ARCTIC BAY TRUCKFILL
ARCTIC BAY, NT

OPERATIONS AND MAINTENANCE MANUAL

1998

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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 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 was 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 and Truckffill Building

- *Truckfill pumps (1 duty, 1 standby).*
- *In-line chlorination through the truckfillline.*
- *Insulated and heat traced overhead truck fill arm, with water totalizer meter.*
- *Building heating and light.*
- *System controls I 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 I generator sets (1 duty) and are to be low RPM units.*

- *Heat trace (1 duty, 1 standby) c/w heat trace monitoring capability.*

- *Bench I cupboard for storage.*

- *Eyewash station.*

- *Exterior Fuel Tank.*

- *Interior day tank clw (1 duty, 1 standby) fuel transfer pumps.*

- *Metal skid foundation for portability.*

- *Truckfi/1 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.

2.1 SYSTEM DESIGN STANDARDS

2.2 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.

2.3 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

2.4 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 truckfi/1 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 truckfi/1 station must provide for spill containment.*

- *Water supplied from the truckfi/1 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 Joss of power and low building temperature, is required."*

2.5 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 (led)
1976	387	N/A
1978	414	34
1986	480	50
1994	592	73.9

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 32 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

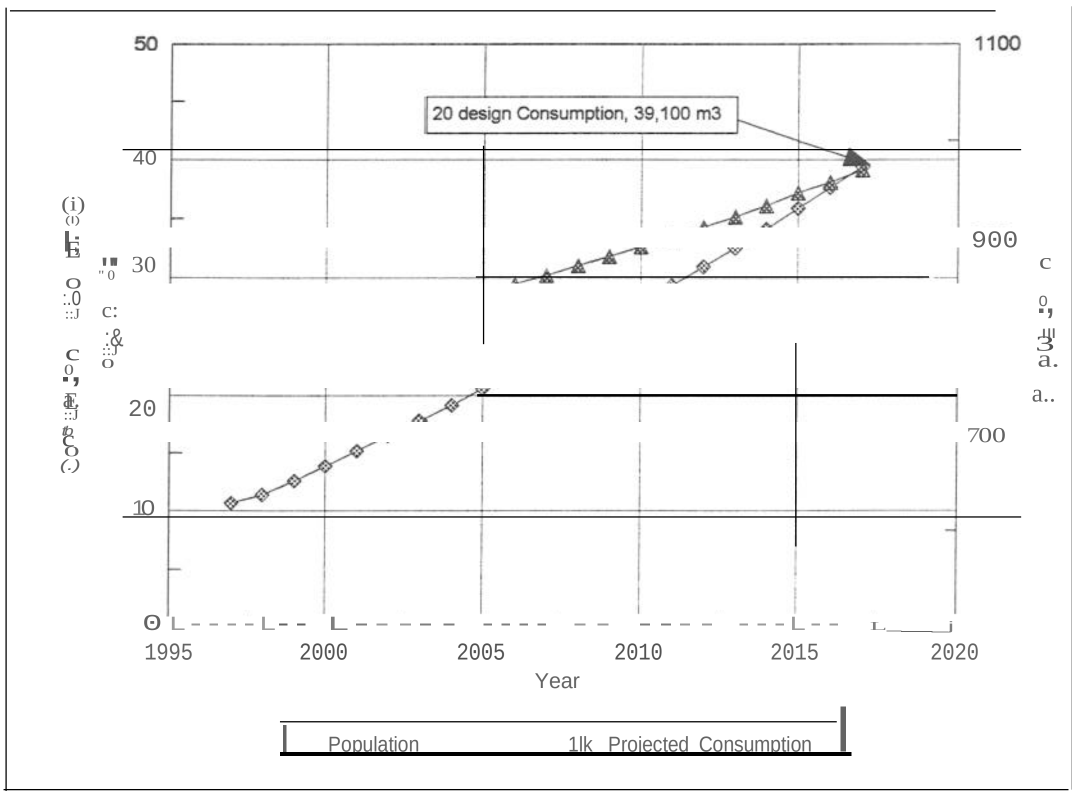


Figure 3.1 Population Projections, Arctic Bay
Predesign Report, Arctic Bay Truck Fill Station, NWT

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 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)

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 (TOG) 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 -1OoC). 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 O	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 transportation cost for sodium hypochlorite in this analysis 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 litre.

