGN OF THE STRUCTURAL ELEMENTS, AND PROVIDE FULL DETAILS WITH HIS TENDER.

.2 LATERAL RESTRAINT TO THE STRUCTURAL MEMBERS MUST BE PROVIDED BY BRACING INDEPENDENT OF THE TENSIONED FABRIC.

.3 STRUCTURAL FRAMES SHALL BE SUFFICIENTLY STIFF AND WELL BRACED TO ENSURE THAT THEIR DEFLECTION DOES NOT RESULT IN EXCESSIVE STRESS CONCENTRATIONS IN THE MEMBRANE PANELS.

.4 FRAME SPLICES AND CONNECTIONS SHALL BE DESIGNED AND DETAILED TO PREVENT ANY SHARP EDGES, CORNERS OR PROTRUSIONS FROM BEARING ONTO THE MEMBRANE MATERIAL, AND TO AVOID LOCAL MEMBRANE STRESS CONCENTRATIONS.

.5 MEMBRANE PANELS

.1 ALL MEMBRANE PANELS SHOULD BE TENSIONED AND SHAPED IN SUCH A WAY AS TO ENSURE STABILITY UNDER WIND LOADING AND TO AVOID FLAPPING OR CHAFFING. WHERE MEMBRANE MATERIALS ARE EXPECTED TO CREEP AND STRETCH OVER TIME, RETENSIONING OF THE MEMBRANE PANELS SHALL BE POSSIBLE.

.2 ALL MEMBRANE PANELS SHALL ALSO BE TENSIONED AND ORIENTATED TO SHED WATER AND TO AVOID PONDING OCCURRING DURING AND AFTER RAINFALL.

.3 THE TENSILE AND TEARING STRENGTHS OF THE MEMBRANE MATERIAL SHALL BE DETERMINED FROM SUITABLE TESTS CARRIED OUT IN ACCORDANCE WITH THE RELEVANT NBC OR EQUIVALENT INTERNATIONAL STANDARDS. TESTS SHALL PREFERABLY BE PERFORMED ON SAMPLES OF THE MEMBRANE MATERIAL IN A CONDITION REPRESENTATIVE OF THE END OF ITS DESIGN LIFE AS WELL AS ON NEW MATERIAL.

.4 THE MEMBRANE JOINTS WHETHER FACTORY OR SITE MADE SHALL HAVE A TENSILE STRENGTH OF A LEAST 90% OF THE UNJOINTED MATERIAL THROUGHOUT THE LIFE OF THE FRAMED-FABRIC STRUCTURE.

.6 MEMBRANE ATTACHMENT SYSTEM

.1 THE ATTACHMENT SYSTEM SHALL BE DETAILED TO PREVENT MEMBRANE DAMAGE OCCURRING. MEMBRANE ATTACHMENT AND TENSIONING DEVICES SHALL BE DESIGNED TO EVENLY DISTRIBUTE THE TENSIONING FORCE INTO THE MEMBRANE MATERIAL.

.2 PUNCHED BOLT HOLES IN STEEL OR ALUMINIUM COMPONENTS SHALL BE GROUND SMOOTH WHERE THEY ATTACH TO OR COME INTO CONTACT WITH THE MEMBRANE.

.3 STEEL OR ALUMINIUM SECTIONS SHALL BE PROPERLY ALIGNED WITHOUT ANY STEPS OR SHARP PROTRUDING EDGES.

.4 HOLES IN MEMBRANES, FOR EXAMPLE TO PERMIT BOLTS TO PASS THROUGH, SHALL BE PUNCHED WITH AN APPROPRIATE CIRCULAR PUNCH, TO ENSURE A SMOOTH CIRCULAR PROFILE AVOIDING SCORES, SHARP CORNERS OR OVERCUTS.

.5 WHERE THE MEMBRANE IS DIRECTLY TENSIONED BY ROPE OR CABLE, CORROSION PROOF EYELETS SHALL BE USED TO REINFORCE THE HOLES.

.6 ALL ATTACHMENT COMPONENTS SHALL BE SUFFICIENTLY STIFF TO ENSURE THAT THEIR DEFLECTION DOES NOT RESULT IN UNEVEN STRESS DISTRIBUTION IN THE MEMBRANE MATERIAL.

.7 THE MEMBRANE ATTACHMENT SYSTEM SHALL BE PROPERLY DESIGNED AND DETAILED IN ACCORDANCE WITH CURRENT GOOD PRACTICE AND THE RELEVANT ?? STANDARDS OR CODES. THE LOADS ON THEM SHALL BE DERIVED FROM THE MAXIMUM FORCES ON THE MEMBRANE, AND THE DETAILS SHOULD PERMIT THE FORCES TO PASS ALONG SMOOTH LOAD PATHS, TAKING CARE TO AVOID STRESS CONCENTRATIONS AND ECCENTRICITIES WHICH COULD CAUSE DISTRESS IN ANY COMPONENTS OF THE STRUCTURE.

.8 THE DESIGN STRENGTHS OF PROPRIETARY MEMBRANE ATTACHMENT SYSTEMS SHALL BE PROVEN BY TESTS DEMONSTRATING THEIR ADEQUACY, AND COPIES OF THE RELEVANT TEST CERTIFICATES SHALL BE MADE AVAILABLE BY THE FRAMED-FABRIC STRUCTURE SUPPLIER UPON REQUEST.

.7 DOORS AND EMERGENCY EXITS

.1 ALL DOORS SHALL BE FITTED WITH CLEAR VIEWING PANELS TO PERMIT SAFE ENTRY AND EXIT AND CODE COMPLIANT EXIT SIGNAGE AT EACH LOCATION.

3.2 DESIGN SUBMISSIONS

.1 GENERAL ARRANGEMENT PLANS AND ELEVATIONS SHOWING THE LOCATION, ORIENTATION AND OVERALL DIMENSIONS OF THE FRAMED-FABRIC STRUCTURE, AND THE MAN AND O/H DOORS.

.2 GENERAL LAYOUT OF FRAMES, BRACING AND ALL OTHER ELEMENTS OF THE STRUCTURAL SYSTEM INCLUDING FOUNDATIONS AND OUTLINE DETAILS OF THE MEMBRANE ATTACHMENT SYSTEM.

.3 OUTLINE DETAILS OF THE TYPES AND GRADES OF MEMBRANE FABRIC, FRAME MATERIAL AND OTHER STRUCTURAL ELEMENTS TO BE USED.

.4 OUTLINE DETAILS OF ALL OTHER ITEMS TO BE PROVIDED UNDER THE CONTRACT

.5 FULL STRUCTURAL CALCULATIONS DEMONSTRATING THE COMPLIANCE OF THE DESIGN WITH RELEVANT CODES AND STANDARDS.

.6 FULL STRUCTURAL DESIGN DRAWINGS AND SPECIFICATIONS

.7 MEMBRANE PROPERTIES: THE FRAMED-FABRIC STRUCTURE SUPPLIER SHALL PROVIDE EVIDENCE INCLUDING TEST RESULTS TO SUPPORT THE PARTICULAR VALUE OF THE MEMBRANE STRENGTH AND STRENGTH REDUCTION FACTORS (FOR AGING AND FOR FACTORY/SITEJOINTS) ADOPTED IN HIS CALCULATIONS.

.8 SECTION SIZES, MATERIAL PROPERTIES AND FULL DETAILS OF ALL COMPONENTS USED IN THE MEMBRANE ATTACHMENT SYSTEM, INCLUDING DETAILS OF THE TYPES AND SIZES OF ALL FIXINGS USED TO ANCHOR THE MEMBRANE TO THE GROUND AND ANY SUPPORTING STRUCTURES.

.9 FULL DETAILS OF THE DOORS AND ALL ANCILLARY ITEMS.

.10 IF REQUESTED, THE SUPPLIER SHALL SUPPLY FULL SUPPORTING DATA AND INFORMATION, INCLUDING TEST RESULTS, TO ACCOMPANY THE ABOVE SUBMISSIONS.

.11 TFS SUPPLIERS TO PROVIDE LETTERS OF REFERENCE FROM PREVIOUS SIMILAR PROJECTS.

3.3 MAINTENANCE MANUAL

.1 PROVIDE A COMPREHENSIVE MAINTENANCE MANUAL TAILORED TO THE SITE. THIS SHALL DESCRIBE ALL ASPECTS OF THE BUILDING, RELATING TO THE INSPECTION AND MAINTENANCE REGIME REQUIRED FOR ITS SECURE AND SAFE OPERATION. THE FOLLOWING ITEMS SHALL BE INCLUDED, BUT NOT LIMITED TO:

.1 THE MEMBRANE FABRIC ITSELF, DETAILING REPAIR METHODS AND PROCEDURES, CLEANING TECHNIQUES, AND HIGHLIGHTING AREAS WHICH MAY REQUIRE PARTICULAR CARE AND ATTENTION.

.2 FRAME MAINTENANCE REQUIREMENTS.

.3 BRACING CABLES AND ATTACHMENTS.

.4 MEMBRANE ATTACHMENT SYSTEM.

.5 ALL DOORS AND OTHER ELEMENTS.

.6 INSTRUCTIONS FOR OPENING PANELS OR SECTIONS.

.7 AN INSPECTION LOG BOOK TO RECORD THE DAILY, WEEKLY, MONTHLY AND ANNUAL INSPECTIONS.

3.4 NOTICES

.1 A NOTICE SHALL BE FIXED ON THE OUTSIDE OF THE FRAMED-FABRIC STRUCTURE ADJACENT TO THE MAIN ENTRANCE GIVING DETAILS OF THE SUPPLIER'S NAME, ADDRESS AND CONTACT TELEPHONE NUMBER.

.2 A NOTICE SHALL BE FIXED ON THE INSIDE OF THE FRAMED-FABRIC STRUCTURE ADJACENT TO THE MAIN ENTRANCE GIVING EVACUATION INSTRUCTIONS FOR OCCUPANTS TO FOLLOW IN THE EVENT OF AN EMERGENCY.

.3 EMERGENCY DOORS SHALL BE CLEARLY SIGNED. THE SIGNAGE SHALL DISCOURAGE NON-EMERGENCY USE.

