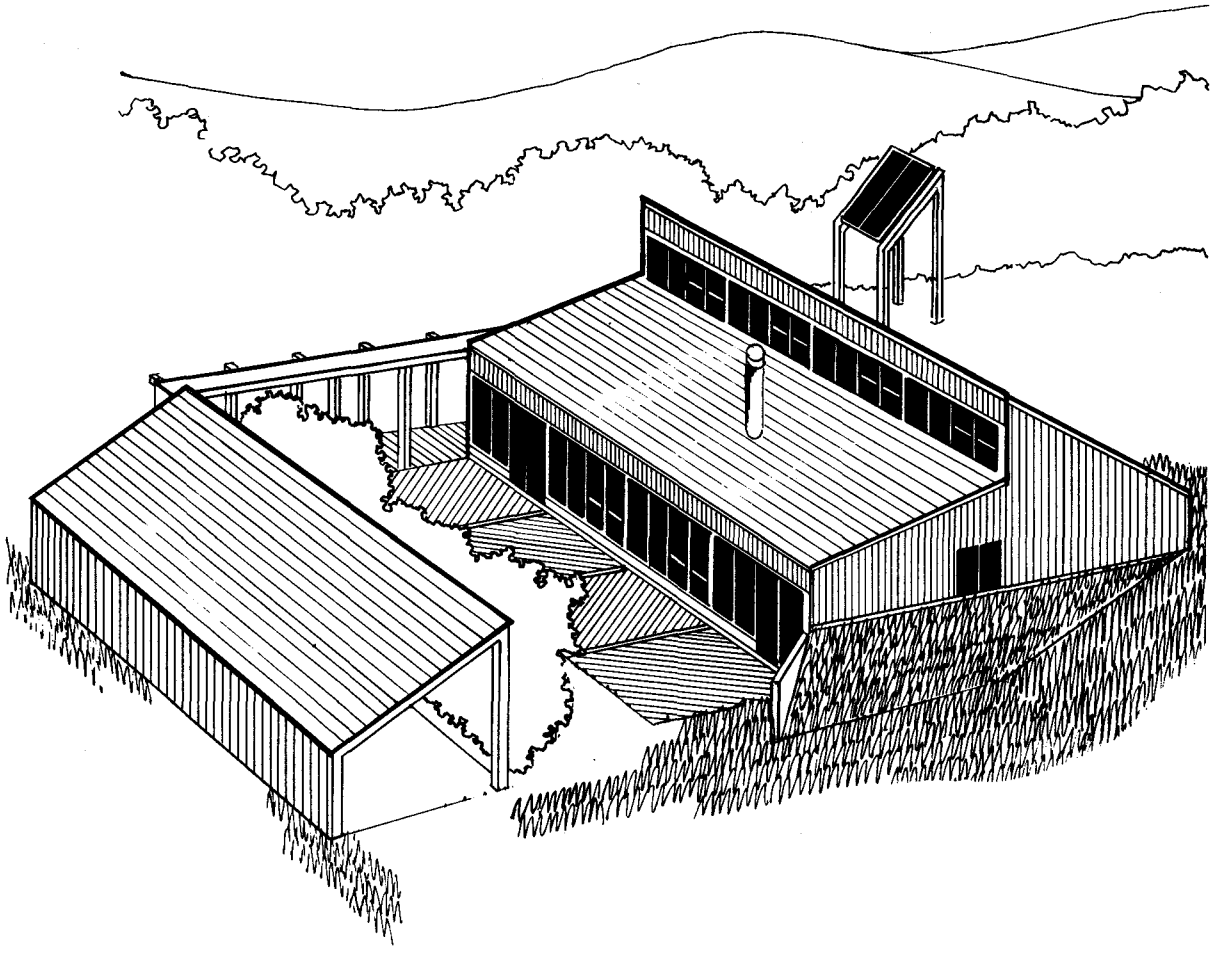
Wytheville, VA



Builder: Bradco Construction Company, Inc., Wytheville, VA

Designer: Chris Umberger, Architect Inc., Wytheville, VA

Solar Designer: Bob Livingstone and Chris Umberger

Price: $75,000

Net Heated Area: 1694 ft²

Heat Load: 77.3 x 10⁶ BTU/yr

Degree Days: 4907

Solar Fraction: 60%

Auxiliary Heat: 3.80 BTU/DD/ft²

Passive Heating System(s): Direct gain

