USERS MAKING CHOICES: ALTERNATIVES TO THE ONE MILLION DOLLAR FLUSH

FIRST TECHNICAL REPORT OF THE BIG TROUT LAKE SEWAGE SYSTEM ENVIRONMENTAL ASSESSMENT

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We are grateful as well to the Toronto staff of the International Council for Adult Education for providing the necessary organizational support to complete this report. Other agencies contributing valuable resources to this study include: the International Development Research Centre; the McGill School of Architecture; the Institute of Environmental Studies, University of Toronto; and the Department of Zoology, University of Toronto.

FINDINGS

1. The native people of Big Trout Lake have a number of sources for water, the most important of which is the lake itself. The Indian people have expressed deep concern about the pollution of the lake.

Water supply for the non-native households is treated lakewater or drawn from a borehole and piped in. The native people of the community do not enjoy such facilities. This has serious implications for the health of the Indian people, particularly for their children, and especially during the spring when overland run-off from melting snow brings sediment and faecal matter onto the ice--a primary source of water at that time of year.

2. The area of Big Trout Lake immediately surrounding Post Island shows classic symptoms of cultural eutrophication, that is, reduction in water clarity, nuisance algal growth, hypolimnetic oxygen deficits and increased nutrient levels. Flushing of the bay is hampered by the island-to-mainland causeway. Of a more serious nature is the prevalence of unacceptably high levels of faecal coliform bacteria.

3. The sources of this contamination are a number of the non-native houses which are using septic tanks and chemical toilets. Similarly, a number of native outhouses, particularly those along the shore areas, are also contributing to the pollution of the lake.

4. The proposed DIAND Sewerage system and treatment plant are inappropriate to conditions at Big Trout Lake for the following reasons:

1) As designed, the system will have major maintenance and repair problems.

2) The sewerage system has no real chance of being extended to include a significant number of native homes. It is too expensive for Indian people to afford. As well, no Indian houses have piped water supply.

3) Apart from short term employment, the sewerage system would be of no direct benefit to the native community.

4) The system as proposed will not service all of the non-native community, part of which is one of the major point sources of contamination.

RECOMMENDATIONS

The data indicate that the problems of excreta disposal, water supply and community health cannot be dealt with separately. They are intimately related and must be solved with a comprehensive approach.

1. In order to improve and preserve hygiene, greater quantities of water should be made available in the native households:

a) Rainwater collection should be encouraged.

b) Malfunctioning wells should be repaired.

c) A street-tap system should be investigated.

d) A truck delivery system should be studied as offering a long-term solution.

2. The outhouse system must be improved, particularly in those areas where outhouses, depending on their design, proximity to the lake, and subsoil conditions, contribute to lake pollution. This involves a combination of improved outhouses, outhouses with liners, and mouldering toilets.

3. The sewage system should not be installed.

4. The only way to transport wastewater from all the non-native houses requires the adoption of a truck system. This truck system should be expanded to provide water supply and sewage disposal to native houses as the need arises.

Water delivery and sewage collection by two trucks is recommended as the long-term affordable solution for both native and non-native buildings to provide:

1) total containment, removal and treatment of human wastes;

2) protection of the environment; and

3) improvements in public health and hygiene

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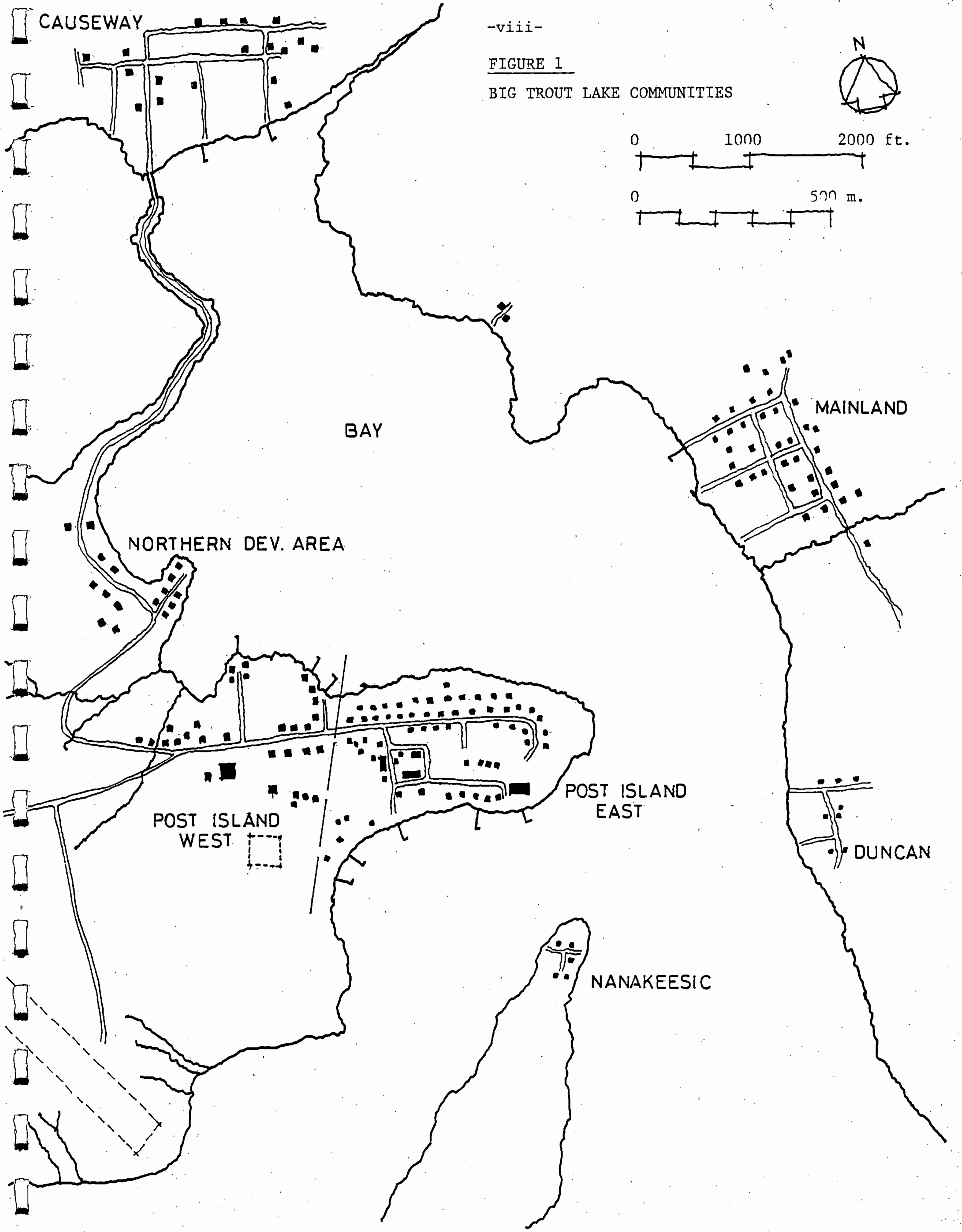
FIGURE 1

BIG TROUT LAKE COMMUNITIES



INTRODUCTION

1. Background

Detailed negotiations between the Participatory Research Project of the International Council for Adult Education and the Band Council of the Big Trout Lake Indian Reserve began in the fall of 1977, in response to the Band's Terms of Reference for the Big Trout Lake Sewage System Environmental Assessment. The Terms of Reference are reproduced here as Appendix A.

In May, 1978 the Band Council voted to accept the proposal of the Participatory Research Project to recruit a team of southern technical consultants who would work under the direction of the Band in carrying out the Assessment. The team, selected with the approval of the Band Council, included a sanitary engineer, a chemical limnologist, an architect specializing in sanitation systems, a water and environment specialist and a participatory research consultant. All parties agreed that the Assessment should be directed by the community, maximize the involvement of local residents, and that the research should be an educational process itself of direct benefit to Big Trout Lake.

Since funds to carry out the Assessment were not immediately forthcoming from government, the Band Council took the decision, in light of the urgency of the sewage and water problem, to allocate from its own capital accounts partial funding for the study.

In June, 1978, after several weeks of preparation and two planning conferences, the technical team travelled to Big Trout Lake and worked there for one week, representing approximately 300 man-hours of consultation time. The present report is the result of that work and subsequent research in the south.

2. Data Collection Procedures

The team employed an inter-disciplinary battery of data collection methods, including the following:

1) Chemical analysis of 6 stations on Big Trout Lake, selected drinking water sources and the existing sewage lagoon.

2) Technical assessment of the proposed DIAND sewerage system on the basis of reports and plans furnished by the Band and the government.

3) A technical survey of existing water sources of both native and non-native households.

4) A technical survey of excreta disposal systems and practices in both native and non-native households.

5) Interviews with native families in and around their homes. Twenty homes were selected for unstructured interviews on the basis of all water sources used and all sub-communities being represented.

6) Group discussions with the Band Council during two general meetings organized by the Band Council. The minutes of these meetings are presented in Appendices B and C.

7) Observation while living in native homes; observation of water collection points in the community generally, and observations during the interviews in homes of water-related behaviour.

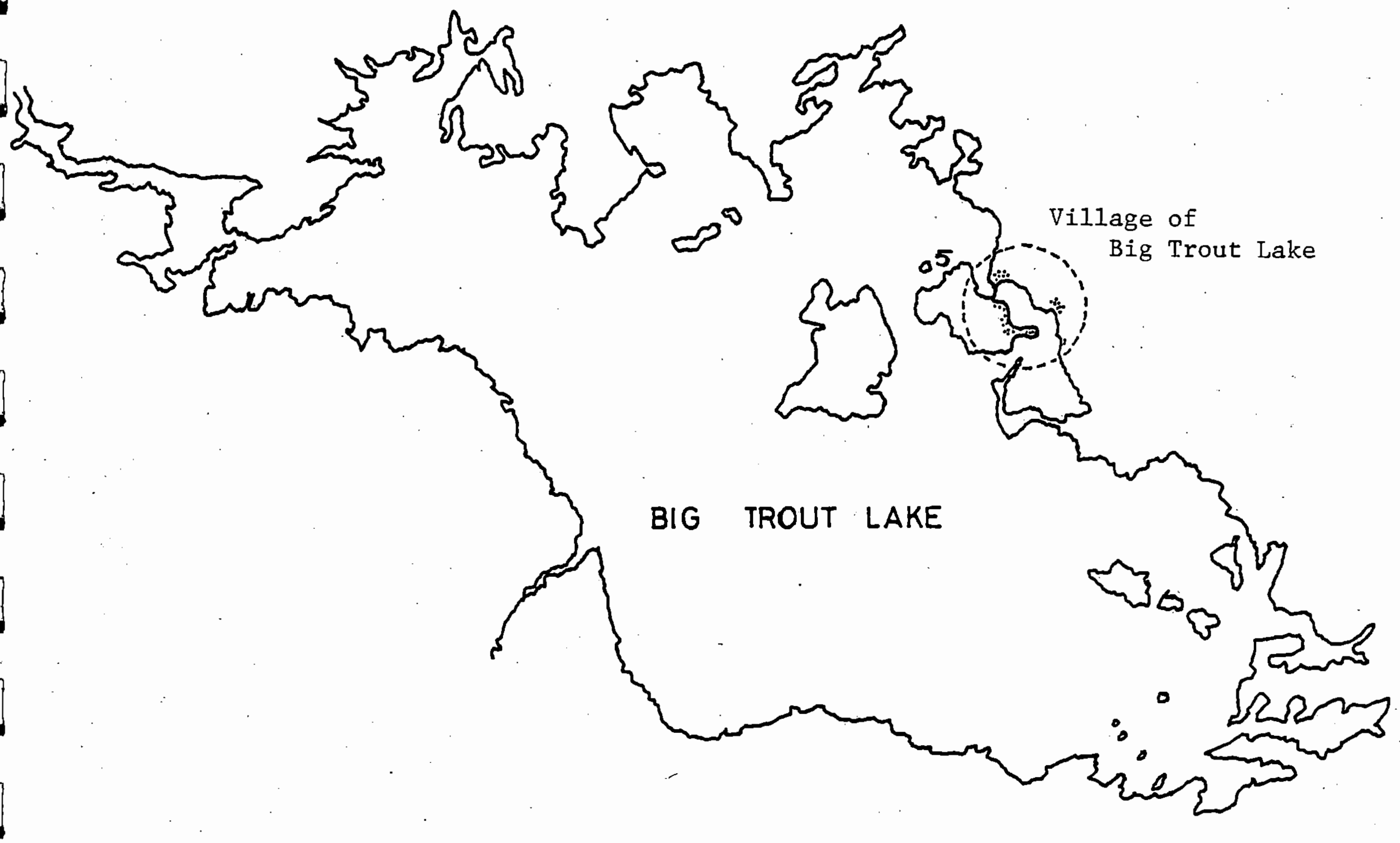
8) Collection of documentation on waste and water systems in the Canadian north and in rural communities in developing countries.

The consulting team lived in native homes during their work in the community, and for a brief period experienced the sanitation and water supply conditions with which the Indian people cope daily. The team made efforts to report their findings in progress to Big Trout Lake residents. One major means of doing so was making announcements which were translated into Cree over the community radio station, in addition to public meetings. All research activities in the community were undertaken with the co-operation, and under the auspices, of the Trout Lake Band Council.

3. The Report

The report may be divided into two large sections each containing several specific sub-sections. That is, Sections 1 through 7 present the problems and practices associated with excreta disposal and water supply in Big Trout Lake as they are now. The second group, Sections 8 through 14, presents ways and means of improving excreta disposal and water supplies in the future. Sub-topics within sections are identified for easy reference.

This report summarizes the technical research undertaken to date by the Southern Consulting Team in conjunction with the Trout Lake Band Council. The purpose of the report is to present an overview of the existing technologies and problems of waste and water in Big Trout Lake and at the same time to suggest, supported by technical analysis, a range of alternatives on which residents may take action. The theme of this report is that the users must understand and choose the technologies for effective, long term solutions to result. This theme, of course, has wide application to a variety of development issues. Our approach--that the problems of sewage disposal, water supplies and community health are inseparable, and must be viewed within the larger context of development in Big Trout Lake--is guided by the philosophy of the native people of Big Trout Lake which recognizes that the people and the land are one.



Sampling Area and Station 5,
Big Trout Lake, June, 1978.

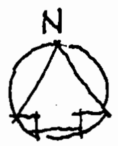
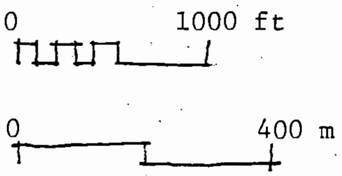


FIGURE 2

Plan of Big Trout Lake



SECTION 1: LAKE ECO-SYSTEM

The area of Big Trout Lake immediately surrounding Post Island shows classic symptoms of cultural eutrophication, that is, reduction in water clarity, nuisance algal growth, hypolimnetic oxygen deficits and increased nutrient levels. Flushing is hampered by an island-to-mainland causeway. Of a more serious nature is the prevalence of unacceptably high levels of faecal coliform bacteria Nutrient and bacterial sources are diffuse and will require a total community solution if any improvements are to be effected.

1.1 Chemical Water Quality in the Bay

Members of the Big Trout Lake community have stated that over the years water quality in the Bay has decreased. There are no historical water clarity data from the Bay for comparison. However, the readings taken 18 June, 1978 are sufficient to document lake-Bay differences. Sampling stations are indicated in Figures 2 and 3. The reading of 5.5 m in the open lake compares favourably with the average Secchi Disc reading of 5.3 m from the Ontario Ministry of Natural Resources survey work in 1961-1963 (Lewis et al, 1964).

Oxygen levels are lower in the Bay and not at 100% of O_2 saturation. The open lake is saturated (see Table 1). The lake is not strongly stratified, with only a $1^{o}C$ difference between top and bottom, but hypolimnetic oxygen levels are reduced by approximately half a p.p.m. The Patricia lakes are classified by Ryder (1961) as oligotrophic and should demonstrate orthograde, not clinograde, curves. pH's are higher in the bay while organic carbons and conductivities are lower. All of these factors are indicative of higher primary production.

Nutrient levels are variable. Total phosphorous is approximately twice as high in the Bay as outside. Iron, manganese and aluminum are also elevated. Biomass indicators--organic carbon, organic nitrogen--are elevated. With only one sampling period, conclusions are difficult to draw about the potential significance of the data. The most likely explanation is sewage input combined with soil run off. The occupied portions of the island are virtually bare of top soil and there are few trees. Other possible sources which may be contaminants are oil and gas spilled by the airline operations in the bay or dump leachates.

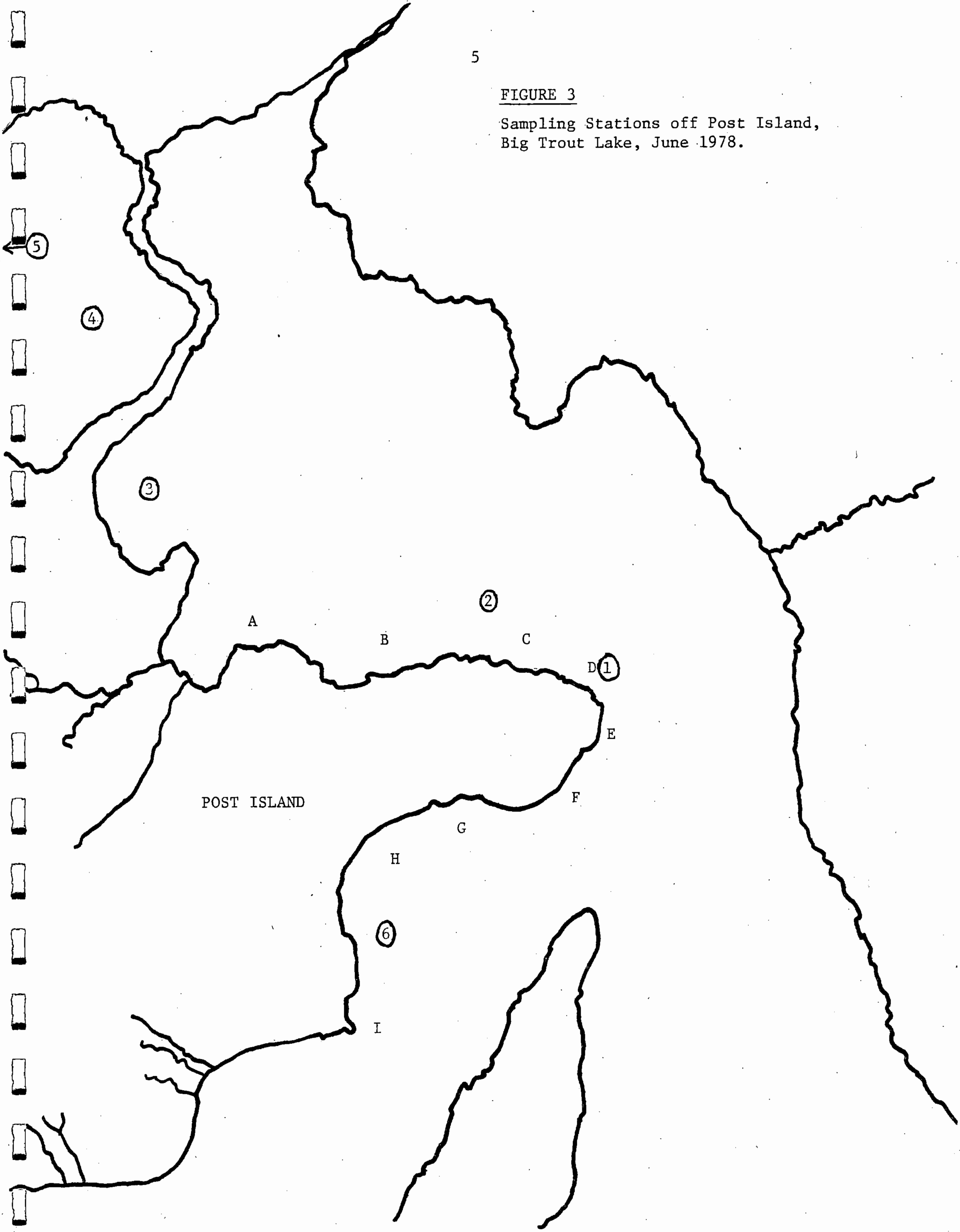
1.2 Point Sources

Shoreline point sewage sources are easily identified by increased filamentous algal growth and increased particulate matter at the outfalls. The two most serious sources are off the Department of Environment weather station and Bearskin Airways. The Hospital does not appear to be as serious but may be of about equal significance to the non-point sources of contamination.

The low-lying tip of Post Island appears to function as a non-point contamination source. Soil is very shallow here and significant seepage from between soil layer and bedrock occurs. Bacteria and chemical contaminants are undoubtably carried in the run off.

FIGURE 3

Sampling Stations off Post Island, Big Trout Lake, June 1978.



STATION	1	2	3	4	5	6
Secchi depth (metres)	3m	2m	2m	2m	6m	
temperature (surface)	13° C	13° C	13° C	13° C	10° C	
temperature (1 m off bottom)	12° C	13° C	13° C	12.5° C	9° C	
oxygen (surface) (mg/ℓ)	8.8	8.8	8.4	8.8	13.0	
oxygen (off bottom) (mg/ℓ)	8.2	8.4	8.4	8.3	10.0	
pH	7.8			7.7	7.3	7.8
Inorganic Carbon (mg/ℓ)	11.0			12.0	12.8	11.6
Inorganic Phosphates Total PO_4 (mg/ℓ)	.012			.015	.007	.018
Total Kjeldahl Nitrogen Total K-N (mg/ℓ)	.33			.37	.29	.37
Total Organic Carbon Total O.C. (mg/ℓ)	6.2			6.8	5.6	5.8
Nitrite + Nitrate NO_2 + NO_3 (mg/ℓ)	<.005			.005	.005	.005
Ammonia NH_3 (mg/ℓ)	.016			.008	.004	.012
Sulphate SO_4 (mg/ℓ)	2.5			.4	.3	.3
Chloride Cl (mg/ℓ)	.4			1.0	1.0	1.0
Iron Fe (mg/ℓ)	.16			.15	.05	.19
Manganes Mn (mg/ℓ)	.02			.038	.017	.022
Silica Si (mg/ℓ)	.3			.45	.80	.85
Calcium Ca (mg/ℓ)	15.4			16.6	17.2	15.6
Magnesium Mg (mg/ℓ)	2.3			2.6	2.85	2.45
Sodium Na (mg/ℓ)	.5			.6	.6	.6
Potassium K (mg/ℓ)	.25			.25	.35	.30
Copper Cu (mg/ℓ)	<.001	<.001	<.001	<.001	<.001	
Nickel Ni (mg/ℓ)	<.002	<.002	<.002	<.002	<.002	
Zinc Zn (mg/ℓ)	.01	.005	.017	.009	.005	
Aluminum Al (mg/ℓ)	.084	.038	.050	.080	.014	
Lead Pb (mg/ℓ)	<.003	<.003	<.003	<.003	<.003	
Chromium Cr (mg/ℓ)	<.002	<.002	<.002	<.002	<.002	
Cadmium Cd (mg/ℓ)	<.001	<.001	<.001	<.001	<.001	
Cobalt Co (mg/ℓ)	<.002	<.002	<.002	<.002	<.002	
Molybdenum Mo (mg/ℓ)	<.002	<.002	<.002	<.002	<.002	
Alkalinity (mg/ℓ) $CaCo_3$	49			53	55	50
Conductivity (umho cm^{-2} sec^{-1})	96			102	106	98

Chemical Water Quality for Six Stations off Post Island,
Big Trout Lake, June, 1978

TABLE 1

The importance of these sources as sewage contaminants is reinforced by faecal coliform data. In water off the DOE and Bearskin Airways, 80+ faecals /100 ml were present. Off the Island tip 59/100 ml were present. Off the hospital outfall, a rating of 61/100 ml was found. Other data are presented in Table 2.

