ARCTIC BAY TRUCKFILL
ARCTIC BAY, NT

OPERATIONS AND MAINTENANCE MANUAL

VOLUME 1 OF 2

Prepared for:
Government of Northwest Territories
Department of Public Works and Services
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Iqaluit, NT
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Department of Public Works and Services Project No. 4-001-658
Dillon Project No. 96-3817

June 1998

1.0 INTRODUCTION

1.1 Project Title

ARCTIC BAY TRUCKFILL

ARCTIC BAY, NT

JUNE 1998

Set No. 2 of 4

Distribution:

Set 1:	Sam Willie, Truckfill Station, Arctic Bay, NT
Set 2:	David Parker, Dept. of Public Works and Services, Iqaluit, NT
Set 3:	Vincent Tam, P.W.S., Technical Services Div., Yellowknife, NT
Set 4:	Dillon Consulting Limited, Yellowknife, NT

1.2 Revision Data

Date	Description	Pages

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1.3 Changes after Commissioning

Date	Change

1.4 Project Representatives

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3.0 DESIGN DATA

3.1 General

This section contains the predesign report entitled "Truckfill Stations - Arctic Bay & Clyde River, NWT Predesign Report" as originally published. The page numbering, figure numbers, table numbers, headers, footers, and appendices are independent of this manual's organization.

Truckfill Stations - Arctic Bay & Clyde River, NWT
Predesign Report

November 19, 1996

Truckfill Stations
Arctic Bay & Clyde River, NWT

Government of the Northwest Territories
Department of Public Works & Services

96-3817-01-01

Submitted by

Dillon Consulting Limited

December 18, 1996

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Attention: David Parker, P. Eng
Project Officer

Arctic Bay and Clyde River
Truck Fill Stations, NWT

Dear Mr. Parker;

Enclosed, please find three copies of the final version of the predesign report for the above project. As requested we have forwarded a copy of this report to the NWT and Nunavut Water Boards for their review and comment. This report has been revised to the comments we received from you recently.

The design of the truck fill stations is proceeding based on the information contained in the document. We anticipate the design will be completed early in the new year. We trust that you find this final report to your satisfaction.

Yours sincerely

Dillon Consulting Limited

Gary Strong, P.Eng.

Project Manager

THE ASSOCIATION OF PROFESSIONAL ENGINEERS, GEOLOGISTS and GEOPHYSICISTS OF THE NORTHWEST TERRITORIES
PERMIT NUMBER
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REGISTERED PROFESSIONAL ENGINEER
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GS:gs
96-3817/158/draft.let

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1.0 INTRODUCTION

General

The Government of the Northwest Territories (GNWT) identified the installation of truckfill stations in the communities of Arctic Bay and Clyde River as priorities in the 1997/98 fiscal period. The implementation of these initiatives was combined by the Department of Public Works and Services (PW&S) into one project. The facilities will have many similar components in the design and construction, and it was determined by PW&S that there will be economies in scale in the completion of these projects as one design assignment. In October of 1996, Dillon Consulting Limited was retained to complete the engineering services related to this assignment.

Background

Planning studies for the water supply systems in Arctic Bay and Clyde River were completed by Dillon in 1995. These planning studies identified the conceptual water supply system for each community. The water supply systems, as set out in the planning studies, and stated in the project terms of reference, are as follows:

"The new facility shall accommodate the following design characteristics:

It is assumed that power to the site will be provided by on site power generation, however the consultant is to investigate the construction of a power line to the site and provide a cost analysis for both alternatives.

Pumphouse / Truckfill Building

- *Truckfill pumps (1 duty, 1 standby).*
- *In-line chlorination through the truckfill line.*
- *Insulated and heat traced overhead truckfill arm, with water totalizer meter.*
- *Building heating and light.*
- *System controls / monitoring.*
- *Spares for the critical components subject to breakdown.*

- *One year supply of consumable (ie. chlorine)*
- *Adequate storage space for chlorine chemicals, space should be secure.*
- *On site power source for the station to be diesel motor / generator sets (1 duty) and are to be low RPM units.*
- *Heat trace (1 duty, 1 standby) c/w heat trace monitoring capability.*
- *Bench / cupboard for storage.*
- *Eyewash station.*
- *Exterior Fuel Tank.*
- *Interior day tank c/w (1 duty, 1 standby) fuel transfer pumps.*
- *Metal skid foundation for portability.*
- *Truckfill intake to be, single intake with screen and intake protection.*
- *Insulated and heat traced intake pipe at minimum length."*

Report Approach

This design concept brief will develop the planning concepts for the water supply system to a design level of detail. Where alternative approaches are possible, these will be discussed, and cost estimates developed. Recommendations for each of the component systems will be made. The report will deal with each of the community water supply systems individually. Where components can be maintained through both facilities to reduce costs, this will be identified.

2.0 SYSTEM DESIGN STANDARDS

2.1 Design Criteria

The design criteria for this project will be completed in accordance with the parameters set out by the GNWT, "Water and Sewage Facilities Capital Programs" and as modified by the terms of reference. These are as follows:

Facility	Design Horizon	Design Economic Life	Design Expected Life
Building	20	20	40
Pumps	10	20	20
Pipelines	20	20	30

Where the:

a) Design horizon is the period used to establish capacity requirements for a facility.

b) Design economic life is the period used in the economic analysis to establish the present value (or equivalent capital cost) of a facility.

c) Design expected life is the practical maximum expected life of a facility assuming no premature failure, destruction or obsolescence.

2.2 Design Standards

The following is a list of the design standards to be used in the development of the water supply system. These are derived from the GNWT "General Terms of Reference for Water and Sanitation" (GTR), and the "National Building Code" (NBC), and "Capital Standards Criteria, September 1993," MACA.

Water Consumption Rates		Reference
Domestic	90 litres per capita per day	MACA
Commercial	0.00023 x population	MACA
Total Consumption per Capita	90 x (1.0 + 0.00023 x pop.)	MACA
Fire Demand	910 litres per minute for 60 minute duration	MACA & Fire Marshal
Discount Rates	4%, 8% and 12%	MACA

Environmental Conditions		Arctic Bay	Clyde River
Design Minimum Temp.		-43◦C	-41◦C
Degree Days (18◦C)		11693	11006
Snow Load	SS SR	1.9 kPa 0.1 kPa	3.2 kPa 0.2 kPa
Wind Pressures		0.5 kPa	0.8 kPa

2.3 Design Parameters

The project terms of reference identified the following as design parameters for the facilities.

- *"Facilities must be simple to operate and maintain by local forces with limited equipment, and parts and materials which are available locally.*
- *Reliability of the facility is extremely important.*
- *The facility must be efficient and cost effective.*
- *The truckfill supply shall have a minimum pumping capacity of 1000 L/min.*
- *All equipment and pipes must be self draining after each use cycle, where practical. When self draining of any major component cannot practically be accommodated, some other means of frost protection should be incorporated.*
- *All major components must be capable of recovering from a frozen condition, in an operable state, if there is any possibility of freezing.*
- *Provisions of spares for all equipment is required, particularly components that have bulbs, fuses, relays, timers, etc.*
- *The first year supply of consumable, such as calcium hypochlorite, must be a requirement of the construction contract.*
- *Provision for standby power generation at the truckfill station is in accordance with GNWT's Municipal and Community Affairs Guidelines.*
- *The electrical drawings are to be provided to an industrial electrical standard and all drawings must have adequate detail to ensure that they are easily understood by*

local and northern contractors.

- *If the truckfill station is constructed at some location other than the site, the building is to be mounted on skids should relocation be required.*
- *Fuel storage at the truckfill station must provide for spill containment.*
- *Water supplied from the truckfill station must be metered.*
- *A copy of the design must be submitted to the NWT Water Board, for review.*
- *Provision for an alarm system which indicates loss of power and low building temperature, is required."*

2.4 Cost Analysis

Throughout this document, there are cost analysis of various options. The analysis have been carried out as outlined in the GTR as described below:

Capital Cost

Cost of construction for the facility

Annual Operation and Maintenance Costs

The cost of operation, which may include manpower, energy requirements, fuel, general maintenance (light bulbs, paint), and equipment replacement.

Life Cycle Costs

The calculation of the total facility cost over a 20-Year period. This includes the capital, operations and maintenance costs. The life cycle value is shown as a present value which is calculated at a discount rate of 4%, 8% and 12%.

3.0 WATER QUANTITY REQUIREMENTS

The water supply system for the communities is to meet the 20-Year demand. The program implementation schedule and fiscal budgets set out by the GNWT indicate that the construction of the facility will be completed in 1997 and therefore, Year 0 of the facility is 1997. In the planning study completed by Dillon, Year 0 was set at 1998. The water consumption data from the planning study has been brought forth into this document, and updated to reflect the change in the design horizon.

The following illustrates the historical population and water consumption data for the communities.

ARCTIC BAY		
Year	Population	Water Consumption (lcd)
1976	387	N/A
1978	414	34
1986	480	50
1994	592	73.9

CLYDE RIVER			
Year	Population	Growth Rate of Population	Water Consumption (lcd)
1974	350	4.6%	N/A
1979	439	4.5%	20.6
1981	443	1.2%	N/A
1986	471	3.7%	N/A
1989	500	2.0%	49.2
1991	565	2.4%	49.9
1993	592	1.5%	48.0
1994	601	1.5%	N/A

The Bureau of Statistics for the Northwest Territories provides population projections for all communities in the NWT with a population in excess of 100 people. **Figure 3.1** shows the population growth and annual water consumption for the community of Arctic Bay and **Figure 3.2** for Clyde River. Based on the values presented in this table, the 20-Year design population and consumption for Arctic Bay are 973 people and 39,100 m^3 respectively, and for Clyde River are 1,076 people and 44,100 m^3.

Design Year	Year	Population	Consumption		
			Litres per Capita	Daily (litres)	Annual (cubic metres)
0	1997	628	103.0	64,700	23,600
1	1998	637	103.2	65,700	24,000
2	1999	651	103.5	67,400	24,600
3	2000	666	103.8	69,100	25,200
4	2001	682	104.1	71,000	25,900
5	2002	698	104.4	72,900	26,600
6	2003	714	104.8	74,800	27,300
7	2004	730	105.1	76,700	28,000
8	2005	747	105.5	78,800	28,800
9	2006	763	105.8	80,700	29,500
10	2007	780	106.1	82,800	30,200
11	2008	797	106.5	84,900	31,000
12	2009	815	106.9	87,100	31,800
13	2010	833	107.2	89,300	32,600
14	2011	852	107.6	91,700	33,500
15	2012	871	108.0	94,100	34,300
16	2013	890	108.4	96,500	35,200
17	2014	910	108.8	99,000	36,100
18	2015	931	109.3	101,800	37,200
19	2016	952	109.7	104,400	38,100
20	2017	973	110.1	107,100	39,100

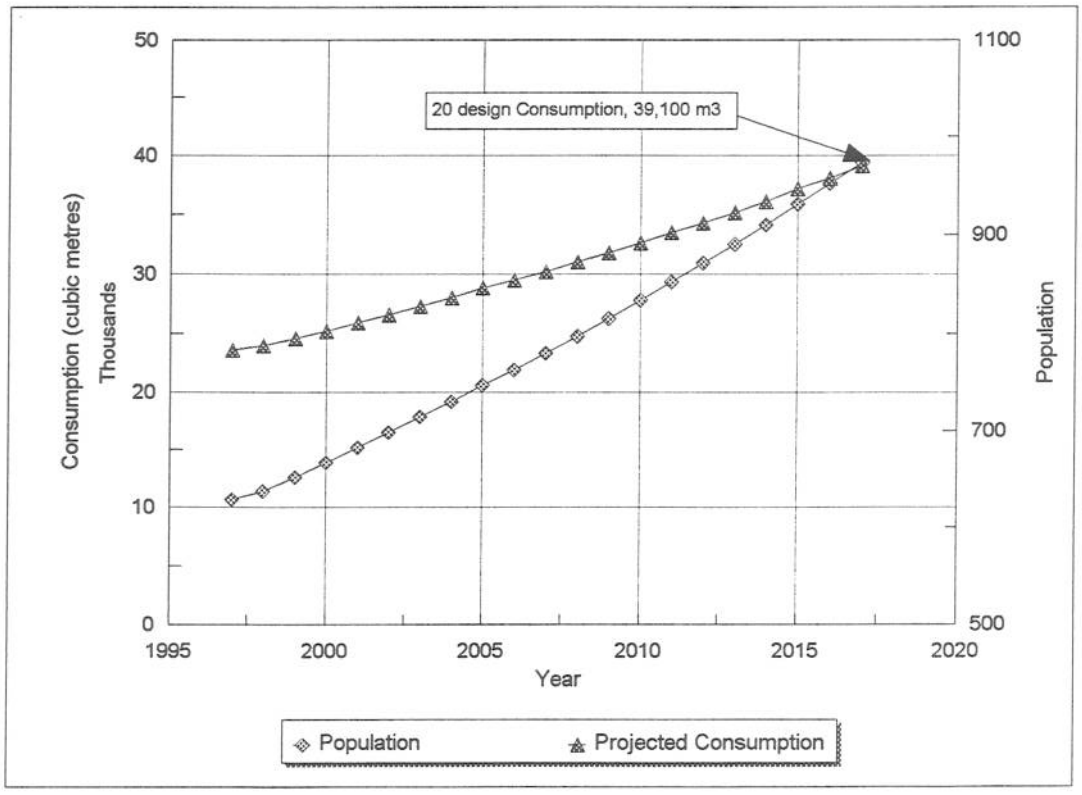

Figure 3.1 Population Projections, Arctic Bay
Predesign Report, Arctic Bay & Clyde River Truck Fill Station, NWT

Public Works and Services

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Design Year	Year	Population	Consumption		
			Litres per Capita	Daily (litres)	Annual (cubic metres)
0	1997	655	103.6	67,900	24,800
1	1998	672	103.9	69,800	25,500
2	1999	688	104.2	71,700	26,200
3	2000	706	104.6	73,800	26,900
4	2001	723	105.0	75,900	27,700
5	2002	742	105.4	78,200	28,500
6	2003	760	105.7	80,300	29,300
7	2004	779	106.1	82,700	30,200
8	2005	799	106.5	85,100	31,100
9	2006	819	107.0	87,600	32,000
10	2007	840	107.4	90,200	32,900
11	2008	861	107.8	92,800	33,900
12	2009	882	108.3	95,500	34,900
13	2010	905	108.7	98,400	35,900
14	2011	927	109.2	101,200	36,900
15	2012	951	109.7	104,300	38,100
16	2013	975	110.2	107,400	39,200
17	2014	999	110.7	110,600	40,400
18	2015	1,024	111.2	113,900	41,600
19	2016	1,050	111.7	117,300	42,800
20	2017	1,076	112.3	120,800	44,100

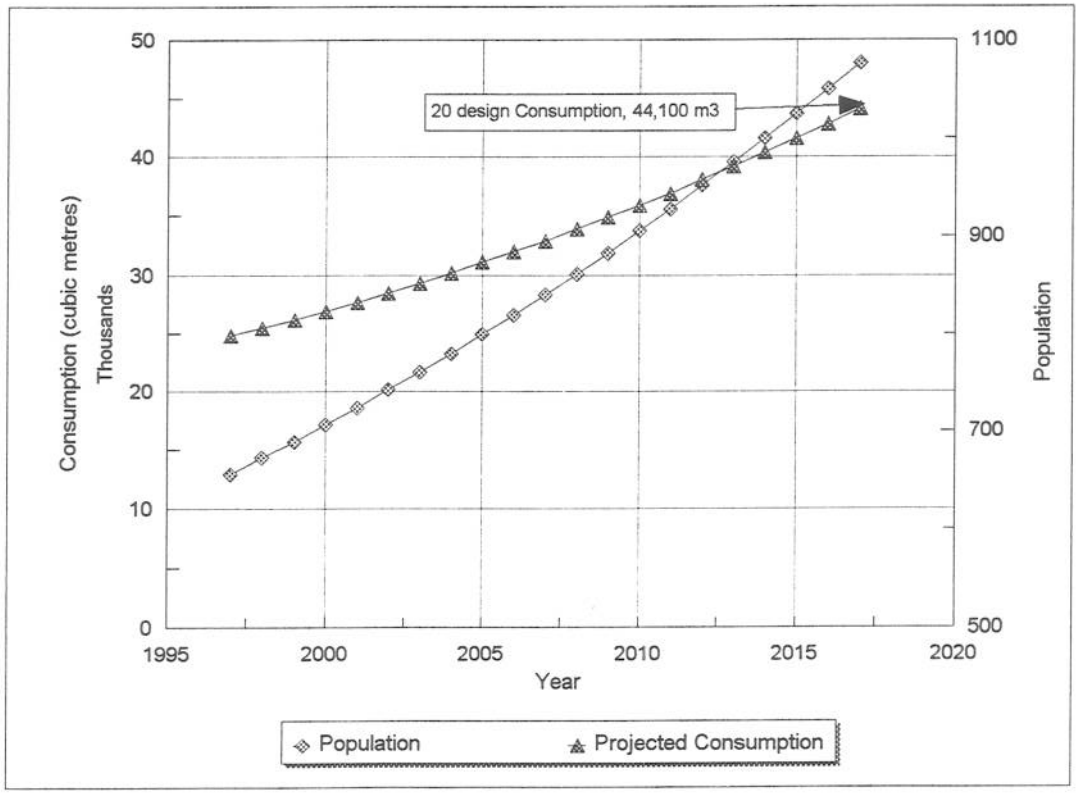

Figure 3.2 Population Projections, Clyde River
Predesign Report, Arctic Bay & Clyde River Truck Fill Station, NWT

Public Works and Services

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3.1 Water Quality and Water Treatment

3.1.1 Arctic Bay

The long term water supply for Arctic Bay has been identified as Marcil Lake. The community has indicated that they accept this water source, and that they find the water aesthetically acceptable.

Water quality testing has been completed on this water source by various parties, including Dillon during the previous planning assignment. **Figure 3.3** summarizes the water sample data completed on Marcil Lake in previous studies.

Parameters tested were selected to provide indicators of the water quality of the raw water source. The test results indicate that there is not a particular area of concern with the water source. The water quality meets the requirements of the Guidelines for Canadian Drinking Water Quality (1996) (GCDWQ) for all parameters except turbidity. The guidelines require an average level of turbidity below the level of 1.0 NTU (Nephelometric Turbidity Units). However, the guidelines allow the average level of turbidity to be less than 5.0 NTU if it can be shown that disinfection is not affected by the higher level of turbidity.

The water data indicates that turbidity ranged from 1 to 15 NTU with an average of 6.2 over the test samples. The historic use of the water source by the community with no reported problems of water related disease attributed to the raw water source, suggests that the presence of the slightly elevated levels of turbidity do not affect the disinfection of the water. The number of data sets available is limited, and the data doesn't provide a clear understanding of the temporal water charateristics.

In discussions with MACA it was decided that the truckfill station is to be designed to allow for the addition of filtration to remove the turbidity in the future. This addition will be made if the operation of the facility and the results of the sampling program indicate that the turbidity levels are problematic.

Monitoring of the raw water source should be done as part of the operation of the facility. The parameters to be tested for should include the major ions and turbidity. Monthly testing should be completed of the raw water supply to develop a more extensive data base to allow for future treatment assessment. Parameters to be tested for are to include; balance, bicarbonate, chloride, carbonate, conductance, fluoride, hardness, calcium, iron, potassium, magnesium, manganese, sodium, sulphate, nitrate, nitrite, pH, total alkalinity, TDS, and turbidity.

3.1.2 Clyde River

Historic water sampling has been completed on the selected water source from 1983 to date. **Figure 3.4** illustrates the sample collection and analysis completed. The 1994 samples were collected from various depths. The results of the samples indicated that the water is of good quality with no major areas of concern.

Turbidity levels are slightly elevated, the average is 3.0 NTU, which is within the guidelines.

Two samples indicate that the pH is below the aesthetic guidelines. The community has not raised concerns with the taste of the water, however, should continued sampling indicate that the water is consistently below the guideline, remedial treatment is to be considered. Treatment would consist of the addition of Soda Ash ($NaCO_3$) to the water. This can be completed automatically or manually. Due to fluctuations in the pH, monthly testing of the water for pH, and pH control manually is recommended. A supply of Soda Ash, and a hach pH Kit will be included in the design. The design of the facility will not address this issue.

There has been concerns expressed by MACA and/or the community with respect to late spring water quality. In other communities, water quality deteriorates over the winter due to a decrease in the level of dissolved oxygen. Sampling to date indicates that this will not be a concern at Clyde River. However, if in future a concern is raised, the small lake can be aerated using a compressor and a hose to convey air to the intake screen. This system is in place elsewhere in the NWT (Rankin Inlet). No provision in the design of the facility is required to address this future installation.

3.1.3 Disinfection

The GCDWQ require that the disinfection process for raw water also have a residual disinfection component. This is achieved through the use of chlorination. A typical residual chlorination level is 1 part per million (ppm). Many communities in the NWT find the taste of chlorine unpleasing, and residual levels are often set at 0.5 ppm. Several chemicals are available for disinfection of domestic water supplies. These include:

- Gaseous Chlorine
- Sodium hypochlorite (liquid)
- Calcium hypochlorite (solid)

Date Sampled :		Aug 26/83	Mar 13/84	Oct 24/84	Sept 10/85	Sept 11/85	Dec 1/87	Aug 18/92	July 26/94						GCDWQ GUIDELINES		
Sample Depth (m):		0	0	0	0	0	0	0	2.0	4.0	6.0	8.0	10.0	12.0			
PARAMETER	NOTES														Maximum Acceptable Concentrations	Interim Maximum Acceptable Concentrations	Aesthetic Objectives (Max. Conc.)
Ammonia									0.0250	0.0090	0.0030	0.0030	0.0110	0.0005			
Arsenic		0.0010	0.0010			<0.5		<0.005	0.0003	<0.003	0.0003	<0.0003	0.0003	0.0003	0.05	0.025	
Cadmium		<0.05	0.0013					<0.0002							0.005		
Calcium		<0.10	0.50	0.20	1.20	<1.0	1.70	<1.0	0.67	0.62	0.62	0.59	0.62	0.62			
Chloride		2.00	4.50	3.80	3.20	3.30	4.10	3.90	2.42	2.34	2.30	2.29	2.31	2.28			250
Chromium		0.0080	0.0045					0.0030							0.05		
Color (TCU)	2	<5.0	<5.0	10.0	15.0	10.0	10.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0			15
Conductivity (µmho/cm)		18.0	36.0	29.0	28.9	9.0	46.1	22.5	23.2	22.5	22.3	22.2	22.6	22.3			
Copper								0.003									1.0
Iron		0.0555	0.0400	0.2300	0.2300		0.0200	0.0055									0.3
Lead			0.0057					<0.001							0.01		
Magnesium		0.53	0.80	0.60	0.20	0.54	0.80	0.60	0.50	0.50	0.50	0.50	0.50	0.60			
Manganese				0.006	0.005		<0.01										0.05
Mercury		0.00010	0.00006						0.00022	0.00002			0.00030		0.001		
Nickel			0.001					0.001									
Ortho Phosphate	3								<0.002	0.002	0.002	0.002	0.002	0.002			
pH (unitless)		6.50	6.60	6.90	7.43	4.10	6.90	6.76	6.46	6.53	6.59	6.58	6.58	6.60			6.5 - 8.5
Potassium		0.35	0.70	0.70	0.60	0.60	0.60	0.50	0.58	0.41	0.41	0.41	0.42	0.42			
Silica									0.061	0.135							
Sodium		1.80	3.60	2.70	3.60	2.35	2.70	2.50	2.13	1.90	1.92	1.89	1.91	1.90			200
Sulphate		<1.0	1.5	2.0	2.0	2.0	<1.0	<2.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0			500
Suspended Solids		<5	<5					<3	<3	<3	<3	<3	<3	<3			
Total Alkalinity	4	3.1	5.8	8.2	8.4	Note 1.	7.5	4.0	3.1	3.1	3.1	3.0	3.1	3.0			
Total Dissolved Solids								19.0	17.0	<10.0	13.0	10.0	10.0	11.0			500
Total Hardness	4	2.36	4.50	3.00	3.80	4.20	7.40	5.00	3.70	3.60	3.60	3.50	3.60	4.00	500.00		100
Total Kjeldahl N	5								<0.008	<0.008							
Total Nitrates	6			0.050	0.050		<0.05	<0.04	<0.008	<0.008	0.011	0.011	0.038	0.012	45.0		
Total Nitrites	6			0.005	0.003		<0.05				0.011	0.011	0.038	0.012	3.2		
Total Phosphorus	3							<0.005	<0.002	0.008	0.007	0.005	0.010	0.008			
Turbidity (NTU)	7	1.5	0.6	5.0	6.5	6.0	1.0	15.0	2.2	2.2	2.0	2.1	2.1	2.3	1		5
Zinc		0.0440	0.0052					0.0010									5

Notes

All Results are expressed in mg/L, unless indicated in brackets ( ).

Blank cells indicate that the sample was not tested for that parameter.

Shaded cells indicate that the sample exceeds the GCDWQ guidelines for the indicated parameter.

1. Sample was too acidic for alkalinity titration.
2. TCU - True Color Units
3. Ortho Phosphate, and Total Phosphorus are stated in terms of mg/L of P (phosphorus)
4. Total Hardness, and Total Alkalinity are stated in terms of mg/L of CaCO3 (calcium carbonate)
5. Total Kjeldal N is stated in terms of mg/L of N (Nitrogen)
6. Equivalent to 10.0 mg/L nitrate as nitrogen, where nitrate and nitrite are determined separately. Levels of nitrite should not exceed 3.2 mg/L
7. NTU - Neophelometric Turbidity Units

Figure 3.4 Clyde River Water Samples
Arctic Bay & Clyde River Truck Fill Stations, NWT

Public Works and Services
Dillon Consulting limited

Gaseous chlorine requires storage in a separate room that is monitored for chlorine gas emissions. Safety equipment and training is necessary to comply with the Occupational Health and Safety Regulations when chlorine gas is used. The transparent of gaseous chlorine is regulated by the Transportation of Dangerous Goods (TDG) and it cannot be transported by passenger airplane. For these reasons, the use of gaseous chlorine is not recommended for small facilities such as the Arctic Bay or Clyde River Truckfill Stations.

Sodium hypochlorite is shipped and stored as a liquid. The liquid is subject to freezing, and is to be stored in a heated room (above -10∘C). Sodium hypochlorite used in water treatment is similar to house hold bleach. It is available at 12% available chlorine, whereas bleach is 6% available chlorine. Sodium hypochlorite looses its concentration with time. After 90 days the level of available chlorine drops slowly and may reach a level similar to bleach after 6 months. If the 12% available sodium hypochlorite is diluted to 2% available, the shelf life is significantly extended. The operation of the disinfection system using sodium hypochlorite is relatively simple. The liquid is used directly without mixing. An injection pump is used to inject the liquid into the water as it flows through the truckfill arm.

Calcium hypochlorite is shipped and stored as a powder. There is no concern with freeze protection, and heated storage is not required. Calcium hypochlorite has 65% available chlorine by weight. The powder is mixed with water to make a solution that can be used in the disinfection process. Typically the solution is mixed at a concentration similar to that of sodium hypochlorite (2% available chlorine is typical). The disinfection system for calcium hypochlorite requires a mixing tank, a solution tank, and an injection pump.

Both calcium and sodium hypochlorite are commonly used for disinfection in small facilities. The use of calcium hypochlorite is more common in the NWT. The issues to be addressed in the selection of a disinfectant are; the cost of the optional system; the relative ease of use; and the risk of failure.

Cost of System

Sodium hypochlorite, as a liquid, requires a greater volume of disinfectant to be shipped to site than calcium hypochlorite. Based on 12% available chlorine for sodium hypochlorite and 65% available for calcium hypochlorite the required shipping weight of disinfectant and volume to be shipped to site are as follows:

Disinfectant	Year 0 (1997)	Year 20 (2018)
Calcium Hypochlorite	37 Kg	60 Kg
Sodium Hypochlorite	200 L (200 Kg)	325 L (325 Kg)

The supply and transportation costs associated with each chemicals.

Disinfectant	Supply (Year 0)	Transportation (Year 0)	Life Cycle
Calcium Hypochlorite	$270	$20	$2,850
Sodium Hypochlorite	$160	$77	$2,350

The above is based on using the sealift for all transportation.

Operation

The mechanical and control systems for either disinfectant is similar. The difference is that calcium hypochlorite requires a mixing and solution tank. Typically these are 30 to 60 litre tanks each. They require a floor area of 1.5 m^2 for the tanks. The mixing tank is elevated to allow it to gravity feed into the solution tank. The sodium hypochlorite does not require any additional tanks as it is transported in its own 22 litre container. The tanks and additional space required for the calcium hypochlorite system increases the capital cost of the facility.

The mixing process requires approximately 1 hour of operation time every 2 weeks for the calcium system. Less than 10 minutes per month will be required for the sodium system.

Risk of Failure

As the two systems are mechanically and electrically the same, the risk of failure for these systems are also similar. These is an additional risk associated with the sodium hypochlorite when there is a power failure. The liquid could freeze during an extended power loss. With the calcium system, the mixed disinfectant will also freeze, however, the remaining powdered calcium hypochlorite will not be damaged.

Summary

The use of sodium hypochlorite is operatively more simplistic and user friendly. The difference in supply ad transportation costs for these chemicals is negligible. The sodium hypochlorite has a risk of freezing in the event of a power outage. Should this occur, standard household bleach from the local Northern Store can be used as a substitute until additional sodium hypochlorite is flown in. To assess the risk, it is assumed that each year 50% of the sodium hypochlorite is flown to site.

Item	Sodium Hypochlorite	Calcium Hypochlorite
Supply Cost (Year 1)	$ 77.00	$ 170.00
Transportation Cost (Year 1)	$ 421.00 * 400	$ 7.00
Operations Time (Year 1)	$ 40.00	$ 520.00
Total Annual Cost (Year 1)	$ 1,015.00	$ 1,140.00
Capital Cost	$ 800.00	$ 920.00
Life Cycle Cost	$ 12,000.00	$ 16,000.00

The above analysis indicates that sodium hypochlorite is the more economical system for disinfection. The detailed cost calculation is Appended.

* The transportation cost for sodium hypochlorite in this annalysis is based on 50% of the required volume being transported by air to the community.

The Department of Municipal and Community Affairs selected the use of the calcium hypochlorite for disinfection in these facilities.

4.0 TRUCKFILL STATION

The truckfill station will have the following major components:

1. Building Foundation
2. Truckfill controls and metering
3. Conveyance Pipes
4. Power Supply
5. Freeze Protection
6. Monitoring and Alarms
7. Building Construction
8. Building Layout
9. Site Access
10. Spares and Ancillary Components

The following section will describe these components for each facility.

4.1 Building Foundation

The geotechnical reports completed by Agra Earth and Environmental for the facility locations are included in the appendix. Recommendations for the foundation from these reports are for steel skid mounted building and a granular pad foundation. The granular pads are to be a minimum of 1.0 m in depth.

4.2 Truckfill Controls and Metering

The truckfill control has been established in accordance with the Government of the Northwest Territories standard for similar facilities in other small communities. The truckfill control system will have the following components:

- Truckfill control with one customer key lock. This will have an individual flow accumulator to record cumulative flows. The control will be on the truckfill arm, with a start/stop and resume button. The fill volume for each fill cycle will be variable, however, it will be pre-selected from within the building.

- Building flow totalizer to indicate total volume of water delivered by the truckfill station.

- Flow rate indicator.

- Flow sensor installed in the truckfill pipe to control individual and building flow

accumulations.

- Control device for chlorine feed pump.
- Flow switch to interlock with the pump and chlorine pump to avoid damage to the equipment or excessive chlorine injection into an empty line.
- All measurements for the metering are to be in SI units (litres).

The accumulators, flow indicator, and miscellaneous control devices will be located in a main control panel inside the pumphouse. All flow sensor equipment will be by Signet.

4.3 Conveyance Piping

The process piping is required to deliver 1,000 l/min of treated water to the truckfill discharge point. The pump curves for this system have been developed and are shown in **Figure 4.1 and 4.2**. The flow requirements can be met with a 7.5 h.p. pump and a minimum 100 mm discharge line. This is based on the available prime power supply 120 VAC single phase power. The pump will require an inclined shaft casing of 300 mm.

The process piping will consist of the following:

- Off-take pumps and 100 mm HDPE piping DR17, contained within a 300 mm HDPE DR17, insulated with 50 mm of rigid foam and heat traced, incline shaft conduit. The in-take piping will enter the truckfill station and terminate with a flange connection just inside the truckfill station wall.
- The in-take pipe line will be weighted using pre cost concrete weights.
- The in-take will have large diameter (300 to 1,000 mm) riprap installed over the pipeline to protect against mechanical ice damage.
- Galvanized 100 mm Schedule 40 steel piping with Victaulic system connections from the intake to the truckfill discharge point.
- Chlorine injection diffuser, located on the galvanized steel piping within the building.
- Pipeline drain line, that drains the line into the outer casing of the off-take line, after each fill cycle.

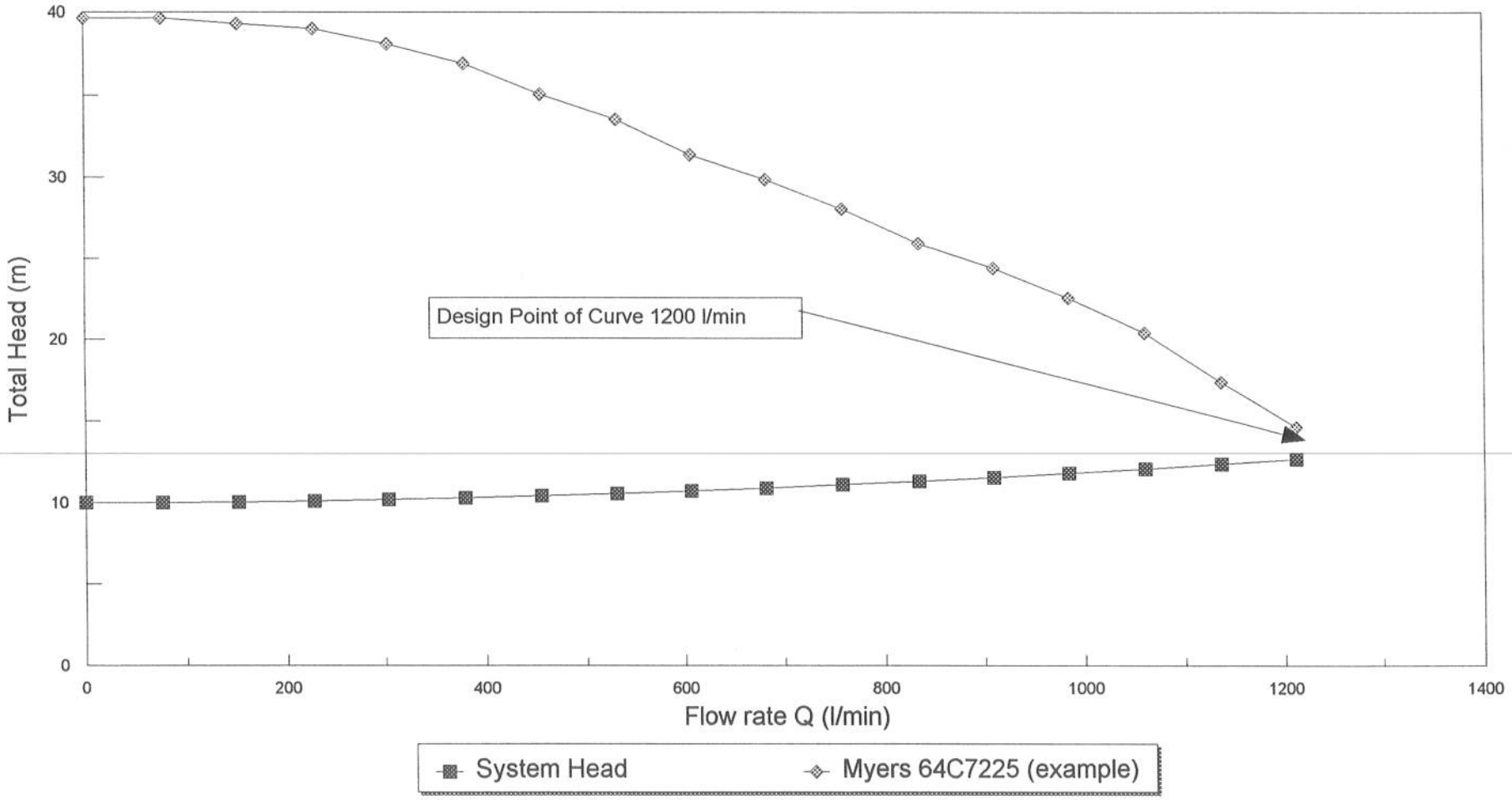


Figure 4.1 Truck Fill Pump Selection- Arctic Bay
Predesign Report, Arctic Bay and Clyde River Truck Fill Stations, N.W.T.
Public Works and Services
Dillon Consulting limited

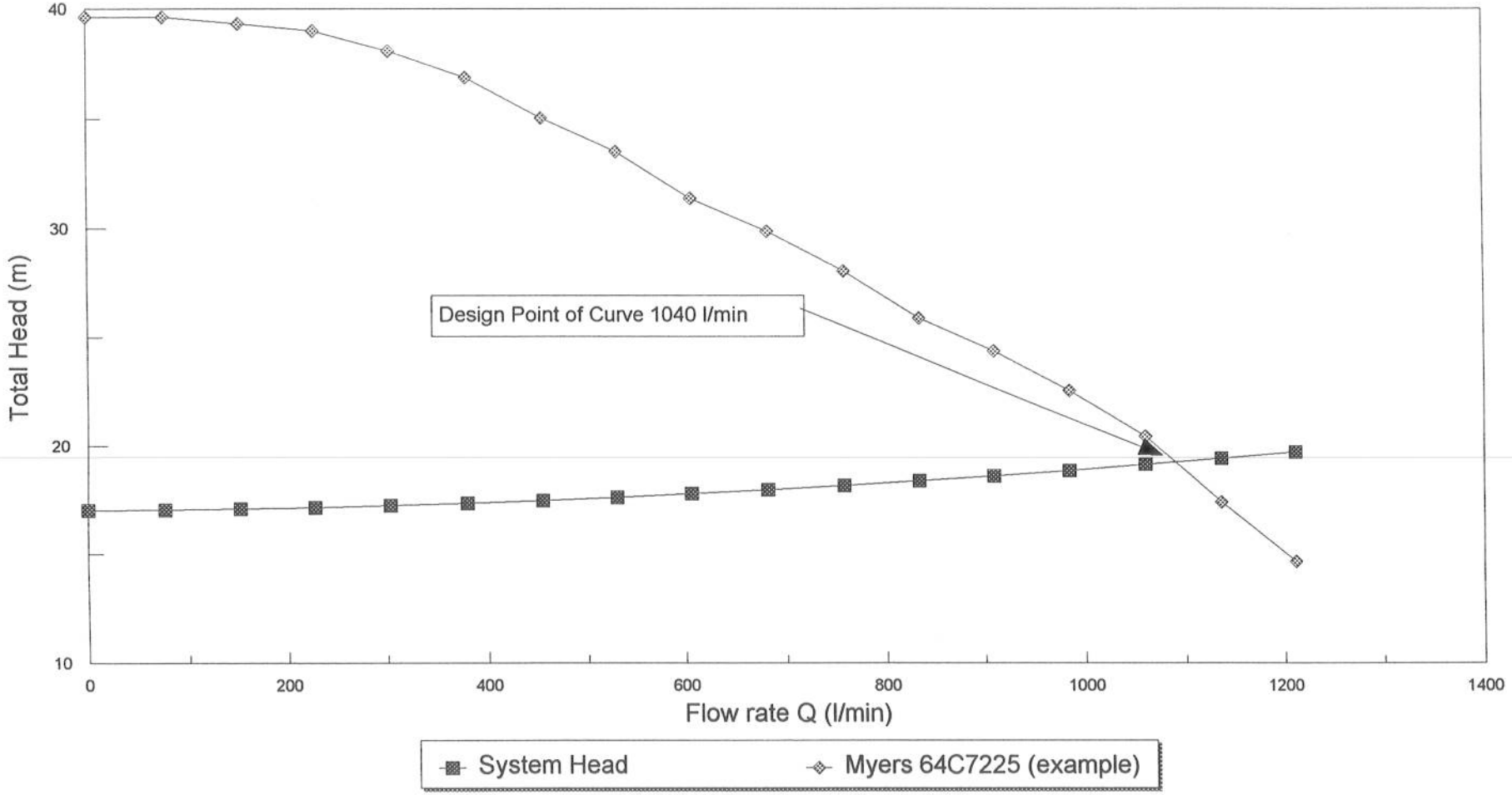


Figure 4.1 Truck Fill Pump Selection- Clyde River
Predesign Report, Arctic Bay and Clyde River Truck Fill Stations, N.W.T.
Public Works and Services
Dillon Consulting limited

- Flow switch to activate the chlorine pump.
- Flow sensor for the truckfill control system.

A schematic of the process piping is shown in **Figure 4.3**.

4.4 Power Supply

Prime Power

Prime power can be obtained from either:

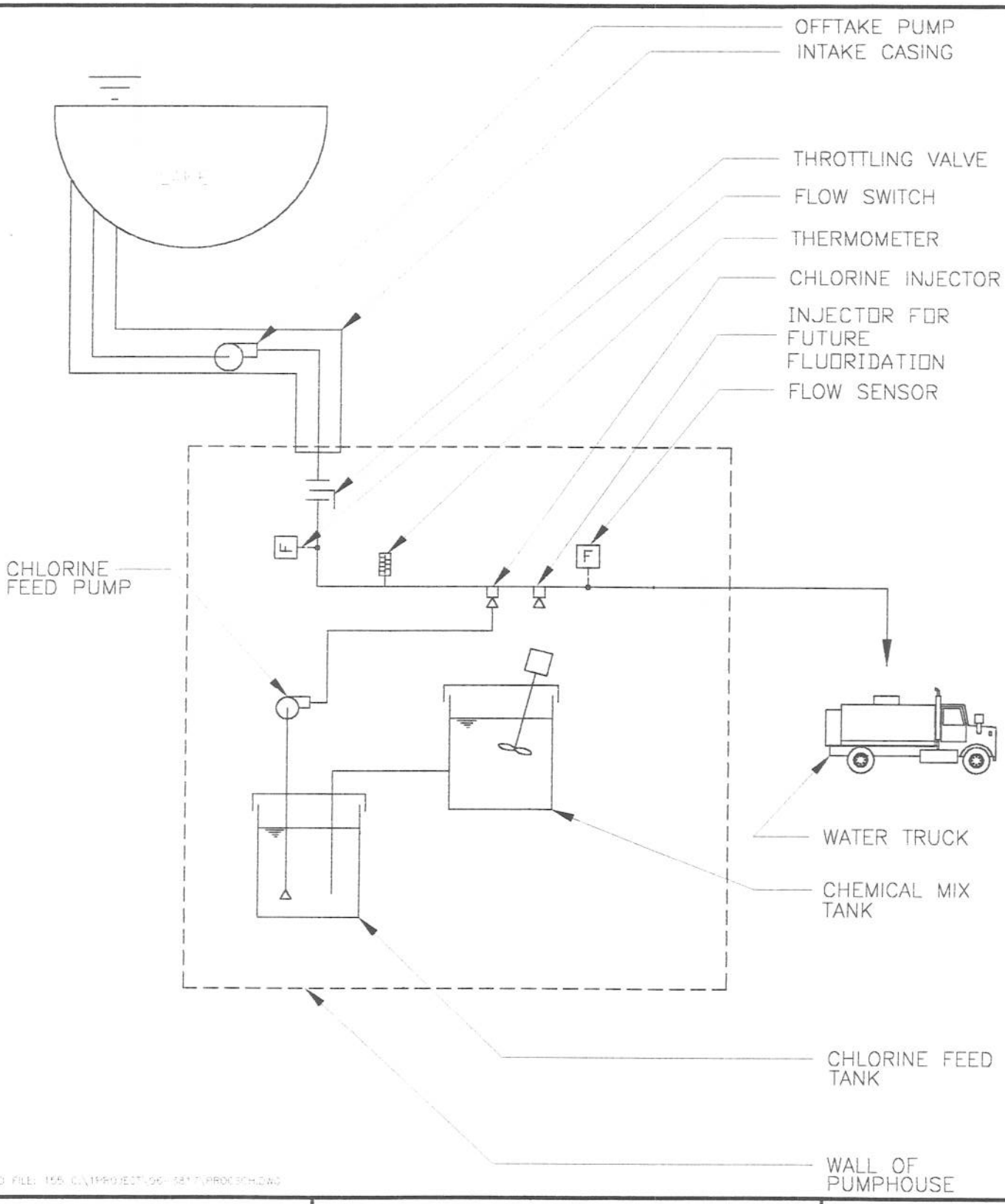
- Northwest Territories Power Corporation's power plant, or
- An on-site electric generator.