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 .** 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 HOPE piping DR17, contained within a 300 mm HOPE 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.

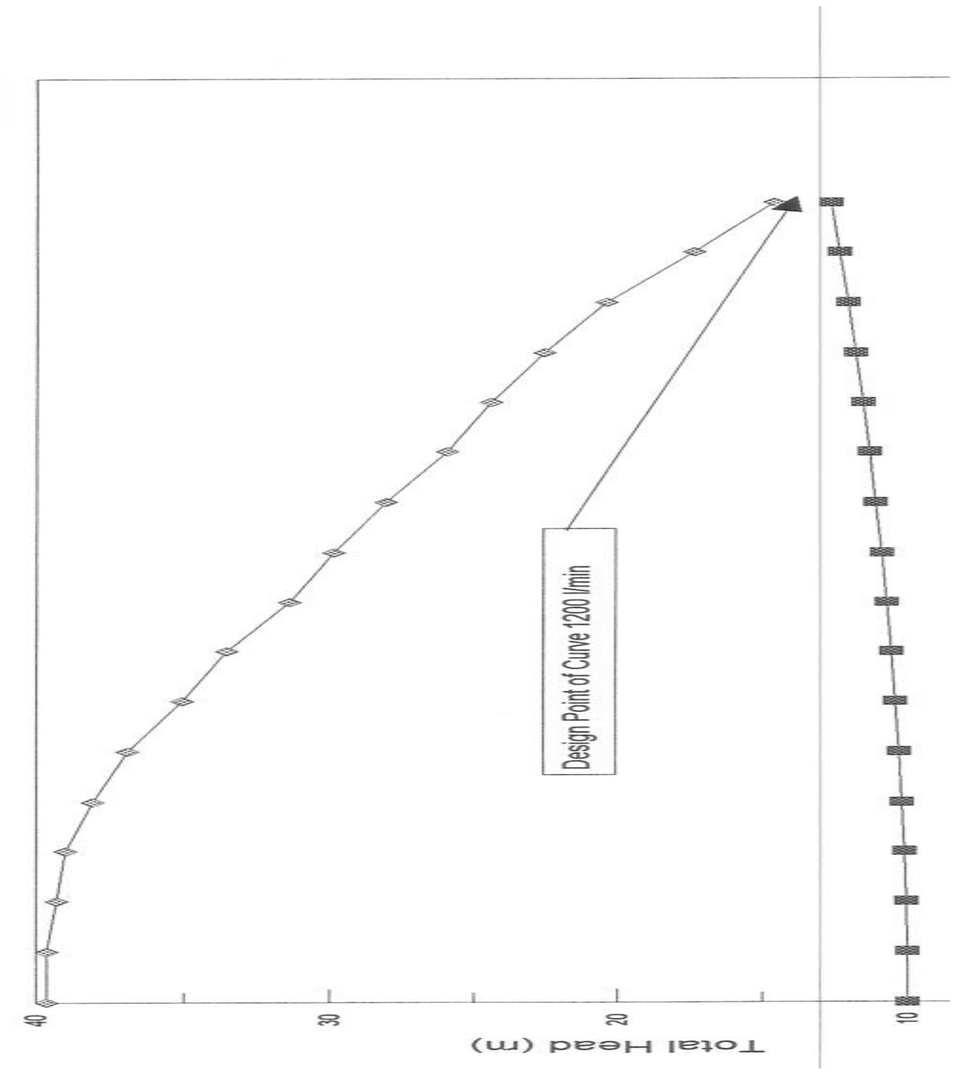


Fig.-4.1: Pump Selection

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

4.4 Power Supply

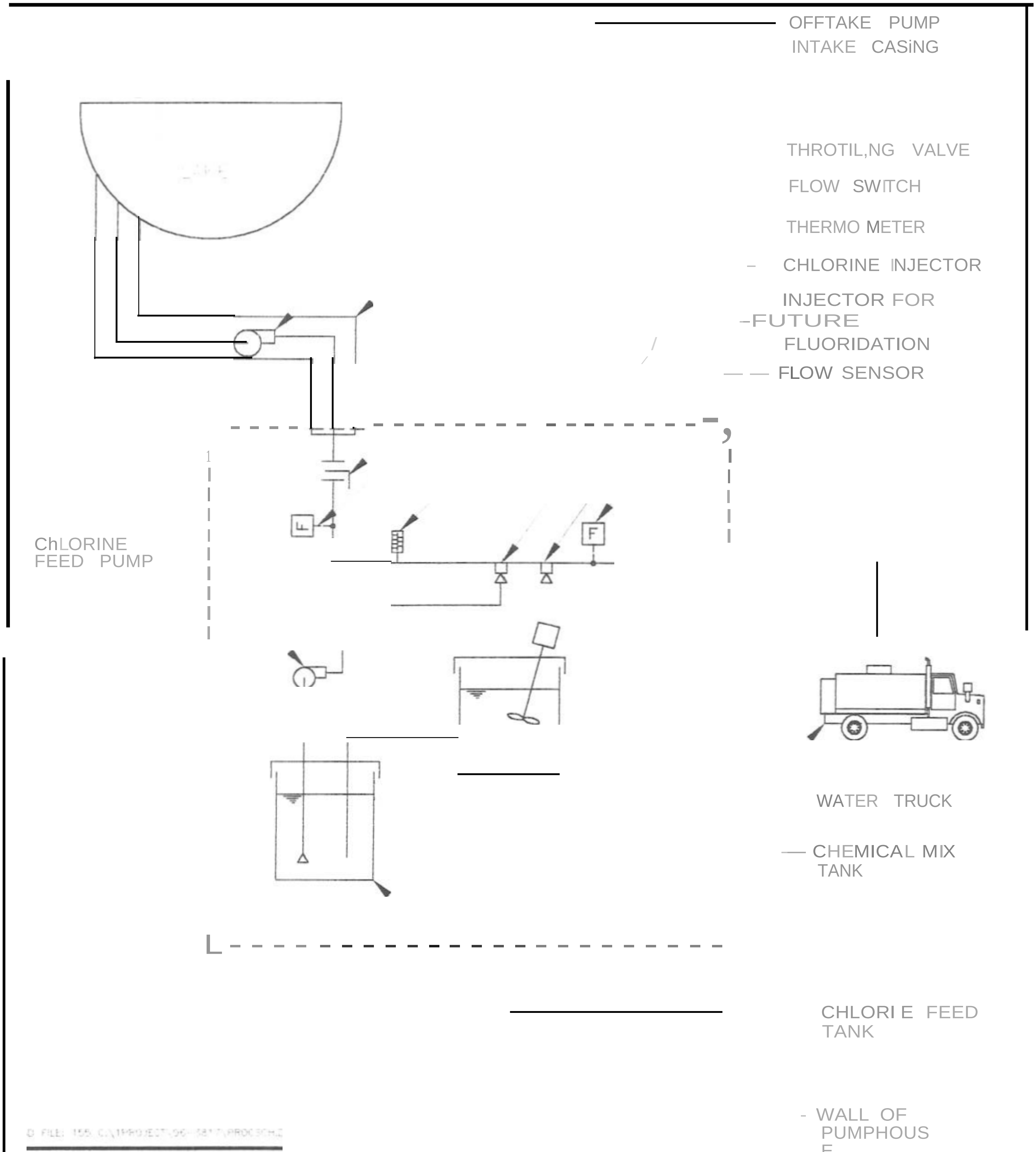
Prime Power

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:

- 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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96-3817

PROCESS SCHEMATIC

FIGURE NUMBER
4.2

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

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

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%	a% ::\	1 .k
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

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

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 -45oC January design temperature. Based on these factors, a 4 m x 4 m x 3m 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 $0.68/1 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/1 was used for diesel.

Freeze Protection System	Capital Cost	Annual Power/Fuel Cost	Annual Maintenance Cost	Life eyd Cost		
				4%	a%	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 HOPE 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. Inthe 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 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.