3.5 SITE SUPERVISION

.1 THE FRAMED-FABRIC STRUCTURE SUPPLIER SHALL USE A SUITABLY QUALIFIED AND EXPERIENCED PERSON OR PERSONS TO SUPERVISE THE ERECTION OF THE FRAMED-FABRIC STRUCTURE. THE SUPERVISION IS TO INCLUDE THE WORKS OF ADJUSTMENT AND COMMISSIONING.

3.6 CERTIFICATION

.1 AT THE COMPLETION OF FORMWORK AND SHORING, THE CONTRACTOR'S PROFESSIONAL ENGINEER SHALL CERTIFY ALL FORMWORK COMPONENTS FABRICATED AND ERECTED BY THE CONTRACTOR IS IN ACCORDANCE WITH HIS DESIGN DRAWINGS.

.2 CERTIFY THAT ALL FORMWORK, SHORING AND COMPONENTS ARE CAPABLE OF SUPPORTING ALL THE CONSTRUCTION LOADS AND FORCES REQUIRED TO COMPLETE THE CAST-IN-PLACE CONCRETE WORK.

4.0 ADDITIONAL REQUIREMENTS:

.1 TENSIONED FABRIC STUCTURE (TFS) MANUFACTURER SUPPLIED ITEMS

.1 ALL COMPONENTS OF TFS INCLUDING INSULATED DOORS AS DETAILED.

.2 FOREMAN TO ATTEND ON SITE FOR DURATION OF TFS ERECTION (EXCEPT AS NOTED).

.3 TO ARRANGE FOR LOCAL ACCOMODATION. BUDGET COSTS TO BE IDENTIFIED AND ACTUAL COSTS FOR ACCOMODATION AND MEALS TO BE INVOICED TO CLIENT ON A TIMES MATERIAL BASIS.

.2 OWNER SUPPLIED ITEMS

.1 LOCAL LABOR AND LIFTING AND MATERIAL TRANSPORT, EQUIPMENT FOR PRE-ENGINEERED STRUCTURE TRANSFER FROM AIRPORT AND STRUCTURE ERECTION.

.2 BALLAST BOXES WHERE REQUIRED.

.3 BALLAST MATERIAL WHERE REQUIRED.

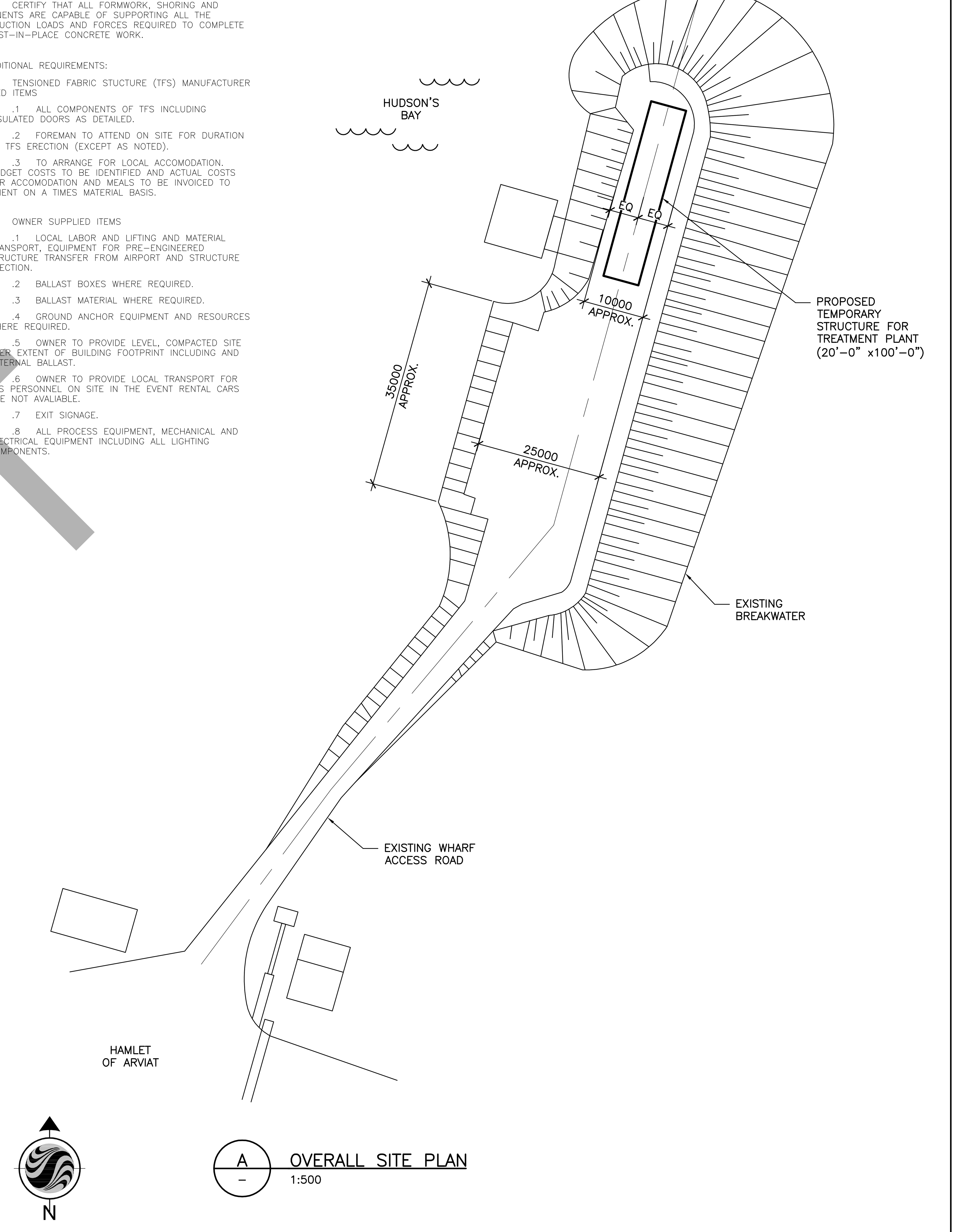
.4 GROUND ANCHOR EQUIPMENT AND RESOURCES WHERE REQUIRED.

.5 OWNER TO PROVIDE LEVEL, COMPACTED SITE OVER EXTENT OF BUILDING FOOTPRINT INCLUDING AND EXTERNAL BALLAST.

.6 OWNER TO PROVIDE LOCAL TRANSPORT FOR TFS PERSONNEL ON SITE IN THE EVENT RENTAL CARS ARE NOT AVALIABLE.

.7 EXIT SIGNAGE.

.8 ALL PROCESS EQUIPMENT, MECHANICAL AND ELECTRICAL EQUIPMENT INCLUDING ALL LIGHTING COMPONENTS.



A OVERALL SITE PLAN
– 1:500

Revision	By	Appd.	YY.MM.DD
ISSUED FOR QUOTATION	KN	DMCC	11.04.08
Issued	By	Appd.	YY.MM.DD

Consultants

Permit-Seal

PRELIMINARY
NOT TO BE USED FOR CONSTRUCTION

ISSUED FOR QUOTATION
APRIL 8, 2011

Stantec
10160 – 112 Street
Edmonton AB Canada
T5K 2L6
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Fax. 780.917.8588
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Client/Project
GOVERNMENT OF NUNAVUT
COMMUNITY & GOVERNMENT SERVICES

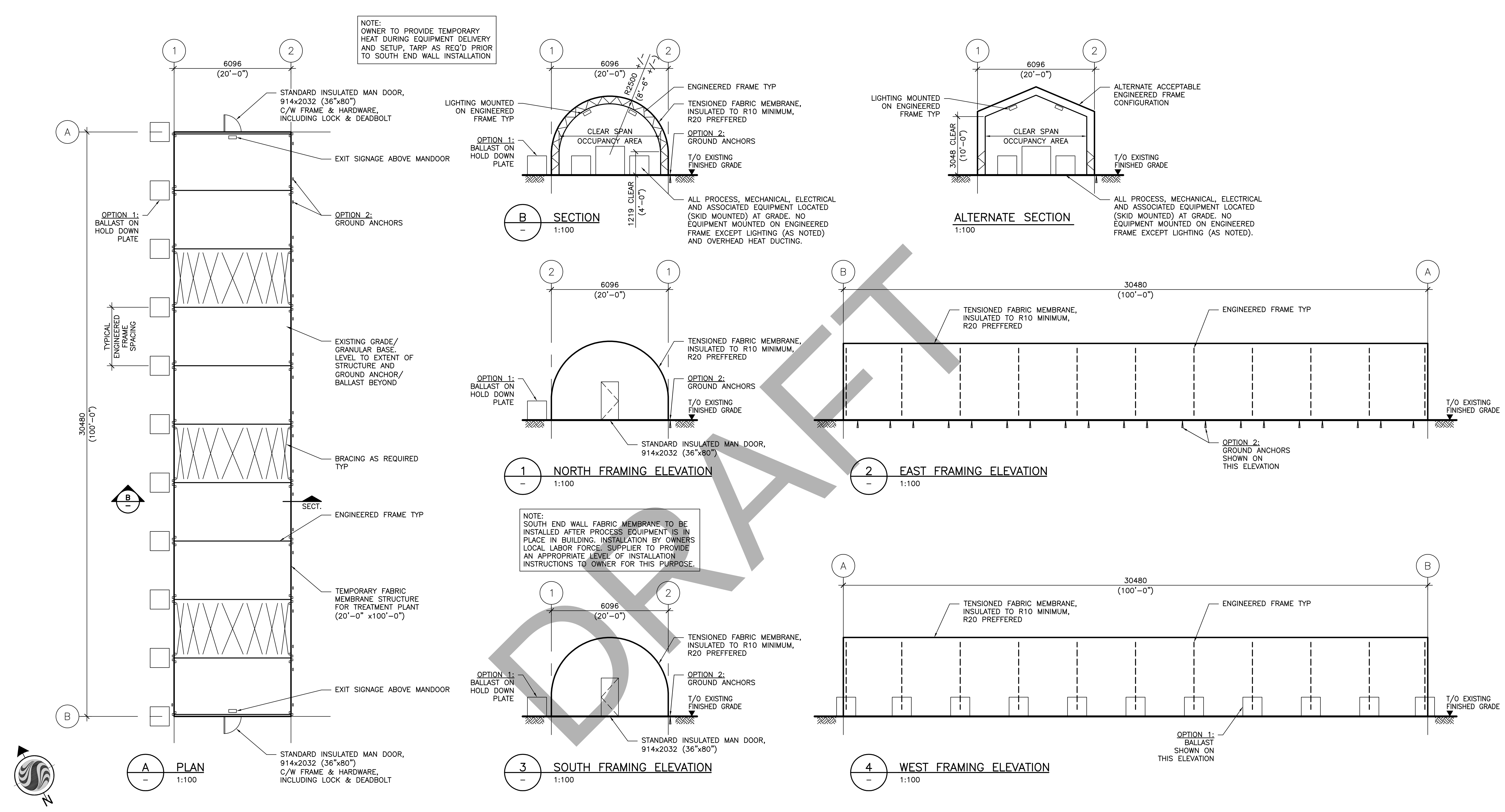
EMERGENCY WATER SUPPLY
& TREATMENT SYSTEM