Typically, the use of grid power generated by the Power Corporation is the source of prime power. However, the new facilities are not directly adjacent to the community, and a new power line is required to service the truckfill station. Based on estimates received from the Power Corporation, the cost to install the new lines will be approximately:

Clyde River	**700 m**	**=**	**$ 95,000**
Arctic Bay	**9000 m**	**=**	**$ 900,000**

The installation of on-site power generation will require:

- A building or space within the truckfill building to house the generator.
- A generator sized to meet the power requirements of the truckfill station.
- Controls, monitoring and alarms for the power supply system.



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DILLON CONSULTING

PROJECT: ARCTIC BAY AND CLYDE RIVER TRUCKFILL STATIONS, NWT	PROJECT NUMBER: 96-3817
TITLE: PROCESS SCHEMATIC	FIGURE NUMBER: 4.3

The estimated steady-state power requirements of the truckfill station are:

	Power (kW)
• Truckfill Pump	6.0
• Building Heat	0.5
• Heat Trace	1.0
• Lighting	1.0
• Chemical Feed Pumps	0.1
TOTAL	9 kW

This results in a minimal generation requirement of 9 kW. Start-up power for the truckfill pump is not included, but will be approximately 2 kW more for total of 11 kW.

The on-site generator is assumed to run continuously for the 20-Year design horizon. The estimated daily power requirements are 36 kW/h in winter. The capital and life cycle costs of these options are as follows:

Prime Power System	Capital Cost	Operation Cost	Annual Maintenance Cost	Life Cycle Cost		
				4%	8%	12%
Arctic Bay						
Power Line	900,000	2,700	0	937,000	925,000	920,000
On-site Generator	150,000	30,000	6,000	640,000	510,000	420,000
Clyde River						
Power Line	95,000	2,700	0	133,000	122,000	116,000
On-site Generator	150,000	30,000	6,000	640,000	510,000	420,000

The use of an on-site generator at Arctic Bay is significantly more economical and, therefore, recommended over the use of a power line. The generator system will consist of:

- A 9 kW generator and diesel engine.
- Fuel storage for 30 days of operation (calculated to be 792 l, and a 1,120 l tank will be used which will supply 42 days of fuel supply).
- Fuel supply and return line.
- Engine and room ventilation and cooling

The use of a power line is significantly more economical at Clyde River and is, therefore, recommended for prime power.

Standby Power

Clyde River

Two methods of standby power for Clyde River are possible:

- Standby diesel electric generator
- Uninterruptible power supply (UPS) by battery bank.

The requirements for standby power is to supply emergency power for fire fighting protection during a power outage. The fire protection requirements are 60 minutes of water supply at 910 l/min. Based on the pump power consumption, a UPS must supply 6 kW/hr of stored power at a peak load of 8 kW.

A UPS can be supplied to meet this requirement. A Best Ferups EBP9F - 2.5 KVA has been identified for this analysis. The UPS system requires a space of 0.7 m^2 in the pumphouse. No maintenance is required for this system.

The standby diesel would be similar to the system required by a prime power generator. This system would require:

- A 3.0 m x 4.0 m addition to the pumphouse,
- Switch gear, monitoring and controls,
- Ventilation, duct work and cooling system,
- Fuel storage, fuel storage containment and fuel oil piping,
- UPS supply for initial start-up.

Monthly and annual maintenance is required to ensure the diesel will operate properly when it is required.

A cost analysis of the two options is as follows:

Standby Power System	Capital Cost	Operation	Annual Maintenance Cost	Life Cycle Cost		
				4%	8%	12%
Diesel Electric Power	150,000	2,000	6,000	250,000	230,000	210,000
UPS	30,000	1,000	0	44,000	49,000	38,000

The use of a UPS system for Clyde River is significantly more economical and is recommended for this facility.

4.5 Freeze Protection

To protect the water supply system from failure due to freezing, three freeze protection systems are required:

1. Truckfill building heating.

2. In- take casing freeze protection.

3. Truckfill arm.

Truckfill Building

Heating load calculations for the truckfill building are based upon 38 mm x 140 mm wood frame wall construction, vapour barrier, air barrier, and sheathing, with climatic factors of 8,101 degree C days and -45◦C January design temperature. Based on these factors, a 4 m x 4 m x 3 m high truckfill building will require 3.2 kW of heat for peak load and an annual requirement of 9,400 kWh. The costs of electricity and diesel fuel for the GNWT in the communities are $0.70/kWh and $0.68/l respectively. The table below shows the estimated costs of heating systems using electric heat or a diesel furnace. For comparison, a heating value of 10 kWh/l was used for diesel.

Freeze Protection System	Capital Cost	Annual Power/Fuel Cost	Annual Maintenance Cost	Life Cycle Cost		
				4%	8%	12%
Diesel Furnace or Unit Heater	3,000	300	5,000	75,000	55,000	42,000
Electric Unit Heater	1,500	3,100	0	46,000	32,000	25,000

The life cycle cost for electric heat is lower than for a diesel furnace. Also, electric heating is much more convenient and the maintenance is minimal. Additionally, electric heating will not require fuel to be stored at the truckfill building, greatly reducing the risk of fire. We recommend the use of an electric unit heater.

In-take Casing and In-take Pipe

The in-take casing and in-take pipe must be protected from freezing. This will be accomplished by electric heat trace cable installed in conduit, located outside the in-take pipe. The cable will be 15 W/m self-limiting, heat trace cable, chosen with the assistance of the manufacturer, such that it will not damage the HDPE pipe. Two lengths of cable will be installed. The second cable will also provide backup in case of failure of the first cable. Automatic controls will be used. The cable will be removable.

Truckfill Arm

A method must be used to protect the truckfill pipe from freezing and to recover the pipe if it freezes. Various methods have been used in past designs, including insulation and heat trace cable. A key to successfully avoiding freezing of the truckfill pipe is to ensure that it drains quickly and completely after use. The truckfill pipe will be installed with a 5% or greater slope back into the pumphouse, and an automatic draining mechanism at the intake. The pipe will be bare steel and not insulated or heat traced. Freezing of the pipe is unlikely, due to the draining system. In the unlikely event that the pipe freezes, a propane tiger torch will be supplied to thaw the pipe.

4.6 Monitoring and Alarms

The truckfill building will have the following monitoring and control system. The system will have two (2) levels of alarms: major and minor. Major alarms will cause an alarm light, and will cause a horn to sound at the pumphouse. Major alarms will activate an auto dialler system that will call the facility operator. At Clyde River this will use the main UPS System, and a land line to the normal phone system. At Arctic Bay the UPS will be included in the auto dialler system, and a remote transmitter system will be used. Minor alarms will only

sound an internal horn and flash a light. The alarms for this system are set as follows:

Major
- High building temperature alarm
- UPS failure with power on (Clyde River)
- Power Off/UPS at less than 1 hour storage (Clyde River)
- Power off/Generator failure (Arctic Bay)
- Low fuel level 2 (Arctic Bay)

Minor
- Truckfill pump failure
- Power Off/UPS On
- Building temperature low
- Low fuel level 1 (Arctic Bay)

4.7 Building Construction

There are two types of building construction available for this facility, namely:

- Wood frame, on-site construction.
- Pre-engineered, prefabricated construction, that is built off-site.

The wood frame building would be constructed to the standard for truckfill stations used by the Government of the Northwest Territories Standard as follows:

- Wall construction consisting of 38 mm x 150 mm with 150 mm of fibreglass batt insulation.
- Walls with vapour barrier on the inside and air barrier on the outside of the wall studs.
- Walls with plywood sheathing on the outside face and 50 m of rigid foam insulation.
- The interior of the walls sheathed with dry wall, plywood, and clad with metal siding. (The interior plywood is for convenient equipment installation.)
- Roofing provided by a pre-manufactured truss, or rafter system.

The pre-manufactured building would be constructed to provide the equivalent insulation value as the wood frame building. Several companies produce these structures (Baily, Brytex, Butler), and each have a slightly different building design. Typically these buildings have an insulation value of R-32.

The use of on-site construction will typically add $40,000 to $50,000 to the total facility cost. The increase in cost is a result of the required accommodations, flights and additional man hours on-site for down time. The local involvement created by on-site construction will be approximately 10 man days, or the equivalent of $2,000 in wages the economic benefit to the community is not justified and off-site construction is recommended.

On previous projects, the GNWT has had success with pre-manufactured buildings (Cold Stream). This building type will be used in the final design.

4.8 Building Layout

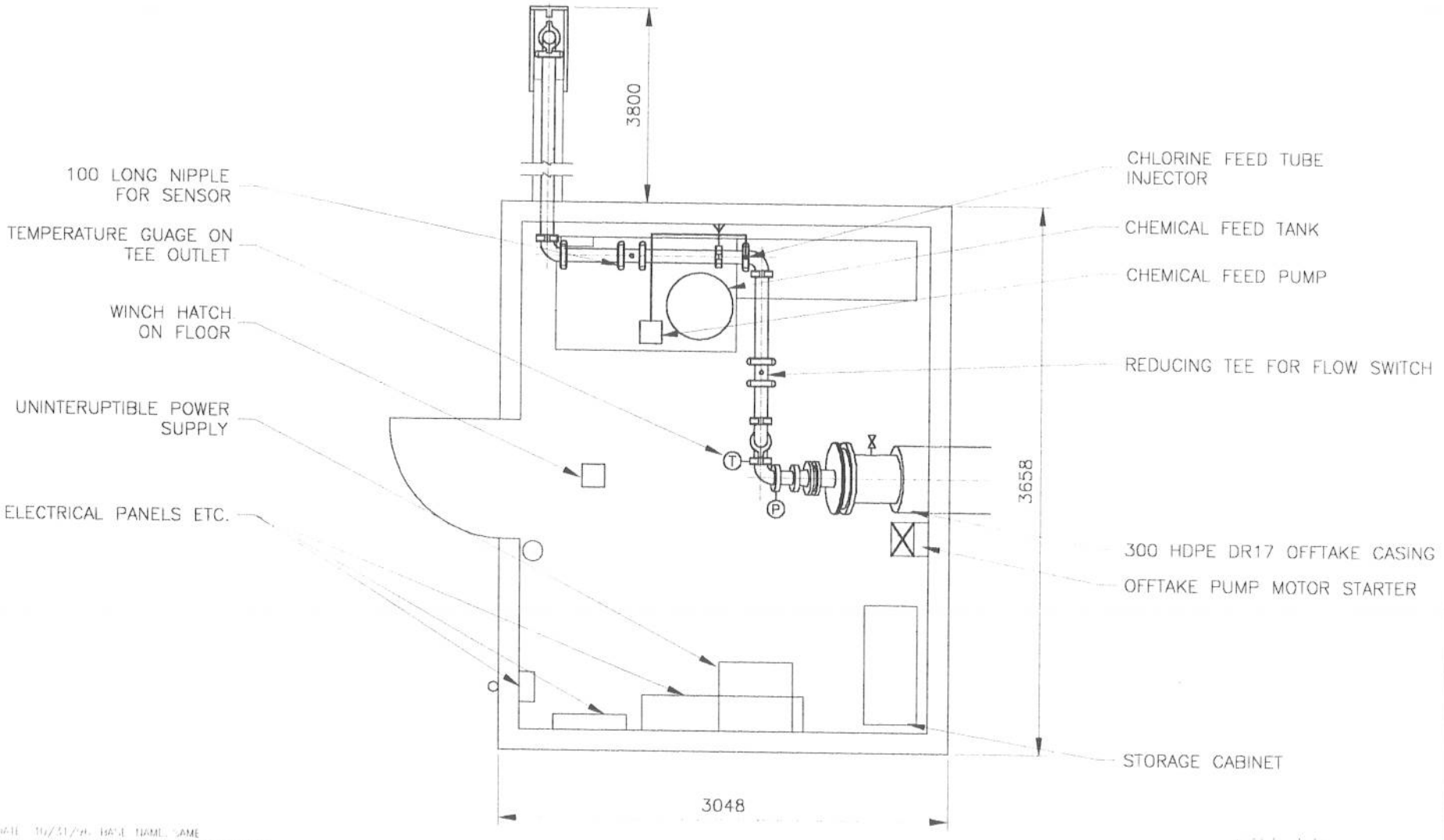
A summary of the requirements for the special allowance for the building is shown below:

- In-take piping and truckfill discharge piping, including allowance for intake pump removal.
- Chlorination system with chlorine pump and injection point.
- Work bench for water testing.
- Control panels, electrical panels.
- UPS System. (Clyde River only)
- Truckfill control box.
- Seasonal fill line through pumphouse.
- Storage of chemicals and spare parts.
- Diesel electric generator, and fuel supply system. (Arctic Bay only)

Future expansion for, and special allocation are to be made for:

- Fluoridation equipment and storage of chemical.
- Filtration equipment. (Arctic Bay only)

Figure 4.4 and 4.5 shows the building layouts providing for the above in each facility.



DILLON CONSULTING

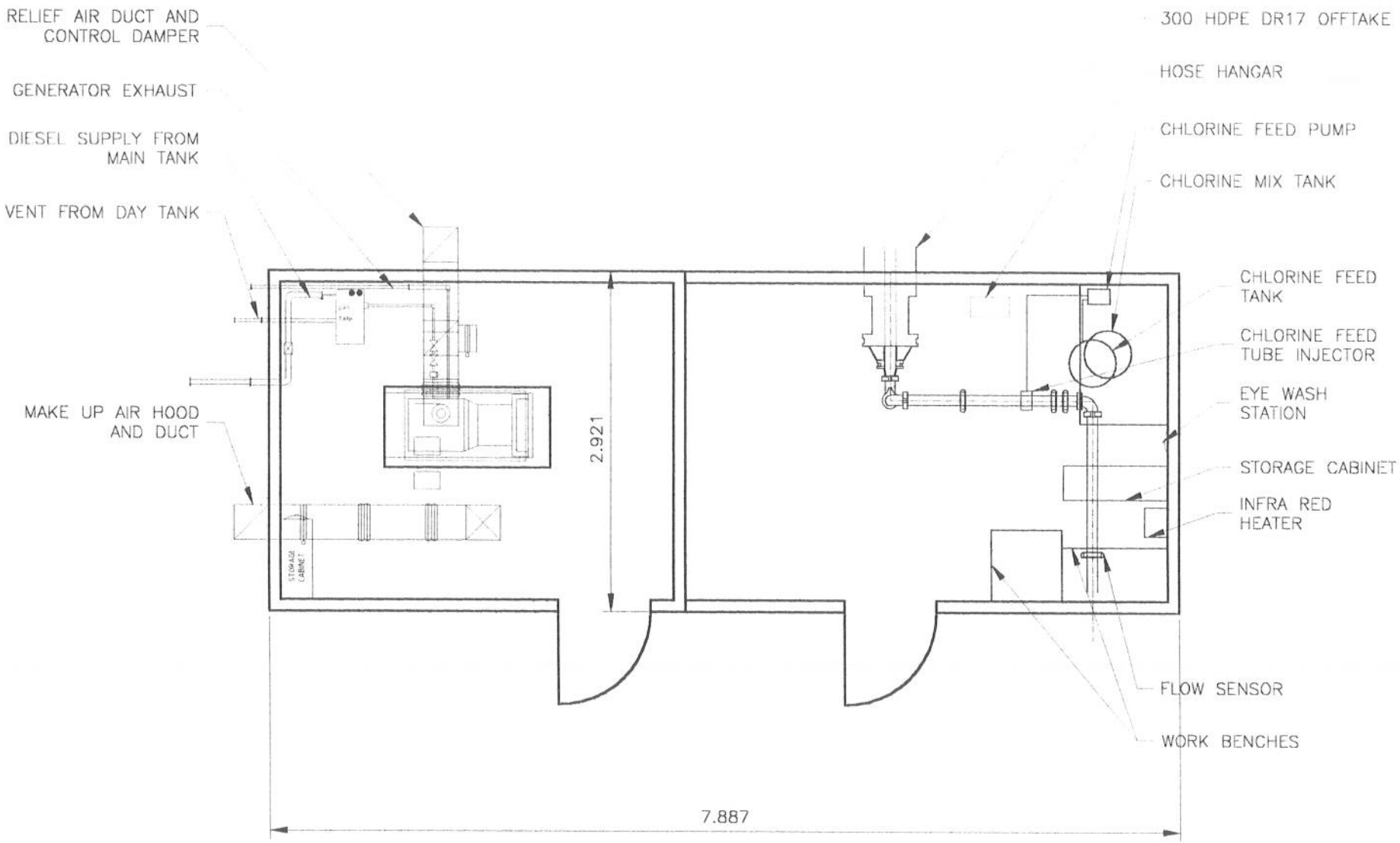
TITLE: ARCTIC BAY AND CLYDE RIVER TRUCKFILL STATIONS, NWT

PROJECT: CLYDE RIVER BUILDING LAYOUT

PROJECT NUMBER: 96-3817

DRAWING NUMBER: 4.4

DATE: OCT 96



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DILLON CONSULTING

PROJECT: ARCTIC BAY AND CLYDE RIVER TRUCKFILL STATIONS, NWT

TITLE: ARCTIC BAY BUILDING LAYOUT

PROJECT NUMBER: 96-3817

DATE: NOV 96

DRAWING NUMBER: 4.5

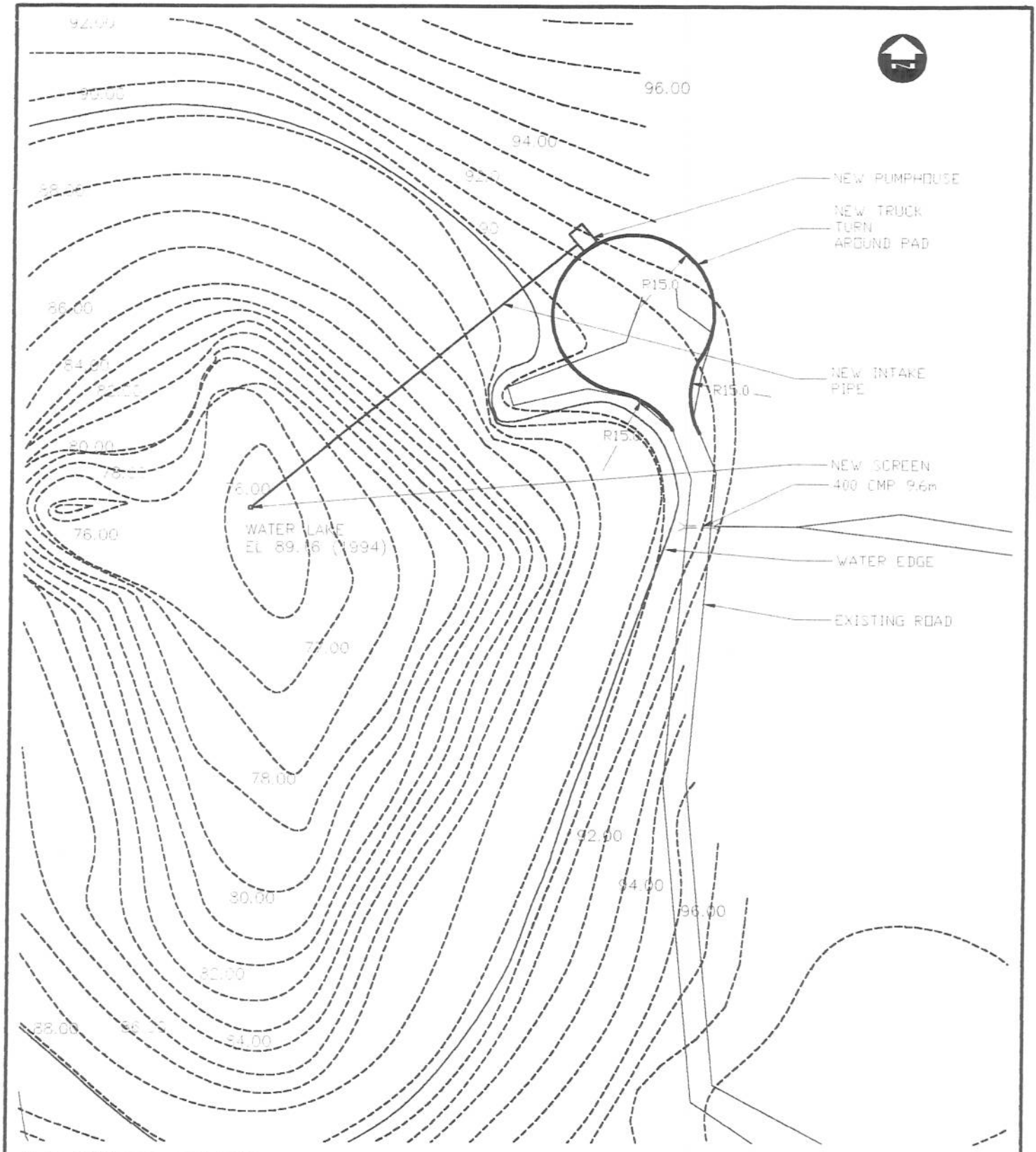
4.9 Site Layout

The access road can be constructed from available granular soil materials. The roadway and granular pad will consist of:

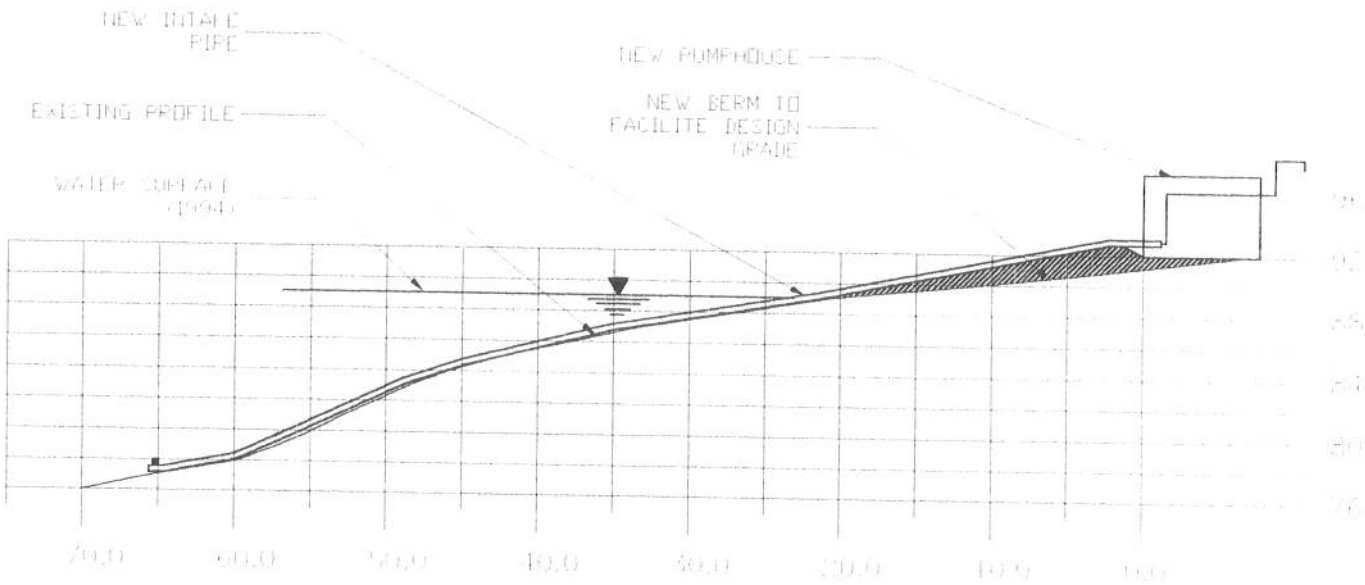
- 8.0 m wide travelling surface to meet Municipal & Community Affair's standard.
- 1,000 mm depth of granular sub base compacted in place.
- 100 mm of granular base.
- Ditching along both sides of the road to remove run-off water, and culverts.

The site and road drainage is important to remove snow melt and run-off water away from the water source area. The truck pad is designed to allow the trucks to turn around without backing up. The granular pads will be well compacted to prevent erosion.

Figure 4.6 through 4.9 show the site layout for the Clyde River and Arctic Bay truckfill facilities.



DILLON CONSULTING	PROJECT: ARCTIC BAY AND CLYDE RIVER TRUCKFILL STATIONS, NWT	DATE: OCT 96	PROJECT NUMBER: 96-3817
	TITLE: CLYDE RIVER SITE PLAN	SCALE: 1:1000	FIGURE NUMBER: 4.6



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DILLON CONSULTING

TITLE

ARCTIC BAY AND CLYDE RIVER
TRUCKFILL STATIONS, NWT

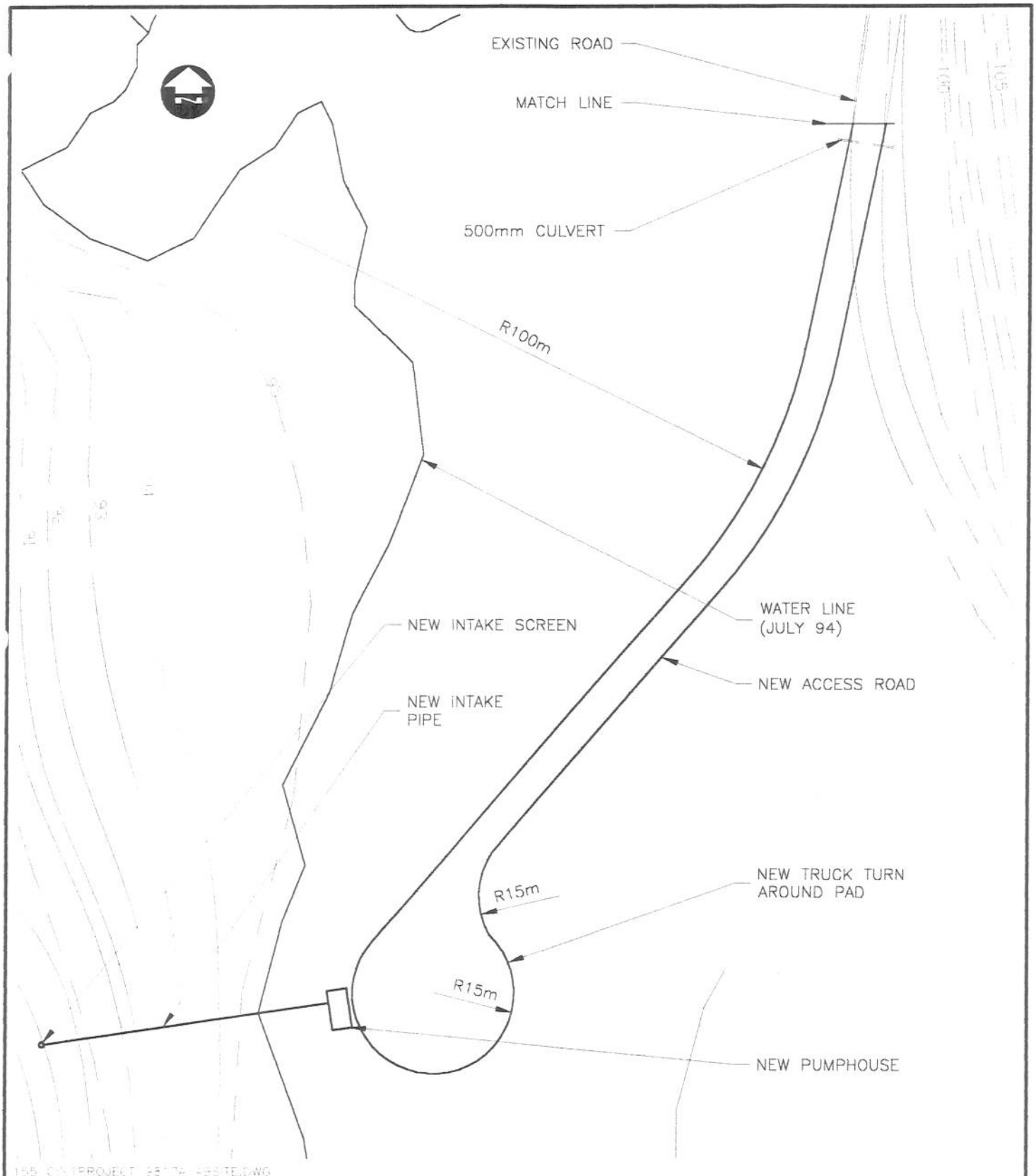
PROJECT

CLYDE RIVER
INTAKE PROFILE

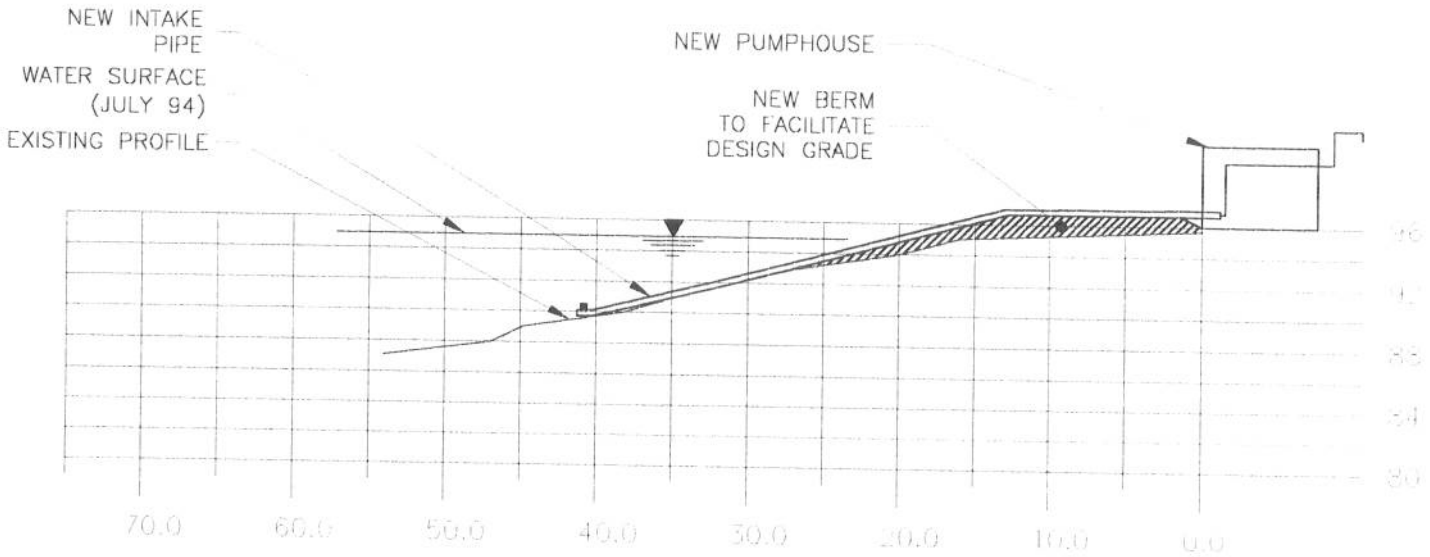
PROJECT NUMBER
96-3817

FIGURE NUMBER
4.7

DATE
OCT 96



DILLON CONSULTING	ARCTIC BAY AND CLYDE RIVER TRUCKFILL STATIONS, NWT	NOV 96	96-3817
	ARCTIC BAY SITE PLAN	1:1000	4.8



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DILLON CONSULTING

TITLE: ARCTIC BAY AND CLYDE RIVER TRUCKFILL STATIONS, NWT

PROJECT: ARCTIC BAY INTAKE PROFILE

PROJECT NUMBER: 96-3817

FIGURE NUMBER: 4.9

DATE: NOV 96

4.10 Spares and Ancillary Components

The following is a list of spares, replacement parts, and ancillary components that will be included.

Spare Components	Parts
In-take Pump	• 1 complete submersible pump complete with power cable.
Calcium Hypochlorite Feed System	• 3 replacement part kits for chemical pump. • 1 chlorine flow switch. • 1 chemical feed pump. • Nylon tubing.
Eyewash	• 1 spare container of solution.
Lighting - exterior	• 2 spare lamps each type.
Distribution Panel	• 2 breakers of each size and type.
Terminal Blocks	• 1 set of blocks for each size and type installed including end caps, end plates, cross connectors and tear-off markers.
Fuses	• Unless noted elsewhere, 12 spares for each type required in facility.
Motor Starters	• 6 of each type of pilot light and over load heaters. • 1 of each type of coil and contact.
Control Devices	• 1 of each type of push button pilot light and lens. • 1 spare rotational water flow paddle wheel. • 1 spare flow display/totalizer. • 1 spare flow switch.
Alarm Panel	• 1 alarm annunciator.
6 of each Fuses or Mini-breaker	• 2 of each relay and timer. • 1 of each relay and timer base.
Generator (Arctic Bay Only)	• Fuel filters (12) • Oil filters (12) • Oil 30 @ 4L • Belts • Air filters (18)
K Valves	• 1 spare of each type of valve.
Themostats	• 1 spare of each type of thermostat.
Heat Trace	• Spare controller • Spare thermostat
Miscellaneous	• Damper motors • Fan motors • Timers

Miscellaneous Equipment

1. Fire Extinguisher: One (1) Ansul A20E, Class ABC, UL listed, 9 kg capacity, external nitrogen cartridge Foray powder with wall mounting brackets. Mount on wall near exterior door.

2. Dustmasks: Fisher 11-875-54 disposable masks supply three(3) packs of 50 masks each.

3. Face Shield: One (1) Fisher 11-409-5, optically clear 1.5 mm polycarbonate shield with adjustable head band.

4. Gloves: Twelve(12) Fisher 11-394-30, large, extra long, heavyweight rubber gloves, 19 mm by 380 mm length.

5. Apron: One (1) Fisher 01-357 double coated abrasion resistant, rubberized cloth apron.

6. Fush Broom: One (1) Dustbane 403089, 600 mm wide, horse hair and synthetic bristle broom with handle.

7. Mop: One (1) Dustbane 481127, Syntex Flat size #20 with handle.

8. Mop Bucket and Wringer: One (1) Dustbane No. 2024X, 27 L, round, with Cam Squeezer Wringer.

9. Dust Pan: One (1) Dustbane No. 8 Hooded 300 mm.

10. Garbage Can: One (1) 100 L, galvanized, with cover.

11. Floor Cleaner: Dustbane No. 501379 Liquid cleaner, one (1) 20 L container.

12. Lighting: Two (2) fluorescent tubes and One (1) low temperature ballasts.

13. Storage Cabinet:

    1 Combination shelving/wardrobe unit.

    2 Two (2) doors.

    3 Four (4) half shelves.

    4 Pre-finished in grey.

    5 Standard of Acceptance: Par Equipment Ltd. Model No. 4273

14. Work Benches: (Supply one (1), 1200 mm x 760 mm x 825 mm high, heavy duty construction steel table, no shelves.

15. Cabinet Table: 610 mm x 610 mm x 860 mm high, 50 mm lip on three sides of top, locking cabinet door.

16. Stepstool: 400 mm diameter, treaded top, expanded step, one piece construction, anti-skid bottom with retractable castes.

17. Hand Winch: 1500 lbs. hand winch, 5,1:1 gear ratio.

18. Hach Kit Dr 100 c/w 1 year supply of consumables (100 pillows)

19. Hach pH Kit (Clyde River) c/w 1 year supply of consumables.

5.0 SUMMARY AND IMPLEMENTATION

Arctic Bay

The truckfill facility at Arctic Bay will consist of:

- A skid mounted building constructed on a 1.0 m thick well compacted granular pad.
- An intake pipeline constructed of a 300 mm HDPE casing pipe with 50 mm of insulation and protected with riprap.
- A intake screen, 6 kw pump, and 100 mm conveyance piping.
- Prime power will be by on site 11 kw diesel electric generator. On site fuel storage will be a 1,100 l tank mounted on the building skids.
- Freeze protection of the intakes will be by 2 self-limiting heat trace cables.
- The building will be constructed off site and be a cold stream building. Electric unit heaters will provide freeze protection.
- Disinfection will be by injection of calcium hypochlorite.
- The truckfill control will be from the truckfill arm, with one customer key.
- The alarm in the system will consist of:
  - Major
    - High building temperature
    - Generator failure
    - Low fuel level 2
  - Minor
    - Truckfill pump failure
    - Building low temperature
    - Low fuel level 1

Major alarms will be annunciated on site, and to the plant operator by auto dialler.

The estimated cost of construction for this facility is $550,000.00 GST and engineering not included. This estimate is based on the actual cost of construction for Lake Harbour, which is of similar construction.

The project is to go to tender in January 1997, with construction completed by November 1997.

Clyde River

The truckfill facility at Clyde River will consist of:

- A skid mounted building constructed on a 1.0 m thick well compacted granular pad.
- An intake pipeline constructed of a 300 mm HDPE casing pipe with 50 mm of insulation and protected with riprap.
- A intake screen, 6 kw pump, and 100 mm conveyance piping.
- Prime power will be by Grid power from NWTPC.
- Standby power will be by UPS system.
- Freeze protection of the intakes will be by 2 self-limiting heat trace cables.
- The building will be constructed off site and be of wood construction. Electric unit heaters will provide freeze protection.
- Disinfection will be by injection of calcium hypochlorite. Soda Ash will be supplied for possible pH control.
- The truckfill control will be from the truckfill arm, with one customer key.
- The alarm in the system will consist of
  - Major
    - High building temperature alarms
    - UPS failure with power on power off / UPS with less than 1 hour
  - Minor
    - Truckfill pump failure
    - Building low temperature
    - Power off / UPS on

Major alarms will be annunciated on site, and to the plant operator by auto dialler.

The estimated cost of construction for this facility is $380,000.00 GST and engineering not included. The power line to the facility is estimated to cost $95,000. This estimate is based on the annual cost of construction for Trout Lake, which is of similar construction. The estimate has been adjusted to the community location. The project is to go to tender in January 1997, with construction completed by November 1997.

APPENDIX A

GEOTECHNICAL REPORT ARCTIC BAY

AGRA
Earth & Environmental

AGRA Earth & Environmental Limited
135 Enterprise Road
P.O. Box 2245
Yellowknife, N.W.T.
X1A 2P7
Tel (403) 920-4140
Fax (403) 920-4402

January 16, 1995

File No. YX00387

M. M. Dillon Limited
201-5102 51 Street
Yellowknife, N.W.T.
X1A 1S7

Attention: Mr. Gary Strong, P.Eng.
Manager

Dear Sir:

Re: Report on Geotechnical Conditions
Water Supply Improvements
Arctic Bay, N.W.T.

This letter summarizes the results of a geotechnical investigation undertaken by AGRA Earth & Environmental Limited at two alternate sites for the proposed Water Supply Improvements and Truckfill Station in Arctic Bay, N.W.T.

1.0 TERMS OF REFERENCE

The Terms of Reference for the investigation, as outlined in the GNWT's Request for Proposal, and AGRA E&E's proposal of June 7, 1994 were to include:

- review available geotechnical information and examine aerial photographs;
- conduct a field investigation limited to test pits (with locally contracted equipment) in order to identify the soil and bedrock conditions at the proposed truckfill sites and turn-around areas;
- provide recommendations for the design and construction of the foundation for the pumphouse/truckfill station, water intake line, and armour rock/rip-rap; and,
- provide comments as to the availability of suitable granular materials in the community.

2.0 FIELD INVESTIGATION

The field investigation was conducted under the supervision of Mr. James Anklewich, P.Eng., of AGRA Earth and Environmental's Yellowknife Office. Mr. Gary Strong, P.Eng., of M. M. Dillon's (MMD) Yellowknife Office was also present during the field investigation. The field program included a visual recconaissance of the sites, excavating test pits in the vicinity of the proposed pumphouse/truckfill station, and inspection of potential granular borrow sources.

Asistance was provided by AGRA Earth and Environmental to MMD in conducting the topographic and bathometric surveys, the results of which are reported by M. M. Dillon separately.

The following sections summarize the geotechnical observations.

2.1 BACKGROUND

The hamlet of Arctic Bay receives its potable water from Marcil Lake, which is some 9 kilometres from the community toward Nanisivik. Two sites on Marcil Lake presently are being used for the water supply. The selection of sites is dependent on the season (that is, winter versus summer) as access to the relatively closer winter location is not available during the warmer periods of the year. The relative locations of the two sites, and the major topographic features of the general area are shown on Figure 1.1 attached to this letter-report.

As it is desired to have a single, all-season truckfill/water supply station, the objective of the present study was to provide an assessment of the geotechnical conditions at the respective sites. It is anticipated that the results of this assessment and the geotechnical recommendations contained herein would assist in the selection of a permanent facility. However, non-geotechnical considerations may govern the site selection.

3.0 SITE CONDITIONS

3.1 WINTER FILL LOCATION

3.1.1 Site Description

The winter fill site, which is situated furthest to the west, is accessed from the Arctic Bay-Nanisivik Road by an all-weather, narrow road over a distance of about 600 metres. Based on visual observations, the road was constructed by dozing local gravel materials from the slopes of an adjacent ridge on to the native tundra terrain which prevails along the lake shore at the winter fill location. The thickness of the road embankment was estimated to be in the order of 1 to 1.5 metres. The surface of the road is rutted extensively suggesting that the granular materials were not compacted during construction and that possible soft, unfrozen native soils exist beneath the fill.

In the winter time, the trucks must travel beyond the end of this road on the frozen tundra and ice for a distance of approximately 45 metres to the fill point on Marcil Lake. When thawing conditions exist, truck access to the fill point over the tundra and ice is not possible.

At the time of the field reconnaissance, the water level in the lake appeared to be raised (from winter levels) such that the truck fill location and the possible area for the proposed pumphouse was flooded. The ground surface of the possible pumphouse location is about 2 metres below the top of the access road. The adjacent tundra terrain above the water level in the lake was observed to be soft and spongy.

As noted above, the winter fill site and the access road lie adjacent to an elevated ridge, the height of which is in excess of 25 metres above the level of the road. The slopes of the ridge are inclined at at about 2H:1V and are underlain by coarse gravel beneath a thin cover of lichen and moss. On some slopes, the organic cover was stripped. The materials comprising the ridge are likely similar to that observed on an exposed portion of the ridge near the end of the existing access road (sand and gravel).

A substantial quantity of cobble and boulder sized rocks, some as large as 600mm diameter, have accumulated along a stretch of the shoreline in the vicinity of the proposed water intake line at the winter truckfill site. These rocks were piled along the lake shoreline to a height of 1 to 1.5 metres above the water level in the lake on that date (July 21/94). It is conceivable that the rocks piled against the shoreline were deposited by ice movements resulting from wave action and frost processes.