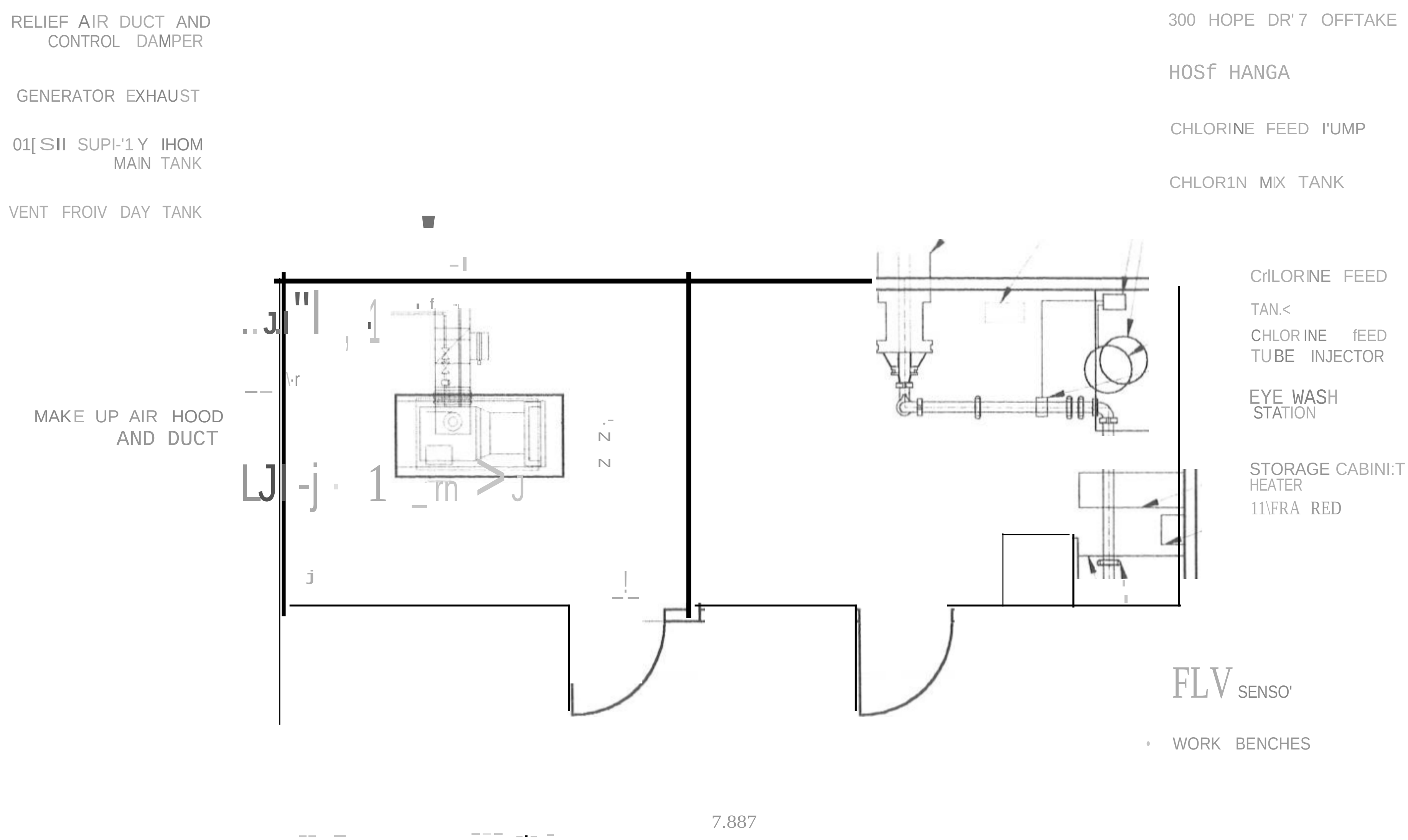
On previous projects, the *GNWT* has had success with pre-manufactured buildings (Cold Stream). This building type will be used in the final design.

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.
- Truckfill control box.
- Seasonal fill line through pumphouse.
- Storage of chemicals and spare parts.
- Diesel electric generator, and fuel supply system.
- Future expansion for, and special allocation are to be made for:
- Fluoridation equipment and storage of chemical.
- Filtration equipment.

Figure 4.3 shows the building layouts providing for the above in each facility.



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STATION, NWT

ARCTIC BAY
BUILDING LAYOUT

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4.3

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 4.4 show the site layout for Arctic Bay truckfill facility.

