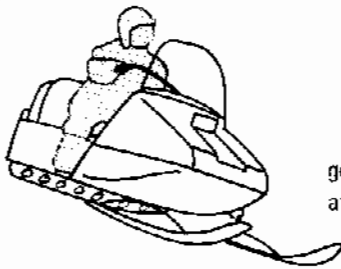


AN ARCTIC HOUSE

by Dennis Nottingham and Marcia Stevens



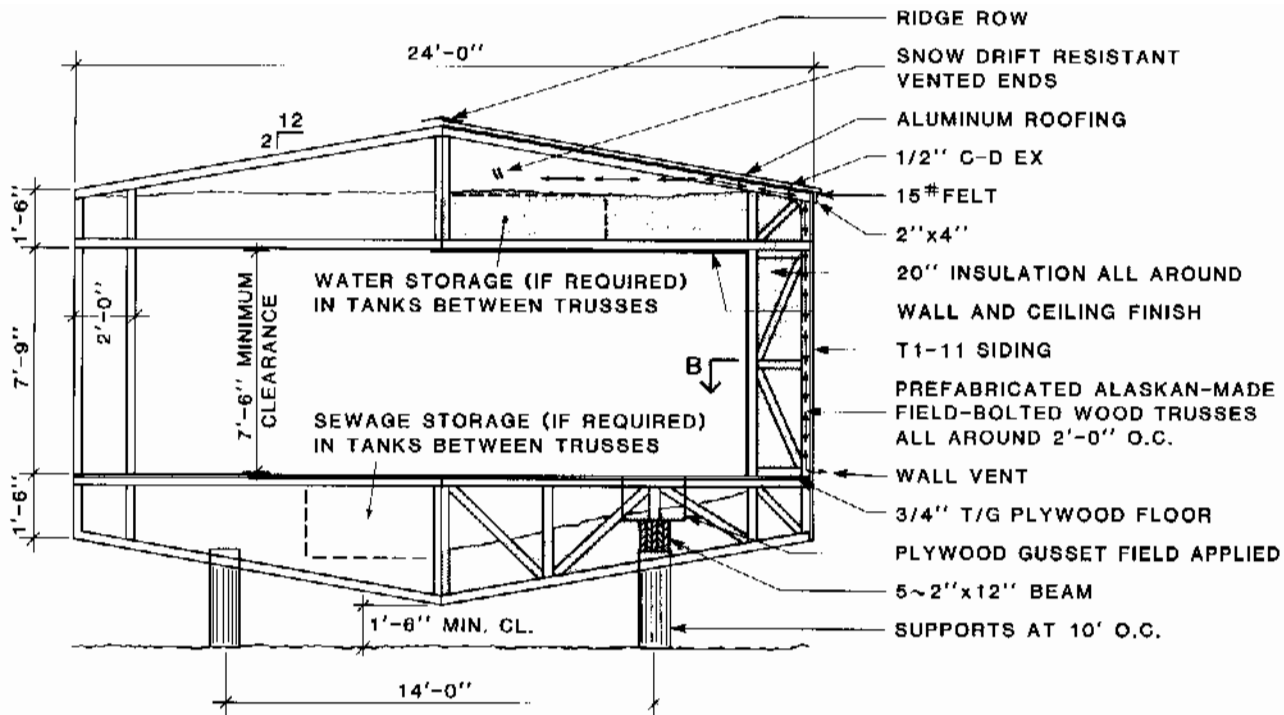
CONCEPT

The underlying concept for this design stems directly from our experience in the Arctic: so many times during our Alaska travels, we have come across badly designed housing. It is inefficient, in that the codes and construction practices are