3.1.2 Subsurface Conditions

A single test pit was excavated near the end of the access road using a front end loader contracted from Enokseot Holdings of Arctic Bay. The soils observed at the test pit location generally consisted of a nominal 300mm thick cover of sandy, gravel fill underlain by a sand with a high silt content and scattered gravel sizes up to 150mm. Based on the relative ease of excavation by a loader, the gravel fill is considered to be loose. Organic soil inclusions were observed in the upper portions of the native soil. The native brown sand was observed to be saturated and in a loose state. Due to the fines content, the sand displayed a low plasticity.

Movement of the front end loader on the tundra immediately beyond the access road was difficult as it soon became bogged down in the saturated organic and sandy soils. Manoeuvring became increasingly difficult as the excavation proceeded, indicating that the native sand is somewhat sensitive to disturbance.

Groundwater seepage into the excavation was noted. After a period of several minutes, approximately 150mm of water was recorded. Frozen ground was encountered at a depth of 1 metre; however, the depth to frozen ground may be deeper in the immediate vicinity of the lake shoreline. The excavation was terminated at this depth and immediately backfilled.

3.2 SUMMER FILL LOCATION

3.2.1 Site Description

The summer fill location is located approximately 1 km east along the lake shore from the winter fill location. It is located some 150 metres away from the main road and is accessed by a sloping all-weather road. A turn-around pad is available for the trucks at the fill location. The existing summer fill location is not used during the winter due to the greater distance.

Drainage down the access road is poorly defined with the surface runoff flowing over the road in a random fashion. Several runoff gulleys have been created near the shoulders of the road.

Marcil Creek provides drainage of the uplands to the north and drains into Marcil Lake in the immediately vicinity of the fill location. Within approximately 100 to 150 metres upstream from the point of discharge at the lake shore, the river is braided with numerous wide and shallow channels. The soils in the vicinity of the point of discharge at the lake shore are generally rounded, gravel and cobble sizes with an abundance of particles exceeding 200mm to 300mm (boulders) in average diameter. The ground surface in this area is strewn with many such cobbles and boulders. Similar sizes of granular materials were noted in the water in the immediate vicinity of the shoreline.

At the time of the field reconnaissance (July 21/94), a considerable number of ice blocks were shoved on to the shoreline from the lake. At one location, which was situated approximately 30 metres southwest of the proposed fill location, the ice was pushed some 3 to 5 metres on to the shore. These blocks of ice were not observed the previous day, suggesting that the lake ice is relatively mobile during the breakup season.

3.2.2 Subsurface Conditions

Two test pits were excavated in the immediate vicinity of the proposed pumphouse location and turn-around pad. The soils encountered at these two test pit locations comprise a sandy gravel with a trace to little silt (less than 20 percent passing 0.075mm/#200 sieve screen). Cobble-sized materials (greater than 100mm diameter) were frequently noted in the test pits. The soils were moist to wet near the surface, but became saturated at a depth of approximately 500mm. Excavating beyond this depth was difficult as caving conditions prevailed in response to the groundwater seepage. Frozen ground was observed at a depth of 1 metre; however, the depth to frozen ground may be deeper in the immediate vicinity of the lake shoreline. The excavations were terminated at this depth and the test pits were immediately backfilled.

4.0 GRANULAR RESOURCES

Observations from the field reconnaissance indicate that suitable granular resources can be obtained at locations in the near vicinity of each proposed truck fill sites. Utilization of these natural gravelly materials would likely require that the boulders and cobbles be removed prior to transport and placement.

It is understood that a crusher operation was producing aggregate for the community in recent years at a location situated on a ridge to the northeast of the winter fill location. A sieve analysis on a sample indicates that the source is a reasonably well graded gravelly sand (25mm minus) with approximately 8 percent fines. Based on this result, the material would be suitable for the construction of the foundation pads for the truckfill/pumphouse.

5.0 RECOMMENDATIONS

5.1 PUMPHOUSE FOUNDATION

Based on the typical configurations at other truckfill sites, it is envisaged that the pumphouse for the truckfill station will consist of an insulated building of wood construction that is mounted on skids and supported on a compacted granular pad. Such a foundation is considered to be feasible for both of the proposed truckfill sites. It is not likely that other foundation types, such as piles (adfreeze or bedrock grouted) or spread footings would be necessary or economical.

It is conceivable that the new pumphouse building would be located in the immediate vicinity of the existing truckfill at the summer location and in the vicinity of the shoreline at the winter location. However, the actual location of the pumphouse at the selected site should be established with shoreline engineering input. The pumphouse must be positioned at locations where the safety of the structure would not be jeopardized by shoved ice blocks.

For both sites, the granular pad should be placed directly on the existing surface underlain by permafrost ground. The granular pad should be a minimum of 1 metre thick such that the annual depth of thaw is maintained within the granular pad and not in the native soils. At the winter location, the pad should be 1 to 1.5 metres thick and placed directly on the existing organic mat.

Backfill for pad construction should be a well graded gravel that is free of organics and compressible material. Ideally, the backfill should contain less than 5% fines (particles passing the 0.075mm/#200 screen) to reduce the potential for frost heave. The maximum particle size is dependent on the compactive equipment available for construction; however, in the absence of a specified value, a maximum size of 75mm is recommended.

At the existing truckfill location and approach pad at the summer location, which has been in use for several years, the surficial soils at this location are expected to be moderately

dense due to the daily truck traffic. Although the test pits did not encounter any "soft" spots or weak zones, such zones may still exist elsewhere in the near vicinity.

The gravel fill should be placed in lifts not exceeding 200 mm in loose thickness and should be compacted to at least 95% of standard Proctor maximum dry density (ASTM D698). The compacted fill pad should be placed a minimum of 2 metres beyond the perimeter of the building. To facilitate the recommended compaction of the gravel fill in the pad construction, a geotextile should be placed on the existing surface. The geotextile would act as a separator and minimize the potential of displacement of the gravel into the soft subgrade. The initial lift of gravel fill may be increased to 300mm, and spread over the geotextile with light tracked equipment.

The allowable soil bearing of a well compacted pad may be taken as 150 kPa. Long term settlement of the fill structure,. if constructed according to the above guidelines, may be expected to be in the order of 2% of the fill thickness. Monitoring of the construction of the granular pad would verify that good construction construction procedures are implemented and reduce the potential for differential settlement.

5.2 WATER INTAKE LINE AND EROSION PROTECTION

The potential ice forces and ice shove at the intake have been analyzed using the following data:

- a design wind speed of 85 kph. This is equivalent to the maximum hourly wind speed observed at Resolute Bay in July, when the breakup occurs. At Resolute, the maximum observed wind speeds in summer are consistently from the east, but the same value was assumed for the southeast exposure at the site.
- a fetch of 1 km from the southeast
- a beach slope of 1V:44H, based on the bathymetry data obtained during the site reconnaissance.

The 85 kph wind over the 1 km wide ice sheet would generate a force of 1.5 kN/m of shoreline. Assuming an ice thickness of 0.6

metres, such a force would push the ice almost 13 metres up the beach. Thicker ice may not be pushed as far. The ice shove could be greater than 13 m at exposed structures or points of land. If the pumphouse is located at A1 (bathymetry profile, as shown on Figure 1.3 attached), the site does not project into the lake and is in fact sheltered slightly by the adjacent shoreline. At this location, a setback of 13 metres is considered to be adequate to protect the pumphouse against ice shove.

If a location closer to the shoreline is desired, or for additional protection against ice forces, the pumphouse could be located northeast of A1 to take advantage of the shelter provided by the protruding shoreline between A1 and A2. Moving the site northeast would require a review of the bathymetry to verify that the mouth of the intake would have enough submergence to function under the assumed 2 metre ice thickness.

For the winter fill location, this 13 metre setback would be conservative, as the prevailing wind direction is from the east. A setback distance in the order of 10 to 13 metres is considered appropriate for the winter location.

To protect the intake pipeline against ice damage, it may be covered by a riprap berm. Details of the berm design are shown on the appended Figures 1, and 2. The riprap size is based on ice damage experienced at other site. The riprap should be angular in shape, and have an average diameter (D_{50}) of 400mm. It should consist of rock sizes from 200mm to 600mm diameter.

Although the riprap will provide a good degree of protection, it can not be considered to be immune to damage. Some maintenance is likely to be necessary because the berm protrudes from the shore and is therefore subject to much higher forces than the rest of the shoreline.

An alternative solution is to bury the pipeline for all or part of its length as shown on the appended Figure 3. Option 1, complete burial requires no riprap at all. In this case, the ice forces are not concentrated at the pipeline, but are spread out along the beach. Complete burial is preferable from the point of view of mitigating the effects of ice forces, but may have other

drawbacks related to disturbing the permafrost by trenching. Therefore, a second option, partial burial, is also presented. In this case, the above-ground portion of the pipeline is protected by a riprap berm. The berm does not extend into the lake and as such, it is easier to construct and requires much less riprap than the complete riprap protection.

This assessment was limited strictly to the assessment of ice shove. Other hydrotechnical issues which should be addressed are:

- the potential range of water levels which could occur on the lake and the impact of extremely high or low levels on the intake;
- wave effects on the shoreline and the design of wave erosion protection; and,
- design of the water intake.

AGRA Earth & Environmental would be pleased to address any of these issues and provide a hydrotechnical review of the proposed pumphouse and water intake on request.

5.3 SLOPE STABILITY

As stated in Section 2.2.1 above, the large ridge located at the winter fill location rises to an elevation in excess of 25 metres higher than the surrounding area with a slope angle that is locally as steep as 2H:1V. At this angle, the slope is stable with factors of safety against failure in the range of 1.4 to 1.5 or greater.

Any construction activities that would adversely affect the stability of the slope should be avoided. Examples of these activities would include, but are not limited to, the following:

- excavation or cuts near the toe of the slope;
- scraping the surficial materials from the slope, thereby creating a deeper zone of thaw; and,

- restricting active layer and surficial seepage along the slope by constructing, for example, a swale or berm immediately adjacent to the toe of the slope.

5.0 CLOSURE

We trust the foregoing is sufficient for your present purposes. Should any questions arise, please contact the undersigned at your convenience.

Yours truly,

AGRA Earth and Environmental Limited

REGISTERED PROFESSIONAL ENGINEER
J. L. ANKLEWICH
N.W.T.

THE ASSOCIATION OF PROFESSIONAL ENGINEERS, GEOLOGISTS and GEOPHYSICISTS OF THE NORTHWEST TERRITORIES
PERMIT NUMBER P 047
AGRA Earth & Environmental Limited

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Reviewed by:

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Senior Geotechnical Engineer

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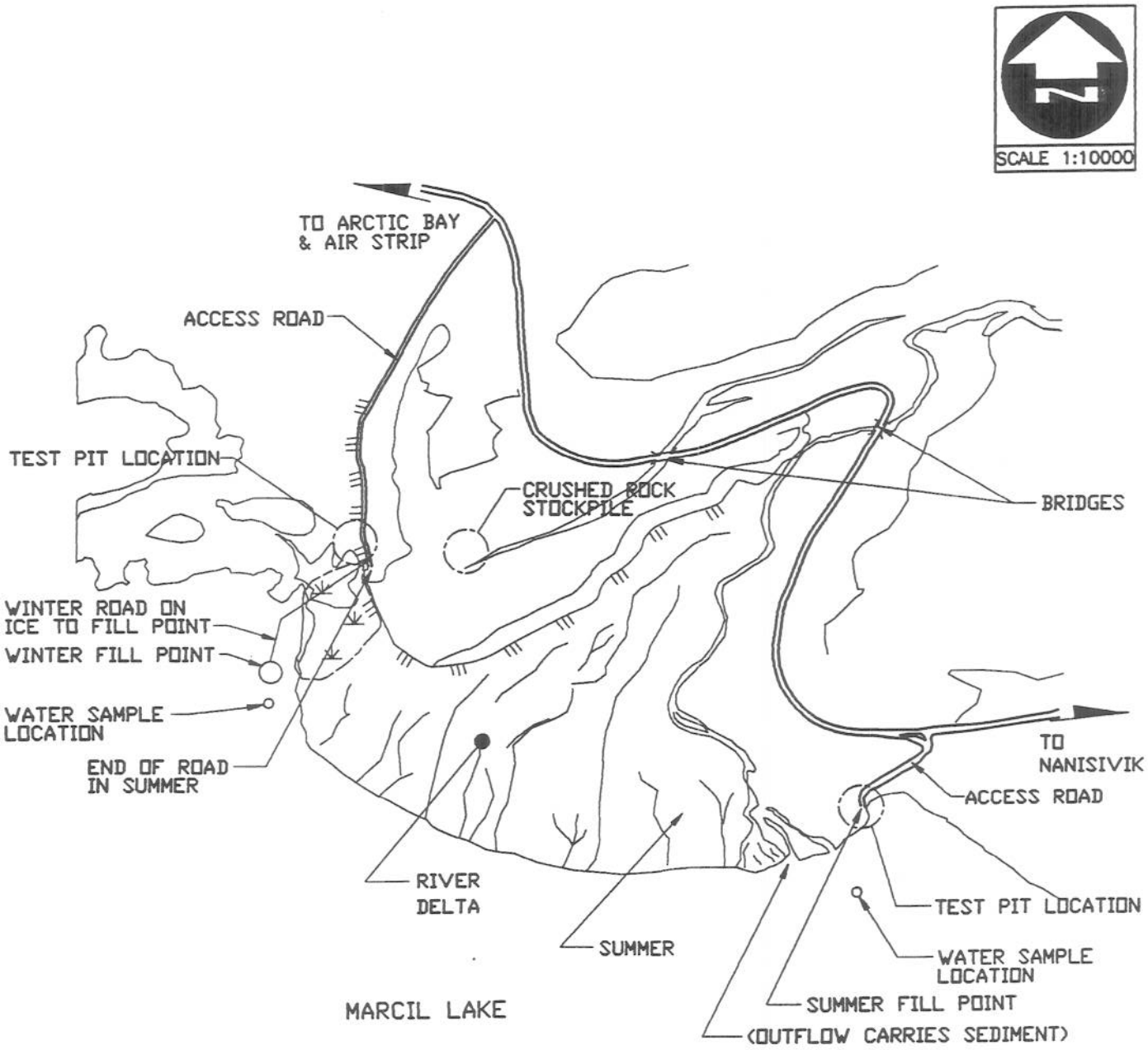
YX00387.REP

APPENDIX A



DILLON
Consulting Engineers · Planners
Environmental Scientists

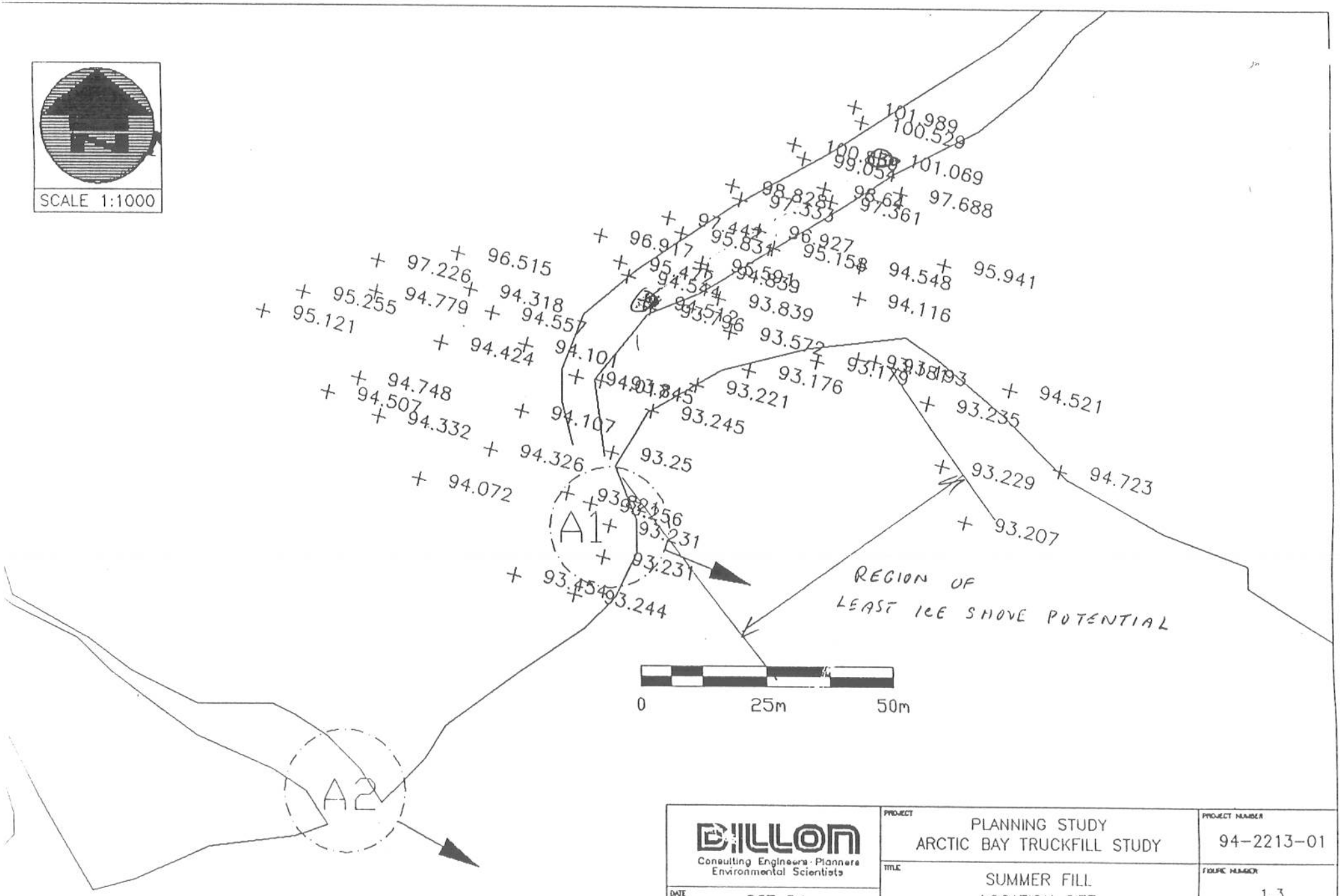
PROJECT
TRUCKFILL STATION PLANNING STUDY
ARCTIC BAY

PROJECT NUMBER
94-2213-01

TITLE
LOCATION PLAN

FIGURE NUMBER
1.1

DATE
OCT 94



BILLON Consulting Engineers · Planners Environmental Scientists	PROJECT: PLANNING STUDY ARCTIC BAY TRUCKFILL STUDY	PROJECT NUMBER: 94-2213-01
DATE: OCT 94	TITLE: SUMMER FILL LOCATION SITE	FIGURE NUMBER: 1.3

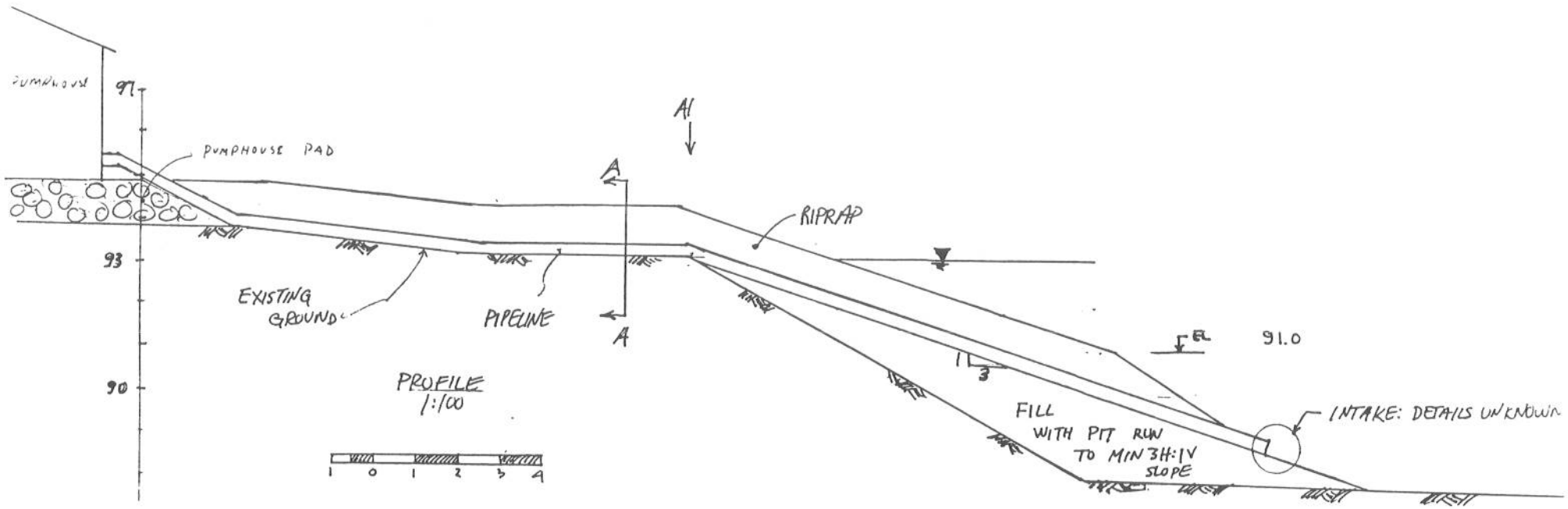


FIGURE 1

RIPRAP PROTECTION

AGRA
Earth & Environmental

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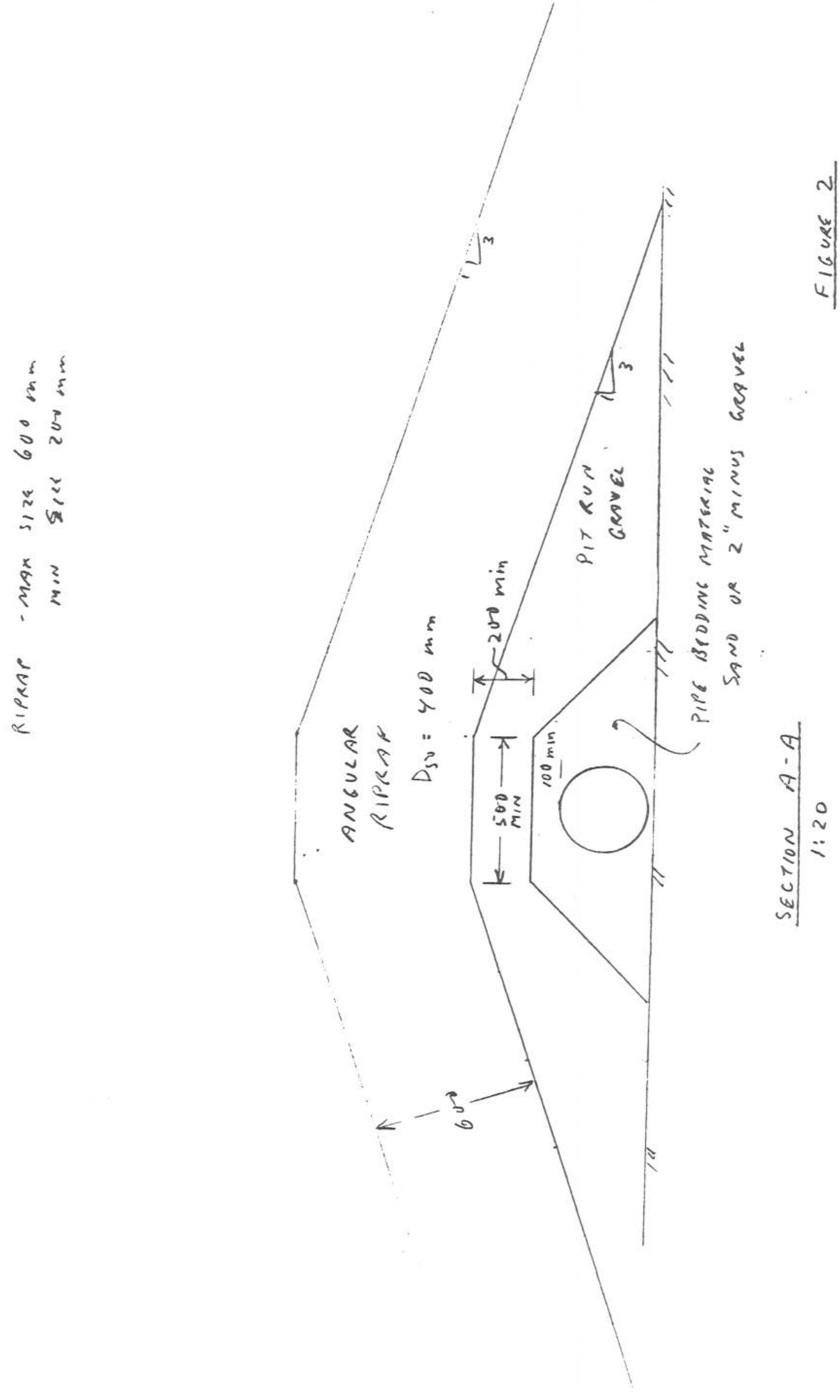

FIGURE 2

RIPRAP BERM DETAIL

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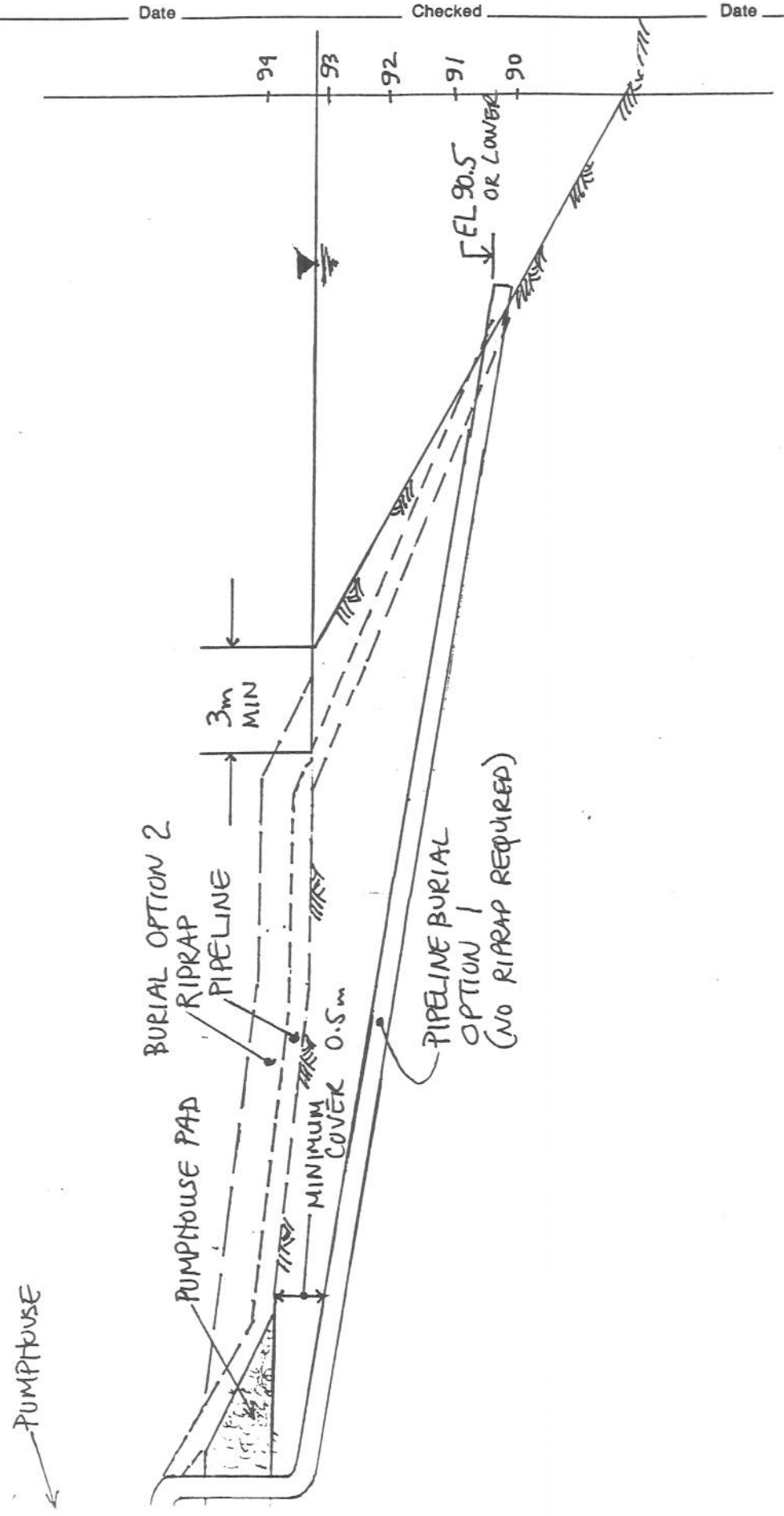

FIGURE 3
BURIAL OPTIONS

Option	Pros	Cons	Recommendations
Winter Intake Site	• If a road can be built to the high ground to the south (the ancient alluvial fan of the Marcil Creek), then the problems of the soft low-lying ground at the existing site can be overcome.	• The site is exposed to west and northwest winds, and resultant wave action and ice movement. The effects of wave and ice action are evident in the rocks and boulders piled up on the shoreline immediately south of the present winter water intake site.	Not the preferred site from a hydrotechnical standpoint. Geotechnical considerations dealing with the pump house and access road foundations would need to be overcome. Significant fill would need to be added to bring the pump house and road above the high water level of the lake. The site is prone to more significant wave and ice action than the summer site.
	• Water quality (suspended solids) may be at acceptable levels as there are no major streams entering the lake in the vicinity.	• The low-lying ground at the existing site is soft, and may be prone to inundation.	
		• Soft and low-lying ground conditions exist at the site, necessitating the importation of fill. (The winter site cannot be accessed in the summer, hence the summer fill site.)	
Summer Intake Site	• Generally firmer ground conditions appear to be available at this site, due primarily to the coarse bed material transported and deposited by Marcil Creek.	• The site is close to the mouth of Marcil Creek, which may result in water quality problems at the intake during peak runoff periods.	Recommended as the better site from a hydrotechnical standpoint, provided that water quality is acceptable. Of the local sites proposed, site A1 is preferred because of the separation from the mouth of Marcil Creek and the short distance to adequate depths.

Option	Pros	Cons	Recommendations
	• The site surveys indicate that adequate depths for the intake can be provided offshore.	• The input of coarse sediment from Marcil Creek may build up a delta which could affect the water intake, especially at site A2.	
	• The exposure of the site to wind and wave action appears to be less than for the winter site, because there is not the same accumulation of boulders along the shoreline. (the presence of the wind driven ice pile-up along the shoreline during the July 1994 site visit appears to have been a minor event, because the ice was well-candled and easily broken up, and therefore posed no significant danger to the shoreline or any structure.		
	• The site is only a short distance off the main all-weather road between Arctic Bay and Nanisivik.		

APPENDIX B

GEOTECHNICAL REPORT CLYDE RIVER

AGRA
Earth & Environmental

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December 21, 1994

File No. YX00388

M. M. Dillon Limited
201-5102 51 Street
Yellowknife, N.W.T.
X1A 1S7

Attention: Mr. Gary Strong, P.Eng.
Manager

Dear Sir:

Re: Report on Geotechnical Conditions
Water Supply Improvements, Clyde River, N.W.T.
MMD Reference 94-2214, MMD-GNWT Ref. SC320524

This letter summarizes the results of a geotechnical investigation undertaken by AGRA Earth & Environmental Limited (AGRA E&E) at the site of the proposed Water Supply Improvements and Truckfill Station in Clyde River, N.W.T.

1.0 TERMS OF REFERENCE

The Terms of Reference for the investigation, as outlined in AGRA E&E's proposal to M. M. Dillon of June 7, 1994 were to include:

- review available geotechnical information and examine aerial photographs;
- conduct a field investigation consisting of test pits (with locally contracted equipment) in order to identify the soil and bedrock conditions at the proposed truckfill sites and turn around areas;
- provide recommendations for the design and construction of the foundation for the pumphouse/truckfill station, water intake line, and armour rock/rip rap, and any site improvements, if required; and,

- provide comments as to the availability of suitable granular sources in the community.

2.0 PROJECT BACKGROUND

The hamlet of Clyde River receives its potable water from a lake which is approximately 1.6 kilometres northwest of the community. The lake has been chosen to fulfill the potable water supply needs of the community for the next 20 years. As such, a single, all-weather truckfill/pumphouse facility is required.

The truckfill station is understood to comprise the following:

- a pumphouse building of wooden construction with dimensions that are approximately 3.5m x 7.5m; it will be heated to +10°C;
- 300mm nominal diameter HDPE intake pipe will extend from the pumphouse to a depth in the order of 2 metres (design ice thickness); and,
- the intake line will be equipped with a heat trace line to reduce the potential for freezing; it will also be covered with 50mm of rigid foam insulation.

3.0 FIELD INVESTIGATION

The field investigation was conducted under the direct supervision of Mr. James Anklewich, P.Eng., of AGRA E&E's Yellowknife Office. Mr. Gary Strong, P.Eng., of M. M. Dillon's (MMD) Yellowknife Office was also present during the field investigation. The field program, which was conducted on July 26, 1994, included a visual reconnaissance of the site, excavation of test pits in the vicinity of the proposed pumphouse/truckfill station, and inspections of potential granular borrow sources.

The field program also included assisting MMD during the topographic and bathometric surveys, the results of which are reported by M. M. Dillon separately.

4.0 SITE CONDITIONS

4.1 PHYSICAL FEATURES

The subject lake is located in a natural depression with an elevation difference between lake level and the surrounding ridges being in the order of 7 to 10 metres. A second lake, which is located some 100 metres to the east, is approximately 6 metres higher in elevation and as such, drains into the subject lake. Based on the results of the topographic survey (reported by M. M. Dillon), the total area of the water shed affecting the subject lake is in the order of 50 hectares.

At the time of the field reconnaissance, the subject lake was clear of ice; however, the second lake still had a considerable amount of ice on the surface. A multibead thermoprobe was lowered into the water of the subject lake during the bathometric survey in order to establish the water temperature and confirm the presence of a thermocline. The thermoprobe data showed that the water was at a temperature of approximately +5°C (+/- 0.5°C) over the entire depth.

A nominal 3 metre wide and 75 metre long access road lies adjacent to portions of the south and east sides of the lake. The alignment of the road at this location is in an approximately north-south direction. At the approach to the lake, the top of the road is about 5.5 metres above the lake and gently slopes down to the location of the proposed new truckfill location, where the road surface is approximately 1 metre above the lake. The west bank of this access road (adjacent to the lake) has a slope angle of approximately 2.5H:1V. Although the bank appeared to be relatively stable at present, small cracks were observed in the road surface and were oriented parallel to the alignment of the road at a location where the top of the road is about 3 to 4 metres above the lake level. These cracks are indicative of movements of the active layer beneath the slope toward the water's edge (shoreline). These slope instabilities are likely attributed to saturated conditions of the active layer during prolonged rainfall whereby the unfrozen soil moves downwards over top of the frozen soil towards the shoreline.

At the most easterly edge of the lake, a 400mm diameter CMP culvert provides (outflow) drainage from the lake to the lower elevations to the east. Both inverts of the culvert, particularly the eastern invert, were noted to be damaged as a result of repeated vehicle traffic since minimal soil cover was observed on the culvert crowns. At the time of the site reconnaissance, the flow rate through the culvert was such that little to no sediment was being transported; however, several erosion scours were observed within 50 metres of the downstream invert of the culvert. These scours suggest that relatively high flow rates have occurred in the past, perhaps during peak runoff at spring thaw, or during prolonged rainfall.

4.2 SUBSURFACE CONDITIONS

A total of three test pits were excavated in the vicinity of the access road and truckfill location using a rubber-tired loader provided by the Hamlet of Clyde River. The test pits locations are shown on the attached Site Plan. The test pits were advanced to a depth of approximately 1 metre below existing grade whereupon frozen ground was encountered. Seepage from the active layer immediately above the permafrost table was observed in all of the test pits. The test pits were terminated at this depth and backfilled immediately.

The soils encountered at the test pit locations generally consisted of a fine to coarse grained, loose, brown sand overlying a brown, frozen silt. Thin beds of low plastic, brown silt were noted within the sand as well. Based on our experience elsewhere in the community, the deposit of silt observed at the 1 metre depth is expected to be ice rich and potentially unstable if allowed to thaw.

5.0 GRANULAR RESOURCES

AGRA Earth & Environmental previously reported on the availability of suitable granular materials in the community of Clyde River. The information was summarized in our June 11, 1993 letter to M. M. Dillon Ltd.

Based on a review of recent aerial photographs and available geotechnical data, several potential borrow deposits in the community were identified. All of the potential borrow sources identified, which are located in the vicinity of the existing airstrip, were reported to be poorly graded gravelly sands with a variable fines content (material passing 0.075mm/#200 sieve screen). These information is summarized in a letter to M. M. Dillon Ltd., dated June 11, 1993.

Sieve analyses were conducted on samples of granular materials, which were obtained by MMD field personnel and delivered to our Yellowknife laboratory. The results of these tests confirm that the samples are poorly graded, gravelly sands with a fines content varying from 10 percent to 22 percent. These results were reported in a letter dated July 26, 1993. The June 11, 1993 and July 26, 1993 letters are appended.

Other potential granular borrow sources exist in the immediate vicinity of the proposed truckfill station; however, the quantity remaining in these sources is not confirmed, nor has the quality of the material been identified. Moreover, it is uncertain whether the hamlet prefers to use the sources located near the airstrip or those located near the truckfill station. Regardless of which granular borrow source is chosen, samples of the materials should be shipped to our laboratories prior to construction in order to determine the specific construction criteria (standard Proctor density, grain size distribution).

6.0 RECOMMENDATIONS

6.1 PUMPHOUSE FOUNDATION

Based on AGRA E&E's past experience, it is envisaged that the pumphouse for the truckfill station will consist of an insulated building of wood construction that is mounted on skids and supported on a compacted granular pad. Such a foundation is considered to be feasible for the present truckfill site. It is not likely that other foundation types, such as piles (adfreeze or bedrock grouted) or spread footings would be necessary or economical.

It is likely that the new pumphouse building would be located in the immediate vicinity of the existing truckfill location. In such a case, the granular pad should be placed directly on the existing surface. The granular pad should be a minimum of 1 metre thick such that the summer depth of thaw is maintained within the granular pad and not the native soils.

Backfill for pad construction should be a well graded gravel that is free of organics and compressible material. Ideally, the backfill should contain less than 5% fines (particles passing the 0.075mm/#200 screen) to reduce the potential for frost heave. The maximum particle size is dependent on the compactive equipment available for construction; however, in the absence of a specified value, a maximum size of 75mm is recommended.

As the existing truckfill location and approach pad have been in use for several years, the surficial soils at this location are expected to be relatively dense due to the daily vehicular traffic; however, there may still exist localized "soft" spots, or zones of weaker material. As such, preparation of the existing surface should include proof-rolling with heavily loaded trucks. Where appreciable deflections are observed beneath the truck tires, the soils at this location should be subexcavated for a depth of at least 300mm and recompacted to a minimum of 95 percent of standard Proctor density.

All fill for the granular pad should be placed in lifts not exceeding 200 mm in loose thickness and should be compacted to not less than 95% of standard Proctor density. The compacted fill pad should be placed a minimum of 2 metres beyond the perimeter of the building. The bearing capacity of a well compacted pad may be taken as 150 kPa.

Long term settlement of the fill structure, if constructed according to the above guidelines, may be expected to be in the order of 1 to 2 percent of the fill thickness. However, if the granular pad is saturated prior to freezing, some heave can be expected during freezeback. For the minimum fill thickness specified above, potential heave in the order of 30mm to 40mm can be expected. Monitoring of the construction of the granular

pad would verify that high quality construction is maintained and would reduce the potential for differential settlement.

6.2 WATER INTAKE LINE AND EROSION PROTECTION

At the time of the field reconnaissance, strong southerly winds were noted. During the spring breakup, such winds could cause any large blocks of loose ice on the lake to be deposited onshore and could infringe on the pumphouse building. Hence, consideration should be given to selecting the final locations for the pumphouse intake facility.

The need for a protective berm is envisaged near the shoreline for the water intake line. It is anticipated that sufficient quantities of the larger diameter rocks (boulders) which are required for the armour rock are available in a neighboring borrow source in the near proximity of the proposed pumphouse location. Recommendations with respect to the extent of erosion protection and rip rap size can be provided on request, when the design profile details have been established.

6.3 STABILITY OF ROAD EMBANKMENT

As noted in Section 4.1 above, small cracks were observed in the surface of the road adjacent to the lake and were oriented parallel to the alignment of the road. These cracks are likely due to slope instabilities caused by displacement of the soil in the active layer downslope. The concern is that this portion of the road could continue to move and become increasingly unstable. Saturated soil conditions resulting from extended rainfall events, combined with strong winds and wave action on the toe of the slope, could result in undermining the road embankment and failure of a portion of the access road. Periodic regrading of the road and slope will be required as future instabilities and slope movements occur.

Consideration could be given to improving the stability conditions of this slope. The most feasible mitigating measure includes placing large diameter rocks (cobble and boulder sizes) along the shoreline, particularly at the toe of the road embankment. These large diameter rocks would effectively act as

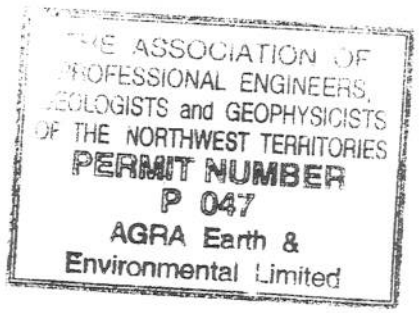
a toe berm and serve to provide restraint against any potential slope movements. Additionally, a suitable geotextile (filter fabric) could be placed between the existing soils on the slope and the overlying rip rap so that the potential for migration and washing of the soils from wave action is reduced.

6.0 CLOSURE

We trust the foregoing is sufficient for your present purposes. Should any questions arise, please contact the undersigned at your convenience.

