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U. S. ENVIRONMENTAL PROTECTION AGENCY
ARCTIC ENVIRONMENTAL RESEARCH LABORATORY
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ALASKA VILLAGE DEMONSTRATION PROJECTS: FIRST GENERATION OF INTEGRATED UTILITIES FOR REMOTE COMMUNITIES

by

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Abstract

The U.S. Congress authorized projects to demonstrate provision of sanitation utilities for remote villages using concepts not previously applied. Water supply, waste treatment and personal sanitation facilities were required. Costs of construction and operation were minimized in order to allow future ownership by low income communities. Water, wastewater and emissions are required to meet the State or Federal regulations and guidelines. Projects were placed at two locations and brief experience indicates such concepts are practical. The systems approach to village utilities appears to be worthy of further development.

Introduction

Alaska, as much of the far north, has been marked by boom and bust development (1). Overall, growth has been slow and progress in the sanitary engineering and public health fields has kept a similar pace. As the economics for boom were established, justification for application of traditional sanitary engineering techniques was found (2). This application invariably required the expense of vast amounts of energy (and dollars). As boom times passed the economic resources for supporting sanitary engineering public works disappeared and the works failed because the few remaining people could not afford the cost.

Public health has been dependent upon engineering for a considerable time to provide reliable water supplies, adequate waste treatment and disposal and reliable sources of dependable power. Until Engineering can provide these needs, Medicine is limited (3).

Conditions in rural Alaskan communities are as bad as any in the western hemisphere as related to the economic, public health and social problems dependent upon sanitary engineering utilities. Advancement beyond traditional subsistence living for residents of rural Alaska will be based on economics primarily, but solution of many public health and social problems depends upon utility services (4) appropriate for the economic, social and natural environment.

The Congress of the United States, in Section 20. Public Law 91-224, April 3, 1970 authorized the Alaska Village Demonstration Projects (AVDP). Stating in part, the projects ... "shall includeprovisions for community safe water supply systems, toilets, bathing and laundry facilities, sewage disposal facilities, and other similar facilities ..." Responsibility for the administration was assigned to the Secretary of the Interior who assigned the task to the Federal Water Quality Administration (FWQA), forerunner of the U. S. Environmental Protection Agency (EPA). Because of the developmental nature of the projects, they were assigned further to the Office of Research and Development and the Arctic Environmental Research Laboratory.

In 1972, Congress again authorized the Administrator of EPA to proceed with the Alaska Village Demonstration Projects under Section 113, Public Law 92-500. These laws are appended.

Project Concept

A review of earlier attempts to provide the required services by other agencies yielded two important conclusions: (1) conventional watering point and honey bucket projects have been unsuccessful because they fail to provide a real improvement, and (2) many projects have failed due to the absence of financial and conceptual endorsement by the population they are intended to serve. Restated this means that any successful project must be acceptable to its recipients and it must provide an actual improvement. Conventional approaches were clearly to be avoided if possible.

It is logical that poor people cannot support projects which are expensive to operate and maintain, thus a concept was developed which would minimize cost by maximizing overall system efficiency. At the outset it was recognized that some rather sophisticated equipment would be used and that operators would have to be prepared for the eventual responsibility.

Village councils were consulted in selection of some of the specific components of the projects and in the selection of individuals to begin training as operators. Design criteria were developed after surveying requirements of the residents. In evaluating suggestions and comments by village residents, intent was weighed more heavily than literal words. For example, when someone said, "I want a water system just like they have in Anchorage", we interpreted that to mean the individual wants an adequate supply of water in his home.

Study has shown that water consumption can be significantly reduced through the use of available conventional plumbing fixtures (5). Incorporation of these and other readily available devices of non-conventional nature resulted in a decision to further reduce per capita quantities of potable water.

The result of the background work was the formulation of a number of "ground rules" and a few specific numbers upon which to begin design. Ground rules established are:

1. Use adequate water but waste none. (No conventional toilets).
2. Water for consumption must meet quality requirements of Federal and State drinking water standards.
3. Treat all wastes. Water pollution, air pollution and solid waste disposal regulations and guidelines are to be acheived.
4. Consider water recycle for non-potable uses.
5. Minimize costs. Essentially this means, use as little energy as possible.
6. Water must be distributed to the homes to assure its purity. Since direct connections are prohibited, vehicular distribution will be used.
7. Facilities must be relocatable.

The specific numbers used were:

1. Water supply
   a. Home use - 3gpcd
   b. Laundry - 2 loads/family/week
   c. Showers - 2 showers/person/week
   d. School - 250 gallons/teacher/day

2. Wastewater - treatment capacity equal to water supply capacity.
3. Air pollution - emissions to be within future state requirements for CO, SO_x, NO_x and particulates.
4. Solid wastes to be disposed of by best practical method.

These few ground rules and numbers allowed us to contract for construction of two projects within our allotted budget. The projects are somewhat unconventional by design and we feel that so far they are performing up to our expectations with the operators chosen by the villages and trained by EPA for the job.

Project Design

In order to avoid possible confusion this part of the discussion will be limited to the project at Wainwright. Both projects are quite similar and description of either is adequate to convey our message.

The contractor was issued a statement of the scope of work and not a rigid set of specifications. Phase I of the contract provided for production of a design which was implemented in Phase II. Close communication was maintained between the contractor and AVDP staff in order to assure correct interpretation of guidelines and intent.

Cost reduction or minimization was of particular concern because of the possible future village ownership of the facilities. Initial cost had to be limited to the funds available, while operation and maintenance costs were minimized so as to impose the least burden on village economy. The nature of the R&D contract and the haste to complete it within the allotted time impared the demonstration of lowest possible costs.

Modularization of the structure was considered as a significant means of reducing cost and increasing reliability. Construction in the bush is both expensive and subject to the hazards of northern climate. Furthermore, compromise of design features is occasionally necessitated in order to complete the job at all. These factors strengthen the argument in favor of pre-building component modules of the facility, pre-installing equipment, pre-assembly of the complete units and testing prior to shipment to the ultimate project location. It was recognized also that modules which could be fairly easily transported may be useful in another location if the initial village outgrew the capacity of the system. Further attractive features are the potential of incremental modular addition to increase system capacity and possible mass production of identical units for many locations. In this way the village or agency might purchase a water treatment module, a waste treatment module and two laundromat modules to satisfy immediate needs much as the drilling and construction camps are designed.