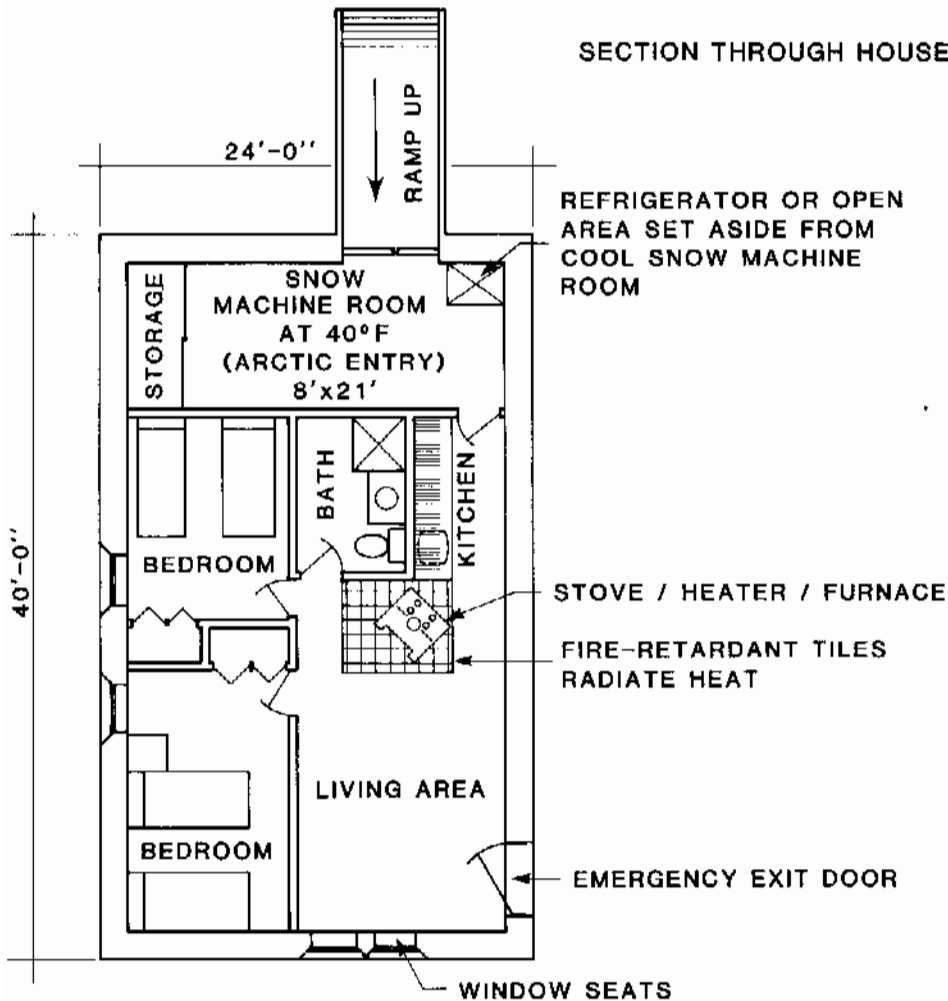
geared primarily toward a more temperate zone. It is inappropriate, in that more often than not the designs show little regard for the arctic lifestyle. The realities of arctic conditions and the way of life of arctic residents have not been adequately considered by the government agencies that set minimal housing standards; as a result, homes built to such standards have been uncomfortable at best, unusable at worst.

To avoid such problems, the starting point for our design was a realistic consideration of the rural arctic environment and lifestyle. We assumed a heating index of up to 20,000 degree-days, blowing snow as a winter constant, and permafrost soils. Gas or oil would be available for heating, but would be expensive. Electricity might or might not be available; the same uncertainty applies for sewer or water systems. Transportation costs are likely to be high,

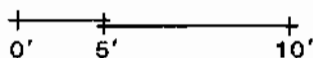
Dennis Nottingham is President of Peratrovich, Nottingham & Drage, Inc., of Anchorage, a consulting engineering firm specializing in arctic engineering design. He is a registered professional civil engineer in Alaska and Washington. Marcia Stevens is a landscape architect and a graduate of Louisiana State University. She has a consulting practice in landscape architecture in Anchorage.



SECTION THROUGH HOUSE



PLAN



and the construction season is short. The residents' lifestyle involves using snow machines and hunting, so they need an area maintained at about 40 to 50°F year around for repairing machines and storing meat.

Absolute simplicity, in both construction and operation, was our basic standard for an efficient design. The final plan should easily meet all applicable State or municipal building codes.

