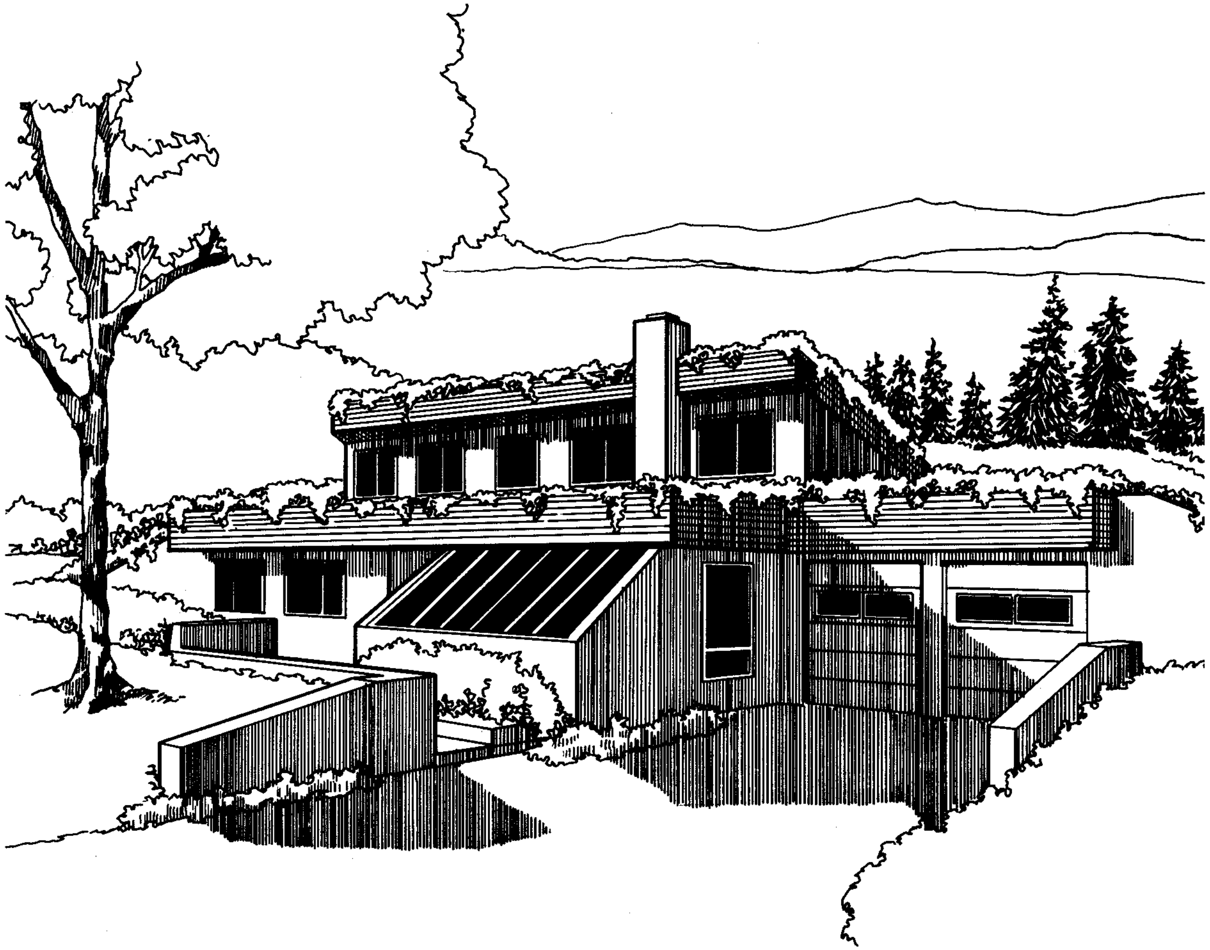
Myersville, MD



Builder: M.S. Milliner Construction, Inc., Myersville, MD

Designer: Malcolm B. Wells, A.I.A., Brewster, MA

Solar Designer: Solar Energy Systems and Products, Inc., Emmitsburg, MD

Price: $120,000

Net Heated Area: 2036 ft^2

Heat Load: 46.1 x 10^6 BTU/yr

Degree Days: 5087

Solar Fraction: 63%

Auxiliary Heat: 1.63 BTU/DD/ft^2

Passive Heating System(s): Direct gain, suntempering, isolated gain