Arviat, Nunavut

Title
PREFABRICATED
TEMPORARY STRUCTURE
SCHEMATIC LAYOUT

Project No.	Scale	
149239001		
Drawing No.	Sheet	Issue / Revision
S001	1 of 2	0

ORIGINAL SHEET – ISO A1



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Title
PREFABRICATED
TEMPORARY STRUCTURE
SCHEMATIC LAYOUT

Project No. 149239001
Scale

Drawing No. S002
Sheet 2 of 2
Issue / Revision 0

ORIGINAL SHEET – ISO A1

ATTACHMENT B

NEED FOR UPGRADES OF WHARF/BREAKWATER

ARVIAT (601)

DESCRIPTION OF CURRENT FACILITIES FOR LOCAL VESSELS AND FLOAT EQUIPPED AIRCRAFT

- Rock armoured steel / timber wharf with an added timber face. 4.5m x 25m plus hammerhead. 15m free docking length on both sides. Construction completed by DOT in 1989. An extra timber crib was added by the community in 1990. Total cost to GNWT to date: $175,000.
- Extensive beach front for landing local vessels.
- Annual O&M requirements are estimated at $10,000.

DESCRIPTION OF CURRENT FACILITIES FOR MARINE RESUPPLY

- Beach pushout for landing dry cargo East of community wharf
- POL manifold next to Community Wharf.
- Annual O&M requirements are estimated at $5,000-$10,000 (DPW&S).

INSPECTIONS AND COMMUNITY PERSPECTIVES

- 1996: Responsibility for the maintenance of resupply facilities have been transferred to DoT from DPW&S.
- March 7, 1995: Transportation staff met with community representatives. After reviewing the DoT's conceptual designs for the harbour development the hamlet council proposed the following: remove the hammerhead protection, construct a 60 m extension to existing wharf, remove existing timber crib and dredge area adjacent to it, upgrading & 5 m extension to the existing steel and timber dock structure, and construction of a similar structure parallel to it. The Department will respond by preparing a new conceptual design to reflect these requests.
- November 16,1993 : Arviat SAO Bob Lawson wrote to John Todd, Minister Transportation, stating that *"...we are aware that plans are being developed to enhance the existing community wharf probably during 1994-95. Unfortunately, the concept plan which we expected to receive after the short visit earlier this summer with officials from Yellowknife has yet to materialize. While it is understood that the view of the value of the community's participation is limited, some local involvement would serve to sense to engender an element of ownership and ultimately community pride."*
- The Department responded : "...to properly respond to this need, the Department requires the community's input. Local perspectives and suggestions are key to ensuring that the wharf facility meets the needs of local boaters...Department staff inspected Arviat's wharf in July 1993. As a result, we are in the process of preparing a conceptual improvement plan for the Arviat wharf. We will forward the conceptual plan to the Arviat Hamlet Council early in the new year. Once council has had an opportunity to adequately review the proposal, and to develop comments and suggestions, my staff will travel to Arviat to discuss the appropriate course of action. Subject to all parties agreeing on the type of improvement required, I will do my best to see that remedial work on the wharf is Initiated as soon as funds can be identified."
- Transportation staff had initially met with SAO Bob Lawson on August 3, 1993.

ASSESSMENT OF NEED

- The existing local facility is in poor condition and requires an upgrade or replacement.
- The wharf provides moorage for 1 Peterhead only; a larger structure that could accommodate 2 of these vessels would be more suitable to the community.

The following table identifies potential marine facility needs in Arviat:

Arviat	REQUIREMENT	EST COST	PRIORITY
local	construct partial breakwater	$ 150,000	Short
	floating wharf construction/O&M	$ 90,000	Short
	wharf/breakwater repairs	$ 300,000	Short
	Projected annual O&M years 4 to 7	$ 10,000	
resupply	expand marshalling area	$ 100,000	Medium
	relocate sealift facility (phase 1)	$ 225,000	Short
	relocate sealift facility (phase 2)	$ 350,000	Medium
	Rebuild pushout, grade/gravel landing and marshalling area	$ 10,000	Annual O&M