Yours truly,

AGRA Earth and Environmental Limited

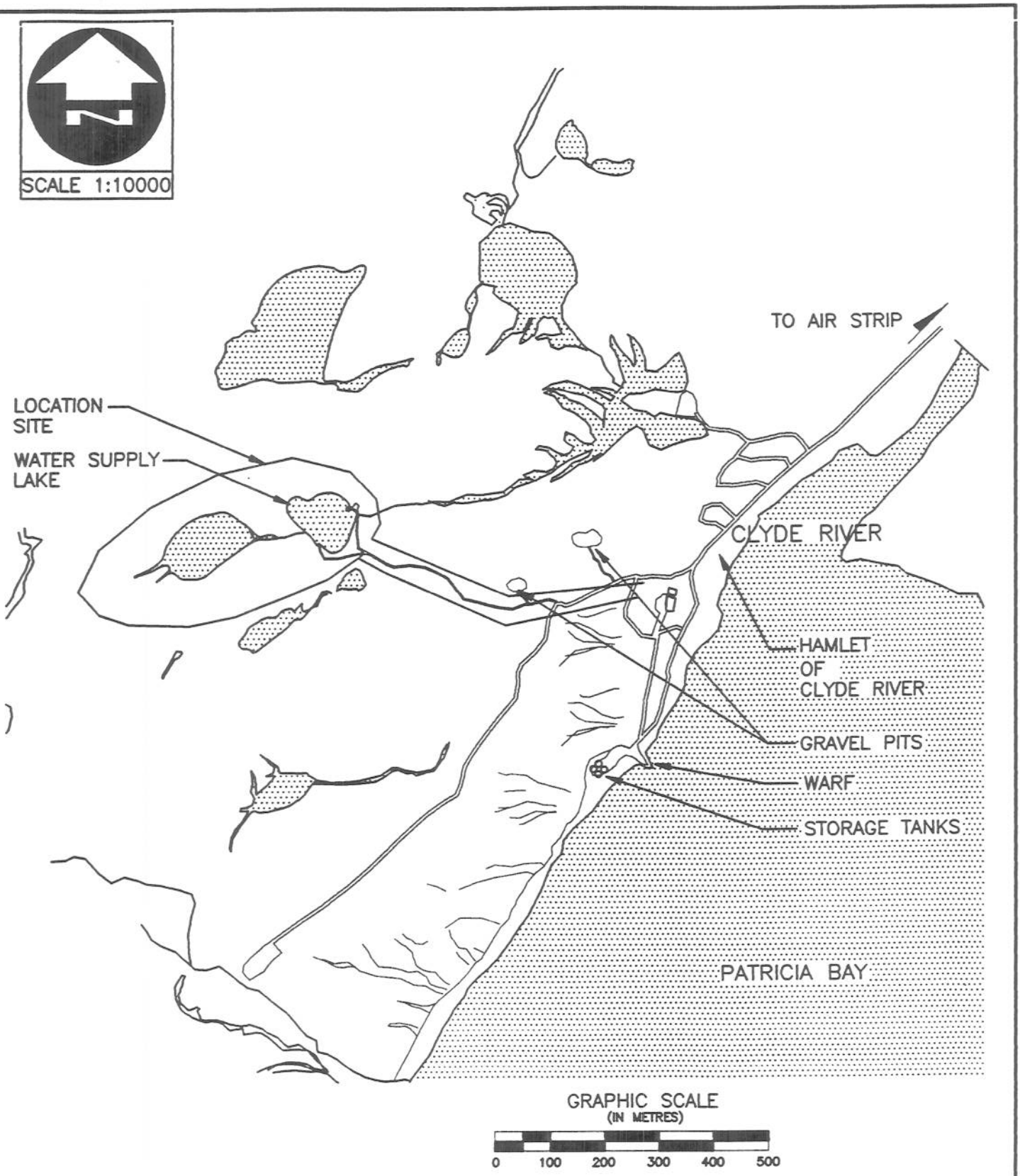


James L. Anklewich
Manager, Yellowknife Office

Reviewed by:

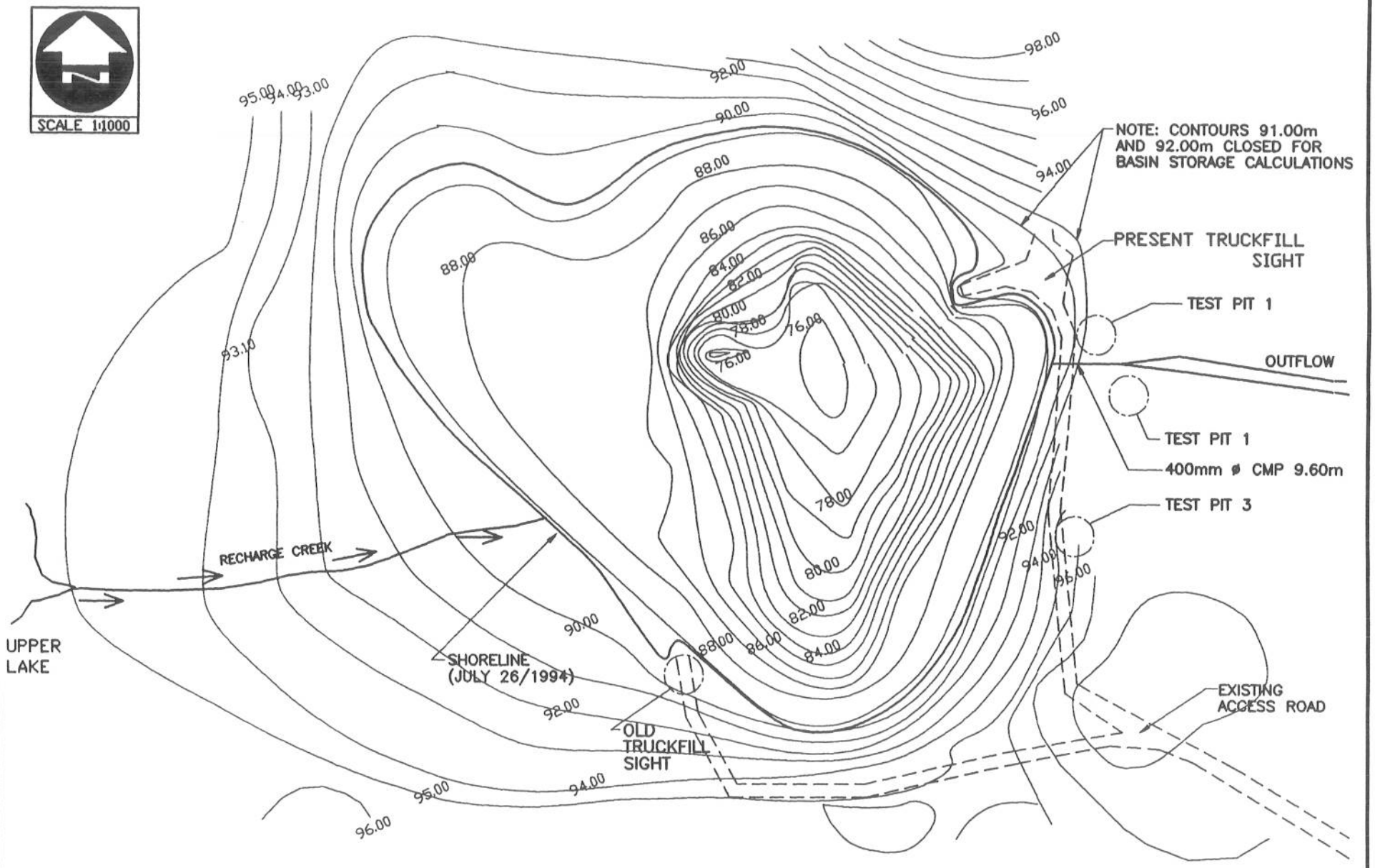
Marv J. Cherniawski, P.Eng.(Alberta)
Senior Project Engineer

YX00388.REP



DILLON
Consulting Engineers · Planners
Environmental Scientists

PROJECT: PLANNING STUDY		PROJECT NUMBER: 94-2214-01
TITLE: CLYDE RIVER TRUCKFILL STATION		FIGURE NUMBER: 1.2
DATE: AUG 94		



GRAPHIC SCALE
(IN METRES)

0 25 50 75 100

DILLON
Consulting Engineers · Planners
Environmental Scientists

DATE: AUG 94

PROJECT: CLYDE RIVER WATER SUPPLY ANALYSIS

PROJECT NUMBER: 94-2214-01

TITLE: WATER SUPPLY LAKE ELEVATIONS & CONTOURS

FIGURE NUMBER: 1.1

APPENDIX C

COST ESTIMATE DATA

Midnight Sun Energy
the remote power experts
5 Ellesmere Drive
Yellowknife, NT
873-8760 Fax 873-8768

FACSIMILE TRANSMISSION SHEET

TO: Gary Strong

FAX NO: 873-3328

FROM: Alex Hampson

DATE: Oct. 28/96

NUMBER OF PAGES INCLUDING COVER: 3

MESSAGE:

Hi Gary,

Here is the information you requested.

Cheers,

Alex.

Midnight Sun Energy
the remote power experts
5 Ellesmere Drive
Yellowknife, NT
873-8760 Fax 873-8768

~system design, sales and installation
~solar panels ~wind generators ~inverters ~ batteries ~water pumps
~hot water systems ~energy-efficient lighting ~other alternative energy products
~diesel generators ~gas generators ~heaters ~camp supplies ~ floating dock systems

Gary Strong
Dillon Engineering
Yellowknife, NT

October 28,1996

Gary:

Thanks for your call. Here are the specs on the Trace 4000W pure sine wave inverters. I have included some pricing based on the battery bank you specified.

QUANTITY	DESCRIPTION	UNIT PRICE	AMOUNT
2	Trace 4000W inverters	3995.00	7990.00
24	2V cells -1560Ahrs		11,900.00
	(2 sets of 12=3120Ahrs)		
	Other configurations are also available		

If you need further information on sizing , pricing or design, please give us a call any time.

Regards,
Alex. Hampson
Alex. Hampson

Model SW4024

POWER CONVERSION CENTER

A Revolution in Power Technology

The result of new ideas and technologies, the Trace Model SW4024 delivers sine wave power without compromise. Now sine wave output with high efficiency, high surge and low idle current is available. It is more than just the finest inverter, with three microprocessors and bi-directional power topology, it has features and capabilities that were previously either non-existent or available only as separate products.

From Trace Engineering, maker of the world's most reliable inverters

An advanced original and revolutionary design

Sine wave power without compromise

Inverter

- *Multiple step, low distortion, 4000 watt continuous sine wave output, 94% maximum efficiency.*
- *Units may be operated in series to provide 8000 watts at 240 vac, three wire, with optional series interface cable.*
- *Adjustable search mode circuit can reduce idle power to 1 watt.*
- *Current compensated, adjustable low battery cutout voltage. Adjustable low battery cut-in, high battery cutout and high battery cut-in voltages.*
- *Protection circuitry guards against over-current, short circuit, over temperature, low battery and high battery conditions.*

Battery Charger

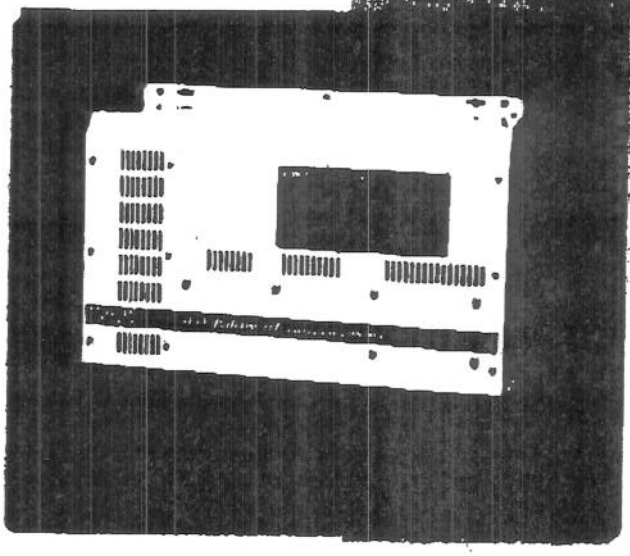
- *Continuous 120 amp rated. High efficiency, low current distortion design allows the use of smaller generators.*
- *Three stage, temperature compensated charging algorithm ensures maximum battery life. Remote battery temperature probe is standard.*
- *Adjustable temperature compensation, charge rate. LCD meter indicates, BULK VOLTS, FLOAT VOLTS and BULK DONE AMPS.*

When connected to grid or generator, the SW4024 synchronizes its waveform to that of the AC source, locks to it and operates in parallel. This ability, coupled with the bi-directional power topology and microprocessor control, makes it possible for the unit to offer multiple operating modes.

Generator Support Mode: *When charging from a generator, the generator's output voltage and current are monitored. If either falls below user adjustable limits, the unit sheds itself as a load and then reverses the power flow if necessary. This delivers energy from the batteries to the loads assisting the generator. When operating two units in series at 240 VAC, one 120 VAC leg can be charging while the other is supporting.*

Standby Power Mode: *Two AC inputs are provided - one for generator and one for utility grid. When AC falls, transfer to inverter power is no longer than 34 milliseconds. If the grid and generator are connected, the unit can be set to start the generator if the grid falls. After grid returns, the generator is automatically stopped. The inverter output is synchronized to the grid and the grid is reconnected to the loads.*

Battery Voltage Transfer Mode: *If the batteries are low, a current compensated low battery set point triggers connection to the grid. The charger operation may be enabled or disabled during grid connection.*



Generator Start Mode: *Extensive automatic generator start features are standard and user programmable. Gen start can be triggered by battery voltage, load size in amps or time of day. QUIET TIME can be set during which the generator is not allowed to start unless a MUST START override voltage is reached. WARMUP SECONDS, MAX CRANKING SECONDS and MAX STARTING ATTEMPTS are some of the user adjustable parameters.*

THE POWER COMPANY
Trace ENGINEERING

"I don't have enough house loads to find out what the limits of this baby are."
John C. Wiles, Research Engineer, Southwest Technology Development Institute

Model SW4024

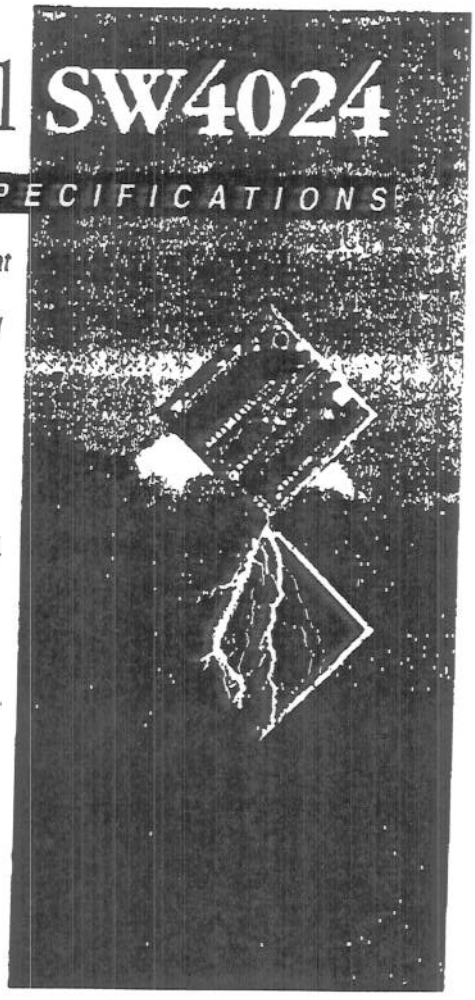
SPECIFICATIONS

Utility Interactive Mode: *Operating as a bi-directional battery charger, power from any source that tries to raise the batteries above their programmed float voltage is delivered to the grid. A GRID USAGE TIMER can be set to allow selling of electricity to the utility only during prescribed hours. Sell back current is adjustable.* ***Caution:*** *Utility intertie must have approval of local utility company.*

Peak Load Shaving Modes - *(1) The SW4024 may be programmed to operate from batteries only during a specified period of the day. Batteries may be charged during lower rate periods. (2) During a programmable time of the day, power is delivered to the grid from the batteries. An alternative (lower) adjustable float voltage is employed to allow variable battery discharge depths.*

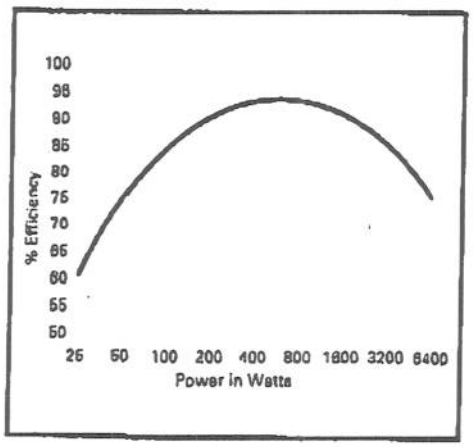
Three user adjustable voltage-controlled relays are provided to turn charging sources and loads on and off.

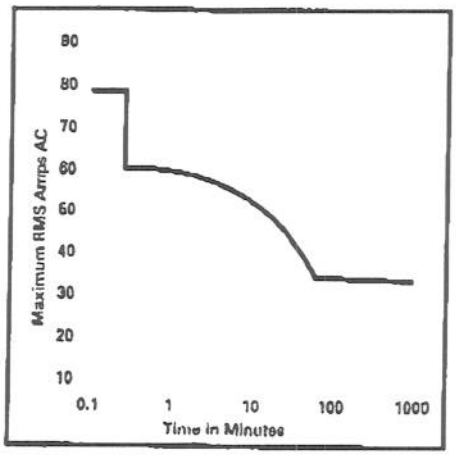
Selecting modes, enabling features and adjusting parameters are easily accomplished by moving thru a menu tree that is displayed on the control panel's LCD read-out. Doubling as a meter, the LCD will display INVERTER AMPS, INPUT AMPS, LOAD AMPS, BATTERY VOLTS DC and INVERTER VOLTS AC. Additionally, control panel LED's report the status of eight battery charger and AC input conditions.

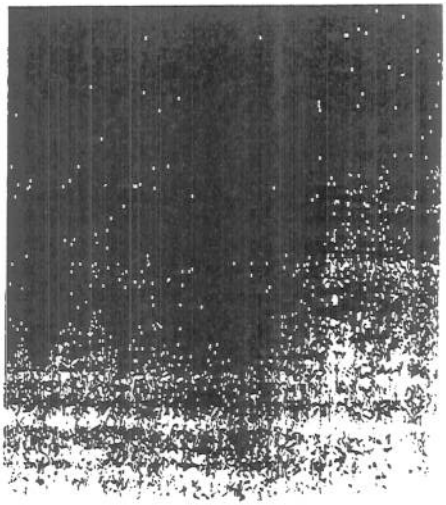


Specifications	Model SW4024	Model SW4048
Input Voltage	24 VDC	48VDC
Output Power	4000 watts	4000 watts
Surge Power	10,000 watts	10,000 watts
Output Voltage	120 VAC	120 VAC
Efficiency	94% maximum	94% maximum
Voltage Regulation	±2%	±2%

Output Voltage	120 VAC	120 VAC
Efficiency	94% maximum	94% maximum
Voltage Regulation	±2%	±2%
Frequency Regulation	±.04%	±.04%
Input Requirements		
Min Search Power	1 watt	1watt
Full Voltage	.66 amps	.33 amps
Rated Power	227 amps	113 amps
Distortion	3 to 5%	3 to 5%
Power Factor Allowed	1 to -1	1 to -1
Max. Charge Rate	120 amps	60 amps
Automatic Transfer Relay	60 amps	60 amps
Weight	105 lb	105 lb
Size	8"deep, 21"wide, 15.1"high	







THE POWER COMPANY
TRACE ENGINEERING
Available From:

*specifications may change without notice
Options: Remote control panel (SWRC), stacking interface cable (SWSI), conduit box for code approved DC input battery cables (SWCB).

Certified by ETL to meet Underwriters Laboratories specification UL1741 (residential use).

Approved by Warnock Hersey to Canadian specification CSA-C222 No. 107.1.

Printed on recycled paper

DILLON
Consulting Engineers • Planners
Environmental Scientists

Telephone Discussion Record

Call to: Bill Slater From: Gary Strang

Organization: Adco Date: 29/Oct/96

Phone No. 403-465-3265 File No. 96-3817

Project: Arctic Bay + Clyde

Regarding: Costs

Adco completed the Lake Harbour TF plus others

- cost saving to build in south

$200/man day (Accom)
$60/man day wages
$260

Total of 60 site man days can be saved plus 10 flights

- Total savings ⇒ $45k to $50K.

- If Building cladding can be put on after ~~=~~ does shipping hassels -

- Bill willing to help us costs various Building types

Signed: G Strang

MMD-154-67 (Rev. 3)

DILLON
Consulting Engineers • Planners
Environmental Scientists

Telephone Discussion Record

Call to: Midnight Sun From: Gary Strong

Organization: _____ Date: Oct 28/96

Phone No. _____ File No. 96-3817

Project: _____

Regarding: UPS.

- 4000 watt inverter can be stacked
- $4,200 each
- Use 2 volt industrial batteries
  - 24 Volt system
  - 12 batteries/per set
- At 3000 amp hours needs 2 sets of batteries.
-

± $ 20,000

Signed: _____

MMD-154-67 (Rev. 3)

DILLON
Consulting Engineers • Planners
Environmental Scientists

Telephone Discussion Record

Call to: _____ From: Gary Strang

Organization: Prairie Chem Inc Date: Oct 23/96

Phone No. 403-452-6000 File No. 96-3817

Project: Arctic Bay and Clyde River Truckfill

Regarding: Disinfectant Prices.

Looking for disinfectant prices

Sodium in 12% 22.7 liter non returnable
in flats of 24 → $17.71 each

- shelf life - end of 90 days Strength will decrease
- can not be frozen (can stand ± 70°C)

Normally fly Calcium - 65% available

Calcium - 2.5kg plastic Bottles
- Cases of 9
- $133.20 / case.

Signed: _____

MMD-154-67 (Rev. 3)

DILLON
Consulting Engineers · Planners
Environmental Scientists

Telephone Discussion Record

Call to: Grahamedwards From: Gary Strong

Organization: ~~First~~ A Petrua Canada Date: 23 Oct/96

Phone No. 403-250-2650 File No. 96-3817

Project: Arctic Bay & Clyde River

Regarding:

- $50 to $60 per tank for Calcium
- Pump stays the same
- total system is ±$200 to delete the tank from the system.
- The use of sodium is common, it doesn't present a problem to the system.

Signed:

MMD-154-67 (Rev. 3)

FACSIMILE COVER SHEET

M. M. Dillon Limited
#201, 5102 - 51 St.
Yellowknife, NWT, X1A 1S7
Phone: (403) 920 - 4555
Fax: (403) 873 - 3328

TO COMPANY: Transport Nanuk
FAX NO.: 1-514-523-7875
ATTENTION: John
DATE: Oct 23
FROM: Gary Strong
TIME:
DILLON PROJECT NO.: 96-3817
TOTAL PAGES SENT (including this page): 1

MESSAGE

Re Shipping Rate:

I'm looking for "budget $", just
years will be fine to ship
material to Arctic Bay and
Clyde River.

Fairly large kg and Volume

Call or fax information to my
attention @ F 403 873-3328
call 920-4555

Thanking you in advance

G Strong

DILLON
Consulting Engineers • Planners
Environmental Scientists

Telephone Discussion Record

Call to: John Lepine From: Gary Strong

Organization: Transport Date: Oct 25/96

Phone No. 514 - 597-0186 File No. 96 3817

Project: Arctic and Clyde River Truck fill stations

Regarding: Sea lift Costs.

The rate for bulk material to the communities is as follows.

Clyder River $379 /tonne or $379 / 2.5 m3

Arctic Bay $384/tonne or $384 /2.5 m3

If a large quantity is being shipped the rate would be closer to $350/tonne on 2.5 m3

Signed: GS

MMD-154-67 (Rev. 3)

GARY

Bradley Air Services Ltd
carrying on business under the
firm name and style of FIRST AIR

DOMESTIC SCHEDULED TARIFF
12th Revised Page 87
cancels
11th Revised Page 87

FROM **YELLOWKNIFE - YZF** **TO**

FOR PICK-UP & DELIVERY SERVICES SEE PAGES 89 - 92

BROUGHTON ISLAND YVM
RTG 7F YFB 7F
DELIVERY N/A

RATE	KG	$/KG	PIVOT
GEN	MIN	31 00	4
GEN	1	7 33	41
GEN	45	6 71	196
GEN	200	6 59	459
GEN	500	6 06	
PRI	MIN	48 00	4
PRI	1	9 90	41
PRI	45	9 06	196
PRI	200	8 90	459
PRI	500	8 18	
ENV	MIN	25 00	

CAMBRIDGE BAY YCB
RTG 7F DIRECT
DELIVERY N/A

RATE	KG	$/KG	PIVOT
GEN	MIN	25 00	9
GEN	1	2 52	43
GEN	45	2 46	198
GEN	200	2 44	497
GEN	500	2 43	
PRI	MIN	39 00	11
PRI	1	3 40	43
PRI	45	3 32	198
PRI	200	3 29	497
PRI	500	3 28	
ENV	MIN	12 50	
SCR	MIN	25 00	
#16	1	1 89	13

CAPE DORSET YTE
RTG 7F YFB 7F
DELIVERY N/A

RATE	KG	$/KG	PIVOT
GEN	MIN	31 00	4
GEN	1	6 87	41
GEN	45	6 26	195
GEN	200	6 13	457
GEN	500	5 61	
PRI	MIN	48 00	5
PRI	1	9 27	41
PRI	45	8 45	195
PRI	200	8 28	457
PRI	500	7 57	
ENV	MIN	25 00	

CLYDE RIVER YCY
RTG 7F YSR 7F YIO 7F
DELIVERY N/A

RATE	KG	$/KG	PIVOT
GEN	MIN	31.00	3
GEN	1	8 16	42
GEN	45	7 79	198
GEN	200	7 72	495
GEN	500	7.65	
PRI	MIN	48 00	4
PRI	1	11 02	42
PRI	45	10.52	198
PRI	200	10 42	495
PRI	500	10.33	
ENV	MIN	25 00	

CORAL HARBOUR YZS
RTG 7F YFB 7F
DELIVERY N/A

RATE	KG	$/KG	PIVOT
GEN	MIN	31 00	3
GEN	1	8.16	41
GEN	45	7 44	194
GEN	200	7 23	436
GEN	500	6.31	
PRI	MIN	48 00	4
PRI	1	11 02	41
PRI	45	10 04	194
PRI	200	9 76	436
PRI	500	8.52	
ENV	MIN	25 00	

FORT RESOLUTION YFR
RTG 7F DIRECT
DELIVERY PAGE 89

RATE	KG	$/KG	PIVOT
GEN	MIN	25 00	21
GEN	1	1 15	189
GEN	200	1 09	
PRI	MIN	32 00	20
PRI	1	1 55	189
PRI	200	1 47	
ENV	MIN	20 00	

FORT SIMPSON YFS
RTG 7F DIRECT
DELIVERY INCLUDED

RATE	KG	$/KG	PIVOT
GEN	MIN	25 00	16
GEN	1	1 52	180
GEN	200	1 37	
PRI	MIN	32 00	15
PRI	1	2 05	180
PRI	200	1 85	
ENV	MIN	20 00	

GJOA HAVEN YHK
RTG 7F DIRECT
DELIVERY N/A

RATE	KG	$/KG	PIVOT
GEN	MIN	31 00	10
GEN	1	3 02	42
GEN	45	2 88	197
GEN	200	2 84	496
GEN	500	2 82	
PRI	MIN	48 00	11
PRI	1	4 08	42
PRI	45	3 89	197
PRI	200	3 83	496
PRI	500	3 81	
ENV	MIN	20 00	
SCR	MIN	31 00	
#16	1	2 27	13

HALL BEACH **YUX**
RTG 7F YSR 7F
DELIVERY N/A

RATE	KG	$/KG	PIVOT
GEN	MIN	31 00	4
GEN	1	6 35	43
GEN	45	6 10	198
GEN	200	6 04	494
GEN	500	5.97	
PRI	MIN	48 00	5
PRI	1	8 57	43
PRI	45	8 24	198
PRI	200	8 15	494
PRI	500	8 06	
ENV	MIN	25 00	

HAY RIVER YHY
RTG 7F DIRECT
DELIVERY PAGE 89

RATE	KG	$/KG	PIVOT
GEN	MIN	25 00	18
GEN	1	1 35	182
GEN	200	1.23	
PRI	MIN	32.00	17
PRI	1	1 82	182
PRI	200	1 66	
ENV	MIN	20 00	

HOLMAN YHI
RTG: 7F DIRECT
DELIVERY N/A

RATE	KG	$/KG	PIVOT
GEN	MIN	31.00	7
GEN	1	3 94	40
GEN	45	3.58	161
GEN	200	2 89	442
GEN	500	2.56	
PRI	MIN	48 00	9
PRI	1	5 32	40
PRI	45	4 83	161
PRI	200	3 90	442
PRI	500	3 46	
ENV	MIN	20.00	
SCR	MIN	31 00	
#16	1	2 96	10

IGLOOLIK YGT
RTG ~~2F YSA 7F~~ 4 7 YB 3 7F
DELIVERY N/A

RATE	KG	$/KG	PIVOT
GEN	MIN	31 00	4
GEN	1	6 35	43
GEN	45	6 10	198
GEN	200	6 04	494
GEN	500	5 97	
PRI	MIN	48 00	5
PRI	1	8 57	43
PRI	45	8 24	198
PRI	200	8 15	494
PRI	500	8 06	
ENV	MIN	25 00	

IQALUIT YFB
RTG 7F DIRECT
DELIVERY PAGE 89

RATE	KG	$/KG	PIVOT
GEN	MIN	25 00	6
GEN	1	4 01	39
GEN	45	3 54	194
GEN	200	3 44	427
GEN	500	2 94	
PRI	MIN	39 00	7
PRI	1	5 41	39
PRI	45	4 78	194
PRI	200	4 64	427
PRI	500	3 97	
ENV	MIN	12 50	
SCR	MIN	25 00	
#16	1	3 01	8

KIMMIRUT YLC
RTG 7F YFB 7F
DELIVERY N/A

RATE	KG	$/KG	PIVOT
GEN	MIN	31 00	5
GEN	1	5 41	40
GEN	45	4 85	195
GEN	200	4 74	446
GEN	500	4 23	
PRI	MIN	48 00	6
PRI	1	7 30	40
PRI	45	6 55	195
PRI	200	6 40	446
PRI	500	5 71	
ENV	MIN	25 00	

KUGLUKTUK YCO
RTG 7F DIRECT
DELIVERY N/A

RATE	KG	$/KG	PIVOT
GEN	MIN	25 00	13
GEN	1	1.91	39
GEN	45	1 67	197
GEN	200	1 65	493
GEN	500	1 63	
PRI	MIN	39 00	15
PRI	1	2 58	39
PRI	45	2 25	197
PRI	200	2 23	493
PRI	500	2.20	
ENV	MIN	12 50	
SCR	MIN	25 00	
#16	1	1 62	15

KUUJJUAQ YVP
RTG. 7F YFB 7F
DELIVERY PAGE 90

RATE	KG	$/KG	PIVOT
GEN	MIN	26.00	4
GEN	1	5 36	40
GEN	45	4 79	194
GEN	200	4 67	443
GEN	500	4.14	
PRI	MIN	48 00	6
PRI	1	7 24	40
PRI	45	6 47	194
PRI	200	6 30	443
PRI	500	5.59	
ENV	MIN	12 50	

LUTSEL K'E YSR
RTG: 7F DIRECT
DELIVERY PAGE 90

RATE	KG	$/KG	PIVOT
GEN	MIN	25 00	18
GEN	1	1 73	180
GEN	200	1 20	
PRI	MIN	32 00	17
PRI	1	1 80	180
PRI	200	1 62	
ENV	MIN	20 00	

MONTREAL YMQ
RTG. 7F YFB 7F
DELIVERY PAGE 90

RATE	KG	$/KG	PIVOT
GEN	MIN	26.00	4
GEN	1	6 32	40
GEN	45	5 70	177
GEN	200	5 06	489
GEN	500	4 95	
PRI	MIN	48 00	5
PRI	1	8 53	40
PRI	45	7 70	177
PRI	200	6 83	489
PRI	500	6 68	
ENV	MIN	12 50	

ISSUED
1996 June 15

ISSUED BY. G R PLEXMAN
DIRECTOR MARKETING SUPPORT SERVICES
CARP, ONTARIO K0A 1L0

EFFECTIVE
1995 July 01

Bradley Air Services Ltd
carrying on business under the
firm name and style of FIRST AIR

DOMESTIC SCHEDULED TARIFF
8th Revised Page 88
cancels
7th Revised Page 88

FROM **YELLOWKNIFE - YZF** **TO**

FOR PICK-UP & DELIVERY SERVICES SEE PAGES 89 - 92

NANISIVIK YSR

RTG 7F DIRECT
DELIVERY N/A

RATE	KG	$/KG	PIVOT
GEN	MIN	26 00	6
GEN	1	3 83	42
GEN	45	3 63	198
GEN	200	3 61	497
GEN	500	3 59	
PRI	MIN	48.00	9
PRI	1	5 17	42
PRI	45	4 90	198
PRI	200	4 87	497
PRI	500	4 85	
ENV	MIN	12 50	

OTTAWA YOW

RTG 7F DIRECT
DELIVERY PAGE 91

RATE	KG	$/KG	PIVOT
GEN	MIN	25.00	4
GEN	1	6 32	40
GEN	45	5 70	177
GEN	200	5 05	489
GEN	500	4 95	
PRI	MIN	48 00	5
PRI	1	8 53	40
PRI	45	7 70	177
PRI	200	6 83	489
PRI	500	6 68	
ENV	MIN	12 50	

PANGNIRTUNG YXP

RTG. 7F YFB 7F
DELIVERY N/A

RATE	KG	$/KG	PIVOT
GEN	MIN	31 00	4
GEN	1	6.34	40
GEN	45	5 77	195
GEN	200	5 63	454
GEN	500	5 12	
PRI	MIN	48 00	5
PRI	1	8 56	40
PRI	45	7 79	195
PRI	200	7 60	454
PRI	500	6 91	
ENV	MIN	25 00	

PELLY BAY YBB

RTG: 7F DIRECT
DELIVERY N/A

RATE	KG	$/KG	PIVOT
GEN	MIN	31.00	8
GEN	1	3.77	42
GEN	45	3.59	198
GEN	200	3.56	492
GEN	500	3.51	
PRI	MIN	48.00	9
PRI	1	5.09	42
PRI	45	4.85	198
PRI	200	4.81	492
PRI	500	4 74	
ENV	MIN	20.00	
SCR	MIN	31.00	
#16	1	2.83	10

POND INLET YIO

RTG: 7F YSR 7F
DELIVERY N/A

RATE	KG	$/KG	PIVOT
GEN	MIN	31 00	5
GEN	1	5.30	43
GEN	45	5.07	198
GEN	200	5.03	495
GEN	500	4.98	
PRI	MIN	48 00	6
PRI	1	7 16	43
PRI	45	6.84	198
PRI	200	6.79	495
PRI	500	6 72	
ENV	MIN	25 00	

[redacted]

RANKIN INLET YRT

RTG 7F YFB 7F
DELIVERY PAGE 91

RATE	KG	$/KG	PIVOT
GEN	MIN	31 00	4
GEN	1	6 75	38
GEN	45	5 80	189
GEN	200	5 50	440
GEN	500	4 84	
PRI	MIN	48 00	5
PRI	1	9 11	38
PRI	45	7 83	189
PRI	200	7 43	440
PRI	500	6 53	
ENV	MIN	25 00	

RESOLUTE BAY YRB

RTG 7F DIRECT
DELIVERY N/A

RATE	KG	$/KG	PIVOT
GEN	MIN	26.00	8
GEN	1	3.02	37
GEN	45	2 55	185
GEN	200	2 37	474
GEN	500	2 25	
PRI	MIN	48 00	11
PRI	1	4 08	37
PRI	45	3 44	185
PRI	200	3 20	474
PRI	500	3 04	
ENV	MIN	12 50	

TALOYOAK YYH

RTG. 7F DIRECT
DELIVERY N/A

RATE	KG	$/KG	PIVOT
GEN	MIN	31 00	9
GEN	1	3.40	42
GEN	45	3.23	198
GEN	200	3.21	493
GEN	500	3 17	
PRI	MIN	48 00	10
PRI	1	4 59	42
PRI	45	4.36	198
PRI	200	4 33	493
PRI	500	4 28	
ENV	MIN	20 00	
SCR	MIN	31.00	
#16	1	2 55	12

VAL D'OR YVO

RTG 7F YFB 7F
DELIVERY N/A

RATE	KG	$/KG	PIVOT
GEN	MIN	26 00	4
GEN	1	6.32	40
GEN	45	5.70	173
GEN	200	4.95	500
GEN	500	4.95	
ENV	MIN	12 50	

WHA TI YLE

RTG 7F DIRECT
DELIVERY PAGE 92

RATE	KG	$/KG	PIVOT
GEN	MIN	25 00	22
GEN	1	1 13	187
GEN	200	1 06	
PRI	MIN	32 00	20
PRI	1	1 53	187
PRI	200	1 43	
ENV	MIN	20 00	

WHITEHORSE YXY

RTG 7F DIRECT
DELIVERY PAGE 92

RATE	KG	$/KG	PIVOT
GEN	MIN	25 00	16
GEN	1	1 55	186
GEN	200	1 44	
PRI	MIN	32 00	16
PRI	1	2.09	186
PRI	200	1 94	
ENV	MIN	20.00	

DELIVERIES

KUUJJUAQ 8.00/ over 16kg 10.00
[redacted]
RANKIN INLET 8.00/over 61 .13 per kg
WHA TI 8.00
WHITEHORSE 8.00/ over 50kg 8.00+ 0.05 per kg
HAY RIVER 10.00 2.5Kg -
16.00 over 50Kg
Sch Env 40 2.5kg

ISSUED
1996 June 15

ISSUED BY. G R PLEXMAN
DIRECTOR. MARKETING SUPPORT SERVICES
CARP. ONTARIO K0A 1L0

EFFECTIVE
1996 July 01

DILLON
Consulting Engineers · Planners
Environmental Scientists

Telephone Discussion Record

Call to: Dan Rate From: Gary Stacey

Organization: Best Tech Date: Oct/28/96

Phone No. 1-905-564-7655 File No. 96-3817.

Project: Arctic Bay + Clyde River

Regarding: UPS Systems

Run time -

- need 6 KW for 60 min
- will run for 48 mins
- Put on EBP9F - ~~93~~ 73 mins @ 5 KW
  12.5 KVA - 27 mins @ or 5 dy ± 60 mins @ 6 KW
  - @ 0.2 KW - 269 mins (4 or 5 hours)
- what is power requirements -
- $ for Supply. Best $12,448.00 F.O.B. Mississauga
  Battery $5,239.00
  $17,700.00
- Dimensions,
  Battery Pack included. → 3' high x 19" wide, x 32" deep - 580 lbs
  30" high x 15" wide x 32" deep - 1002 lbs

Signed: G Stacey

MMD-154-67 (Rev. 3)

APPENDIX D

SAMPLE CALCULATIONS

CHLORINE SAMPLE CALCULATION

Parameters

1 ppm C1 residual is required.

Sodium Hypochlorite is 12% available C1

Calcium Hypochlorite is 65% available C1

Year 1 **Arctic Bay** **24,000 m^3**

This requires 24 L of C1

i.e. (24,000 x 1 x 10^{-6} x 1000)

24 L of C1 requires 200 L (or 200 Kg) of Calcium Hypochlorite

Year 2

Requires

325 L (or 325 Kg) of Sodium Hypochlorite

Using Calcium Totals are: Year 1 - 37 Kg
Year 2 - 60 Kg

discount rat 0.08
Residual Cl 5.0E-07

Design Year	Litres of Cl
0	11.8
1	12
2	12.3
3	12.6
4	12.95
5	13.3
6	13.65
7	14
8	14.4
9	14.75
10	15.1
11	15.5
12	15.9
13	16.3
14	16.75
15	17.15
16	17.6
17	18.05
18	18.6
19	19.05
20	19.55

Calculation of Chlorine Costs on Annual basis

	Sodium Hypochloride							Calcium Hypochloride						
Litres Required	Supply Cost	Transport	Maintenanc	Operation	Total Annua	Present value	Kilograms	Supply Cost	Transport	Maintenanc	Operation	Total Annua	Present val
98.3	76.7	398.4	500.0	40.0	1015.1	1015.1	18.2	107.5	7.0	500.0	520.0	1134.4	1134.4
100.0	78.0	405.2	500.0	40.0	1023.2	947.4	18.5	109.3	7.1	500.0	520.0	1136.4	1136.4
102.5	80.0	415.3	500.0	40.0	1035.3	887.6	18.9	112.0	7.3	500.0	520.0	1139.3	1139.3
105.0	81.9	425.5	500.0	40.0	1047.4	831.4	19.4	114.8	7.4	500.0	520.0	1142.2	1142.2
107.9	84.2	437.3	500.0	40.0	1061.5	780.2	19.9	117.9	7.7	500.0	520.0	1145.6	1145.6
110.8	86.5	449.1	500.0	40.0	1075.5	732.0	20.5	121.1	7.9	500.0	520.0	1149.0	1063.9
113.8	88.7	460.9	500.0	40.0	1089.6	686.7	21.0	124.3	8.1	500.0	520.0	1152.4	988.0
116.7	91.0	472.7	500.0	40.0	1103.7	644.0	21.5	127.5	8.3	500.0	520.0	1155.8	917.5
120.0	93.6	486.2	500.0	40.0	1119.8	605.0	22.2	131.2	8.5	500.0	520.0	1159.7	852.4
122.9	95.9	498.1	500.0	40.0	1133.9	567.2	22.7	134.3	8.7	500.0	520.0	1163.1	791.6
125.8	98.2	509.9	500.0	40.0	1148.0	531.8	23.2	137.5	8.9	500.0	520.0	1166.4	735.1
129.2	100.8	523.4	500.0	40.0	1164.1	499.3	23.8	141.2	9.2	500.0	520.0	1170.3	682.9
132.5	103.4	536.9	500.0	40.0	1180.2	468.7	24.5	144.8	9.4	500.0	520.0	1174.2	634.4
135.8	106.0	550.4	500.0	40.0	1196.3	439.9	25.1	148.5	9.6	500.0	520.0	1178.1	589.3
139.6	108.9	565.6	500.0	40.0	1214.5	413.5	25.8	152.6	9.9	500.0	520.0	1182.4	547.7
142.9	111.5	579.1	500.0	40.0	1230.6	387.9	26.4	156.2	10.1	500.0	520.0	1186.3	508.8
146.7	114.4	594.3	500.0	40.0	1248.7	364.5	27.1	160.3	10.4	500.0	520.0	1190.7	472.8
150.4	117.3	609.5	500.0	40.0	1266.8	342.4	27.8	164.4	10.7	500.0	520.0	1195.1	439.4
155.0	120.9	628.1	500.0	40.0	1289.0	322.6	28.6	169.4	11.0	500.0	520.0	1200.4	408.7
158.8	123.8	643.3	500.0	40.0	1307.1	302.9	29.3	173.5	11.3	500.0	520.0	1204.8	379.8
162.9	127.1	660.1	500.0	40.0	1327.2	284.8	30.1	178.1	11.5	500.0	520.0	1209.6	353.1
						12054.8							16063.2

4.0 SCHEMATICS AND FUNCTIONAL DATA

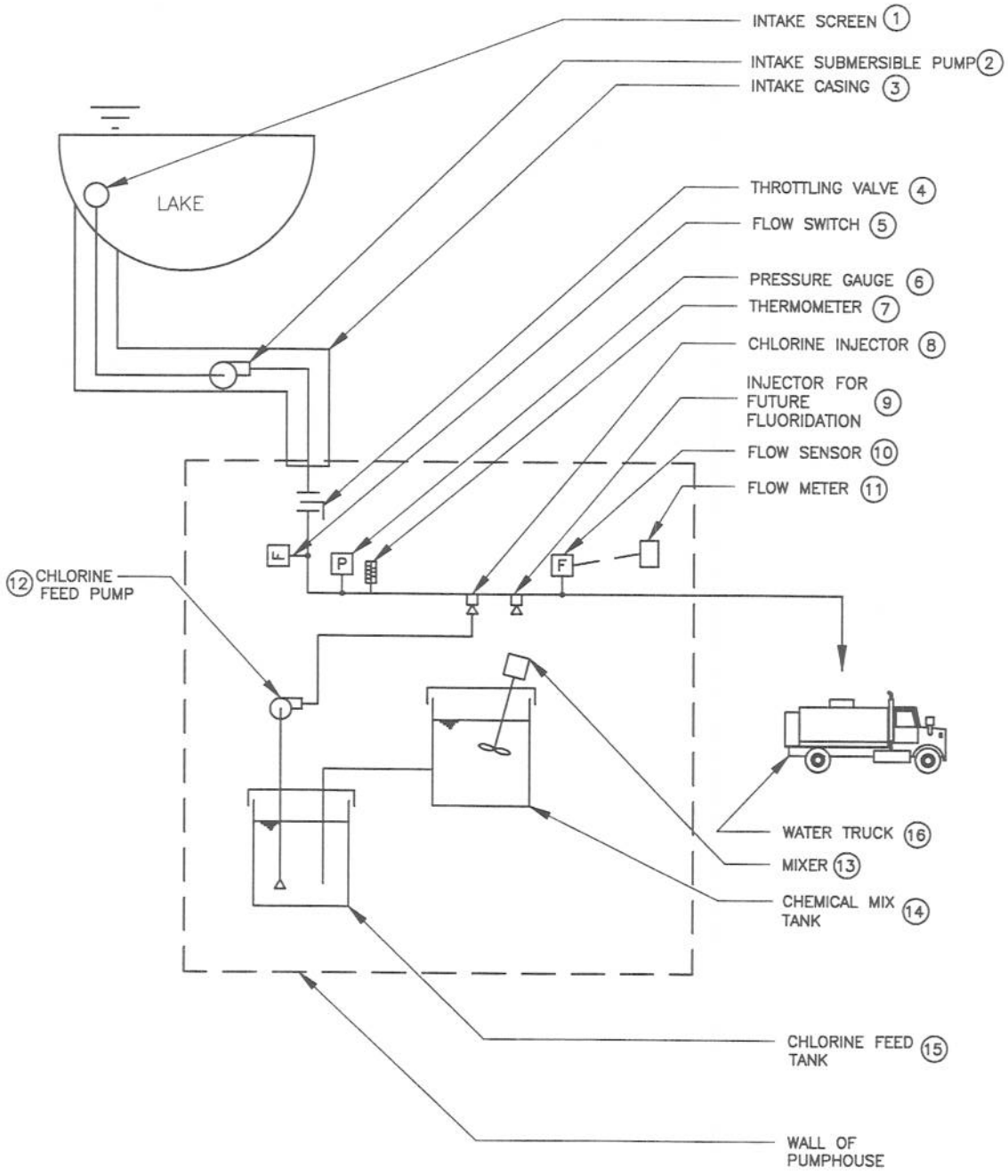
4.1 General

Chapter 4 contains tables and sketches that list components and a short description of their function.