Plankton data are being processed and will be included as an Appendix when completed. Preliminary analysis of the data indicates that plankton biomasses are 2-10 times higher in the bay than in the open water, but species composition data are necessary to draw specific conclusions.

Of interest is the small sewage lagoon under operation at the present. The lagoon is not operating properly and seepage is occurring. Soluable reactive phosphorus (SRP) levels in the lagoon are high at 2.7 $\pm$ 1.2 mg/litre. Tracking levels along the stream to the lake shows significant reductions in SRP. At the outfall readings are 0.7 $\pm$ 0.15 mg/litre. Offshore, below the limits of detection of the technique, most of the phosphorus reduction appears to come through the action of aquatic macrophytes which form a small marsh near the outfall and through which the effluent stream passes. Additional data are required before predictions can be made, but natural marsh filtration offers an attractive possibility for effluent polishing.

1.3 Implications

Faecal contamination of the water of Big Trout Lake is a serious problem. The sources are multiple: some discrete, others diffuse. Nutrient loading, most probably from sewage, is of sufficient magnitude to cause unmistakable signs of cultural eutrophication.

Three major conclusions are suggested by the lake eco-system data:

1) Sewage must be contained. Methods of containment will necessarily vary depending upon the system in use in a particular household, but all sources of contamination must be contained if improvement in bacterial contamination of water supply is to be achieved.

   Improvement in chemical water quality will depend upon whether nutrients --phosphorus in particular--are returning to the system from bay sediments and the quality of effluent released from any future sewage system. Big Trout Lake is phosphorus-limited and any phosphorus addition will almost certainly generate more algal biomass, decreased water clarity and hypolimnetic oxygen losses.

2) Big Trout Lake is a small, remote, cold-stressed community. Any system for effluent clean-up which requires constant maintenance, constant electricity or chemical additions is probably doomed to failure. A passive system utilizing gravity and time combined with a natural marsh tertiary treatment is worth serious consideration.

3) Other aspects of the Big Trout Lake community must be considered if reclamation of the bay aquatic eco-system is to succeed. The dump must be evaluated. It is currently located at a high point on the island and leachates probably reach the lake. Growth of the community and increased solid waste disposal requirements will aggravate the situation.

   The seaplane operations pose a difficult problem. Oil and grease are evident

	Total Coliform/100ml	Faecal Coliform/100ml
A	80+	80+
B	80+	44
C	80+	37
D	80+	59
E	80+	32
F	80+	80+
G	80+	61
H	80+	37
I	80+	19

Total Coliform and Faecal Coliform Levels for Nine Shoreline Point Sources off Post Island, Big Trout Lake, June 1978.

TABLE 2

in the area of the plane docks. The Bay sediments also appear contaminated though extensive sampling was not carried out. It appears, however, that more care should be exercised in the maintenance of aircraft and the disposal of waste oil.

SECTION 2: WATER SOURCES

Present water sources include the lake, the Weather Station intake, the school well, a creek on the mainland, rainwater and snow. Water is taken from the lake at the shoreline, out in the bay and far out in the lake.

In addition to present water sources are seven 2 in. (5 cm) boreholes fitted with handpumps and one 4 in. ((10 cm) borehole with an electric pump which was drilled in 1971-72. All the handpumps are broken and the larger borehole produced sulphorous water with a bad smell. None of the boreholes are presently being used. (See Section 8.3).

The locations of all water sources in relation to homes using them are shown in Figure 4 and the numbers of households using each source for their main supply of drinking water are presented in Table 3.

2.1 Lake Water

Water from the lake shoreline is the most accessible source to most houses and up until about 10 years ago this was the main source. Today it is regarded as polluted by almost all families and is largely used only for washing clothes and household cleaning. A few families in the causeway communities, Duncan area and the Mainland still collect drinking water directly from the shore. They tend to be old people without ready access to boats, who with one exception, are concerned about the pollution at the shoreline. Families in the northern Causeway area try to collect water west of the Causeway, which they believe is less polluted. Most families maintain that they boil all drinking water from the shoreline.

On windy days shoreline water is muddy with sediments disturbed from the bottom and it is said to be sometimes oily from outboard motors and airplanes.

Many people who live on the communities away from Post Island walk down to the lake shore and in summer take their boats out into the centre of the Bay, or farther into the main lake. They believe the Bay to be less polluted than nearer the shore and that the main lake is still pollution-free. Some of these trips are made solely to collect water, while others are made en route to visiting the store etc.

In winter, between October and May, when the lake is frozen, ice is collected from the lake as far out from shore as necessary to avoid surface pollution from oil and gasoline, and from sediment charged run off during the spring. Ice is selected for its clarity and absence of visible pollution and sedimentation. It is usually carried home on ski-doos.

Except for those living near the school (who have access to hot water), the lake water is used everywhere for laundry. This is carried up in buckets from the nearest shore to the home except in Mainland where a gasoline pump is used to lift water along a hose to a central storage point within the community.

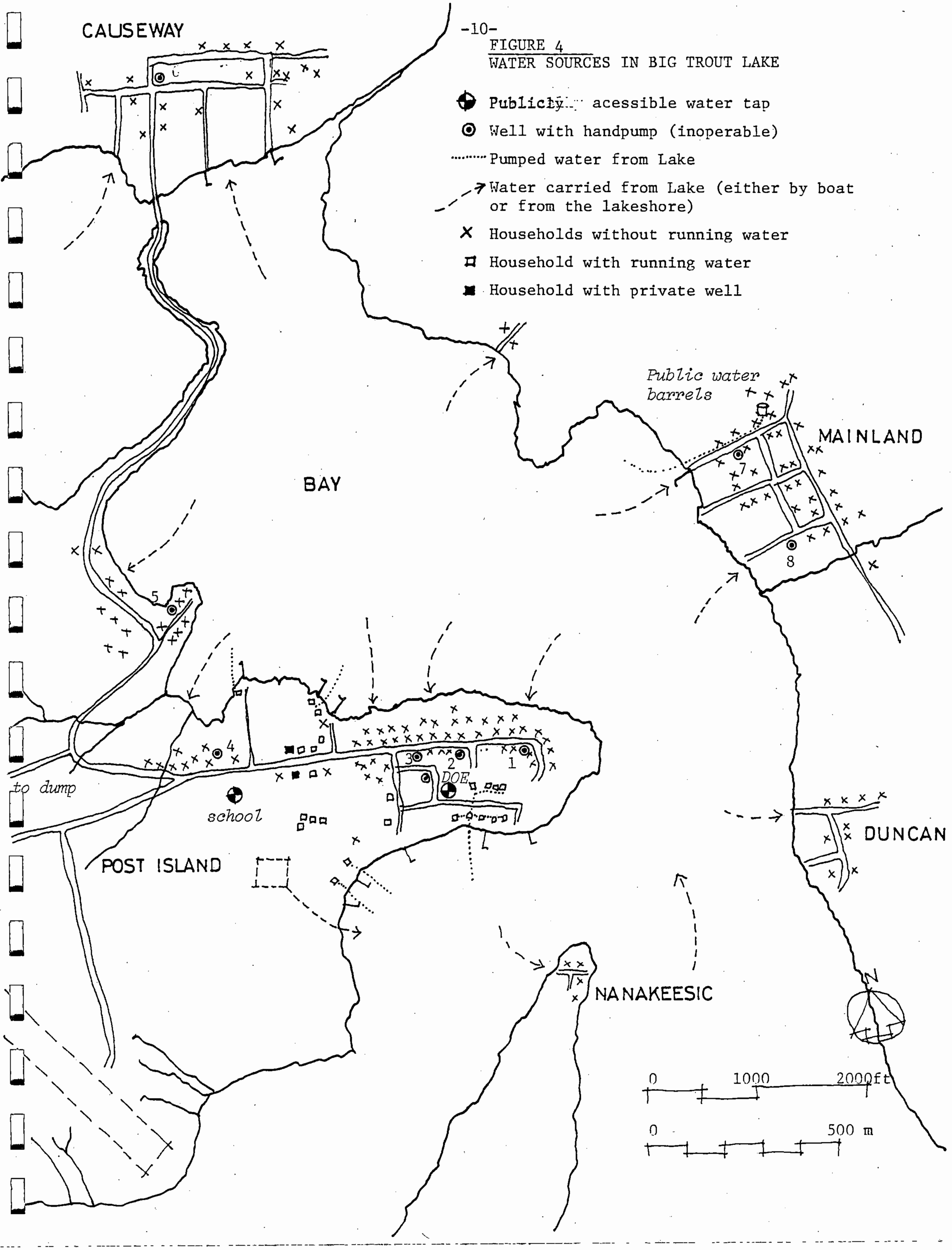


FIGURE 4
WATER SOURCES IN BIG TROUT LAKE

	No. of Households
Lake water	46
Weather Station tap	66
School tap	19
Mainland creek	10
Private piped supplies (non-Indian homes)	20
TOTAL HOUSEHOLDS	161

Households Using Each
Source of Drinking Water

TABLE 3

2.2 Weather Station Intake

A pipe intake 150 ft. - 200 ft. (46 m - 61 m) into the lake on the southern side of the Post Island settlement supplies running water to a complex of houses used by non-native government officials, the manager of the Hudson Bay Company and the nursing station. No native homes are served directly but the Indian people have access to a tap at the Weather Station (outside in summer and inside in winter). The intake is chlorinated regularly but not filtered. It is regarded as good water and no objections were voiced about the taste of chlorination. It is not usually boiled for drinking water by the native people, except perhaps for babies.

The tap is fitted with a rubber hose that is kept coiled by all users to avoid contact with the muddy ground below it. This is the main supply for Post Island and people living on the mainland also use it for drinking water, although it means a boat trip and carrying the water at either end. The supply is available at all times during the summer and when the Weather Station is open 9:00 a.m. to 5:00 p.m. only during the winter.

2.3 School well

A deep borehole provides running water for the school, four teachers' houses and a DIAND official's home. A boiler room heats water for the school and a public tap is available to native people in the boiler house during school hours and on part of Saturday. No water is available on Sunday and people living near the school must use the lake or walk over half a mile to the Weather Station -- a trip which takes more than half an hour carrying five gallons (23 ℓ) of water.

Hot water can also be obtained from the boiler room and this is much used for laundry, especially on Saturday by people living close by. The cold water is considered to be safe to drink but regarded by some as having poor taste.

2.4 Mainland creek

Families living on the mainland also use a creek for drinking water in the summer. The creek is small, about 4 ft. (1 m) wide and 2 ft. (0.6 m) deep at the collection point, and has no habitation upstream. A box has been inserted into the natural channel to enable buckets to be lowered into it without eroding sediment from the banks.

Water quality from the creek is believed to be good and it is said to have a good taste. Ontario Ministry of Health analyses show no faecal content.

2.5 Rainwater and snow

Four houses (one in the northern development area and three in the Causeway region) were observed to have simple rainwater collection systems. These involved guttering along the bottom edges of the pitched roofs and 5 gal. (23 ℓ) oil drums or similar metal containers with wooden cases placed at the corners. Only one house had drainpipes leading into the containers. Other houses sometimes put buckets outside to collect rainwater just when it is raining. Rain falls for the six month period, May through October, and is able to supply water for laundry and house cleaning needs. It is not used for drinking as the containers themselves are not clean.

During winter, some families use snow for drinking water, expecially those away from the lake. Care is taken to choose uncontaminated ground away from houses. Snow is used on hunting and trapping trips and is regarded as the purest source of drinking water by those who use it. People are said to be much healthier when drinking snow water out in the bush and to get sick when they return to Big Trout Lake.

2.6 Private water sources

In addition to the non-native homes which have running water supplied by the Weather Station Intake, or the school well, the other non-native families have running water from private supplies served either by lake intakes pumped to the homes or by private wells. None of these are accessible to any Indian families.

2.7 Public groundwater supplies

Seven boreholes fitted with handpumps and one borehole housed in a pumphouse and served by an electric motor were used for a short time between 1971-3. None are available now. The water supplied by the handpumps was oily for several months and was beginning to clear when all the pumps broke down, mainly through freezing. Although people complained about the mineralized taste of the water, the main concern was the oily deposits which turned teapots black. The wells were regarded as highly convenient sources of water for drinking water (except at North Causeway where the well water was said to be good tasting and cold once the oil had disappeared). Many people want the wells to be operating again.

SECTION 3: DOMESTIC WATER USE

3.1 Amounts Used

3.1.1 Drinking Water

The average amount of drinking water used per person is a little over one gallon (5.4 litres) per day (Table 4). This includes water used for drinking, personal washing, cooking, and some washing of dishes, in approximately the following proportions:

3 pints (2ℓ) drinking water (mainly as tea for adults)

1-2 pints (0.6ℓ - 1.2ℓ) cooking and food preparation

1-2 pints (0.6ℓ - 1.2ℓ) washing dishes (non-drinking water is also used)

2 pints (1.2ℓ) personal daily washing

WATER CONSUMPTION AND STORAGE CAPACITY IN TEN SAMPLE FAMILIES[1]

Family Size		Distance From Service (Walking)		Distance From Service (Boat)		Drinking Water per Family per Day		Drinking Water Consumption per Person per Day		Drinking Water Storage Capacity		Laundry Water Use per Week	
(Adults)	(Children)	(ft.)	(m)	(ft.)	(m)	(gal.)	(litre)	(gal.)	(litre)	(gal.)	(litre)	(gal.)	(litre)
4	-	900	274	-	-	4	18	1.0	4.5	5	23	20	91
4	1	300	91	1 mi.	1.6km	4	18	0.8	3.6	5	23	20	91
2	1	300	91	1 mi.	1.6km	1	4.5	0.3(2)	1.4	5	23	20	91
2	-	300	91	-	-	4	18	2.0	9.0	5	23	20	91
5	-	750	229	-	-	10	45	2.0	9.0	16	73	25	114
2	-	420	128	-	-	1.5	6.8	0.75	3.40	4	18	16	73
2	-	300	91	-	-	2	9	1.0	4.5	-	-	-	-
3	3	1,000	305	3,300	1,006	10	45	1.6	7.3	10	45	20	91
2	2	1,000	305	3,500	1,066	5	23	1.25	5.67	10	45	20	91
2	4	300	91	200	61	6	27	1.0	4.5	10	45	10	45
								(average) 1.2	5.4				

[1]This does not include water for house cleaning, particularly floor washing, which is approximately two gallons per household per day.

[2]Wife and husband both work outside home and child is cared for by relatives during day: hence low consumption.

TABLE 4

During summer cooking and food preparation demands for water are low. Vegetables are mainly processed and cans are often set to heat on the stove so that the contents heat in their own juice. Fish, the main source of protein during summer, is usually fried. Water fowl and moose are stewed in water but are eaten much less frequently than fish during summer. Processed bread is usually eaten at meals. Tinned evaporated milk is used rather than powdered milk. Many homes do not have ovens, and cookies, candies and soft drinks, though consumed in quantity, are bought processed at the store. Water is used to mix with Koolaid for childrens' drinks. The considerable use made of processed food thus reduces the water requirements for food preparation.

The low amount of water used for personal daily washing will be discussed in section 3.3. Dishes are washed with drinking water supply when there are few of them, when there is no lake water in the house for cleaning, or when the water is heated in a kettle usually used for drinking water.

The daily amount of drinking water used per person does not vary greatly. Table 4 shows a range of 0.8 - 2.0 gallons (3.6 - 9.0ℓ) excluding the unusual household. This amount does not seem to be related to family size or distance from source.

3.1.2 Laundry and cleaning water

Water used for housecleaning is more difficult to measure as it is not usually stored in the house nor fetched on a daily basis. Estimates range from 1-2 gallons (4.5 - 9.0ℓ) per household per day although several times this amount can be used once or twice a week. Laundry is done weekly and many households use washing machines powered by electricity (where there is hydro) or gasoline motors. These use about 20 gallons (91ℓ) each washday per household (Table 4).

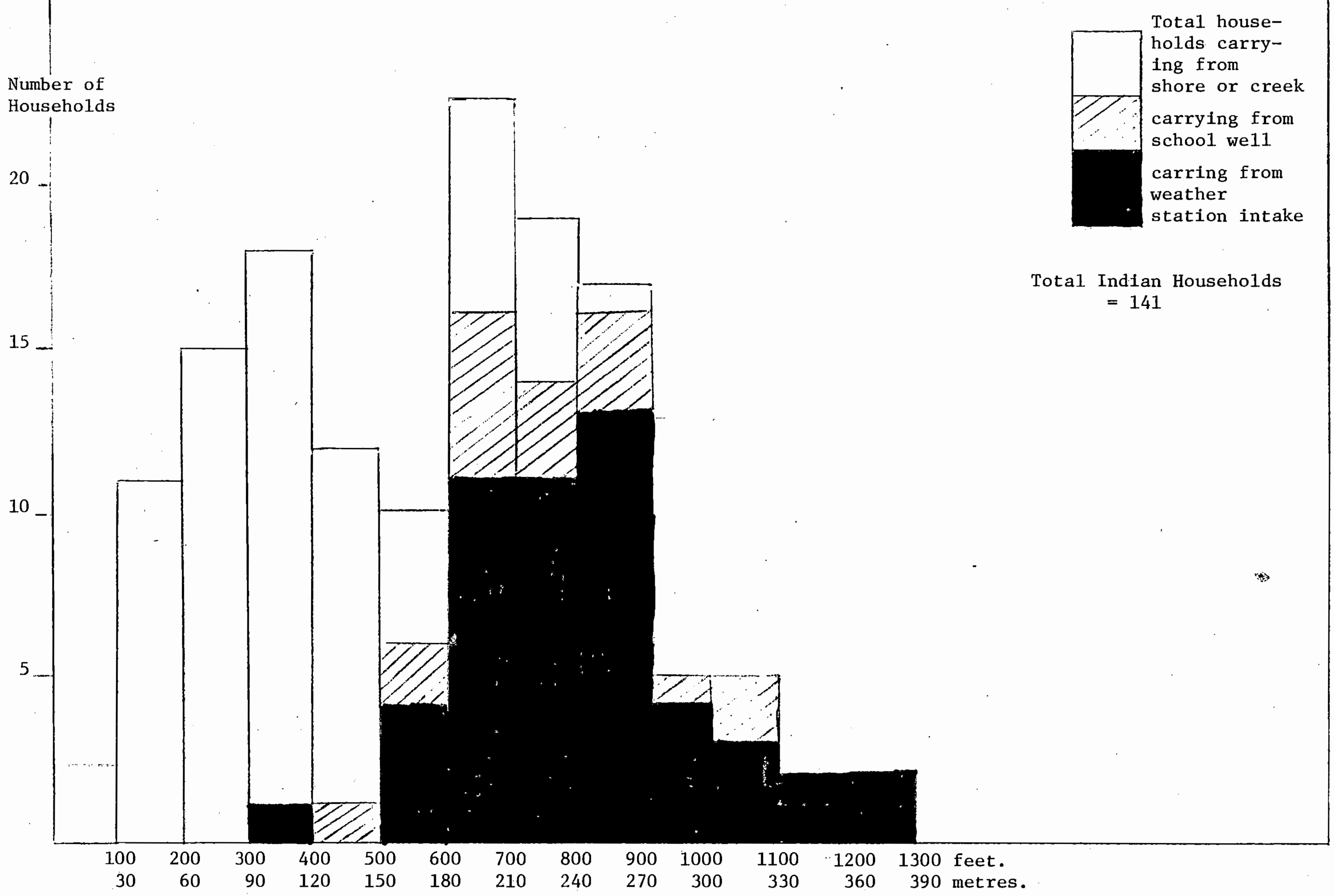
Thus total amounts of water used from drinking water sources and laundry and cleaning water sources are about 2 - 3 gallons (9-14 litres) per person per day. Personal bathing is said to take place about once per month, so it would not influence these figures very much.

3.2 Carrying and storage

Water is carried from the water source in open metal or plastic 2 gal. (9ℓ) buckets or in 5 gallon (23ℓ) covered polythene water carriers. Formerly this was the women's task but today many men, particularly teenage sons, carry water as well. Buckets are carried by hand but the 5 gallon container, which is poorly designed for carrying any distance, is sometimes wheeled in a wheelbarrow or child's four wheeled wagon. There is one water vendor on Post Island who charges 50 cents for fetching 5 gallons, using a child's wagon. For people using water from the lake or those who come to the Weather Station from the mainland settlements, a boat trip in summer is necessary in addition to carrying water to and from the shore. In winter skidoos make this task easier, but add to the cost since gasoline is $2.65 per gallon.

The distances water is carried (excluding boat distances) from the source to the home is shown in Figure 5. Most people have to carry water between

FIGURE 5 Distances walked carrying drinking water from source to home by Indian families in Big Trout Lake.



Distances Walked Carrying Drinking Water from Source to Home by Indian Families in Big Trout Lake.

600-900 feet (180 - 270m). People are willing to go farthest to fetch water from the Weather Station tap which they believe to be safest to drink.

