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.

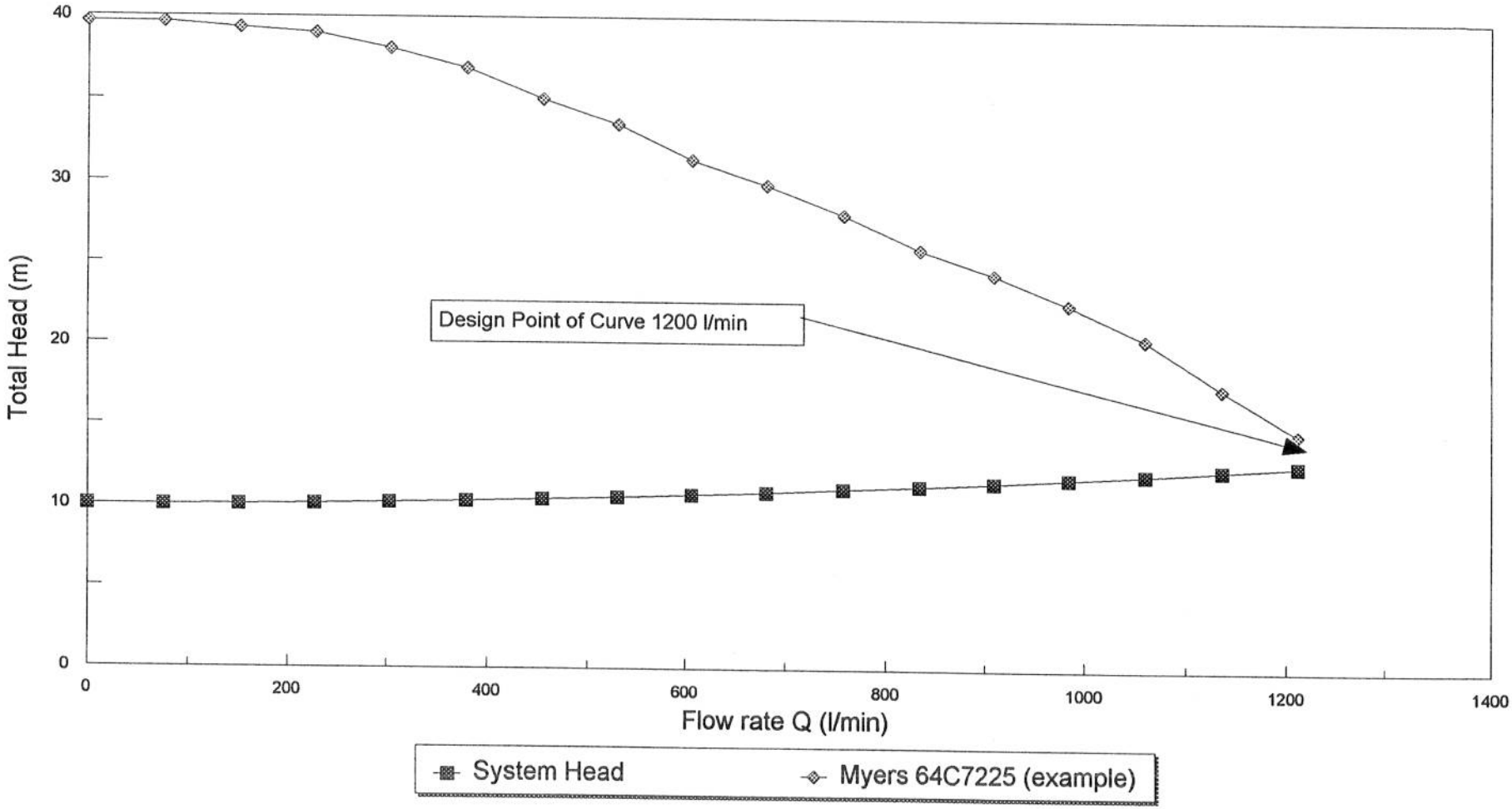


Figure 4.1 Truck Fill Pump Selection- Arctic Bay
Predesign Report, Arctic Bay and Clyde River Truck Fill Stations, N.W.T.
Public Works and Services
Dillon Consulting limited