For each system in the plant, there is a Table listing each component, it's function and cross references to the attached Figure and the Manufacturer's data in Chapter 9.

Six (6) systems are shown:

	Table	Figure
Water Treatment System	4.1	4.1
Power Distribution System	4.2	4.2
Controls and Alarms	4.3	4.3
Intake Casing, Pipe, and Cables	4.4	4.4
Heat Trace System	4.4	4.4, 4.5
Fuel Supply System	4.5	4.6



PROCESS SCHEMATIC

NTS

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DILLON CONSULTING

PROJECT	ARCTIC BAY TRUCKFILL ARCTIC BAY, NT
TITLE	WATER TREATMENT SYSTEM
PROJECT NUMBER	96-3817
DATE	JUNE 98
FIGURE NUMBER	4.1

ARCTIC BAY TRUCKFILL
ARCTIC BAY, NT

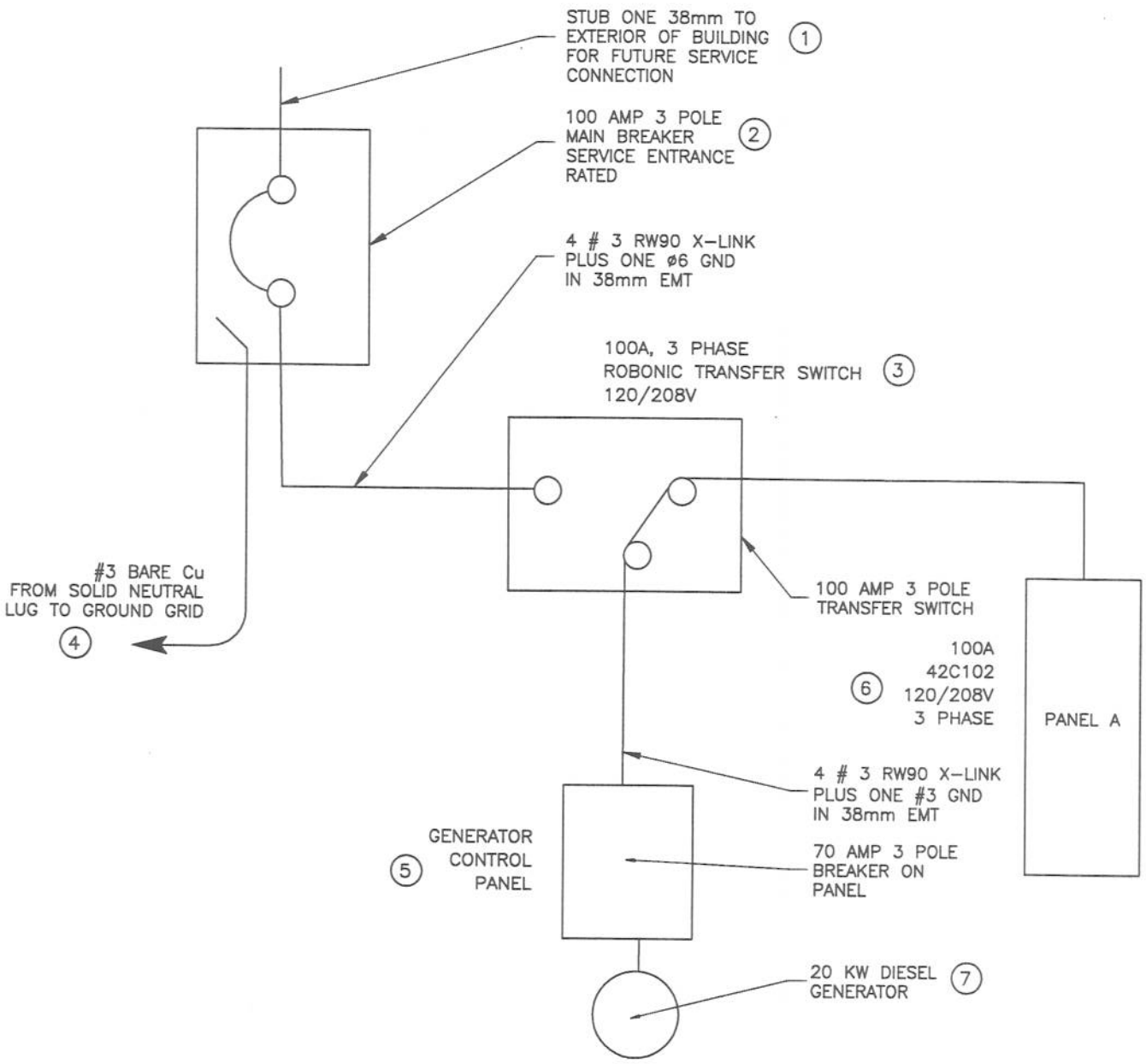
WATER TREATMENT SYSTEM
TABLE 4.1

Figure	No.	Section 9 Tab	Component	Function	Remarks
4.1	1	9.1	Intake Screen	Prevents larger solids from entering intake line and submersible pump	Stainless Steel Drum Screen
4.1	2	9.2	Submersible Pump	Pumps water from lake through intake pipe for treatment and distribution	Submersible 150 mm Diameter centrifugal pump, 7.5 HP, mounted on skid. Spare pump supplied.
4.1	3	9.1	Intake Casing	Screen flanged to casing. Casing houses and protects intake line and submersible pump.	Casing is insulated 300 mm Diameter DR17 HDPE pipe.
4.1	4	9.1	Throttling Valve	Control flow rate of water being pumped through system	Butterfly Valve
4.1	5	9.9	Flow Switch	Activates chlorine feed pump in a flow condition. Deactivates pump in no-flow condition	-
4.1	6	9.3	Pressure Gauge	Measures the water's gauge pressure in the system piping	-
4.1	7	9.3	Thermometer	Measures water's temperature	-
4.1	8	-	Chlorine Injector	Allows chlorine to be injected into raw water. Does not allow raw water into chlorine line.	-
4.1	9	-	Future Fluoridation Injector	For future fluoridation system	-
4.1	10	9.9	Flow Sensor	Paddle wheel that turns proportional to the flow rate. Connected to flow meter and accumulator.	-
4.1	11	9.3	Flow Meter	Displays flow rate of system	Flow Meter/Accumulator housed in control panel.

ARCTIC BAY TRUCKFILL
ARCTIC BAY, NT

WATER TREATMENT SYSTEM
TABLE 4.1

Figure	No.	Section 9 Tab	Component	Function	Remarks
4.1	12	9.4	Chlorine Feed Pump	Pumps chlorinated stock from feed tank to raw water in system piping.	Positive displacement pump with adjustable stroke and rate.
4.1	13	9.4	Mixer	Physically mixes calcium hypochlorite and water for treating raw water.	Neptune 120 V, 1/20 HP agitator.
4.1	14	9.4	Chemical Mix Tank	Vessel used to mix calcium hypochlorite and water for treating raw water.	Translucent plastic tank with lid.
4.1	15	9.4	Chemical Feed Tank	Stores mixed stock of calcium hypochlorite and water for injection into raw water.	Translucent plastic tank with lid.
4.1	16	-	Water Truck	Delivers treated water	-



POWER DISTRIBUTION SYSTEM

NTS

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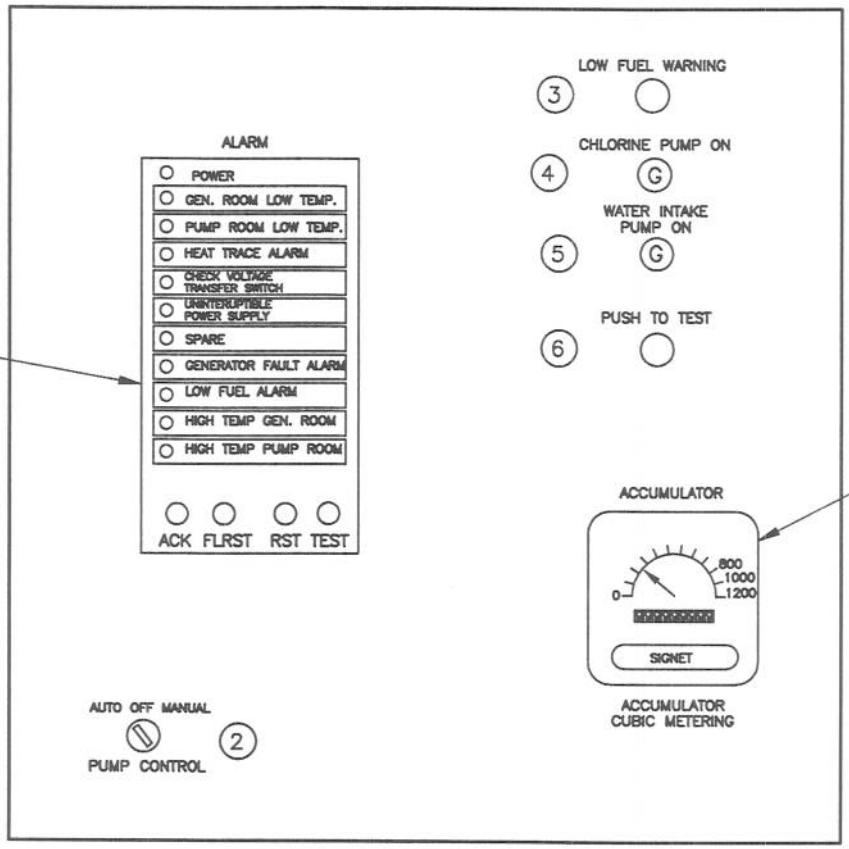
DILLON CONSULTING

PROJECT: ARCTIC BAY TRUCKFILL ARCTIC BAY, NT	PROJECT NUMBER: 96-3817
TITLE: POWER DISTRIBUTION SYTEM	DATE: JUNE 98
	FIGURE NUMBER: 4.2

ARCTIC BAY TRUCKFILL
ARCTIC BAY, NT

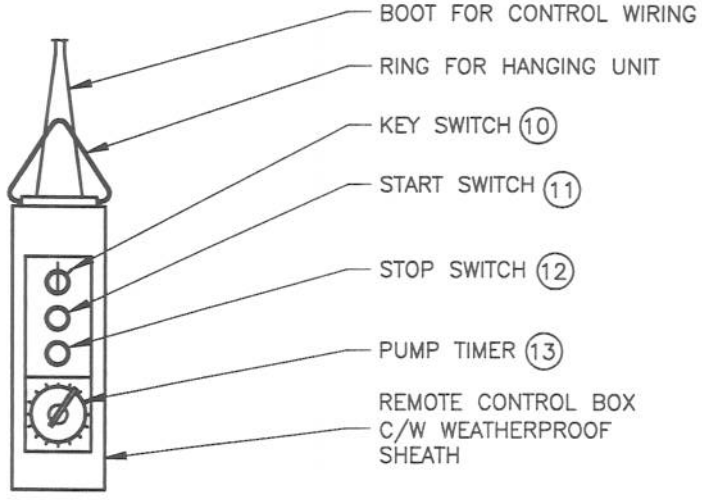
POWER DISTRIBUTION SYSTEM
TABLE 4.2

Figure	No.	Section 9 Tab	Component	Function	Remarks
4.2	1	-	For Future Connection to Overhead line	Future Suppy of Main Power to Pumphouse.	-
4.2	2	-	Main Breaker	Main Throw Switch for Future Service Connection	-
4.2	3	9.7	Transfer Switch	Future Function is to Switch between Service Power and Emergency Generator Power	-
4.2	4	-	Ground Bus	Provides grounding connections for breaker panel and intake pump.	-
4.2	5	9.7	Generator Control Panel	Control and Alarms relating to Generator including Breaker	-
4.2	6	9.6	Combination Disconnect/Breaker Panel	Facilitates circuit connections for pumphouse.	-
4.2	7	9.7	Generator	Produces Power for Operating Truckfill Station	-



CONTROL PANEL ①

NTS



REMOTE CONTROLLER ⑨

NTS

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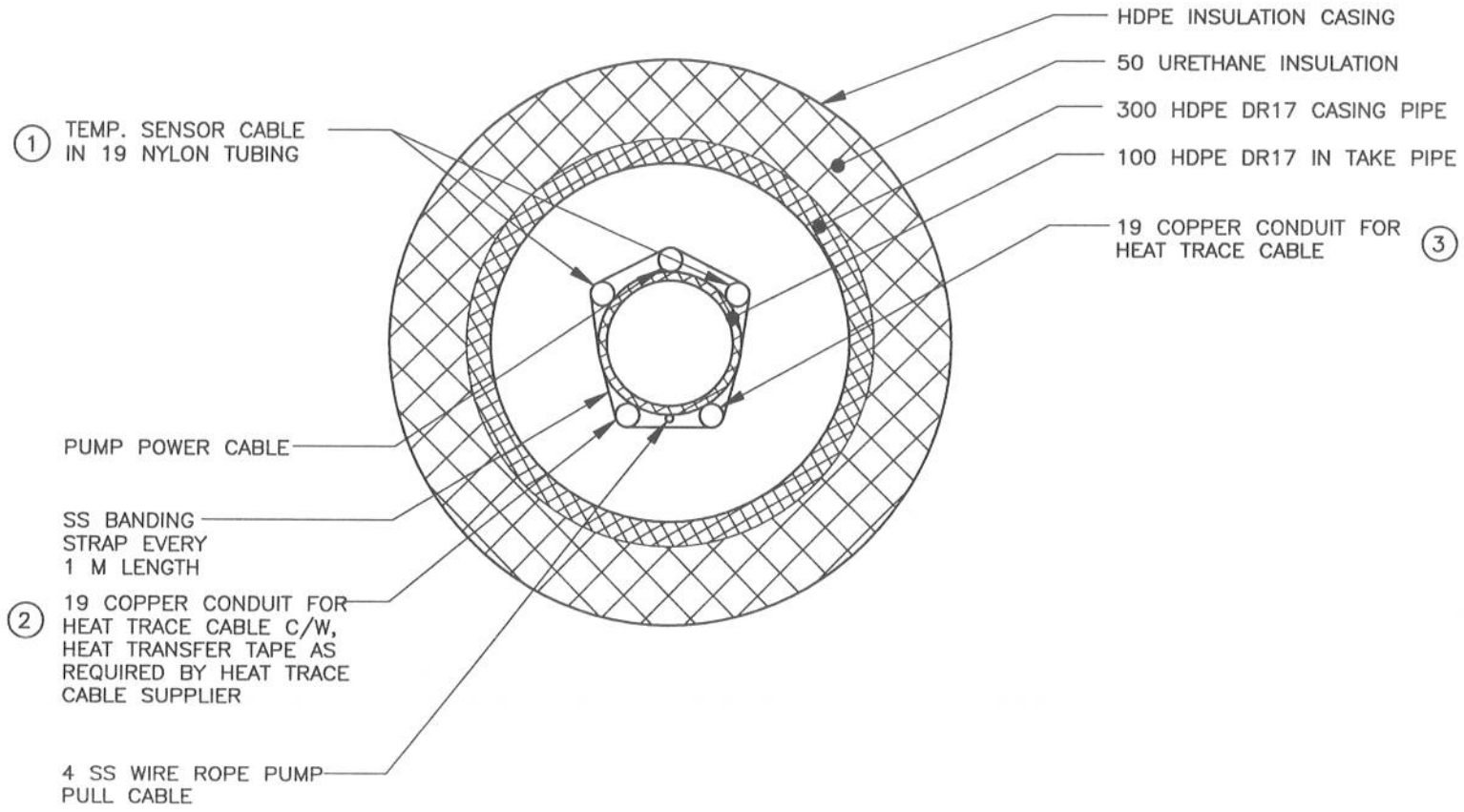
DILLON CONSULTING

PROJECT	ARCTIC BAY TRUCKFILL ARCTIC BAY, NT
TITLE	CONTROLS AND ALARMS
PROJECT NUMBER	96-3817
DATE	JUNE 98
FIGURE NUMBER	4.3

ARCTIC BAY TRUCKFILL
ARCTIC BAY, NT

CONTROLS AND ALARMS
TABLE 4.3

Figure	No.	Section 9 Tab	Component	Function	Remarks
4.3	1	9.9	Control Panel	Houses flow gauge/accumulator, alarm annunciator, pilot lights, pump control, and pump control switch.	-
4.3	2	9.9	Pump Control Switch	Switch is used to enable pumping mode — automatic, manual, or off.	-
4.3	3	9.9	Low Fuel Warning Light	Turns on when fuel sensor detects a low fuel level.	Set at 50% minor, and 30% major.
4.3	4	9.9	Chlorine Pump Pilot Light	Turns on when chlorine pump is activated.	-
4.3	5	9.9	Water Intake Pump Pilot Light	Turns on when submersible intake pump is activated.	-
4.3	6	9.9	Push to Test	Tests the alarms circuit by activating the strobe light, and horn.	-
4.3	7	9.1	Panalarm Annunciator	Allows operator to respond and control alarm conditions that occur with truckfill station.	-
4.3	8	9.3	Flow Gauge/ Accumulator	Displays flow rate and cumulative flow of water pumped through system.	-
4.3	9	9.9	Remote Controller	Allows water truck operator to fill truck without having to enter pumphouse.	Located on truckfill arm. Comes with weatherproof sheath.
4.3	10	9.9	Key Switch	Closes circuit allowing operator to start or stop the truckfilling process.	-
4.3	11	9.9	Start Switch	Pushing button starts truckfilling process, provided that key switch is turned on.	
4.3	12	9.9	Stop Switch	Pushing button stops truckfilling process, provided that key switch is turned on.	
4.3	13	9.9	Pump Timer	Timer may be set to run pump for period of time. Stop switch will interrupt timer setting, and stop the filling process.	Automates filling process. Different sized trucks will have different fill times.



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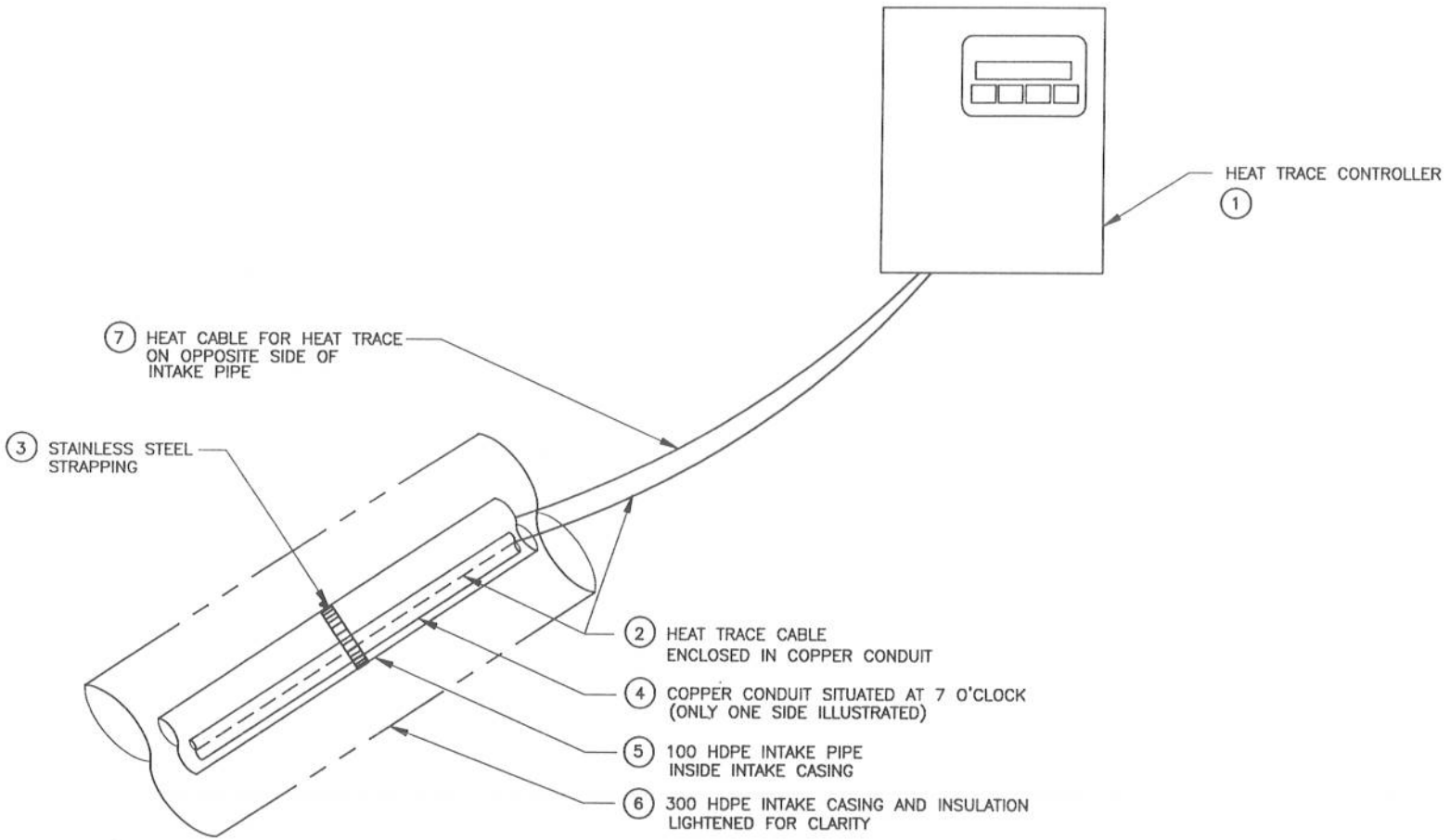
DILLON CONSULTING

PROJECT	ARCTIC BAY TRUCKFILL ARCTIC BAY, NT
TITLE	INTAKE CASING, INTAKE PIPE, AND CABLES
PROJECT NUMBER	96-3817
DATE	JUNE 98
FIGURE NUMBER	4.4



HEAT TRACE SCHEMATIC

NTS

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DILLON CONSULTING

PROJECT: ARCTIC BAY TRUCKFILL
ARCTIC BAY, NT

TITLE: HEAT TRACE SYSTEM

PROJECT NUMBER: 96-3817

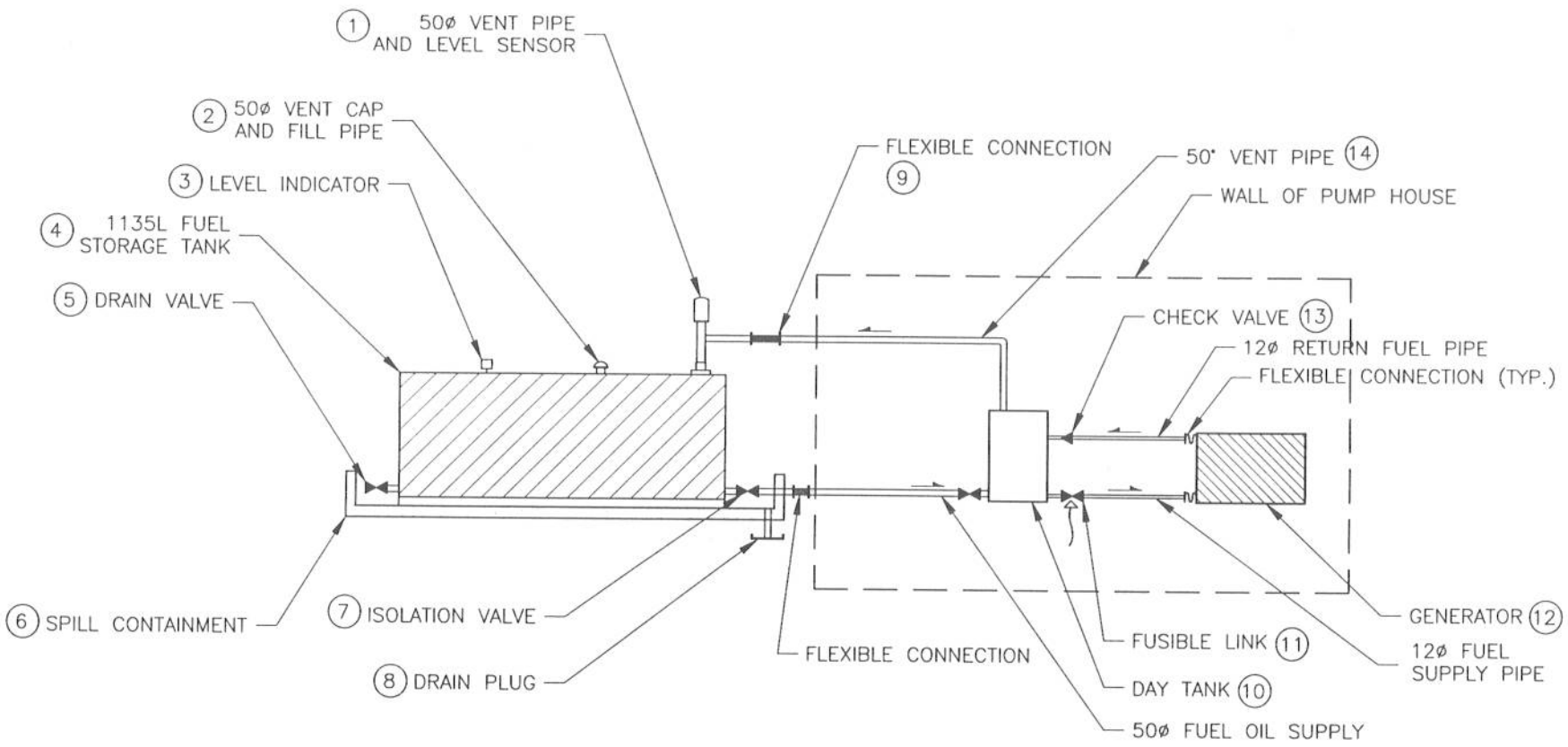
DATE: JUNE 98

FIGURE NUMBER: 4.5

ARCTIC BAY TRUCKFILL
ARCTIC BAY, NT

HEAT TRACE SYSTEM
TABLE 4.4

Figure	No.	Section 9 Tab	Component	Function	Remarks
4.4	1	9.12	Temperature Sensor Cable in Nylon Tubing	Sensor cable detects temperature against intake pipe. Heat trace control and alarms based on sensed temperatures.	-
4.4	2	-	Copper Conduit for Heat Transfer Cable	Encases heat trace cable and conducts heat to 100 HDPE intake pipe	19 copper conduit. Located at 7 O'clock.
4.4	3	-	Other Copper Conduit for Heat Transfer Tape	Encases heat trace cable and conducts heat to 100 HDPE intake pipe	19 copper conduit. Located at 5 O'clock.
4.5	1	9.12	Heat Trace Controller	Turns heat trace system on and off depending on sensed temperatures. Controls alarming of heat trace.	Accutron TS202 controller. Separate control for two heat trace cables.
4.5	2	9.12	Heat Trace Cable	Uses power to generate heat that will be transferred through copper conduit into intake pipe.	
4.5	3	-	Stainless Steel Strapping	Hold copper conduit against intake pipe.	
4.5	4	-	Copper Conduit for Heat Trace Cable	Encases heat trace cable, and conducts heat to 100 HDPE intake pipe	19 copper conduit. Located at 7 O'clock.
4.5	5	9.1	Intake Pipe	Carries water to steel piping system leading to water truck	100 HDPE DR17 pipe
4.5	6	9.1	Intake Casing and Insulation	Encloses intake pipe	50 Insulation
4.5	7	9.12	Heat Trace Cable	Identical circuit on other side of intake pipe	Circuit location at 5 O'clock



FUEL PUMPING SCHEMATIC

NTS

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DILLON CONSULTING

PROJECT	ARCTIC BAY TRUCKFILL ARCTIC BAY, NT
TITLE	FUEL SUPPLY SYSTEM
PROJECT NUMBER	96-3817
DATE	JUNE 98
FIGURE NUMBER	4.6

ARCTIC BAY TRUCKFILL
ARCTIC BAY, NT

FUEL SYSTEM
TABLE 4.5

Figure	No.	Section 9 Tab	Component	Function	Remarks
4.6	1	9.10	Vent Pipe and Fuel Level Sensor	Vent Pipe allows Fumes and Excess Fuel to Return to Storage Tank. Level Sensor sends signals to the Alarms when Fuel is Low.	Level Sensor set at 50% (minor) and 30% (major).
4.6	2	9.13	Vent Cap and Fill Pipe	Vent Cap allows pressure to escape to Atmosphere. Removal of Vent Cap allows fueling.	-
4.6	3	9.13	Level Indicator	Gauge for Visual indication of Fuel Level.	-
4.6	4	9.13	1135L Fuel Storage Tank	Stores Diesel Fuel to supply Generator.	-
4.6	5	-	Drain Valve	Valve for draining Storage Tank if required.	-
4.6	6	-	Spill Containment	Contains any Diesel if Storage Tank develops Leaks or becomes Ruptured.	-
4.6	7	9.13	Isolation Valve	Normally Open, but can Close if Maintenance is required along the Fuel Supply System.	Can also Close Valve in Emergency, i.e., Fire.
4.6	8	-	Drain Plug	Use to Drain Diesel from Spill Containment.	Also Drain Meltwater or Rainwater as required to prevent Rusting.
4.6	9	9.13	Flexible Connection	Allows some Differential Movement between joined Pipes, or Components.	Typical throughout Fuel Supply System.

ARCTIC BAY TRUCKFILL
ARCTIC BAY, NT

FUEL SYSTEM
TABLE 4.5

Figure	No.	Section 9 Tab	Component	Function	Remarks
4.6	10	9.13	Day Tank	Allows Fuel from Storage Tank to become Warm before Supplying Generator.	-
4.6	11	9.13	Fusible Link	Closes Fuel Supply in Case of a Fire.	-
4.6	12	9.7	Generator	Provides Power to Operate Truckfill Station.	-
4.6	13	9.13	Check Valve	Prevents Fuel from Flowing Backward from Day Tank.	-
4.6	14	-	Vent Pipe	Allows Vapour and Fuel to Return to Supply Tank.	-

5.0 COMPONENT DATA

5.1 General

Chapter 5 contains information on equipment used, including the manufacturer, model, and size. Cross references to the manufacturers' data in Chapter 9, and functional data in Chapter 4 are included. The suppliers' names, addresses, and telephone numbers are also listed on this table.

ARCTIC BAY TRUCKFILL
ARCTIC BAY, NT

COMPONENTS, MANUFACTURERS, AND SUPPLIERS
TABLE 5.1

Section 9 Tab	Section 4 Tables and Figs	Description	Manufacturer and Model	Supplier
9.1	4.1, 4.4, 4.5	HDPE Insulated Pipe	Sclairpipe with Urecon Insulation	Perma Engineered Sales (1983) Limited P.O. Box 76 Group 200, R.R. #2 34 Roy Roche Drive Winnipeg, Manitoba R3C 2E6 Ph: (204) 633-7213 Fax: (204) 694-7228 Contact: David Sylvestre
9.1	4.1	Intake Screen	Screen Services StatiOrb Drum Screen	Screen Services 16748 - 110 Street Edmonton, Alberta T5X 2V1 Ph: (403)460-8043 Fax: (403) 460-8045 Contact: Kevin Whitham
9.1	4.1	Throttling Valve	Jenkins Lever Operated 100 mm	CCTF Quebec 1840 O'Gagnon Lahcine, Quebec H8T 3M6 Ph: (514) 636-1886 Fax: (514) 636-6022
9.1	4.1, 4.4, 4.6	Pipe Fittings	Various Victaulic	CCTF Quebec 1840 O'Gagnon Lahcine, Quebec H8T 3M6 Ph: (514) 636-1886 Fax: (514) 636-6022
9.2	4.1, 4.2, 4.3, 4.4, 4.5	Intake Pump & Various Fittings	Berkley 6T250 150mm Submersible Pump	Deschenes 8335, St.. Michel Montreal, Quebec H1Z 3E6 Ph: (514) 374-3110 Fax: (514) 374-5141 Contact: Pierre Milot
9.2	4.2	Pump Starter	NEMA Combination 512	LUMEN 120 Dubois St.. Eustache, Quebec Ph: (514) 436-3225 Fax: (514) 436-2537 Contact: M. Collin
-	-	Pump Skid	-	TAC 264 Montigny St.. Jerome, Quebec J7Z 5P9 Ph: (514) 438-1279 Fax: (514) 438-0813 Contact: D. Desjardins

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Section 9 Tab	Section 4 Tables and Figs	Description	Manufacturer and Model	Supplier
9.3	4.1, 4.3	Flow Meter & Accumulator	Signet 5500 Flow Monitor	Brian Control 8600 St.. Patrick Ville Lasalle, Quebec H8N 1V1 Ph: (514) 366-5757 Fax: (514) 366-1134 Contact: Joe au Rolland
9.3	4.1	Pressure Gauge	Chevrier SG500	Chevrier Instruments Montreal, Quebec Ph: (514) 328-2550 Fax: (514) 327-0604
9.3	4.1	Thermometer	Ashcroft 30 EL 60 R040 0150 CENT	Chevrier Instruments Montreal, Quebec Ph: (514) 328-2550 Fax: (514) 327-0604
9.4	-	Chlorine	Calcium Hypochlorite 65%	Hall-Chem 11865 70 Ave Montreal, Quebec Ph: (514) 648-6050 Fax: (514) 648-9235
9.4	4.1, 4.3	Chlorine Injection Pump	Wallace & Tiernan Premia 75 Micro MPM4	US Filter 243 Bren, bur.210 Repentigny, Quebec J6A 6M4 Ph: (514) 585-5464 Fax: (514) 585-5464 Contact: Marcel Comtois
9.4	4.1	Chlorine Mixer	Neptune Flange Mount	US Filter 243 Bren, bur.210 Repentigny, Quebec J6A 6M4 Ph: (514) 585-5464 Fax: (514) 585-5464 Contact: Marcel Comtois
9.4	4.1	Chlorine Mix and Feed Tanks	Wallace & Tiernan 55 gal	US Filter 243 Bren, bur.210 Repentigny, Quebec J6A 6M4 Ph: (514) 585-5464 Fax: (514) 585-5464 Contact: Marcel Comtois

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Section 9 Tab	Section 4 Tables and Figs	Description	Manufacturer and Model	Supplier
9.4	4.1	PVC Ball Valves on Tanks	Chemtrol 25 mm	Miller 10229 Cote de Liesse Dorval, Quebec H9P 1A3 Ph: (514) 631-4355 Fax: (514) 631-6695 Contact: Roy Seguin
-	4.1	Flex Tube for Chemical Tanks	-	Flexi-Tube 1116 Berlier Laval, Quebec H4S 1V8 Ph: (514) 384-6157 Fax: (514) 384-6157
9.5	-	Radiant Heaters	Chromalox CRT-3512	Binette 1231 Berri Montreal, Quebec H2J 4A2 Ph: (514) 274-2583 Fax: (514) 274-2583 Contact: J.M. Lambert
9.5	-	Electric Heater Thermostat	Tradeline T498B1678	Binette 1231 Berri Montreal, Quebec H2J 4A2 Ph: (514) 274-2583 Fax: (514) 274-2583 Contact: J.M. Lambert
9.5	-	Percentage Input Controller for Radiant Heaters	Caloritech Type OKT	Binette 1231 Berri Montreal, Quebec H2J 4A2 Ph: (514) 274-2583 Fax: (514) 274-2583 Contact: J.M. Lambert
9.6	4.2	Electrical Panel	Square D PS-1	CDE 2522 LeCorbusier Laval, Quebec H7S 2K3 Tel: (514) 438-1263 Fax: (514) 438-3728 Contact: Yvon Clement
9.6	-	Receptacles	Hubbel 5252	CDE 2522 LeCorbusier Laval, Quebec H7S 2K3 Tel: (514) 438-1263 Fax: (514) 438-3728 Contact: Yvon Clement

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Section 9 Tab	Section 4 Tables and Figs	Description	Manufacturer and Model	Supplier
9.6	-	Switches	Hubbel HBL 1201	CDE 2522 LeCorbusier Laval, Quebec H7S 2K3 Tel: (514) 438-1263 Fax: (514) 438-3728 Contact: Yvon Clement
9.6	-	Junction Boxes, and Unilets	Various	CDE 2522 LeCorbusier Laval, Quebec H7S 2K3 Tel: (514) 438-1263 Fax: (514) 438-3728 Contact: Yvon Clement
9.7	4.2, 4.3, 4.5, 4.6	Generator and Associated Components	20kW Genset K7 Prime Power Supply for Truckfill Station	Mechron Power Systems Inc. 2437 Kaladar Avenue Ottawa, Ontario K1V 8B9 TEl: (613) 733-3855 Fax: (613) 733-8197 Contact: Elmer Langford
9.8	4.2, 4.3	Uninterruptible Power Supply (UPS)	Best Ferrups Model FE2.1 KVA	Best Power Technology of Canada Limited 1555 Bonhill Road, Unit 11 Mississauga, Ontario L5T 1Y5 Ph: (905) 564-7655 Fax: (905) 564-7657
9.9	4.3	Control Panel	Optoinfo	Optoinfo Electric Inc. 542 Bran St.. Jerome, Quebec J7Z 2B1 Ph: (514) 436-6050 Fax: (514) 436-4846
9.9	4.3	Pilot Lights	Allen Bradly 800T-QH10G	Optoinfo Electric Inc. 542 Bran St.. Jerome, Quebec J7Z 2B1 Ph: (514) 436-6050 Fax: (514) 436-4846
9.9	4.3	Push Buttons	Allen Bradly 800T-ATA	Optoinfo Electric Inc. 542 Bran St.. Jerome, Quebec J7Z 2B1 Ph: (514) 436-6050 Fax: (514) 436-4846

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Section 9 Tab	Section 4 Tables and Figs	Description	Manufacturer and Model	Supplier
9.9	4.1	Flow Switch	McDonnel Miller FS4-3D	Optoinfo Electric Inc. 542 Bran St.. Jerome, Quebec J7Z 2B1 Ph: (514) 436-6050 Fax: (514) 436-4846
9.9	4.1	Flow Sensor	Signet 515 Rotor-X P51530-P0	Optoinfo Electric Inc. 542 Bran St.. Jerome, Quebec J7Z 2B1 Ph: (514) 436-6050 Fax: (514) 436-4846
9.9	-	Relays	Allen Bradley 700-HG45A1 and Potter & Brumfield KRPA-14AN-120	Optoinfo Electric Inc. 542 Bran St.. Jerome, Quebec J7Z 2B1 Ph: (514) 436-6050 Fax: (514) 436-4846
9.9	-	Time Delay Relays	Potter & Brumfield CNS-35-76	Optoinfo Electric Inc. 542 Bran St.. Jerome, Quebec J7Z 2B1 Ph: (514) 436-6050 Fax: (514) 436-4846
9.9	-	Terminal Blocks	Entrelec	Optoinfo Electric Inc. 542 Bran St.. Jerome, Quebec J7Z 2B1 Ph: (514) 436-6050 Fax: (514) 436-4846
9.9	4.3	Remote Control Enclosure	Telemecanique W913065520111	Optoinfo Electric Inc. 542 Bran St.. Jerome, Quebec J7Z 2B1 Ph: (514) 436-6050 Fax: (514) 436-4846
9.9	4.3	Key Switch	Allen Bradley 800T	Optoinfo Electric Inc. 542 Bran St.. Jerome, Quebec J7Z 2B1 Ph: (514) 436-6050 Fax: (514) 436-4846
9.9	4.3	Fill Timer	Paragon SWP15M	Optoinfo Electric Inc. 542 Bran St.. Jerome, Quebec J7Z 2B1 Ph: (514) 436-6050 Fax: (514) 436-4846

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Section 9 Tab	Section 4 Tables and Figs	Description	Manufacturer and Model	Supplier
9.10	4.3	Annunciator	Panalarm 910	Provan Meter 2011 Halpern Ville St.. Laurent H4S 1S3 Ph: (514) 332-3230 Fax: (514) 332-3552 Contact: M. Lachance
9.10	4.5, 4.6	Fuel Level Sensor	Magnetro Kotron Sentinel Point Level Switch 842-1001-C00	Provan Meter 2011 Halpern Ville St.. Laurent H4S 1S3 Ph: (514) 332-3230 Fax: (514) 332-3552 Contact: M. Lachance
9.10	4.3	High/Low Temperature Thermostat	Honeywell Farm-O-Stat T631A	Denbec 9855 B.Hyp. Lafontaine Anjou, Montreal, Quebec H1J 2A3 Ph: 1-800-465-0950 or (514) 355-4540 Fax: (514) 355-4346
9.10	-	Horn	Panalarm	Provan Meter 2011 Halpern Ville St.. Laurent H4S 1S3 Ph: (514) 332-3230 Fax: (514) 332-3552 Contact: M. Lachance
9.10	-	Strobe Beacon	Adapta Beacon	Edwards Unit Of General Signal 625 6th St. E Owen Sound, Ontario N4K5P8 Ph: (519) 376-2430
9.10	-	Exterior Truckfill Light	Caretaker HPCT-35-120V-LL	Cooper Industries, Inc Crouse-Hinds Airport Lighting Canada 5925 McLaughlin Road Mississauga, Ontario L5R 1B8 Ph: (905) 507-4187 Fax: (905) 501-4078
9.11	-	High Pressure Sodium Lamps	Cermalux ED-231/2 Mog. 52V	Wesco 281 Traders Blvd. Mississauga, Ontario L4Z 2E5 Ph: (905) 890-3344 Fax: (905) 890-8533