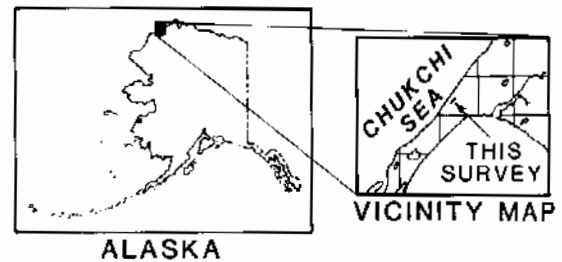
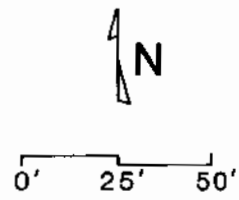
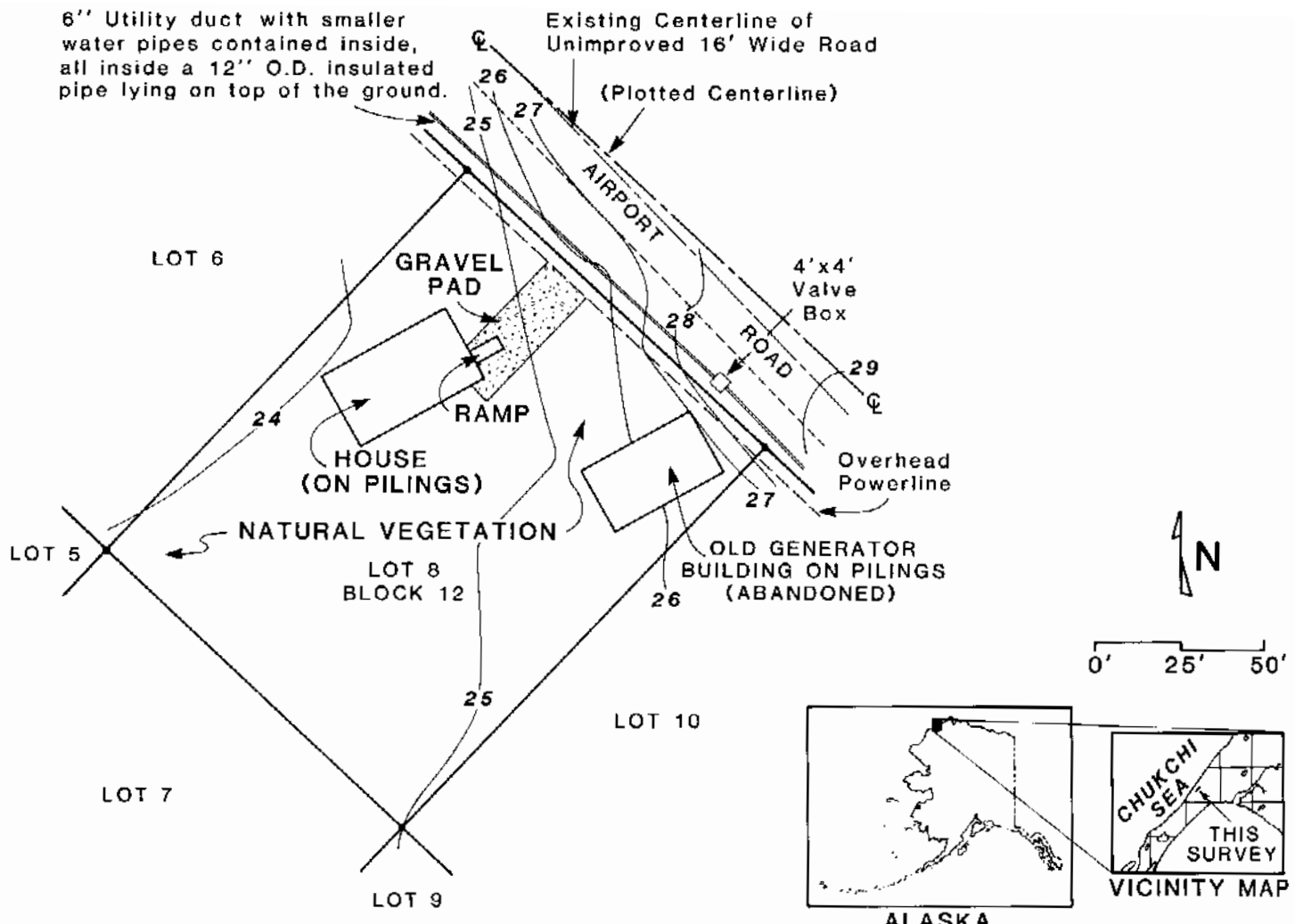
SITE

We designed our house to be located on a specific site, Lot 8, Block 12, of a subdivision in the village of Wainwright, Alaska. Located near the shore of the Chukchi Sea, the site is gently sloping, moderately well drained, and underlain by continuous permafrost. It is ideally suited for a frozen pile foundation system. Electricity and a municipal water main are accessible to the site, but sewage is dealt with by the "honey bucket" method and must be hauled away.