Recognition Factors: Collector(s): South-facing clerestory windows and glazing, 248 ft^2 **Absorber(s):** Concrete floors and wall **Storage:** Concrete floors and wall—**capacity:** 18,100 BTU/°F **Distribution:** Radiation, natural and forced convection **Controls:** Roll-down aluminum shades, overhangs

Back-up: Air-to-air heat pump (16,000 BTU/H), woodburning stove, electric strip heaters

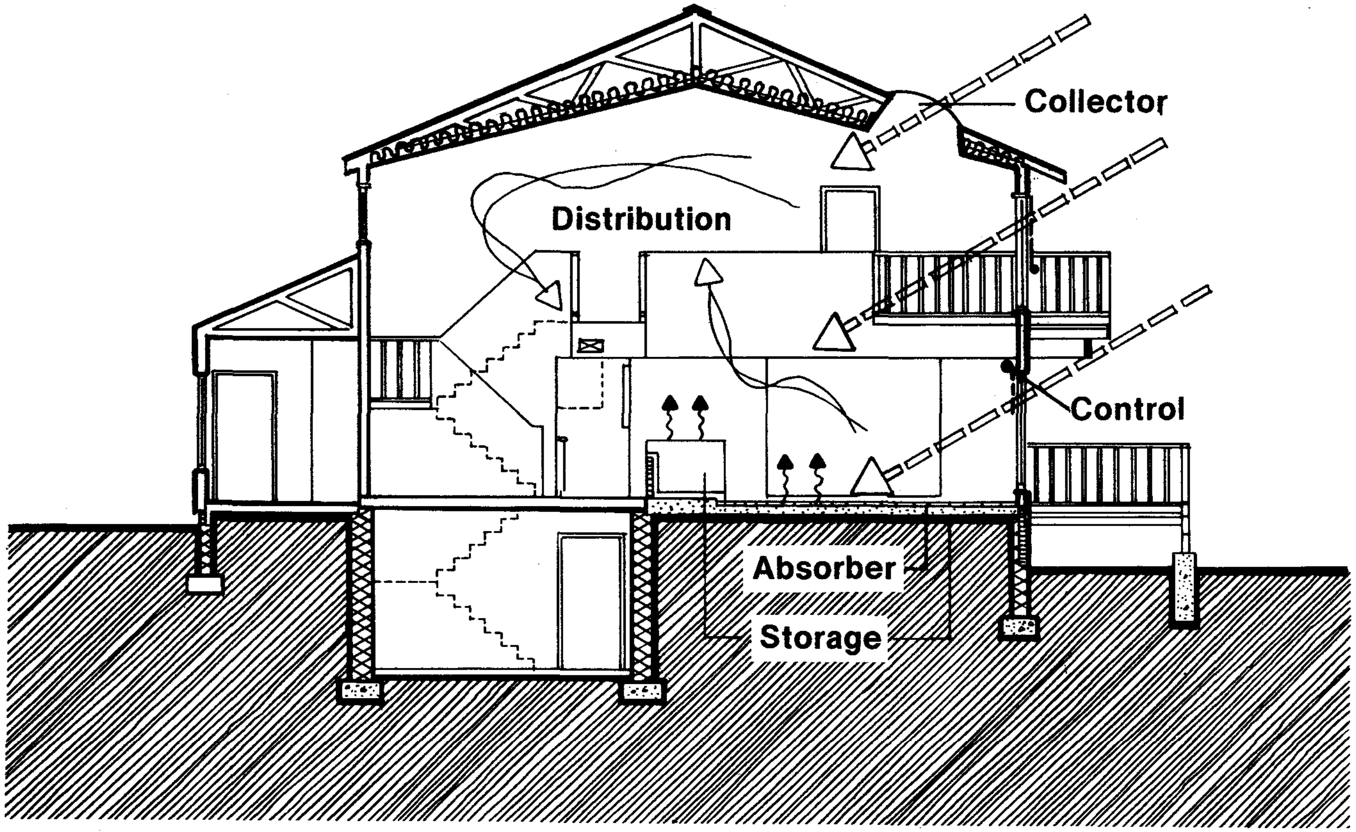
Passive Cooling Type: Earth-cooled air from underground tubes, natural and forced ventilation