Figure 1 is a schematic presentation of the facility at Wainwright. Dashed lines on the plan indicate the dimension of the modules (12 in all) which are approximately 9'0" H x 9'6" W x 18'0" L. These units were built at Lacey, Washington, where equipment was installed and pre-tested as much as time would allow. They were then uncoupled and prepared for shipment to Wainwright. Sea transportation proved more economical in this case but the modules were of a size and weight to permit shipment by truck or C-130 (Hercules) aircraft. All materials used in shipment such as plywood covers for openings, lifting cages and skids were later used in final assembly of the structure.

Timing did not permit complete testing of the AVDP units but it is felt that the principle has been adequately justified. Subsystems which were tested were simple to restart and have operated reliably. Conversely, the subsystems which were not tested prior to shipment exhibited numerous minor flaws which caused problems of grave proportion when they were discovered in Wainwright. Problems were not due to unique equipment because

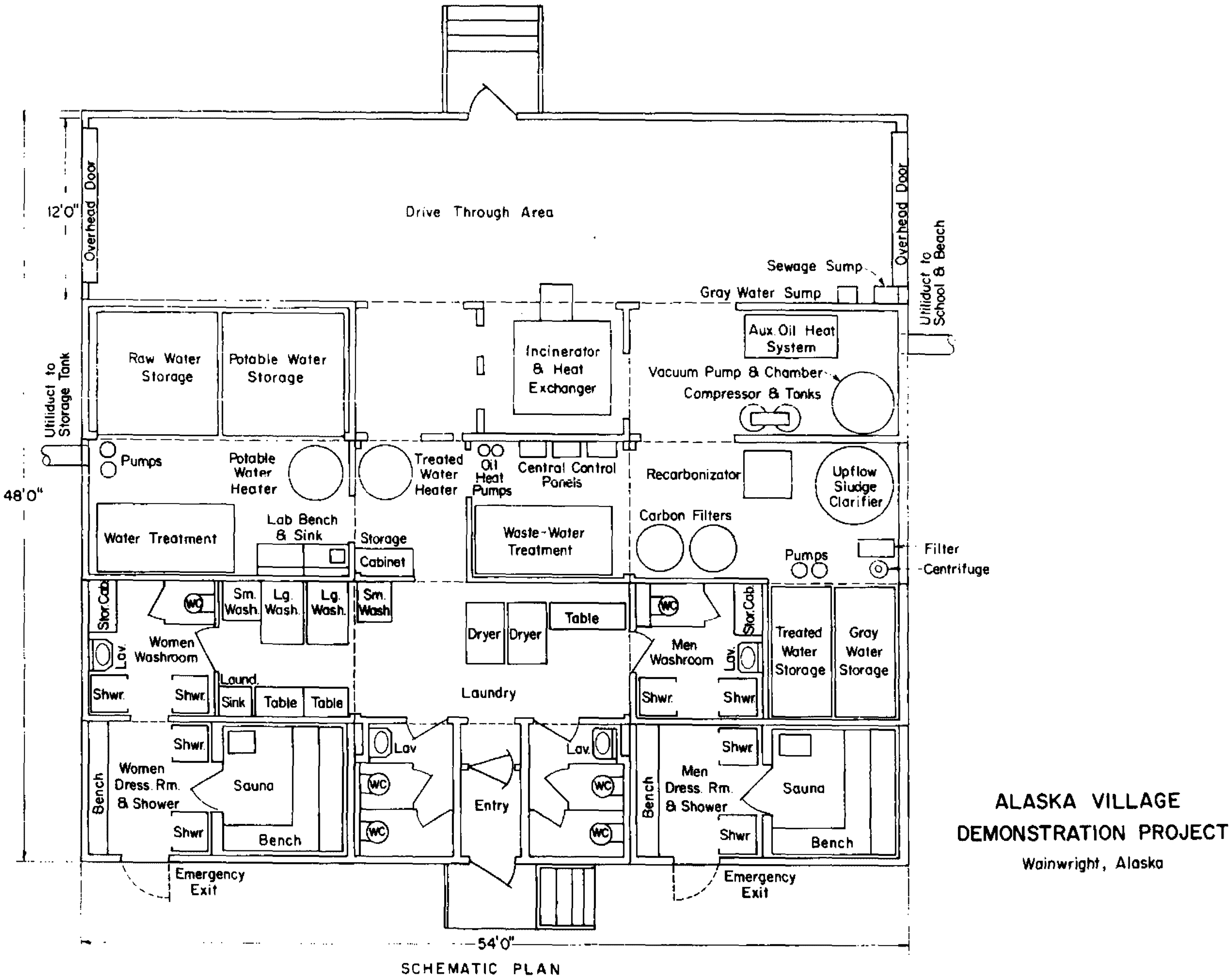


Figure 1. Schematic Plan of AVDP - Wainwright, Alaska. Dashed lines indicate individual modules.

all subsystems were bought as ready-to-install packages. Rather, the difficulties were manifest in the form of faulty air regulators, defective electrical relays and other such minor flaws which escaped factory inspection. Diagnosis of problems and acquisition and replacement of defective subsystem parts in the bush cost at least twice as much as it would have in the city and worse, it cost precious time.

If any single factor were to be singled out as the most important design consideration it would be the economics of operation and maintenance (1). Virtually all utility services are cost dependent, that is you get what you pay for -- quality wise. AVDP attempts to show that high quality central utilities can be provided at lower cost. However, recognizing that utility services will not be inexpensive.

The schematic diagram of Figure 2 is presented to show the interfaces between the various processes and the general flow pattern. Essential processes are water supply, water treatment, laundry, showers, wastewater treatment, human waste collection, human waste disposal and heating. It will be noted that the incinerator and heat exchanger are linked to virtually every process which requires heat energy. This in effect permits the use of a process which is usually called extravagant by reclaiming the usable by-product.