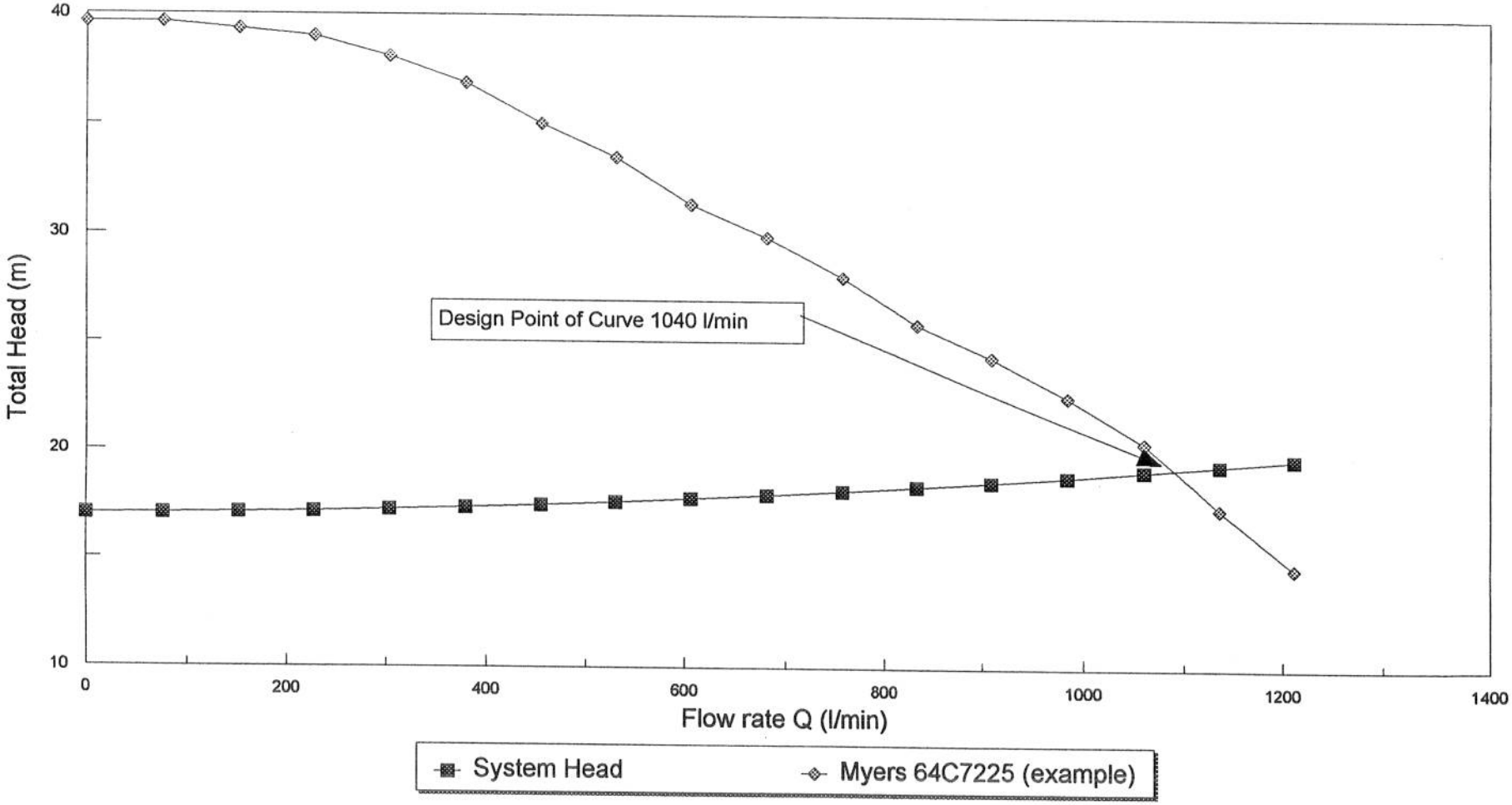


Figure 4.1 Truck Fill Pump Selection- Clyde River
Predesign Report, Arctic Bay and Clyde River Truck Fill Stations, N.W.T.
Public Works and Services
Dillon Consulting limited