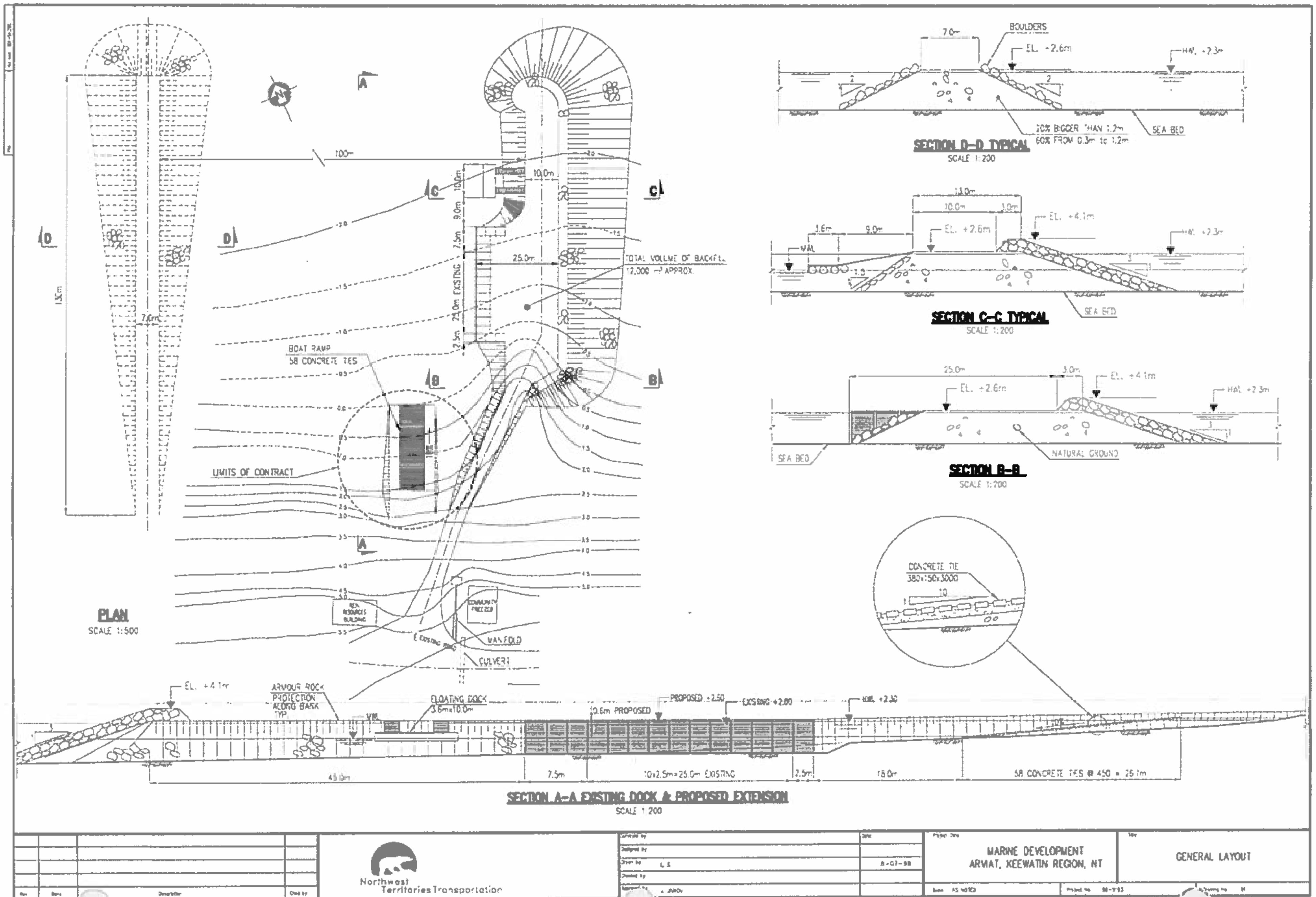
CURRENT PLANS / COMMITMENTS

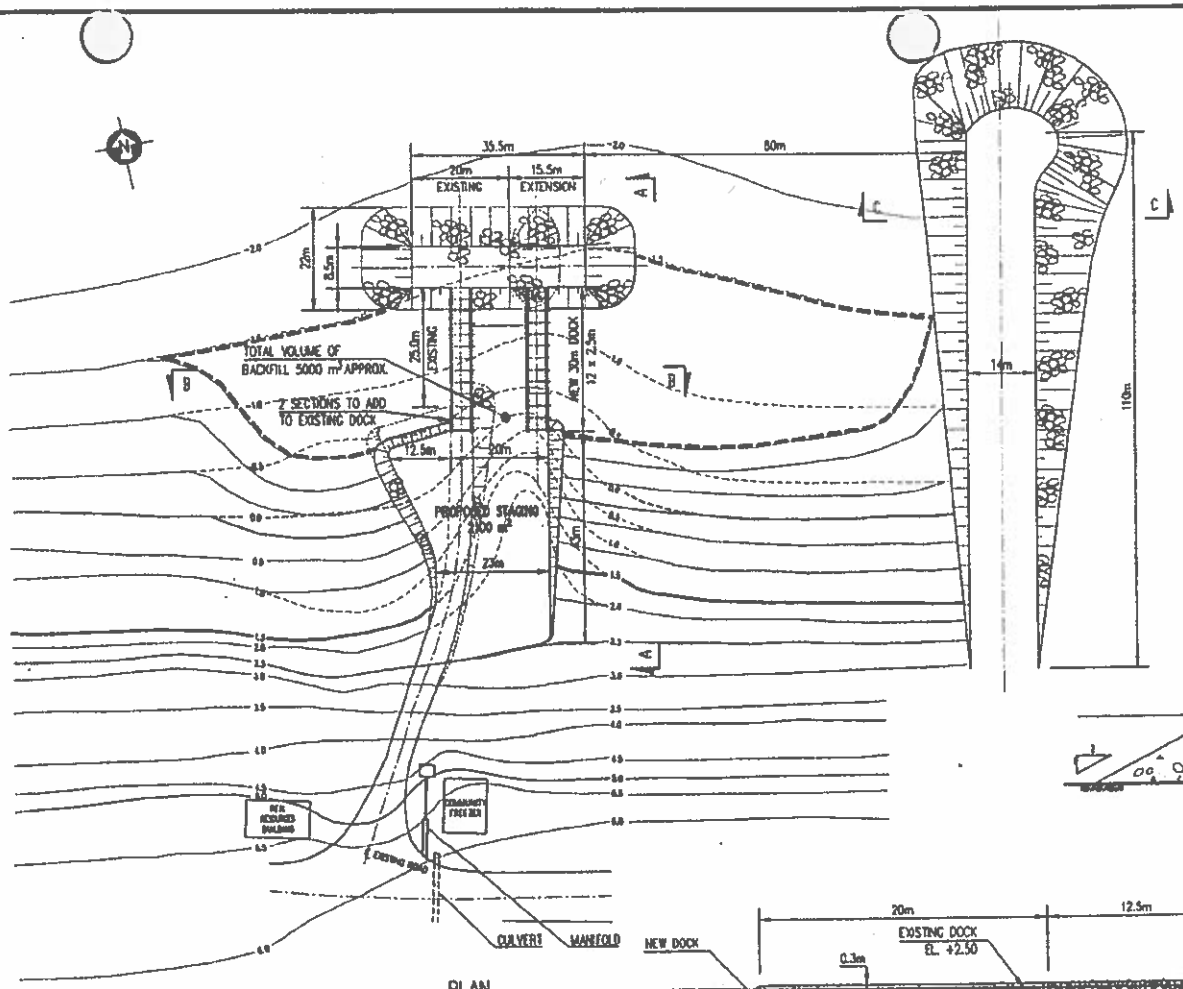
- Wharf enhancement (advanced from 97/98), approval pending.
- 1996/97 CCG Minor Works Program, Vote 4/5. $5,000 has been committed for the maintenance of the sealift landing.
- O&M Community Wharves seasonal repairs, $10,000.
- Marine pre-engineering to complete feasibility studies and conceptual designs - $5,000. Presentation to Community proposed for October, 1995.
- Arviat has been identified as a priority under the present five year capital plan.
- Engineering division is presently working on a proposal to be presented to the community for approval.

INFORMATION NEEDS

- Consultations with the Hamlet are required to reach a consensus on facility development.
- The volume of local vessel activity should be monitored to determine the size and layout of the proposed facility.
- Consultation with DPW&S for take over of future sealift O&M activities in 1995/96.

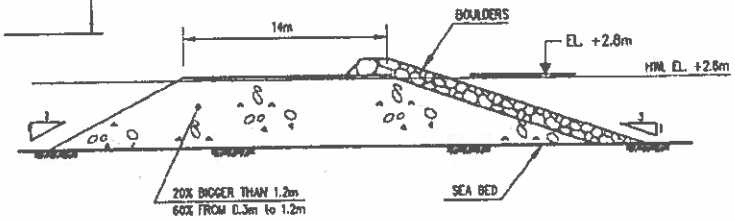
N
20 0 20 40 60
-5.0
-2.5
-5.0
-2.5
-5.0
-7.5
EL -1.5
EL -2.3
EL -1.3


PLAN
SCALE 1:500
100m
7.0m
BOAT RAMP
58 CONCRETE TIES
LIMITS OF CONTRACT
TOTAL VOLUME OF BACKFILL
12,000 m³ APPROX.
10.0m
25.0m
12.5m 25.0m EXISTING 7.5m 9.0m 10.0m
MANIFOLD
CULVERT
SECTION D-D TYPICAL
SCALE 1:200
BOULDERS
EL. +2.6m
HWL +2.3m
20% BIGGER THAN 1.2m
60% FROM 0.3m to 1.2m
SEA BED
SECTION C-C TYPICAL
SCALE 1:200
13.0m
10.0m
3.0m
3.6m
9.0m
EL. +2.6m
EL. +4.1m
HWL +2.3m
SECTION B-B
SCALE 1:200
25.0m
EL. +2.6m
EL. +4.1m
HWL +2.3m
NATURAL GROUND
CONCRETE TIE
380x150x3000
EL. +4.1m
ARMOUR ROCK
PROTECTION
ALONG BANK
TYP.
FLOATING DOCK
3.6m x 10.0m
0.6m PROPOSED
PROPOSED +2.50
EXISTING +2.00
HWL +2.30
45.0m
7.5m
10x2.5m=25.0m EXISTING
2.5m
18.0m
58 CONCRETE TIES @ 450 = 26.1m
SECTION A-A EXISTING DOCK & PROPOSED EXTENSION
SCALE 1:200
Northwest Territories Transportation
MARINE DEVELOPMENT
ARVIAT, KEEWATIN REGION, NT
GENERAL LAYOUT



PLAN

SCALE 1:750



SECTION C-C TYPICAL

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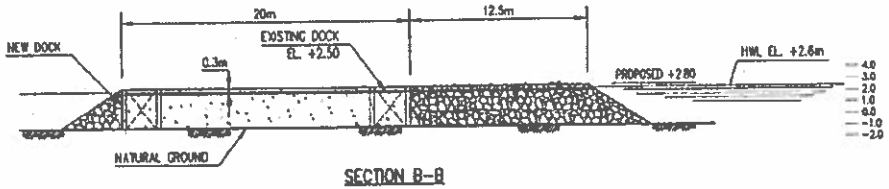
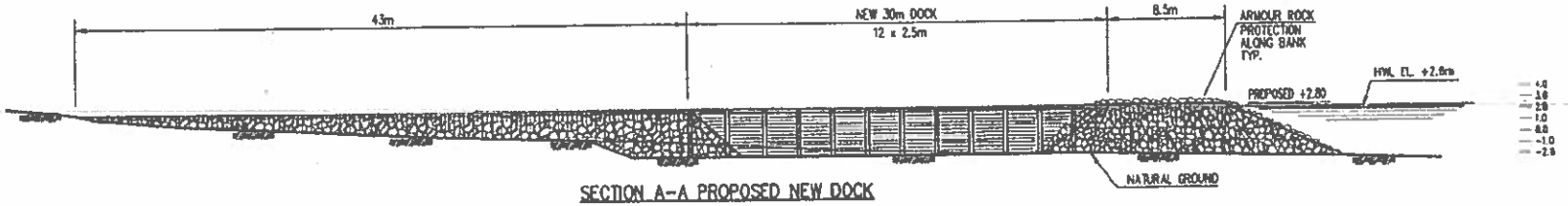


SECTION B-B

1:250



SECTION A-A PROPOSED NEW DOCK

SCALE 1:250

Rev.	Date	Description	Chkd by

Northwest Territories Transportation

Designed by:	
Drawn by: J. JIVKOV	Date:
Checked by: B. LACASSE	7-07-94
Approved by: J. JIVKOV	

Title:

ARVIAT COMMUNITY DOCK
PROPOSED EXTENSION TO THE EXISTING DOCK

Scale: AS NOTED | Project No. | Drawing No. 01

ATTACHMENT C

DIURNAL TIDE TABLE FOR ARVIAT

January-janvier

Day	Time	Metres	jour	heure	mètres
1	0317	3.2	**16**	0239	3.0
	0917	1.0		0841	1.3
SA	1532	3.3	SU	1454	3.1
SA	2153	0.7	DI	2118	1.0
2	0422	3.3	**17**	0344	3.1
	1021	1.0		0946	1.2
SU	1634	3.3	MO	1555	3.2
DI	2251	0.6	LU	2217	0.8
3	0519	3.4	**18**	0443	3.3
	1118	0.9		1044	1.0
MO	1730	3.4	TU	1652	3.3
LU	2343	0.5	MA	2311	0.6
4	0609	3.5	**19**	0535	3.4
	1207	0.8		1136	0.8
TU	1821	3.5	WE	1745	3.5
MA			ME	2359	0.4
5	0029	0.5	**20**	0624	3.6
	0654	3.6		1223	0.6
WE	1252	0.7	TH	1835	3.7
ME	1906	3.5	JE		
6	0112	0.5	**21**	0046	0.3
	0735	3.7		0709	3.8
TH	1332	0.7	FR	1308	0.5
JE	1946	3.6	VE	1923	3.8
7	0151	0.5	**22**	0130	0.2
	0813	3.7		0754	3.9
FR	1410	0.7	SA	1353	0.4
VE	2024	3.6	SA	2010	3.8
8	0228	0.5	**23**	0214	0.2
	0849	3.7		0838	3.9
SA	1446	0.7	SU	1437	0.3
SA	2100	3.6	DI	2056	3.8
9	0303	0.6	**24**	0259	0.2
	0924	3.6		0922	3.9
SU	1522	0.8	MO	1523	0.4
DI	2135	3.5	LU	2143	3.8
10	0337	0.8	**25**	0345	0.4
	0958	3.5		1008	3.8
MO	1558	1.0	TU	1612	0.5
LU	2211	3.4	MA	2233	3.6
11	0411	1.0	**26**	0434	0.5
	1033	3.4		1057	3.7
TU	1636	1.1	WE	1705	0.6
MA	2250	3.2	ME	2328	3.4
12	0449	1.1	**27**	0528	0.8
	1112	3.3		1150	3.5
WE	1719	1.2	TH	1805	0.8
ME	2335	3.1	JE		
13	0533	1.3	**28**	0031	3.3
	1157	3.2		0631	1.0
TH	1809	1.3	FR	1251	3.3
JE			VE	1912	0.9
14	0028	3.0	**29**	0143	3.1
	0628	1.4		0744	1.2
FR	1250	3.1	SA	1401	3.2
VE	1908	1.3	SA	2027	0.9
15	0131	2.9	**30**	0259	3.1
	0732	1.4		0901	1.2
SA	1351	3.0	SU	1517	3.1
SA	2013	1.2	DI	2139	0.9
			31	0410	3.2
				1012	1.1
			MO	1627	3.2
			LU	2242	0.8

