BENEDICTINE MISSION

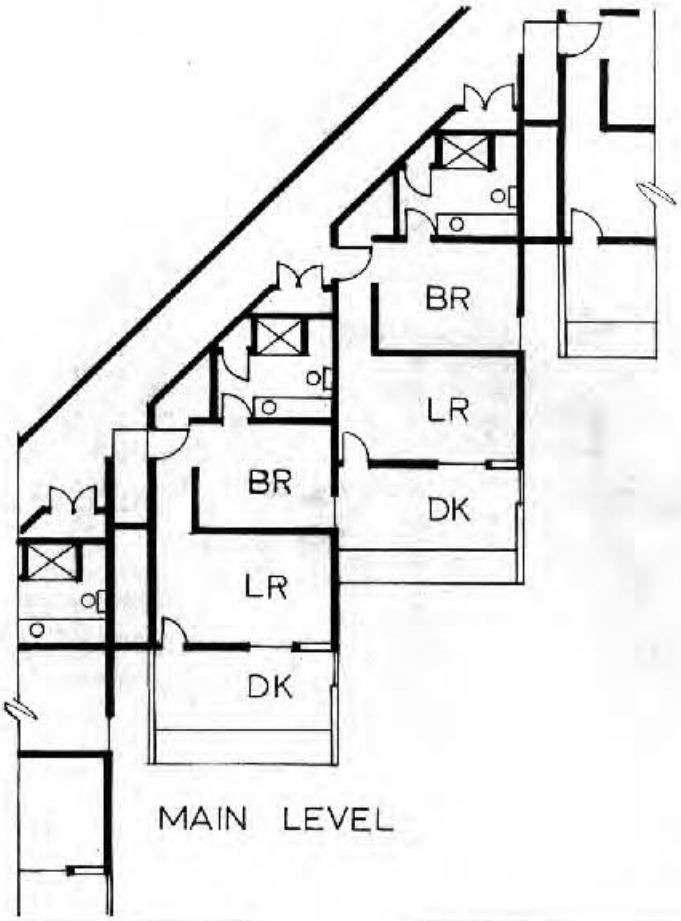
SCHUYLER

EARTH SHELTERED-DIRECT GAIN

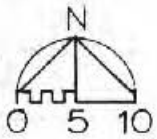
The earth covered Benedictine Mission House, designed by Astle, Ericson and Associates of Omaha, is a support center for other missions of the order throughout the world. The 40,000 sq ft building is roughly "Y" shaped: the right arm is guest quarters, the left arm is living quarters for the occupants (floor plan opposite), the shaft is the office/work area which includes a full-size printing press, and the hub is the commons and gallery/chapel (opposite right).

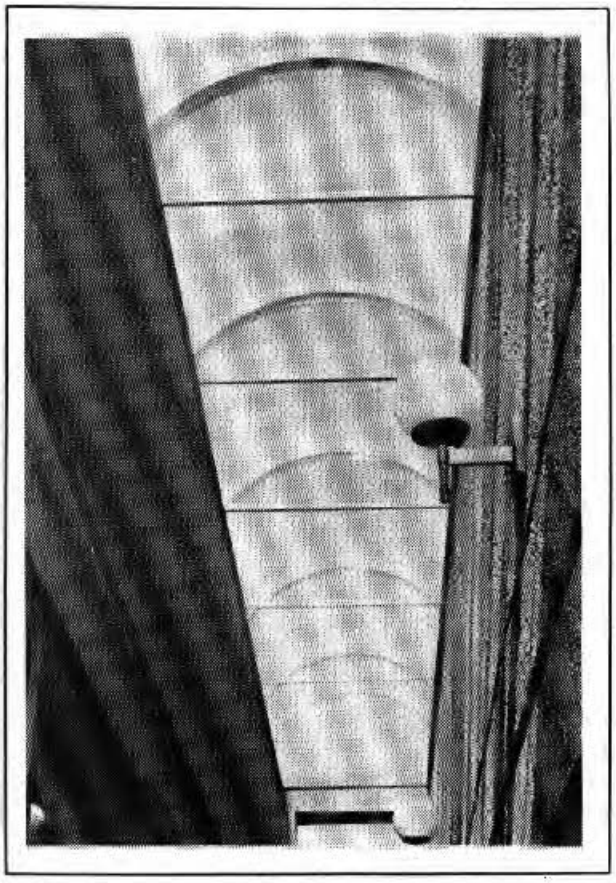
The north, west, and east sides of the monastery are bermed except for a small entry on the north. The building is lightly insulated with 2" of rigid insulation on the roof, perimeter wall, and below grade. The combination of earth cover, earth berm, and the considerable thermal mass of the all concrete building combine to create a structure with fairly constant temperatures, required for the paper storage. The energy conscious occupants contribute to the energy efficiency of the building, and the architect has indicated that the mechanical system in the monastery is smaller by one third than the mechanical system required in a comparable above grade structure. Skylights (opposite left) are distributed throughout the building to provide daylighting, thereby eliminating some of the need for artificial lighting and the energy it uses. Direct passive solar gain is gathered through glazing in the office/work areas and the living quarters. No night shutters are used on the glazing.

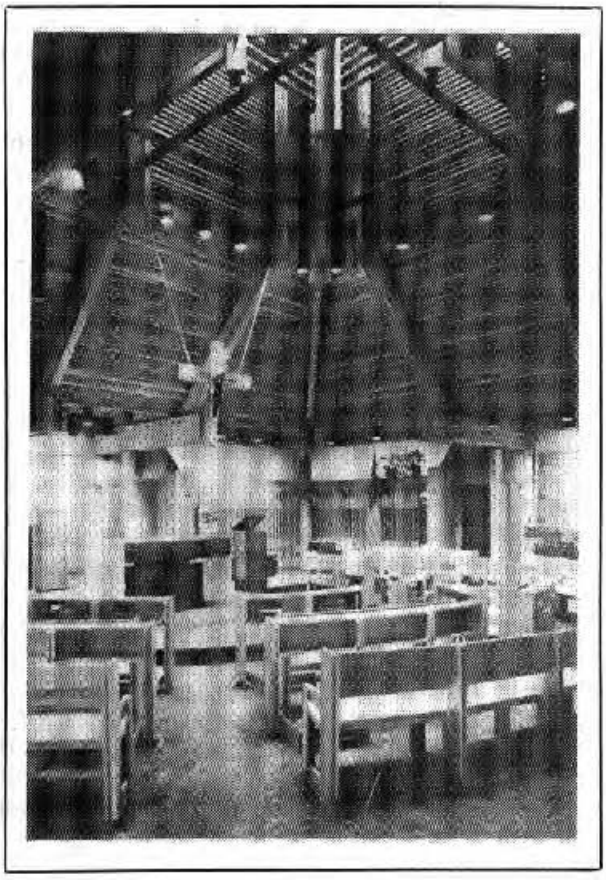
The earth contact aspect of the monastery helps minimize cooling requirements, and the main cooling strategy is nighttime natural ventilation through ventilation panels -- the windows are fixed/non-operable. A conventional backup chiller unit is available for emergency use.



MAIN LEVEL







GUSTAFSON

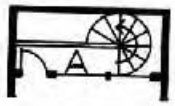
KEARNEY

EARTH SHELTERED-PASSIVE

The earth covered Gustafson home was one of the first earth sheltered houses built by Sunshine Construction of Kearney which also built the Nelson earth sheltered residence described later in this inventory. In addition to the inherent energy efficiencies of earth sheltered construction, the house incorporates direct gain and greenhouse passive solar heating techniques.