- 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:

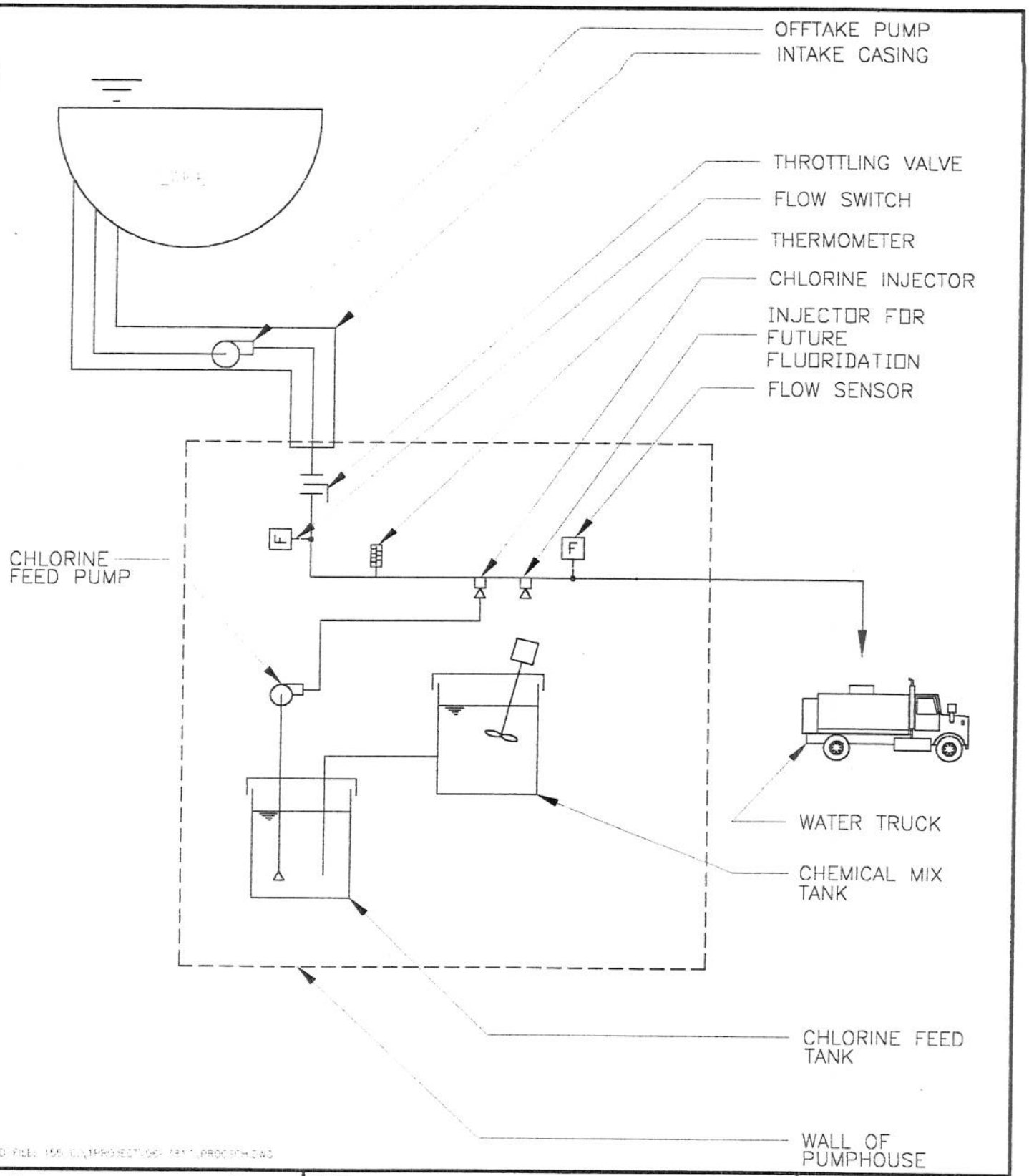
- Northwest Territories Power Corporation's power plant, or
- An on-site electric generator.