At the taps considerable care is taken to wash out buckets and to keep the hose pipe from being contaminated on the ground. Similarly, in the homes, drinking water is stored in covered containers, usually holding 5-6 gallons, (23 - 27ℓ) which have their own lids or are covered with tin trays or cheesecloth. Some houses use 2 gallon (9ℓ) buckets or 16 gallon (73ℓ) plastic garbage bins for water storage. These containers are washed out whenever they are emptied and refilled (usually every 1 - 2 days). Water is usually stored in the kitchen on the floor by the wood stove or, when it is not lit, on top of it.

3.3 Use in the home

Jugs and cups are dipped into the container for drinking water and for making tea. In some families using only lake water, all drinking water is boiled and cooled in a separate container before use. Care is taken to avoid contamination of this water in the home.

In the morning members of the family wash their hands and face while fully dressed in a small bowl of 1 - 2 pints (0.6 - 1.1ℓ) of warm water in the kitchen. During the day a similar bowl of soapy grey water is left in the kitchen for people to wash their hands in. The same water is used by different people, and may be a means of spreading faecal contamination between individuals and to food.

Separate buckets are used for lake water for house cleaning and laundry. The main uses of water in the house are washing dishes and floor washing. Commercial household cleaning powders, fluids and detergents are used, as is toilet soap and commercial hair shampoos.

SECTION 4: WASTE DISPOSAL PRACTICES

4.1 Excreta

The distinction between native and non-native housing is an important one in the context of waste disposal practices. As noted previously, all of the non-native houses have running water inside the house, either from a well, or pumped from the lake. None of the native houses have running water in the house. It is estimated that a person living in a house with running water will produce daily about 30 to 50 gallons (136-227ℓ) of wastewater (including toilet flushing). Our survey indicates that the average water consumption in the native houses is 2 - 3 gallons (9 - 14ℓ) per person daily. Hence the non-native population today produces two or even three times as much wastewater as the native population, though the latter is ten times as numerous.

4.1.1 Post Island East

A number of the commercial buildings have no water supply, no toilets and hence no waste disposal problem (this includes Band Office, Drug & Alcohol Program Office, Coffee Shop, Old School, Radio, Freezer Plant, Hydrogen Building, Power Plant, Hudson Bay Store, Anglican Church, Coop Store). Ten non-native houses, the Nursing Station and Meteorological Station have individual septic tanks. One non-native house has a Humus toilet. The fifty one native houses have individual pit latrines.

4.1.2 Post Island West

The school and teacherage (4 houses) are connected to the sewage lagoon via underground pipe. Five non-native houses have chemical toilets which are discharged in the Bearskin Airways area. One non-native house has a septic tank, and one discharges to the sewage lagoon, via a manhole, though only during the warm season. Two non-native houses have individual pit latrines. The twenty-one native houses have individual pit latrines.

4.1.3 Northern development area

Fifteen native houses all have individual pit latrines.

4.1.4 Causeway

Seventeen native houses all have individual pit latrines.

4.1.5 Mainland

Thirty-five native houses all have individual pit latrines.

4.1.6 Duncan

Eight native houses all have individual pit latrines.

4.1.7 Nanakeesic

Four native houses all have pit latrines.

Indian homes all have pit latrines situated outside the houses from 10 - 30 ft. (3 - 9 m) away. These are used by everyone in summer and winter although some old people use honey buckets inside during the winter and young children use pots inside. In winter there are problems of excreta forming a narrow frozen pile rather than spreading out and the difficulty of getting to and using the latrine in sub-zero temperatures. Sometimes salt is applied to help overcome the first problem. In summer, the latrines smell and attract flies, and the way to them becomes muddy after rain.

Pit latrines are also used for dumping household garbage. Some become filled with paper refuse before they can decompose and need to be moved every year. Others only need to be moved once every 2 - 4 years. Much commercial toilet paper is used; present annual sales for Big Trout Lake residents are 20,000 rolls which averages 125 rolls per year per household, or more than 2 per week (calculated at 140 native and 20 non-native households).

In addition to quantities of toilet paper, which does not degrade effectively, the use of plastic-lined, disposable paper diapers presents a difficult waste disposal problem. These are almost univerally used now in the community rather than either the traditional moss, or cloth diapers. They have health benefits in ensuring regular changing of babies' diapers and have reduced skin infections related to diapers. However, annual sales of the disposable diapers are now nearly 300,000 for less than 150 households. These are usually deposited in latrines or in garbage bins for burning. However, many soiled diapers litter the ground around the houses and do not appear to degrade, probably because the paper is protected by a plastic liner.

4.2 Grey Water and Wet Household Garbage

Waste water from washing dishes or clothes is commonly emptied on to the ground around the house and allowed to drain away over the surface. Some houses have built covered sumps by the houses into which grey water is allowed to seep. Wet household garbage such as tea bags is first put into a slop bucket in the house or on the outside steps and then put into the sump or into the pit latrine.

Non-native homes have piped grey water disposal facilities. Native homes do have these facilities although outside of the home the grey water may not be piped but runs in open ditches.

4.3 Dry Household Garbage

Dry household garbage is put into cardboard boxes in the kitchen or (in larger houses) a semi-partitioned hall by the door. These are emptied daily into 45 gal. (205ℓ) oil drums outside the home and burnt every 1 - 3 days when the weather allows. Full containers outside the houses are open to the wind and frequently garbage is blown out of them. It is left on the ground and gives the settlement a very littered appearance. Many Indian families have also constructed underground garbage pits near their homes. These have a wooden framed hole at the top and are closed with a wooden lid. They are well constructed and used mainly as a final repository for non-burnable gargage on Post Island and more as a general garbage pit in the smaller communities.

The use of processed and packaged food, especially cans, produces much garbage which needs to be collected and removed to a central dump. There is a dump located less than a mile from the village on Post Island but few people carry their non-burnable garbage there. Well-built log garbage containers have been placed around all the communities for a garbage collection system but these are unused since money for maintaining the collection system ran out.

SECTION 5. COMMUNITY CONCERNS AND DESIRED IMPROVEMENTS

5.1 Community concerns

From points raised in community meetings, and from interviews with people in their homes, a general picture emerges of the structure of the Big Trout Lake Band's concerns and their priorities for action.

The prime issue is the pollution of the lake and the improvement of its water quality. This deeply felt and widely voiced concern acts as a yardstick against which all other desired improvements are measured. The young and the old, men and women, are all worried about declining water quality of Big Trout Lake. The reasons for their concern can be ranked in the following order of importance:

1. The irreversible effects on their environment, particularly on fish, water, fowl, and, to a lesser extent, animals.

2. The future harm to their children's and grandchildren's ability to follow their way of life,and basis of livelihood, if pollution continues.

3. Illnesses such as diarrhea and dysentery, affecting adults and children from drinking the water.

Everyone agrees that pollution of the lake has already occurred. The following effects were cited as evidence (in order of frequency of mention):

1. The lake water, particularly that at the shore and in the bay, <u>looks</u> polluted. It is not as clear as it was in the 1930's or even in 1950's when you could see to the bottom through several feet of water, whereas today you cannot.

2. The water in the bay has a different <u>taste</u>, especially when drunk as tea.

3. People become ill now by drinking lake water, especially children during the spring break up.

4. Fish, especially trout, have left the Bay where they used to be caught.

5. Green algae grow on the rocks now around the shore at some points, where before there were no algae.

6. The waterfowl are fewer in numbers and are less tasy and fat.

The perceived sources of pollution are primarily the sewage outflow pipes of the non-native houses and the lagoon of the school sewerage system. The locations of each outflow are widely known among the community and the effluent has been frequently observed. It is also common knowledge that the sewerage lagoon gets blocked during the spring run off and has to be opened to let the sewage into the lake. However, other sources of pollution are also recognised by members of the Big Trout Lake Band, some of whom have a good grasp of the 'total problem' rather than being strictly 'them' and 'us' in their attitudes. The sources of pollution perceived by the native people were mentioned in the following order of frequency:

1. Sewage from white houses
2. Sewage from school lagoon
3. Oil and fuel from skidoos and outboard motors
4. Oil and fuel from aircraft landing on ice and water
5. Oil and fuel from aircraft repair and maintenance operations
6. Pit latrines close to shore
7. Grey water from white houses
8. Garbage lying around settlement, especially oil containers thrown on shore or into lake

5.2 Desired improvements

The most urgent priority in most people's minds is to stop pollution of the lake and allow it to recover. This they see as being achieved largely through eliminating raw sewage disposal from the non-native houses. The immediate benefits to the community of doing this would include improving the quality of their drinking water supplies, thus enabling them to take water from the shoreline near their houses, instead of going by boat to the middle of the lake, or fetching water from the two public taps.

Beyond this first course of action lie other desired improvements which seem to be in the following order of priority:

1. Repair and improve the seven wells with handpumps to make them reliable all year.
2. Install more wells to increase the convenience of wells to all houses.
3. Provide a tap in every house.
4. Improve the latrines so that people can reach them without going outside, and so that they do not smell.
5. Have a garbage collection system.

From these priorities it can be seen that, as far as native homes are concerned, improving water supply is a higher priority than improving sanitation. The Band is very sensitive to the issue of water quality. This is borne out by their attention to drinking water clean and their willingness to walk farther than the nearest source to get the chlorinated supply at the Weather Station. They are also concerned with the convenience of water to the house - a concern which was equally voiced by men as by women.

Everyone who was asked would like a tap in the home in order to avoid going outside for water. Some thought it would be too expensive or be too long in coming so that they would rather get the wells operating first, as an immediate improvement and interim measure. However, old people, without younger relatives nearby, complained about the difficulty of carrying water, and young wives earnestly desire running water as a modern convenience. In both groups the motivation to have, and pay for, running water is strong.

The fact that all non-native houses have running water in Big Trout Lake also makes for strong feeling among the native people, especially among the young. For example, twenty-five percent of children in Grades 5 and 6 in the local school when asked to write free responses to "Being Indian is . . . " in a school exercise included "having no running water" in addition to more common responses like "to hunt your own food and fish". This implies a strong, underlying awareness of the issue even on the part of children.

The desire to change the pit latrine is there but the motivation is much less strong than to improve water supplies. Pit latrines are still accepted as part of the way of life by many people in a way that carrying water in buckets is not any longer.

5.3 Willingness and capacity to pay

It would appear that there is a willingness and capacity to pay for desired improvements in standard of living in Big Trout Lake. Many homes that have hydro have several electric domestic appliances including washing machines, cooking burners, kettles, toasters, and even electric can openers. All homes visited had a transistor radio and those with hydro usually also had a television, although the latter has been available only since December 1977. (Some houses have colour televisions.) The use of telephones is also widespread throughout the community. Similarly, the large number of skidoos and sales of processed foods indicate both that purchasing power is there and that people will pay for domestic convenience and aids to 'modern living'.

There are more specific indicators of willingness to pay for improved water supplies and sanitation. Some people are willing to pay the water vendor 50 cents for having five gallons of water delivered to their door. One young woman admitted that on washing days she paid a taxi $1-2 to fetch laundry water from the school. In interviews, people said they would willingly pay $5 per week to have a tap in their home. They have shown willingness to pay for convenience such as toilet paper (sales for Big Trout Lake are $8,000 per year) and disposable diapers (sales are $33,500 per year). The motivation to reduce the necessity to carry water is strong enough for people to be willing to pay. Although some families are too poor (especially old people living by themselves) it seems likely that most families could pay $5 or even more per week for running water in the home. However, this aspect clearly needs further investigation.

SECTION 6. SOCIAL CRITERIA IN THE DESIGN OF IMPROVEMENTS

6.1 Water Supply Improvements

6.1.1 Convenience

The main reason for people wanting improved water supplies in or near their homes is convenience. However, from a health point of view, another important reason is to enable hygiene practices to be improved in the homes. No one mentioned the desire to improve personal washing facilities, but it is likely that water and faecal-related diseases would decline if more hand washing and personal bathing could take place.

In present circumstances where water is carried to the home, minimal amounts are used in washing and it is not possible for people to wash their hands in clean water after defecation.

Contamination of drinking water stored in the home probably occurs through the hand dipping of jugs into the container to obtain water. One sample taken from a storage container in an Indian home using the weather station chlorinated supply was found to have 80 total coliform count and 80+ faecal contamination (See Section 1).

It is unlikely that bathing and handwashing would increase significantly if water is brought nearer the home only to the nearest well. Probably, running water in the home together with some piped waste disposal facilities, is the minimal change that will effect this improvement in hygiene.

However there is an important caveat to providing running water to each home. This is the escalating demand for water that is almost certain to follow which, in turn, will provide greater problems of waste water disposal. The evidence of domestic appliance and processed food purchases, together with the greatly increased exposure of Indian families, particularly the wives, through television, to commercial advertising of consumer goods and modern domestic life, suggests that domestic water consumption would dramatically increase from its present 2-3 gallons (9-14 litres) per person per day. Within a few years it is not inconceivable that people would want to purchase dishwashers and automatic washing machines, which are heavy users of water. One family bought a bathtub ten years ago on the rumour that running water would be coming. It is still waiting to be installed.

It is important, therefore, to consider limiting the supply of water to homes to a level which can be adequately disposed of. However, the price that people would be willing to pay for a limited supply of running water, and the effect on personal hygiene needs further investigation, once specific improvements are decided upon by the Band.

6.1.2 Water taste

Almost all people interviewed consider ground water inferior in taste to lake water. It tastes mineralised or "flat" and makes poor tea even after the oil problem from the well installations disappear. People prefer lake water supplies and may continue to use them for drinking water, even if groundwater supplies are provided in or near homes.

6.2 Sanitation Improvements

6.2.1 Pit Latrines

The pit latrine is used at present as a general dump for refuse as well as a toilet. If any change is made to a system that cannot accept large quantities of paper including diapers and sanitary pads, then provision must be made in both health education programmes and garbage collection and burning practices to dispose of this waste by some other sanitary means.

The standard of hygiene in some latrines is poor and below that of the homes - which are usually very clean despite the mud treked in. Some women seem to have a different attitude to the latrine in terms of sweeping it out or cleaning it. This situation is likely to improve if the latrine is moved by or in the home.

6.2.2 Household Garbage

The present trend of using processed food and consumer products seems likely to continue. These provide considerable quantitites of waste, some of which cannot be burned, and needs to be collected in a centralized system. Already some homes have broken washing machines and other machines lying abandoned in their yards and some provision for collecting and disposing of these larger articles is also needed.

6.3 Implications for Other Changes

6.3.1 House Design

In the present homes there is little or no provision for privacy in personal hygiene. Washing takes place in the kitchen in view of those in the living room and anyone who comes in the front door. Not all bedrooms are provided with doors although these are often screened with a curtain. New homes should be designed with a view to providing a private washing area (preferably with running water and drains) in addition to any changes necessary to accommodate an improved internal toilet.

6.3.2 Community Facilities

There are already modern community showers in the nursing station which cannot be used until a better waste disposal system can be installed. In view of the present limitations in native homes in personal washing and the problems of waste water disposal from them, it would seem advisable to encourage the use of these communal facilities as soon as practicable.

Many daughters do washing for their aged parents already, and many women are prepared to carry hot water from the school for laundry. Clothes are changed frequently and there is pride in the appearance and cleanliness of clothes. It seems therefore that a communal laundry facility providing hot water, machines and convenient drying facilities would be a practicable way to centralize the problems of grey water disposal and water heating.

6.3.3 Health Education

The present health education programme appears to be effective. The advice of the two Community Health Councillors, Moses Mosquito and John Childs, was often repeated during interviews and general awareness of hygiene is good. Any proposed changes in water supply and sanitation should take the benefit of this well established programme to make sure that the ground for any necessary changes in attitudes and behaviour is well prepared beforehand by the local health councillors.

SECTION 7: ASSESSMENT OF THE PROPOSED DIAND SEWERAGE SCHEME

In 1971 the Environmental Protection Service (EPS) conducted a survey of wastewater discharges into surface waters in Northern communities. The Big Trout Lake community was identified as a priority for the ensuing EPS "Clean-Up" campaign in that the lake waters around Post Island were found to be polluted and the septic tanks servicing federal buildings deficient in operation (Connelly, 1972). Feasibility and final designs were drawn up and in 1976 construction started on a sewer line which would have collected sewage from federal and other neighbouring buildings and transported it via two pumping stations to an extended aeration plant for treatment followed by chlorination before being discharged through an existing stabilization pond and submerged pipe into the lake.

The design, which was finally accepted by the EPS and the Federal Department of Indian and Northern Affairs to be installed by the Department of Public Works was to run east to west from the Hudson's Bay Store through to the treatment plant. As illustrated in Figure 6, first priority was to be given to collection of the Department of the Environment's building. Second priority was the Hudson's Bay Store and residence. A northern branch line would have connected the Band Office, the nursing station, the DIAND school, the nursery, the DOE's recreational club and meteorological building, the Co-Op store and an Indian residence. On its way to the treatment plant the main sewer would have collected sewage from the nurses' residence, the treaty office, an Indian residence, the Church of England's buildings, and the Department of Forestry (Ministry of Natural Resources) building.

A pumping station was to be installed to drive the sewage over a small hill to a second pumping station. This station would receive sewage from the school and teacherage complex. An Indian and pilot's residences were also to be connected.

Most government buildings enjoy piped water drawn from the lake and chlorinated prior to distribution. Presumably those to be sewered would have been tied into the water system. Little was known within the Indian community of the proposed sewerage scheme prior to actual construction. No plans were made available and it was not until the construction crew entered the Indian cemetery and dynamited graves that severe criticism was raised by the Indians to the point that construction was stopped.

7.1 Technical Assessment of the Proposed Sewerage Scheme

7.1.1 Pumping Equipment

The sewerage scheme as proposed would have successfully removed

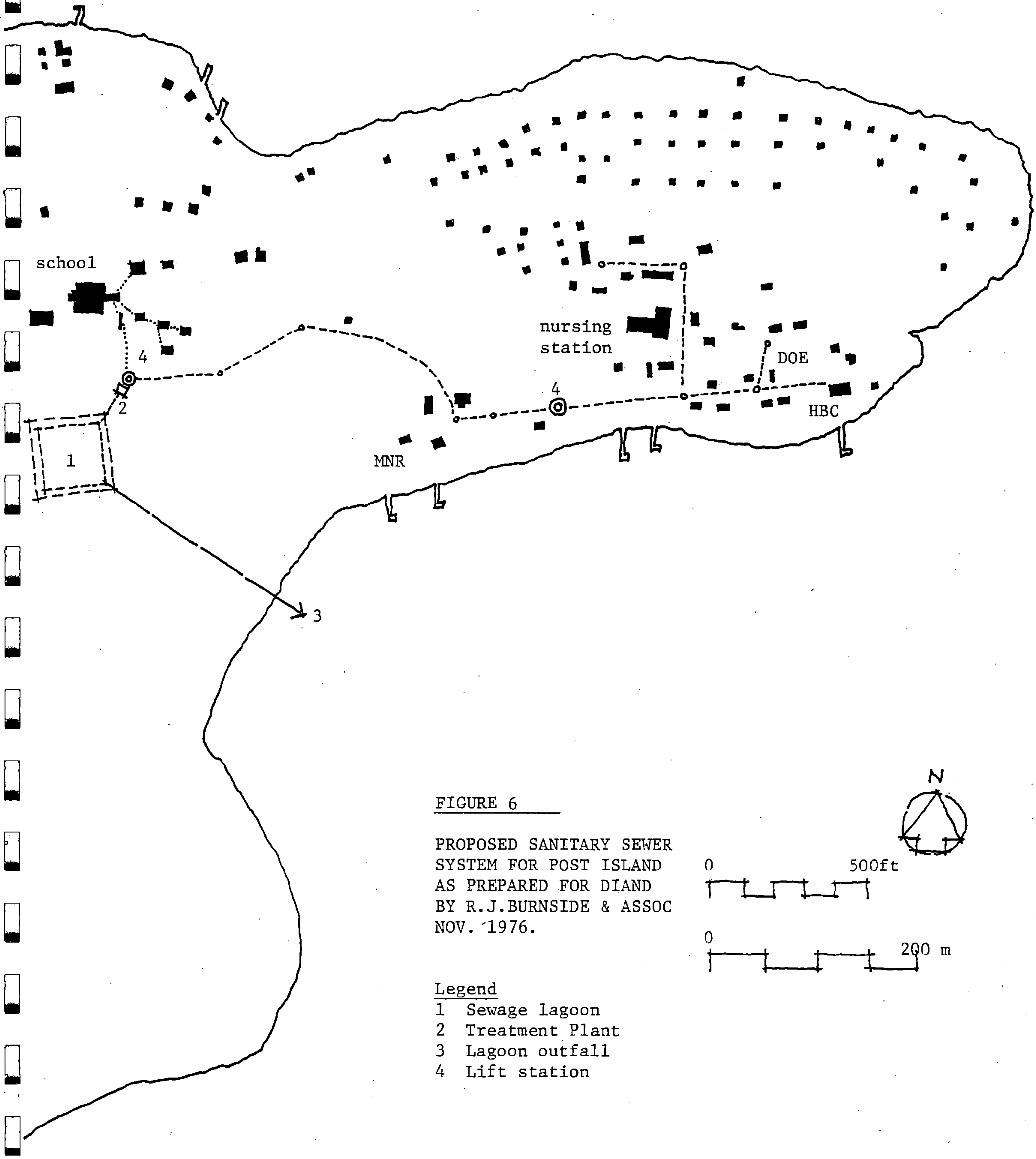


FIGURE 6

PROPOSED SANITARY SEWER
SYSTEM FOR POST ISLAND
AS PREPARED FOR DIAND
BY R.J.BURNSIDE & ASSOC
NOV. 1976.

Legend
1 Sewage lagoon
2 Treatment Plant
3 Lagoon outfall
4 Lift station

human wastes and greywater from the connected buildings which were connected to the water supply. No serious problems are seen in terms of freezing within the sewer pipes in that an 8 foot minimum trench depth was to be assured and the wastewater was to come from houses which would have remained heated throughout the winter. The first pumping station was to be equipped with a dual pneumatic ejector pump and the second with two submersible pumps. Since problems could have arisen with the breakdown of pumping equipment, additional stand-by pumps should have been specified as back-up in case of failure - particularly in view of the remoteness of the location. The equipment itself is reliable but needs a good maintenance program. If either station broke down, the sewage would back up into the houses and buildings along the line.