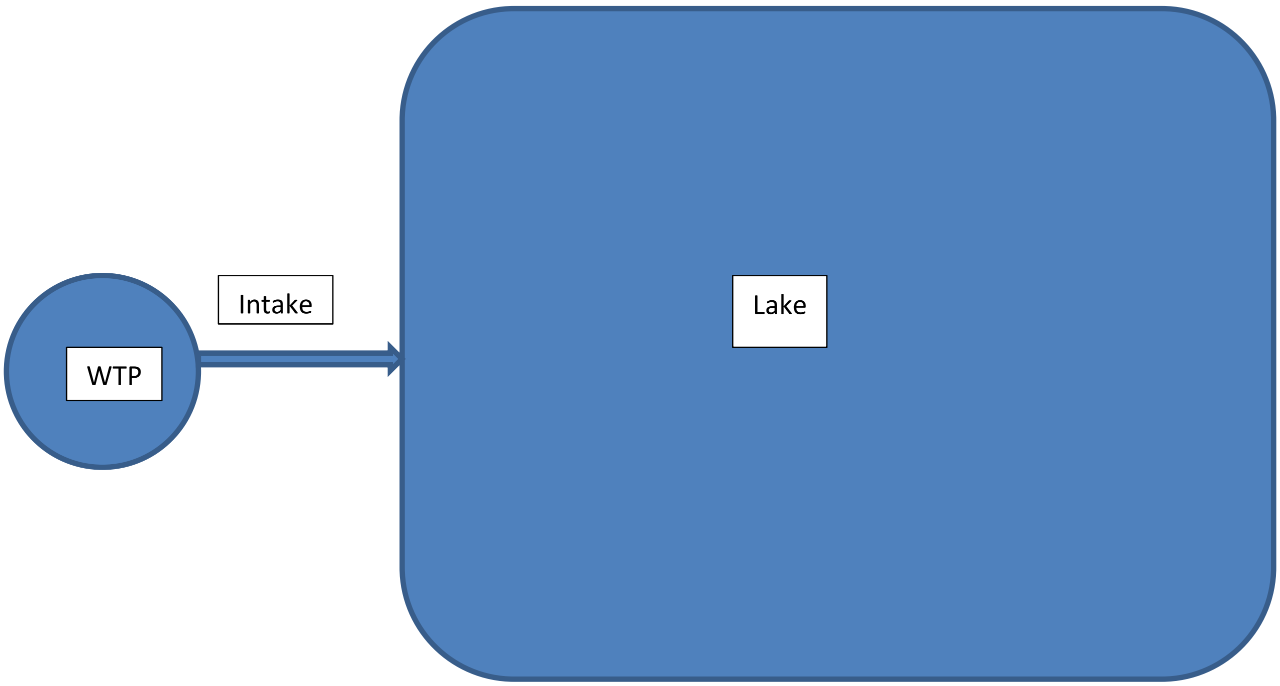
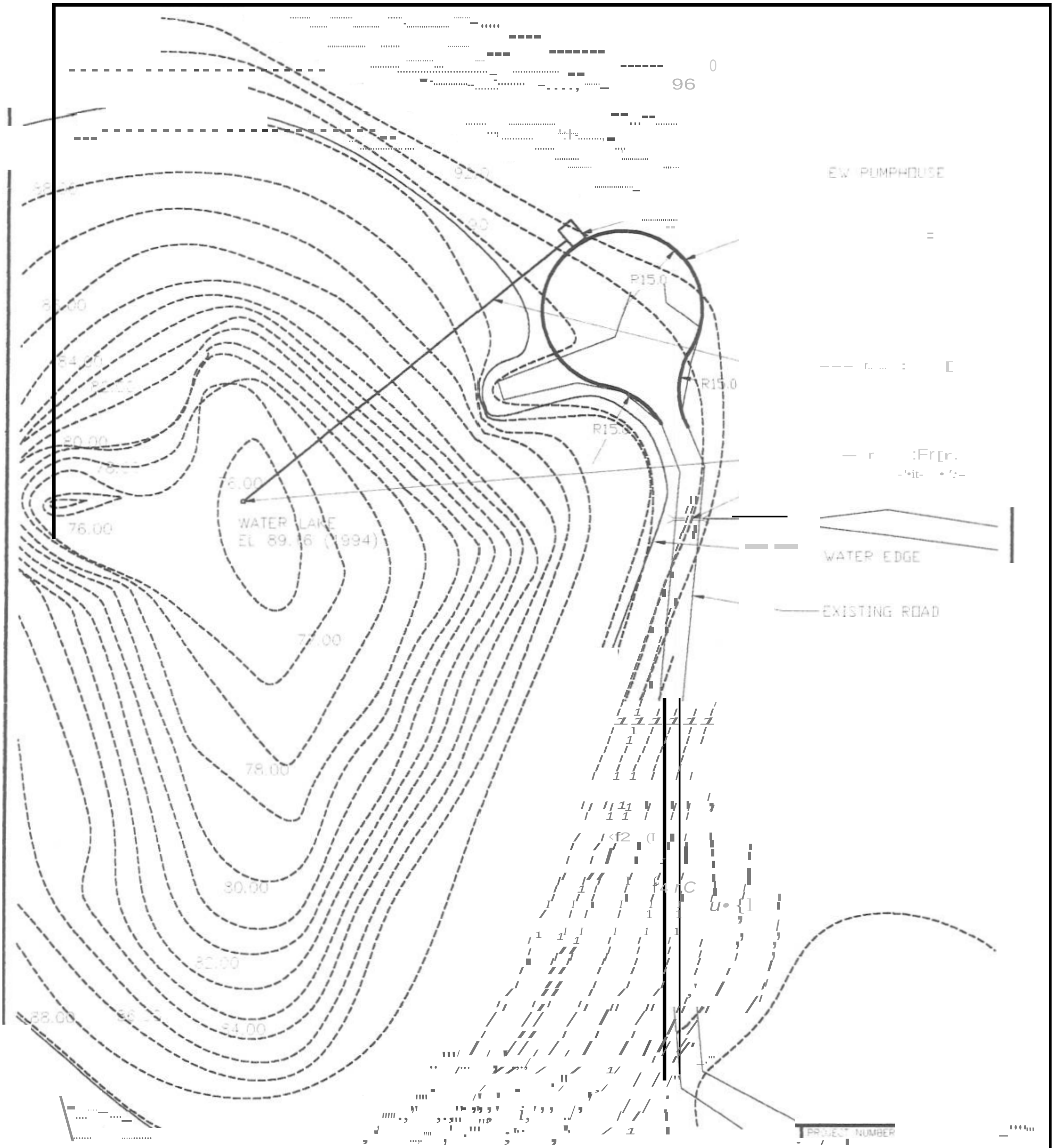