Skylights are frequently used in earth sheltered houses to bring daylighting to back rooms. Unfortunately, they are the source of heat loss in winter and unwanted heat gain in summer, and they often leak. For these reasons, vertical skylights -- skylights with vertical glazing -- are the recommended design choice in an earth sheltered dwelling. Perhaps the most unique feature of the Gustafson house is the vertical skylight/lightwell. In addition to admitting light to back rooms, the lightwell in the Gustafson house can also serve as an exit -- a circular stairway (opposite right) connects the main level of the house with the roof. In fact, such an exit from a back bedroom may be a requirement of certain building codes. Although the lightwell is adjacent to the dining room, they are separated by a glass wall to minimize heat loss. During the summer, the door from the dining room and the operable windows in the skylight can be opened (opposite left) to permit natural ventilation and cooling.

An active two plate collector system with freon refrigerant circulating liquid was installed for water heating and is mounted over the roof of the lightwell (opposite left). The performance of the system proved to be unsatisfactory to the owner, however, as he felt that the high cost of operating the active solar system pumps exceeded the cost of using a conventional natural gas water heater, and the system was disconnected.



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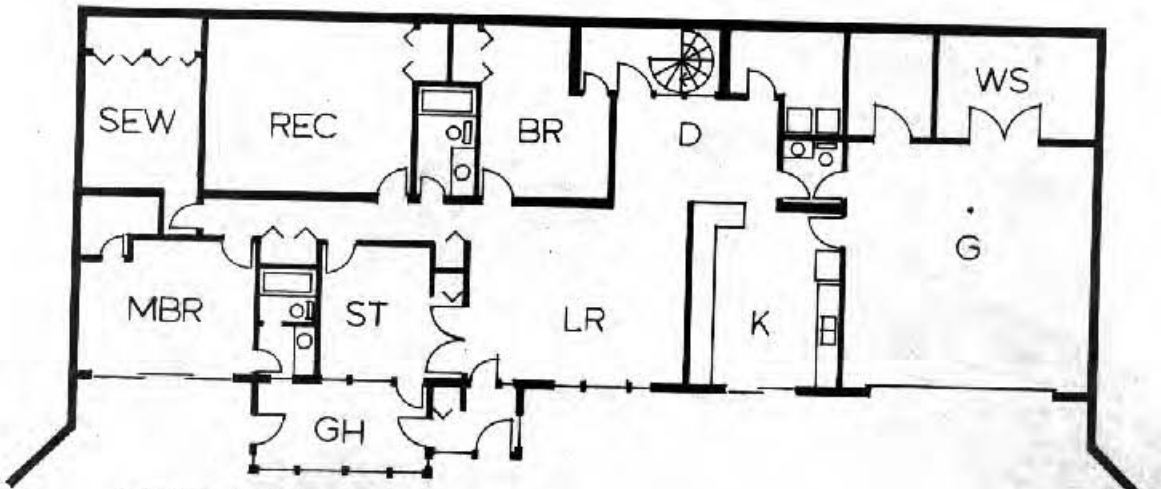

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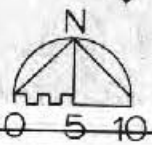
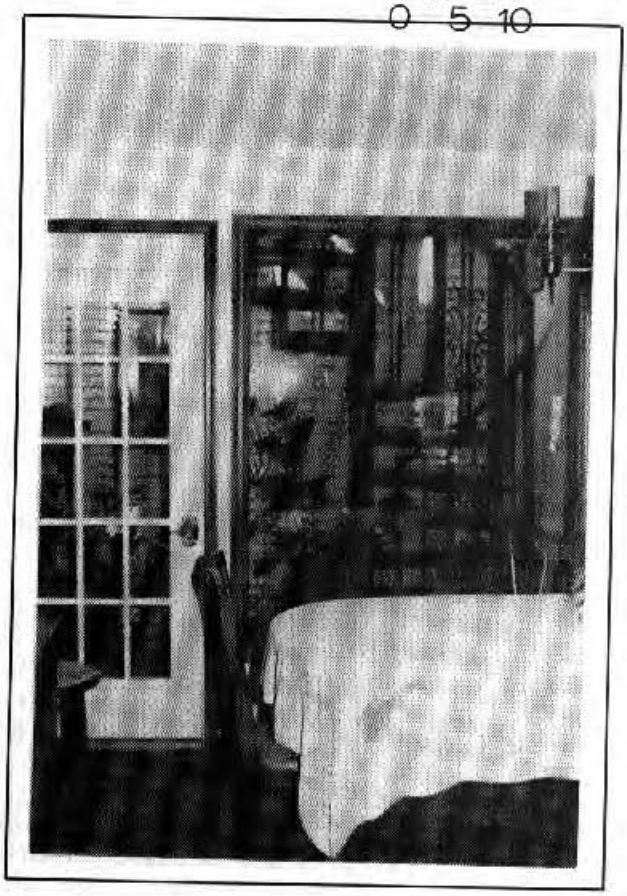




HOSCHIET

FREMONT

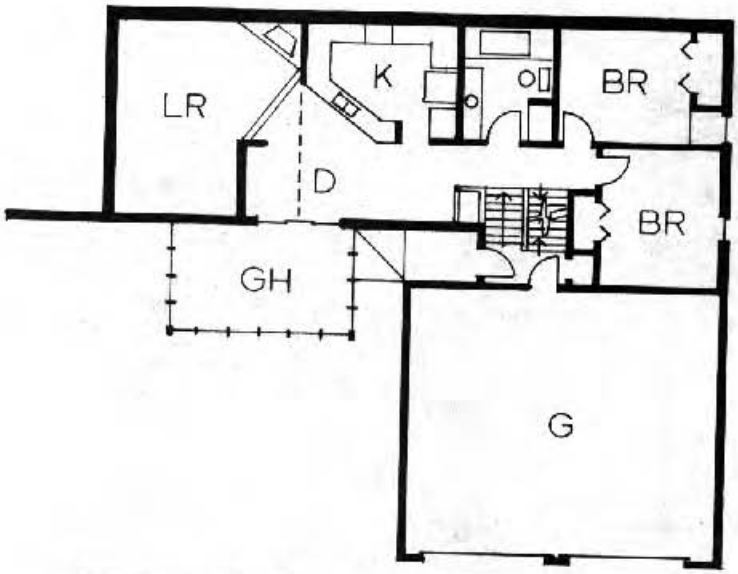
EARTH BERMED-PASSIVE

The 2075 sq ft Hoschiet home, earth bermed and contemporary in appearance, was designed and built by the owner who utilized the knowledge and experience he gained assisting during the construction of the earth sheltered Lively house which is also featured in this inventory.

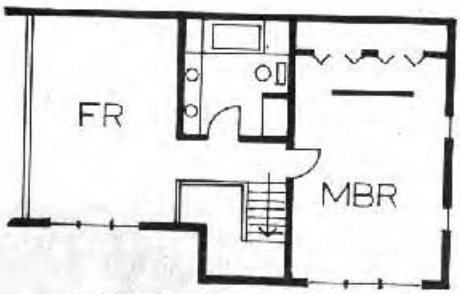
Earth is bermed against a 17' high by 54' long poured concrete wall on the north side of the building. The base of this wall, upon which floor joists are placed, is 1' wide. Above the base, the poured wall is 10" thick. The bottom portion of the poured concrete wall, the basement level, is uninsulated. The upper portion of the wall, the main level of the house, is 2x4 framed and insulated to R-11. The exposed walls in the house are insulated to R-25 and the roof to R-38.