7.1.2 Treatment System

The choice of treatment system is a matter of serious concern. Good equipment maintenance is difficult in remote communities. Maintenance of pumping or other similar mechanical equipment is relatively simple and common-place. However, extended aeration treatment of sewage is complex both in terms of mechanical/electrical equipment and the biological process itself. The unit would have performed screening, grinding, aeration, clarification, chlorination, and sludge holding and digestion. The equipment required to do this comprised (a) a bar screen to take out solids which are larger than one inch; (b) a comminutor which is a revolving screen through which sewage is passed and against which carbon chrome steel cutters mascerate the faecal and other waste material; (c) a large aeration chamber with a minimum retention period of 24 hours; (d) positive displacement air blowers to force air through air diffusers within the aeration tank; (e) a four hour retention clarifier chamber with a sludge hopper; (f) a positive airlift skimming device for the clarifier; (g) an airlift pump for activated sludge return to the aeration chamber; (h) a froth control pump and spray nozzles for the aeration chamber; (i) a sludge storage tank and (j) a hypochlorination unit which is a chemical feed pump specially designed to feed chlorine in solution into effluents. Each mechanical device would have had its own drive mechanism, including gears and requiring electrical circuitry often involving relatively sensitive automatic control devices such as magnetic starters, time clocks and switches. For example, the comminutor was to have an automatic overload reversing device with momentary time delay and the blowers were to vary the out-flow of the diffusers automatically and approximately in proportion to the demand for oxygen by the in-flow of sewage. In contrast to statements claiming ease of operation and maintenance normally made by manufacturers of such equipment, the extended aeration plant needs to be checked out at least once per day by a trained and competent technician. Such plants do function effectively when this level of maintenance is available and a skilled technician or specialist is available on short notice. Such services are available in most of the major southern cities; placing this kind of equipment in an isolated reserve is inviting failure as past experience has amply illustrated.

The process is not only mechanical and chemical in nature, it is also biochemical and relies on a sensitive balance between micro-organisms and nutrients functioning only within a relatively narrow range of temperature and oxygen supply. A spill of toxic waste into the sewer system could cause complete failure as could a sudden temperature drop or loss of power supply. The micro-organisms would die, the system turn anaerobic and raw sewage pass through the unit without treatment until such time as expertise could be brought from the South to set the plant operating by building up the necessary microorganisms (activated sludge) - a slow process taking weeks to effect.

In general, experience in northern communities has shown that extended aeration plants perform poorly. Reasons for poor performance are associated both with poor design and operation. Some of the more frequent causes of failure have been listed by the Northern Technology Centre (Griven and Smith, 1977). These causes include overloading the plant, hydraulic surges, differential settlement, clogging of the sludge return line, failure to scrape the clarifier, and under-aeration. Problems specifically related to northern regions were reported as being air-borne disease transmission hazards to the operator, ice fog generation, humidity problems with housed units, survival of disease causing organisms at low temperatures and frequent power failures and voltage variation.

In terms of treating sewage, northern extended aeration plants again have a poor record. The average removal of organic wastes (measured as biochemical oxygen demand or B.O.D.) of northern plants was found to be only 56%. In terms of phosphorus removal, these plants had an average of 16.3 mg/ℓ total phosphorus in their effluents. The possibility of the proposed extended aeration plant removing phosphorus below 6 mg/ℓ on a consistent basis is very remote. The effluent would not meet the Provincial total standard of 1 mg/ℓ. As noted in Section 1, the lake is phosphorus-limited. Elevated phosphorus will increase nitrogen levels, in turn leading to a rate of production of blue-green algae well above government guidelines. Thus the effluent would not meet provincial water quality standards on several counts.

Extended aeration plants in Northern areas of Canada vary considerably in their capacity to kill disease-causing organisms. No data is available on specific pathogens such as Salmonella typhi or Entamoeba. However, the E. coli bacteria, a very common bacteria in faecal matter is used as an indicator organism. It is expected that the effluent of the extended aeration plant will contain some 10^3 to 10^6 coliform (total) organisms per 100 ml. Chlorination of the effluent would satisfactorily reduce the coliform levels. However, in isolated areas, installation of chlorination equipment does not ensure chlorination itself. More often than not, effluent chlorination is given very low priority and after an initial period of conscientious application, the practice is stopped and the equipment falls into disrepair. In addition, chlorine is toxic to fish. It is a stress on fish and fish in the lake are already under oxygen stress. Chlorination will aggravate this situation, especially during the winter months.

The oxidation pond would also vary considerably in its capacity to reduce total coliforms if operated on a continuous basis.

The more important mechanisms for pathogen removal in waste stabilization ponds are settlement (in the case of parasite ova such as the round-worm egg) and retention time (in the case of bacteria). It is therefore important to avoid short circuiting caused by poor design. The pond lagoon at Big Trout Lake can be faulted in this respect. The existing lagoon would have received chlorinated effluent from the extended aeration plant. Assuming that this treatment was effective and chlorination continued without interruption, the pond would act as a long termed chlorine contact chamber.

Chlorination levels would have to be held down to avoid killing the algae in the pond. However, it is expected that, providing the extended aeration plant and chlorine were operated effectively, the effluent from the pond would have low enough levels of coliform organisms for discharge to the lake. However, as described above, the assumption that treatment will be constant and effective is open to question.

The same cannot be said for virus removal. There is insufficient data available in the literature to draw firm conclusions on the reduction of virus in extended aeration ponds. Research in Israel has illustrated that chlorination as it was to be applied to the extended aeration plant effluent would not have adequately reduced viral levels for discharge into surface water levels being used as a drinking water source without further treatment. It is unfortunate that one cannot be more definite, but the science of quantifying viral pathogenic agents in water and wastes is in its infancy. Despite this, the potential for transmitting disease via effluent cannot be ignored. Human excreta has been shown to contain strains of poliovirus, cocksackie virus., rotavirus and infectious hepatitis virus.

Of course, neither the extended aeration plant nor the oxidation pond would produce water accepable for drinking. The capacity of the effluent stream through swampy areas and the lake itself for further reduction of coliforms is a subject for speculation. The Province of Ontario's (1976) Criteria for total coliforms in Private Water Supplies (PW-3) is zero total coliforms per 100 ml sample. However,where chlorination is to be subsequently applied it is 100/100 ml.

7.2 Costs and Benefits of the Proposed Sewerage System

As in all cases of public expenditure, it would be desirable to estimate the cost and benefits of the proposed sewerage system. The objective would be then to carry out an analysis of the present value of all costs and benefits, both private and external in order to determine what is known as an internal rate of return on the investment. Thus the sewerage scheme would be directly compared with other proposed development projects, including ways of coping with the sanitation/pollution problem. However, the majority of external costs and benefits are not quantifiable. Even the impact of the sewerage scheme on health of the population - the primary direct benefit - is not quantifiable. We can, however, use the principles of economic analysis to highlight what are the major costs and benefits.

7.2.1 Health

The costs of ill health to a community without adequate facilities for proper collection and disposal of excreta are significant. Unsanitary conditions foster transmission of such gastro-enteric diseases as ascaris, amoebic and bacilliary dystentery, leptospirosis, enterobiasis, trichuriasis, paratyphoid and typhoid fevers, infectious hepatitis, tapeworm, hookworm and polio. Diarrhea of unknown aetiology is endemic in the Big Trout Lake community. Bacilliary dystentery (Shigella flexernii) is prevalent every year in spring in what can be termed a mild epidemic. Similarly infectious hepatitis is a major cause of concern at the community's hospital. Salmonella is also evident. It is very probable that these and other diseases are "under-reported" and many more cases occur in the community without the medical staff being made aware as to the extent or severity of the disease.

Such gastro-enteric diseases are transmitted by drinking water which is not treated by chlorination or boiled. They are also transmitted more directly through contact with faeces which for example occurs when a mother prepares food after changing a baby's diapers or "pampers" and not washing her hands properly. Disease can pass between children through hand contact when a child who has not wiped himself properly following defecation passes food or holds hands with a second child. The disease is effectively passed on when the second child eats the food or sucks his thumb or bites his fingernails. It is likely that this more direct transmission is more important than the drinking water route once the disease is within the community. However, both are important and both need tackling together.

7.2.2 Sewerage Costs

Sewerage is expensive under the best of conditions and Big Trout Lake offers some of the worst. Problems in constructing and operating a complete sewerage scheme are bad enough in northern climates where isolation and winter cold mitigate against it, without having to cut through bedrock to imbed it in trenches which are at least eight feet deep. As a result of such adverse conditions, the cost estimated in 1972 was $275,000 (Underwood McLellan, 1972). Soon after construction it was realized that the sewerage scheme was going to cost a great deal more. In February 1977 the estimate was revised to $750,000 (Sainnawap and Hyder, 1977). The estimated population which was to be connected to the system was 100, implying that the cost per building connected would have been in the order of $30,000. This excludes the costs of connecting the household to the system. This figure of $30,000 represents more than twice the amount spent on constructing an Indian household. It is easy to visualize why sewerage remains and will remain well beyond the financial capability of the Indian. Government assistance in the form of soft loans and grants is not the solution where there are alternatives. Selection of such technologies under these circumstances is entirely inappropriate and wasteful of material and financial resources - especially where funds for water and sanitation are scarce.

It has been repeatedly stated that one of the direct benefits to the native community would be in the form of "day labour" wages. It appears that this may be the only possible direct benefit. Wages did and would have continued to reach the community. These went into purchase of goods and food. Several families are still in debt to the Co-Op store for goods purchased on credit and some are said to have been over $10,000 in debt before construction was halted. It was estimated that of the $750,000 estimated $350,000 would be spent on Indian wages (Sainnawap and Hyder, 1977). This appears highly improbable. A review of the four months construction towards the end of 1975 indicates that about 11 men were employed at $4 - $6/hour, at an average of 10 hours per day. Thus, some $16,500/month was distributed for day labour. Construction was to be completed within 12 months, giving an estimated total of about $200,000.

These costs are small when compared to the opportunity cost of the project. By the time construction was halted, $800,000 had been spent. Recent statements by DIAND officials indicate that since the time of construction stoppage, an additional $900,000 has been spent, making a total project cost of $1.8 million. It is not clear what this additional $900,000 was put towards and an itemization of this expenditure from the Department would be useful at a later date. However, if $1.8 million had been devoted to an alternative technology, it is more than likely that the entire community, including the native population, could have been serviced. The opportunity cost of this project, therefore, has been high indeed. This has been a direct consequence of selecting the wrong technology, and of poor communications between the Indian people and those responsible for implementing the project.

SECTION 8: RECOMMENDED IMPROVEMENTS IN WATER SUPPLIES

The Weather Station and School taps are used throughout the year as sources of water as has been described elsewhere in this report (Sections 2 and 3). Lake water during the summer, and ice and snow during the winter are other secondary but important sources. These sources are clearly unsatisfactory from the native point of view. They imply frequent trips with buckets and limit the amount of water used in the home. In the case of collecting water from the lake near the community there are health and aesthetic problems. There is a real chance of disease transmission via the lake at locations near sources of discharge of wastes. At spring break-up, at the time when lake water is not available at the shore-line and ice is still being cut, melting snow and ice discharge over the lake - ice surface. This surface run-off can, and most likely does, include melting excreta from poorly constructed and operated pit latrines.

Improvements are needed. The native community perceives them as a top priority and has expressed willingness to contribute native time, labour and funds towards early solutions. The following paragraphs describe the alternatives. Fully piped water supply to each home is not seen as viable. Apart from being expensive, more water to the home implies more wastewater to be discharged into the environment. The present methods of waste and sullage (grey water) disposal would be inadequate to cope with the large volumes which would have to be disposed of if water was piped into the home. This is particularly true of conditions during the winter time.

There is a middle range of water consumption which is viewed as having major benefits to health by increasing consumption above the 2 - 3 gal. (9-14ℓ) per day, yet not surpassing the capacity of the environment to absorb discharges. The following are suggested as logical alternatives within this "middle range" of water use.

8.1 Lake Sources

At present water is being drawn from (a) locations at the shoreline near the community, and (b) several kilometres away on the main part of the lake. The nearby sources are used as a matter of convenience for a variety of purposes within the home. Their use for drinking water is to be condemned due to the common contamination by faecal matter. Collection of ice for drinking water further off-shore during winter is also considered hazardous practice, although samples have not been taken for analysis. Certainly water melted down from ice taken from the Lake during spring break-up should not be used to drink directly. If used at all, it should in every case be boiled. Even if this practice is rigorously adhered to there is a real danger of pathogens from latrines reaching the ice as runoff and being returned to the home environment in or with lake ice. The "brown" portion of the ice so collected may be cut off and discarded, but handling the ice would leave the pathogens on the hands and therefore easily transmitted within the family and community. Moreover, frozen bacteria, preserved over the winter, thaws out all at once and is distributed across the ice at break up, further intensifying the contamination problem during the spring months.

The use of lake water from the main body of the lake far from the community is to be condoned. Although this practice results from a search for the "purest" and best tasting water and is based on finding local waters unattractive, it is in fact possibly the best current source for drinking.

8.2 Rainwater Collection

The collection of rainwater during the summer period, although not widely practiced (only 4 native houses presently collect rainwater), would be a practical measure to supplement water supply in houses without running water, particularly when these are located a great distance from water supply. This water could be collected in refurbished oil drums and would most probably be used for laundry rather than drinking purposes.

8.2.1 Rainfall

The monthly mean rainfall measured at the Big Trout Lake Meteorological Station (for the useful months) over the last 30 years is as follows:

May	0.47 in.	(11.93 mm)
June	2.63 in.	(66.80 mm)
July	3.74 in.	(94.99 mm)
August	3.40 in.	(86.36 mm)
Sept.	2.80 in.	(71.12 mm)
Oct.	1.35 in.	(34.29 mm)

8.2.2 Collection

The average roof collection area of the native houses is 500 $ft.^2$ (46.5 m^2). Assuming a collection efficiency of 80% (in a temperate climate there is little evaporation) one could expect to collect the following:

May	10 gal.	(45ℓ)
June	53 gal.	(241ℓ)
July	78 gal.	(354ℓ)
August	72 gal.	(327ℓ)
Sept.	58 gal.	(263ℓ)
Oct.	29 gal.	(132ℓ)

The cost of installing the gutters and spouts (vinyl) and refurbishing two oil drums for water storage, would be $150 - $200 per household.

Another option for rainwater collection might be the use of a ferrocement tank. Construction, installation and maintenance costs should be investigated. Designs are available.

Research into the chemical content of rainwater collected in Cree communities in James Bay is currently being undertaken by Prof. Carol Farkas of Man-Environment Studies University of Waterloo. She should be contaced by the Big Trout Lake Band to evaluate the results of that research.

8.3 Handpumps

As illustrated in Figure 4, eight handpump installations were made during the early 1970's. All have failed since and are now abandoned. Although only one has handpump equipment still attached above the ground, all were originally supplied with Monarch No. 2 type pumps. All were drilled into rock and had 4 in. (10.2 cm) steel casing in the overburden. No information is available on the below-grade components such as the well screens used, the cylinder and piston, etc. It appears that they failed principally because of three reasons: (1) freezing conditions during winter resulted in excessive force being used resulting in breakage; (2) jamming of the piston below ground; and (3) releasing the pump rod by undoing the accessible holding pin. There have been attempts at repair. A technician was flown into Big Trout Lake by DIAND but failed in his mission by not having the proper equipment to reach the below-ground components. Efforts to reinstate pump number 8 have left behind a wooden adaptation of the pump head which failed and the pump has not been used since. Some casings have been capped (Nos. 3, 4 and 5) whereas others have been cut off by welding torch. Only Nos. 7 and 8 have remains of the original Monarch 2 pump still in place.

Pumps 1, 2 and 3 yielded rather poor quality water. Reports vary from their producing a "white" coloured water to water which turned pots a black colour. Despite this the wells were continuously used for laundry if not for drinking and cooking. All pumps failed within a few months of installation and before the onset of winter - except for number 6 which was reported to operate for 2 years. The complaint against it however was that it yielded an oily substance which floated on the surface. This was probably due to greasing up on installing the pump which should not have been necessary. Despite all the above complaints and problems, the Indian people, almost unanimously, wanted the handpumps repaired. It was frequently remarked that some form of thermal protection should be installed around the pumps (thermal insulating materials and/or a small cabin) to guard against freezing up in the winter.

It is recommended that all eight pumps be repaired by the Band Council itself. This implies a short training course on pump maintenance and repair being undertaken by one or two Indians in the South. No handpump is maintenance free. Relying on expertise for maintenance outside of the community would be unwise. Even if the pumps were reinstated, most of them would again need repair within a year. Relying on someone flying up from the south to undertake this repair work would not be cost-effective, and as a result of frequent failures would tend to aggravate the situation whereupon the Band would come to rule-out handpumps as a feasible solution.

In most cases the pump, drop-pipe, foot valve and piston will have to be replaced, although in some the drop-pipe may be reuseable. This pipe will have to be removed by rig and winch. It is expected to be between 50 and 100 ft. (15.2 - 30.5 m) long in each case and can be unscrewed into 20 ft. (6 m) sections. Once the pipe is removed and inspected, orders can be placed for the required parts.

Handpumps and their requirements for maintenance have long been a problem for villages in the Third World. They appear to be an appropriate technology but most programmes have run into similar difficulties as Big Trout Lake. The International Development Research Centre has been supporting research on an all-plastic pump which is maintainable at the village. Research will soon begin in England, Kenya, Malawi, Ghana, Ethiopia, The Philippines, Thailand, Malaysia and Sri Lanka. Unfortunately, the pump has not been adequately tested in the field and thus it is not recommended for installation at Big Trout Lake, although it may be the most appropriate pump for Big Trout Lake and other Indian communities in the future.

In response to the handpump problem, the Canadian International Development Agency has been supporting a study comparing 50 handpumps from 10 countries. The work is being carried out in Northern Ghana and has produced its first report (Wardop and Associates, 1977). Out of the 50 pumps tested two have thus far shown to be reliable and the most cost effective solution, the Monarch P3 and the Moyno Pump. The Monarch P3 is a heavy-duty pump which is an improved version of the Monarch 2 formerly installed at Big Trout Lake. In fact the Monarch 2 was installed in Ghana also but very few of them lasted more than 2 weeks.

The Monarch P3 is a lever-operated, reciprocating plunger pump with ball bearings at the pivot points. It has a cast iron body with a wooden handle. The vertical travel of the pump rod is maintained by two bronze oilite bushings. The below grade piston is bronze but has a galvanized steel part. It is strongly recommended that all parts should be bronze to avoid corrosion problems. This pump has operated for over two years in Ghana at the two test installations without maintenance. All bearings are sealed so that no lubrication is required. The Monarch Company is presently carrying out studies to design and improve the below grade components which were used in the Ghana studies and which proved to be satisfactory. Monarch will likely be manufacturing their own cylinders.

The Monarch Company would be receptive to the concept of a short (3 day) training programme for two technically-oriented native people from Big Trout Lake. The three days would be spent in studying components of the Monarch No. 2 pump for purposes of repair and the Monarch P3 pump should it be used in the future. This short course is recommended to be followed by instruction in well maintenance, including how drop-pipes are removed and disassembled for inspection and repair. Some of this instruction could take place in Big Trout Lake itself. Such an approach to within-community maintenance training would not only be more cost-effective than relying on DIAND to send up technicians, but it would also create a capability for repair and maintenance of pumps in satellite communities around Big Trout Lake. It is conceivable that future pump maintenance courses designed specifically for satellite repair persons be held in Big Trout Lake and coordinated by the Big Trout Lake well technicians.

Only three wells' test records are available. They were drilled, exact location unspecified, on the mainland and on Post Island in August of 1974 and yeilded between 4 - 6 gal/minute (18 - 27ℓ/min). Unfortunately other well test data have been lost. It is recommended that all wells be re-tested to determine quality and quantity of water they can produce vis-a-vis handpump use. It is likely that most, if not all, wells are capable of yielding good water in sufficient quantity for handpump use.

One pump per household would be prohibitively expensive. However, the number of handpumps could be increased by two to permit a ratio of one pump per 7 - 10 households.

Use of handpumps during the winter poses its own problems. The Monarch No. 2 pumps have a small hole in the drop pipe at about 8 - 10 ft. (2 - 3m) below well head through which the water can drain immediately after use to prevent freezing of the above-ground components. Construction of small cabins around the handpumps is recommended. These structures would also permit a minimum of comfort to those collecting water during the bitterly cold winter months. This would not totally exclude the possibility of the pump freezing. It is recommended that thermal heating tape be wrapped around the down-pipe to ten feet (3m) below grade and the leads able to be plugged into a supply of electricity. This supply could come from a portable gas driven generator (there are several in the community) if and when the well head freezes up.

It is estimated that the cost of repairing the existing handpumps (8) serving the 150 Indian houses would be $80 - 100 per household. An annual maintenance programme to check and maintain pumps and repair where necessary, the cost of which will be in the order of $15 per household, is also required.

8.4 Piped Water to Street Taps

Another alternative for supplying water to points within the near vicinity of the houses is through a piped distribution system to street taps. The ratio of houses to taps could be in the order of 5:1 so that water would be available within 100 ft. (30m) of nearly all houses on Post Island. The water could be drawn from the existing school house well, stored and pumped through the distribution system or from a lake supply in which case clarification of the water by pressure filter would be desirable before chlorination and distribution.

Naturally the amount of water used in the household would rise but not by such large amounts as one might think. This is due to the requirement of carrying the water. It is expected that the demand would rise from about 2-3 gallons (9-14ℓ) to 3 - 4 gallons (14 - 18ℓ) per person per day. This increase of water usage would be very desirable, from the health point of view, but would not likely exceed the capacity of the soil to absorb the resulting wastewater. The piped water to street taps system would at this point in time apply only to the community on the east tip of Post Island. It would not immediately apply to the mainland and the small cluster of houses across the causeway.

Specially designed street taps are available on the market which deter freezing up by having the valve below the freezing line and a small hole for draining the pipe once the tap is shut off. However, a realiable supply of electricity or gasoline-driven generators would be required for thermal tape heating of the street taps during the winter months in the event that the freeze-free valves failed.

The cost of constructing a pipeline from Post Island across the causeway and to the mainland community or alternatively constructing a separate water intake and treatment plant would be prohibitively expensive for such a small community to afford. Yet, another alternative for the Mainland community would be using one of the existing wells to supply the distribution system through motorized pumps and storage tank. This would likely be the least costly approach but would, again, require electricity for the pumps.