February-février

Day	Time	Metres	jour	heure	mètres
1	0509	3.3	**16**	0416	3.2
	1109	1.0		1019	1.0
TU	1725	3.3	WE	1631	3.3
MA	2334	0.7	ME	2248	0.6
2	0557	3.4	**17**	0512	3.4
	1156	0.8		1115	0.7
WE	1811	3.4	TH	1728	3.5
ME			JE	2340	0.4
3	0018	0.6	**18**	0602	3.6
	0638	3.6		1204	0.5
TH	1236	0.7	FR	1819	3.7
JE	1851	3.6	VE		
4	0056	0.5	**19**	0027	0.2
	0714	3.6		0648	3.8
FR	1313	0.7	SA	1250	0.3
VE	1927	3.6	SA	1907	3.9
5	0130	0.5	**20**	0112	0.1
	0748	3.7		0732	4.0
SA	1346	0.6	SU	1334	0.2
SA	1959	3.6	DI	1952	4.0
6	0202	0.5	**21**	0155	0.1
	0819	3.7		0815	4.0
SU	1418	0.7	MO	1417	0.1
DI	2031	3.6	LU	2037	4.0
7	0232	0.6	**22**	0237	0.1
	0849	3.7		0858	4.0
MO	1449	0.8	TU	1501	0.2
LU	2102	3.5	MA	2122	3.9
8	0302	0.8	**23**	0321	0.3
	0920	3.6		0941	3.9
TU	1521	0.9	WE	1547	0.3
MA	2135	3.4	ME	2210	3.7
9	0333	0.9	**24**	0408	0.5
	0952	3.5		1028	3.7
WE	1556	1.0	TH	1638	0.5
ME	2212	3.3	JE	2303	3.5
10	0409	1.1	**25**	0501	0.8
	1029	3.3		1120	3.5
TH	1635	1.1	FR	1735	0.8
JE	2254	3.2	VE		
11	0451	1.2	**26**	0006	3.3
	1112	3.2		0605	1.1
FR	1723	1.2	SA	1224	3.2
VE	2346	3.0	SA	1846	1.0
12	0544	1.3	**27**	0121	3.1
	1205	3.1		0725	1.3
SA	1821	1.2	SU	1343	3.0
SA			DI	2008	1.1
13	0050	2.9	**28**	0242	3.1
	0649	1.4		0849	1.3
SU	1309	3.0	MO	1507	3.0
DI	1930	1.2	LU	2126	1.0
14	0201	3.0			
	0802	1.4			
MO	1418	3.0			
LU	2042	1.0			
15	0312	3.1			
	0915	1.2			
TU	1527	3.1			
MA	2149	0.8			

March-mars

Day	Time	Metres	jour	heure	mètres
1	0353	3.2	**16**	0243	3.1
	0959	1.2		0848	1.2
TU	1617	3.2	WE	1504	3.1
MA	2228	0.9	ME	2123	0.9
2	0450	3.3	**17**	0349	3.2
	1053	1.0		0955	0.9
WE	1710	3.3	TH	1611	3.3
ME	2317	0.8	JE	2225	0.6
3	0535	3.4	**18**	0447	3.5
	1137	0.8		1053	0.7
TH	1752	3.5	FR	1709	3.5
JE	2357	0.6	VE	2318	0.4
4	0613	3.5	**19**	0537	3.7
	1214	0.7		1143	0.4
FR	1828	3.5	SA	1800	3.7
VE			SA		
5	0032	0.6	**20**	0006	0.2
	0647	3.6		0624	3.9
SA	1248	0.6	SU	1228	0.2
SA	1901	3.6	DI	1847	3.9
6	0103	0.6	**21**	0050	0.1
	0717	3.7		0707	4.0
SU	1318	0.6	MO	1312	0.0
DI	1932	3.6	LU	1931	4.0
7	0132	0.6	**22**	0132	0.1
	0746	3.7		0749	4.1
MO	1348	0.6	TU	1355	0.0
LU	2002	3.6	MA	2015	4.0
8	0201	0.7	**23**	0214	0.2
	0815	3.6		0831	4.0
TU	1418	0.7	WE	1438	0.1
MA	2033	3.5	ME	2101	3.9
9	0231	0.8	**24**	0258	0.4
	0845	3.6		0915	3.9
WE	1449	0.8	TH	1523	0.3
ME	2106	3.5	JE	2148	3.7
10	0303	0.9	**25**	0345	0.6
	0918	3.5		1002	3.7
TH	1523	0.8	FR	1613	0.5
JE	2143	3.4	VE	2242	3.5
11	0339	1.0	**26**	0439	0.9
	0955	3.4		1056	3.4
FR	1602	0.9	SA	1710	0.8
VE	2225	3.2	SA	2344	3.3
12	0421	1.1	**27**	0545	1.2
	1038	3.2		1203	3.2
SA	1649	1.0	SU	1822	1.0
SA	2316	3.1	DI		
13	0512	1.3	**28**	0058	3.1
	1131	3.1		0705	1.3
SU	1746	1.1	MO	1325	3.0
DI			LU	1946	1.1
14	0018	3.0	**29**	0216	3.1
	0616	1.3		0827	1.3
MO	1236	3.0	TU	1446	3.1
LU	1856	1.1	MA	2103	1.1
15	0130	3.0	**30**	0324	3.2
	0732	1.3		0934	1.1
TU	1350	3.0	WE	1551	3.2
MA	2011	1.0	ME	2202	1.0
			31	0419	3.3
				1026	1.0
			TH	1642	3.3
			JE	2249	0.9

TABLE DES MARÉES **2011** **ARVIAT** HNC Z+6

April-avril

Day	Time	Metres	jour	heure	mètres
1	0503	3.4	**16**	0419	3.5
	1109	0.9		1029	0.6
FR	1723	3.4	SA	1648	3.5
VE	2328	0.8	SA	2254	0.5
2	0540	3.5	**17**	0511	3.7
	1146	0.8		1120	0.3
SA	1759	3.4	SU	1739	3.7
SA			DI	2342	0.3
3	0002	0.7	**18**	0557	3.8
	0613	3.5		1206	0.1
SU	1219	0.7	MO	1826	3.8
DI	1832	3.5	LU		
4	0033	0.7	**19**	0027	0.2
	0643	3.6		0641	4.0
MO	1249	0.6	TU	1250	0.0
LU	1903	3.5	MA	1911	3.9
5	0103	0.7	**20**	0110	0.2
	0713	3.6		0725	4.0
TU	1319	0.6	WE	1333	0.0
MA	1935	3.6	ME	1956	3.9
6	0133	0.8	**21**	0154	0.3
	0744	3.6		0808	3.9
WE	1349	0.6	TH	1417	0.1
ME	2008	3.5	JE	2042	3.8
7	0205	0.8	**22**	0239	0.5
	0817	3.5		0854	3.8
TH	1422	0.7	FR	1503	0.3
JE	2043	3.5	VE	2131	3.7
8	0239	0.9	**23**	0328	0.7
	0852	3.5		0943	3.6
FR	1458	0.7	SA	1552	0.6
VE	2121	3.4	SA	2223	3.5
9	0316	1.0	**24**	0421	0.9
	0930	3.4		1038	3.4
SA	1538	0.8	SU	1649	0.8
SA	2204	3.3	DI	2322	3.4
10	0359	1.1	**25**	0524	1.1
	1014	3.3		1142	3.2
SU	1625	0.9	MO	1757	1.0
DI	2255	3.2	LU		
11	0450	1.2	**26**	0028	3.2
	1107	3.1		0636	1.2
MO	1721	1.0	TU	1255	3.1
LU	2355	3.1	MA	1912	1.1
12	0553	1.3	**27**	0137	3.2
	1213	3.0		0750	1.2
TU	1829	1.1	WE	1407	3.1
MA			ME	2023	1.2
13	0104	3.1	**28**	0241	3.2
	0708	1.3		0855	1.2
WE	1328	3.0	TH	1510	3.1
ME	1944	1.0	JE	2121	1.1
14	0216	3.1	**29**	0335	3.2
	0824	1.1		0948	1.1
TH	1443	3.1	FR	1603	3.2
JE	2056	0.9	VE	2209	1.0
15	0321	3.3	**30**	0420	3.3
	0931	0.9		1033	1.0
FR	1550	3.3	SA	1647	3.2
VE	2159	0.7	SA	2251	1.0