Direct gain and sunspace passive solar heating strategies are present in this home. An attached, 10'x16', Lord and Burnham commercial add-on greenhouse (opposite left and right) is adjacent to the dining room at the southwest corner of the residence. A family room overlooks the dining room/greenhouse and living room area.

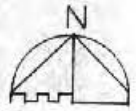
The energy conservation strategies at work in the Hoschiet house resulted in a heating bill of only $146.87 for the period from October 1982 to March 1983. Backup heat is provided by a 3 ton York water-to-air heat pump, that utilizes two wells -- one for the heat source and the other for a return. A 15kw electric strip heater is an additional backup. One cooling benefit of the earth contact was the air conditioning requirements of the Hoschiet house did not exceed $ 31 per month in all of 1982 and averaged approximately $18 per month for the summer of 1982. The overall success of the earth berming and passive solar combination is evidenced by the computed TIF value of just under 2.0.

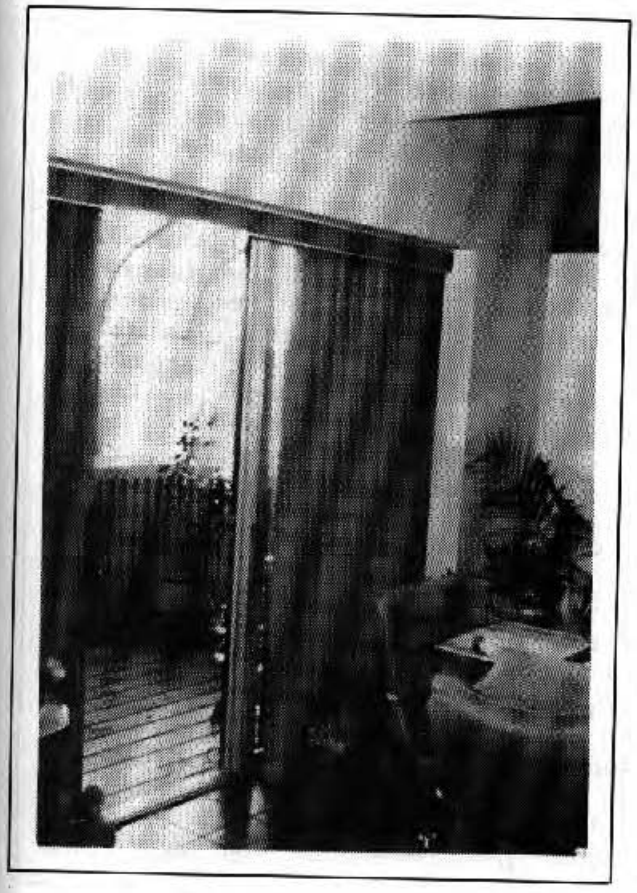


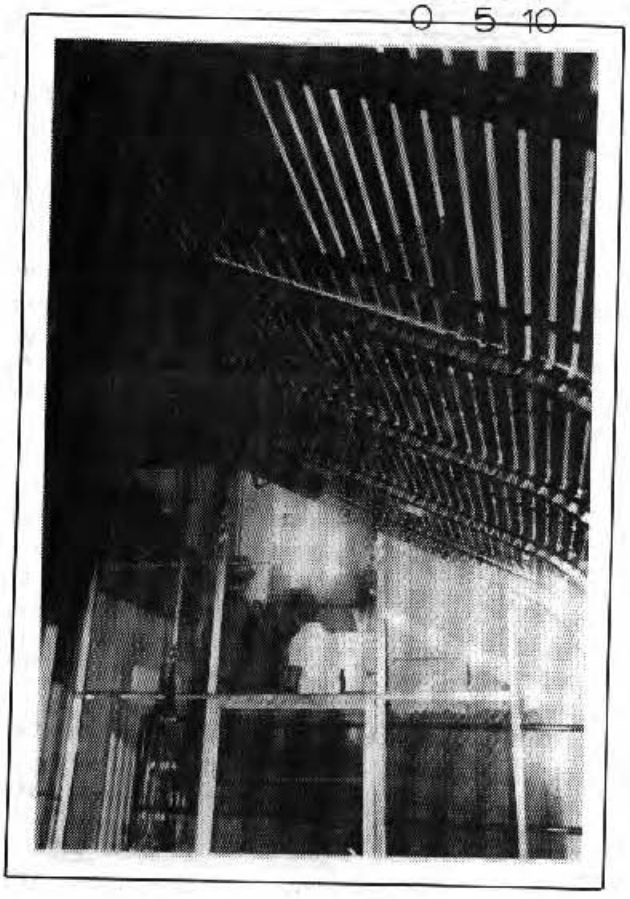
MAIN LEVEL



UPPER LEVEL







D. JOHNSON

OMAHA

EARTH SHELTERED

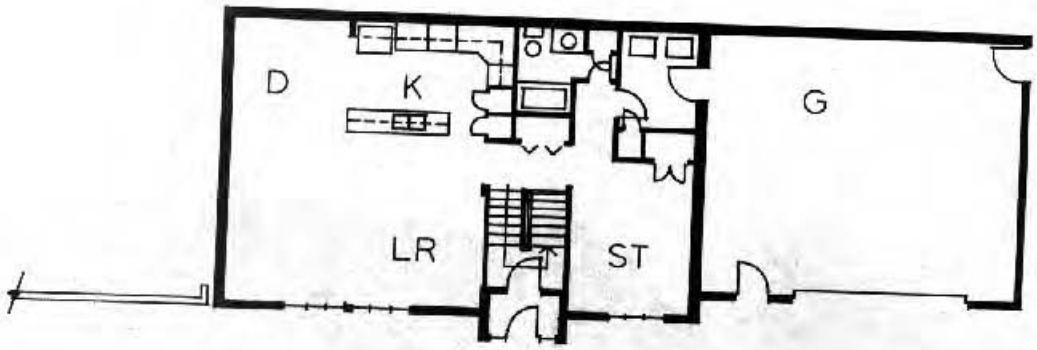
The two-story earth sheltered Johnson home, built by HM Smith & Son of Omaha, combines the inherent energy efficiency of a properly designed, situated, and constructed earth shelter with direct gain passive solar strategies. The house is earth bermed on the north and west walls -- as well as to the lower level window sills on the south, earth covered on the roof, and protected from northeast winter winds by the garage (with conventional roof).

The house has an open floor plan with a clearspan of over 25'. The north and west walls are 12" poured concrete with steel reinforcing. The roof, which supports an earth cover of approximately 18", is comprised of 10" hollow core concrete slabs with grouted joints. The slab is supported in front by a beam and columns concealed in the 2x6 wood framed wall (opposite left).

HLM waterproofing is used on the vertical earth contact walls. An elastomeric membrane was installed on the roof after HLM on the horizontal surface proved unsatisfactory.

6" styrofoam insulation is used on the roof and the first 4' down the earth contact walls. 4" styrofoam is placed the second 4', and the remainder of the wall is uninsulated. The front earth contact walls are insulated with 2" styrofoam. The exposed wall has 5.5" of batt insulation and 3/4" high R sheathing. A woodburning stove provides backup heating to solar gain, and the all electric house has a forced air resistance furnace. Active solar stubbing is also in place.

The wood deck between the 1150 sq ft main level and the 1050 sq ft lower level is cantilevered to provide shading to the bedroom windows (opposite right). No air conditioning is used, and the owner reports that although the main level gets a little warm, the lower level always remains cool and comfortable.