There are two sources of water available on Post Island - the Lake and the existing school well. The Weather Station water supply comes from the lake and is chlorinated. If a lake supply is to be used for the Indian Community it should also be filtered. In view of the limited capacity of the existing MOT system, and the need for better treatment (particularly during the spring break-up) the more cost effective solution would be to construct a separate intake well out into the lake. Water quality studies would be required to identify the preferred location for the intake. The water should be passed through a sand pressure filter (which would require maintenance - frequent back-washing during spring) and be then treated by chlorination. Reliable hypochlorite solution feeders using dry calcium or sodium hypochlorite as feed stock are available on the market and would require a minimum of maintenance. The present system of using Javex is inconsistent and has given rise to complaints of over-dosing. Under or no-dosing is probably occurring also. The chlorinated water would then have to be stored in a pressure tank before distribution.

No data was available on the original testing of the school well. However, an injector pump (Monarch Deep-well type 6465) is installed and supplies water to the teacherage and school. The well is 250 ft. (76.2m) deep and the intake placed at 140 ft. (42.7m). At this depth the pump has a capacity of 4.2 gallons/minute(19ℓ/min.). Assuming the teacherage and school requirement is 50 gallons/day (227ℓ/day) and future Indian demand would be 3-4 gallons per person (14-18ℓ/person) per day, the average daily demand would be in the order of 3,000 gallons (13,620ℓ) per day, which the existing pump could supply. The underground storage tank is reportedly 8,000 gallons (36,320ℓ) which would suffice. It is likely that the existing pressure system would have to be replicated but this would need to be confirmed.

The distribution system would require only one inch (2.5cm) pipes layed, if possible, 8ft. (2.4m) below the surface to prevent freezing. Otherwise the water could be kept circulating through return lines. In this case every street tap would have a delivery and a return line from and to the underground storage tank. Each street tap should be housed to provide some comfort from the weather during winter. If each above ground pipe and tap were wound with thermal tape and supplied with reliable electricity it would not be necessary to heat shelters around the taps.

The costs of providing ten taps (1 per 8½ households) on Post Island would be in the order of $2200 per household which includes alteration to the existing well, storage tank and pressure system, the pipeline and street taps and their superstructures. Annual maintenance costs would be in the order of $25 per houshold per year.

This would seem to be an interim solution leading up to house connections. It is not. House connections would give rise to the need for sewers to collect the wasted water. Sewerage will not be affordable for many years to come. Subsidy for full water and sewerage would not be desirable in terms of the ensuing environmental disbenefits caused by disposing large volumes of secondary treated sewage in the vicinity of Post Island and in terms of selecting a costly inappropriate technology when alternatives are available.

The piped water system with street taps would not be intended to provide protection against fire in the sense that the central water supply system and fire hydrants are used in the south. Upgrading domestic water supply systems to provide fire protection necessitates very large increases in pump capacities and pipe diameters. These increases are costly and of doubtful benefit as the materials used and type of construction in native houses result in their complete destruction in minutes after the onset of a fire. Serious consideration is being given to a fast and mobile fire fighting capability in the Northwest Territories to replace the southern style hydrant dependant system. Quite probably the most effective fire damage protection measure would be a sizeable hand-held fire extinguisher in each home. In short, use of central water supplies as a fire protection technique would be less than cost effective in isolated northern communities.

8.5 Trucked Water Delivery

Another,more convenient alternative, which would increase present water use in the home yet enable restraint on over-use, is the delivery of water by truck. Water which is acceptable both in terms of quality, as stated by the native people, and quantity would be available at the school. Water could be delivered on a regular one or two week basis to storage tanks in the homes which could supply water by gravity to appliances. Control of the quantities could ensure that discharges to soak-pits were not excessive. This system is used in Indian/Inuit communities in the North West Territories. It is successfully applied in suburbs of Yellowknife.

According to experience in N.W.T., water supplied by trucks can be held as low as 2 gallons (9ℓ) per person per day, if surrounding conditions dictate. In this case a family of six would require 84 gallons (381ℓ) per week which could be stored in two or preferably three 44 gallon (200ℓ) drums in the attic. Insulation would be required if the attic temperature fell below freezing during the winter, although such is not likely to be the case. The storage tank and water is likely to be in the vicinity of 900 lb. (405 kg.- equivalent to six medium sized men). Some bracing would be required in most cases to support the storage tank.

An overflow pipe would be required on each tank to indicate when the tank was full. Water would be taken from the bottom of the tank by a simple connection and fed to a kitchen sink. The most important and most likely applicance to be installed first is the sink. It is installed in many Indian homes already, and services hand, cutlery, plate and general household washing. A drain would be required, wastewater would be drained through plastic pipes below the house and out to a subterranean rock filled soak-pit.

Care would also have to be taken to ensure that the drain-pipe and pit did not freeze up during the winter. If freezing could not be avoided, wastewater would have to be taken out of the house by buckets.

The kitchen sink is the minimum appliance possible. It should be fitted with a robust automatic shut-off such as the Fordilla or other water-limiting spring valves available today on the market. ~~It is~~ unlikely that showers would be installed however desirable from the ~~health point~~ of view. Additional sinks would be possible but a conventional flush toilet would not. Low volume flush toilets are available commercially but the soak-pit could not handle these wastes. Sewage collection by truck would be necessary. An integrated system of water delivery and sewage collection by truck is feasible and indeed used in the N.W.T. It is described in Section 11.

The truck would be capable of delivering 1,000 gallons (4,540ℓ) on each round (11 houses), if delivery were to be made once per week. One truck and one driver would be adequate, however, an additional truck should be purchased as a back-up vehicle in case of break-down. The tank should be removable by winch so that the truck could be used for other duties or if it need to be repaired. The garage should be heated to prevent freezing of the tank during winter and partitioned or entirely separated from the sewage collection truck bay. During the winter the tank could be placed on sleds and drawn by bombadier where roads were impassable by trucks. This would be a relevant approach to the more distant communities such as on the mainland.

8.6 Communal Bath-House/Laundry/Sauna

An interesting option for efficiently increasing water use for hygienic purposes is that of a communal combined bath-house/laundry/sauna facility. This is not a communal toilet facility. The emphasis is rather on increasing water use without pumping water into the houses. Saunas are indigenous to the Cree people as sweathouses. Such an installation exists in the Inuit village of Wainwright, Alaska. It is recommended that details regarding the design, operation, maintenance, current uses and costs of this facility be investigated.

SECTION 9: EXCRETA DISPOSAL SYSTEMS NOT RECOMMENDED FOR BIG TROUT LAKE

Introduction

A number of the waste disposal systems currently being used in Big Trout Lake are having deletrious environmental effects, and possibly negative health effects as well. Section 9 attempts to briefly review these systems, as well as others that are sometimes proposed for nothern settlements. Section 10 will concentrate on those systems that are felt to be appropriate to the climatic, environmental and economic conditions of Big Trout Lake.

9.1 Septic tanks

A septic tank consists of a watertight container, usually buried, which receives all the wastewater from the house. Through interior baffles, solids and liquids are separated, the wastewater is detained for a certain time, and clarified liquid is discharged into a buried tile field where it is infiltrated into the ground. It is now felt that very little, if any, biological treatment takes place in the tank and that the liquid leaving the tank is at least as contaminated as when it enters (C.M.H.C., 1977). Biological treatment takes place in the tile field and in the soil immediately surrounding the field area. Solids settle in the tank and must be periodically removed.

The key to successful septic tank operation is the suitability of the soil. Two conditions must be met: 1) Adequate percolation time, and 2) the maximum seasonal elevation of the groundwater table should be at least 4 ft. (1.2m) below the bottom of the tile field, and rock formation should be likewise at a depth greater than 4ft (1.2m) below the bottom of the tile field. "Unless these conditions can be satisfied the site is unsuitable for a conventional subsurface sewage disposal system" (Dept. H.E.W., 1969).

The subsurface conditions of Post Island make it extremely difficult, and probably impossible, to operate an environmentally sound septic tank. "Post Island appears to be made up predominantly of glacial soils controlled by a bedrock basement at generally shallow depths...the soils consist of predominantly a wet clayey silt till which is covered by a forest litter of 1-3 feet (0.3 - 0.9m) thickness (our emphasis)" (Gartner Lee Associates, 1973). The combination of a high water table during the spring (due to shallow bedrock and clayey soil) and the fact that tile fields in this climate must be buried below the frost line (6-8 feet) (1.8 - 2.4m) accounts for the failure of some of the existing septic tank systems at Big Trout Lake.

9.2 Septic toilets

Septic toilets are not being used in Big Trout Lake but have been installed in Western Canada. They are a Canadian version of the aqua-privy, and resemble the septic tank in some ways. The toilet is located directly above the tank and a 8-11 in. vertical drop (20-28cm) pipe extends into the vented tank. A bucket of water is added to the tank each day displacing the sewage downward and maintaining aerobic conditions in the drop pipe. The drop pipe extends below the liquid surface to prevent odours from entering the house. The overflow from the tank goes to a leaching pit.

Though water consumption is less than with a septic tank (2 gallons vs. 60 gallons (9 vs. 2.70 ℓ) for a four person household per day) the problem of soil suitability for infiltration remains. At the same time serious problems are reported with odours, and an Environment Canada report on toilets for northern communities states that: "...this type of unit is definitely not recommended" (Grainge and Slupsky, 1973).

9.3 Chemical toilets

Chemical toilets are essentially buckets to which are added chemicals (e.g. lye) which inhibit decomposition and reduce odours. The initial low cost of this system makes it widespread in the Canadian north. When used in settlements there can be environmental problems resulting from the disposal of the chemically treated wastes, as is in fact the case in one area of Big Trout Lake (see Section 2).

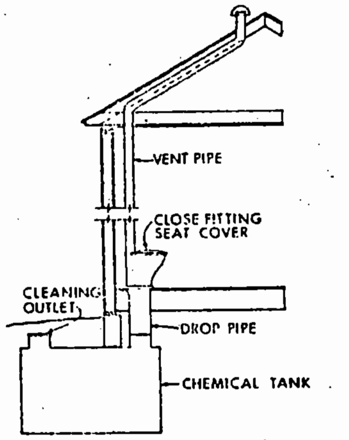


FIGURE 7

SEPTIC TOILET

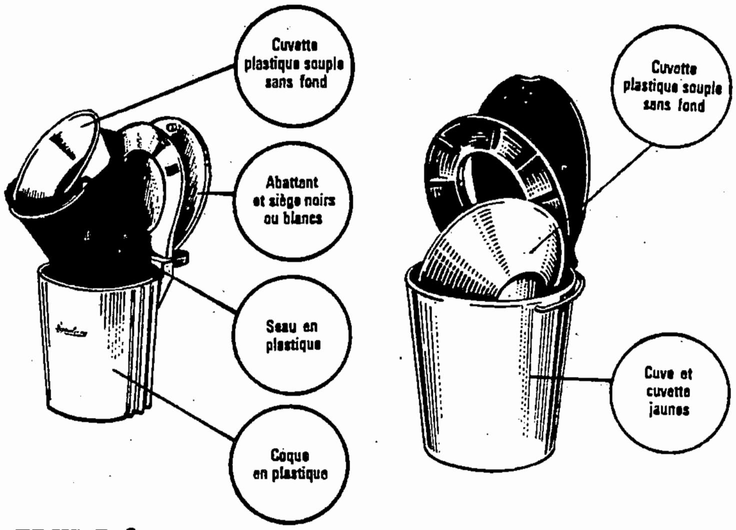


FIGURE 8

BUCKET TOILETS

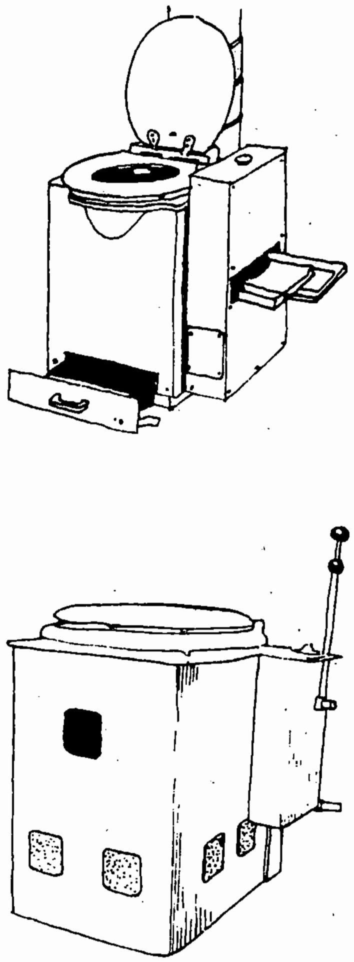


FIGURE 10

INCINERATING TOILETS

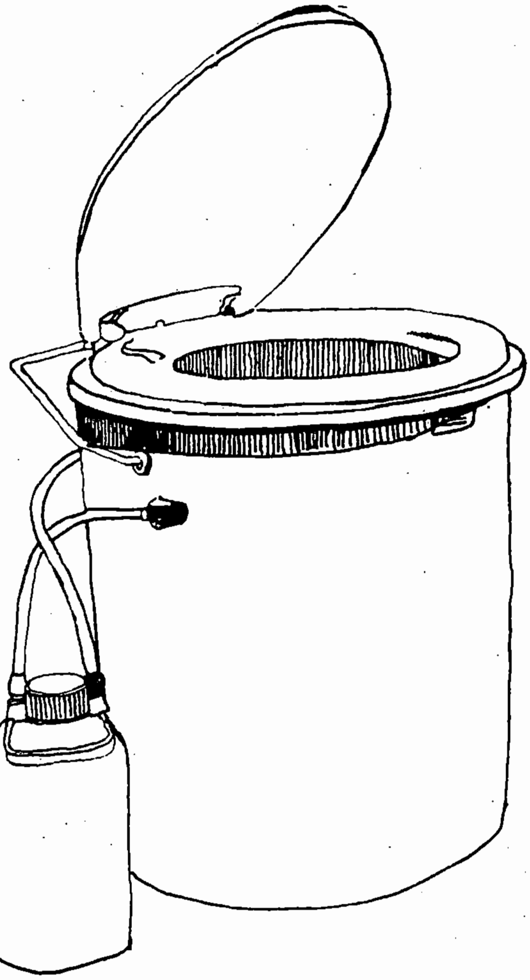


FIGURE 9

CHEMICAL TOILET

9.4 Bucket toilets

Bucket toilets (also called "honey buckets") are in use in some of the native houses at Trout Lake, especially during the winter. The buckets can be used with a plastic liner, which makes removal more hygienic. The contents of the bucket must of course be disposed of somehow, usually in a pit latrine, and hence it represents, like the chemical toilet, only a partial solution.

9.5 Incinerating toilets

The incinerating toilet consists of a bowl with a combustion chamber below. Most models utilize a liner that absorbs the urine and is also incinerated. The source of heat may be electrical, propane or oil. Ashes must be periodically removed. The initial cost is high ($400-$600) and operating cost is about $0.05-0.10 per use.

There are problems encountered with combustion odours and excessive maintenance, and a U.S. Navy test of a number of incinerating toilets for polar camp use found none of the models to be suitable (Nehlsen, 1961).

9.6 Biological toilets

A U.S. company has developed a toilet which is based on biological decomposition; body wastes and toilet tissue are liquified and purified by the continuous action of enzymes and bacteria. The effluent is said to be odourless and containing no pathogenic bacteria. It is disposed of in a dry-well. Once a week a package of enzymes is added to the toilet. Every two years the charcoal filters must be replaced. The unit does not require electricity and costs $400-$500 (Bio-Flo, Biocycle).

Recent test installations in rural houses in Maryland and Virginia have reported problems with odours and clogging (Washington Post, 1975). No installations in northern communities are reported.

9.7 Small composting toilets

A composting toilet is a device wherein the decomposition of faecal wastes occurs through the action of various micro-organisms. Urine is evaporated through a vent pipe, with the aid of an electric fan. Decomposition is encouraged by an electric heater within the unit that maintains an optimal temperature of 90^{o} - 100^{o}F (32 - 38^{o}C). These units were originally developed in Scandinavia and are now available in Canada (Humus, Bioloo, Bio-Systems, Tropic).

Experiences with small composting toilets in the north have been consistently negative, and indeed in Big Trout Lake itself a number of units were installed in non-native homes and in the Nursing Station. All of these units were removed due to failure. Similar experiences have been reported in northern Manitoba, where nine units were tested and the conclusion was that "they had little practical value for use in northern Manitoba" (McKernan and Morgan, 1976). The main problem is that these units are designed for weekend vacation home use and simply cannot handle regular, and especially

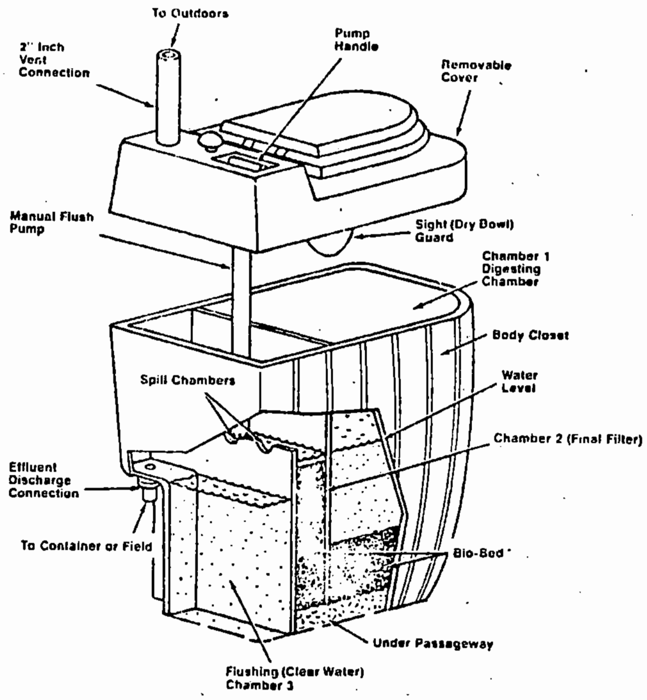


FIGURE 11

BIOLOGICAL TOILET

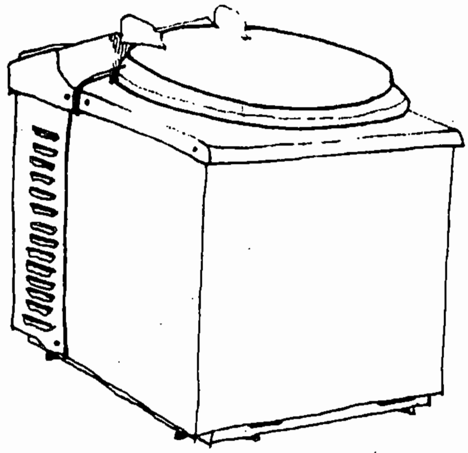


FIGURE 12

FREEZE TOILET

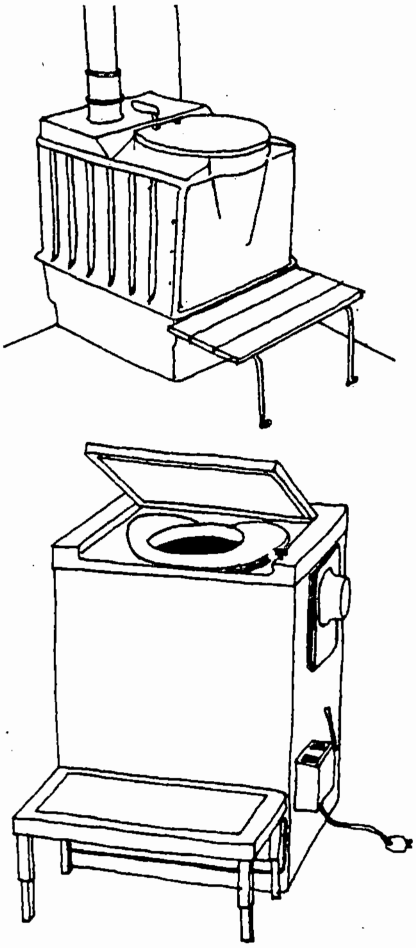


FIGURE 13

SMALL COMPOSTING TOILETS

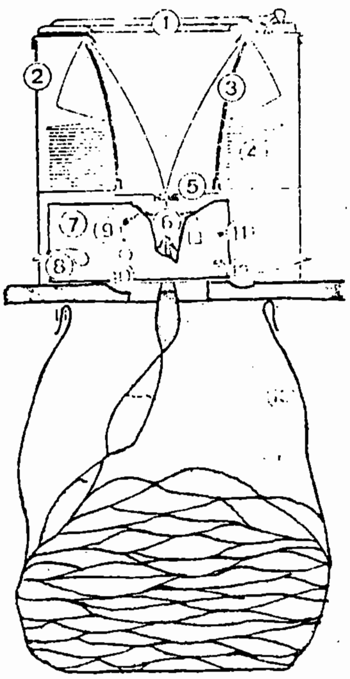


FIGURE 14

PACKING TOILET

peak, loads. The units cost from $500 to $800.

9.8 Packing Toilets

The packing toilet (made in Sweden by Pacto; not distributed in Canada) is essentially a sophisticated honey bucket. The main refinement is that the plastic liner is a continuous tube that is sealed with every use, and collected in a plastic bag below the unit. Although the initial cost is relatively high (about $800) the operating cost is said to be low.

The packing toilet has been proposed for northern Manitoba, in conjunction with a collection system and a composting plant (Nimpuno, 1976). Though attractive in many ways, the serious drawback of this system is that special machinery would be required to separate the wastes from the plastic bags. No such machinery exists at present, and its adaptability to northern conditions is unknown.

9.9 Freeze toilets

Another variation of the honey bucket, the freeze toilet is essentially a small freezer (a number of manufacturers exist in Scandinavia: Markt, Elstar, Minihjartat, Te-Be though none are marketed in Canada). The waste falls into disposable paper bags which sit in a container whose temperature is maintainted at 5^{o}F. The full bag is removed and can be composted. Unlike the packing toilets there is no plastic material. Prices are $400 - $500, but operating cost is said to be low (about 5 cents per day).

This system is attractive when coupled with a well organized collection system. It would have limited application in Big Trout Lake since few of the native houses have electricity.

9.10 Conclusions

Traditional southern systems such as the septic tank are inapplicable to both native and non-native housing in Big Trout Lake due to the unsuitability of the soil.

Chemical and bucket systems are inexpensive and widely used in the north but do not solve the problem of waste treatment. Disposal of chemically treated wastes creates additional environmental problems.