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

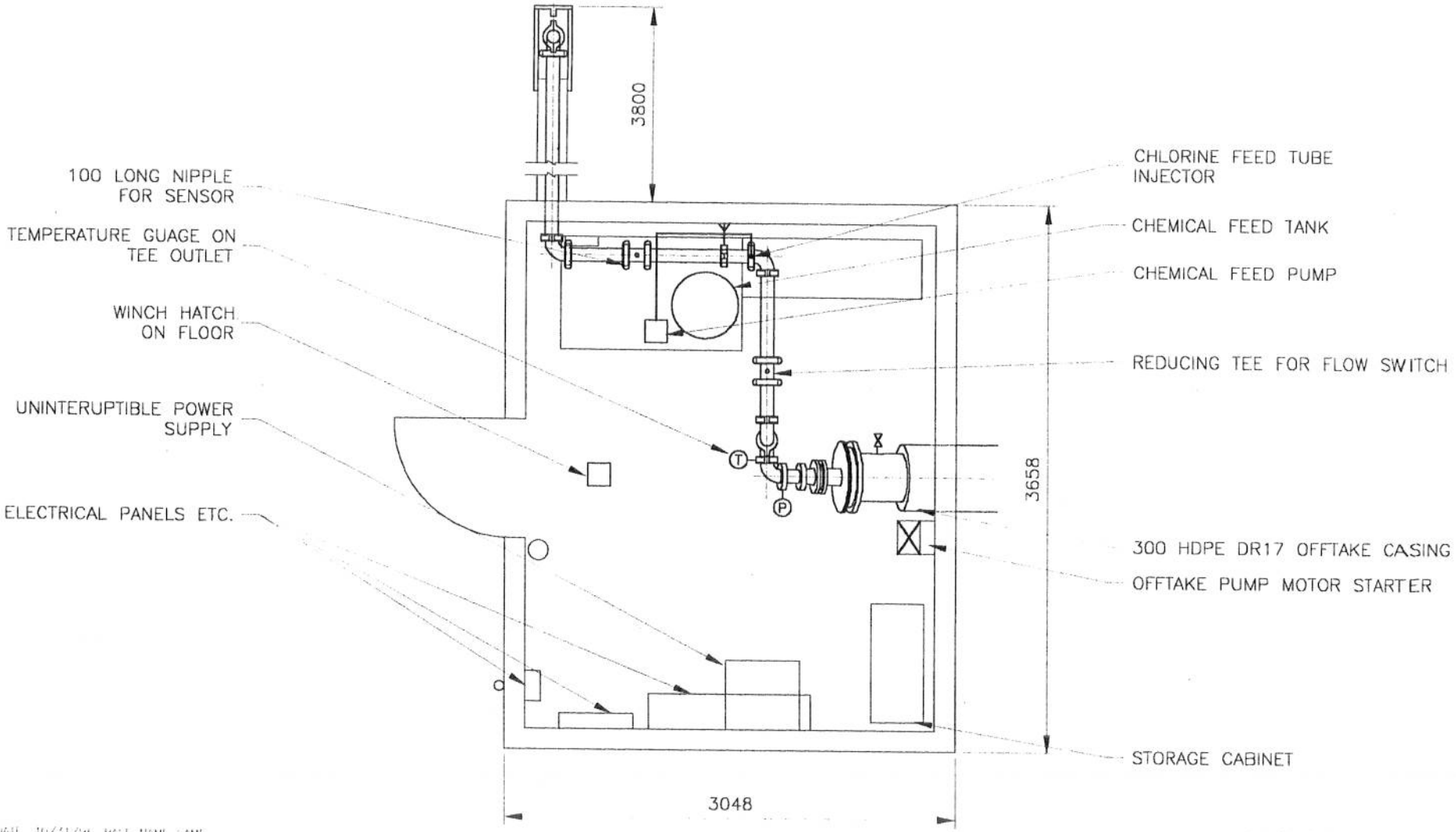
A summary of the requirements for the special allowance for the building is shown below:

- 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.