This house was built "underground," using the earth for shelter from the elements, and it also uses passive solar features to provide much of its heating requirement.

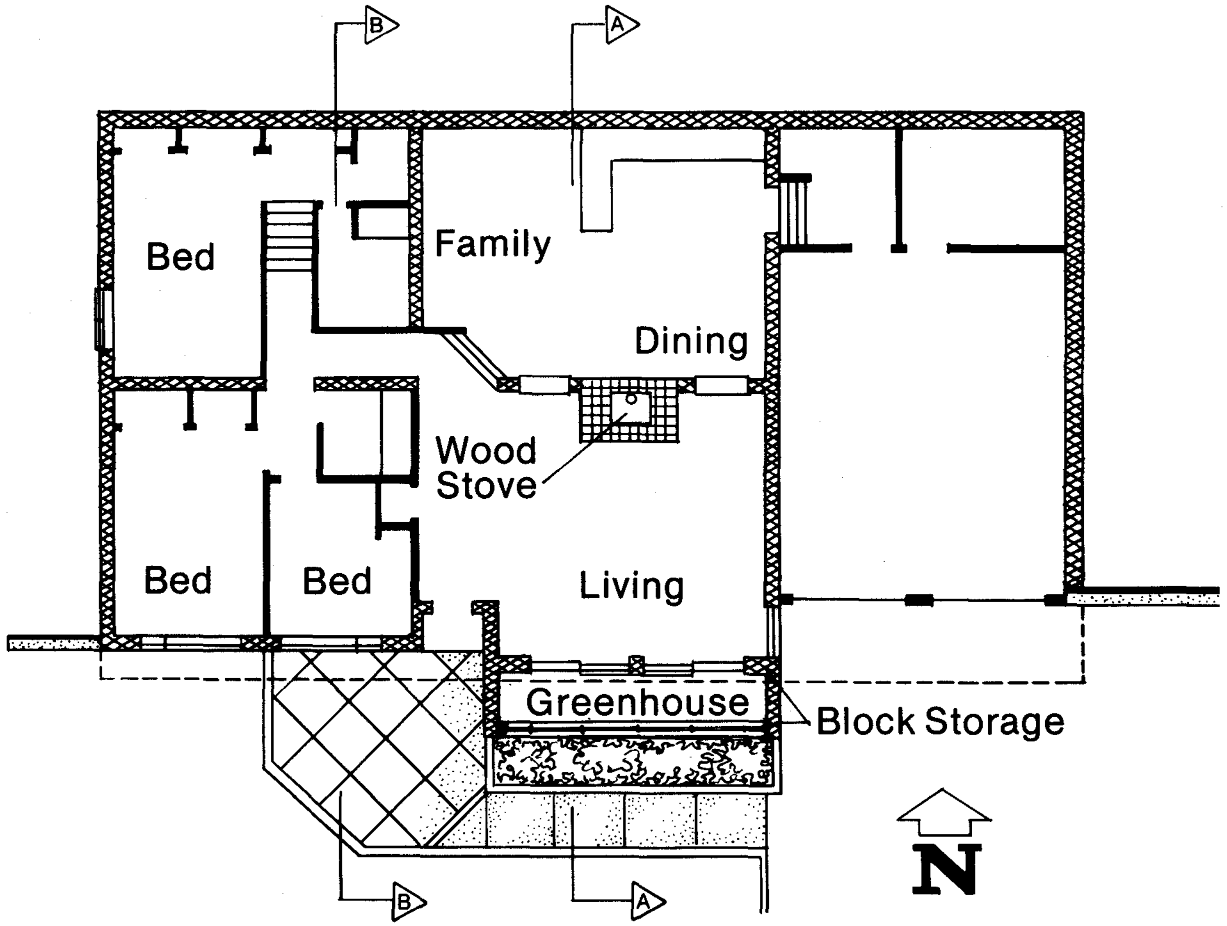
The site is well suited for an earth-sheltered, passive solar house. Located in a custom home subdivision, the 4-acre site is on the south side of a 10 percent grade that also slopes off to both east and west for good drainage. A stand of pine trees, along with a higher hill to the northwest, affords protection from the prevailing northwest winter winds.