It cannot yet be stated from our experience that incineration is an economical means of disposing of human wastes. AVDP includes incineration because it was apparently the best of the available alternatives. Unless more than one building requiring heat is part of the system, there should

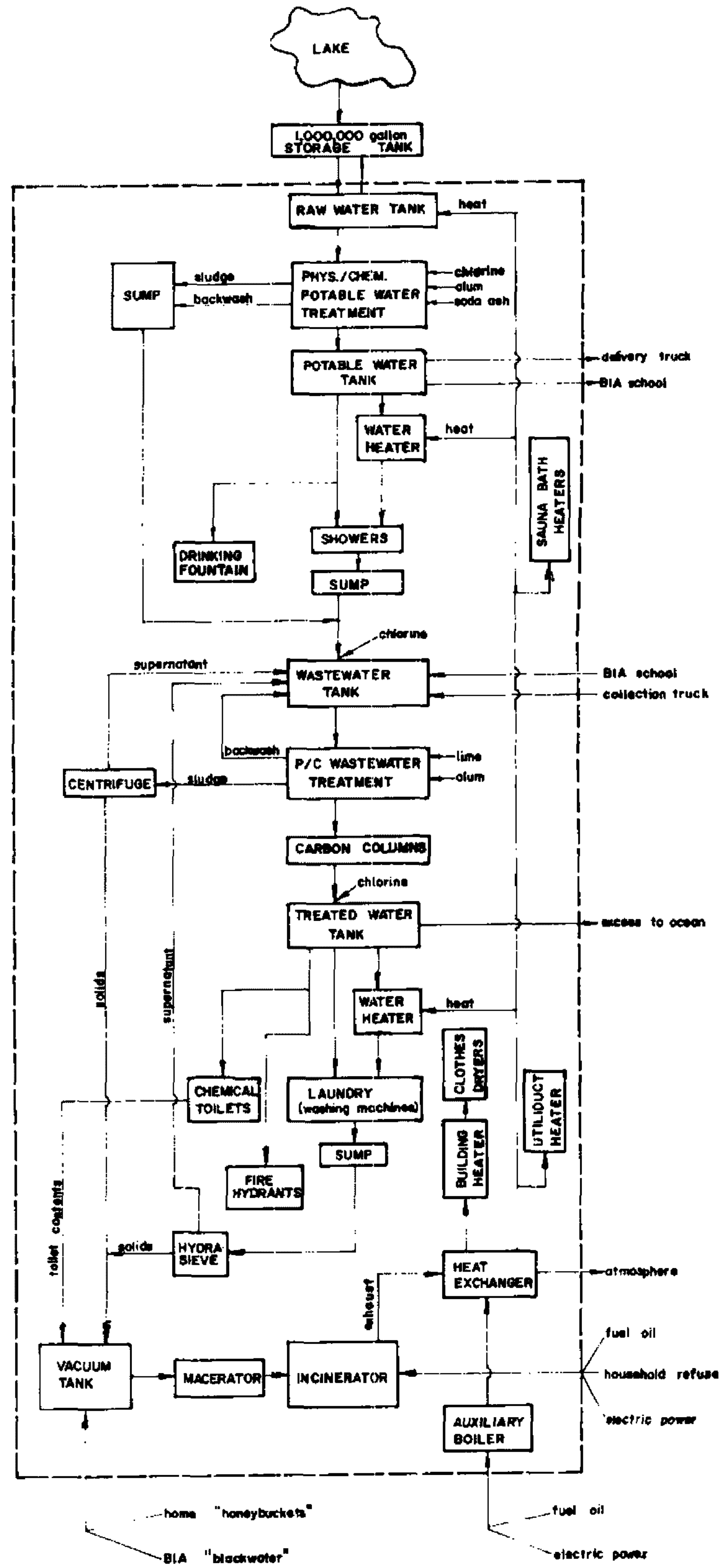


Figure 2. Schematic Flow Diagram for AVDP - Wainwright, Alaska. Note the use of salvaged heat, water recycle and vacuum collection.

be more than enough heat generated by the incinerator. Improvement of heat exchangers and salvage of heat from diesel-electric generators will increase the amount of "free" heat available and indicates potential resource for heating schools, homes and other buildings.

In order to illustrate the value of heat salvage, let us consider an example. The Wainwright facility requires approximately 25 kw electrical power which is provided by diesel generator. Thermal energy amounting to 4000 BTU/kw/hr can be readily recovered with equipment presently on the market (6). In terms of BTU's, this is about 2,400,000 BTU/day or 8.7×10^8 BTU/year. Incineration of human wastes will also release a quantity of thermal energy. Using 0.5 lb. dry solids per capita per day with a heat value of 8000 BTU/lb dry solids (7) for calculations at Wainwright, we calculate that 4.4×10^8 BTU/year is available. Adding a conservative figure of 4×10^8 BTU/year for domestic garbage and trash, a total of 1.71×10^9 BTU/year is obtained. In terms of fuel oil (140,000 BTU/gallon) this equates to about 12,200 gallons which at prices in Wainwright ($0.35 per gallon) has a value of $4300 annually.