Incinerating toilets, biological toilets, small composting toilets, packing toilets and freeze toilets share a number of similar drawbacks. High initial cost, in some cases on-going operating costs, in others energy requirements. Some of these systems are unproven, even in the south, others have proved to be failures when tried in the stringent conditions of the north. Many have originally been designed for vacation-home use and would not be able to stand up to the rigours of daily, intensive use in northern houses. Overly complicated systems, with the problems of maintenance and spare parts, have no place in the north, whether in native or non-native housing.

Waste disposal systems for non-native housing must deal with grey-water as well as human wastes; many of the above systems are "dry" and leave the problem of grey-water unresolved.

Waste disposal systems for native housing should be low in cost (to install and operate and maintain), and should not require water or power, as neither are necessarily available.

SECTION 10: UPGRADING EXCRETA DISPOSAL IN BIG TROUT LAKE: RECOMMENDED SYSTEMS

It would be a mistake to imagine that there is a single waste disposal solution for the variety of conditions found in Big Trout Lake. An examination of the variables indicates that a combination of solutions is more likely to have success, always recognizing that environmental improvement to the lake requires upgrading of waste disposal for the large majority of the population of Big Trout Lake.

Successful upgrading must deal with the following variables.

10.1 Economic

The ability to pay for waste disposal varies between the native and non-native population, and also varies among the native population.

10.2 Water

The non-native houses have a large grey-water problem that must be dealt with, as well as waste disposal. The native houses, for the moment, have only a waste disposal problem.

10.3 Subsoil

There is significant variation in subsoil conditions between Post Island and the mainland communities. Subsurface waste disposal (e.g. outhouses) are a more sound solution in the latter locations. Certain locations have bedrock only a few feet below the surface and any infiltration solution, even an outhouse, is environmentally unsound.

10.4 Proximity to Lake

Native and non-native housing which is located close to the lake, especially over shallow bedrock or in low-lying areas, requires to be considered as a "zero-discharge" case.

10.5 Dispersed housing

Some of the housing, especially native, is dispersed and will require an autonomous waste disposal system, even if a common system is established in other parts of the community. At the moment only Causeway is linked to Post Island by road, and Mainland, Duncan and Nanakeesic should be considered "dispersed".

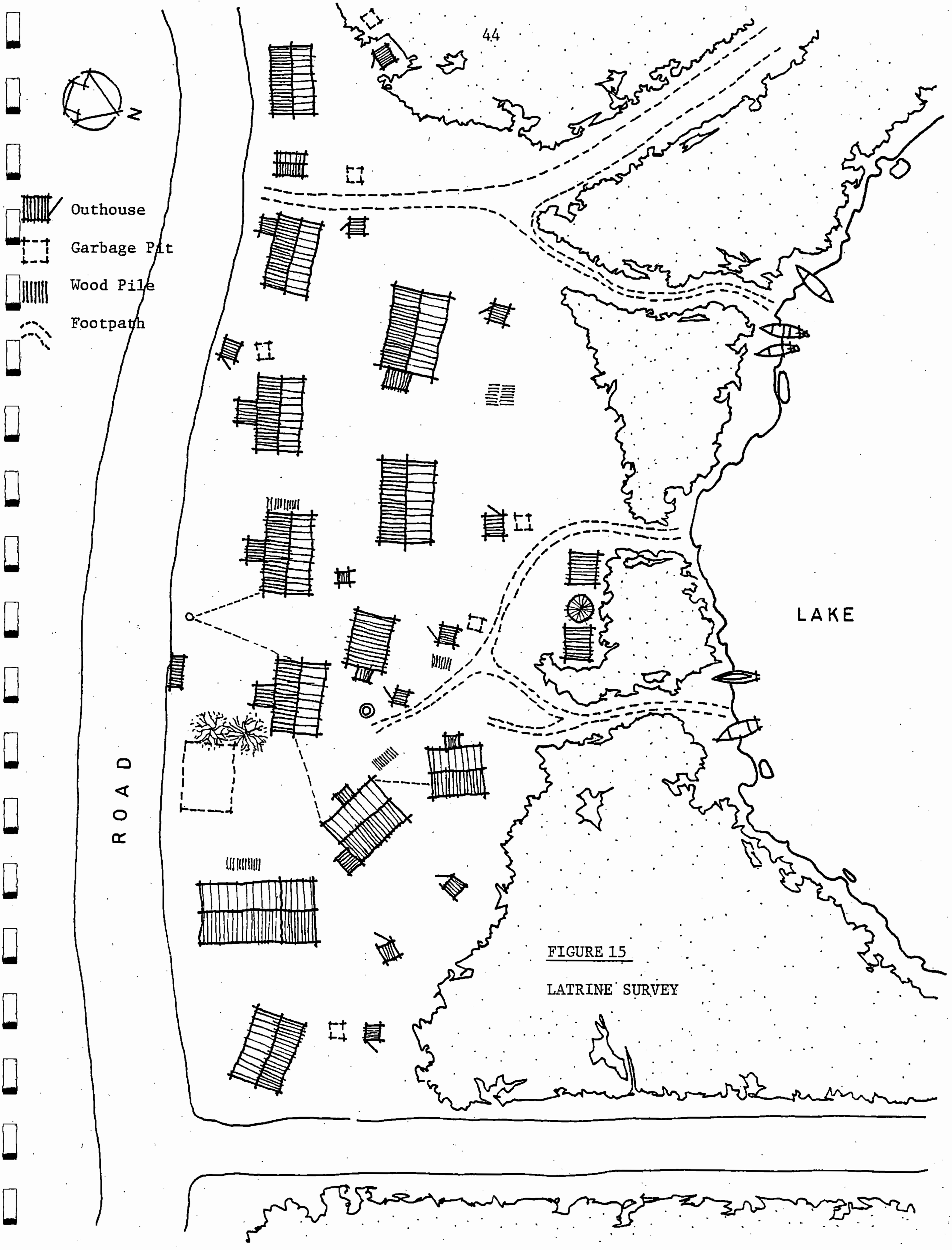


FIGURE 15

LATRINE SURVEY

10.6 New housing

Certain waste disposal systems imply changes to the design of the house. Although unsuitable for retro-fitting these should be considered for new housing. This is a significant consideration given the short life expectancy of the existing native houses.

10.7 Outhouses

Almost 90% of the housing in Big Trout Lake is served by outhouses (also referred to as pit latrines, privies, outdoor toilets and popularly known as shithouses). The environmental soundness of this solution depends mainly on subsurface conditions, though less so than the septic tank since smaller quantities of water are involved. However, where bedrock is shallow, in low lying, swampy areas, and when located in close proximity to the lake (or to wells) they can pose an environmental hazard, and will contribute to the pollution of the Lake.

Nevertheless, outhouses do remain a viable solution for some locations, and when managed well are environmentally sound (Wagner and Lanoix, 1958).

10.8 Outhouse survey

A detailed outhouse survey was performed over a selected area (see Figure 15). Nine of the ten outhouses were in use. Eight of the latrines were built on cribs according to recommended practice, and this significantly reduced settlement as evidenced by the fact that the two uncribbed outhouses were both settling badly while only one of the cribbed structures was tilting. Nevertheless seven of the latrines were badly eroded around their base allowing water to enter the pit during rain.

The superstructure of the outhouses was generally in good condition. New pits are dug every 1-2 years and the outhouse moved (one was on permanent skids). As the pits are supposedly dug to a depth of 5ft. or 6ft. (1.5-1.8m) their short life is probably due to the slow rate of decomposition in the cold climate. It should be stressed that by and large the outhouses are well maintained and their environmental failure is due mainly to topographic factors.

The majority of outhouses surveyed had either poor, or no, methods of securing the door and hence half of the doors were wide open when the survey was made. As none of the privies had lids, flies were observed in and around the pit. The level of the excreta in the pit varies from 2 ft. to 3 ft. (0.6m-0.9m) below the seat.

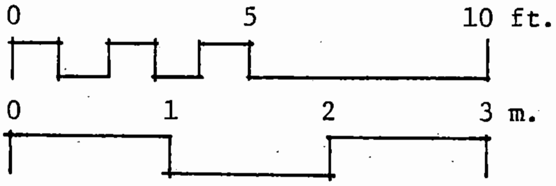
The majority of the outhouses had a garbage pit located nearby, consequently extraneous materials were not generally present in the outhouse pit.

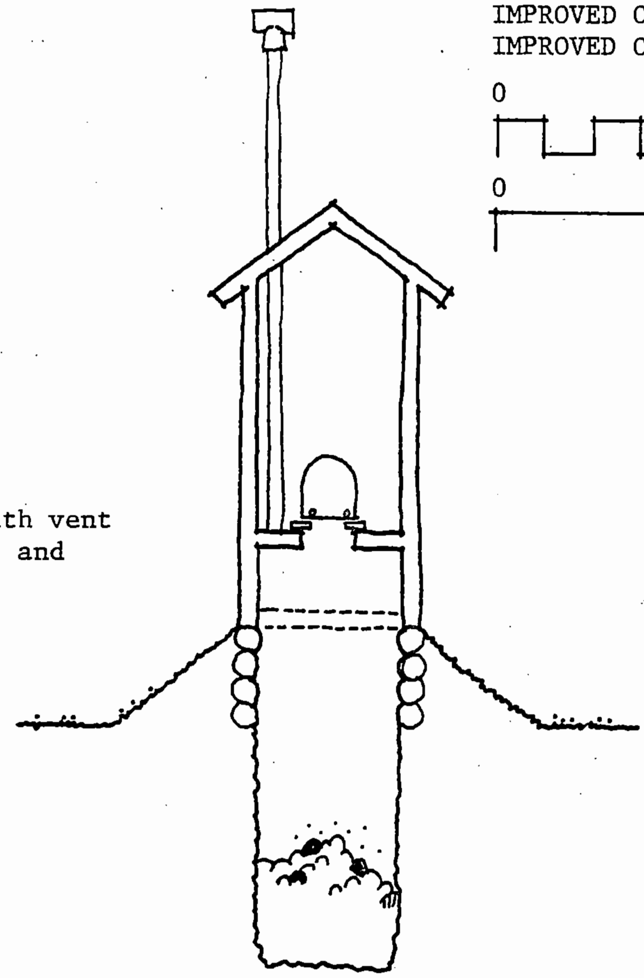
10.9 Improved outhouse

For most of the native people the outhouse remains the only viable economic waste disposal system. It could be improved in three areas which would affect the environment, hygiene and comfort. If the crib were built above, instead of inside the pit and earth were banked around the crib

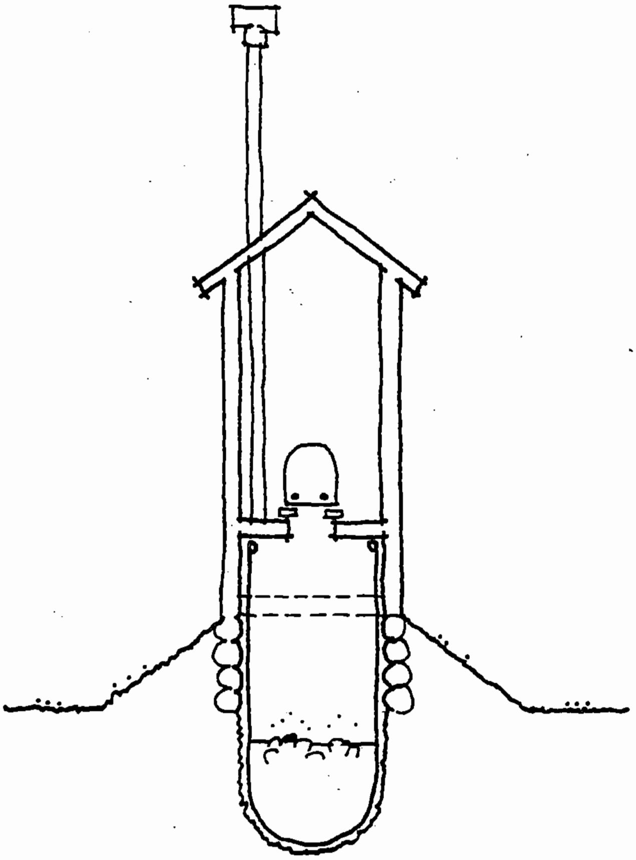
FIGURE 16

IMPROVED OUTHOUSE &
IMPROVED OUTHOUSE PLUS LINER

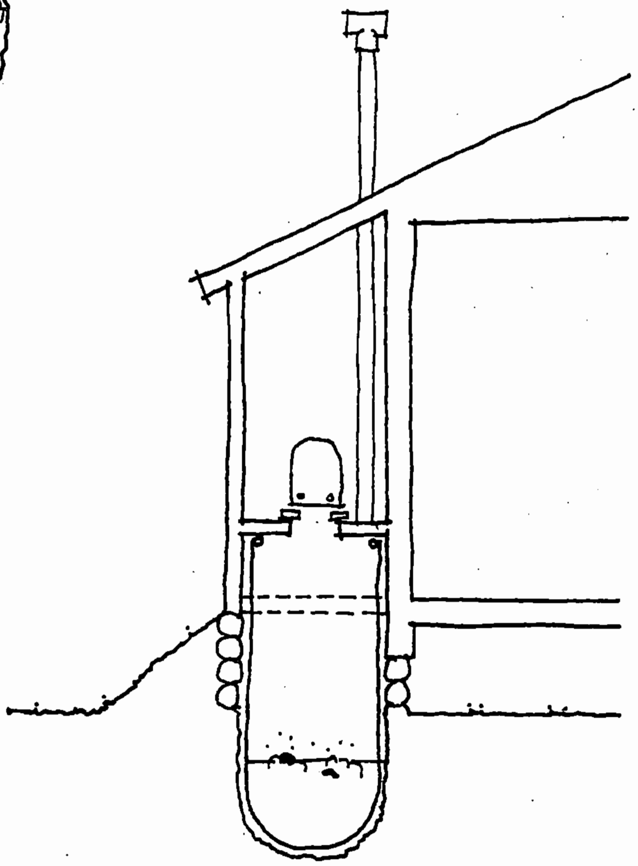




Improved outhouse with vent pipe, seat with lid, and bermed crib.



Improved outhouse plus rubber liner to contain wastes.



Improved outhouse plus rubber liner shown attached to house.

rainwater would be excluded from the pit. The latrine would then be largely dry rather than largely wet as in the case now, thus significantly reducing the amount of flies. This would have the effect of reducing the distance that coliform organisms could travel from the pit. The second improvement is a toilet seat with lid. Present outhouses have only a rough-cut hole in plywood, difficult to keep clean. A lid would reduce access of flies to the pit. Finally, installing a vent to the pit will decrease odours which presently make the toilets unpleasant to use. At the same time users should be encouraged to add wood ash from their stoves regularly to the pit, to promote anaerobic decomposition and reduce smell (and acidity).

The improvements (seat and vent) could be carried out by a Band organization and should cost $40-$50 per outhouse (including labour). Raising the outhouse and berming the crib would be carried out by the owner, supported by a health education program.

10.10 Improved outhouse plus liner

There are areas of the Big Trout Lake community where outhouses are an environmental hazard. This is especially true in Post Island East, where proximity to the lakeshore is coupled with shallow bedrock. In such cases, and only when truck access is possible, the outhouse could be turned into a holding tank (also called a conservancy vault) through the provision of a rubber liner (i.e. bag). The solid and liquid waste would be thus contained and removed twice a year, once in the spring, and once in the fall before freeze-up. This procedure has previously been used with the Nursing Station (when its septic field failed) and equipment is available at Big Trout Lake for sewage removal.

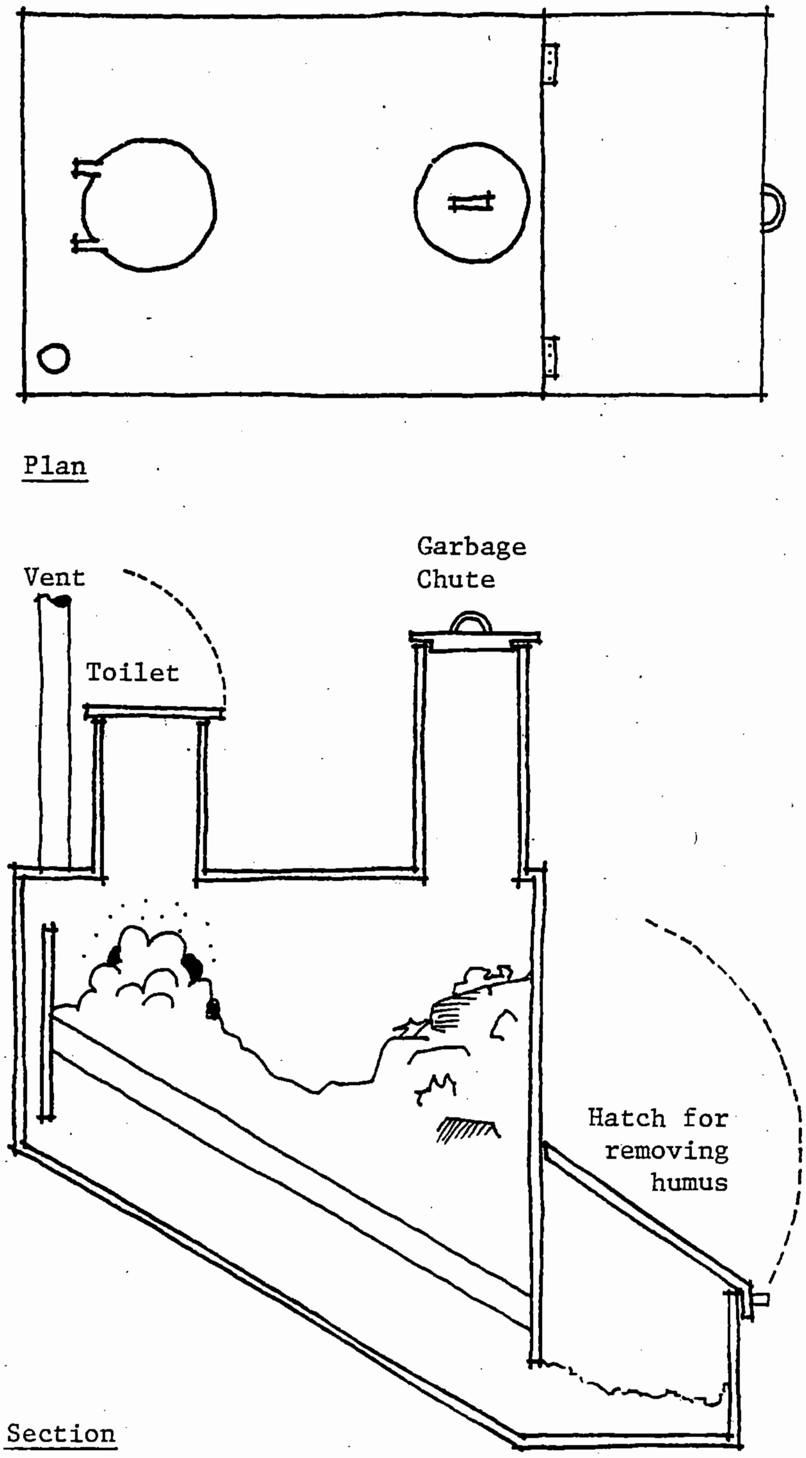
It is estimated that a family of six will produce about 80 cubic feet (2.2 m^3) of waste (urine plus faeces) per year. With twice yearly removal a liner of 50 (1.4 m^3) cubic feet capacity will be required.

An improved outhouse plus liner is a fixed installation and permits the outhouse to be located adjoining the house if desired, with its entrance off the vestibule. This will significantly improve convenience during the winter and will encourage hand-washing after defaecation, as the toilet will now be closer to the water-bucket in the kitchen.

A flexible liner rather than a tank has been chosen to reduce transportation costs. It is estimated that a neoprene liner would cost about $250-$300 installed. To this should be added the cost of improving the outhouse, about $40-$50. The cost of truck removal of the waste twice a year will vary depending on the number of houses that adopt this system, but is expected to be in the vicinity of $50 per house per year.

10.11 Mouldering toilets

There will be houses which because of location will not be able to use either an improved outhouse, nor an outhouse plus liner. In these cases it will be necessary to consider an on-site treatment of wastes which is self-contained. One of the few such systems that can function without external power is the mouldering toilet.



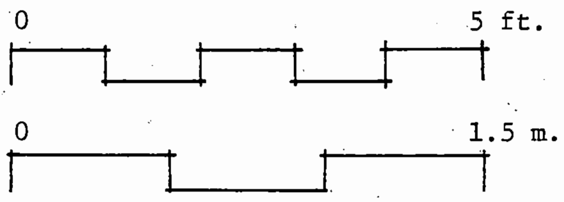


FIGURE 17

MOULDERING TOILET DESIGN

The mouldering toilet consists of a large container within which human wastes together with organic kitchen wastes are stored for long periods of time, up to two or three years. Urine is evaporated and vented through a stack. During the holding period the material undergoes organic decomposition and is turned into humus. Unlike the small composting toilets, mouldering toilets can accept regular intensive use and peak loads. A number of mouldering toilets (Clivus-Multrums) have been tested in northern Manitoba with some positive results (McKernan and Morgan, 1976).

Experience has shown that there are severe difficulties with installing mouldering toilets in northern Canada. These can be resolved only if the unit is inside the house. Obviously this has important implications for house design and hence mouldering toilets are only recommended in the case of new houses.

There have been experiences in a number of countries with a mouldering toilet constructed on-site (Rybczynski and Ortega, 1978). It is proposed to adapt this design, the Minimus, to fabrication from fibreglass-sheathed plywood. It is estimated that the cost, including labour, will be \$500 - \$600. There are no operating costs.

The mouldering toilet is a novel system that demands changes in user habits and which has not been widely used in the north. It is recommended that a small number of units be installed so that social and biological performance can be assessed.

10.12 House Design

The utilization of mouldering toilets requires modifications to the house design. In southern locations such toilets are generally located in a basement, or even outside. Experiences in Manitoba (McKernan and Morgan, 1976) with insulated and heated units located outside in the crawl-space below the house have met with difficulties. If mouldering toilets are to be used in the north they must be located within the house shell, which implies a two-storey or split-level arrangement.

Figure 18 shows how a mouldering toilet as well as a water storage system could be incorporated in a two floor house. Water supply is on the second level. It is provided by a truck system (see chapter on Water Supply). Gravity feed is to a single faucet located in the vestibule. Grey water is disposed of in a soakage pit outside. Other variations of this design could include rainwater collection and/or an interior faucet with sink. The gross area of the house is 640 ft^2 (58 m^2).