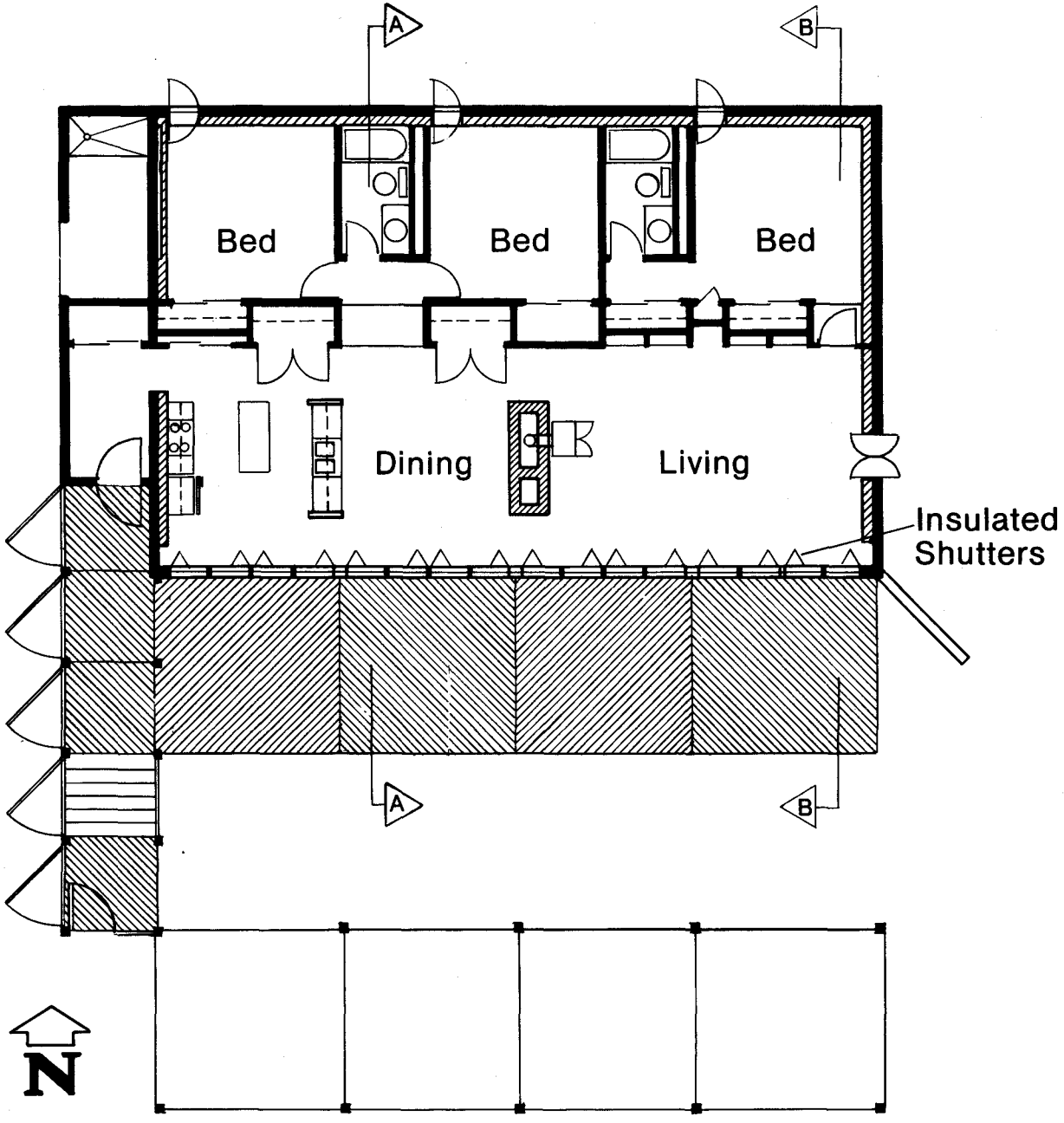
Recognition Factors: Collector(s): South-facing clerestory windows, double-glazed windows, and sliding glass doors, 355 ft² **Absorber(s):** Quarry tile over concrete floor, masonry wall, brick wall **Storage:** Concrete slab floor, masonry wall—**capacity:** 26,286 BTU/°F **Distribution:** Radiation, natural and forced convection **Controls:** Window shutters, canvas awning