To augment the **collection** of solar energy, the house is built on two levels, with the north half higher than the south half. This division permits a row of south-facing clerestory windows for the northern rooms. Sunlight is **collected** through these and a double band of south windows and through

Along the house perimeter, a 1-inch foamboard (R-5) is installed across the face of the first-floor slab and turns under the slab for 2 feet. Finally, all cracks around windows, doors, and exterior corners are hand-chinked prior to insulation to minimize air infiltration into the building envelope.



B-B



the greenhouse, which is on the lower level and in front of the living room. While part of the solar energy warms all of the rooms directly, much of it is **absorbed** and **stored** in the house's internal masonry. The interior north walls of all rooms are stuccoed 12-inch cored concrete block. The roof is stuccoed 8-inch to 12-inch precast concrete with additional 2-inch concrete topping. This **absorbs** solar heat that collects in the rooms by day and is able to **store** most of it because it is underground, not exposed to the elements. The exposed concrete floor slab of the greenhouse also **absorbs** and **stores** solar energy. Heat is distributed from the greenhouse into the living room by convection when the sliding door is opened. There is also a continuous register in the greenhouse ceiling that opens into the hollow cores of the concrete plank roof. Since the cores of the plank run toward a continuous vent on the north rooms (about 4 feet above floor level), heat also flows directly from the greenhouse to these rooms.

At night, heat is **distributed** as it radiates out from the walls and ceiling to warm the rooms. While the greenhouse register and sliding door are closed to isolate it from the house, radiant heat from its floor and walls keeps it warm enough to act as a buffer for the living room. Additional radiant heat can be provided by the centrally located wood stove.