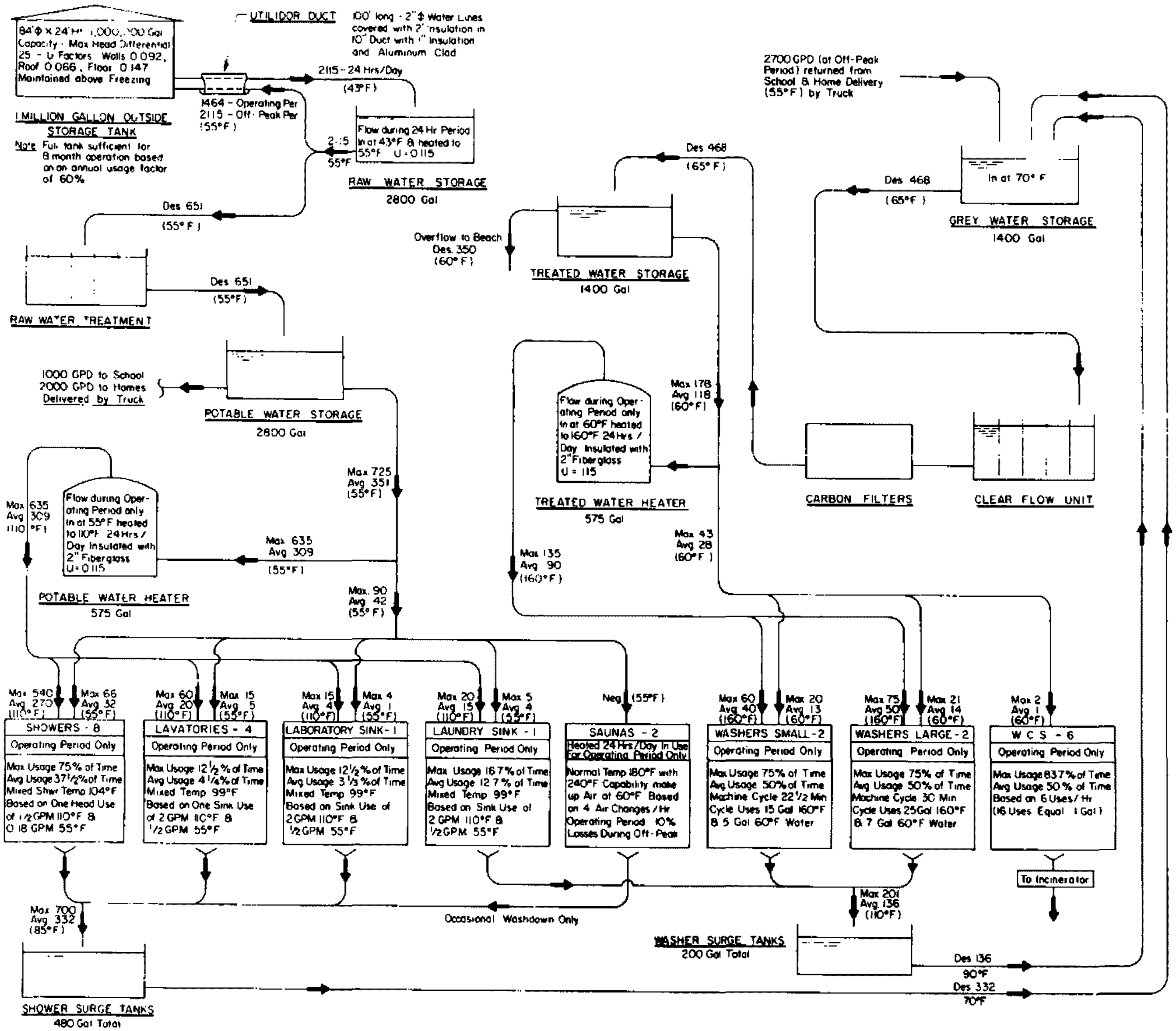
Water and energy are two very important elements of utility service and in the Arctic, particularly, they are inseparably linked. Ambient energy at Wainwright as expressed in terms of temperature is well below that which water can be readily found and stored in its useful liquid state. This of course means the application of additional energy either to acheive that state or to maintain it. Consequently, water becomes an extremely important factor. By reducing water use, energy requirements are reduced and costs are reduced.

Figure 3 is a flow sheet for both water and heat. It will be noted that hourly heat requirements are linked to water requirements and are carried through the systems. Close examination will disclose large gaps in this concept, however, since electric power generation is not included. Early plans called for purchase of electricity from the city generating plant but it was discovered that the facilities were incapable of meeting AVDP requirements. Electrical generation was added too late to interface this subsystem with others.

Water saving devices were widely used for two reasons: (1) to reduce operating cost and (2) to prove that conventional per capita requirements for water can be reduced while maintaining health and comfort. Flow regulating devices are used in the central facility to control the amount of water used. Showers are controlled by both timers and flow regulators which limit the water used per shower to about 6 gallons. We are contemplating reducing this to about 4 1/2 gallons. A totally adequate and satisfying shower is provided by such a quantity of water.

Sauna baths are provided to permit bathing with even smaller volumes of water. This technique has been used for centuries in northern climates with acceptance becoming wadespread in recent years (8). It is unnecessary to say more about this water saver at this time.

Toilet flushing uses as much as 70 percent of all water used in the average American home (4). By eliminating this extravagance, one begins



1. The operating period is defined as 10hrs per day, 7 days per week. The off-peak period is the remaining 14 hrs per day.
2. Water flows are indicated beside the flow lines. All flows are in GPH unless otherwise stated. Maximum is the flow to be expected in any one hour during the operating period and is used for the design of individual units. Average is the flow to be expected over the 10 hr operating period and is used for the overall system design. Design is the avg. uniform flow to maintain & operate the system.
3. Additional design criteria is given inside the illustrated equipment boxes.
4. Area heating calculations are based on
   Outside ambient at -30°F
   Minimum outside temp -56°F
   Building U-factors (all U-factors in BTU/°F/ft²/hr)
   Inside walls = 0.306, Ceiling = 0.036
   Outside walls = 0.057, Floor = 0.030
   Sauna U-factors
   Inside walls = 0.073, Ceiling = 0.025
   Outside walls = 0.033, Floor = 0.030
   Drive thru U-factors as for building
   The community complex area (washrooms, laundry, entrance & center hall) is heated directly. The drive thru area is to be heated with a standard type unit heater. The raw and treated water areas are heated both directly by the community complex area heater and indirectly by heat transfer from process. The incinerator area is heated indirectly by heat transfer only.
5. This flow sheet is intended only as an overall criteria guide and does not indicate such items as pumps, valves etc.