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TABLE 5.1

Section 9 Tab	Section 4 Tables and Figs	Description	Manufacturer and Model	Supplier
9.11	-	Exterior Wall Light	Holopane Wallpackette WP2B	Lumen 500- Boul. Daniel Johnson St.-Jerome, Quebec J7Y 4C5 Ph: (514) 436-3225 or 1-800-363-3678 Fax: (514) 436-2537
9.11	-	Interior Fluorescent Lights	K172120	CDE 2522 LeCorbusier Laval, Quebec H7S 2K3 Tel: (514) 438-1263 Fax: (514) 438-3728 Contact: Yvon Clement
9.11	-	Exit Light	Emergi-Lite EX42WEM12R120V	Emergi-Lite 1800 Hymus Blvd Dorval, Quebec H9P 2N6 Ph: (514) 685-2270 Fax: (514) 685-2394
9.11	-	Emergency Lights	Emergi-Lite 12ESL250	Emergi-Lite 1800 Hymus Blvd Dorval, Quebec H9P 2N6 Ph: (514) 685-2270 Fax: (514) 685-2394
9.12	4.4, 4.5	Self Regulating Heat Trace Cable	Accutron SRL5-1	Accutron 6600 Trans.Can Pointe-Claire H9R 4S2 Ph: (514) 695-7032 Fax: (514) 695-4784
9.12	4.5	Heat Trace Control Panel	Accutron TS202 Controller	Accutron 6600 Trans.Can Pointe-Claire H9R 4S2 Ph: (514) 695-7032 Fax: (514) 695-4784
9.13	4.6	Fuel Tank	Custom	Kingland Ford 922 MacKenzie Hwy Hay River, NT Ph: (867) 874-6734
9.13	4.6	Day Tank	Custom	Optoinfo Electric Inc. 542 Bran St.. Jerome, Quebec J7Z 2B1 Ph: (514) 436-6050 Fax: (514) 436-4846

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Section 9 Tab	Section 4 Tables and Figs	Description	Manufacturer and Model	Supplier
9.13	4.6	Fusible Valve	Webstone No. 819 Fusible	Deschenes 8335, St.. Michel Montreal, Quebec H1Z 3E6 Ph: (514) 374-3110 Fax: (514) 374-5141 Contact: Pierre Milot
9.13	4.6	Gate Valve	Jenkins 50mm	Deschenes 8335, St.. Michel Montreal, Quebec H1Z 3E6 Ph: (514) 374-3110 Fax: (514) 374-5141 Contact: Pierre Milot
9.13	4.6	Pipe Elbows	50 mm Grinnell	Deschenes 8335, St.. Michel Montreal, Quebec H1Z 3E6 Ph: (514) 374-3110 Fax: (514) 374-5141 Contact: Pierre Milot
9.13	4.6	Tank Gauge	King 4448	Deschenes 8335, St.. Michel Montreal, Quebec H1Z 3E6 Ph: (514) 374-3110 Fax: (514) 374-5141 Contact: Pierre Milot
9.13	4.6	Vent Cap	King 4021	Deschenes 8335, St.. Michel Montreal, Quebec H1Z 3E6 Ph: (514) 374-3110 Fax: (514) 374-5141 Contact: Pierre Milot
9.13	4.6	Flexible Connection	Flexi Tube 50	Deschenes 8335, St.. Michel Montreal, Quebec H1Z 3E6 Ph: (514) 374-3110 Fax: (514) 374-5141 Contact: Pierre Milot
9.14	-	Temperature Control	Johnson A350P Electronic Proportional Plus Integral Temperature Control	EECOL Electric Ltd. 23 Melvile Dr. Yellowknife, Northwest Territories Ph: (867) 873-3964 Fax: (867) 873-3965

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9.14	-	Termperature Stage Module	Johnson S350 Temperature Stage Module	EECOL Electric Ltd. 23 Melvile Dr. Yellowknife, Northwest Territories Ph: (867) 873-3964 Fax: (867) 873-3965
9.14	-	Blower Box	Loren Cook 1.5" SP and 5/8" SP	B.P.L. Sales Manitoba, Winnepeg Phone: 204-694-9790 Fax: 204-694-7221
9.14	-	Blower Motor	Doer LR22132	EECOL Electric Ltd. 23 Melvile Dr. Yellowknife, Northwest Territories Ph: (867) 873-3964 Fax: (867) 873-3965
9.14	-	Motor Starter for Blower Motor	Square D AG-2	CDE 2522 LeCorbusier Laval, Quebec H7S 2K3 Tel: (514) 438-1263 Fax: (514) 438-3728 Contact: Yvon Clement
9.14	-	Damper	Tamco Series 9000	B.P.L. Sales Manitoba, Winnepeg Phone: 204-694-9790 Fax: 204-694-7221
9.14	-	Damper Actuator	Belimo NF24-SR	B.P.L. Sales Manitoba, Winnepeg Phone: 204-694-9790 Fax: 204-694-7221
9.14	-	Damper Actuator	Belimo LM24-10P-J6	B.P.L. Sales Manitoba, Winnepeg Phone: 204-694-9790 Fax: 204-694-7221
9.15	-	Satellite Phone	Mitsubishi ST121	Mitsubishi Electric 4299 14th Avenue Markham, Ontario L3R 0J2 Ph: (905) 475-7728 Fax: (905) 475-7958
9.15	-	Auto Dialer	Dialex 4500 Emergency Voice Dialer	Deltavision 395 Industrial Blvd. St. Eustache, Quebec J7R 5R3 Ph: (514) 974-3244 Fax: (514) 974-3242

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Section 9 Tab	Section 4 Tables and Figs	Description	Manufacturer and Model	Supplier
9.15	-	Power Supply	Deltavision DV124F	Deltavision 395 Industrial Blvd. St. Eustache, Quebec J7R 5R3 Ph: (514) 974-3244 Fax: (514) 974-3242
9.15	-	Satellite Phone and Auto Dialer Interface	Telular Version 5	Telular Canada Inc 93 Skyway Avenue, Suite 108 Toronto, Ontario M9W 6N6 Ph: 1-800-646-5455 Fax: 1-416-675-0676
9.16	-	Chlorine Tester	HACH Pocket Colorimeter for Chlorine	Anachemia Science 15006-116 Avenue Edmonton, Alberta T5M 3T4 Ph: (403) 451-0665 Fax: (403) 452-2478
9.16	-	Fire Extinguisher	Flag 400-11155ULC 20lb Nitrogen	Fyremaster Equipment Sales 4101 49a Ave Yellowknife, NT X1A 1A3 Ph: (867) 873-6990
9.16	-	Eyewash Station	Fisher Scientific EYE2	Fisher Scientific 112 Colonnade Road Nepean, Ontario K2E 7L6 Ph: 1-800-234-7437 Fax: 1-800-463-2996
9.16	-	Valved Respirators	NIOSH 8500 by 3M	Fisher Scientific 112 Colonnade Road Nepean, Ontario K2E 7L6 Ph: 1-800-234-7437 Fax: 1-800-463-2996
9.16	-	Safety Gloves	Trionic Special Blend	Fisher Scientific 112 Colonnade Road Nepean, Ontario K2E 7L6 Ph: 1-800-234-7437 Fax: 1-800-463-2996
9.16	-	Rubberized Safety Apron	Fisherbrand 01-357	Fisher Scientific 112 Colonnade Road Nepean, Ontario K2E 7L6 Ph: 1-800-234-7437 Fax: 1-800-463-2996

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Section 9 Tab	Section 4 Tables and Figs	Description	Manufacturer and Model	Supplier
9.16	-	Face Shield	Nalgene 11-409-5	Fisher Scientific 112 Colonnade Road Nepean, Ontario K2E 7L6 Ph: 1-800-234-7437 Fax: 1-800-463-2996
9.17	-	Combination Storage Wardrobe Unit	Kleton Combination FB041	Tenaquip 20701 Ste-Marie Ste. Anne Bellevue, Quebec H9X 3L2 Ph: 1-800-263-7576 or (514) 457-7800 Fax: 1-800-263-3324 or (514) 457-9807
9.17	-	Cabinet Table	Kleton Model FF075	Tenaquip 20701 Ste-Marie Ste. Anne Bellevue, Quebec H9X 3L2 Ph: 1-800-263-7576 or (514) 457-7800 Fax: 1-800-263-3324 or (514) 457-9807
9.17	-	Winch	Posi-Brake LA692 1500lb	Tenaquip 20701 Ste-Marie Ste. Anne Bellevue, Quebec H9X 3L2 Ph: 1-800-263-7576 or (514) 457-7800 Fax: 1-800-263-3324 or (514) 457-9807
9.17	-	Winch Cable	Stainless Steel 3.2 MM 2100 lb	General Bearing 789 St. Georges St.. Jerome, Quebec Ph: (514) 438-3315 Fax: (514) 438-3315
9.17	-	Janitorial Equipment	Misc.	Belisle & Carriere 1313 St.. Antoine boul. St.-Antoine, Quebec H1P 1Y5 Ph: (514) 438-7834 Fax: (514) 438-2806
9.17	-	Interior Paint	Laurentide Interior Semi-gloss Latex 694-500	Cyr & Nepveu St.-Anne Des Plain 323, Monte Gagnon Montreal, Quebec J0N 1H0 Ph: (514) 478-0907

6.0 OPERATING PROCEDURES

6.1 General

The water supply system for Arctic Bay, N.W.T. consists of:

.1 An intake screen connected to a 300 mm diameter high density polyethylene (HDPE) intake casing. The casing accesses the water supply lake, and enters the pump house through a wall.

.2 A submersible pump connected to a 100 mm HDPE intake pipe is situated inside the 300 HDPE casing at a depth near the intake screen.

.3 A chlorine solution is made in a mix tank by mixing calcium hypochlorite with water. The chlorine solution is drained to a feed tank after mixing.

.4 A flow switch is activated when water is flowing through the truckfill line. This switch activates an injection pump.

.5 The injection pump pumps the chlorine solution from the feed tank into the truckfill line. The injection pump stops when a no-flow condition exists in the truckfill line.

6.2 Start-up Procedures

Throughout the normal life of the facility, it should rarely have to be started from an off condition. If, for some reason, all power to the truckfill station has been switched off, follow the procedure below to restore power.

6.2.1 Start-up from Utility Power

.1 **Location**: inside station at the truckfill pump starter.
Turn the pump starter to the OFF position.

.2 **Location**: inside station at the combination electrical panel.
Turn the main disconnect on. Power should be connected to the station. If there is no power, call the utility company.

.3 Turn the truckfill pump starter to the AUTO position.

.4 Turn UPS AC Line disconnect switch to "On" if not already in this position.

6.2.2 Start-up from Prime Generator

.1 **Location**: inside pump room at the control panel.
Turn the pump starter to the OFF position.

.2 **Location**: inside station at the combination electrical panel.
Turn the main disconnect on.

.3 **Location**: adjacent to truckfill station.
Check that the fuel tank is full, and that the fuel tank supply valve and fusible link valve are open. Fill fuel tank if required.

.4 **Location**: inside generator room.
Check generator oil. Fill if required.

.5 **Location**: inside generator room.
The transfer switch is in a panel near the door. The arm inside the panel should be set to the NORMAL position (down). The selector switch on the exterior of the panel should be switched to AUTO. Consult Section 9.7 for details regarding the transfer switch.

.6 **Location**: inside station at the generator control panel.
Turn the function switch for operation to MANUAL.

.7 **Location**: on generator.
Turn the generator's keyswitch to position 3 for starting. Release the key after the engine has started. If the generator does not start, consult the engine's user manual in Section 9.7.

.8 Turn the truckfill pump starter switch to the AUTO position.

.9 Turn the UPS AC Line disconnect switch to "On".

6.3 Normal Operating Procedures

The normal operating procedures for the water supply system includes:

- Filling of water trucks.
- Chlorination system preparation.
- Main control panel operation.
- Intake screen backwashing.
- Heat trace system operation.
- Heating system operation.
- Fuel Supply

Each of these procedures is discussed in the following sub-sections.

6.3.1 Truckfilling Procedure

Trucks are filled with chlorinated water from the truckfill station for delivery to houses in Arctic Bay. The trucks are filled by either using the truckfill controller hanging from

the truckfill arm, or by using the "manual" position on the pump motor starter switch on the control panel inside the pumphouse. Normally the pump motor starter switch is set to "Auto" and the truckfill controller is used for filling trucks.

.1 **Location**: Under the truckfill arm.
Drive the truck under the truckfill arm so that the fill hole of the truck tank is directly under the pipe. Watch the arm to make sure that the truck does not hit it.

.2 **Location**: On top of the truck.
Open the fill hole and place the fill hose in the hole.

.3 **Location**: Hanging from truckfill arm.
Insert your key and turn the key switch to the 'on' position in the remote controller.

.4 There are two ways you can fill the truck with the truckfill controller:

1. Using the Timer

.1 Turn the timer to the desired time setting. Different water truck tank sizes will have different time settings.

.2 Press the 'Start' button on the truckfill controller.

.3 The pump will start pumping after a short delay. It will continue pumping until the timer completes its cycle.

.4 If the timer is set too long (i.e. tank overfilling), press the 'Stop' button on the truckfill controller. Please note that severe weather conditions may have an impact on the timer's accuracy.

.5 The 'Stop' button may be used any time during truckfilling to stop filling operations.

Manual Control

.1 To manually fill the truck, simply press the 'Start' button on the truckfill timer.

.2 The pump will start pumping after a short delay.

.3 When the truckfill tank is full, press the 'Stop' button on the truckfill controller. The pump will stop.

.5 The filling is NOT automatic. The driver should observe the filling process, and be ready to stop the pump if the truck starts overfilling. Once the pumping rate is set, the operator should be able to time how long it takes the truck to fill.

.6 Following the truckfill, turn the key switch to the 'off' position and remove the key.

.7 **Location**: On top of the truck.
Remove the fill hose from the truck and close the fill hole. Hang the hose on the hook at the end of the arm.

.8 Deliver water.

6.3.2 Chlorination Process

Chlorine is injected into the truckfill piping with a chemical injection pump. The injection pump is turned on by a flow switch when the water starts being pumped to the water truck. Chlorine kills bacteria and microorganisms in the water that might cause people to become sick. Chlorine MUST be added to all water leaving the truckfill station or residents may become sick. Never turn the chlorine system off, always ensure that it is working properly, and ensure there is sufficient solution for operation.

6.3.2.1 Chlorine Solution Mixing

Chlorine solution is mixed using calcium hypochlorite powder (65%) and water. The calcium hypochlorite powder is in 1 kg (liter) containers in the standing storage closet.

.1 **Location**: Tap for hose connection on truckfill pipe (close to temperature and pressure gauges).
Connect the water hose to the threads on tap. Put the other end of the hose into the top tank on the workbench.

.2 Close the butterfly valve on the truckfill pipe to the stop bolt, and ensure there is a truck underneath the fill arm because the valve is still partially open.

.3 Close the valve on the bottom of the mix tank, and feed tank.

.4 **IMPORTANT**: Open the 25 mm ball valve on the intake bypass hose. The open valve allows the pump to circulate the water without damaging the pump, and relieves some of the high pressure. Caution should be taken when filling the tanks as the pump does produce a very high pressure.

.5 **Location**: The control panel.
Turn the intake pump starter switch to the MANUAL position. The pump will start.

.6 Open the tap and fill the chemical tank on top of the bench to the 120 litre mark.

.7 Turn off tap.

.8 Turn the truckfill pump starter to the AUTO position. The pump will stop.

.9 Open the butterfly valve on the truckfill pipe.

.10 Close the valves for the 25 mm bypass hose.

.11 **NEVER** operate the truckfill pump with all valves closed. Either the butterfly valve must be open and a truck placed under the truckfill arm, or the bypass valve must be open. Operating the pump with no flow **will damage** it, and **high pressures are dangerous** to personnel.

.12 Put on rubber apron, rubber gloves, and face shield.

.13 Read manufacturer's safety data sheet for Calcium Hypochlorite.

.14 Add five (5) liters (bottles) of Calcium Hypochlorite 65% to water. This will give a 1 bottle of Calcium Hypochlorite to 24 liters of water ratio.

.15 Plug in mixer for two (2) hours. Unplug mixer.

.16 Let the solution settle overnight if possible.

.17 Open the valve at the bottom of the chemical mixing tank. The chlorine solution will drain into the chemical feed tank.

.18 Close valve at bottom of mix tank. Disassemble piping by unscrewing collar after the mixing tank valve.

.19 Thoroughly rinse the agitator paddle and tank with water from hose to prevent corrosion of paddle.

.20 Reassemble mix tank piping.

.21 If the butterfly valve was closed to the stop bolt, all the water collected in the water truck is to be dumped, as it will not be properly chlorinated.

.22 Fill truck with treated water.

.23 Test the first truck of day for adequate chlorination by using the HACH Colorimeter test kit. See details in following section 6.3.2.2 Chlorine Testing.

.24 Adjust the stroke length and/or rate of the injection pump to either increase or decrease the chlorine dosage if required. Retest FREE CHLORINE after adjusting the stroke and/or rate.

This procedure mixes the chlorine stock to approximately 3% chlorine by volume. A higher chlorine ratio may be used if it is found that the injection pump can not achieve adequate chlorination. A lower chlorine ratio may be used if the pump's stroke and rate are set below 40%.

6.3.2.2 Chlorine Testing

Chlorine levels must be tested for the water in the delivery truck. For safety, chlorine should be delivered to homes with a minimum free chlorine level of 0.5 mg/L. However, as there may be bacteria in the storage tanks in homes, higher levels of chlorine to 1.0 mg/L would be safer to allow for some chlorine to kill the

bacteria in the tanks. The chlorinated water should be sampled and tested daily prior to any deliveries. This will ensure that the following deliveries will be adequately chlorinated, provided that the chemical injection pump settings remain the same for that day.

The operator of the truck will have to balance the chlorine level to satisfy both the tastes of the people of the community and safety. Too much chlorine may result in the residents refusing to use the treated water. Not enough chlorine is unsafe.

6.3.2.3 Using the HACH Pocket Colorimeter Chlorine Tester

The following procedure may be used to test for free chlorine in a sample taken from the truck:

.1 Rinse both 20 ml tubes in kit with distilled water.

.2 Obtain a sample of treated water from the water truck after it has been sitting for 20 minutes (the chlorine has had time to disinfect). The sample should be taken from the top hatch of the truck. A clean measuring cup or jar may be used for this purpose.

.3 Fill both tubes to the **10 mL** fill line (the first line) with sample water from the truck.

.4 Differentiate between the two sample tubes so they do not get mixed up. One cell is the "blank", the other will be the "sample".

.5 Put the blank cell in the slot of the Colorimeter with the diamond facing you. Cover the sample with the instrument cap. Press the

"ZERO" key. The instrument will display 0.00. Remove the blank cell from the slot.

.6 Take a foil package marked FREE CHLORINE, and tear the top off. Carefully pour the contents (reagent) into the sample tube.

.7 Agitate the contents by shaking the capped tube for 15 to 20 seconds. The tube contents should start to turn to a pink, or magenta colour. If the contents **do turn to a pink colour, go to step 10.**

.8 If the sample does not turn colour at all or turns very little, the truck water is inadequately chlorinated, and should not be delivered to the residents unless its chlorine dosage is increased. You may manually add bleach to the truck to increase the dosage.

.9 If you do add additional bleach, another 20 minutes will be required for reaction time. 10 ml of bleach will raise the chlorination of 1000 litres of water by approximately 0.6 mg/l. If the truck size is 2500 litres, then 25 ml of bleach will also raise the chlorine content by approximately 0.6 mg/l. By adding bleach to under-chlorinated truck loads, you will not waste any truck loads by having to discard inadequately chlorinated water.

.10 If the sample turns pink or magenta, place the tube in the chlorine tester's slot, and cover the capped sample with the instrument cap.

.11 Press the "READ" key. The instrument will display the FREE CHLORINE result in mg/L or parts per million (ppm). It should read at 1.0 mg/l to be considered safe to deliver.

.12 Empty and rinse tubes after using.

6.3.2.4 Chlorine Injection Pump Adjustment

The chlorine injection pump is located beside the chlorine mixing tank. This pump can have both the rate of pumping and the length of the stroke adjusted to obtain the correct chlorine injection rate that will provide enough chlorine for disinfection in the water truck.

The chlorine pump will be set to provide 1.0 mg/l of residual chlorine in the water truck. It may be required to pump more than 1.0 mg/l of chlorine into the truckfill pipe to obtain a residual chlorine of 1.0 mg/l.

The test should be performed on a full truck. The filling of the truck will mix the water resulting in a test that shows the average chlorine residual of the water.

.1 **Location**: Inside the truckfill station beside the chemical pump.
Ensure the chemical pump is plugged into the receptacle labelled CHLORINE PUMP.

.2 Set the pump knobs to a rate of 80% and a stroke of 100%. This has been found to be a good starting place.

.3 **Location**: Outside at the truckfill arm.
Fill the truck per the instructions above in section 6.3.1.

.4 Allow the truck to sit for 20 minutes.

.5 Take a small sample in a measuring cup or some clean container from the fill hole in the top of the truck.

.6 Test the sample as per section 6.3.2.3, "Using the HACH Pocket Colorimeter Chlorine Tester".

.7 If the test result is below 1.0 mg/l, increase the stroke of the pump and/or the rate. However, the stroke and rate should always be between 30% and 100%.

.8 Empty the truck and repeat steps 3 to 7. Repeat the test until 1.0 mg/l residual chlorine is reached.

.9 If the test is above 1.0 mg/l, decrease the stroke and/or the rate. Follow the stroke and rate limits in step .7.

.10 Empty the truck and repeat steps 3 to 7. Repeat the steps until 1.0 mg/l residual chlorine is reached.

6.3.3 Intake Screen Backwashing

The intake screen has been sized such that cleaning should not ever be required. In the unlikely event that the screen is becoming plugged, the intake screen may be backwashed by recirculating water from the existing intake line through the casing. This procedure may help to remove some silt or material that otherwise plugs the screen. However, it is not a completely effective cleaning because the intake pump recirculates more than it will backwash. The only practical methods to completely clean the screen is to have divers unclog and clean the screen by hand, or by applying high pressure air from the inside of the screen.

6.3.4 Heat Trace System

There is a heat trace system installed against the intake pipe inside the intake casing. The electric heat trace cables in the casing will prevent freezing and aid in thawing of the pipe should it ever become frozen.

The heat trace cables are operated by a dual temperature monitor and controller called the Accutron TS 202a.

Use of the heat trace during summer is not required. The controller will be enabled, but the heat trace cables will not be activated during warmer weather.

The heat trace controller has been set to perform optimally. However, should power to the controller be disrupted for a long period, the controller may require reprogramming. See the TS-202 Programming Manual in Section 9.11 for programming details. The following identifies the general steps to setup the controller as well as some settings found to be specific for the truckfill station.

.1 **Location**: The Heat Trace Controller is inside the truckfill station above the intake pipe coming into the building.

Open the cover on the controller panel. When the unit is powered up, a power loss alarm will occur. This is normal. Press the ACK on the controller to acknowledge the alarm. You will also need to acknowledge this alarm on the main control panel (horn, strobe, and buzzer in panel) by pushing the BLACK acknowledge button, and the red ACK button on the panalarm.

.2 Press the SHIFT key to enter the TS 202 programming mode.

.3 Press the MAINTAIN TEMP key to set the operating temperature. Enter '12' which sets the operating temperature to 12°C.

.4 Press the DEAD BAND key. The DEAD BAND is defined as the number of degrees above the setpoint at which the tracer is de-energized. Set to 1°C. Whenever the intake water temperature is above 13°C the heat trace cables will be turned off.

.5 Press the AUTO TEST key. The controller will perform diagnostic tests on the circuit at preset time intervals. Enter the YES key. Set the CYCLE HOURS to 24. This will automatically test the circuits once/day. Set this alarm so that it is timed to check during normal delivery hours.

6. Press the CURRENT ALARM key. The TRIP ON HIGH AMPS will be displayed. Enter NO for this option. This will ensure power is maintained in the heat trace cables during a high amp alarm condition. The alarm must be cleared, and the problem attended to, even though the heat traces will remain in operation.

7. Press the NEXT key. The LOW TRACER CURRENT ALARM function option is displayed. This value should be left at the default value, unless an electrician or heat trace expert recommends it be changed.

8. Press the NEXT key. The HIGH TRACER CURRENT ALARM function option is displayed. This value should be left at the default value, unless an electrician or heat trace expert recommends it be changed.

.9 Press the NEXT key. The TRIP ON HI AMPS TRIP TRACER function option is displayed. This value should be left at the default value, unless an electrician or heat trace expert recommends it be changed.

.10 Press the HI GND CURRENT key. The GND FAULT MILLIAMPS function option is displayed. This value should be left at the default

value, unless an electrician or heat trace expert recommends it be changed.

.11 Press the HI GND CURRENT key, then the NEXT key. The TRIP ON HI GND TRIP TRACER function option is displayed for tracer #1. Set this value to NO. This will enable heat tracing even with ground current leakage. An alarm will sound, and the problem must be remedied as soon as possible to ensure safe operation.

.12 Press the NEXT key. The TRIP ON HI GND TRIP TRACER function option is displayed for tracer #2. Set this value to NO. This will enable heat tracing even with ground current leakage. An alarm will sound, and the problem must be remedied as soon as possible to ensure safe operation.

.13 Press the ENABLE TRACER key. The ENABLE TRACER #1 CHANGE function option is displayed for tracer #1. Set this value to YES. This will enable heat tracing, and monitoring for tracer #1. Press the NEXT key. The ENABLE TRACER #2 CHANGE function option is displayed for tracer #2. Set this value to YES. This will enable heat tracing, and monitoring for tracer #2.

.14 Press the UNITS key. The SETTINGS IN DEG C CHANGE function option is displayed. Leave this value at NO. This will display units in degrees Celsius.

.15 Press the HI TEMP SEEN key. The #1 RTD HI=???.? C RESET function option is displayed. YES will reset the present high temperature being measured as the new value. NO will retain the high temperature read previously. Normally leave the setting at NO.

.16 Press the HI TEMP SEEN key, then the NEXT key. The #1 LOW=???.? C RESET function option is displayed. YES will reset the present temperature being measured as the new low value. NO will retain the low temperature read previously. Normally leave the setting at NO.

.17 Press the DATA HIGHWAY key, then the NEXT key. The DATA HIGHWAY ON ENABLE function option is displayed. Set this option to NO, unless connecting to a computer.

.18 Press the HI TEMP ALARM key. The #1 HI TEMP ALARM SET function option is displayed. This value should be left at the default value, unless consistent false alarms are occurring. Try increasing the setting to reduce false alarms.

.19 Press the HI TEMP ALARM key, then the NEXT key. The #1 HI TEMP ALARM TRIP TRACER function option is displayed. This value should be set to YES. This will shut off the heat trace if the set HI TEMP is exceeded. Tripping the tracer could prevent possible melting through the intake pipe.

.20 Press the HI TEMP ALARM key, then the NEXT key twice. The #1 RTD FAILURE TRIP TRACER function option is displayed. This value should be set to NO. This will enable heat tracing even with a failing RTD sensor. An alarm will sound, and the problem must be remedied as soon as possible to ensure safe operation.

.21 Repeat the programming of steps .18 through .20 for tracer #2 by using the NEXT key.

.22 Press the TRACER CURRENT key. The CURRENT CLAMPING #1 ENABLE function option is displayed for tracer #1. Normally set this value to NO. This setting will not restrict amperage allowed to the heat trace.

Any alarm conditions that occur with either tracer, the TS 202 will illuminate the ALARM ON indicator and alternate the Main Operations Display with the ALARM CODE display and corresponding tracer circuit. Any alarms can be acknowledged by pressing the ACK key on the heat trace controller. The alarm will also have to be acknowledged on the Panalarm in the main control panel. Acknowledging an alarm does not clear its condition.

For TRIP ALARMS, the alarm must be acknowledged before automatic control of the heat trace system is restored. Consult section 9.11 Appendix A of the TS202 programming manual for details on alarm messages.

6.3.5 Heating System

Heat is supplied to the truckfill station on the pumps side by two electric radiant heaters mounted on the ceiling. The generator supplies the heat on the generator side of the truckfill station.

The heaters are controlled by a thermostat and a proportional controller. The thermostat for each heater controls the room temperature. They should be both set to the same value. The normal setting is 16°C. This temperature is above the low temperature alarm setting of 13°C and below the high temperature alarm setting of 35°C. The setting should always be between the high and low alarm temperatures. There should not normally be a need to change the thermostat settings.

The amount of heat provided by the heaters is controlled by the proportional controllers located beside each thermostat. These controllers can be set from MIN to MAX which determines the time that the heater is turned on per cycle. If the heaters are failing to maintain room temperature, the controller settings can be increased. In warmer weather, the controller settings can be reduced.

For fast warmup of the building, adjust the proportional controllers to MAX (100%). This is recommended if personnel are going in and out of the pumphouse frequently in cold weather, i.e. servicing.

6.3.6 Fuel Supply

The fuel supply system for the generator is automatic and requires no operation except for regular filling of the fuel tank with diesel. A minor and major alarm are associated with different a low and high level respectively.

The fuel tank must be filled from the outside at the vent/cap on top of the fuel tank. Care should be taken during filling that no fuel is spilled.

6.4 SPECIAL PROCEDURES

6.4.1 Truckfill Pump Removal

If the truckfill pump, or other equipment within the intake casing, fails, the intake pipe and all attached equipment can be removed from inside the truckfill station. DO NOT attempt to remove the pump unless an electrician is present to disconnect the power cables.

It has been found that the winch for removal of the intake pipe is useful for the initial start, but that a loader or truck connected to the cable reduces the time required for

removal. Care must be taken when using a vehicle to assist removal to ensure that the cable is not snapped which could cause injury, and make the remaining pump removal extremely difficult.

Water from the pumphouse will not be available during the pump removal and replacement.

Location: All of the following procedures can be completed within the truckfill station or just outside the door.

.1 **Location**: At the main breaker panel.
Turn off the breakers for the truckfill pump and the heat trace controllers.

.2 **Location**: At the UPS controller.
Turn the UPS controller switch to OFF. This will turn off the control panels.

.3 **Location**: At the intake casing.
Turn the truckfill pump starter to the OFF position.

.4 Disconnect the truckfill pump power cable from the starter. This must be done by a **certified electrician**.

.5 Unplug the heat trace cables from the receptacle.

.6 Disconnect one of the victaulic fittings on the truckfill pipe closest to the intake casing.

.7 Move the truckfill pipe out of the way. More fittings may need to be removed to accommodate the pump removal.

.8 Remove the outer set of bolts on the intake casing flange.

.9 Loosen the inner set of bolts on the flange which loosens the rubber plug.

.10 Pull the flange and plug out of the casing.

.11 Remove the bolts from the flange.

.12 Remove the flange and plug.

.13 Set the winch stand pipe in the hole in the floor.

.14 Wind the intake pull cable onto the winch.

.15 Winch out the intake pipe, carefully supporting the pipe and cables. Once the pipe is a meter or so out of the casing it may be easier to connect the cable to a loader to continue pulling.

.16 Carefully support the pipe and cables during pulling. Watch for snags, and any wedging that may occur during removal.

.17 The pipe is approximately 80 metres long and will go out the door.

.18 Once the pipe is pulled, the pump, heat trace RTD sensors, or heat trace cables can be maintained, repaired or replaced.

.19 Reverse the above procedures to replace the pump and pipe.

6.4.2 Programming the Emergency Autodialer

The general steps for programming the emergency autodialer are summarized in this section. A standard touch tone telephone is used for inputting program options. For a detailed description regarding the emergency satellite/autodialer phone system, consult Section 9.15 of the manual.

Following are the general steps for programming the autodialer:

.1 Enter the Telephone Directory - Obtain a list of the telephone numbers (8 numbers maximum) you want the autodialer to call.

.2 Select the Communication Format for Each Number - For each number decide whether it will be used for a voice or pager, as the autodialer will send a different signal depending on the answering mode.

.3 Link Inputs to the Telephone Directory - Order the telephone numbers in the priority that you wish the autodialer to call for different alarm conditions. Using the prioritized list, the autodialer can be programmed to know which available numbers it should call, in what order, and for which input. Note that different inputs may call different numbers. For example, with the Arctic Bay Truckfill Station, an alarm condition for low fuel may call the fuel distributor, while an alarm condition for a failed generator may call the Truckfill Station Maintainer.

.4 Record Voice Messages - The common identification voice message and the individual channel messages are recorded for the human listeners.

.5 Enter Pager Numbers - For phone numbers with pagers, the numerical messages to be displayed by the pagers are entered.

.6 Enter Communication Choices and Input Modes - This step would be programmed where delays before dialling, delays before transmitting, or waiting for a dial tone would be required. An option for repeating the voice message may also be set here.

.7 Call Options - This step allows programming for the number of call sequences, and a redial delay time.

.8 Input Detection Mode - The input detection mode can be set to Standard Detection Mode (SDM), or Pulse Bell Detection Mode. Set this option to SDM as a touch tone telephone was supplied for programming the autodialer.

.9 Verify Programming - This step allows the user to read the programming. Using the touch tone telephone, the autodialer will display the programming content for various locations.

It is recommended that the programming be tested. Inform the receivers of calls that you will be testing the system so that they do not react on the alarm calls. Simply invoke each of the alarm conditions (inputs), and verify that the autodialer is calling the correct telephone numbers.

6.5 TROUBLE SHOOTING PROCEDURES

6.5.1 Alarm System

The alarm system for the Arctic Bay truckfill station consists of an external horn, a flashing strobe beacon, and an autodialer to indicate the alarm. There is a ten point alarm annunciator set into the front of the main control panel, even though all ten positions are not occupied by an alarm. The record drawings and control panel schematics in Appendix A, and Section 9.9 respectively show the physical layout of the annunciator within the panel. Alarms are indicated by a red light flashing on the annunciator. Alarms sound the outside horn, the strobe beacon flashes, and the autodialer calls the Hamlet Office.

The alarm annunciators each have four control buttons: ACK, FLRST, RST, and TEST. The TEST button causes each alarm light to illuminate while it is pressed. The FLRST (flash reset) button is not used with the operating mode the annunciators are programmed for in this facility. The ACK (acknowledge) button stops the flashing and horn, but the alarm light remains lit. The RST (reset) button cancels all alarms. However, if a device continues to send an alarm to the annunciator, the RST button will not reset that alarm.

The alarms are emergency conditions which may result in a failure of the facility to deliver treated water as required or may result in damage to the facility or persons. Therefore, these alarms are to be treated as emergencies and must be corrected immediately. To ensure that alarms are corrected immediately, the alarm annunciator is connected to an external horn and strobe beacon.

The alarms are listed, along with the response to each alarm condition.

Alarms

.1 Generator Room Low Temperature and Pump Room Low Temperature

These two alarms are transmitted from the low temperature alarm thermostats. The indicate that the room temperature are lower than the set point (initially set at 10 °C) and may indicate a heater failure, or ventilation fault. THIS ALARM MUST BE DEALT WITH PROMPTLY TO ENSURE THAT THE FACILITY AND INTERNAL EQUIPMENT DOES NOT FREEZE. Freezing of water within the facility may cause very severe damage to the piping, UPS batteries, and chlorine injector.

One of the following conditions may be causing the alarm:

- The building thermostat may have failed and the infrared heater is not operating.
  - Acknowledge the alarm annunciator (ACK). Increase the setting on the building thermostat to above room temperature, and turn on the infrared heaters. Have an electrician repair the heating system if the heaters do not turn on.

- The building thermostat may be set too low.
  - Acknowledge the alarm annunciator (ACK). Increase the setting on the building thermostat to above the low temperature alarm thermostat setting. Wait a few hours for the building to warm. The alarm light should turn off when the room temperature rises above the alarm thermostat setting.

- The low temperature alarm thermostat may be set too high.
  - Acknowledge the alarm annunciator (ACK). Decrease the setting to approximately 10 °C. The alarm light should turn off as long as the room temperature is above 10 °C.

- The low temperature alarm thermostat may have failed.
  - Acknowledge the alarm annunciator (ACK). Check the thermostat for function by decreasing the setting to below the room temperature. The alarm light should turn off. If the thermostat fails to operate properly, have an electrician repair the heating system.

- The outside temperature may be very low and doors or vents may be open. Therefore, the heaters may not be able to heat the building to the thermostat setting.
  - Acknowledge the alarm annunciator (ACK). Ensure the door is not open, and look for major air leaks. Seal up the building as well as possible.

- The ventilation system may not be operating correctly. Therefore, the generator may not be able to heat the generator side of the building to the thermostat setting.
  - Check the fan box, and dampers for correct operation on the generator side of the truckfill station. The actuators may not be closing the dampers, or the dampers may be sticking. If the ventilation system is suspected of malfunctioning, an electrician may be required for servicing the ventilation system.

.2 Heat Trace Alarm

An alarm will be activated when the heat trace controller sends an alarm signal to the control panel. Consult the TS202 Programming Manual, Appendix A for specific alarm messages, and potential problems. Also refer to section 6.3.4 and the TS202 Programming Manual for programming details if required.

The heat trace alarm on the control panel can be cleared by taking the following actions:

- Acknowledge the alarm on the heat trace controller by pushing the ACK button.

- Acknowledge the alarm on the control panel by pushing the black ACK button on the panel, and then the red ACK button on the panalarm.

- Determine the cause of the alarm.

- After resolving the problem, press the RST button on the Panalarm to clear the alarm.

.3 Voltage Transfer Switch Alarm

The alarm is activated when the transfer switch is sending a signal that the voltage is incorrect.

- Acknowledge the alarm on the panalarm by pressing the ACK button. An electrician is needed to confirm this alarm case. If the alarm is confirmed, further services to repair the problem may be required from an electrician. If the electrician confirms that the alarm is false, the RST button can be pushed.

.4 Uninterruptible Power Supply Alarm

An alarm will be activated if the generator power fails. The UPS will be engaged and the alarm will continue until the prime power is restored.

The UPS alarm on the control panel can be cleared by taking the following actions:

- Acknowledge the alarm on the control panel by pushing the red ACK button on the panalarm.

- Restore the main power to the pumphouse.

- Press the RST button on the Panalarm to clear the alarm.

.5 Generator Fault Alarm

This alarm is transmitted from the diesel generator control panel located in the generator room. It indicates that an alarm situation has occurred with respect to the generator.

- Acknowledge the alarm (ACK) on the alarm annunciator in the main control panel. The alarm light should turn off.

- Go to the generator control panel in the generator room and check the alarm. Look up the alarm in the generator control panel in Section 9.7. There are five possible alarms that are indicated from this panel: no speed signal, overcrank, low oil pressure, high coolant temperature, and overspeed. With the help of the generator manuals, the maintainer can try find the cause of the alarms, remedy the problems, and restart the generator. If the alarm is activated again, or the problem to the alarm cannot be found, generator/electrical servicing may be required.

- After alleviating the problem, press the RST button on the Panalarm to clear the alarm.

.6 Low Fuel Alarm

There are two (2) low fuel alarms, but only the major alarm (25% full tank) is latched to the panalarm, horn, siren, and autodialer. The major alarm activates at the low fuel point from the Magnetrol sensor. When the major alarm is activated, the panalarm, horn, siren, and autodialer are activated. The minor alarm (50% full) flashes the strobe beacon only. To alleviate the alarm condition:

- Acknowledge the alarm (ACK) on the alarm annunciator in the main control panel. The alarm light, horn, and autodialer should turn off.
- Fill the fuel tank with diesel.
- Press the RST button on the Panalarm to clear the alarm.

.7 Generator Room Low Temperature and Pump Room Low Temperature

These alarms are transmitted from the high temperature alarm thermostats. The indicate that the building temperature is higher than the set point (initially set at 32 °C). THIS ALARM MAY INDICATE A FIRE IN THE BUILDING.

Upon determining that the high building temperature alarm is on, look for signs of fire within the facility, or excess heat output. Small fires may be controlled with the fire extinguishers located at each exterior door. Larger fires will require the assistance of the Arctic Bay fire brigade.

If fire is not the cause of the high temperature alarm, then one of the following conditions may be causing the alarm:

- The high temperature alarm thermostat may be set too low.

- Acknowledge the alarm annunciator (ACK). Increase the setting to approximately 32 °C. The alarm light should turn off.

- The high temperature alarm thermostat may have failed.
  - Acknowledge the alarm annunciator (ACK). Check the thermostat for function by increasing the setting to above the room temperature. The alarm light should turn off.

- The building thermostat may be set too high.
  - Acknowledge the alarm annunciator (ACK). Reduce the setting on the building thermostat to below the high temperature alarm thermostat setting. Wait a few hours for the building to cool. The alarm light should turn off when the room temperature drops below the alarm thermostat setting.

- The temperature control thermostats may have failed and the infrared heaters are not turning off.
  - Acknowledge the alarm annunciator (ACK). Reduce the setting on the building thermostat to below room temperature, and turn the heaters' controls off. Have an electrician repair heating system if controls are not functioning properly.

- The outside temperature is very high and, therefore, the building is overheated. This would be indicated by both an outside temperature and a building temperature above the high temperature alarm thermostat setting the alarm off. Adjust the high thermostat alarm setting to a temperature higher than the room temperature.

- The ventilation system may not be operating correctly. Therefore, the generator may be overheating the generator side of the building.
  - Check the fan box, and dampers for correct operation on the

generator side of the truckfill station. The fan may have become overloaded, the actuators may not be opening the dampers, or the dampers may be sticking. If the ventilation system is suspected of malfunctioning, an electrician may be required for servicing the ventilation system.

7.0 MAINTENANCE PROCEDURES

7.1 General

Section 7 contains tables describing the periodic maintenance tasks to be performed in the plant. The tables are organized By Schedule and By Equipment and contain cross references to Sections 4 and 9. For detailed descriptions of each maintenance task, refer to the manufacturers' manuals in Section 9.

Tables for spare parts and miscellaneous equipment are included in this section.

Finally, a clear plastic sleeve contains maintenance, chlorination, and consumable logs. Make copies as required. **DO NOT USE THE LAST COPY** before making more copies. Keep a clean copy in the sleeve. The logs are an important part of facility operation. They should be filled out immediately following maintenance. They are critical to trouble shooting when problems arise, determining "rules of thumb" for operation, and are used for designing changes to the facility when required.

Consumables and spare parts are provided for convenient and fast maintenance, thereby causing very little down time. When consumables are used be sure to record the usage on the consumables log. Order replacement consumables with plenty of lead time so no disruption in water delivery occurs.

Sleeve	Contents: Chlorination Log, Maintenance Logs, and Consumables Usage/Reorder Log.
Table 7.1	Maintenance Tasks by Equipment
Table 7.2	Maintenance Tasks by Schedule
Table 7.3	Spare Parts and Miscellaneous Equipment

7.2 Maintenance Logs

The following tables are maintenance logs for facility operation. Please make copies from the clear sleeve, ensuring that a clean copy remains in the sleeve for future copying.