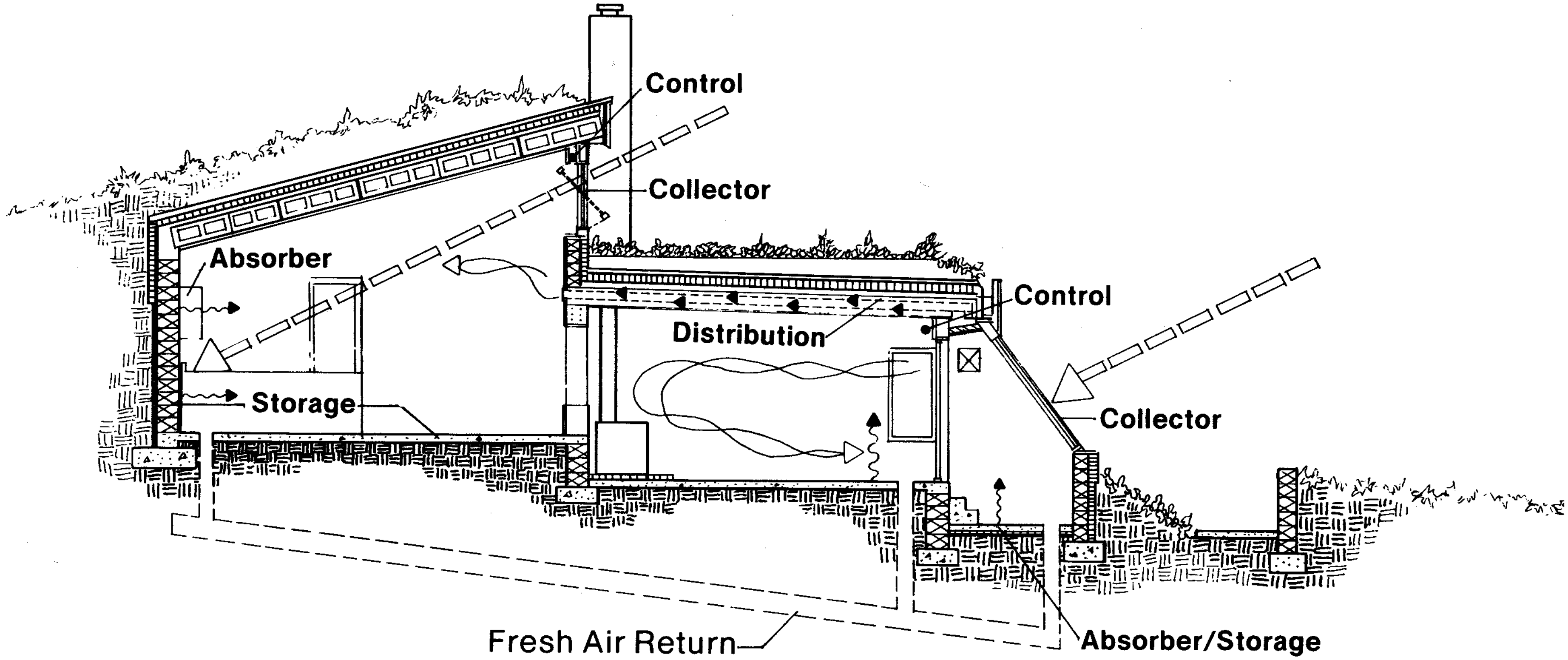
Windows, as well as the sliding glass door at the greenhouse, are double glazed and heat loss through them at night is **controlled** by roll-down interior insulating shades (R-15). The louvers at the clerestory can also be covered at night with moveable insulating panels to **control** heat loss. Glazing for the greenhouse consists of two layers of Teflon® film sandwiched between two layers of crystal glass (R-4). Both entrances are separated from living spaces by air-lock vestibules.

The two roofs overhang the south-facing glazing at both levels to shade the windows from summer sun. Vines are planted at the overhangs and a vine-covered trellis is located at the main entrance in front of the windows. These vines extend the window shading into late summer and early fall to prevent overheating. As solar heating is required, they are trimmed back.

An aluminum slat shade is extended over the greenhouse in summer while ventilation is induced by opening the vents located in the east and west walls; the ventilation is aided by a thermostatically controlled fan. In the main part of the house, a 6-inch diameter buried tube that tempers combustion air for the wood stove in winter also provides low-humidity, earth-cooled air in the summer to both levels of the house. Warm air in the house is absorbed in the thermal mass walls and roofs from where it is absorbed by the earth, which has a nearly constant temperature for natural cooling. Also, any excess warm air is exhausted through fixed louvers in the clerestory by the effects of natural heat rise.