HEAT DATA IN BTUs / HR			
Heat Use	Operating Period	Off Peak Period	Unit Design
Dryers	140,000	—	105,000 (210,000)
Community Complex Heater	151,600	24,750	183,000
Treated Water Heater	76,900	1,900	168,600
Potable Water Heater	143,500	1,900	218,200
Raw Water Tank Process (67,180) Outside Storage (140,700)	207,880	142,680	265,300
Saunas	24,190	6,020	25,600 (51,200)
Drive Thru Heater Future	12,980	4,430	17,900
Total	757,050	181,680	N A

DRYERS - 2
Operating Period Only
Max Usage 100% of Time
Avg Usage 66% of Time
Each Dryer Uses 950 SCFM Air at 160°F when operating

DRIVE THRU HEATER
24 Hrs / Day
Based on maintaining 40°F with 2 Air Changes / Hr during the Operating Period & 10% Air Loss during the Off-Peak Period. Make Up Air at Outside Ambient

COMMUNITY COMPLEX HEATER
Based on maintaining Temp in Complex, Raw Water and Treated Water Areas at 60°F 24 Hrs / Day. Washroom Shower Areas to be maintained at 70°F during Operating Period. Plenum Temp at 100°F. 4 Air Changes / Hr during the Operating Period. 10% Air Loss during the Off-Peak Period. Make Up Air at Outside Ambient

Figure 3. Water, Wastewater and Heat Flow AVDP - Wainwright, Alaska.

to realize significant water conservation. Such savings are being realized in the village projects by substituting air for water as the transport medium in sewers. Homes are not yet equipped with toilets but plans are to install them this summer. These toilets will be of the recycling type which are common in jet aircraft, and use only 3 gallons of water for about 150 flushes. Toilets in the school and the central facility are also of this type. Compare this with the usual 5 gallons per flush of the common water closet.

Vacuum is used to periodically evacuate these toilets which are then recharged with treated wastewater and a deodorant/disinfectant chemical. There has been no objection to these toilets and they have operated quite reliably thus far.

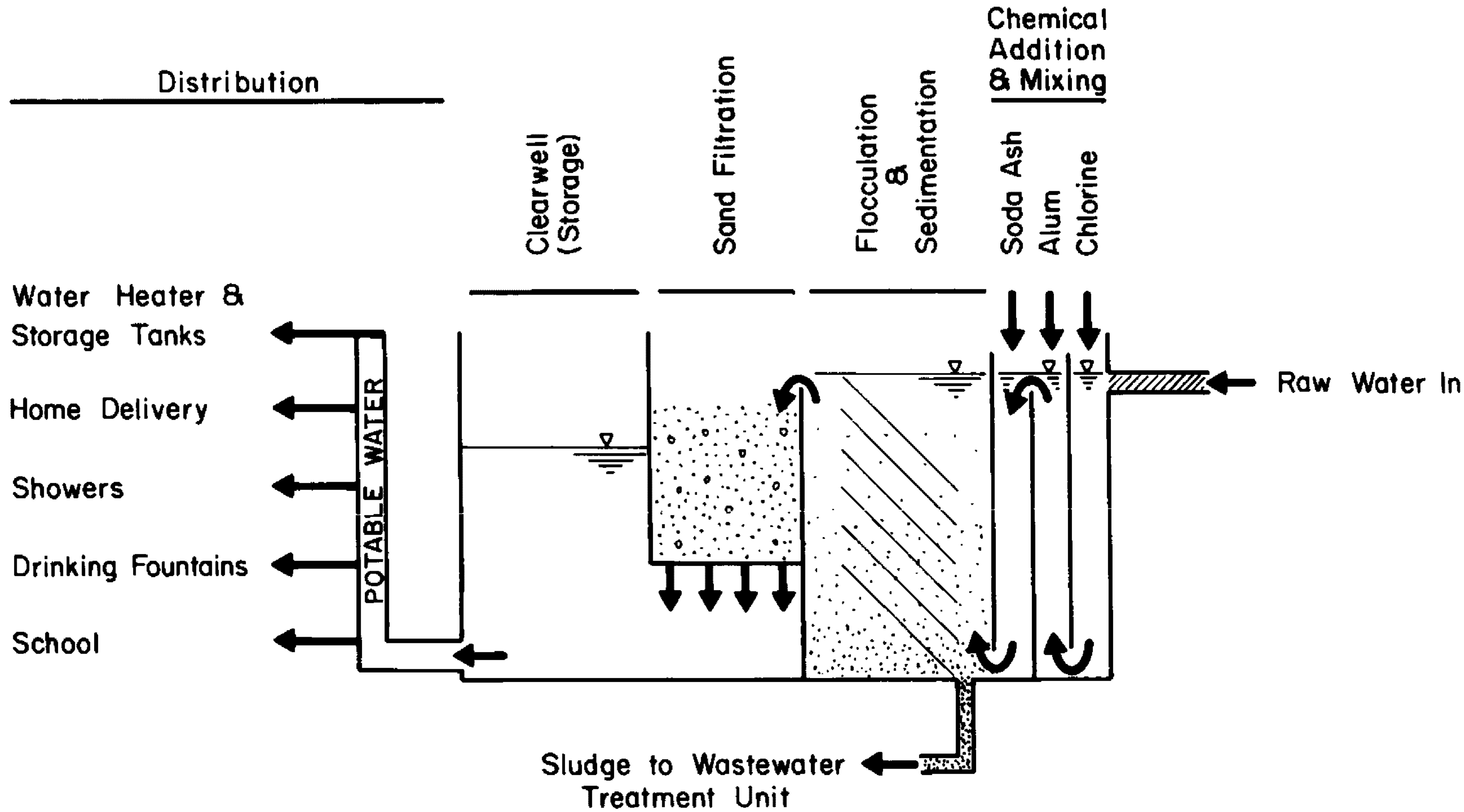
No reliable figures for water requirements were available for this type of system during our design phase. The numbers used are quite speculative and only time and use of facilities will test our assumptions. At this early date it would appear that the design values we used were quite adequate.

At Wainwright no year-round supply of fresh water is available so a one million gallon storage tank was provided. Design of the system was required to stay within this 1,000,000 gallon volume for the eight months of the year when water is frozen. The tank was provided by the U. S. Public Health Service (USPHS) and its cost is not reflected in any costs mentioned in this report. Similarly, vehicles for distribution of water to homes and for collection of human wastes and refuse were provided by the USPHS and their cost is not reflected in this report.