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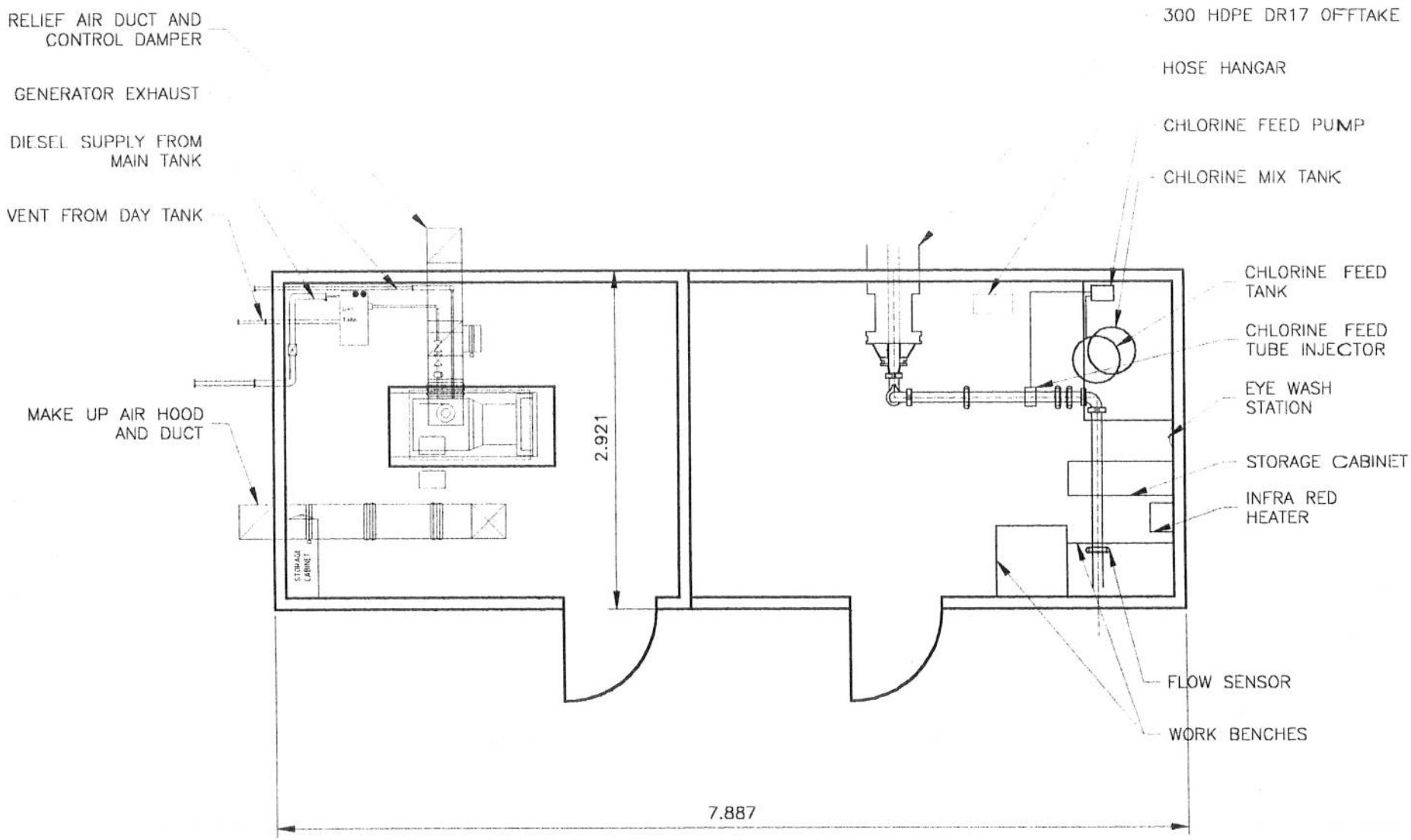
TITLE: ARCTIC BAY AND CLYDE RIVER TRUCKFILL STATIONS, NWT