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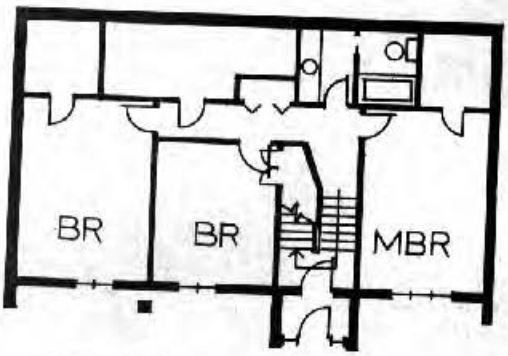
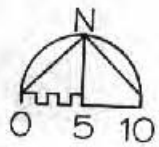
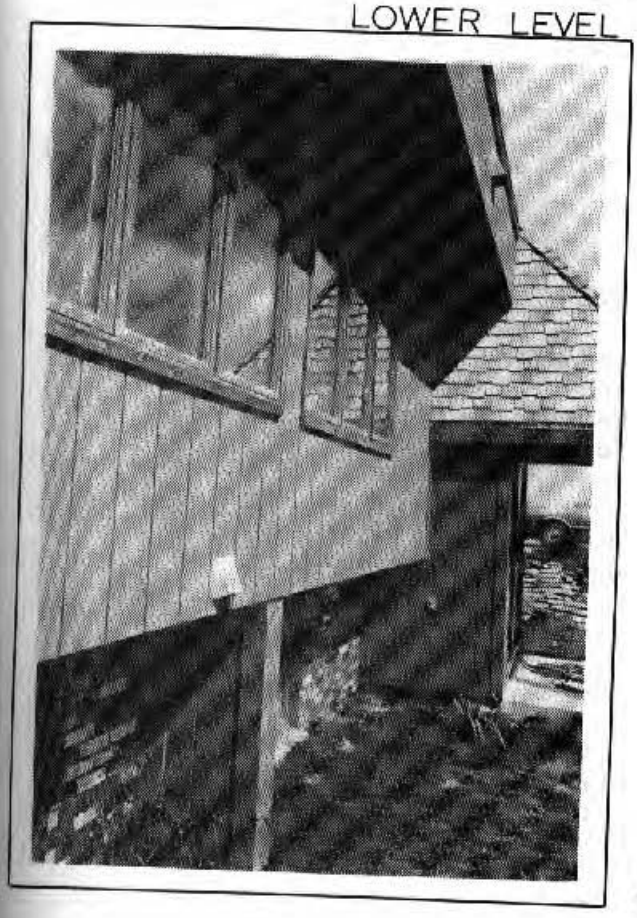
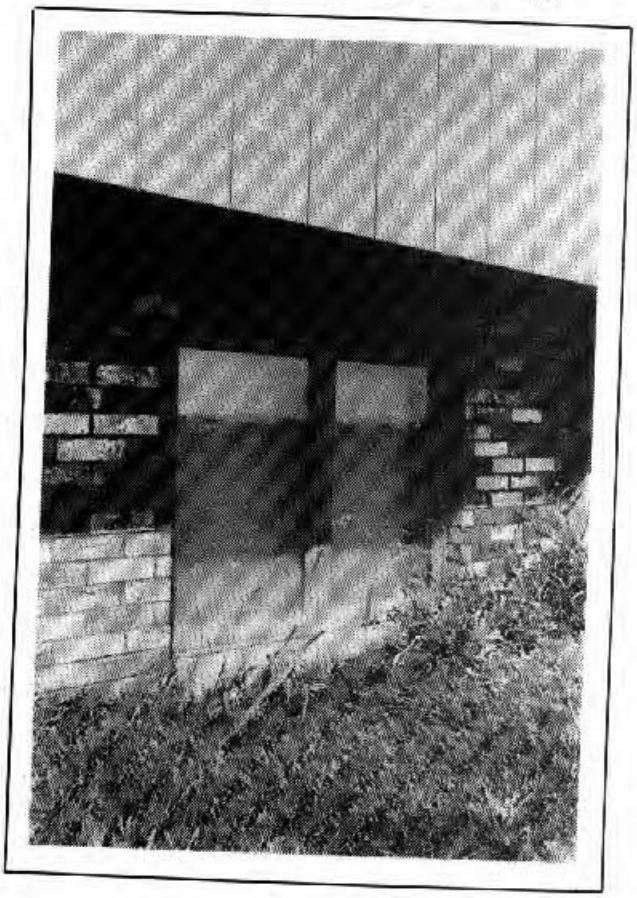


LOWER LEVEL







LIVELY

CEDAR BLUFFS

DIRECT GAIN-EARTH BERMED

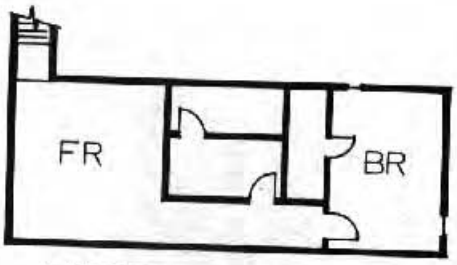
The earth bermed Lively home, begun in October of 1978 and completed in June of the following year, was designed and contracted by the owner. The house is a carefully planned design that would require few changes if started anew today -- something which cannot be said of all early solar efforts in Nebraska.

Vaulted ceilings on the main level of the 1800 sq ft house allow winter sunlight to penetrate to the north walls because the kitchen level actually has a lower elevation than the south portion of the house which includes the living room and master bedroom. Several small windows at the top of the bermed north wall (opposite left) also admit light to the north rooms. An overhang prevents unwanted gain through south facing glass in summer.

The earth contact portions of the house are insulated with 4" of rigid insulation from the footings to the window sills. The exposed walls are double 2x6 framed stud walls, and the conventional roof has 12" of cellulose insulation.

Solar heated air is ducted from the attached greenhouse (opposite right), the main purpose of which is for the generation of solar heat for space heating, although it can also be used for winter sunbathing and relaxing. Commercial grade filon was chosen as the glazing for the modest 10'x10' glazing area. Night insulation is not used on the greenhouse glazing.

A woodburning stove located in the living room supplements solar heat generated by the direct gain and greenhouse systems. 1.25 cords of ash was burned in the period from October 1982 through April 1983. A 2 ton General Electric heat pump system is also available for backup.