The two-floor house has certain advantages with respect to efficient heat distribution from a point heat source (i.e. wood stove) and hot air tends to be trapped in the upper (sleeping) floor at night.

SECTION 11: TRUCKED EXCRETA DISPOSAL

11.1 Capacity and Costs

The improvements that have been mentioned thus far are concerned with the waste disposal problem of houses without running-water, that is,

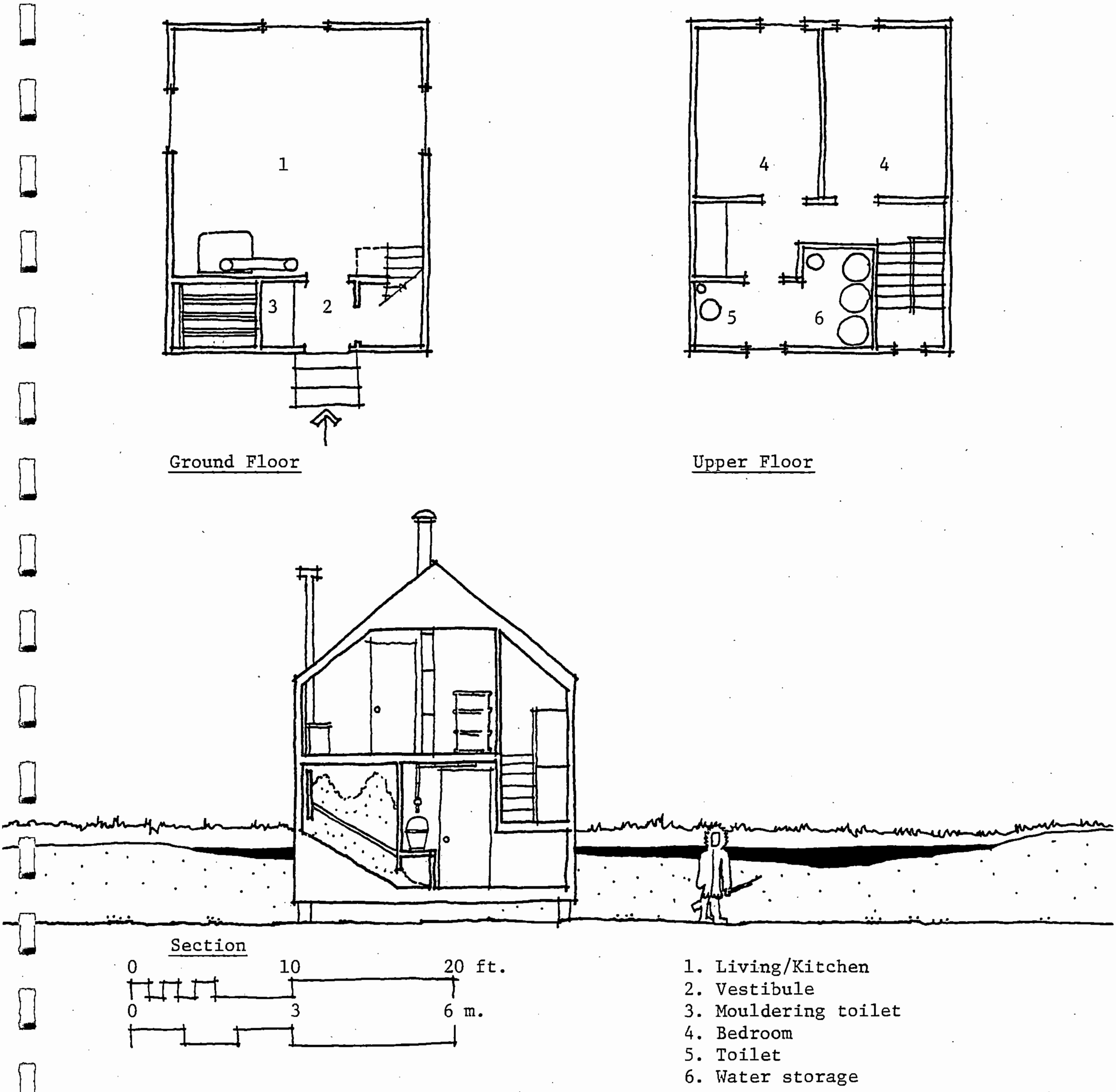


FIGURE 18

HOUSE DESIGN INCORPORATING MOULDERING TOILET & WATER STORAGE predominantly native houses. However, as water consumption increases, and especially for houses which have running-water already, it is necessary to deal with relatively larger quantities of sewage, and to transport this sewage away from the house to a treatment facility. A traditional system that, for good reasons, is being revived in the north is the truck system.

Truck systems incorporate vehicles with insulated tanks (about 1000 gallons, 4500 ℓ) that supply potable water and haul away the liquid wastes for disposal. Although such systems usually function for water supply and waste removal, this section will deal only with the latter.

Truck systems are widely used in villages and towns in the Northwest Territories, and successful operation is reported in quite large communities such as Frobisher Bay (Heinke and Deans, 1973). Perhaps a more pertinent example is the Alaskan Inuit village of Wainwright which, with 375 persons, is not dissimilar to Big Trout Lake. A truck system was established in 1974 and is reported to be working well (Reid, 1977).

At Big Trout Lake a truck system using two Bombardier Husky Carriers, tracked vehicles, would permit access to all areas on Post Island as well as the Causeway area in all weather. Two persons would be employed to operate the system and the total annual cost (including amortization of vehicles and garage) would be about $60,000 - $70,000 per year. The initial cost for the two vehicles (700 gal. , 3178ℓ capacity each) and garage would be about $100,000. The cost of installing a toilet and sewage holding tank (250 gal. , 1135 ℓ.) would be $400 - $500.

A detailed engineering study would have to be made in order to establish exact operating costs. The above estimates are based on reported costs of similar systems in other northern communities (Heinke and Deans, 1973; Reid, 1977).

The advantage of a truck system in Big Trout Lake is that it could be installed on a step-by-step basis, and, unlike a sewerage system, it could be expanded to serve a large part of the community. The first houses to be served would be those already having running water, irrespective of location. As additional houses increased water consumption (see Section 8), they could be progressively linked to the system.

11.2 Truck System Sewage Treatment Plant

Conceptually, the recommended treatment system would consist of four ponds (see Figure 21). The first two would operate in parallel as primary ponds giving treatment by settling the solids to the bottom and anaerobic digestion. These primary ponds would remain anaerobic throughout. Two would be constructed so that one could be operated while the other bypassed, if necessary. The should be designed on the basis of 9 lb. BOD/1000 ft.^{3} (4 kg BOD/28.3 m^3) and 10-day retention -- whichever provides the larger volume. They should have a depth of some 15 to 25 feet (5 to 8 m) depending on sub-soil conditions. They would accumulate sludge at about 13 cu. ft. (.3 m^3) per day for the 1000 design population.

The two secondary ponds should be operated in series, their design loading should be 20 lb. BOD/acre-day (22.5 kg. BOD/hectare-day). In all, four acres (1.6 ha.) of pond site should be adequate for the treatment system.

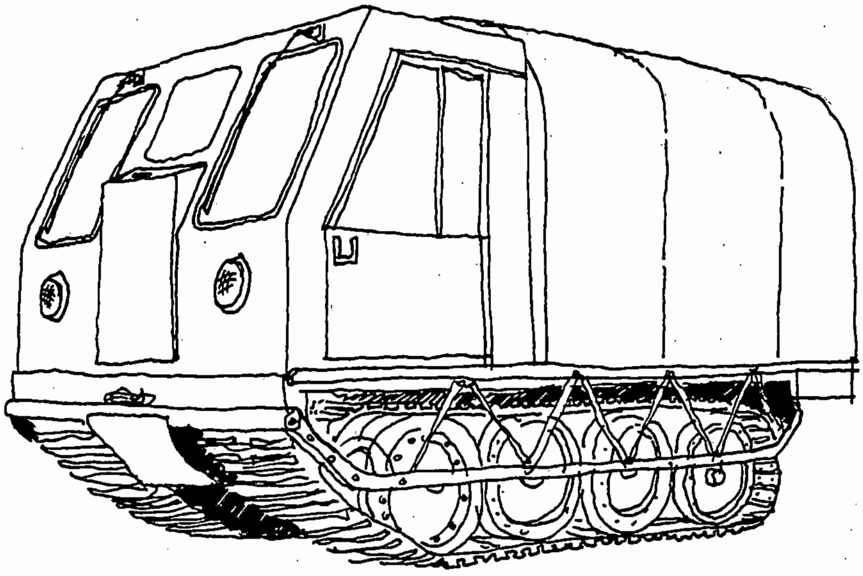


FIGURE 19

VEHICLE FOR DISTRIBUTION OF POTABLE WATER & COLLECTION OF WASTES

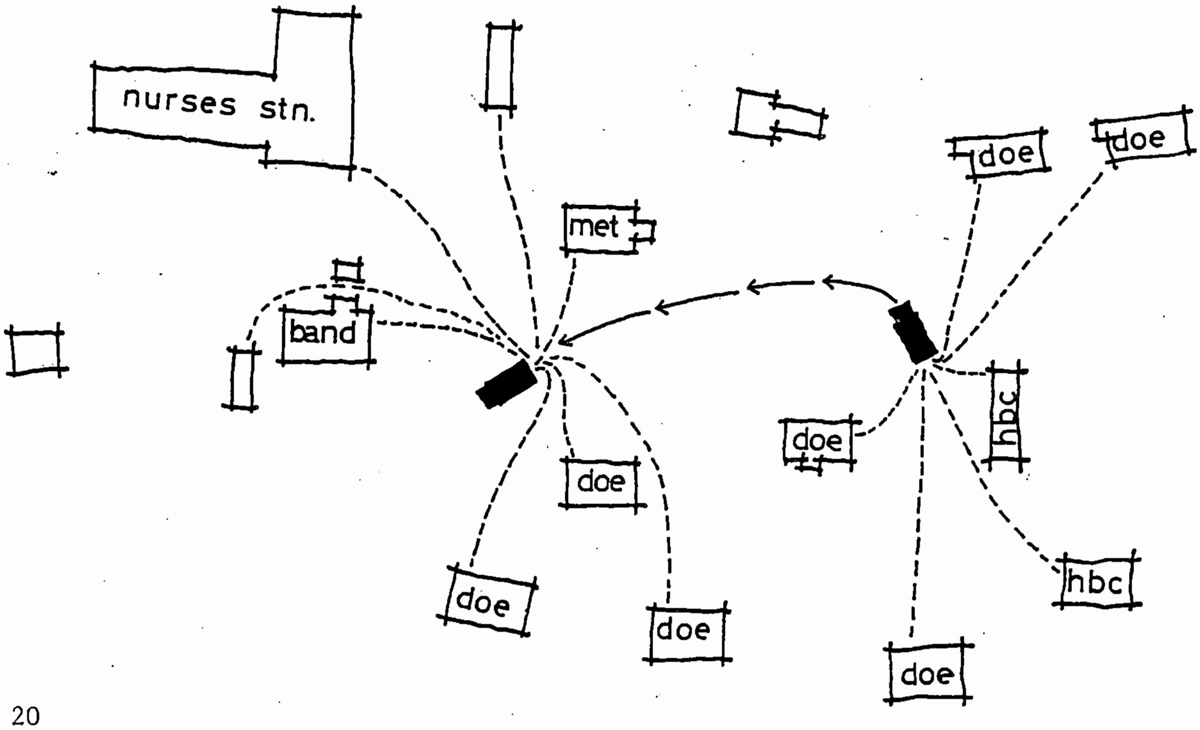


FIGURE 20

PLAN OF D.O.E. AREA INDICATING VEHICLE COLLECTION AND DISTRIBUTION POINTS (150 FEET RADIUS) (46m RADIUS)

The four acres of pond site should be located a minimum of one mile (1.6 km) from the community.

Little data exists in the literature on the efficiency of oxidation ponds operating in northern climates. The suggested design does not discharge during the winter but acts as a holding basin for a whole year's wastes. The collected excreta receives extensive treatment during the summer, after ice break-up. One can thus refer to the literature based on temperate zone oxidation pond experience.

Coliform bacterial are common to the intestinal tract of man and are used as an indicator organism to quantify the degree of pollution or contamination in an attempt to assess possible levels of disease-causing organisms (pathogens). Noramlly, one can assume an oxidation pond, when properly designed and operated, to remove 99% of total coliform (Gloyna, 1971).

The mechanism is one of competition for nutrients with other bacteria as well as settling out the bacteria in aggregates or flocs. It is therefore logical that ponds should be designed and operated in series - especially in this case where they would receive concentrated trucked excreta. Some work has been conducted on Salmonella typhi, the causative bacteria of typhoid, which is closely related to the bacterium causing Salmonellosis - of bacilliary dysentery - which persists within the Indian community. Salmonella typhi has been found to die off rapidly in ponds with low loading (50 lb. BOD/acre-day or 56.25 kg/ha-day) but remain viable for up to eleven days at 4000 lb/acre-day or 4,500 kg/ha-day (McGarry and Bonthillier, 1966).

It is known that some enteric viruses survive conventional sewage treatment processes such as extended aeration, oxidation pond treatment and chlorination. This data however is not well quantified. Retaining the waste for extended periods of time in a series operated pond system would afford reasonable protection against discharge of viral agents into the environment. In this case, the wastes would be held up to eleven months.

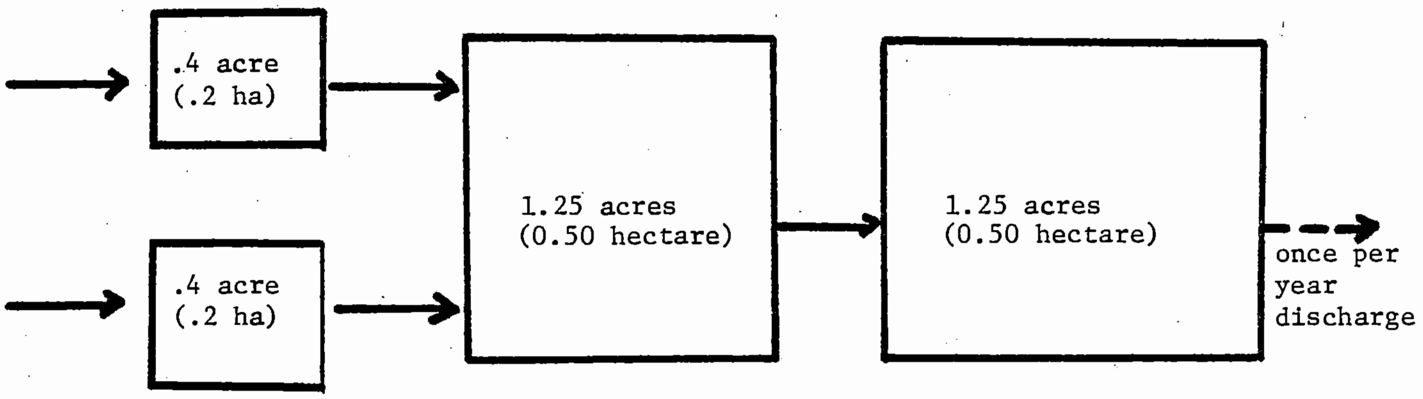
Oxidation pond systems are well known for their efficacy of reducing worm (helminthic) parasites which normally enter the treatment process as eggs or cysts. Although larvae of hookworm, shistosomes, whipworm and cysts of Giardia were isolated from raw sewage no trace of them was observed in the effluent of ponds in one study (Gloyna, 1971). Again design and operation of the pond to maximize reduction of such parasites depends on designing the ponds to operate in series and using long retention periods.

During the summer months prior to discharge of the ponds in the fall, it is expected that BOD reduction would be at least 70% (McGarry and Bonthillier, 1966) in either of the two final ponds and 40% minimum in the primary pond. Thus an overall reduction of 95% is to be expected between the wastes entry and discharge points. Using the oxidation ponds as holding ponds in this fashion would allow a check to be made of the water quality prior to discharge. It is envisaged that the final pond could be checked for quality and emptied during mid-summer and again towards winter.

Location with respect to discharge is also important. Care should be taken to discharge into surface water having adequate dilution or self-purification capacity.

FIGURE 21

FOUR POND
TRUCKED TREATMENT SYSTEM



Further research to determine precise sizes and loading rates of the ponds in light of local temperatures and rates of water use needs to be undertaken in detail. In addition, consideration should be given to constructing covered, underground ponds to allow anerobic digestion to proceed through the winter, eliminating the possibility of surface runoff during break-up.

SECTION 12: THE WASTE DISPOSAL/WATER SUPPLY MATRIX

It is the recommendation of this study that Water Supply and Waste Disposal be considered jointly, and that a step-by-step upgrading of present practices is a more appropriate solution than a once-and-for-all "solution". Particularly when that "solution" is applied, and applicable, to only a small fraction of the population.

An upgrading program will have to take into account a number of variables: domestic water consumption, proximity to the lake, house location, subsoil conditions and ability-to-pay. This implies that for different households, and at different times in the upgrading process, different combinations of Water Supply/Waste Disposal technologies will be adopted.

The Matrix (Figure 22) shows these possible combinations and their costs, both initial and operating.

SECTION 13: COMMUNITY EDUCATION AND COMMUNITY RESEARCH

13.1 The Development Context

Big Trout Lake is perhaps one of the most dynamic native communities north of 50 in Ontario. A multitude of recent economic development projects are ongoing or in preparation (see for example, Sainnawap and Hyder, 1977). Studies are currently being carried out to assess the critical questions of energy needs and production and of transportation. Future land use is a central development problem, attracting increasingly detailed attention in light of intensified pressure on local natural resources from southern interests. Within this context, the goals of self-determination, education of the young people, the Band Council has been working steadily towards the goals of self-determination and local government. Within this context, utilizing the traditional knowledge of the Elders and the southern education of the young people, the Band Council has been working steadily towards the goals of self-determination and local government.

13.2 Need for Community Education

The need for community education to be integrated into the development process is well-recognized. The term community education may refer to an informal group discussion in someone's kitchen; a talk by an outside specialist followed by critical questions from community residents; the design of posters, pamphlets and radio programs on a particular development problem or individual learning through reading reports, talking to Elders and other means. Three of the most important outcomes of community education are: 1) increased involvement of residents in solving development problems; 2) better informed, better evaluated and therefore more effective development solutions and 3) continuous replenishment of local leadership capability. All of these outcomes are extremely important to the particular development problem under study here -- sewage disposal and water supply.

BUCKET FROM LAKE, SCHOOL & DOE. $0 ($0)	$0 ($0)	$40-$50 ($0)	$300-$350 ($50)	$500-$600 ($0)	
RAINWATER $150-200 ($0)	$150-$200 ($0)	$190-$250 ($0)	$450-$550 ($50)	$650-$800 ($0)	
$80-$100 ($15) HAND-PUMP[1]	$80-$100 ($15)	$120-$150 ($15)	$380-$450 ($65)	$580-$700 ($15)	
$2000-$2200 ($25) STREET-TAP[2]	$2000-$2200 ($25)	$2040-$2250 ($25)	$2300-$2550 ($75)	$2500-$2800 ($25)	
TRUCK SYSTEM[3]					$1800-$2000 ($500)
	OUTHOUSE $0 ($0)	IMPROVED OUTHOUSE $40-50 ($0)	IMPROVED OUTHOUSE PLUS LINER $300-350($50)	MOULDERING TOILET $500-600($0)	TRUCK SYSTEM[4]

FIGURE 22

THE WASTE DISPOSAL/WATER SUPPLY MATRIX

Capital cost per household , estimated operating cost per household per year is indicated in brackets.

1 Based on repairs to eight existing handpumps.
2 Based on system serving 85 houses on Post Island.
3 Based on system serving 100 houses on Post Island & Causeway.
4 Based on system serving 100 houses on Post Island & Causeway.

Past experience with community education in Big Trout Lake is rich. The radio station, a vehicle for community education, has an excellent reputation for facilitating programs on issues of importance to the Indian people. Anyone who has something to say can go into the station and say it. Anyone who has a radio can listen. Since programs are broadcast in Cree, the radio is almost exclusively a native medium.

Another community education experience is that initiated by the Community Health Workers, Moses Mosquito and John Childs over the past few years. As noted previously, their programs have enjoyed good success as indicated by the high degree of awareness of health issues on the part of Big Trout Lake residents. Most of their educational work is carried on in the public meetings, in the schools and on an individual basis in people's homes.

A final example of community education in Big Trout Lake is the case of the Alcoholism Program. Many signs, with slogans and warnings, and sometimes drawings, are placed in stores and other public buildings both on the inside and outside. There is group support (at AA meetings) and counselling services are available. Alcoholism counsellors talk to children in the school and screen public films. It seems there is strong support for this program from local churches. There was strong agreement from Big Trout Lake residents that a successful community education program is characterized by a good working relationship between the program initiators and the Band Council.

13.3 Sewage Disposal and Water Supply: A New Focus for Community Education

Clearly, previous sections of this report indicate that there is much information of a technical nature which must be translated, then transmitted to, and discussed by, the broad population of the Big Trout Lake Band. The choosing of the technologies for improving excreta disposal and for improving water supply must be a participatory one if the implementation of these solutions is to succeed. People must be thoroughly informed and have enough time to evaluate all of their options. Therefore, it is recommended that as the Big Trout Lake Sewage System Assessment proceeds, that the Band Council initiate a detailed program of community education. This community education program would include focussing on the key issues contained in this report. The production of pamphlets, fact sheets, posters, audiotapes, and other educational materials; the organizing of public discussions, lectures, study tours and radio programs - all around the problems of sewage disposal and water supply.

13.4 The Community Research Function

A structure should be set up whereby the Band can direct and carry out any research into local sewage and water supply questions. The building, operation of test projects; more specialized water quality analysis; investigations of recommended systems such as the trucked sewage treatment system; all should be organized and undertaken by Band members representative of the wide range of interests of Big Trout Lake. The intention here is, in addition to achieving the most appropriate solutions, to develop local research capabilities and local maintenance and operation skills in the systems involved. In a systematic way, this research group could monitor water quality and give regular progress reports on pilot waste and water systems as well.

This local research body might also search out and evaluate funding schemes offered by various government departments. This group as well could be responsible for selection of outside specialists for particular research efforts.

13.5 A Possible Structure for Implementation

The Band Council is the primary decision-making body in Big Trout Lake. The rapid development of the community is making serious demands on the time and energy of the Council. It is recommended that, for the combined, urgent problem of sewage and water, a new committee would be struck by the Band Council to implement the recommendations of this report. The composition of this committee would reflect key interests of the native community affected by sewage and water problems.