Fig: 4.4



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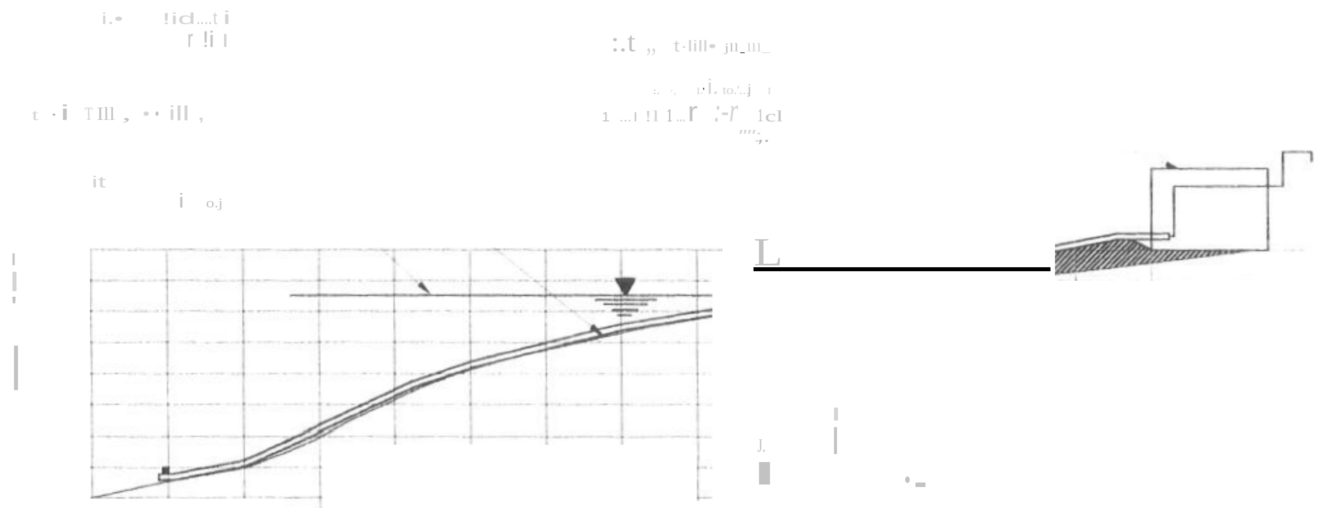

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