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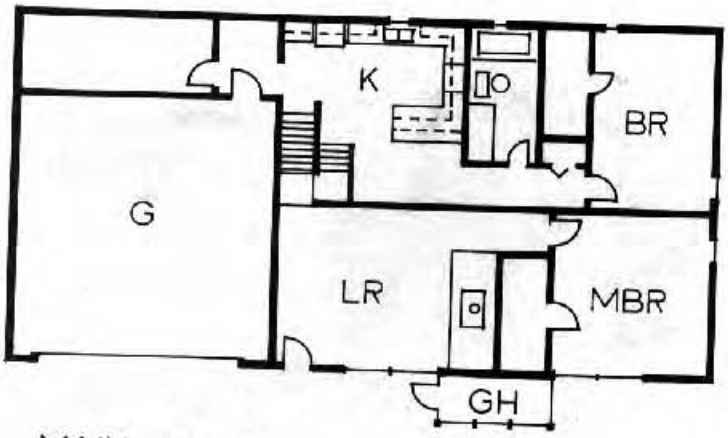
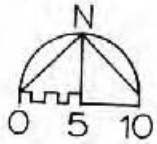
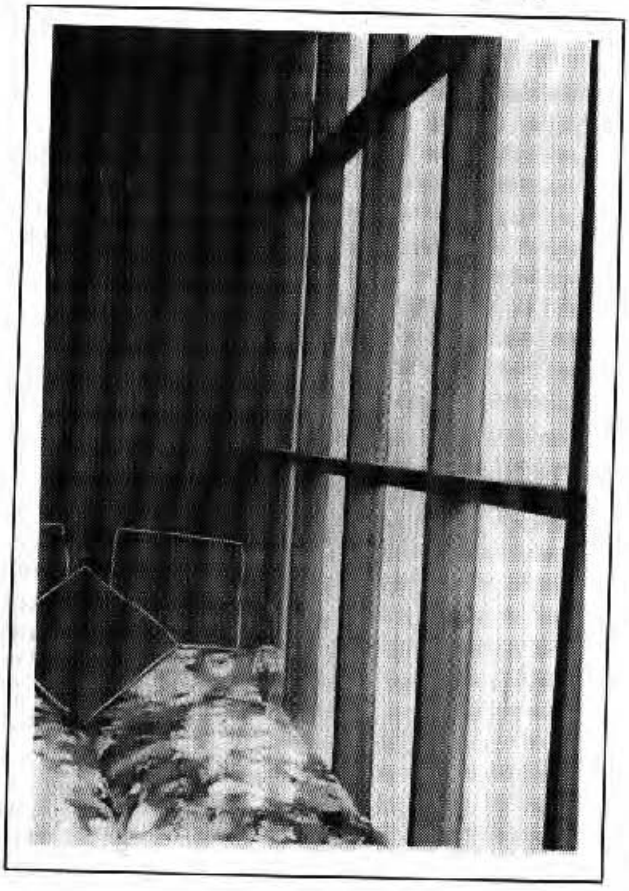


MAIN LEVEL

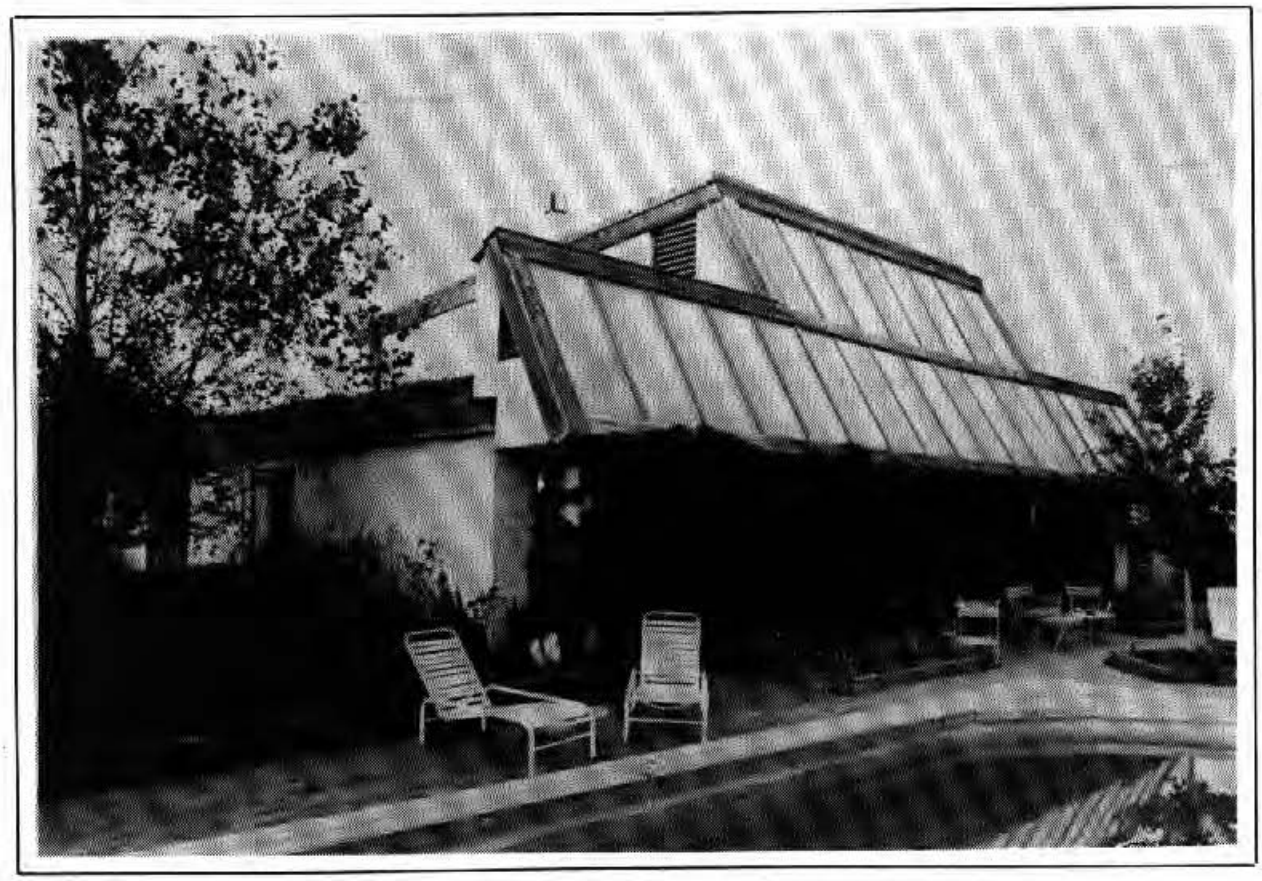




MORTON

FORT CALHOUN

EARTH SHELTERED-MIXED SOLAR



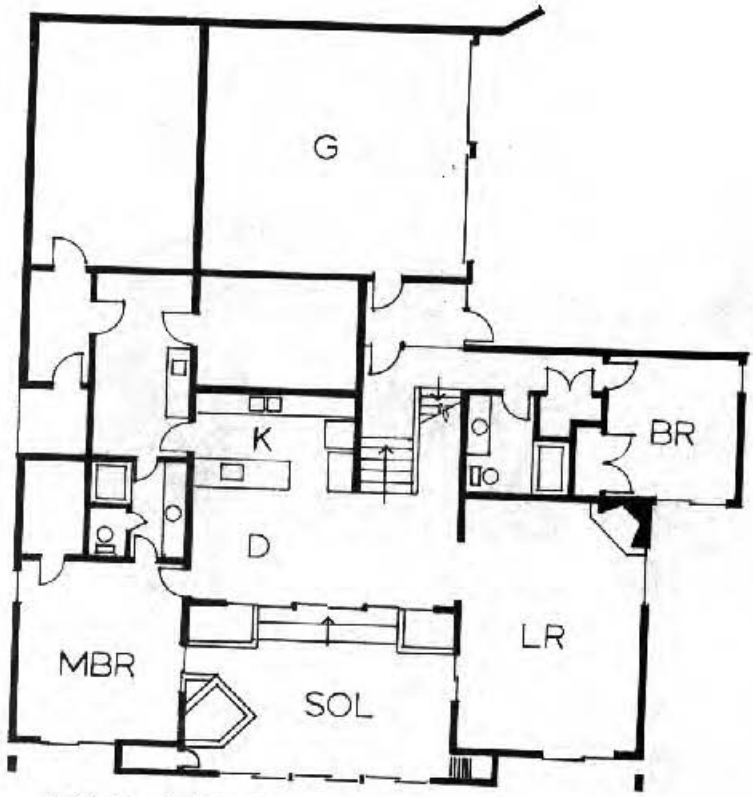
The Morton home, "Maka-Ina" which is Sioux for "Mother Earth", is an exquisite earth covered design, complete with a swimming pool that graces the south terrace of the house and cools southerly breezes during the summer. The owner, an architect in Omaha, designed and built the structure, and the attention that he paid to detail -- like the use of wood throughout the house to give the concrete warmth -- makes this house exceptional.