May-mai

Day	Time	Metres	jour	heure	mètres
1	0459	3.4	**16**	0443	3.6
	1112	0.9		1057	0.4
SU	1725	3.3	MO	1718	3.6
DI	2327	0.9	LU	2319	0.5
2	0535	3.4	**17**	0532	3.7
	1146	0.8		1145	0.2
MO	1801	3.4	TU	1808	3.7
LU			MA		
3	0001	0.9	**18**	0007	0.5
	0609	3.5		0619	3.8
TU	1219	0.7	WE	1231	0.1
MA	1836	3.5	ME	1855	3.8
4	0035	0.8	**19**	0053	0.5
	0643	3.5		0705	3.8
WE	1252	0.6	TH	1316	0.1
ME	1911	3.5	JE	1942	3.8
5	0109	0.8	**20**	0139	0.5
	0717	3.5		0752	3.8
TH	1325	0.6	FR	1401	0.2
JE	1947	3.6	VE	2028	3.8
6	0143	0.8	**21**	0225	0.6
	0754	3.5		0839	3.7
FR	1401	0.6	SA	1447	0.4
VE	2025	3.5	SA	2115	3.7
7	0220	0.8	**22**	0312	0.7
	0832	3.5		0928	3.6
SA	1439	0.6	SU	1535	0.6
SA	2105	3.5	DI	2204	3.6
8	0259	0.9	**23**	0402	0.9
	0912	3.4		1019	3.4
SU	1521	0.7	MO	1627	0.8
DI	2149	3.4	LU	2255	3.5
9	0344	1.0	**24**	0456	1.0
	0958	3.3		1114	3.3
MO	1608	0.8	TU	1723	1.0
LU	2238	3.3	MA	2349	3.3
10	0435	1.1	**25**	0555	1.2
	1052	3.2		1212	3.2
TU	1702	0.9	WE	1823	1.1
MA	2335	3.2	ME		
11	0536	1.1	**26**	0046	3.2
	1156	3.1		0658	1.2
WE	1807	1.0	TH	1313	3.1
ME			JE	1924	1.2
12	0040	3.2	**27**	0142	3.2
	0646	1.1		0801	1.2
TH	1308	3.1	FR	1414	3.0
JE	1918	1.0	VE	2023	1.3
13	0147	3.2	**28**	0236	3.1
	0758	1.0		0858	1.2
FR	1420	3.2	SA	1511	3.0
VE	2028	0.9	SA	2117	1.3
14	0251	3.3	**29**	0326	3.2
	0904	0.8		0948	1.1
SA	1526	3.3	SU	1602	3.1
SA	2132	0.8	DI	2206	1.2
15	0350	3.5	**30**	0411	3.2
	1004	0.6		1032	1.0
SU	1625	3.4	MO	1647	3.2
DI	2228	0.6	LU	2250	1.1
			31	0454	3.3
				1112	0.8
			TU	1729	3.3
			MA	2330	1.0

June-juin

Day	Time	Metres	jour	heure	mètres
1	0535	3.4	**16**	0605	3.6
	1149	0.7		1218	0.3
WE	1809	3.4	TH	1844	3.6
ME			JE		
2	0008	0.9	**17**	0041	0.6
	0615	3.4		0654	3.6
TH	1227	0.6	FR	1304	0.3
JE	1849	3.5	VE	1930	3.7
3	0046	0.8	**18**	0127	0.6
	0654	3.5		0741	3.7
FR	1305	0.5	SA	1348	0.3
VE	1928	3.6	SA	2014	3.8
4	0124	0.8	**19**	0211	0.6
	0735	3.6		0827	3.7
SA	1343	0.5	SU	1432	0.4
SA	2009	3.6	DI	2057	3.7
5	0204	0.8	**20**	0254	0.7
	0816	3.6		0910	3.6
SU	1424	0.5	MO	1515	0.5
DI	2050	3.6	LU	2139	3.7
6	0245	0.8	**21**	0338	0.8
	0859	3.5		0954	3.5
MO	1506	0.5	TU	1558	0.7
LU	2134	3.6	MA	2222	3.6
7	0330	0.8	**22**	0422	0.9
	0947	3.5		1038	3.4
TU	1553	0.6	WE	1642	0.9
MA	2222	3.5	ME	2305	3.4
8	0421	0.9	**23**	0509	1.1
	1039	3.4		1123	3.2
WE	1645	0.7	TH	1727	1.1
ME	2315	3.4	JE	2349	3.3
9	0518	0.9	**24**	0559	1.2
	1139	3.3		1213	3.1
TH	1745	0.9	FR	1816	1.3
JE			VE		
10	0014	3.3	**25**	0037	3.2
	0622	0.9		0654	1.3
FR	1245	3.2	SA	1309	3.0
VE	1850	0.9	SA	1912	1.4
11	0117	3.3	**26**	0129	3.1
	0730	0.9		0753	1.3
SA	1354	3.2	SU	1409	2.9
SA	1958	0.9	DI	2012	1.4
12	0220	3.3	**27**	0225	3.0
	0837	0.8		0851	1.2
SU	1501	3.2	MO	1509	3.0
DI	2103	0.9	LU	2113	1.4
13	0321	3.4	**28**	0320	3.1
	0939	0.6		0946	1.1
MO	1604	3.3	TU	1605	3.1
LU	2205	0.8	MA	2209	1.2
14	0419	3.4	**29**	0414	3.2
	1037	0.5		1035	0.9
TU	1702	3.4	WE	1656	3.2
MA	2301	0.8	ME	2258	1.1
15	0513	3.5	**30**	0503	3.3
	1129	0.4		1121	0.7
WE	1755	3.5	TH	1743	3.4
ME	2353	0.7	JE	2343	0.9

July-juillet

Day	Time	Metres	jour	heure	mètres
1	0549	3.4	**16**	0032	0.7
	1203	0.6		0647	3.6
FR	1827	3.5	SA	1253	0.4
VE			SA	1916	3.7
2	0025	0.8	**17**	0114	0.6
	0634	3.5		0730	3.7
SA	1245	0.4	SU	1334	0.4
SA	1909	3.6	DI	1956	3.8
3	0106	0.7	**18**	0154	0.6
	0718	3.6		0809	3.7
SU	1326	0.3	MO	1413	0.4
DI	1951	3.7	LU	2034	3.8
4	0148	0.6	**19**	0232	0.6
	0802	3.7		0847	3.7
MO	1408	0.3	TU	1450	0.5
LU	2034	3.8	MA	2110	3.7
5	0231	0.6	**20**	0309	0.7
	0847	3.7		0924	3.6
TU	1451	0.4	WE	1525	0.7
MA	2117	3.7	ME	2145	3.6
6	0316	0.6	**21**	0346	0.8
	0934	3.6		1000	3.5
WE	1537	0.5	TH	1600	0.9
ME	2203	3.7	JE	2220	3.5
7	0404	0.6	**22**	0424	1.0
	1023	3.5		1038	3.3
TH	1626	0.6	FR	1637	1.1
JE	2252	3.6	VE	2258	3.4
8	0457	0.7	**23**	0505	1.1
	1118	3.4		1121	3.1
FR	1720	0.7	SA	1719	1.3
VE	2346	3.5	SA	2340	3.2
9	0556	0.8	**24**	0552	1.2
	1219	3.3		1211	3.0
SA	1821	0.9	SU	1809	1.4
SA			DI		
10	0045	3.4	**25**	0030	3.1
	0701	0.8		0648	1.3
SU	1327	3.2	MO	1311	2.9
DI	1928	1.0	LU	1911	1.5
11	0149	3.3	**26**	0130	3.0
	0810	0.8		0753	1.3
MO	1439	3.1	TU	1418	2.9
LU	2039	1.1	MA	2020	1.4
12	0256	3.2	**27**	0233	3.0
	0919	0.8		0858	1.2
TU	1549	3.2	WE	1523	3.0
MA	2149	1.0	ME	2127	1.3
13	0403	3.3	**28**	0336	3.1
	1023	0.7		0959	1.0
WE	1652	3.3	TH	1623	3.2
ME	2251	0.9	JE	2226	1.1
14	0505	3.3	**29**	0433	3.2
	1119	0.6		1052	0.7
TH	1746	3.4	FR	1715	3.4
JE	2345	0.8	VE	2317	0.9
15	0559	3.4	**30**	0526	3.4
	1209	0.5		1140	0.5
FR	1833	3.6	SA	1803	3.5
VE			SA		
			31	0003	0.7
				0614	3.6
			SU	1225	0.3
			DI	1848	3.7

August-août

Day	Time	Metres	jour	heure	mètres
1	0047	0.5	**16**	0132	0.5
	0701	3.7		0747	3.7
MO	1308	0.2	TU	1349	0.5
LU	1931	3.8	MA	2006	3.8
2	0130	0.4	**17**	0205	0.6
	0746	3.8		0820	3.7
TU	1351	0.2	WE	1420	0.6
MA	2013	3.9	ME	2037	3.7
3	0213	0.3	**18**	0238	0.7
	0831	3.8		0852	3.6
WE	1434	0.2	TH	1451	0.7
ME	2056	3.9	JE	2108	3.7
4	0257	0.3	**19**	0310	0.8
	0917	3.8		0925	3.5
TH	1518	0.3	FR	1523	0.9
JE	2140	3.9	VE	2140	3.5
5	0343	0.4	**20**	0344	0.9
	1004	3.7		1000	3.3
FR	1604	0.5	SA	1557	1.0
VE	2226	3.7	SA	2215	3.4
6	0433	0.5	**21**	0421	1.0
	1056	3.5		1040	3.2
SA	1655	0.7	SU	1636	1.2
SA	2317	3.6	DI	2255	3.2
7	0529	0.7	**22**	0505	1.2
	1155	3.3		1128	3.1
SU	1753	0.9	MO	1724	1.3
DI			LU	2344	3.1
8	0015	3.3	**23**	0559	1.2
	0633	0.8		1226	2.9
MO	1304	3.1	TU	1825	1.4
LU	1904	1.1	MA		
9	0124	3.2	**24**	0045	3.0
	0747	0.9		0704	1.3
TU	1421	3.1	WE	1335	2.9
MA	2023	1.2	ME	1936	1.4
10	0241	3.1	**25**	0153	3.0
	0904	0.9		0815	1.2
WE	1537	3.1	TH	1445	3.0
ME	2140	1.2	JE	2049	1.3
11	0357	3.1	**26**	0302	3.1
	1013	0.8		0923	1.0
TH	1642	3.3	FR	1550	3.2
JE	2243	1.0	VE	2155	1.1
12	0459	3.3	**27**	0406	3.2
	1110	0.7		1023	0.7
FR	1734	3.4	SA	1647	3.4
VE	2335	0.8	SA	2251	0.8
13	0551	3.4	**28**	0503	3.4
	1158	0.6		1116	0.5
SA	1818	3.6	SU	1737	3.6
SA			DI	2340	0.6
14	0018	0.7	**29**	0555	3.6
	0634	3.6		1204	0.3
SU	1238	0.5	MO	1823	3.8
DI	1857	3.7	LU		
15	0056	0.6	**30**	0026	0.4
	0712	3.7		0642	3.8
MO	1315	0.4	TU	1248	0.2
LU	1933	3.7	MA	1907	3.9
			31	0110	0.2
				0728	3.9
			WE	1331	0.1
			ME	1950	4.0