Back-up: Air-to-air heat pump (20,000 BTU/H), wood stove

Domestic Hot Water: Liquid flat-plate collectors (49 ft²), 80-gallon storage tank

This contemporary home is located on the south side of a gradual slope. Earth has been bermed on the north and east sides of the house so that the floor level is about 4 feet below grade, giving the house a low profile on those elevations. On the west side, there is a large air-lock vestibule entry, and a storage room that opens only to the outside.

The house is split in two along a central east-west axis. The southern half contains the living areas (living room, dining room, and kitchen) which receive copious solar exposure. The roof over this area slopes up to the north at a 3 in 12 pitch. The sleeping level in the north half of the house is 16 inches higher than the south. All three bedrooms and both bathrooms are located on this side of the house, which has a steep 7 in 12 pitch roof. The different roof slopes enable a string of south-facing clerestory windows to be located above the spine of the house, letting the sun into the bedrooms. Along the north elevation, each bedroom has one small window, while there is but one win-

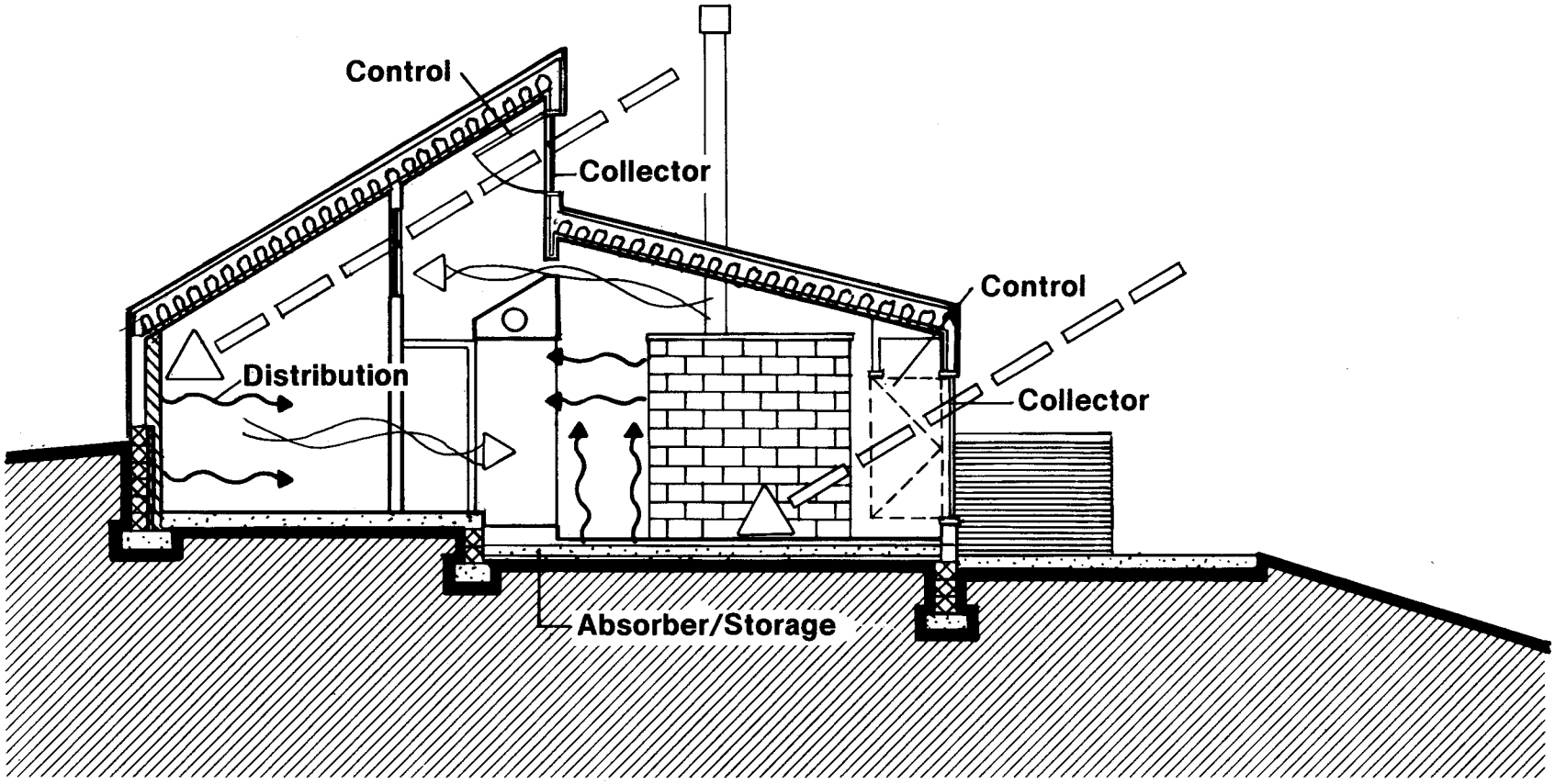


dow on the east elevation. There are no windows on the west to prevent overheating of the interior on late summer afternoons. All glazing is double.

The extensive glazing on the south elevation and the smaller clerestories provide the bulk of the house's natural lighting and heating. Through the array of south-facing glazing, the sun is **collected** during the day to warm the living spaces directly. Much of this solar energy is **absorbed** by the quarry tile and **stored** in the concrete slab floor. Sun shining through the clerestory windows strikes the masonry wall along the north side of the bedrooms and is **absorbed** and **stored**. As the sun progresses from east to west, it also strikes the brick walls on the interior of the kitchen and living room. Heat stored in the slab and the walls is **distributed** as it radiates to the rooms throughout the evening. The warmth of the slab also induces convection currents to **distribute** heat throughout the house, easing temperature variations between different rooms. Through vents located high on the north wall of the kitchen, dining room, and living room, heated air is drawn and moved to hollow walls between the bedrooms and bathrooms.

Nighttime heat loss through each window is controlled by an interior shutter that consists of a 1-inch thick piece of polystyrene encased in wood. When closed, the shutter gives the window opening a thermal value of R-7.