PROJECT: CLYDE RIVER BUILDING LAYOUT

PROJECT NUMBER: 96-3817

FIGURE NUMBER: 4.4

DATE: OCT 96



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PROJECT
ARCTIC BAY AND CLYDE RIVER TRUCKFILL STATIONS, NWT

TITLE
ARCTIC BAY BUILDING LAYOUT

PROJECT NUMBER
96-381 7

DATE
NOV 96

DRAWING NUMBER
4.5

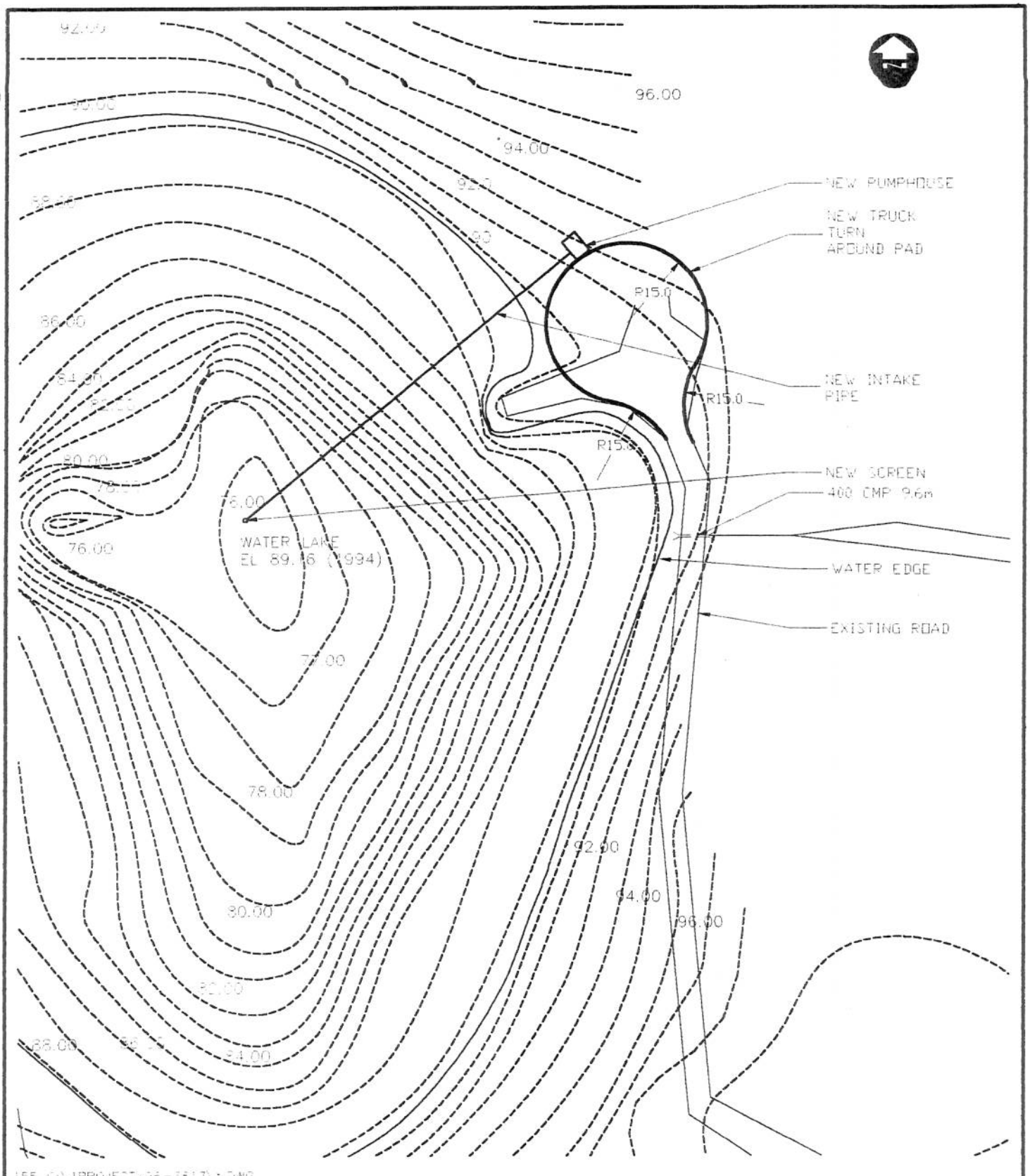