The climate is extreme, with temperatures ranging from -56°F in the winter to +78°F in the summer. Prevailing (and sustained) winds blow from the north-north-east.

Since the sun virtually never rises above the horizon during the coldest months, when energy efficiency is most crucial,

6" Utility duct with smaller water pipes contained inside, all inside a 12" O.D. insulated pipe lying on top of the ground.

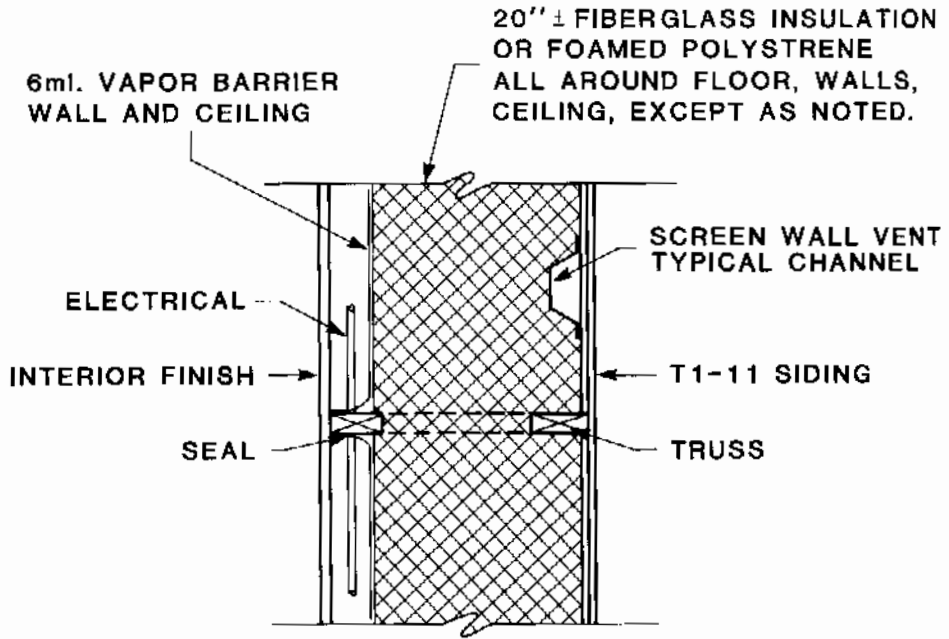


SITE PLAN

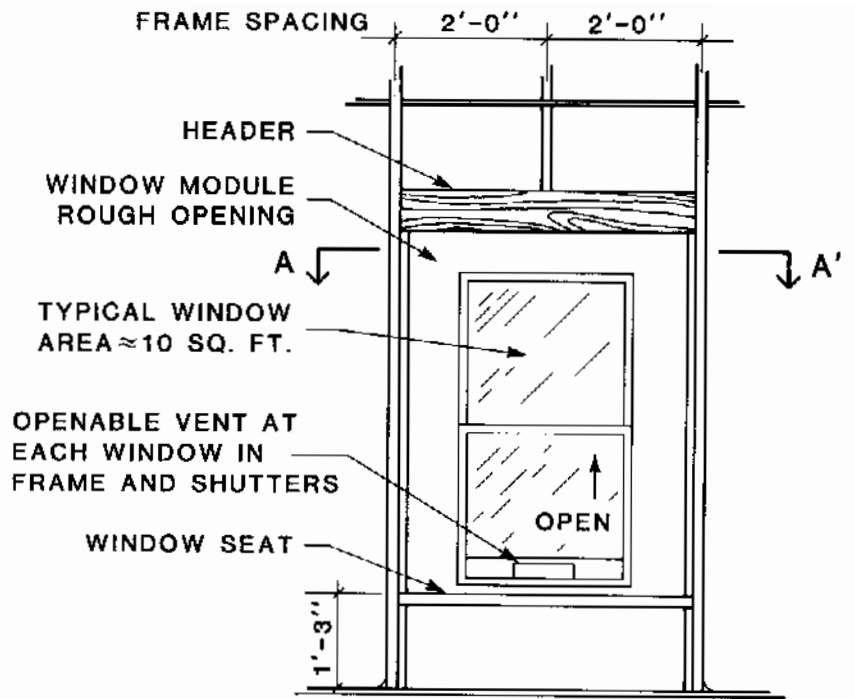
solar orientation is a comparatively minor factor in placing the building on the site. However, proper orientation for the wind is a major factor, to lessen snow loads and drifting and generally to help keep the foundation frozen in place. The venturi ventilating system in our design must also be oriented with the prevailing winds, to keep air infiltration highly controlled.