MAINTENANCE TASKS BY EQUIPMENT
TABLE 7.1

Section 9 Tab	Section 4 Tables and Figs	Item	Maintenance Item	Schedule
9.1 PIPES, PIPE SUPPORT, VALVES, INTAKE SCREEN, AND FITTINGS				
9.1	-	Throttling Valve	Check For Leakage, And Smooth Operation	Daily
9.1	4.1, 4.4	Pipe Fittings	Check For Leakage	Daily
-	-	Bypass Hose	Check For Leakage, Tighten Monthly	Daily
9.2 PUMPS				
9.2	4.1	Submersible Intake Pump	Inspect For Wear	Annually
9.2	4.1	Submersible Pump Engine	Reactive Maintenance, page 25 of Franklin Electric Submersible Motor Manual	As Required
9.3 METERS AND GAUGES				
9.3	4.1, 4.3	Flow Meter & Accumulator	Record Flow Rate and Accumulator Reading	Daily
9.3	4.1	Pressure Gauge	Record Reading	Daily
9.3	4.1	Thermometer	Record Reading	Daily
9.4 WATER TREATMENT				
9.4	-	Chlorine	Inspect Containers for Leaks and Moisture	Weekly
9.4	4.1, 4.3	Chlorine Injection Pump	Replace and Clean Cartridge Valves as Required	Every 8 Months
9.4	4.1, 4.3	Chlorine Injection Pump	Clean or Replace Diaphragm as Required	Every 8 Months
9.4	4.1, 4.3	Chlorine Injection Pump	Clean or Replace Diaphragm on 5-way Valve as Required	Every 8 Months
9.4	4.1	Chlorine Mixer	Rinse Off Shaft and Agitator	Following Each Chlorine Mixing
9.4	4.1	Chlorine Mix and Feed Tanks	Inspect for Leaks and Clean	Following Each Chlorine Mixing

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MAINTENANCE TASKS BY EQUIPMENT
TABLE 7.1

Section 9 Tab	Section 4 Tables and Figs	Item	Maintenance Item	Schedule
9.4	4.1	PVC Ball Valves on Tanks	Check For Leakage, And Smooth Operation	During Each Chlorine Mixing
9.5 HEATING SYSTEM				
9.5	-	Radiant Heaters	Check For Correct Operation	Daily
9.5	-	Electric Heater Thermostat	Check For Correct Operation	Daily
9.5	-	Percentage Input Controller for Radiant Heaters	Check For Correct Operation	Daily
9.6 ELECTRICAL PANELS, AND ASSOCIATED ITEMS				
9.6	4.2	Breaker Panel	Test Breakers	Monthly
9.6	4.2	Main Disconnect in Breaker Panel	Test	Annually
9.6	4.2	Motor Starter for Submersible Pump	Check all Switches	Monthly
9.6	4.2	Meter Socket	Check that Meter is Operating	Monthly
9.7 GENERATOR				
9.7	4.2	Engine	Check Engine Oil Level per Engine Manual	Daily
9.7	4.2	Engine	Check Air Cleaner	Daily
9.7	4.2	Engine	Battery Maintenance and Connections	125 Hrs
9.7	4.2	Engine	Check Cooling System per Manual	125 Hrs
9.7	4.2	Engine	Change Engine Oil	125 Hrs
9.7	4.2	Engine	Change Oil Filter	500 Hrs
9.7	4.2	Engine	Change Fuel Filter	1000 Hrs
9.7	4.2	Engine	Check Valve Clearances	500 Hrs
9.7	4.2	Engine	Check V-belts	250 Hrs
9.7	4.2	Engine	Check Alarm System	250 Hrs
9.7	4.2	Engine	Check Fuel Strainer & Fuel Screen	1000 Hrs
9.7	4.2	Engine	Check Fastenings	1000 Hrs
9.7	4.2	Engine	Check Flame Type Heater Plugs	1000 Hrs
9.7	4.2	Engine	Change Bypass Oil Filter	500 Hrs
9.7	4.2	Engine	Check Injectors	3000 Hrs

MAINTENANCE TASKS BY EQUIPMENT
TABLE 7.1

Section 9 Tab	Section 4 Tables and Figs	Item	Maintenance Item	Schedule
9.7	-	Generator & Alternator	Clean Cooling Air Openings	Monthly
9.7	4.2	Muffler	Check & Remove Ice From Exhaust Pipe	Daily During Winter
9.8 UNINTERRUPTIBLE POWER SYSTEM				
9.8	4.2	Uninterruptible Power System	Periodic Maintenance As Per Manual	6 Months or Per Alarm Conditions.
9.9 CONTROL PANEL, REMOTE CONTROL, AND ASSOCIATED ITEMS				
9.9	4.3	Pilot Lights	Observe Operation	Daily
9.9	4.3	Push Buttons	Observe Operation	Daily
9.9	4.3	Flow Switch	Inspect O Rings, Wheel And Paddles	Annually
9.9	4.3	Flow Sensor	Replace Paddle and/or Sensor	Per False Readings on Flow Gauge
9.10 ALARM ITEMS				
9.10	-	Alarm Thermostats	Check Operation	Weekly
9.10	4.5, 4.6	Fuel Level Sensor	Check Alarm Operation	Weekly
9.10	-	Horn	Check Operation	Weekly
9.10	-	Strobe Beacon	Check Operation	Weekly
9.10	4.3	Annunciator	Press Test Button	Weekly
9.11 LUMINARIES				
9.11	-	Emergency Light	Push To Test Button	Weekly
9.11	-	Exit Light	Test	Annually
9.11	-	Exterior Lighting	Check Lamps	Monthly
9.11	-	Overhead Lighting	Check Lamps	Monthly
9.11	-	Truck Arm Light	Check Lamps	Monthly
9.12 HEAT TRACE SYSTEM				
9.12	4.5	Heat Trace Controller	Check for Messages on Panel	Daily
9.12	4.4, 4.5	Heating Cable	Feel Conduit for Heat	Daily During Cold Weather Conditions
9.13 DIESEL FUEL SUPPLY				
9.13	4.5, 4.6	Fuel Tank (Main & Day)	Check For Corrosion And Leaks	Weekly
9.13	4.5, 4.6	Level Indicator	Check And Compare To Tank Level	Weekly

MAINTENANCE TASKS BY EQUIPMENT
TABLE 7.1

Section 9 Tab	Section 4 Tables and Figs	Item	Maintenance Item	Schedule
9.13	4.5, 4.6	Fill and Vent Caps	Check If Closed And Locked	Weekly
9.13	4.5, 4.6	Drain Valve	Drain Water From Containment	Weekly
9.13	4.5, 4.6	Isolation Valves	Check If Open	Weekly
9.13	4.5, 4.6	Spill Containment	Check For Fuel Leakage, And Clean	Weekly
9.13	4.5, 4.6	Fuel Filter	Replace	Annually
9.13	4.5, 4.6	Flexible Connection	Check Stress On Connections	Annually
9.14 VENTILATION SYSTEM				
9.14	-	Blower Box & Motor	Check for Operation	Daily
9.14	-	Dampers	Check, Clean,and Lubricate	Every 3 Months
9.14	-	Actuators	Check, Clean,and Lubricate	Every 3 Months
9.14	-	Ventilation Thermostat	Check Setting	Weekly
9.15 SATELLITE PHONE SYSTEM				
9.15	-	Autodialer and Satellite Phone System	Test Operation	Weekly
9.16 LABORATORY AND SAFETY EQUIPMENT				
9.16	-	Chlorine Tester	Inventory Chemicals and Reorder as Necessary	Monthly
9.16	-	Fire Extinguisher	Maintain Per Manual's Instructions	Annually
9.16	-	Eyewash Station	Inventory Saline and Reorder as Necessary	Monthly
9.16	-	Valved Respirators	Inventory and Reorder as Necessary	Monthly
9.16	-	Safety Gloves	Inventory and Reorder as Necessary	Monthly
9.16	-	Rubberized Safety Apron	Inspect for Wear and Reorder if Necessary	Annually
9.16	-	Face Shield	Inspect for Wear and Reorder if Necessary	Annually

MAINTENANCE TASKS BY EQUIPMENT
TABLE 7.1

Section 9 Tab	Section 4 Tables and Figs	Item	Maintenance Item	Schedule
9.17 MISCELLANEOUS ITEMS				
9.17	-	Winch	Lubricate and Inspect Cable on Spool	Annually
9.17	-	Winch Cable	Inspect for Corrosion and Fraying	Annually
9.17	-	Janitorial Equipment	Restock as Required	Monthly
9.17	-	Interior Paint	Inspect and Repaint as Necessary	Annually

ARCTIC BAY TRUCKFILL
ARCTIC BAY, NT

MAINTENANCE TASKS BY SCHEDULE
TABLE 7.2

Schedule	Section 9 Tab	Section 4 Tables and Figs	Item	Maintenance Required
HOUR SCHEDULE				
125 Hrs	9.7	4.2	Engine	Check Cooling System per Manual
125 Hrs	9.7	4.2	Engine	Battery Maintenance and Connections
125 Hrs	9.7	4.2	Engine	Change Engine Oil
250 Hrs	9.7	4.2	Engine	Check V-belts
250 Hrs	9.7	4.2	Engine	Check Alarm System
500 Hrs	9.7	4.2	Engine	Change Bypass Oil Filter
500 Hrs	9.7	4.2	Engine	Check Valve Clearances
500 Hrs	9.7	4.2	Engine	Change Oil Filter
1000 Hrs	9.7	4.2	Engine	Change Fuel Filter
1000 Hrs	9.7	4.2	Engine	Check Fuel Strainer & Fuel Screen
1000 Hrs	9.7	4.2	Engine	Check Fastenings
1000 Hrs	9.7	4.2	Engine	Check Flame Type Heater Plugs
3000 Hrs	9.7	4.2	Engine	Check Injectors
DAILY MAINTENANCE				
Daily During Cold Weather Conditions	9.12	4.4, 4.5	Heating Cable	Feel Conduit for Heat
Daily During Winter	9.7	4.2	Muffler	Check & Remove Ice From Exhaust Pipe
Daily	9.1	4.1, 4.4	Pipe Fittings	Check For Leakage
Daily	9.1	-	Throttling Valve	Check For Leakage, And Smooth Operation
Daily	9.12	4.5	Heat Trace Controller	Check for Messages on Panel
Daily	9.14	-	Blower Box & Motor	Check for Operation
Daily	9.3	4.1	Pressure Gauge	Record Reading
Daily	9.3	4.1	Thermometer	Record Reading
Daily	9.3	4.1, 4.3	Flow Meter & Accumulator	Record Flow Rate and Accumulator Reading
Daily	9.5	-	Percentage Input Controller for Radiant Heaters	Check For Correct Operation
Daily	9.5	-	Electric Heater Thermostat	Check For Correct Operation
Daily	9.5	-	Radiant Heaters	Check For Correct Operation

ARCTIC BAY TRUCKFILL
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MAINTENANCE TASKS BY SCHEDULE
TABLE 7.2

Schedule	Section 9 Tab	Section 4 Tables and Figs	Item	Maintenance Required
Daily	9.7	4.2	Engine	Check Engine Oil Level per Engine Manual
Daily	9.7	4.2	Engine	Check Air Cleaner
Daily	9.9	4.3	Push Buttons	Observe Operation
Daily	9.9	4.3	Pilot Lights	Observe Operation
Daily	-	-	Bypass Hose	Check For Leakage, Tighten Monthly
WEEKLY MAINTENANCE				
Weekly	9.10	4.5, 4.6	Fuel Level Sensor	Check Alarm Operation
Weekly	9.10	-	Alarm Thermostats	Check Operation
Weekly	9.10	4.3	Annunciator	Press Test Button
Weekly	9.10	-	Strobe Beacon	Check Operation
Weekly	9.10	-	Horn	Check Operation
Weekly	9.11	-	Emergency Light	Push To Test Button
Weekly	9.13	4.5, 4.6	Fuel Tank (Main & Day)	Check For Corrosion And Leaks
Weekly	9.13	4.5, 4.6	Isolation Valves	Check If Open
Weekly	9.13	4.5, 4.6	Spill Containment	Check For Fuel Leakage, And Clean
Weekly	9.13	4.5, 4.6	Drain Valve	Drain Water From Containment
Weekly	9.13	4.5, 4.6	Level Indicator	Check And Compare To Tank Level
Weekly	9.13	4.5, 4.6	Fill and Vent Caps	Check If Closed And Locked
Weekly	9.14	-	Ventilation Thermostat	Check Setting
Weekly	9.15	-	Autodialer and Satellite Phone System	Test Operation
Weekly	9.4	-	Chlorine	Inspect Containers for Leaks and Moisture
MONTHLY MAINTENANCE				
Monthly	9.11	-	Exterior Lighting	Check Lamps
Monthly	9.11	-	Truck Arm Light	Check Lamps
Monthly	9.11	-	Overhead Lighting	Check Lamps

ARCTIC BAY TRUCKFILL
ARCTIC BAY, NT

MAINTENANCE TASKS BY SCHEDULE
TABLE 7.2

Schedule	Section 9 Tab	Section 4 Tables and Figs	Item	Maintenance Required
Monthly	9.16	-	Chlorine Tester	Inventory Chemicals and Reorder as Necessary
Monthly	9.16	-	Valved Respirators	Inventory and Reorder as Necessary
Monthly	9.16	-	Safety Gloves	Inventory and Reorder as Necessary
Monthly	9.16	-	Eyewash Station	Inventory Saline and Reorder as Necessary
Monthly	9.17	-	Janitorial Equipment	Restock as Required
Monthly	9.6	4.2	Breaker Panel	Test Breakers
Monthly	9.6	4.2	Motor Starter for Submersible Pump	Check all Switches
Monthly	9.6	4.2	Meter Socket	Check that Meter is Operating
Monthly	9.7	-	Generator & Alternator	Clean Cooling Air Openings
ANNUAL MAINTENANCE				
Annually	9.11	-	Exit Light	Test
Annually	9.13	4.5, 4.6	Flexible Connection	Check Stress On Connections
Annually	9.13	4.5, 4.6	Fuel Filter	Replace
Annually	9.16	-	Fire Extinguisher	Maintain Per Manual's Instructions
Annually	9.16	-	Face Shield	Inspect for Wear and Reorder if Necessary
Annually	9.16	-	Rubberized Safety Apron	Inspect for Wear and Reorder if Necessary
Annually	9.17	-	Winch Cable	Inspect for Corrosion and Fraying
Annually	9.17	-	Winch	Lubricate and Inspect Cable on Spool
Annually	9.17	-	Interior Paint	Inspect and Repaint as Necessary
Annually	9.2	4.1	Submersible Intake Pump	Inspect For Wear

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ARCTIC BAY, NT

MAINTENANCE TASKS BY SCHEDULE
TABLE 7.2

Schedule	Section 9 Tab	Section 4 Tables and Figs	Item	Maintenance Required
Annually	9.6	4.2	Main Disconnect in Breaker Panel	Test
Annually	9.9	4.3	Flow Switch	Inspect O Rings, Wheel And Paddles
MISCELLANEOUS				
As Required	9.2	4.1	Submersible Pump Engine	Reactive Maintenance, page 25 of Franklin Electric Submersible Motor Manual
During Each Chlorine Mixing	9.4	4.1	PVC Ball Valves on Tanks	Check For Leakage, And Smooth Operation
6 Months or Per Alarm Conditions.	9.8	4.2	Uninterruptible Power System	Periodic Maintenance As Per Manual
Every 3 Months	9.14	-	Dampers	Check, Clean,and Lubricate
Every 3 Months	9.14	-	Actuators	Check, Clean,and Lubricate
Every 8 Months	9.4	4.1, 4.3	Chlorine Injection Pump	Clean or Replace Diaphragm as Required
Every 8 Months	9.4	4.1, 4.3	Chlorine Injection Pump	Replace and Clean Cartridge Valves as Required
Every 8 Months	9.4	4.1, 4.3	Chlorine Injection Pump	Clean or Replace Diaphragm on 5-way Valve as Required
Following Each Chlorine Mixing	9.4	4.1	Chlorine Mixer	Rinse Off Shaft and Agitator
Following Each Chlorine Mixing	9.4	4.1	Chlorine Mix and Feed Tanks	Inspect for Leaks and Clean
Per False Readings on Flow Gauge	9.8	4.3	Flow Sensor	Replace Paddle and/or Sensor

ARCTIC BAY TRUCKFILL
ARCTIC BAY, NT

TABLE OF SPARE PARTS & MISCELLANEOUS EQUIPMENT
TABLE 7.3

Item	Part Description	Number	Location
1	Submersible Pump Motor	1	Inside Pumphouse
2	Submersible Pump	1	Inside Pumphouse
3	Throttle Valve	1	shelves in storage cabinet
4	Fuel Oil Gate Valve	1	shelves in storage cabinet
5	Fusible Link Valve	1	shelves in storage cabinet
6	Eyewash - Spare container of fluid.	1	shelves in storage cabinet
7	Damper Motors	1	shelves in storage cabinet
8	Thermostats	2	shelves in storage cabinet
9	Generator Fuel Filters	10	shelves in storage cabinet
10	Oil Filters	10	shelves in storage cabinet
11	Respirator Cartridges	12	shelves in storage cabinet
12	Fuel Filter Cartridges	5	shelves in storage cabinet
13	15W40 Engine Oil	12 L	shelves in storage cabinet
14	Chemical Injection Pump - replacement part kits.	3	shelves in storage cabinet
15	Flow Switch	1	shelves in storage cabinet
16	Chemical Feed Pump	1	shelves in storage cabinet
17	Nylon Tubing	5 m	shelves in storage cabinet
18	Pump Replacement Kits	3	shelves in storage cabinet
19	Lighting Lamps & Ballasts	2 for each light type.	shelves in storage cabinet
20	Breakers	2 for each size and type.	shelves in storage cabinet
21	Terminal Blocks c/w end caps, end plates, cross connectors, and tear off markers.	1 for each size and type.	shelves in storage cabinet
22	Motor Starter - pilot light and over load heaters.	6 of each type.	in motor starter panel
23	Motor Starter - Coil and Contact.	1	in motor starter panel
24	Pilot Light and Lense	1 of each type.	in control panel
25	Fuses	6	of each type in panels
26	Motor Starter - Coil and Contact.	6	shelves in storage cabinet, and some panels
27	Panalarm Alarm Annunciator	1	shelves in storage cabinet
28	Flow Gauge/Accumulator	1	shelves in storage cabinet
29	Heat Trace Controller	1	shelves in storage cabinet
30	Termination Boots	2	shelves in storage cabinet
31	RTD Sensor	1	shelves in storage cabinet

ARCTIC BAY TRUCKFILL
ARCTIC BAY, NT

TABLE OF SPARE PARTS & MISCELLANEOUS EQUIPMENT
TABLE 7.3

Item	Part Description	Number	Location
32	Mini Breakers	2 of each relay and timer. 1 of each relay and timer base.	shelves in storage cabinet
28	Ventilation Temp. Control Module	1	shelves in storage cabinet
33	Dust Masks	150	shelves in storage cabinet
34	Rubber Gloves - Fisher large, extra long, heavyweight.	12	shelves in storage cabinet
35	Face Shield	1	shelves in storage cabinet
36	Rubber Apron	1	shelves in storage cabinet
37	Fire Extinguisher	1	mounted by exit
38	Floor Cleaner - Industrial Quality, 20L.	1	on floor of pumphouse

8.0 TESTING AND CERTIFICATION DATA

8.1 General

Section 8 contains copies of the Commissioning Checklist, test results, initial settings for equipment, and warranties. If a warranty is not found in this section, it is probably part of the operating manuals in "Manufacturer Data and Service Information", Section 9. Please search the related material in Section 9 if a warranty for a certain component is not found here.

If a warranty for an item cannot be found anywhere in this manual, please contact the appropriate supplier as listed in Section 5. The supplier will be able to provide service information for the item.

Kudlick construction inc. P.O. BOX 175 , RANKIN INLET, N.W.T.
XOC OGO TEL (819) 645-2839 FAX (819) 645-2493

Dillon consulting
suite 201 ,5102 ,51st street,
yellowknife, N.T.
PHONE 403-920-4555
FAX 403 -873-3328

jan 12 , 1998

Attention MR. KIRK GUENTHER, P.ENG.

Artic Bay Truckfill Station Project# 4-001-659 Report for service call of jan 5 1998 to jan 16 1998

a) Modification of set point alarm on low fuel warning set at 50%

Under instruction of local manager « Sam Willie » set point alarm was changed from 50% to 30% . Reason to do so is to lower cost of call out for fuell to coop.

b) Modification of set point to « acutron heat trace »
Following complain of alarm with heat trace control our investigation show that

1) The two heat trace cable are in perfect condition
2) Origin of alarm is a false alarm caused by deep coll down of filling pipe during truckfill The temperature fall below decent protection set point of 4 centigrade.
3) The two following action where taken wich is alarm set point lower to 3 centigrade, and normal temperature set point raised to 12 centigrad

We recommend following modification in futur desing wich are installation of temperature probe at distance from four inches pipe wich temperature fall to low in winter

c) Electrical defect from inspection services
All defect corrected at satisfaction of inspector according this morning call with our electrician.

d) Oil lost on generator
Now in operation for six month without interruption machine loose 2 liters of oil a week. This situation is quite normal for such an engine.

e) All system where tested and worked ok.

At your services

Guy Fauteux Ing.

C.C.h.McGowan 819-979-4748
c.c.g.fauteux 514-430-7108

ARCTIC BAY TRUCKFILL STATION
ARCTIC BAY, NWT

COMMISSIONING CHECKLIST

DATE: SEPT 17/97
ATTENDING: KIRK GAUTHIER - DILLON
GUY FAUTEUX - KUDLIK CONST.
SAM WILLIE - TOWN FOREMAN
HAROLD McGOWAN - PWS/QAC/LIT

SYSTEM	CHECK	COMMENT	PASS
1 Generator System			
Generator off. Main Breaker off. Go through **major components** (dip sticks, fuel tank, air, fuel, oil filters, decompression lever, alternator etc.). Go through **start up procedures.**	Perform. Emergency Lights Y on? Any alarms? Y UPS on? Y L1-L2 = 206 V L2-L3 = 204 V L3-L1 = 206 V Hours 743.52	Record on Startup Oil Pressure: 4.5 bar (41.4) Engine Temp.: V. LOW (IN GREEN) Amperage: 0/0/0 NO LOADS Voltage: 123/123/123 FREQ. 61.6 Hz Burn Rate of Generator: 1000 L / 10 days	MAYED OUT BUT ON SCALE — GET WITH UNITS? ✓
Simulate Generator Failures	Perform. Alarms function on Generator Control panel? Main control panel? Autodialer?	VIDEO ADEQUATE. FACTORY TESTED.	✓

SYSTEM	CHECK	COMMENT	PASS
Turn on Main Breaker	UPS off? ✓ Emergency Lights ✓ off. Acknowledge alarms. ✓		✓
Transfer Switch Operation	Engages in auto position?	O.K. NO HYDRO. N/A	✓
Readings	Obtain. HOURS 761.62	Record after warm up. Running Time: Oil Pressure: 4,5 bar Engine Temp.: GREEN Amperage: BARELY MOVES. Voltage: SAME AS YESTERDAY 123/123/123 V	✓
Ventilation/Damper Operation. Explain control sequence. Show operation.	Perform.		✓
Shut down: go through procedure..	Go through.	NO LOAD. NO WARM DOWN REQUIRED. SIMPLY SHUT OF GEN-SWITCH.	✓
Typical Maintenance Items: follow manual. Items/fluids to check at this time	Go through.	VIDEO ADEQUATE.	✓

SYSTEM	CHECK	COMMENT	PASS
2 General Electrical			
Check operation of **interior lights.**	Go through.	GOOD	✓
Check **Breakers** in Breaker Panel.	Work and Labeled correctly?	O.K.	✓
Exterior Lights	Override to turn on. Photo Eye working?	GOOD	✓
3 Truckfill System			
Put **empty water truck** under arm and hose in truck.	Fit O.K.? Truckfill control positioned good?	Water Truck size: 6820 (Canadian 1500 gallons	✓
Check action of **butterfly valve** on offtake pipe.	Perform		✓
Turn **agitator** on for short time only to demonstrate working order.		HAS INSTALLED SWITCH SIMILAR TO LIGHT SWITCH FOR OPERATION	✓
Fill feed tank with apx. 20 Liters of **water only** using pump on manual control and valving appropriately.	Perform	PRESSURE TOO HIGH TO USE ONLY BY PASS VALVES NOW. WILL NEED TO ADDRESS.	✓
Demonstrate injection pump operation including: automatic operation, manual operation, priming/bleeding, five way valve settings, typical maintenance.	Perform		✓
Read accumulator	Perform	Accumulator Reading: 197.7 x ~~m~~ ^{3}	✓
Insert key into truckfill controller from arm.	Turn on to engage power.		✓

SYSTEM	CHECK	COMMENT	PASS
Push **Start** button and **time** filling empty truck tank. Read **Flow Gauge** once pump starts. Is **injection pump** working? Read **Pressure gauge, temperature gauge**.	Pump running? Fill tank full. GET TRUCK ✓ INFO 1500 IMP GALL (FROM PLATE ON TRUCK.)	Flow Gauge: ~~[illegible]~~ 1500 m3/min Pressure Gauge: 385 1 Temp. Gauge: 4 °C VOLUME 6820 L 222 rpm START 2:25 pm STOP 4 min	✓
Press **Stop** button when full. **Check operation**: Will pump stop if key turned off also?	Perform	Elapsed Time: 4 min	✓
Read accumulator when **truck full.**	Perform Flow calculation match flow gauge?	Accumulator Reading: 204.3 m3 Accumulator Difference: 6.6 m3 6600 L Calculate Flow Rate: 1650 L/min 3.2% Δ	✓
4 Alarm System Check			
Explain alarms on system, how to test, acknowledge, react, and reset through **PANALARM**.	Perform	DOUBLE GATE HEAT TRACE, VIDEO. WORKS FINE	✓
Demonstrate Autodialer and Satellite Phone Operation and programming.	Perform. Operates with alarm?		✓
Simulate **Low Temp**. Alarm.	Perform	O.K.	✓
Simulate **High Temp**. Alarm.	Perform	O.K.	✓
Simulate **UPS Power Failure** Alarm.	Perform	O.K.	✓

SYSTEM	CHECK	COMMENT	PASS
Demonstrate **UPS power backup**.	Perform	O.K.	✓
Explain maintenance of UPS and Main controller.	Perform	O.K.	✓
5 Heat Trace and Heating			
Operate building heaters. Explain proportional controller usage.	Perform	PROPORTIONAL CONTROLLER'S TO SAVE COST, BUT ARE VERY MECHANICAL AND LIKELY SHORT LIFE.	✓
Operate heat trace, explain usage. Manual Overrides, simulate alarms, explain acknowledging alarms, any maintenance items..	Perform		✓
6 Spare Parts	Check From Tender Document	- BÉCIMO DAMPER ACTUATOR. - SOME EXTRA PARTS. SEE SHEET.	
7 Miscellaneous Items			
Mix Instructions	Posted ✓	CHANGE. DILLON WILL FRAME AND SEND.	✓
MSDS Sheets	Posted	DID. MAY WANT TO MAKE PERMANENT IN FRAME.	✓
Electrical Single Line Diagram	Posted	DILLON WILL DO AND FRAME.	
New deficiencies	Separate List	MAKE ON OFFICE. NO MAJOR.	
Deficiencies Cleared on Preliminary List?	Check	O.K.	✓

- SAMPLING CUP? ✓
- FREE CHLORINE SAMPLE 0.55 ppm
- TOTAL " " ϕ.43 ppm (Guy Did before)

Kudlick construction inc. P.O. BOX 175 , RANKIN INLET, N.W.T.
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DILLON CONSULTING
C/O kirk Guenther ENG.
SUITE 201 5102 , 51ieme street
Yellownife N.W.T. X1A 1S7
fax 403-873-3328
tel 403-920-4555

Re : Artic Bay pressure test report (galvanized 4 inch fill pipe)

1 Victaulic coupling
All coupling were check for mecanical fitness and torque as spec .
All coupling were check for leak under filling pressure and show no leaks.

2 Flow switch
Mecanical fit ok and torque as spec.
Leak free test ok under filling pressure.

3 Metering turbine
Mecanical fit ok and torque as spec.
Leak free test ok under filling pressure.

4 Chlorine injection point and system.
Mecanical fit ok and torque as spec. Plastic tube and pump perform as spec under filling pressure.
Leak free test ok under filling pressure.

5 Temperature gage.
Mecanical fit ok and torque as spec.
Leak free test ok under filling pressure

6 Pressure gage
Mecanical fit ok and torque as spec.
Leak free test ok under filling pressure

7 Hoze fitting
Mecanical fit ok and torque as spec.
Leak free test ok under filling pressure

By Guy Fauteux ing.

C :Contrat/nwt/articwa
ar 17

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tel 403-920-4555

Re : Artic Bay pressure test report (HDPE)

1 Quality evaluation of joint made by fusion process.(4 inches)

Performance of fusion process was inspected by cutting (2) reference joint and analysis show a complete homogeneous pvc material with absolutly no visible or détectable liaison.

With mecanical impact on sample substance show an absolute integrity with no separation.

2 Individual inspection of joint.

All joint were inspected and normal protuberance originating from melting of material was present uniformly on the circonference of four inche pipe.

3 Performance under pressure.

Test was perform at maximum output pressure from pump and canalisation
test ok.

By Guy Fauteux ing.

C :Contrat/nwt/arthdpe
ar18

Kudlick construction inc. P.O. BOX 175, RANKIN INLET, N.W.T.
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Re : Artic Bay Intake flushing

1 Chlorine Mix
20 liter of high concentrate of chlorine is mix with water.

2 Injection of chlorine in containing conduit.(12 inches)
20 liter of mix chlorine is injected thrue one inches orifice for back wash.

3 Back-wash one inche pipe re-installed.
Pump run for four hours with backwash fully open and butterfly valve crack . at maximum for maximum washing.

By Guy Fauteux ing.

C :Contrat/nwt/artde
ab19

Kudlick construction inc. P.O. BOX 175, RANKIN INLET, N.W.T.
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tel 403-920-4555

Re : Artic Bay heat trace insulation test

1 Heating cable Megger test
- 500 volts test results (infinity)
-1000 volts test results (infinity)

2 Heating cable Megger test
- 500 volts test results (infinity)
-1000 volts test results (infinity)

By Guy Fauteux ing.

C :Contrat/nwt/ab20

MECHRON POWER SYSTEMS INC.

July 22, 1997

Mr. Kirk Guenther
Dillon Consulting Ltd.
5102 51st Street, Suite 201
Yellowknife, NWT
X1A 1S7

Subject: System Test Requirements Document

Dear Mr. Guenther:

Enclosed please find a complete copy of the System Test Requirements Document for the Site Test on July 8-10, 1997.

We trust this is satisfactory. Should you have any questions or concerns, please do not hesitate to contact the undersigned.

Regards,

Elmer Langford
Production Engineer

EL:cc

2437 Kaladar Avenue, Ottawa, Canada K1V 8B9 Tel: (613) 733-3855 Fax: (613) 733-8197

MECHRON

K7

KUDLICK CONSTRUCTION

SYSTEM TEST REQUIREMENTS

SITE TEST, ST JANUER, PQ
JULY 8-10, 1997

TABLE OF CONTENTS

1.0 Electrical Systems Testing

All electrical contact and devices on the As-Built drawings are to be verified and checked on the following check sheets verification. This is to ensure that all connections are installed as per schematics. All devices are to be operated to confirm proper functionality and logic as per the design.

Completed by 397

2.0 Non Operational Checks

1.	Belt tensioning	397	checked
2.	Equipment grounds	397	checked
3.	Electrical wiring	397	checked
4.	Grease all lubricating points	397	checked
5.	Personnel safety guards	397	checked
6.	Air cleaner	397	checked
7.	Coolant level and freezing	N/A	checked
	Point of water glycol mixture	N/A	record
8.	Lubricating oil type	10W30	record
	Lubricating oil level	397	checked

3.0 Engine Control Set-up Parameters

Device	Drawing Code	Setting	Setting Confirmed AT
Overcrank Timer	Part of EC319	20 sec.	SEC 20
Fault Bypass Timer	Part of EC319	10 sec.	Sec. 10
Loss of Speed Signal Timer	Part of EC319	3 sec.	Sec. 3
Starter Disconnect Speed Switch	Part of EC319	36 Hz	Hz 36
Overspeed Switch	Part of EC319	66 Hz	Hz 66
Low Oil Pressure Switch	S323	Fixed	✓
High Eng. Temp. Switch	S324	Fixed	✓

Completed by 397

4.0 Engine Shutdown

1.	V belt failure switch S325	✓ checked
2.	No Speed Signal (EC319)	✓ checked
3.	Overcrank (EC319)	✓ checked
4.	Low Oil Pressure S323	✓ checked
5.	High Coolant Temperature S324	✓ checked
6.	Overspeed (EC319)	✓ checked

Completed by 397

5.0 Additional Engine Generator Controls

1.	Hand Off Auto Selector Switch S329	✓ checked
2.	Lube Oil Heater & Thermostat HR328/TH326	T/STAT U/S checked
3.	Battery Charging Alternator BCA307	✓ checked
4.	Starter Relay K322	✓ checked
5.	Starter Motor and Solenoid B305/SOL306	✓ checked
6.	Fuel Solenoid SOL310	✓ checked
7.	Common Shutdown Relay K324	✓ checked
8.	Customer Remote Shutdown Indication	✓ checked
9.	Customer Remote Start in Automatic EC319	✓ checked
10.	Elapsed Time Meter M314b	✓ checked
11.	Oil Pressure Gauge & Sender M314/UA315	✓ checked
12.	Engine Temp. Gauge & Sender M312/UA313	✓ checked
13.	Transformer T327	✓ checked
14.	Frequency Meter M314A	✓ checked
15.	Ac Voltmeter and Switch M311/S311	✓ checked
16.	AC Ammeter and Switch M320/S320	✓ checked
17.	Main Alternator Breaker CB306	✓ checked
18.	Battery Charger BC301	✓ checked

6.0 Transfer Switch Set Up Parameter

Device	Setting	Setting Confirmed At
3 phase normal source over voltage protection	135VL-N	NOTE: 3Ø HYDRO NOT AVAILABLE AT SITE, AND XFR SWITCH COULD NOT BE "FOOLED"
3 phase normal source under voltage protection	90VL-N	
Normal source frequency	69 Hz	
Time delay engine start Range 0-10 minutes	1 minute	
Time delay normal to emergency Range 0-10 minutes	1 minute	
Time delay emergency to normal Range 0-10 minutes	3 minutes	
Time delay cool down Range 0-10 minutes	3 minutes	
Time delay during transfer Range 5 to 300 seconds	120 seconds	

7.0 Additional Transfer Switch Controls

Four position selector switch:

- Test mode _____ checked
- Automatic mode ✓ checked
- Manual mode _____ checked
- Engine start mode _____ checked

Red "emergency on" pilot light ✓ checked

Green "normal on" pilot light ✓ checked

Above pilot lights push to test ✓ checked

2 of engine start contracts _____ checked
(close on failure of normal source)

Elapsed time meter 7 digits ___✓___ checked
(resolution to 0.01 hours)

2 of form C contracts for Customer ___✓___ checked
(alarms to indicate presence of normal power)

2 of form C contracts for Customer ___✓___ checked
(alarms to indicate presence of emergency power)

8.0 Load Tests

Load test unit for 23 hours at full load, 1 hour at 110% load.

Record the following data at 15 minute intervals for initial 4 hours, and final 1 hour of full load test and during 110% load test, hourly for remaining time, record readings on Mechron Standard Load Test Forms.

1. Frequency
2. Voltage L to L and L to N, all phases
3. Current, all phases
4. Kilowatts
5. Engine Temperature
6. Oil pressure
7. Engine cooling, air inlet temperature and air outlet temperature
8. Battery Voltage
9. Battery Charging Alternator Current
10. Exhaust temperature
11. Oil temperature

9.0 Transient Test

	Transient Voltage L to L		Transient Frequency	
	Level	Time	Level	Time
No load to 50% load	210 - 204	100 ms.	62.1 - 61	600 ms
50% load to no load	210 - 218	100 ms.	61.41 - 62.4	600 ms.
No load to 75% load	208 - 200	200 m sec	62 - 60.4	400 ms
75% load to no load	208 - 222	200 ms	60.8 62.6	420 ms
No load to 100% load	208-198	200 ms.	62.1 - 59.8	800 ms.
100% load to no load	208 - 222	200 ms.	60.2 - 62.6	800 ms.

See STRIP CHART.

10.0 Non Operational After Load Test

1. Belt Tensioning	✓	checked
2. Coolant leaks and level	N/A	checked
3. Lubricating oil leaks and level		checked
4. Fuel leaks	✓	checked
5. All electrical connections	✓	checked

TEST

MECHRON POWER SYSTEMS INC.
LOAD TEST READINGS

PROJECT NO.: K7 UNIT SER. NO.: 8362523 TEST DATE: JULY 9, 1997

Time	1	2	3	4	5	6	7	8	9	10	11	12
~~1000~~	~~60.1~~	~~208~~	~~207~~	~~208~~	~~124~~	~~123~~	~~124~~	~~52~~	~~58~~	~~52~~	~~19.5~~	~~5.~~
1100	59.8	207	208	207	124	123	124	52	58	52	19.5	5.1
1115	59.8	208	208	208	123	123	123	52	58	52	19.5	5.0
1130	59.5	208	208	208	125	124	125	53	58	53	20.0	5.0
1145	59.4	207	207	207	124	123	123	53	59	53	20.0	5.0
1200	59.4	208	208	208	125	125	125	53	58	53	20.0	5.0
1215	59.3	207	207	208	124	124	124	53	58	53	20.0	5.0
1230	59.1	208	208	208	125	124	125	53	58	53	20.0	5.0
1245	59.1	207	207	208	124	124	124	53	58	53	20.0	4.9
1300	59.0	208	207	208	125	124	124	53	58	52	20.0	4.9
1315	59.0	206	207	206	124	123	123	53	58	52	20.0	4.9
1330	59.0	207	207	206	125	124	124	53	58	52	20.0	4.9
1345	59.0	206	206	206	123	123	123	53	58	53	20.0	4.9
1400	59.0	207	207	208	125	125	124	53	58	52	20.0	4.9
1415	59.0	207	206	206	124	123	123	53	58	52	20.0	4.9
1430	59.0	207	207	207	124	124	124	53	58	52	20.0	4.9
1445	59.0	207	207	207	124	124	124	53	58	52	20.0	4.9

COLUMN DESCRIPTION

1. FREQUENCY
2. VOLTS L1-L2
3. VOLTS L2-L3
4. VOLTS L3-L1
5. VOLTS L1-N
6. VOLTS L2-N
7. VOLTS L3-N
8. AMPS L1
9. AMPS L2
10. AMPS L3
11. KILOWATTS
12. OIL PRESSURE (BAR)

COMMENTS: A 5T JANVIER

TEST

MECHRON POWER SYSTEMS INC.
LOAD TEST READINGS

PROJECT NO.: K7 UNIT SER. NO.: 8362523 TEST DATE: JULY 9, 1997

Time	1	2	3	4	5	6	7	8	9	10	11	12
~~1000~~	~~14.0~~	~~3.6~~	~~68.1~~	~~88.5~~	~~90.9~~	~~24.8~~						
1100	14.0	2.5	59.4	88.1	82.7	68.2	36					
1115	14.0	2.4	78.6	108.1	104.3	86.0	36					
1130	13.9	2.1	81.8	112.7	107.4	91.5	38					
1145	13.9	1.9	82.0	114.8	105.8	94.0	39					
1200	13.9	1.9	83.6	114.3	107.8	97.3	39					
1215	13.9	2.2	87.0	118.4	109.7	97.3	42					
1230	13.9	2.2	87.1	118.7	111.7	97.1	41					
1245	13.9	2.2	88.0	119.9	113.2	100.0	41					
1300	14.0	2.2	84.1	114.9	108.5	99.6	36					
1315	13.9	2.4	87.1	119.4	111.3	100.5	42					
1330	13.9	2.2	87.3	119.7	111.1	99.1	43					
1345	13.9	2.3	87.6	118.9	111.2	99.4	42					
1400	13.9	2.0	88.4	123.8	112.1	100.5	44					
1415	13.9	2.2	88.2	119.8	110.7	96.4	43					
1430	13.9	2.5	87.5	119.3	109.8	98.3	42					
1445	13.9	2.3	89.1	119.7	110.5	98.4	43					

COLUMN DESCRIPTION

1. BATTERY VOLTS
2. BATTERY AMPS
3. ENGINE TEMP (1)
4. EXHAUST TEMP (2)
5. AIR OUTLET TEMP (3)
6. OIL TEMP (4)
7. AIR INLET TEMP (THERMOMETRE)
8. _____
9. _____
10. _____
11. _____
12. _____

COMMENTS: A. ST JANVIER

TEST

MECHRON POWER SYSTEMS INC.
LOAD TEST READINGS

PROJECT NO.: K7 UNIT SER. NO.: 836523 TEST DATE: JULY 9/01/97

Time	1	2	3	4	5	6	7	8	9	10	11	12
1500	59.0	206	206	207	124	123	123	53	58	53	20.0	4.9
1600	59.0	207	207	207	125	124	124	53	58	53	20.0	4.8
1700	59.0	207	207	208	124	123	123	53	58	52	20.0	4.8
1800	59.0	207	207	207	124	124	124	53	58	53	20.0	4.9
1900	59.4	207	207	208	125	124	124	53	58	53	20.0	5.0
2000	59.4	207	206	206	124	123	123	53	59	53	20.0	5.0
2100	59.4	208	207	207	124	124	124	53	59	53	20.0	5.0
2200	59.5	207	206	206	124	123	123	53	59	56	20.0	5.0
2300	59.6	208	207	208	125	124	124	53	59	53	20.0	5.0
2400	59.5	206	206	207	124	123	124	53	59	53	20.0	5.0
0100	59.5	207	207	208	125	124	124	53	59	53	20.0	5.0
0200	59.5	207	206	206	124	123	123	53	59	53	20.0	5.0
0300	59.6	208	207	208	125	124	124	53	59	53	20.0	5.0
0400	59.7	208	207	208	125	124	124	53	59	53	20	5.0
0500	59.6	207	207	208	124	124	124	53	59	53	20	5.0
0600	59.6	207	207	207	124	124	124	53	59	53	20	5.0
0700	59.7	207	207	207	124	124	124	53	59	53	20	5.0

COLUMN DESCRIPTION

1. FREQUENCY
2. VOLTS L1-L2
3. VOLTS L2-L3
4. VOLTS L3-L1
5. VOLTS L1-N
6. VOLTS L2-N
7. VOLTS L3-N
8. AMPS L1
9. AMPS L2
10. AMPS L3
11. KILOWATTS
12. OIL PRESSURE (BAR)

COMMENTS: AT 5T JANVIER

TEST

MECHRON POWER SYSTEMS INC.
LOAD TEST READINGS

PROJECT NO.: K7 UNIT SER. NO.: 836523 TEST DATE: JULY 9/01 1997

Time	1	2	3	4	5	6	7	8	9	10	11	12
1500	13.9	2.2	89.2	120.5	111.0	99.4	43					
1600	13.9	2.5	90.7	135.8	113.1	100.7	43					
1700	13.9	2.9	85.8	126.1	108.0	97.3	39					
1800	14.0	2.9	82.8	121.1	104.4	95.5	37					
1900	14.0	2.7	80.5	118.6	101.7	90.3	36					
2000	14.0	2.6	79.2	117.8	99.9	89.4	35					
2400	14.0	2.5	76.4	113.6	97.2	89.9	32					
2200	14.0	2.6	75.0	110.4	95.0	87.1	32					
2300	14.1	2.6	73.8	108.9	93.4	86.6	30					
2400	14.0	2.3	79.0	116.2	98.7	88.4	37					
0100	14.0	2.2	77.2	112.2	96.7	88.3	34					
0200	14.0	2.4	76.6	111.2	96.1	86.3	34					
0300	14.0	2.5	74.8	108.5	93.9	83.9	33					
0400	14.0	2.2	74.0	108.1	93.4	82.5	33					
0500	14.1	0.1	72.8	105.8	91.6	82.0	30					
0600	14.1	0.1	73.5	105.7	92.1	79.4	32					
0700	14.0	0.1	76.1	110	94.6	79.4	34					

COLUMN DESCRIPTION

1. BATTERY VOLTS
2. BATTERY AMPS
3. ENGINE TEMP (1)
4. EXHAUST TEMP (2)
5. AIR OUTLET TEMP (3)
6. OIL TEMP (4)
7. AIR INLET TEMP (THERMOMETRE)
8. _____
9. _____
10. _____
11. _____
12. _____

COMMENTS: AT ST JANVIER

TEST

MECHRON POWER SYSTEMS INC.
LOAD TEST READINGS

PROJECT NO.: K7 UNIT SER. NO.: 8362523 TEST DATE: JULY 9/01997

Time	1	2	3	4	5	6	7	8	9	10	11	12
0800	59.6	206	206	206	124	124	124	53	59	53	20.0	5.0
0900	59.4	206	206	206	124	124	124	53	58	53	20.0	5.0
0915	59.4	206	206	207	124	124	124	53	58	53	20.0	5.0
0930	59.3	208	207	208	125	124	125	53	61	53	20.5	5.0
0945	59.3	206	206	207	124	123	123	53	61	53	20.5	5.0
1000	59.2	208	207	208	125	124	124	56	64	56	22.0	5.0
1015	59.1	204	203	205	122	122	122	58	66	58	22.0	5.0
1030	59.1	205	204	205	123	122	123	58	66	58	22.0	4.9
1045	59.1	205	204	203	122	122	122	58	66	58	22.0	4.9
1100	59.1	205	205	205	123	123	123	58	66	58	22.0	4.9

COLUMN DESCRIPTION

1. FREQUENCY
2. VOLTS L1-L2
3. VOLTS L2-L3
4. VOLTS L3-L1
5. VOLTS L1-N
6. VOLTS L2-N
7. VOLTS L3-N
8. AMPS L1
9. AMPS L2
10. AMPS L3
11. KILOWATTS
12. OIL PRESSURE (BAR)

COMMENTS: AT ST JANVIER

TEST

MECHRON POWER SYSTEMS INC.
LOAD TEST READINGS

PROJECT NO.: 17 UNIT SER. NO.: 8362523 TEST DATE: JULY 9/10/1997

Time	1	2	3	4	5	6	7	8	9	10	11	12
0800	14.0	~~0.1~~	~~80~~	112	100	82	/					
0900	14.0	~~0.1~~	83.6	116.5	101.8	89	/					
0915	14.1	2.7	79.8	113.7	98.7	90.0	35					
0930	14.0	2.3	80.8	115.9	100.2	89.8	36					
0945	14.0	2.3	81.1	115.9	100.5	90.6	36					
1000	14.0	2.5	87.6	128.0	109.1	93.3	37					
1015	14.0	2.2	85.9	125.6	107.7	91.4	37					
1030	14.0	2.3	86.3	129.9	109.4	94.7	38					
1045	14.0	2.2	86.9	128.2	110.1	92.5	39					
1100	14.0	2.4	86.7	125.5	109.1	94.7	39					

COLUMN DESCRIPTION

1. BATTERY VOLTS
2. BATTERY AMPS
3. ENGINE TEMP (1)
4. EXHAUST TEMP (2)
5. AIR OUTLET TEMP (3)
6. OIL TEMP (4)
7. AIR INLET TEMP (THERMOMETRE)
8. _____
9. _____
10. _____
11. _____
12. _____

COMMENTS: AT ST JANVIER

TEST

MECHRON POWER SYSTEMS INC.
ACCEPTANCE TEST REPORT

Mechron Project No: K7

Customer: Kudlick Construction

End User: Government of Northwest Territories Dept. of Public Works and Services

Equipment Destination: Artic Bay, N.W.T.