Water for potable uses is treated to insure its purity. Equipment included in the Wainwright facility has consistently produced water which meets USPHS drinking water standards (9). A schematic diagram of the water treatment subsystem is presented in Figure 4. Operational problems have indicated that inadequate attention was given to design of mixing facilities. Flocs form in the mixing chambers and have caused deposits in the distributor to the sedimentation chamber. This is not a serious problem but could have been avoided by using a mechanical mixer and shorter mixing time (10). Similar problems were encountered in the waste-water treatment unit which is nearly identical.

Sewage treatment is a technique which has been well developed to remove wastes from water. It does not provide for ultimate disposal of the wastes. AVDP concept was to provide a non-conventional approach to utility service so it did not seem logical to put human wastes in water for later removal when the problem of ultimate disposal still remained. Traditional methods of putting containers of human waste on the ice for natural disposal at breakup is more convenient than conventional sewage treatment and disposal. However, this method leaves much to be desired since it violates environmental guidelines and poses a danger to health. Incineration is not usually considered economical but when properly interfaced with other processes, can be utilized at reasonable overall cost with superior results (10).

To avoid contaminating water with human wastes, a vacuum transport system is used. In this manner, wastes are collected in a small tank and



TYPICAL POTABLE WATER TREATMENT PLANT
(SCHEMATIC)

Figure 4

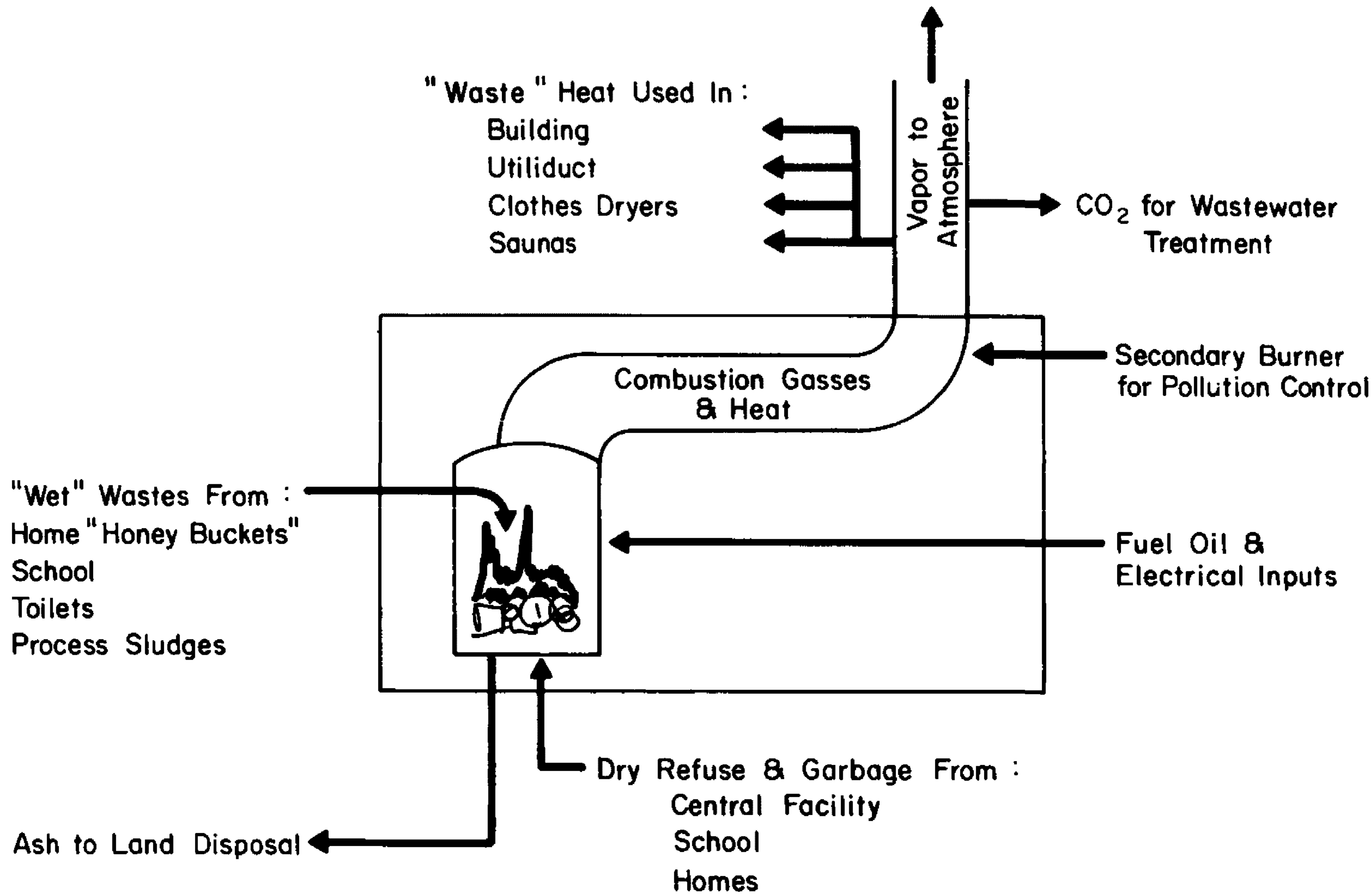
pumped directly into the pathological incinerator. Sludges generated in the water treatment and wastewater treatment processes are disposed of in the same way. Use of vacuum also allows freedom from grades normally required in conventional sewers and drains and permits complete evacuation of pipes as prevention of damage due to freezing.

Disposal of all combustible wastes is accomplished in the incinerator as shown in Figure 5. The unit is of the California Retort type and employs a secondary burner in the stack for air pollution control. Design of the incinerator was based upon simultaneous destruction of 150 pounds of refuse and 30 gallons of sludge per hour. This allows village wastes to be disposed of in a 10-hour-per-day operation.

The incineration subsystem was designed as an integral component of the facility so as to minimize some of the classical disadvantages of its use. We do not believe that analysis of incineration is valid without consideration of the other processes which are linked to it.

Building heat, for example, is taken from a heat exchanger in the incinerator exhaust. This device also provides heat for the sauna baths, hot water, clothes dryers and heat trace in the utiliduct to the Bureau of Indian Affairs (BIA) School.