4.9 Site Layout

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

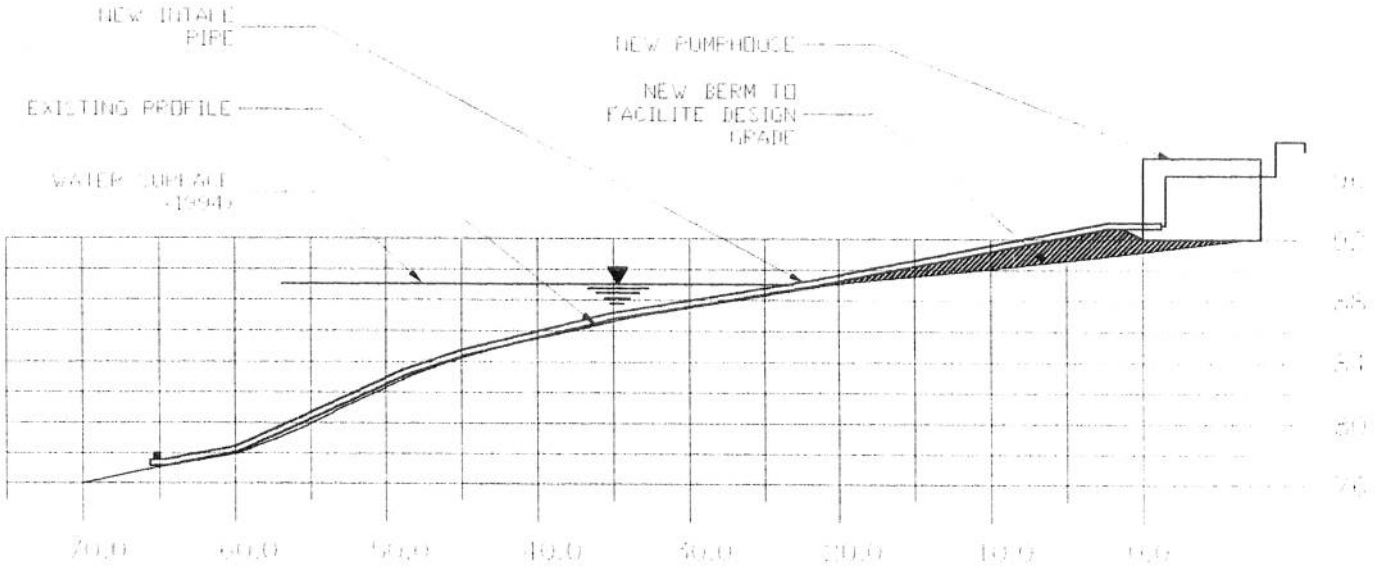
- 8.0 m wide travelling surface to meet Municipal & Community Affair's standard.
- 1,000 mm depth of granular sub base compacted in place.
- 100 mm of granular base.
- Ditching along both sides of the road to remove run-off water, and culverts.