September-septembre

Day	Time	Metres	jour	heure	mètres
1	0153	0.1	**16**	0207	0.6
	0812	4.0		0823	3.6
TH	1413	0.1	FR	1420	0.8
JE	2032	4.0	VE	2034	3.6
2	0236	0.1	**17**	0238	0.7
	0857	3.9		0855	3.5
FR	1456	0.3	SA	1452	0.9
VE	2115	3.9	SA	2106	3.5
3	0321	0.2	**18**	0311	0.8
	0943	3.8		0930	3.4
SA	1541	0.5	SU	1526	1.0
SA	2201	3.8	DI	2141	3.4
4	0409	0.4	**19**	0347	0.9
	1034	3.6		1010	3.3
SU	1632	0.7	MO	1605	1.2
DI	2251	3.5	LU	2221	3.2
5	0504	0.7	**20**	0430	1.1
	1133	3.3		1056	3.1
MO	1731	1.0	TU	1652	1.3
LU	2351	3.3	MA	2309	3.1
6	0609	0.9	**21**	0522	1.1
	1244	3.2		1153	3.0
TU	1846	1.2	WE	1750	1.4
MA			ME		
7	0106	3.1	**22**	0009	3.0
	0729	1.0		0626	1.2
WE	1405	3.1	TH	1259	3.0
ME	2011	1.3	JE	1901	1.4
8	0231	3.0	**23**	0120	3.0
	0851	1.0		0738	1.1
TH	1521	3.1	FR	1411	3.0
JE	2128	1.2	VE	2016	1.3
9	0347	3.1	**24**	0232	3.1
	1000	0.9		0850	1.0
FR	1624	3.3	SA	1517	3.2
VE	2228	1.0	SA	2125	1.0
10	0446	3.3	**25**	0340	3.2
	1054	0.7		0955	0.8
SA	1713	3.4	SU	1617	3.4
SA	2316	0.8	DI	2224	0.8
11	0533	3.5	**26**	0440	3.4
	1138	0.6		1050	0.5
SU	1755	3.6	MO	1709	3.6
DI	2357	0.7	LU	2316	0.5
12	0613	3.6	**27**	0533	3.7
	1216	0.6		1140	0.3
MO	1831	3.6	TU	1757	3.8
LU			MA		
13	0033	0.6	**28**	0003	0.2
	0648	3.6		0621	3.8
TU	1250	0.5	WE	1225	0.2
MA	1904	3.7	ME	1842	3.9
14	0106	0.6	**29**	0048	0.1
	0721	3.6		0707	3.9
WE	1321	0.6	TH	1308	0.1
ME	1934	3.7	JE	1925	4.0
15	0137	0.6	**30**	0131	0.0
	0752	3.6		0752	4.0
TH	1351	0.7	FR	1351	0.2
JE	2004	3.7	VE	2008	4.0

October-octobre

Day	Time	Metres	jour	heure	mètres
1	0215	0.0	**16**	0211	0.7
	0837	3.9		0831	3.5
SA	1435	0.3	SU	1427	0.9
SA	2051	3.9	DI	2038	3.5
2	0259	0.2	**17**	0245	0.7
	0925	3.8		0908	3.4
SU	1521	0.5	MO	1502	1.0
DI	2138	3.7	LU	2115	3.4
3	0348	0.4	**18**	0322	0.8
	1016	3.6		0948	3.4
MO	1613	0.8	TU	1542	1.1
LU	2231	3.5	MA	2156	3.3
4	0442	0.7	**19**	0405	0.9
	1115	3.4		1033	3.3
TU	1715	1.0	WE	1629	1.2
MA	2333	3.3	ME	2244	3.2
5	0549	0.9	**20**	0456	1.0
	1224	3.2		1127	3.2
WE	1829	1.2	TH	1725	1.3
ME			JE	2343	3.1
6	0050	3.1	**21**	0557	1.1
	0709	1.1		1230	3.1
TH	1341	3.2	FR	1833	1.3
JE	1951	1.2	VE		
7	0212	3.1	**22**	0052	3.0
	0829	1.1		0707	1.1
FR	1453	3.2	SA	1339	3.1
VE	2104	1.1	SA	1946	1.2
8	0323	3.2	**23**	0206	3.1
	0935	1.0		0819	1.0
SA	1554	3.3	SU	1445	3.2
SA	2202	1.0	DI	2055	1.0
9	0420	3.3	**24**	0314	3.2
	1027	0.8		0925	0.8
SU	1643	3.4	MO	1545	3.4
DI	2250	0.8	LU	2157	0.7
10	0506	3.4	**25**	0416	3.4
	1110	0.8		1023	0.6
MO	1723	3.5	TU	1640	3.6
LU	2330	0.7	MA	2251	0.4
11	0545	3.5	**26**	0510	3.6
	1148	0.7		1114	0.4
TU	1759	3.6	WE	1729	3.8
MA			ME	2340	0.2
12	0006	0.6	**27**	0600	3.8
	0621	3.5		1202	0.3
WE	1221	0.7	TH	1816	3.9
ME	1832	3.6	JE		
13	0038	0.6	**28**	0026	0.1
	0654	3.5		0648	3.9
TH	1253	0.7	FR	1247	0.3
JE	1902	3.6	VE	1901	3.9
14	0109	0.6	**29**	0111	0.0
	0726	3.5		0734	3.9
FR	1323	0.8	SA	1332	0.3
VE	1933	3.6	SA	1946	3.9
15	0139	0.6	**30**	0155	0.1
	0758	3.5		0821	3.9
SA	1354	0.8	SU	1418	0.4
SA	2005	3.5	DI	2032	3.8
			31	0241	0.2
				0909	3.8
			MO	1506	0.6
			LU	2121	3.7

November-novembre

Day	Time	Metres	jour	heure	mètres
1	0330	0.4	**16**	0303	0.7
	1000	3.7		0930	3.5
TU	1558	0.8	WE	1525	1.0
MA	2215	3.5	ME	2138	3.4
2	0425	0.7	**17**	0346	0.8
	1056	3.5		1015	3.4
WE	1657	1.0	TH	1611	1.0
ME	2316	3.3	JE	2227	3.3
3	0528	0.9	**18**	0435	0.9
	1159	3.3		1106	3.3
TH	1805	1.1	FR	1705	1.1
JE			VE	2323	3.2
4	0025	3.2	**19**	0532	0.9
	0639	1.0		1204	3.2
FR	1307	3.3	SA	1808	1.1
VE	1918	1.2	SA		
5	0138	3.1	**20**	0029	3.1
	0752	1.1		0638	1.0
SA	1413	3.2	SU	1308	3.2
SA	2027	1.1	DI	1917	1.0
6	0245	3.2	**21**	0139	3.1
	0855	1.1		0747	1.0
SU	1511	3.3	MO	1413	3.3
DI	2126	1.0	LU	2026	0.9
7	0342	3.2	**22**	0248	3.2
	0949	1.0		0854	0.9
MO	1602	3.3	TU	1514	3.4
LU	2216	0.9	MA	2129	0.7
8	0431	3.3	**23**	0351	3.3
	1035	1.0		0955	0.7
TU	1645	3.4	WE	1611	3.5
MA	2258	0.8	ME	2227	0.5
9	0514	3.3	**24**	0449	3.5
	1115	0.9		1050	0.6
WE	1723	3.4	TH	1704	3.6
ME	2336	0.8	JE	2319	0.3
10	0552	3.4	**25**	0542	3.6
	1152	0.9		1141	0.5
TH	1758	3.4	FR	1754	3.7
JE			VE		
11	0009	0.7	**26**	0008	0.2
	0627	3.4		0632	3.7
FR	1225	0.9	SA	1230	0.5
VE	1832	3.5	SA	1843	3.8
12	0042	0.7	**27**	0054	0.1
	0701	3.5		0720	3.8
SA	1258	0.9	SU	1317	0.5
SA	1906	3.5	DI	1931	3.8
13	0114	0.6	**28**	0140	0.2
	0736	3.5		0807	3.8
SU	1332	0.9	MO	1404	0.5
DI	1941	3.5	LU	2019	3.7
14	0148	0.6	**29**	0227	0.3
	0812	3.5		0854	3.8
MO	1407	0.9	TU	1452	0.6
LU	2017	3.5	MA	2108	3.7
15	0224	0.6	**30**	0315	0.4
	0850	3.5		0943	3.7
TU	1444	0.9	WE	1541	0.7
MA	2056	3.5	ME	2159	3.6

December-décembre

Day	Time	Metres	jour	heure	mètres
1	0405	0.6	**16**	0329	0.6
	1033	3.6		0957	3.5
TH	1634	0.9	FR	1554	0.8
JE	2252	3.4	VE	2211	3.4
2	0459	0.8	**17**	0416	0.7
	1126	3.5		1044	3.5
FR	1731	1.0	SA	1646	0.9
VE	2349	3.3	SA	2305	3.3
3	0558	1.0	**18**	0510	0.8
	1222	3.3		1138	3.4
SA	1833	1.1	SU	1744	0.9
SA			DI		
4	0051	3.2	**19**	0006	3.2
	0700	1.1		0610	0.9
SU	1320	3.2	MO	1237	3.3
DI	1937	1.2	LU	1849	0.9
5	0153	3.1	**20**	0113	3.2
	0802	1.2		0716	1.0
MO	1416	3.2	TU	1340	3.3
LU	2038	1.1	MA	1957	0.9
6	0254	3.0	**21**	0222	3.2
	0900	1.2		0824	1.0
TU	1510	3.2	WE	1444	3.3
MA	2133	1.1	ME	2103	0.7
7	0349	3.1	**22**	0329	3.2
	0953	1.2		0930	0.9
WE	1559	3.2	TH	1546	3.4
ME	2221	1.0	JE	2206	0.6
8	0438	3.1	**23**	0432	3.3
	1040	1.2		1032	0.8
TH	1644	3.2	FR	1645	3.4
JE	2302	0.9	VE	2302	0.4
9	0520	3.2	**24**	0529	3.5
	1121	1.1		1128	0.7
FR	1725	3.3	SA	1740	3.5
VE	2340	0.8	SA	2354	0.3
10	0559	3.3	**25**	0621	3.6
	1159	1.0		1219	0.6
SA	1804	3.4	SU	1832	3.6
SA			DI		
11	0016	0.7	**26**	0042	0.3
	0637	3.5		0708	3.7
SU	1235	0.9	MO	1306	0.5
DI	1842	3.5	LU	1921	3.7
12	0052	0.6	**27**	0128	0.3
	0715	3.5		0754	3.8
MO	1311	0.8	TU	1352	0.5
LU	1920	3.5	MA	2008	3.7
13	0129	0.5	**28**	0213	0.3
	0753	3.6		0838	3.8
TU	1348	0.8	WE	1436	0.5
MA	1959	3.6	ME	2053	3.7
14	0207	0.5	**29**	0257	0.4
	0832	3.6		0921	3.8
WE	1427	0.8	TH	1520	0.6
ME	2040	3.6	JE	2137	3.7
15	0247	0.5	**30**	0340	0.5
	0913	3.6		1004	3.7
TH	1509	0.8	FR	1604	0.8
JE	2124	3.5	VE	2222	3.5
			31	0425	0.7
				1048	3.6
			SA	1651	0.9
			SA	2308	3.4