The treatment of wastewater is by physical/chemical processes and treated wastewater is recycled to the laundry to minimize overall fresh water requirements. From the several collecting sumps, gray water is pumped into a holding tank. Air is injected into the tank to provide turbulence and prevent settlement of solids. The process train consists of gross solids removal by hydrasive, coagulation and flocculation using



SCHEMATIC OF INCINERATION PROCESS

Figure 5. Incineration has been designed here to be integral with sewage disposal, solid waste disposal and building heating.

alum, lime and polyelectrolyte, sand filtration, carbon absorption and disinfection with hypochlorite. The treated wastewater is then stored for reuse in the laundry. Hydrants for fire protection in the central facility are also connected the treated water distribution system as are the chemical toilets.

The water reclamation plant has been plagued with numberous minor problems including chemical mixing and pH control. Hydraulic problems resulting from sludge buildup in the mixing chambers have further complicated operation. For the most part, however, wastewater treatment has been quite satisfactory with significant reduction of COD, turbidity, and solids. Insufficient data are available for a numerical analysis but the process looks encouraging at this time.

Preliminary water use figures obtained indicate that laundry use (reclaimed water) is about 2-1/2 times the present demand on potable water. When the system is fully operational and all homes are served, this ratio will undoubtedly be reduced.

Because the chemicals used in the processes would tend to accumulate in the wastewater treatment system, a method of removing these was required. Sludge is generally too soft to be removed by the hydra-sieve so it is centrifuged for solids remova. This procedure has been quite successful. Solids removed by the centrifuge are of the consistency and texture of plaster of paris and can be collected in disposable containers for later incineration.

Connection of homes to the AVDP facility was determined to be beyond the scope of the project but service to the BIA school is provided. This was done to minimize government expense for water supply and waste treatment and to provide a source of revenue to help offset the cost of operation.

A "utiliduct" is provided as protection for pipes connecting AVDP with the school and for the effluent line carrying treated wastewater to the beach. The "utiliduct" is considerably smaller than the conventional utilidor of many northern communities and is much cheaper to install and maintain. A utiliduct typical of those used at Wainwright is shown in Figure 6. Carrier pipes are 1-inch diameter but could be slightly larger.

These ducts are factory built of light materials and are pre-insulated. Twenty-foot sections can be easily lifted and placed by two men without heavy equipment. Urethane insulation and heat from water and wastewater provide protection against the cold. A heat trace is provided as a backup for emergency use only. Manholes and other special junctions are built of similar materials to complete an installation. Sections are joined with a bolted coupling and joints are insulated with special flex foam pillows.

The AVDP is new and experience is limited. The data we have accumulated at this point in time is minimal and precludes a technical evaluation. There are other details of the system which remain to be worked out to satisfaction of the recipient villages before the projects can be called viable. These details are mostly of an institutional nature. In the coming year we hope to obtain a great deal of data on the two facilities and to evaluate them; however, two data points are insufficient for the eventual need. Additional projects of this kind should be completed

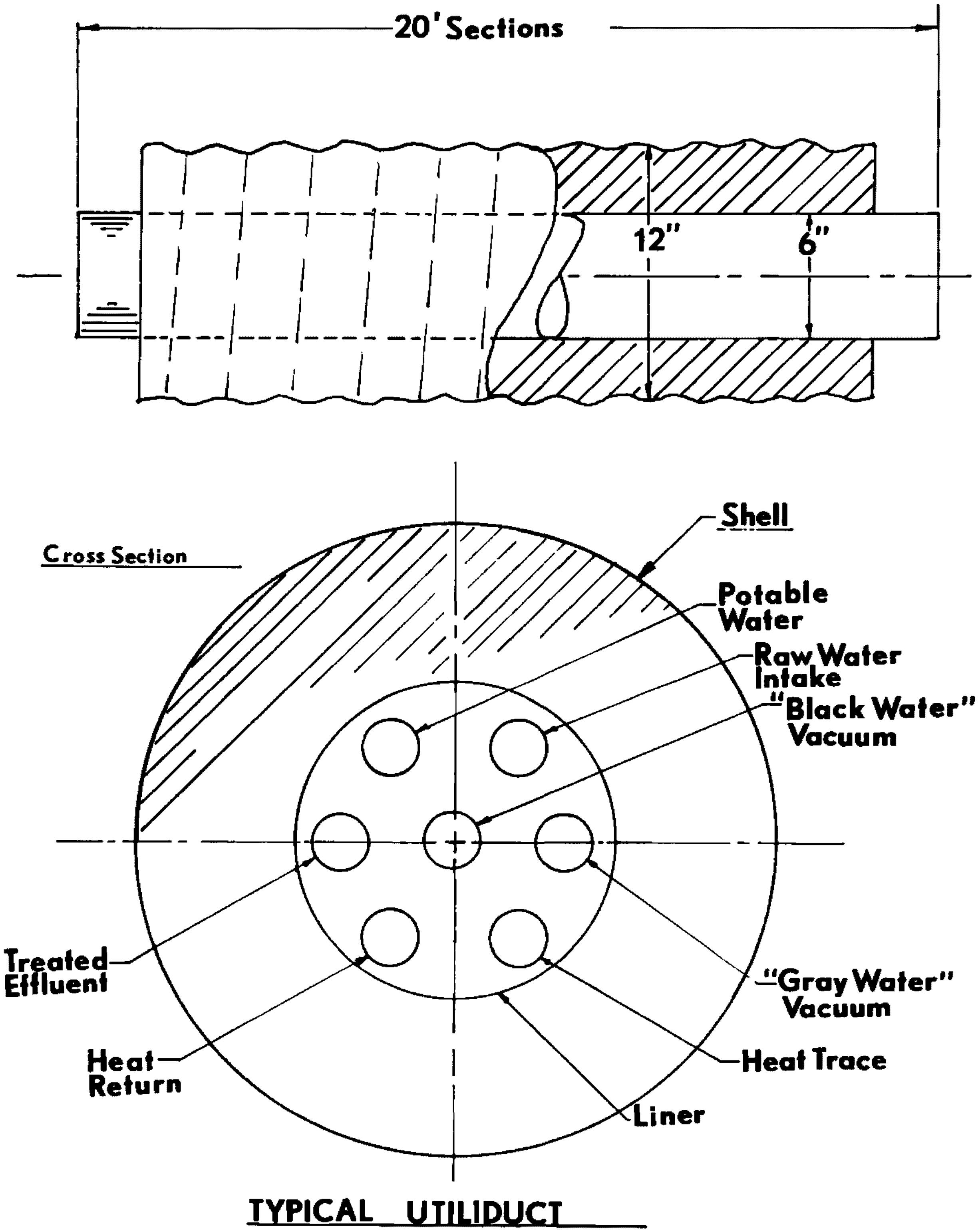


Figure 6. Pipe diameters may be varied to suit the application at the time of design.

and more data collected and evaluated before rational design criteria can be formulated.