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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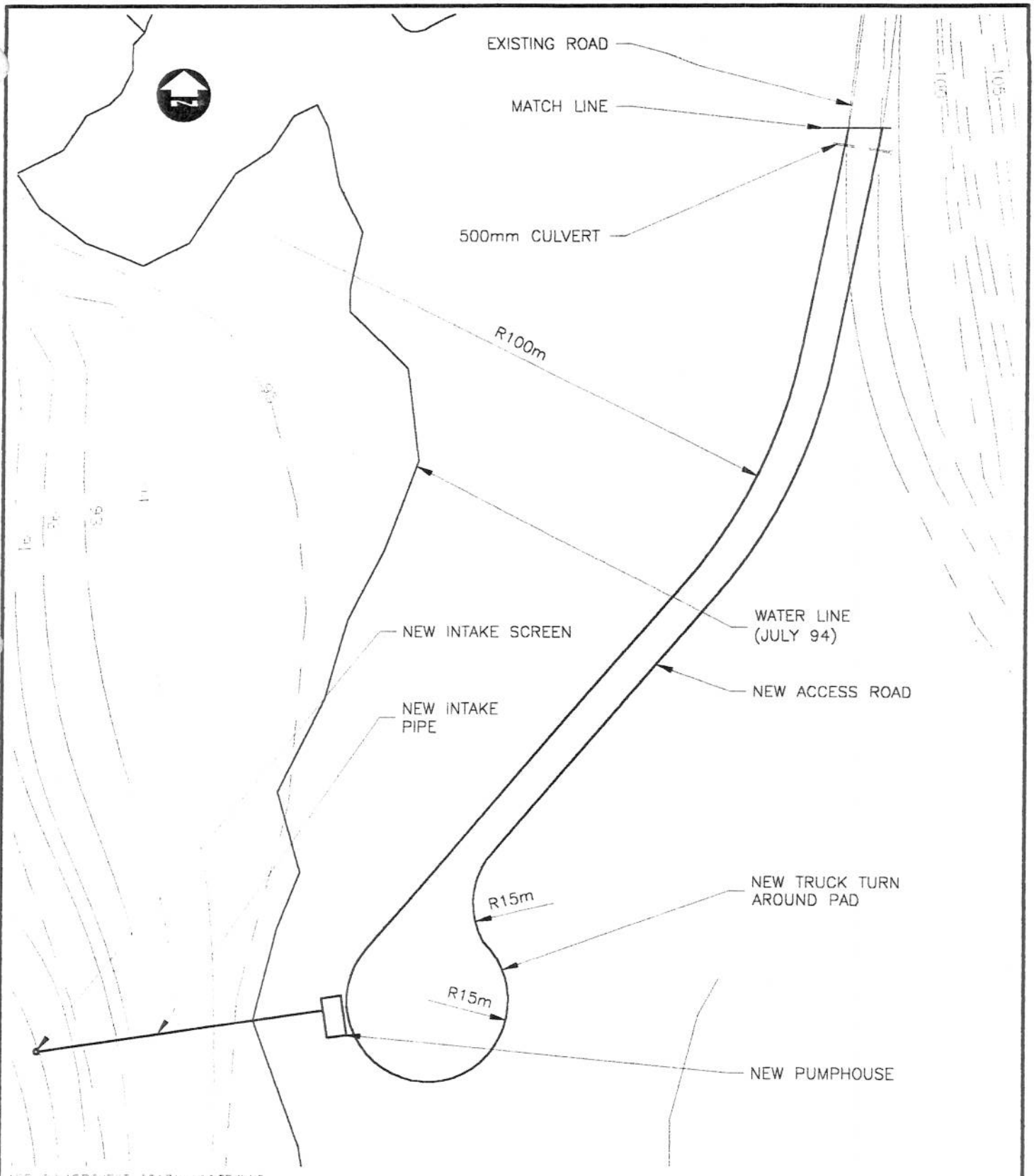
PROJECT	CLYDE RIVER INTAKE PROFILE
PROJECT NUMBER	96-381 7
FIGURE NUMBER	4.7
DATE	OCT 96



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