The 8" concrete roof, waterproofed with a membrane liner and insulated with 4" of rigid insulation, supports 14" of earth over 2" of gravel used for drainage. A drought resistant grass is planted on the roof (opposite left). The earth conctact walls are 8" concrete block walls with sand filled cores and 3" of rigid insulation.

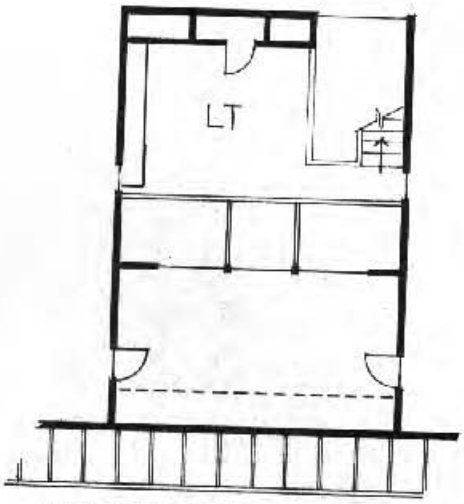
The house relies on both passive and active solar heating strategies. The master bedroom and living room are direct solar gain rooms. Sliding door night shutters are used as insulation on the direct gain glazing of these rooms. The focal point of the house, the two-story solarium (opposite right), around which all rooms are arranged, functions as a greenhouse. The solarium has 126 sq ft of glazing, and the clerestory windows have 168 sq ft of direct gain glazing.

Across the front of the house -- above the vertical glazing and below the clerestory windows -- is a bank of flat plate collector panels which were intended to provide solar heated air to a pebble bed storage. Unfortunately, the system has not worked as the owner hoped.

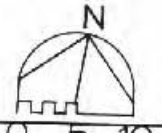
Although a heat pump is used as the main backup system, a Morso woodburning stove, strategically located in the informal dining area, provides heat and is used primarily to take the chill out of the air.

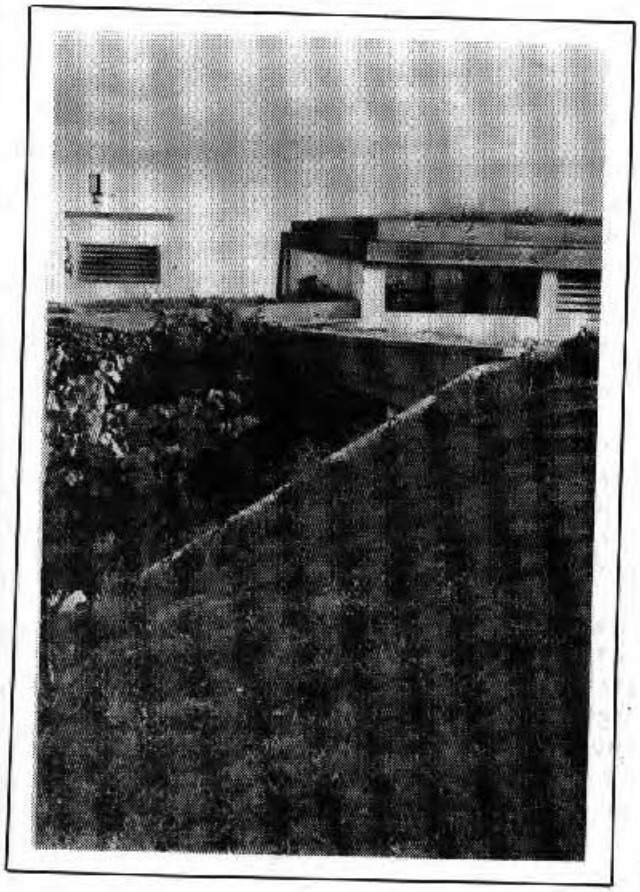


MAIN LEVEL



UPPER LEVEL





J. NELSON

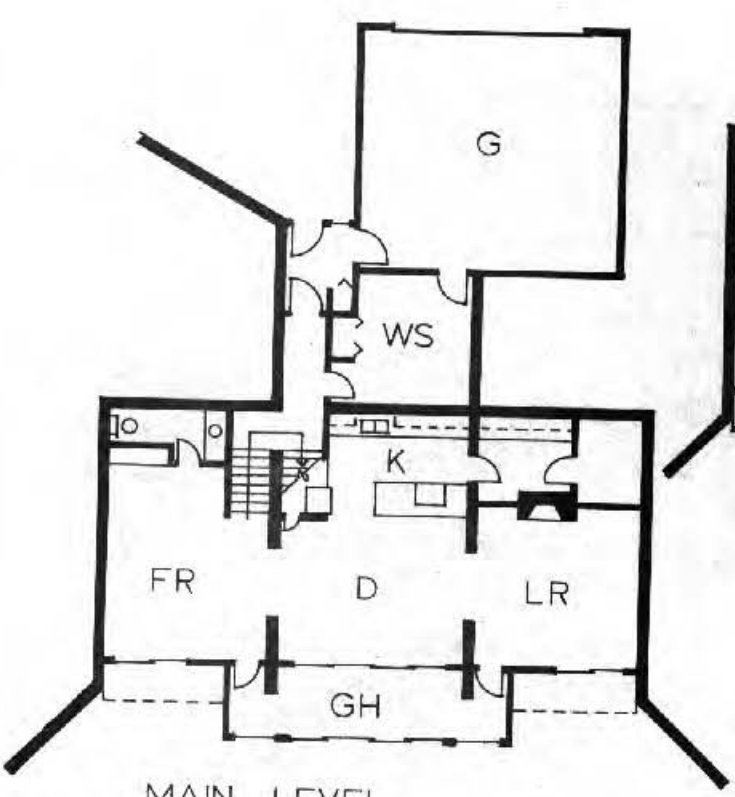
KEARNEY

EARTH SHELTERED-PASSIVE

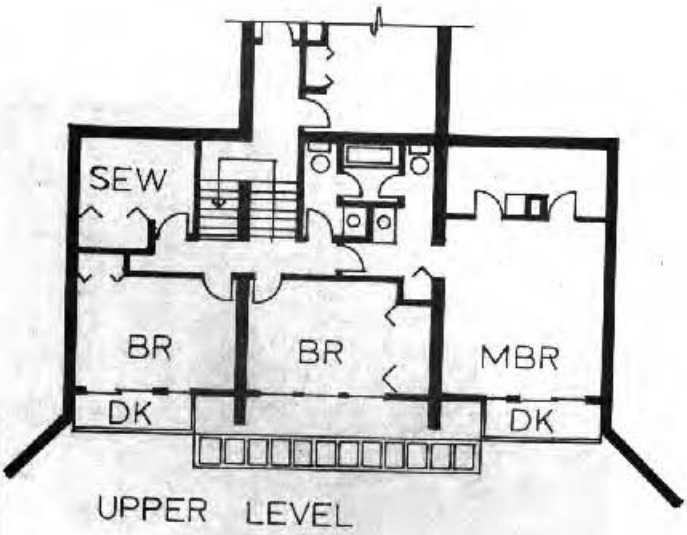
The Nelson residence, like the earth sheltered Gustafson house also in this book, was built by Sunshine Construction of Kearney. Unlike the Gustafson residence, however, the Nelson earth shelter is a two-story earth covered dwelling rather than a single story structure. Although the exterior of the house is certainly contemporary in appearance, the interior is traditionally styled with wood columms, a beautiful candlelabra in the dining room, a comfortable mantle over the fireplace, and a number of pieces of antique furniture.