ATTACHMENT D

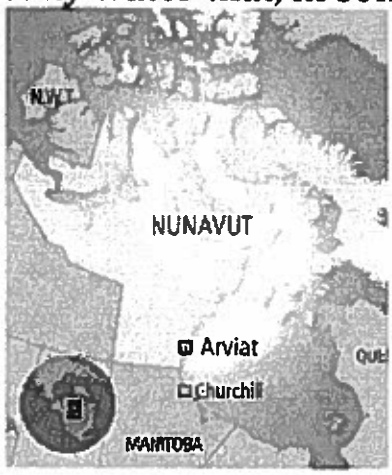
EXAMPLES OF PUBLIC COMMUNICATIONS

Arviat finds solution for its water woes

CBC News

Posted: Mar 11, 2011 1:53 PM CST

Residents in Arviat, Nunavut, may soon have a solution to water problems in their community, after having to put up with murky and salty water that, in some cases, even came with tiny fish.



The central Nunavut hamlet of Arviat is located 265 kilometres north of Churchill, Man. It is about 1,300 kilometres west of the territorial capital of Iqaluit. (CBC)

The hamlet council in Arviat passed a motion on Friday to set up a new pumphouse to draw water from Goose Lake, located 13 kilometres from the community, Mayor Bob Leonard told CBC News.

The Nunavut government will build a road to the Goose Lake site, then "we'll move the pumphouse out there, and that's where people will get the water from," Leonard said.

Water quality in the central Nunavut hamlet, which has a population of more than 2,000, has been a problem since a reservoir sprang a leak and almost dried up a few weeks ago.

The hamlet brought in chunks of ice for drinking water, then it started pumping water from nearby Landing Lake. But residents

complained that the Landing Lake water was often discoloured and smelly.

"I tired giving my son a bath but the water was too yellow," resident Madeline Issakiark said earlier this week.

"It was salty, it was muddy, and it smelled like fish, so I told him, 'Eh, I'll give you a bath some other time.'"

Minnows found

Issakiark said she and other residents also found small minnows in their water tanks earlier this week, when the hamlet was drawing from Landing Lake.

"I was shocked to see the fish, and I tried fishing to take out the fish but it was hard because the tank is too deep," she said. "So I just left it. They're still in my tank."

Leonard said there was a hole in the Landing Lake water filtration system, and that allowed fish to get through. The hole has since been fixed.

Furthermore, the hamlet council decided on Friday that it will no longer use Landing Lake for its water supply. For now, water will be supplied from the leaking reservoir, which still has a very limited supply.

Leonard said the water quality in Goose Lake has been tested and deemed to be excellent, but the challenge will be getting to and from the site.

It will take about a week and a half to tap into the new water supply at Goose Lake, he said.

NEWS: Nunavut March 01, 2011 - 11:52 am

Leaky reservoir causes

Arviat to use ice for water

"We'll figure out some way to keep up with the demand"

JANE GEORGE

The hamlet of Arviat is scrambling to find ways to conserve water and find new sources of drinking water.

To lessen the demand for trucked water, hamlet officials have decided going back to an old-fashioned method of supplying drinking water: cutting ice.

"People in this town, they actually prefer ice for drinking water. We quit hauling ice a few years ago, and people have been bugging us to start up again," mayor Bob Leonard told *Nunatsiaq News* on March 1.

Even with this measure, the water left in the reservoir could run out by the middle of May.

That's because the main reservoir that supplies water to the Nunavut community of 2,300 sprang a leak late last year.

Now water is being pumped out of its smaller, intact reservoir cell— but this source of water could run out by mid-May, said a Feb. 25 hamlet update on the water crisis in the community.

Local officials want to reduce water consumption in Arviat by about a third.

The hamlet has started to cut fresh water ice out of a Wolf Creek and bring it into town to four distribution spots where Arviatmiut may take home the fresh ice to use for drinking water.

"People are welcome to use as much of this ice as they want, and we'll figure out some way to keep up with the demand," said the hamlet update.

Members of Canadian armed forces from 38 Canadian Brigade Group, who arrived in the community by snowmobile from Churchill late last week— and then couldn't leave the community due to a blizzard, also lent a hand to the ice-cutting efforts.

Ice for home use should be ready by later this week, Leonard said.

Due to poor weather, the plan to cut ice has suffered some delays, he said.

"The weather has been terrible," he said.

Even when the ice is ready for distribution, the hamlet will continue to deliver what remains of the reservoir water to restaurants, the health centre, the elders' residence, schools, and the daycare centre so that they have a regular supply of drinking water.

To draw on another source of water, workers with Nunavut's community and government services department set up a second pump house on nearby Landing Lake, about seven kilometres outside town.

The Landing Lake water has been tested, said the hamlet update. Although it is within Canadian safe water standards, many in the community find its water salty, and council members decided "it is now below the standards that we would like to see the people of Arviat using for drinking water."

The department is also setting up a fill station in the local fire hall, where residents will be able bring water containers and fill them with drinking water until about 7 p.m.. Five-gallon containers will be supplied, if needed.

Once all the ice and drinking water stations are set up and running properly, four water trucks will start hauling water from Landing Lake to Arviat homes, offices and businesses for regular use in bathrooms and kitchens, while one truck will be reserved solely for reservoir water.

Although the hamlet said the situation won't last very long, and everything should be back to normal by late spring, it will require everyone's patience until the smaller reservoir cell can be refilled, Leonard said.

"People have been very very good. The inconvenience and the uncertainty of using another water source, some people are uncomfortable with that. But they're typical northerners. When there's a problem, everyone gets together," he said.

As for the leak in the reservoir, this may due to repairs to its plastic liner last summer— and will have to undergo repairs later this year.

(3) Comments:

#1. Posted by Yuck on March 01, 2011

The water we're getting right now tastes awful, like bleach or something, it's quite disgusting...

#2. Posted by Raymond Kaslak on March 01, 2011

One thing that may have to be taken into engineering consideration is the isostatic rebound, the land is still rebounding upwards from the last glacial incubus. On a big scale you can see it in raised beaches and cracks in reservoirs and on smaller scale you can see it in cracks on the walls of buildings.

#3. Posted by Citizen on March 01, 2011

If your using bleach to treat the water, make sure your using enough bleach in the trucks...it's kinda illogical but bleach smells more in water when not enough is being used...or too much, of course.

FROM ARVIAT'S HOME PAGE

February 25, 2011: Update
Hamlet of Arviat – Water Issues

The Hamlet is offering all of our assistance to C&GS to help us all through the water shortage problem created by the leaking reservoir. We will run extra hours, as necessary, to provide the same level of service as the community has now, and we are planning to offer some additional services.

The larger reservoir cell is now empty, and C&GS is pumping water from the smaller cell. If we don't add other sources of water, there might only be enough water in this cell to last the community until the middle of May or so. We might not be able to start refilling this reservoir until the middle of June, depending on how warm our Spring weather is this year.

C&GS have set up a second pump house on Landing Lake, as they discussed doing when they were here in January. The Landing Lake water has been tested, and although it is within Canadian safe water standards, Council members have agreed that it is now below the standards that we would like to see the people of Arviat using for drinking water.

The Hamlet will begin cutting fresh water ice and bringing it into town, to 4 distribution spots, so that Arviatmiut may take home fresh ice to use for drinking water if they wish. People are welcome to use as much of this ice as they want, and we'll figure out some way to keep up with the demand. The ice cutting program will start Monday, and we plan to have ice ready for home use by Wednesday or so.

C&GS is also setting up a fill station in the Fire Hall, so residents can bring water containers to the Fire Hall and fill them with regular drinking water. This will be water from the reservoir, not Landing Lake, so it is the same water we are drinking today. C&GS is flying in 5 gallon water cans to help anyone who doesn't have their own containers. The fill station will be open until 7 or 8 o'clock each night, so that everyone can get water whenever they want.

The Hamlet will continue to deliver reservoir water to the Restaurants, Health Centre, Elders' Residence, Schools (for drinking only), Day-Care and other sensitive buildings, so that they have a regular supply of drinking water.

Once all of these additional ice and drinking water stations are set up and running properly, the water trucks will start hauling water from Landing Lake to the homes, offices and businesses for regular use - toilets, bathing, laundry, etc. We have been assured by C&GS that this water is absolutely safe in every way and it is well within the Canadian guidelines for safe drinking water. C&GS will continue to monitor the water quality daily, until we no longer have to use the Landing Lake water.

The Hamlet would like to thank everybody for their understanding and cooperation. The Hamlet Council and Hamlet staff are working closely together with C&GS to help everybody get through the next 2 to 3 months with as little disruption as possible. This situation won't last very long, and everything should be back to normal by late Spring.

If anyone has advice or ideas for us on how we might improve our services, please pass them on to the Community C&GS Maintainers, or any of the Councillors, or to me. We would appreciate any help that you can give us, or we could pass along any concerns you have to C&GS in Rankin Inlet if you wish.