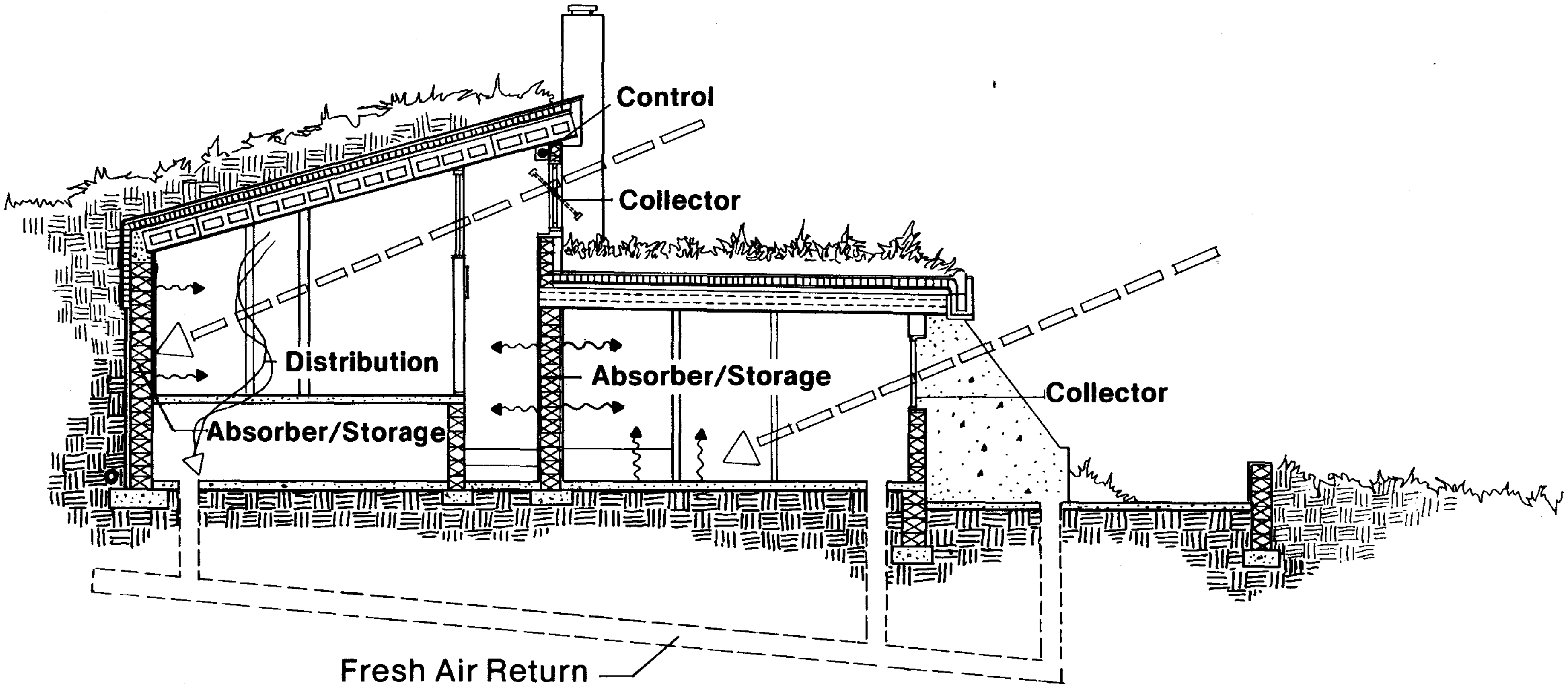
The passive features of the house are augmented by the conservation features of the earth-sheltered design. With 80 percent of the roof and wall surfaces covered with earth, insulation value is inherent. In addition, effects of prolonged cold or warm spells are delayed up to a week, by which time conditions should moderate.

The concrete roof planks with interior stucco and exterior 2-inch concrete are topped by 5 inches of polystyrene insulation, 4 inches of stone, and a minimum of 14 inches of earth for a total average thermal value of R-31. The earth is planted with crown vetch to provide a thick protective ground cover



A-A

which will shade the earth and provide evaporative cooling in the summer. Wall construction is solid concrete block with varying widths of polystyrene insulation applied to the outside of the wall. There is 5-inch insulation down to 8 feet; below that there is 1 inch of insulation. The insulation is covered by a special cement waterproofing. The average wall thermal value is R-23. The exposed south wall has 4-inch polystyrene over block, with stucco finish on both sides (R-23). At the clerestory level, construction is 2- x 6-inch wood frame with full fiberglass batts (R-22). Floors are left uninsulated, except within 3 feet of the south face of the house, to permit the earth mass in contact with it to reach room temperature and serve as a storage area to hold excess heat and moderate the room temperature.



B-B

This plan is from the book
"Passive Solar Homes – 91 new award-winning, energy-conserving single-family homes",
The U.S. Department of Housing and Urban Development, **1982**

The solar homes designs in this book were the winners of HUD's fifth (and final) cycle of demonstration solar homes. The 91 winning home plans in the book were selected from 550 applications from builders.

This was a time of great interest and activity in the passive solar home designs – many of the winning homes show a level of innovation not found in most of today's passive solar designs.