HIGHLIGHTS

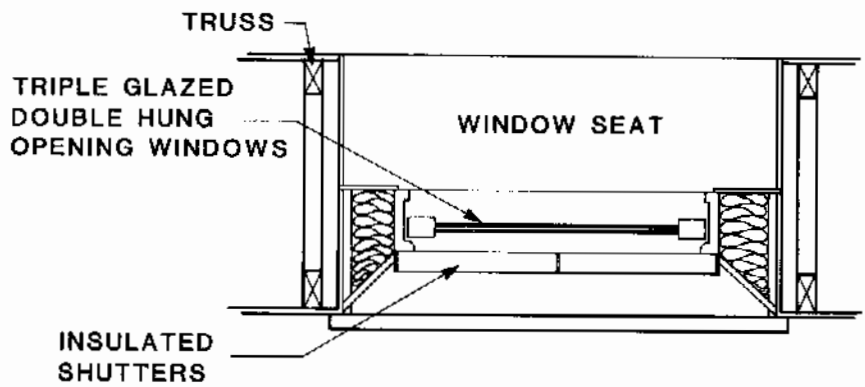
Structurally, the house is made of prefabricated wood trusses connected rigidly by, and strengthened by the diaphragm action of, light plywood sheets. The lightweight prefabricated truss system could be erected easily by unskilled labor; the trusses in our design are presently being manufactured in Anchorage and could be easily flown to Wainwright. No piece is over 12 feet long, and therefore the house components could be transported and assembled without difficulty. The shape of



TYPICAL WALL SECTION B



WINDOW ELEVATION



SECTION A-A'

the building's envelope is a function of its lightweight truss construction and aerodynamically lessens wind effects and snow loading. Because the Arctic is generally considered to be an arid region, we assumed snow loads would be moderate and chose a design load for the roof of 20 pounds per square foot.

The foundation system consists of timber pilings, 12 inches in diameter, seated approximately 10 feet in the ground. The piles are frozen in place within drilled holes sealed with slurry. The capacity of this system should be adequate to carry all vertical and horizontal loads.

Because high construction and heating costs demand that an arctic home be relatively small, living spaces must be multi-purpose. Our design maximizes the general living area, where eating, relaxing and sleeping take place. The lower 7' 6" ceiling height is also both traditionally acceptable and more economical to heat. The generous arctic entry is also a large snow machine room, providing a vitally needed area for storing and repairing equipment. Space for storing food is planned for the outside corner of the room closest to the kitchen.

The plan has an inward orientation, emphasizing a sense of shelter; it is not designed for a view site. The shuttered, triple-glazed windows are placed and sized so they may be used as fire escapes, and an extra door is provided primarily as an

emergency exit. Because the walls are extra thick to contain the necessary insulation, window seats may be built in.

Mechanically, the house would be extremely simple. The ventilation and heating systems are uncomplicated and easily maintained. Because of the home's high energy efficiency, fuel requirements would be so low that the standard 55-gallon drum system found in the villages would handle heating needs effectively. If heated with oil, this house could save \$2000 to \$3000 annually in fuel costs compared to a conventional home with standard stud walls. The centrally located space heater can be used as a cookstove as well.

The heater is also intended to provide the domestic hot water with minimal pip-

ing and plumbing, although the house could be adapted to a more sophisticated system if desired. In isolated locations without water mains, the house could have a holding tank above the ceiling for a gravity water supply. Water could be pumped into the tank by hand or with a small gasoline-powered engine kept in an easily accessible place. The sewer system also has a holding tank, under the floor.

Construction costs for a home such as this can vary significantly in arctic regions. From past experience, however, we estimate that the range should approximate \$40,000 to \$50,000 for materials on site and \$35,000 to \$50,000 for erection costs, for a total cost of \$75,000 to \$110,000. ♦