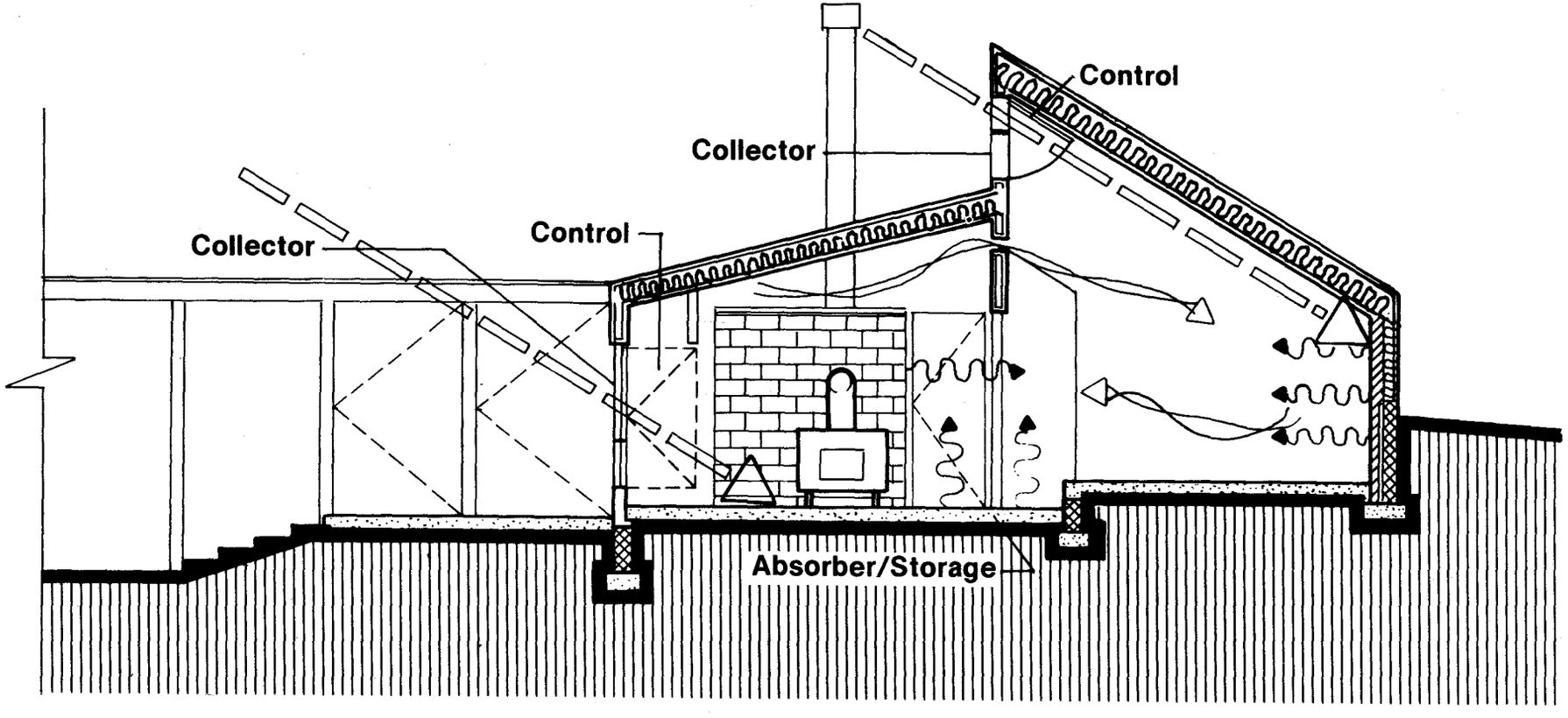
In the summer, a canvas awning is extended to shade the south windows, but not the clerestories, from the sun. All windows are opened to let in breezes, which come from the southwest. The clerestory window shutters can be closed 80 percent during the summer to reflect most of the heat while still permitting ventilation through the open window. As cooler air enters the house from outside, the heat rises and exhausts through the clerestories.



A-A

To preheat incoming city water for household use, there are two liquid flat-plate solar collectors. These are ground mounted on a frame at a 45 degree slope and attached to a concrete pad.

The house construction is very effective for this climate. Ten-inch fiberglass batts are installed in the roof framing for a value of R-33. The wall construction consists of a 6-inch wood frame wall, filled with fiberglass-batts and finished with wood sheathing and plywood siding. Inside the framing is an 8-inch thick solid brick wall along the north, east, and west elevations. The thermal value of this combination is R-24. Below grade, wall construction changes to an 8-inch block with concrete-filled cores, 2-inch polystyrene insulation, and 4-inch solid brick (R-11). The floor is a 4-inch concrete slab with a 1-inch polystyrene thermal break between it and the foundation wall. There is also a layer of 1½-inch polystyrene insulation below slab within 2 feet of the foundation.



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.