The main entrance to the house is located on the north side. Although this entrance is an airlock entry (opposite right), the owner has had difficulty with unwanted air infiltration in winter, as apparently a vapor barrier to the outside was broken during construction. Steps to eliminate the problem, including new double insulated doors and better sealing, are planned. Off the entry is a stairwell that connects the 1310 sq ft main level with the 903 sq ft upper level. A skylight at the top of the stairwell provides excellent daylighting to this back area of the house.

The roof of the Nelson house is insulated to a level of R-36, and the south wall is insulated to a level of R-27. Passive solar space heating is provided by 150 sq ft of direct glazing and 130 sq ft of glazing in the 175 sq ft greenhouse (opposite left). Although the greenhouse has a tile floor for storage mass, it has no night insulation, and heat loss can be severe. Humidity levels -- in the range of 70% -- have been uncomfortably high.



MAIN LEVEL



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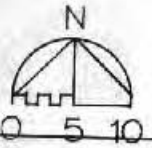
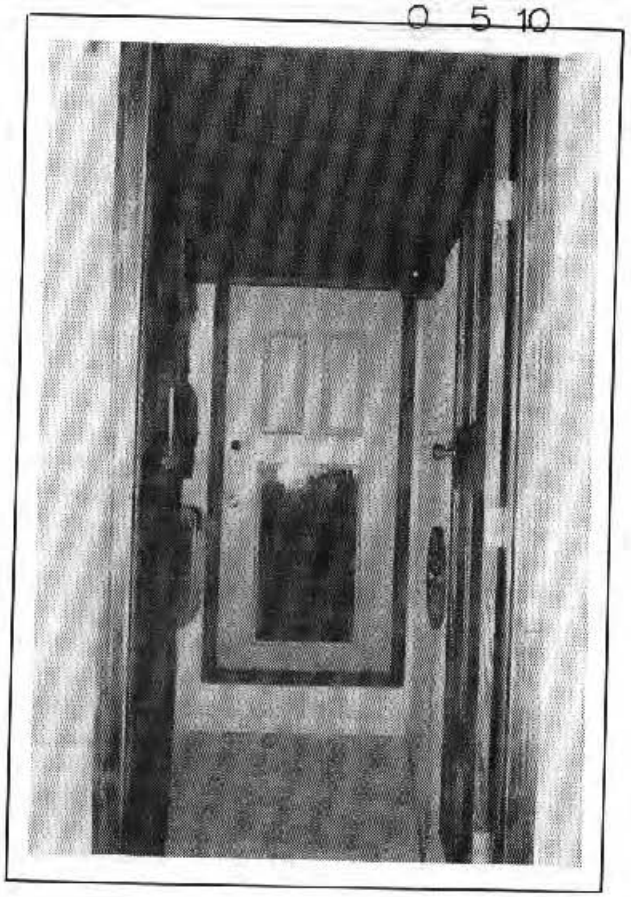
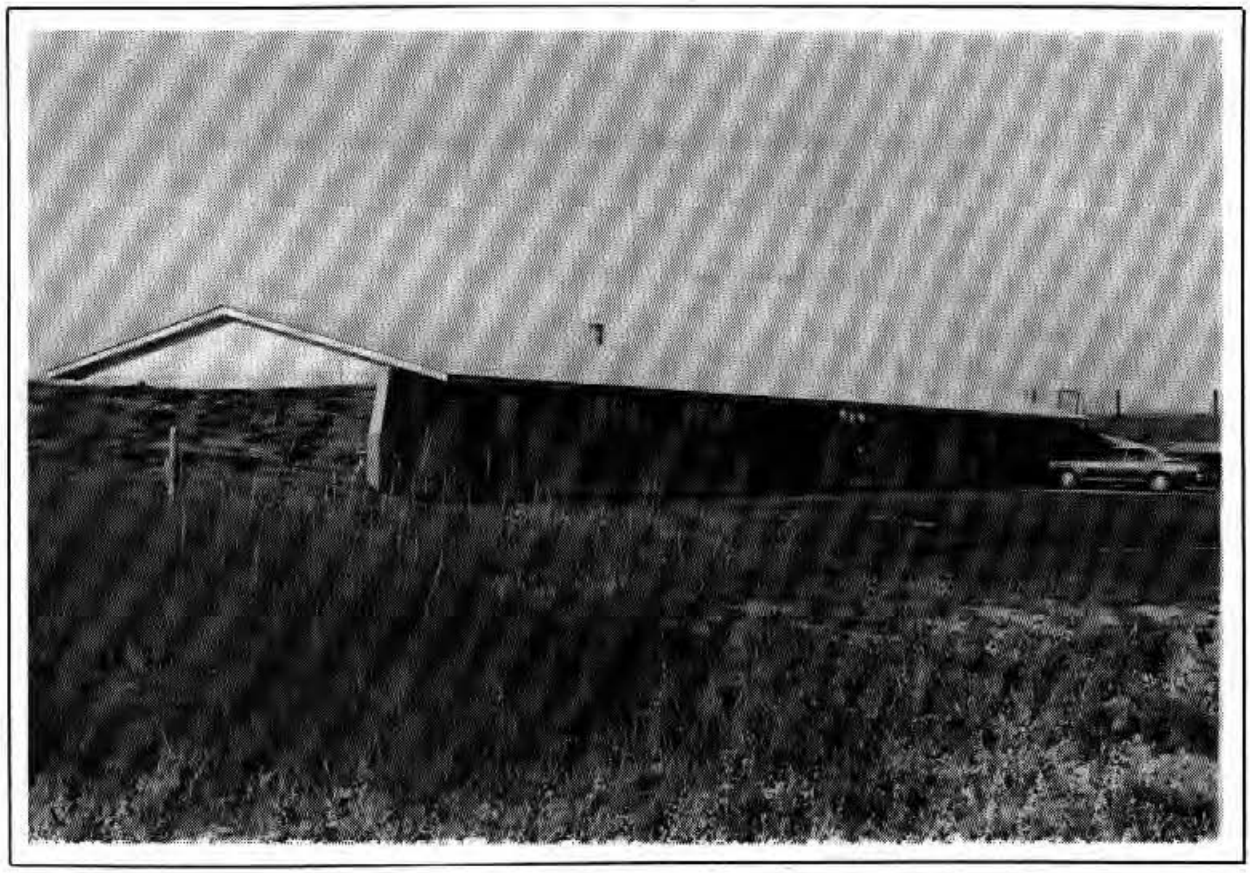




RHODEN

NORTH PLATTE

EARTH BERMED-DIRECT GAIN

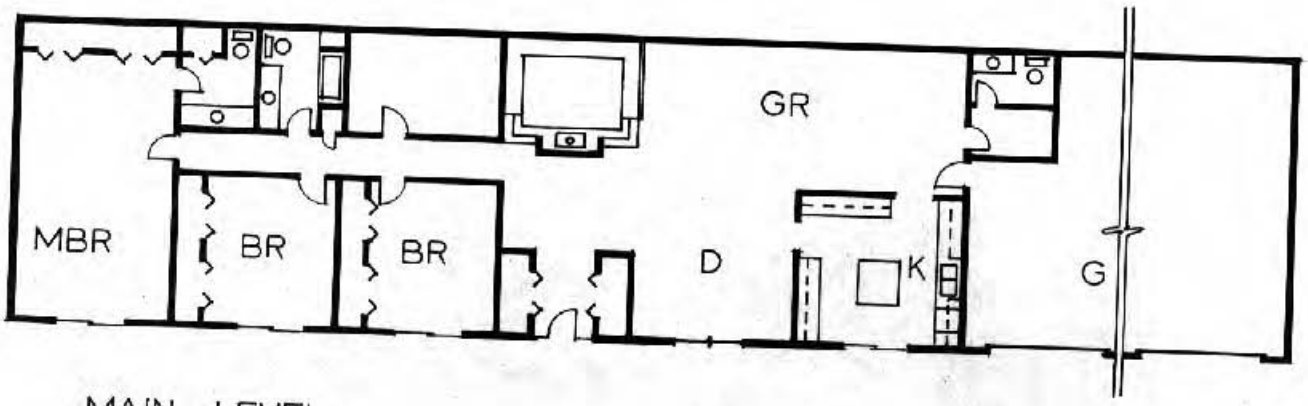


The Rhodens moved into their owner-designed and owner-built earth bermed home in December of 1982. The total cost of construction for the 2300 sq ft dwelling, which is now over 90% complete, is under $30,000 including land and well.