Equipment Description: Standby Generator Set c/w Transfer Switch

MECHRON POWER SYSTEMS INC. hereby certifies that the equipment described herein has been inspected/tested in accordance with the below referenced test specification and the present company quality system.

Factory/Site Inspection and Test Summary

Checked By Factory	Checked By Site		Checked By Factory	Checked By Site	
✓	✓	Mechanical Workmanship	✓	✓	Electrical Workmanship
✓	✓	Alarms and Shutdowns	✓	✓	Safety and Protective Devices
✓	✓	Operational Sequences	✓	✓	Electrical Load Test
✓	✓	Finish/Appearance			

____ Equipment is approved as meeting or exceeding requirements set by Test Specification ✓

____ Equipment is approved as noted (see deficiency list)

FACTORY TESTED AND ACCEPTED BY:

NAME	POSITION	SIGNATURE	DATE
DEVON RUMMER			JULY 3/97

SITE TESTED AND ACCEPTED BY:

NAME	POSITION	SIGNATURE	DATE
		Elmer Longford	July 15/97

TEST

MECHRON POWER SYSTEMS INC.
ACCEPTANCE TEST REPORT

SYSTEM INFORMATION

PROJECT NUMBER K7 SITE Artic Bay, N.W.T.

SYSTEM SPECIFICATION NAME PLATE INFORMATION

KVA: 25

KW:	20	*Freq.:*	60
Volts:	120/208	*RPM:*	1800
Amps:	69.4	*Model:*	SB 120/208/69.4
Phase:	3	*Serial No.:*	25B 4848 M20
Wire:	4	*Project:*	K7

CSA: LR17457-7

SYSTEM EQUIPMENT INFORMATION

DESCRIPTION	MANUFACTURER	MODEL NUMBER	SERIAL NUMBER
DIESEL ENGINE	DEUTZ	F3L912	8362523
GENERATOR	STAMFORD/[illegible]	[illegible]	C081782/06
ENGINE CONTROLLER	STATICRACT LTD.	EC120	F0245

SYSTEM SOFTWARE INFORMATION

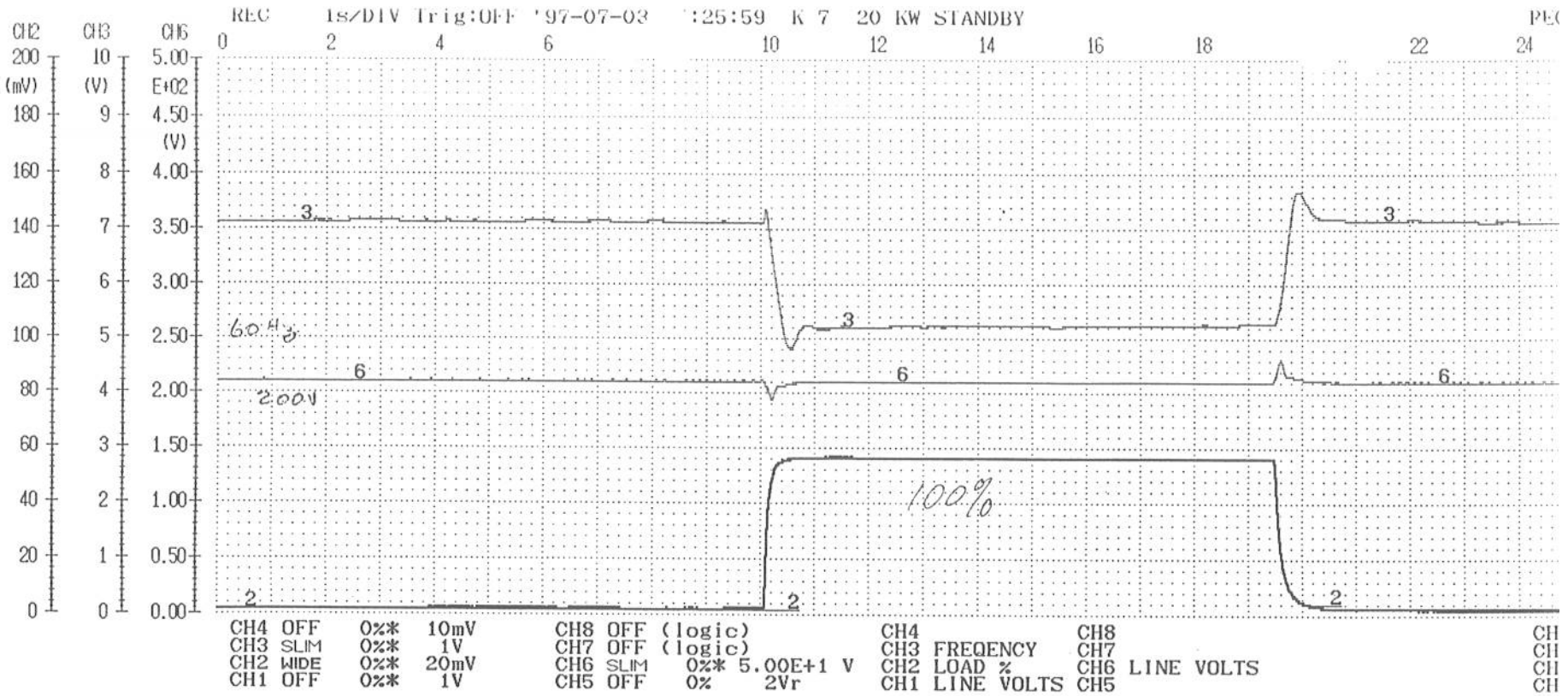
PROGRAM NAME/DESCRIPTION	VERSION NUMBER

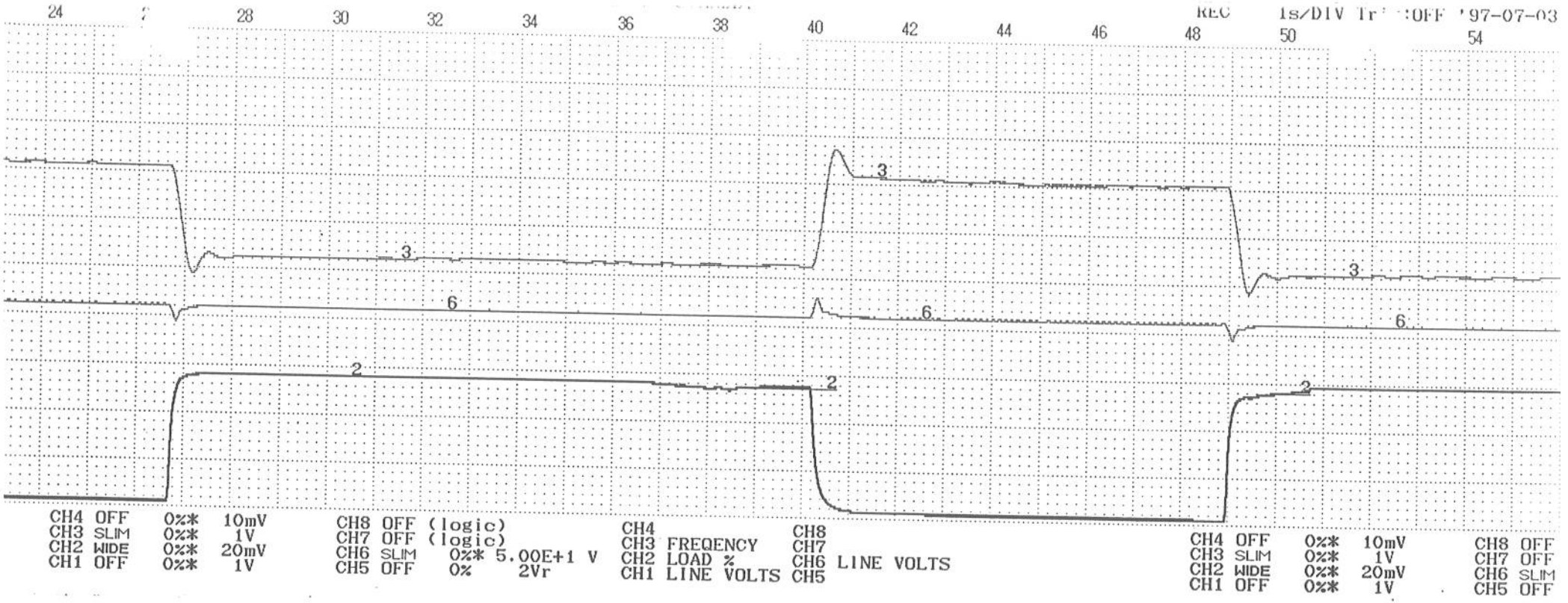
TEST

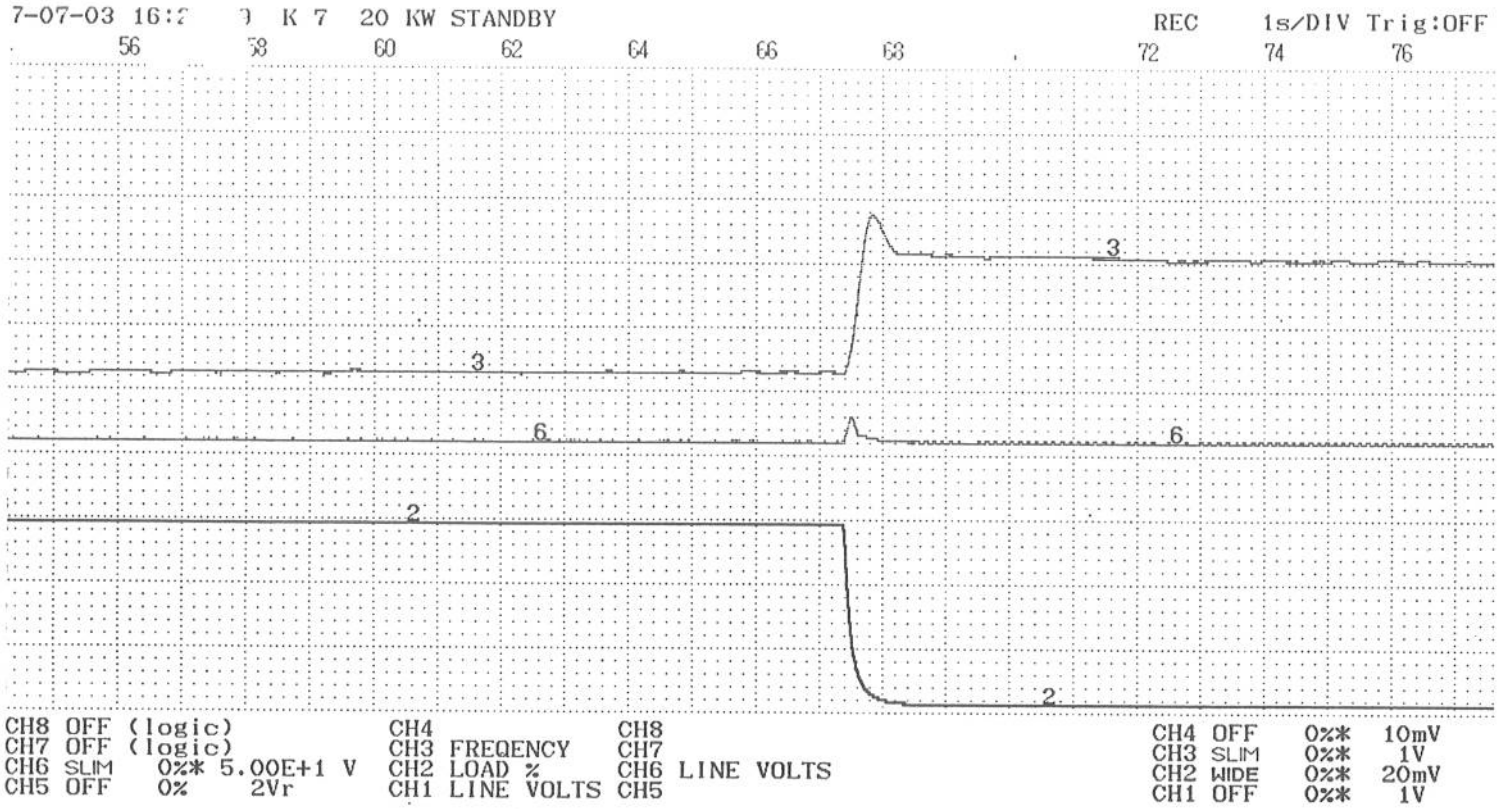
TEST EQUIPMENT UTILIZED DURING ACCEPTANCE TEST

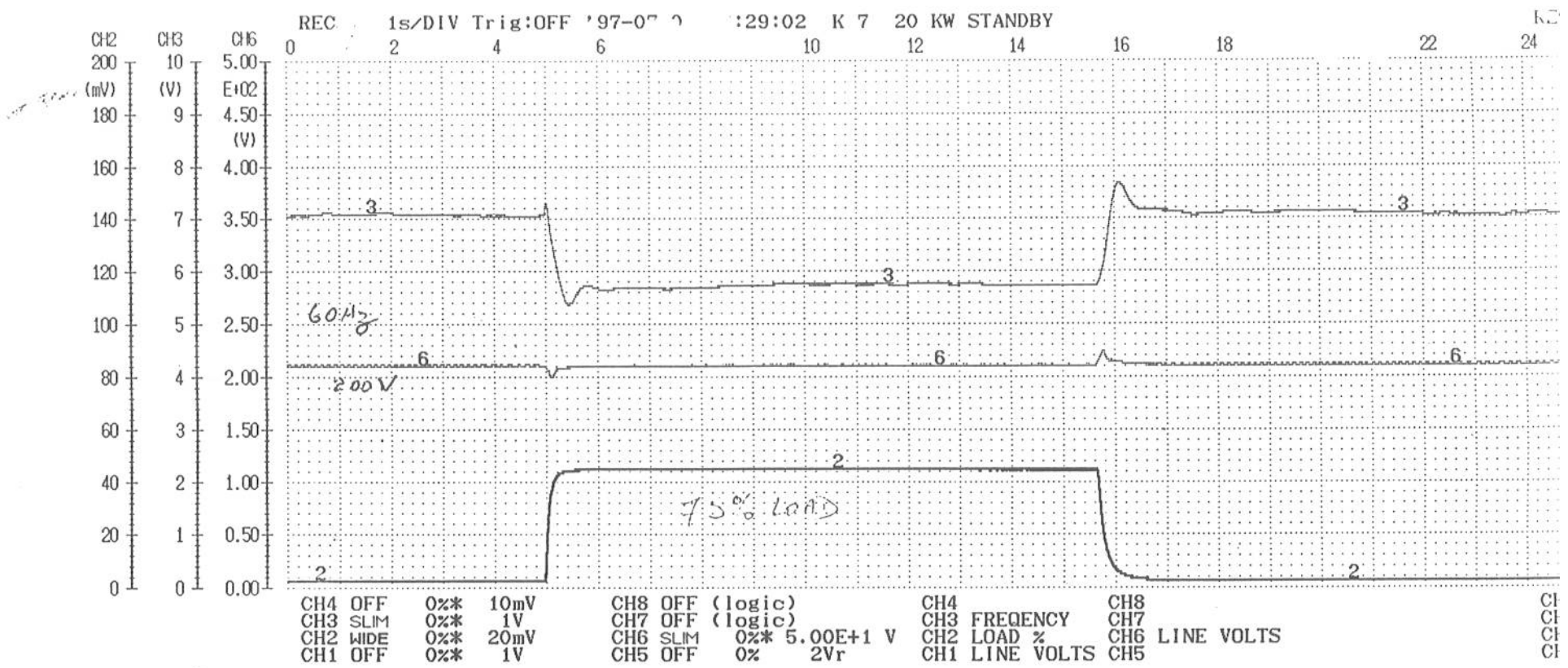
PROJECT NO. K7 *SITE* ARTIC BAY

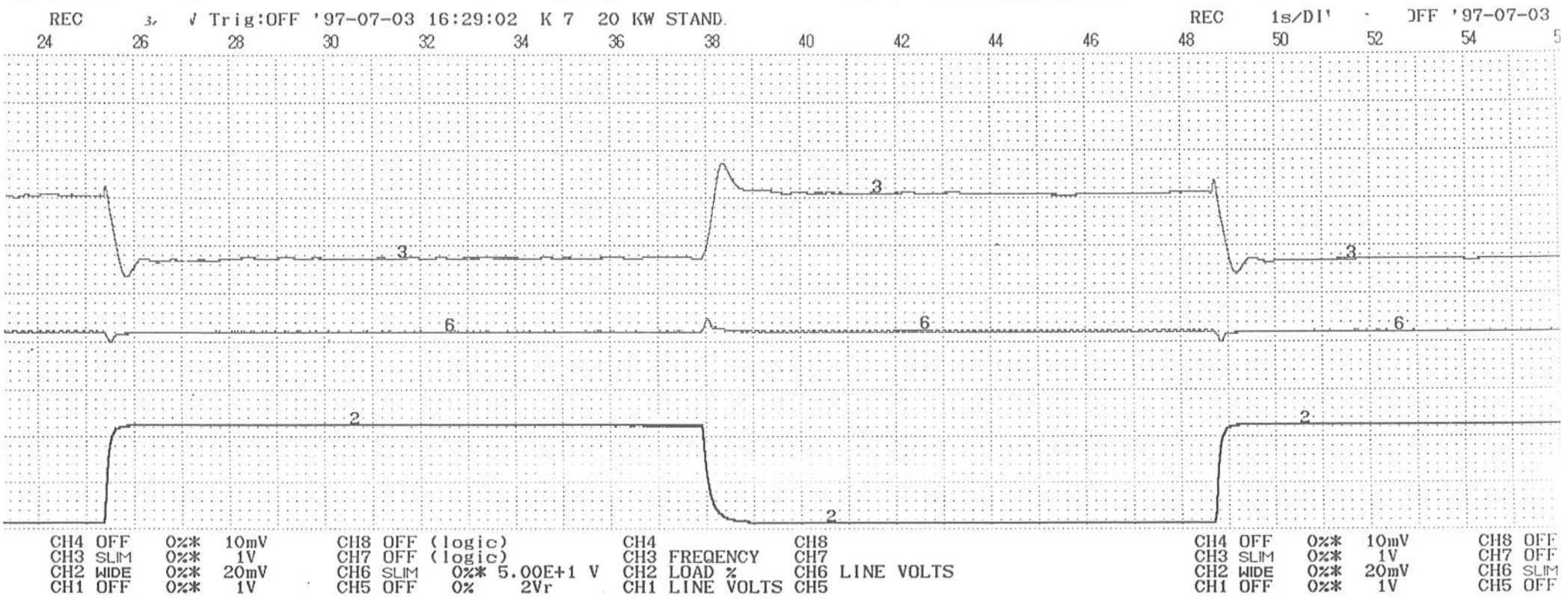
MECHRON SERIAL NO.	*EQUIPMENT DESCRIPTION*
MEL 0239	MULTI METER
MEL 0197	STRIP CHART RECORDER
MEL 00144	FUNCTION GENERATOR
UNIT 10	LOAD BANK 30 KW
107824 09	FEEDBACK TO MAIN SCR TRANSDUCER
MEL 0241	MULTI METER

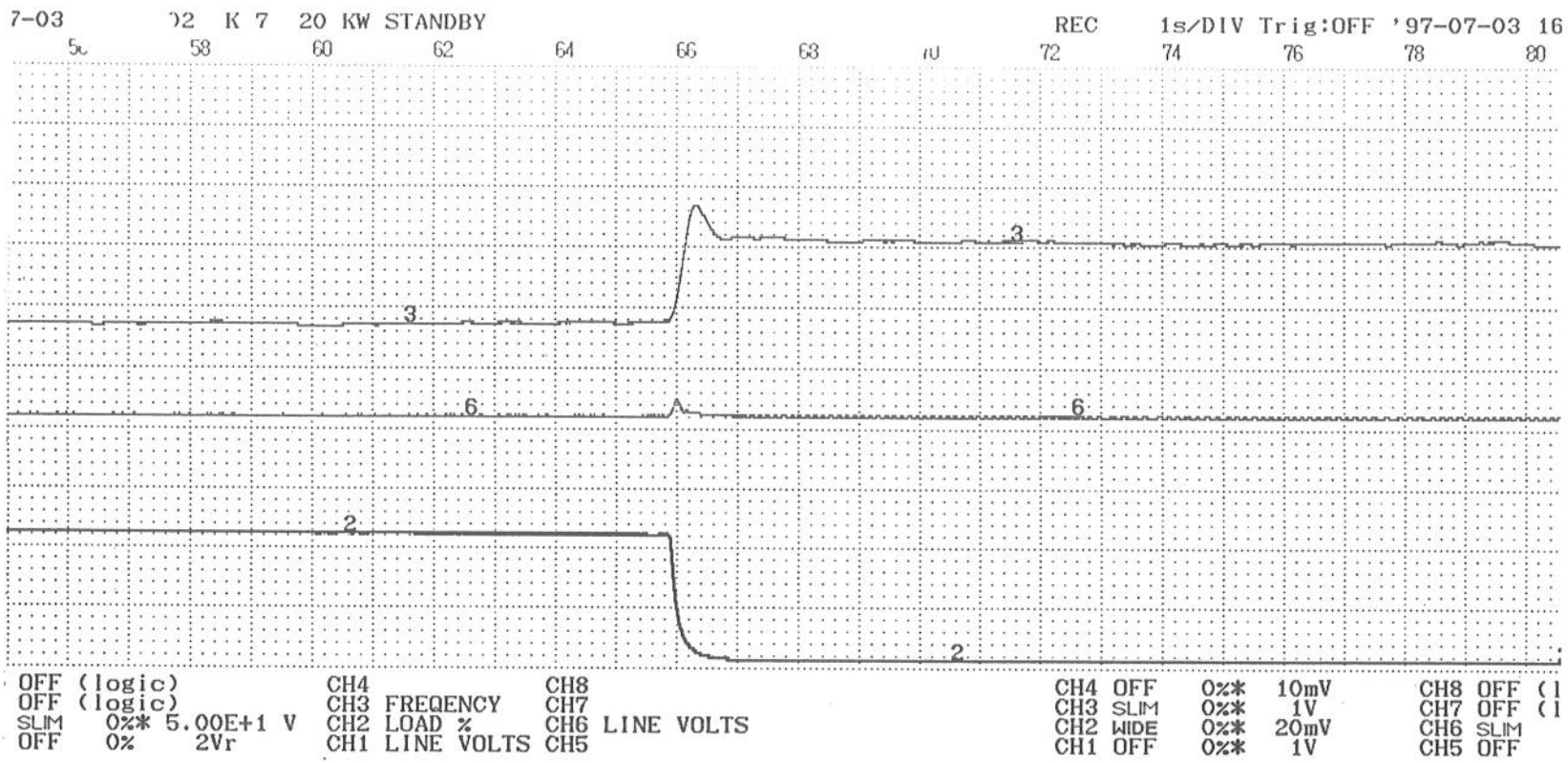

REC 1s/DIV Trig:OFF '97-07-03 :25:59 K 7 20 KW STANDBY
CH2 (mV)
CH3 (V)
CH6 E+02 (V)
60Hz
2.00V
100%
CH4 OFF 0%* 10mV
CH3 SLIM 0%* 1V
CH2 WIDE 0%* 20mV
CH1 OFF 0%* 1V
CH8 OFF (logic)
CH7 OFF (logic)
CH6 SLIM 0%* 5.00E+1 V
CH5 OFF 0% 2Vr
CH4
CH3 FREQENCY
CH2 LOAD %
CH1 LINE VOLTS
CH8
CH7
CH6 LINE VOLTS
CH5

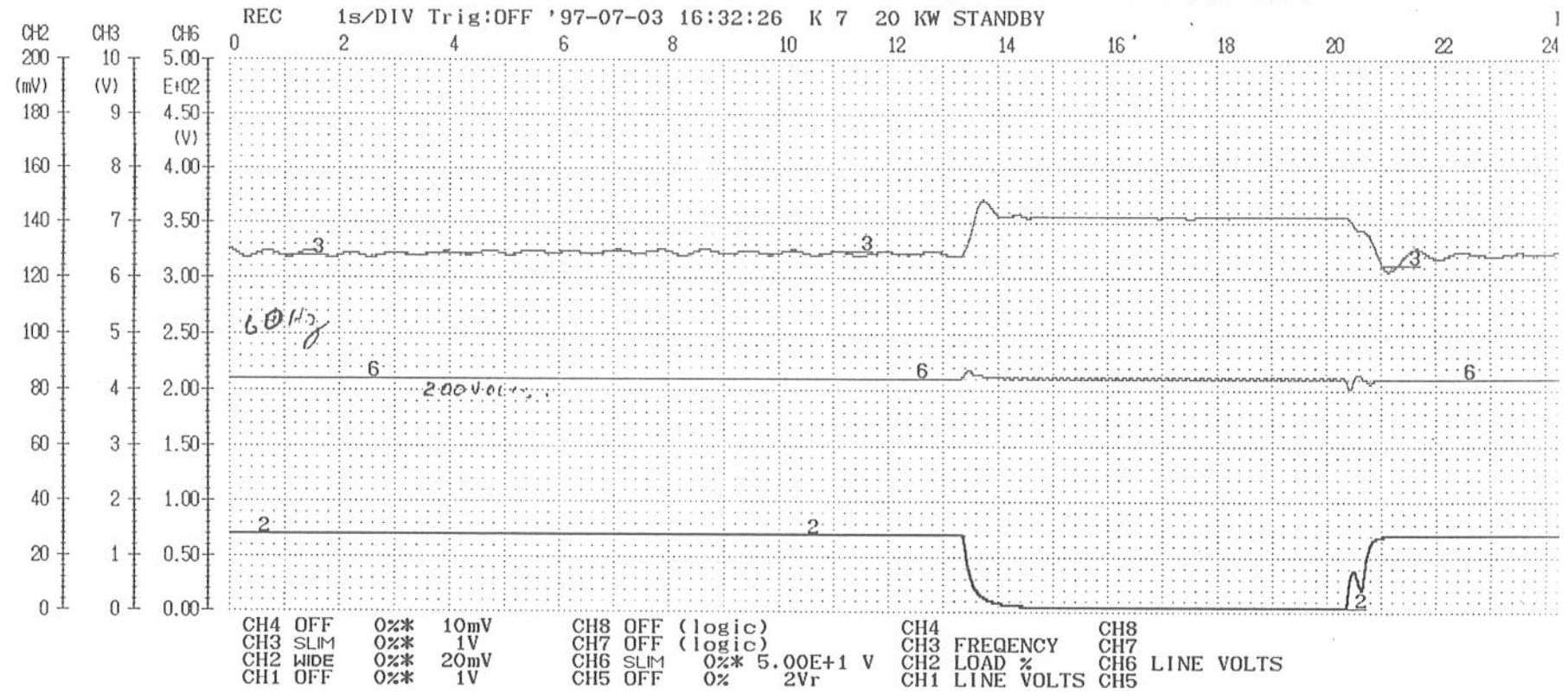

24
28
30
32
34
36
38
40
42
44
46
48
50
54
REC
1s/DIV Tr :OFF '97-07-03
3
6
2
CH4 OFF 0%* 10mV
CH3 SLIM 0%* 1V
CH2 WIDE 0%* 20mV
CH1 OFF 0%* 1V
CH8 OFF (logic)
CH7 OFF (logic)
CH6 SLIM 0%* 5.00E+1 V
CH5 OFF 0% 2Vr
CH4
CH3 FREQENCY CH7
CH2 LOAD % CH6 LINE VOLTS
CH1 LINE VOLTS CH5
CH4 OFF 0%* 10mV
CH3 SLIM 0%* 1V
CH2 WIDE 0%* 20mV
CH1 OFF 0%* 1V
CH8 OFF
CH7 OFF
CH6 SLIM
CH5 OFF

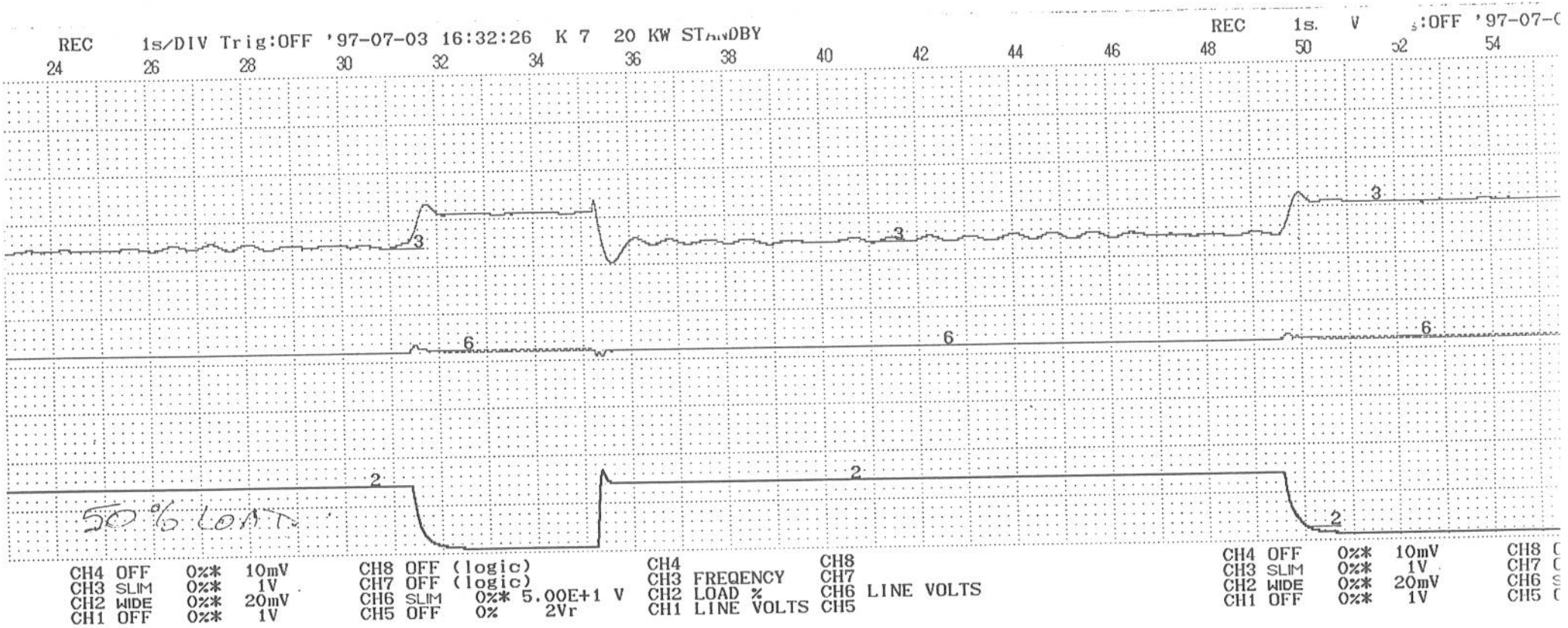

7-07-03 16:? ? K 7 20 KW STANDBY
REC 1s/DIV Trig:OFF
56 58 60 62 64 66 68 72 74 76
3
3
6
6
2
2
CH8 OFF (logic)
CH7 OFF (logic)
CH6 SLIM 0%* 5.00E+1 V
CH5 OFF 0% 2Vr
CH4
CH3 FREQENCY
CH2 LOAD %
CH1 LINE VOLTS
CH8
CH7
CH6 LINE VOLTS
CH5
CH4 OFF 0%* 10mV
CH3 SLIM 0%* 1V
CH2 WIDE 0%* 20mV
CH1 OFF 0%* 1V

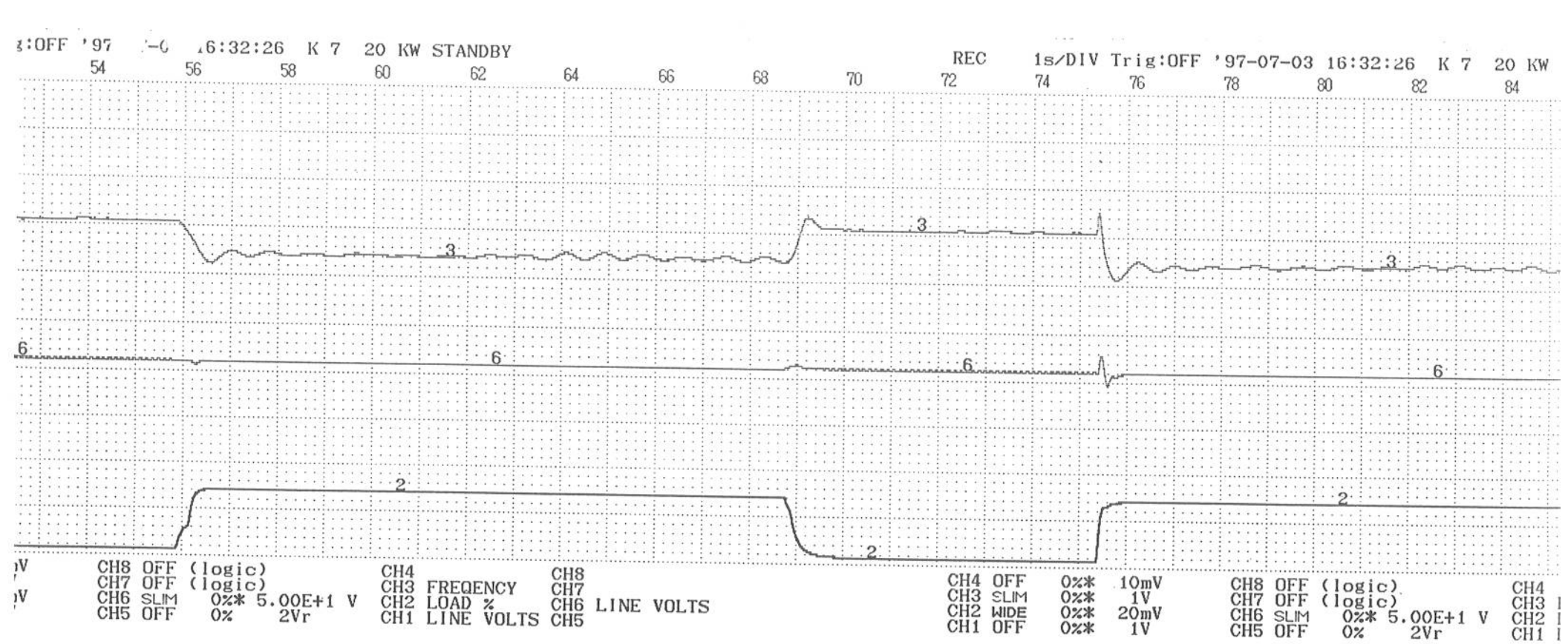

REC 1s/DIV Trig:OFF '97-07 :29:02 K 7 20 KW STANDBY
CH2 CH3 CH6
(mV) (V) E+02 (V)
0 2 4 6 10 12 14 16 18 22 24
60Hz
200V
75% load
CH4 OFF 0%* 10mV
CH3 SLIM 0%* 1V
CH2 WIDE 0%* 20mV
CH1 OFF 0%* 1V
CH8 OFF (logic)
CH7 OFF (logic)
CH6 SLIM 0%* 5.00E+1 V
CH5 OFF 0% 2Vr
CH4
CH3 FREQENCY
CH2 LOAD %
CH1 LINE VOLTS
CH8
CH7
CH6 LINE VOLTS
CH5

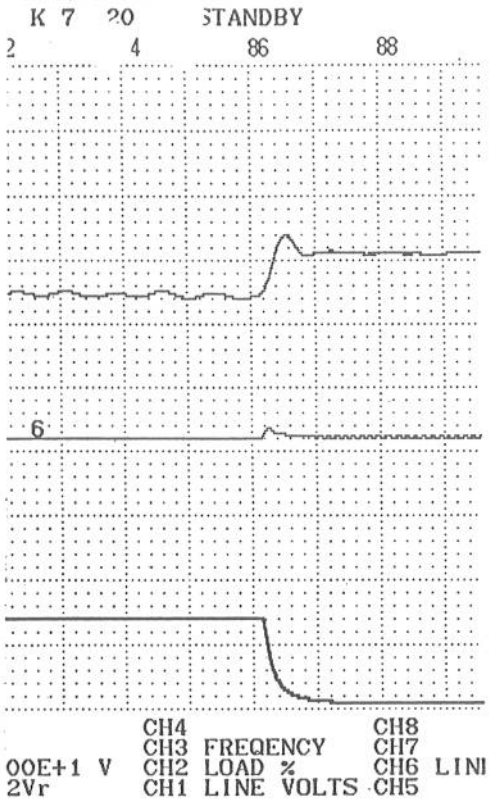

REC
Trig:OFF '97-07-03 16:29:02 K 7 20 KW STAND.
REC 1s/DI
OFF '97-07-03
24 26 28 30 32 34 36 38 40 42 44 46 48 50 52 54
3
6
2
CH4 OFF 0%* 10mV
CH3 SLIM 0%* 1V
CH2 WIDE 0%* 20mV
CH1 OFF 0%* 1V
CH8 OFF (logic)
CH7 OFF (logic)
CH6 SLIM 0%* 5.00E+1 V
CH5 OFF 0% 2Vr
CH4
CH3 FREQENCY
CH2 LOAD %
CH1 LINE VOLTS
CH8
CH7
CH6 LINE VOLTS
CH5
CH4 OFF 0%* 10mV
CH3 SLIM 0%* 1V
CH2 WIDE 0%* 20mV
CH1 OFF 0%* 1V
CH8 OFF
CH7 OFF
CH6 SLIM
CH5 OFF


7-03 02 K 7 20 KW STANDBY
REC 1s/DIV Trig:OFF '97-07-03 16
56 58 60 62 64 66 68 70 72 74 76 78 80
3
3
6
6
2
2
OFF (logic)
OFF (logic)
SLIM 0%* 5.00E+1 V
OFF 0% 2Vr
CH4
CH3 FREQENCY
CH2 LOAD %
CH1 LINE VOLTS
CH8
CH7
CH6 LINE VOLTS
CH5
CH4 OFF 0%* 10mV
CH3 SLIM 0%* 1V
CH2 WIDE 0%* 20mV
CH1 OFF 0%* 1V
CH8 OFF (l
CH7 OFF (l
CH6 SLIM
CH5 OFF


REC 1s/DIV Trig:OFF '97-07-03 16:32:26 K 7 20 KW STANDBY
CH2 CH3 CH6
(mV) (V) E+02 (V)
0 2 4 6 8 10 12 14 16 18 20 22 24
60Hz
CH4 OFF 0%* 10mV
CH3 SLIM 0%* 1V
CH2 WIDE 0%* 20mV
CH1 OFF 0%* 1V
CH8 OFF (logic)
CH7 OFF (logic)
CH6 SLIM 0%* 5.00E+1 V
CH5 OFF 0% 2Vr
CH4 CH8
CH3 FREQENCY CH7
CH2 LOAD % CH6 LINE VOLTS
CH1 LINE VOLTS CH5


REC 1s/DIV Trig:OFF '97-07-03 16:32:26 K 7 20 KW STANDBY
24 26 28 30 32 34 36 38 40 42 44 46 48 50 52 54
3
6
2
50% LOAD
CH4 OFF 0%* 10mV
CH3 SLIM 0%* 1V
CH2 WIDE 0%* 20mV
CH1 OFF 0%* 1V
CH8 OFF (logic)
CH7 OFF (logic)
CH6 SLIM 0%* 5.00E+1 V
CH5 OFF 0% 2Vr
CH4
CH3 FREQENCY
CH2 LOAD %
CH1 LINE VOLTS
CH8
CH7
CH6 LINE VOLTS
CH5
CH4 OFF 0%* 10mV
CH3 SLIM 0%* 1V
CH2 WIDE 0%* 20mV
CH1 OFF 0%* 1V


:OFF '97 -0 16:32:26 K 7 20 KW STANDBY
REC 1s/DIV Trig:OFF '97-07-03 16:32:26 K 7 20 KW
54 56 58 60 62 64 66 68 70 72 74 76 78 80 82 84
3
6
2
CH8 OFF (logic)
CH7 OFF (logic)
CH6 SLIM 0%* 5.00E+1 V
CH5 OFF 0% 2Vr
CH4
CH3 FREQENCY
CH2 LOAD %
CH1 LINE VOLTS
CH8
CH7
CH6 LINE VOLTS
CH5
CH4 OFF 0%* 10mV
CH3 SLIM 0%* 1V
CH2 WIDE 0%* 20mV
CH1 OFF 0%* 1V
CH8 OFF (logic)
CH7 OFF (logic)
CH6 SLIM 0%* 5.00E+1 V
CH5 OFF 0% 2Vr
CH4
CH3
CH2
CH1


K 7 20 STANDBY
2
4
86
88
6
CH4
CH8
CH3 FREQENCY
CH7
00E+1 V
CH2 LOAD %
CH6 LINI
2Vr
CH1 LINE VOLTS
CH5