Appendix D describes the Wastes and Water Monitoring Committee. Its proposed membership is based on the premise that expanded participation in education and research decision-making will strengthen the development process in Big Trout Lake and augment the ongoing efforts of the Band Council.

SECTION 14: USERS MAKING CHOICES

There is much to consider, regardless of the methods used to implement the recommendations of this report. Future development of the community must be taken into account. For example, the planned residential areas across the creek on Post Island and on the mainland require that the community plan street patterns in detail, set policies regarding house design, the size of lots, location of latrines, and standards for wells. The core commercial area, with the coming of a motel and other facilities will require increased access to water. Solid waste disposal will need to be expanded and an appropriate system implemented.

It is difficult enough to solve the existing sewage and water problems of Big Trout Lake. However, it is the contention of the consulting team that the Big Trout Lake Sewage System Environmental Assessment provides an excellent opportunity for the community to integrate its water and sewage service planning with its overall future land use planning.

How the choices are made by the people of Big Trout Lake is as important in the long term as what choices are made. Involvement of the broadest population of the Band in the next phases of the Sewage System Environmental Assessment is fundamental to the ultimate success of improved and new technologies.

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APPENDIX A

TERMS OF REFERENCE

ENVIRONMENTAL ASSESSMENT

BIG TROUT LAKE SEWAGE SYSTEM

BACKGROUND

In the summer of 1975 the Department of Indian Affairs and Northern Development (DIAND), Indian Affairs Branch, Sioux Lookout District began construction on a central sewage collection and treatment system on the Big Trout Lake Indian Reserve. This system was designed to service government, church and Hudson's Bay buildings only: no Indian dwellings were included.

After protests by the new Chief and Council elected in the fall of 1975 on behalf of the community members, work was stopped on the system. The council laid down a number of conditions for its consent to continuation of the project. Among these was that an environmental assessment be carried out by an independent, experienced consultant. This condition was accepted by DIAND, Sioux Lookout District who agreed to fund the study.

TERMS OF REFERENCE

The consultant carrying out this environmental assessment should address himself to the following topics:

1. Assessment of DIAND Design

1.1 Water Quality and Eco-System of Big Trout Lake

1.1.1 Present

1.1.2 Expected results of installation of DIAND sewage system
a) Locally, near effluent discharge
b) Generally in the lake
c) Effect of adding full community sewage service to existing design.

1.2 Other Environmental Effects

1.2.1 During and as a result of construction

1.2.2 As a result of system failure or malfunction

1.2.3 During normal operation

1.3 Reliability and Maintenance Expectations

1.4 Socio Economic Impact on the Community

1.5 Overall Assessment

1.5.1 Cost-effectiveness of system

1.5.2 Explicit listing of advantages and disadvantages of the system to the community

1.5.3 General assessment of suitability of system as designed in light of community size, location, climate, social structure, available technology and other appropriate factors.

2. Modifications to IDAND System

2.1 Modification to avoid discharge of effluent directly into Big Trout Lake

2.2. Other appropriate modifications to improve suitability of system relative to any of the factors listed in 1.5

2.3 Capacity of system to accept future expansion to include Indian homes and motel, school addition, store, coffee shop, DIAND cabin presently under construction, and future day care center and band administration building.

2.4 Suitability of system after modification as in 1.5

3. Alternative Water Supply and Sewage Treatment Systems

3.1 Brief information on several alternative systems, either centralized or individual which appear to be practical alternatives to the proposed system

3.2 Recommendations on which system or systems appear(s) most promising in the light of all the above listed factors and any others which the band or the consultant feels are appropriate to this study.

4. Other Information Which the Consultant Feels is Relevant

CONSULTATION: It is extremely important that consultation take place regularly at all stages of the study between the consultant and the Big Trout Lake Band. Band members must be kept informed on basic questions as the study progresses in order to be able to adequately interpret the report.

The consultant will also find it necessary and desirable to liaise with DIAND, Sioux Lookout District and Region Engineering for similar reasons.

Administration:

DIAND will make drawings and any other necessary information regarding their proposed system available to the band and consultant on request and will fund the study.

The consultant's proposal quotation and final report is to be submitted simultaneously to the Big Trout Lake Band Council and DIAND, Sioux Lookout District. His report should follow, as closely as practical, the format laid out above.

The consultant's contacts will be as follows:

Big Trout Lake Band, BIG TROUT LAKE, Ontario POV 1GO.

Department of Indian Affairs and Northern Development, Box 369, SIOUX LOOKOUT, Ontario

Department of Indian Affairs and Northern Development, 55 St. Clair Avenue East, Toronto, Ontario

Grand Council Treat #9, 22 South Cumberland Street, THUNDER BAY, Ontario P7B 2T2.

COMMENTS

1. Require more than brief information on alternatives to the Department of Indian Affairs and Northern Development design to facilitate a more complete comparison.

2. Environmental input of construction may vary depending on time of year.

3. Provisions for sludge disposal and mithane production should be examined.

4. Details of over flow facilities in the event of a power failure and other problems should be examined.

5. It would be useful to indicate to prospective consultants, what data is available, particularly with the respect to lake water facility.

6. Requests recommended:

   - best sewage treatment systems

   - timing and methods of construction

   - compensation from DIAND for any administration to issue the Band Council on conditions one might meet.

7. State the data by which proposals may be submitted and indicate the approximate size of the budget.

Minutes

General Meeting of Big Trout Lake Band at the Old School House on Post Island, June 15, 1978, 6:30 p.m.

The meeting opened with a Cree prayer.
About 30 residents attended the meeting. Most people spoke in Cree and any English was immediately translated. Chief Stanley Sainnawap and Head Councillor Jerry McKay introduced Ted Jackson who in turn introduced each member of the Sewage System Assessment team. Some background on the development of the project and general principles of operation were outlined. It was stressed that the team was hired by the Band not the government, and that they were here to listen to what the people had to say about the water and sewage. This would guide the team in its study during the next week.

The first person to speak was Danny Cutfeet who said that when the team completes its study, it should give the people options to make a choice on what kind of sewage installation is best.

Levi McKay, who has worked at the Weather Station for ten years, asked where the raw sewage from septic tanks goes. He hoped the team would answer this near the end of the week and would be able to tell the people about other points on the lake.

Danny Cutfeet remarked that when other studies were done on the lake in past, the people were not consulted.

Joe Morris, Chairman of the District Education Committee, said that springtime is when there is the most pollution. He noted that presently the water source is the school and that in the winter people go to the middle of the lake. "The garbage is spread out too much," he said, "not enough of it is burned properly." He said his biggest concern was for the mainland where most of the water was polluted. "Nobody likes to see the lake contaminated," he said.

Former Councillor Jonas Damion who lives on the mainland said many people take their water from one spot on the lake and that local community health representatives can tell the quality of water at that spot. The assessment study must be completed, he stated, and he would be happy to find a solution to the water and sewage problems.

The next speaker urged that the team go with a person from the community to take water samples. This person, perhaps a housekeeper, can take the team to the farther-out places. This person could also learn how to test the water. This would increase the support for the team, he said.

When asked by Engineer Mike McGarry what water source is best for the people, Danny Cutfeet replied: "I prefer the middle of the lake. I don't mix my drinks."

Another speaker noted that planes landing on the lake were causing fish pollution.

Bill Morris, who urged others to give the study as much support as possible, asked this question: "How much sewage is taken away by the current?" When he worked for DPW and asked them if the water was safe to drink, they said yes because the water was carried by the current.

A visitor from Sachigo stated that the pollution in Big Trout Lake was from a mixture of fuel, oil and sewage. The cause of this is white people, he said. "God created the earth and heavens. He gave us fish to eat and water to drink. We are at a point now where hardly an Indian can drink his own water which was God-given."

Jemima Morris, former Councillor from the northern mainland, said she gets her drinking water once a day. Wells were once installed but became damaged, she said. She wondered about the possibility of fixing up the wells. In discussion with Mike McGarry, she pointed out that the wells broke down when the handle on the pump froze and broke off. Early in the use of the pumps, she also noted, the people were told that the deposits floating around in the well water would clear up. The wells broke before they tested this advice.

Mike McGarry said he would go to each well to find out why they broke and how they worked but needed a translator. Jemima Morris said that getting a translator was "more than possible."

Mike McGarry was told that the school's water supply was good all year round.

Former Councillor Mary Anne Anderson who lives at the north end of the island said she has resided here for a long time and is getting old. However, she said, "I am certain that the water is polluted and I also realize where pollution is coming from. It started ever since outsiders moved into Big Trout Lake. I've seen this everywhere I've travelled. Other factors which contribute are skidoos in the winter and outboard motors in the summer, and the airlines in this area of the bay. Those of us who are getting old can't get our water from the lake. Even though there is a river flowing in the vicinity of my residence, there is still pollution. There are lakes but they are quite a distance to provide water."

Bill Morris added that as well as wells, local residents use snow and ice for drinking water.

When asked by Anne Whyte what is the particular problem with contaminated water, a speaker replied that it is not so much the taste as the future health of the children. It might worsen if nothing is done about it. Also, the fish and fowl are contaminated in the land that we use, said the speaker.

Levi McKay stated that when his family goes out in the bush, his children are healthier. But when they return to the settlement, they are often plagued with diahrrea.

Another speaker said that when he brought his kids into the community because they were sick, he was told that the cause of the illness was from contamination of the water.

Still another speaker mentioned that the people had been advised to boil their water before drinking. He asked how much purification is necessary. Mike McGarry responded that the water must be covered after boiling and if it is, can be drunk as purified water for a couple of days. He said that if you boil water you kill the living organisms which cause diahrrea. It is just as important, he continued, to wash hands before cooking and after going to the toilet.

Isiah McKay said the wells which are not operating should have been installed on higher ground, not lower. Shallow water is contaminated faster, he said, especially when it becomes warm. When the water is pure, pipes should be laid one mile away. The old wells could be reactivated or replaced. "We need four wells to service our cluster," he said. The water must be deep, about 1,000 feet, for cold water. "My own source is about one mile away."

Another speaker suggested that the wells should be dug deeper and also have some kind of a shelter on them to keep the pump handles from freezing.

Another speaker said he was happy to hear the chief on the radio talking about this problem. He said the community health representatives are doing a good job testing the water but the people have difficulty in following the instructions of local workers.

John Childs noted that around Bearskin Lake the water has a jelly-like substance.

A speaker who identified himself as a self-proclaimed environmentalist asked whether dumping wash water outside the door helped bugs to grow and cause disease. The health specialists on the team felt that although mosquitoes carry disease, they don't cause the disease and that this practice is not too dangerous. The speaker said that Moses Mosquito, a community health rep, had shown a movie that demonstrated if this practice is done repeatedly, people get very sick. Mike McGarry agreed that if the washwater contained organic material from kitchen wastes, then if the wastes concentrated in one place day after day, maggots would grow.

Another speaker asked if composting was good and Witold Rybczynski replied that it is good for gardens but people should be very careful with that process.

Ted Jackson thanked the people for coming out and giving their opinions and said that the team would be talking about their findings with people and over the radio, throughout the next five days. The meeting was adjourned at about 9:30.

Minutes

General meeting Saturday, 17 June, 6:30 p.m. at Old School House, Big Trout Lake, Ontario. Ten local people attended, including the former Chief and two elders. All English was translated to Cree. Gerry McKay, Head Councillor introduced Ted Jackson who outlined the work the southern team had done over the past 3 days and then introduced each specialist. Each southern team member then gave a summary of the most important issues they had found in their research to date. Bill Sainnawap agreed to take notes and report on the meeting tomorrow in Cree over the radio.

Ann Zimmerman, the biologist/chemical limnologist working on the team, explained that she had completed most of her tests and would have to take the samples back to Toronto within 48 hours for analysis. However, she said that she could say with certainty that the lake is polluted and that the pollution is coming from several different sources. Just how much--what percentage--from each source will be determined in Toronto. She stressed that both federal and provincial governemnts have laws defining environmental standards which must be followed and that all sources will have to clean up their operations in accordance with those laws.

Agliace Chapman, former Chief, said that he inspected the water on the mainland side of the community and when he went to the nurses, found evidence of people being affected by the quality of the water. "There are 30 houses across the lake and if they request help, they should get it," he said. "Two wells are not enough." He said the wells over there go down 127 feet but need a building around them to keep them from freezing in the winter. The water is worse in the springtime, he pointed out. Something needs to be done. He said that he'd been a fisherman for 30 years and that the quality of the water has deteriorated over this time. "Five years from now we won't be able to drink it," he concluded.

The next southern team speaker was Anne Whyte who outlined her survey of community water sources, how far people have to fetch water and how they use it. The major problem, she said, is that because they have to go so far to get water, people do not have enough water in the house to wash hands frequently after going to the toilet. In winter, the situation is better since people can choose the cleanest ice. Diarrhea is worse in the spring when it is most difficult to get water. The community has to consider how to get more water in the community to wash their hands more frequently.

Former Chief Chapman stated that he gets his water 2 miles out in the lake. "Our people are trained to keep their children and their clothes clean. Women do a lot of work because of the water they must carry," he continued. He noted that even when women are sick they must go far to get water. This study should come up with some answers about how we can be helped, he said. "And a separate system is needed for the mainland."

Mike McGarry, the southern team's engineer, reviewed the community's experience with pumps. In 1970 and 1973 pumps were installed for water supply, but they broke down, some within months. He drew a diagram of a pump and showed that the pump is constructed weakly at the top. "When the ice came, somewhere the pump froze, or children undid the bolt, and the rod used to pump the water fell down." He said that this problem can be fixed if a specialist comes. Also, the pumps could be insulated and a small house built around them to keep them from freezing. Thermal wire could also be used. Pumps are the least expensive way to get water closer to the house. But, he pointed out, the people must be careful about the method of insulation, the house around the pump, and the choice of pump. "We can only offer suggestions. It will be up to the Band to get it done," he concluded.

Agliace Chapman spoke again, stating that it was the repairman who caused the problem with the pumps by loosening the bolt. Mike McGarry noted that the entire 127 foot pipe must be taken out if the pumps are to be repaired, because the piston is attached to the downpipe. He said that one of the Band members should to to the pump manufacturer to get trained, since he would always be here to fix the pumps.

Mike McGarry then turned to the problem of sewerage, saying DIAND's proposed system is very expensive, and its treatment technique is very complex and expensive and would break down without constant, skilled attention. The benefits of this system to the Indian community, he said, is labour in the installation of the scheme. None of the Indian homes would be hooked up on the sewage scheme. The piping and plumbing is expensive and water is required to carry shit down the pipes. A whole new system for the Indian community is needed, he concluded.

A speaker asked if we had talked with Indian Affairs about the scheme. The team responded that it had and that the Band had turned over their whole file on the scheme to the southern team. Geerry McKay confirmed this.

Next, Witold Rybczynski, architect, drew a diagram of the local shithouse everyone uses in the Indian community, "to explain why we feel there is a need to make some changes." He noted that when all the material is gathered, then the hole is moved to a new place. But water can fill the hole when it rains, and the material will move away from the hole. "The same thing will happen when water rises from the bottom. It is important to keep water out of the hole." One way to do this is to make a hill and the house higher, he said, illustrating his point with a diagram. "Or you can put wood around the hole." He continued that the shithouse is the cheapest, best known system and should be used as much as possible, but that bad installations must be improved. These could be improved by 1) keeping the flies away; 2) moving them closer to the house (near the water supply).

He went on to say that the team will study other methods of excreta disposal, some more complicated, and explain the advantages and disadvantages of each in order that the Band can make a decision. One system is the composting system. He drew a picture of the 2 box kind, and noted that compost is dry, doesn't smell and can be used to fertilize gardens. "This system should mean a lot of changes for people here," he said. "It can be slowly applied and modified to suite conditions here." Improvements can be done in steps, slowly, trying a few different systems at a time, he stressed.

Mike McGarry then summarized another kind of system: the trucked system. A truck could deliver water to each house. Toilets would sit on top of another tank. Only a very small amount of water would be used for flushing. Then another truck would come along and collect the sewage. Other water could be used for washing. This system, which is used in the Northwest Territories, is more expensive than what is now used.

Demonstration projects are needed for these different systems. There would be ongoing costs for the trucked systems, noted McGarry.

Witold Rybczynski emphasized that the major problem with composting is that the system needs electricity to heat it. In the south these toilets are always in the basement, but here the climate is the problem, he said. When a speaker asked how long the composting process takes, Witold Rybczynski replied: one year, after which it can be used as fertilizer and could be sold down south.

Another speaker said that it would be good to "send some bullshit back" for a change.

The next speaker asked about chemical toilets.

Witold Rybczynski went quickly through the problems of chemical toilets. First, he noted that bucket toilets do not solve the problem of pollution of the lake. Second, he said that the process of burning excreta is smelly and very expensive, "and you'll know it's smelly if any of you have pissed in a fire." Third, experiences here in the nursing station and elsewhere in the north show that small electric composting toilets have performed badly.

"How big is a composting toilet?" asked a speaker. 8 ft.x4 ft. x4 ft. (8 ft. long) was the reply. Rybczynski added that they could be built out of fibreglass or concrete or cement, at different price ranges but all expensive.

"How is the compost waste moved?" asked another speaker. By shovel. The composted material is clean, has a sanitary texture, Rybcznynski replied.

Anne Whyte noted that diapers with plastic liners do not decompose in these toilets. Something else would have to be done with them.

Rybczynski again noted that people's homes here are not heated. There are too many questions about compost toilets which aren't answered. But variations to solve local problems are still possible. But as it stands, the system is not perfect by any means.

Another problem here with the shithouses, said Rybczynski, is that the pile of material keeps going higher until it comes out of the hole. It gets full in the summertime. People throw everything in, diapers, etc.

A speaker asked about solar toilets, and Rybczynski said he wasn't sure that technology was ready yet.

The major point, he thought, was to improve how people already operate their existing systems.

Councillor Cyrus McKay said he was thankful that the southern team has come. "We have the impression that the most blame should be put on the white people for pollution of the lake. Surely we must recognize the fact that the Indian people are a contributing factor to this pollution. For example, along the mainland a lot of wastes are polluting the area." He said he would be happy if the team could tell the people the sources of the pollution, and give some advice on the water quality.

Referring to the comments of reactivating the wells, "a lot of people," he said, "have approached me about this. But I leave for the hospital Monday and can't give much help."

Agliace Chapman stated that he recognized that this was a problem where some sources of assistance will come from the outside. This is why this was an important meeting for him to attend.

Ted Jackson then outlined the proposed next steps in the research process. The team would continue to provide short progress reports to the community. It will prepare a report for mid July and bring it to the people to discuss it with them.

Councillor Jim Morris suggested that the report be translated into Cree by using the telecopiers at Sioux Lookout.

It was confirmed that Bill Sainnawap would prepare a summary of this meeting and read it tomorrow prior to the radio "phone-in" show of the southern team.

The team's July report, Ted Jackson continued, would place a number of options before the Band for action. They would have to approach the various government levels for funds, etc.

Before the meeting closed, several other issues were raised. One was the dilemma between obtaining more water for health reasons versus the expense for sewage and increased wastewater disposal. It was noted that the trucked system is not as expensive, however, as sewerage.

The garbage dump was raised as an issue, and people noted that some local waste tanks were already being dumped up there onto the pile of garbage.

Other speakers raised the problem of septic tanks and Rybczynski said that the soil was not good enough and the tanks were too close to the shore for successful operation.

The meeting adjourned at about 9:00.

WASTES AND WATER MONITORING COMMITTEE

It is recommended that the Band establish a Wastes and Water Monitoring Committee in order to carry out the recommendations of this report. The Committee would coordinate the educational and research functions on sewage disposal and water supply issues.

Membership

We further recommend that the following be included in the membership of the Committee:

1)	Band Councillors	(2)
2)	Community Health Worker	(1)
3)	Women (young homemakers, Elders)	(3)
4)	Pump Technicians	(2)
5)	Lagoon Technician	(1)

6) Individuals interested in experimenting with modifications to their existing waste and water systems (e.g., improving their outhouse) or with new systems such as the water holding tank or the mouldering toilet. (3-4)

The Band Councillors of the Committee would be approved by the Band Council and one would serve as interim chairperson for the first four months. The Hospital would select the Community Health Worker or the existing two might decide to alternate attendance. Women could both volunteer and be asked to sit on the Committee. Pump technicians will have been chosen by the Band Council after an application procedure as referred to in Section 8.3. The school lagoon technician should sit on the Committee. Finally, local interested individuals would volunteer to sit on the Committee.

Tasks

This Committee of 10-15 people, then, would have the following tasks:

1) Monitoring of test systems, e.g., repaired wells, improved outhouses.

   a) by keeping records

   b) by evaluating according to technical, social and environmental criteria previously established by the Committee

   c) by directing the research efforts of outside consultants.

2) Testing, analyzing and reporting water quality changes in lake, lagoon and well water.

3) Organizing a series of study tours to other northern villages to learn about, for example, trucked water and waste systems (e.g., Alaska) or mouldering toilets (Manitoba). Such tours would provide as well a chance for Big Trout Lake people to show slides and talk with others about their own unique problem-solving experience on the wastes and water question.

4) Educating the community about sanitation and water, including health, biological, economic and social issues, using:

a) radio

b) general meetings

c) home visits

d) the school

e) the churches

f) posters

g) a short news bulletin of Committee work in progress

h) slides and drawings

5) Designing and evaluating future training programs for new sanitation and water supply technicians (e.g., truck operators).

6) Developing ideas for funding proposals in cooperation with the Band Council to take advantage of all federal and provincial programs related to sanitation and water.

In the long term, this Committee is seen as the nucleus of what will become the Big Trout Lake water and sanitation commission under local government. In this sense it is both a structure for action and a structure for training. Not only will the Committee expand participation, it will provide for local continuity over the years in the long process of solving sanitation water problems.

Operation

Using funds from the Big Trout Lake Sewage System Assessment to provide honoraria for voluntary Committee members, the Committee would begin as early as fall, 1978. From other funds, such as DIAND Housing,--the Committee acting as a research body--the Committee could aim for independent funding by early 1979. The Committee could meet every 2-3 weeks in the evening.

Being Indian is

1. to work
2. to eat moose meat
3. not to have running water
4. to like the bush
5. to be quiet
6. to be shy
7. to like a job
8. to make things
9. to fish
10. to hunt.

Old School
Big Trout Lake, Ontario
June, 1978