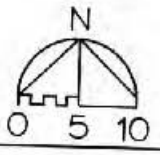
The conventional roof has a 4:12 pitch and is supported by roof trusses which rest, in the back of the 28' deep house, on 8' high concrete walls that are 8" thick. The owner experienced some difficulty placing the insulation in the eaves, and indicated that were he to do it over, he would pour a 9' wall in the back and drop the truss one foot on the inside.

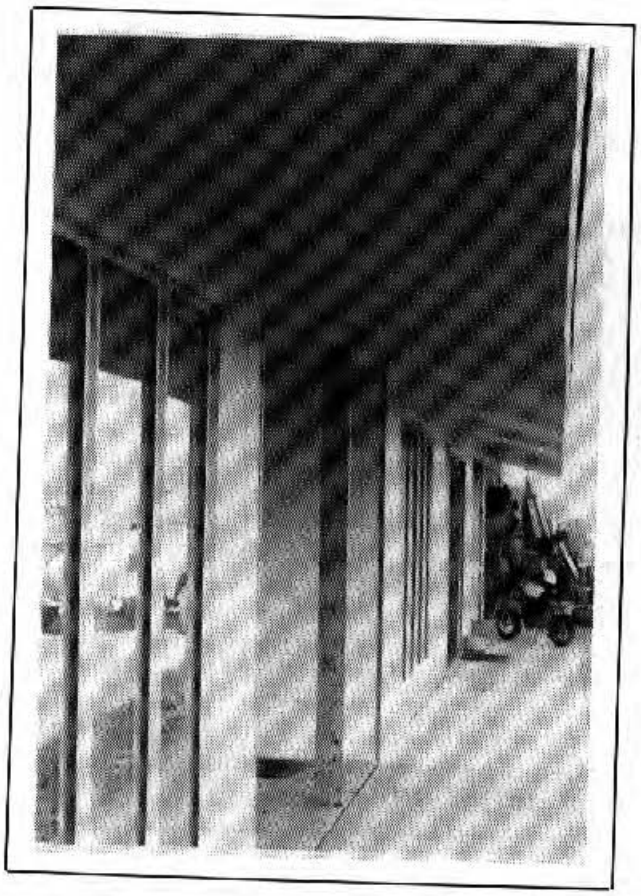
The house is liberally insulated as the ceiling has an insulation level of R-40, the walls have 6" of batt insulation and 3/4" celotex, and even the interior walls have 3" of fiberglass insulation. Although a 55,000 btuh electric furnace -- designed for use in mobile homes -- is available for backup heating, 100% of the backup heating has been provided by a special owner-designed woodburning stove (opposite right). Heat from the stove is allowed to migrate down the hallway to the bedrooms or it can be distributed through the ductwork of the backup furnace to which it is connected.

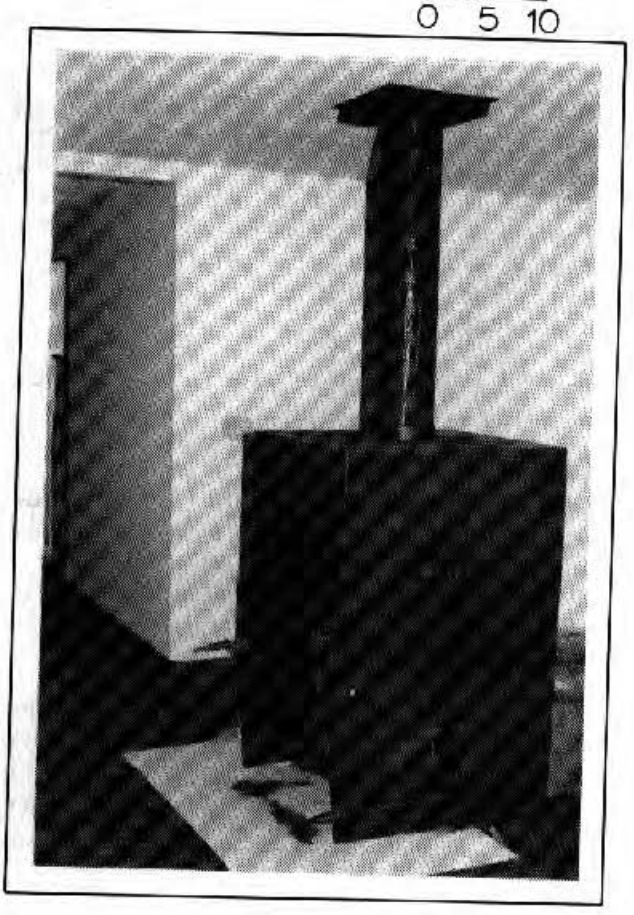
The Rhoden house stays remarkably cool during the summer. Overhangs (opposite left) prevent unwanted solar gain through the vertical south glazing, and despite the high outdoor temperatures of the summer of 1983, the owner states that the house was comfortable -- indoor temperatures never exceeded 80°F. In addition, there were no humidity or dampness problems, most likely the result of a long curing period for the concrete which was exposed for a number of months before the house was framed.



MAIN LEVEL







WIGINGTON

SCHUYLER

EARTH SHELTERED-DIRECT GAIN

The Wigington home is located on a 14 acre nature preserve containing over 50 varieties of trees and shrubs and an artificially created pond. Fuel from the wood, as well as water and fish from the pond, lend an air of self sufficiency to the Wigington homestead.

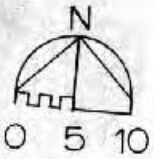
The owner-designed earth sheltered home has 1764 sq ft of living space. It is all earth covered except over the greenhouse and the atrium. The concrete shell, a monolithic pour structure with 8" thick roof and walls, is waterproofed with bentonite. 4" drain tile with gravel backfill is used around the footings to drain water away from the foundation.

Insulation levels in the house are more than adequate as belowgrade walls are insulated to R-20, the earth covered roof to R-30, and the conventional roof on over the greenhouse to R-20. Another feature contributing to the energy efficiency of the house is the airlock entry. The only backup heating source that is used in the house is a woodburning stove, and, during the winter of 1982-83, only one cord of wood was used.

The 669 sq ft greenhouse (opposite), which fronts the entire south wall of the house, is the central passive solar heating system. The greenhouse has 270 sq ft of vertical glazing, and skylights in the greenhouse roof provide an additional 27 sq ft of solar gain glass. The greenhouse is sectioned at the master bedroom for privacy -- the separated portion contains a hot tub.

There is an active two collector system which provides domestic hot water to the Wigingtons.


WS
G
K
BR
A
BR
GR
MBR
GH
MAIN LEVEL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