The Future

A limited systems approach has been developed for the Wainwright project. The essential difference between this first generation and future generations of utility systems will be the type and number of subsystem interfaces included. In order to economize, it appears necessary to systematize. The extent of integration (interfacing) of subsystems will determine the degree of instrumentation and automation. Progress toward highly developed systems will require consideration by multi-disciplinary teams including engineers, sociologists, politicians, educators, economists and ecologists. Engineers will have to broaden their view from subsystem to system and learn to account for more variables.

The systems approach to village utilities must consider virtually all of the requirements of a residence. Future systems will probably not resemble the first generation AVDP just described and will be more complex and invoke numerous changes in our thinking.

Every residence is a system which involves people and "things". Satisfaction and well being of the people is the justification for "things". A residential system includes the following subsystems to name a few:

1. Shelter
2. Heating
3. Lighting
4. Water supply
5. Wastewater disposal
6. Refrigeration

7. Human waste disposal
8. Solid waste collection

Community systems contain all of these subsystems and more such as:

1. Power supply and distribution
2. Communication
3. Water treatment and distribution
4. Waste collection and disposal
5. Environmental protection
6. Public safety
7. Schools
8. Roads
9. Food production
10. Resource conservation
11. Economics

The "systems approach" will not be truly employed until all of the residential and community subsystems have been examined and effectively integrated. Processes are by nature of limited efficiency and many are mutually dependent.

Side by side addition of two processes has the effect of averaging their efficiencies. For example, electric power generation is 30 percent efficient and electric motors are 80 percent efficient so the overall energy conversion is (80 + 30) /2 = 55 percent efficient. The efficiency of this energy conversion subsystem is characteristic and fixed for all practical purposes. If processes are added end to end, the efficiency may be cumulative. This is easiest to demonstrate with two dissimilar subsystems: Electric power generation is 30 percent efficient with 35 percent loss in stack heat and 35 percent loss in cooling water for the engine. If the 35 percent loss in cooling water is recovered for home heating, then overall energy use is 65 percent efficient. In the village this would allow a very significant reduction in fuel costs.

By examining subsystems carefully and with the application of imagination, system efficiencies can be increased by salvaging wastes or by-products. Solid wastes of households contain a certain amount of energy which can be liberated and partially recovered in the process of solid waste incineration as was previously illustrated. Reuse of wastewater permits reclaiming both the water and the thermal energy already imparted to it with little additional cost.

System design is not in common practice among engineers, not because it is too clever or too difficult, but because it does not fit the political mold. That is, full scale system application requires integration of bureaucratic responsibilities and professional disciplines. Governmental agencies with individual responsibilities for schools, sanitation, housing, communication, environment and the many other subsystems must meet at a solution which is mutually attractive. Identification of subsystems should not and cannot be accomplished by engineers alone, but needs the participation of administrators, village people, physicians, teachers, sociologists and economists (11).

The systems approach offers potential for solution to many problems. It may not be extremely efficient, but it is much more efficient than a multiplicity of unit processes and may allow provision of services which singly were economically unfeasible. Progress is required in the north now and the systems approach to utility services offers progress. The Arctic Environmental Research Laboratory is actively seeking new ideas and unit processes for integration into systems which will accelerate progress in cold climates and remote areas.

Section 20. Pub. Law 91-224. April 3, 1970

Alaska Village Demonstration Projects

"Sec. 20. (a) The Secretary is authorized to enter into agreements with the State of Alaska to carry out one or more projects to demonstrate methods to provide for central community facilities for safe water and the elimination or control of water pollution in those native villages of Alaska without such facilities. Such projects shall include provisions for community safe water supply systems, toilets, bathing and laundry facilities, sewage disposal facilities, and other similar facilities, and educational and informational facilities and programs relating to health and hygiene. Such demonstration projects shall be for the further purpose of developing preliminary plans for providing such safe water and such elimination or control of water pollution for all native villages in such State.

"(b) In carrying out this section the Secretary shall cooperate with the Secretary of Health, Education, and Welfare for the purpose of utilizing such of the personnel and facilities of that Department as may be appropriate.

"(c) The Secretary shall report to Congress not later than January 31, 1973, the results of the demonstration projects authorized by this section together with his recommendations, including any necessary legislation, relating to the establishment of a statewide program.

"(d) There is authorized to be appropriated not to exceed $1,000,000 to carry out this section."

Section 113. Pub. Law 92-500

Alaska Village Demonstration Projects

"Sec. 113. (a) The Administrator is authorized to enter into agreements with the State of Alaska to carry out one or more projects to demonstrate methods to provide for central community facilities for safe water and elimination or control of pollution in those native villages of Alaska without such facilities. Such project shall include provisions for community safe water supply systems, toilets, bathing and laundry facilities, sewage disposal facilities, and other similar facilities, and educational and informational facilities and programs relating to health and hygiene. Such demonstration projects shall be for the further purpose of developing preliminary plans for providing such safe water and such elimination or control of pollution for all native villages in such State.

"(b) In carrying out this section the Administrator shall cooperate with the Secretary of Health, Education, and Welfare for the purpose of utilizing such of the personnel and facilities of that Department as may be appropriate.

"(c) The Administrator shall report to Congress not later than July 1, 1973, the results of the demonstration projects authorized by this section together with his recommendations, including any necessary legislation, relating to the establishment of a statewide program.

"(d) There is authorized to be appropriated not to exceed $2,000,000 to carry out this section.

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