18 million hectares of land and over 5900 homes destroyed.

33 deaths and a projected 480 million Australian animals lost.

Australian regional culture and connection with bush landscape

Unaffordable housing market in cities

COVID19
The selected site sits within a High-risk Bushfire Zone, requiring specific design strategies to compensate for this risk. The site is situated on a North-facing slope adjacent to the Murrah River, providing optimal solar access, prevailing onshore winds and ideal views. The climate is Australian Zone 6, which means that it has a mild temperate climate with a low diurnal temperature range typical of coastal areas like our site. According to the Australian Bureau of Statistics, “Zone 6 has four distinct seasons, summer and winter can exceed human comfort range” with temperatures as low as the high-30s Fahrenheit in winter and as high as 100 degrees Fahrenheit in summer. The typical pattern is for cold and dry winters with hot and dry summers, while autumn and spring are very comfortable moderate temperatures.

The coastal location does tend to keep temperatures cool at night even in summer. The proximity to the coast also provides steady and constant breezes with prevailing wind blowing northeast. The local climate, combined with excellent exposure to natural sunlight and wind, makes the site ideal for passive heating and cooling and locally generated energy.
MATERIALS

1. Rammed Earth
2. Corrugated Iron
3. Gabion Wall
4. Timber (Spotted Gum) Framed Windows
5. Polished Concrete

East Elevation 1:100

North Elevation 1:100
### Slab

<table>
<thead>
<tr>
<th>Type</th>
<th>Internal to External</th>
<th>Total Thickness</th>
<th>Total R Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>On-ground Concrete Slab &amp; Insulation</td>
<td>External to Internal</td>
<td>225mm (8 3/4 inch)</td>
<td>3.4</td>
</tr>
<tr>
<td>Off-ground Concrete Slab &amp; Insulation</td>
<td>External to Internal</td>
<td>288mm (11 1/3 inch)</td>
<td>4.6</td>
</tr>
<tr>
<td>Off-ground Timber Deck &amp; FC Sheeting</td>
<td>External</td>
<td>120mm (4 3/4 inch)</td>
<td>N/A</td>
</tr>
<tr>
<td>Bega Scrap Metal Recyclers Bega Timber Bega Landscape Supplies Inspirations Paint Bega</td>
<td></td>
<td></td>
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</table>

### Wall

<table>
<thead>
<tr>
<th>Type</th>
<th>Internal to External</th>
<th>Total Thickness</th>
<th>Total R Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rammed Earth &amp; Insulation</td>
<td>External to Internal</td>
<td>450mm (17 3/4 inch)</td>
<td>4</td>
</tr>
<tr>
<td>Rammed Earth, Insulation &amp; Plasterboard</td>
<td>External to Internal</td>
<td>465mm (18 1/3 inch)</td>
<td>5</td>
</tr>
<tr>
<td>Rammed Earth, Insulation &amp; Ceramic Tile</td>
<td>External to Internal</td>
<td>486mm (19 inch)</td>
<td>5</td>
</tr>
<tr>
<td>Corrugated Metal, Insulation &amp; Plasterboard</td>
<td>External to Internal</td>
<td>220mm (8 1/2 inch)</td>
<td>4.8</td>
</tr>
<tr>
<td>Plasterboard, Insulation &amp; Plasterboard</td>
<td>Internal</td>
<td>176mm (7 inch)</td>
<td>5.2</td>
</tr>
<tr>
<td>Gabion Retaining</td>
<td>External</td>
<td>155mm (6 inch)</td>
<td>N/A</td>
</tr>
<tr>
<td>Tasman Glass &amp; Windows Pambula Tiles</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Roof

<table>
<thead>
<tr>
<th>Type</th>
<th>External to Internal</th>
<th>Total Thickness</th>
<th>Total R Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Corrugated Metal, Insulation &amp; Plywood</td>
<td>External to Internal</td>
<td>370mm (14 1/2 inch)</td>
<td>6.1</td>
</tr>
<tr>
<td>Green Roof, Insulation &amp; Fibre Cement Sheeting</td>
<td>External</td>
<td>340mm (13 1/3 inch)</td>
<td>3</td>
</tr>
</tbody>
</table>
1. Extended roof eaves to protect from harsh sun.
2. The butterfly roof collects rainwater and feeds to a rooftop garden or a retention pond.
3. The rooftop garden consist of native, fire-responsive plants.
4. The planning of the house allows for passive ventilation.
5. The rentention ponds allow for passive cooling.
6. Concrete slabs with in-slab heating allow for passive heating.
7. The house uses simple, iconic Australian materials.
8. The verandah also acts as a fire shutter.
9. The Southerns walls are made from rammed earth, which is fire proof and has good insulative properties.
10. Photovoltaic panels sit on the roof to gain maximum solar intake.
D.01
1. Colourbond Custom Orb Metal Sheet Roofing
2. 310 x 40mm (12 x 1.5 inch) Universal Beam
3. 450 x 54mm (18 x 2 inch) Universal Beam
4. Water Proof Membrane
5. 250mm (10 inch) Recycled Plastic Insulation
6. 13mm (1/2 inch) Plywood
7. Breezeway Aluminium Louvre
8. 450 x 20mm (17 3/4 x 3/4 inch) Steel Plate

D.02
1. 150mm (6 inch) Rammed Earth
2. 150mm (6 inch) Recycled Plastic Insulation
3. 150mm (6 inch) Rammed Earth
4. 150mm (5 inch) Low Carbon Concrete Slab with In-slab Heating
5. Water Proof Membrane
6. 100mm (4 inch) Recycled Plastic Insulation
7. 50mm (2 inch) Clean Sand (fire)
8. Concrete Footing & Pile

D.03
1. 100mm (4 inch) Gravel
2. 50mm (2 inch) Clean Sand
3. 25mm (1 inch) Activated Charcoal
4. 15mm (3/4 inch) Filter Material
5. 50mm (2 inch) Steel Drainage Channel
6. Water Proof Membrane
7. 90 x 45mm (3 1/2 x 1 3/4 inch) Timber Studs
8. 50mm (2 inch) Recycled Plastic Insulation
9. 13mm (1/2 inch) Fibre Cement Sheeting

D.04
1. 90 x 90mm (3 1/2 x 3 1/2 inch) Square Hollow Section Column
2. Timber Decking
3. 90 x 75mm (3 1/2 x 3 inch) Universal Beam
4. 13mm (1/2 inch) Fibre Cement Sheeting

D.05
1. Colourbond Custom Orb Metal Sheet Roofing
2. 310 x 40mm (12 x 1.5 inch) Universal Beam
3. Fold-up Gear Mechanism
4. Breezeway Glass Louvre
5. 100 x 45mm (4 x 3/4 inch) Steel Profile
6. Hinged Fire Shield
7. 310 x 40mm (12 x 1.5 inch) Universal Beam & 300mm (12 inch) Parallel Flange Channel
8. Fold-up Gear Mechanism

D.06
1. Triple Glazed Fixed Window & Sliding Door
2. 125mm (5 inch) Low Carbon Concrete Slab with In-slab Heating
3. 150mm (6 inch) Recycled Plastic Insulation
4. 13mm (1/2 inch) Fibre Cement Sheeting
5. Timber Decking
6. 90 x 75mm (3 1/2 x 3 inch) Universal Beam
7. 13mm (1/2 inch) Fibre Cement Sheeting
In addition, the house is designed to meet bushfire threats common in the area. It meets the strict BAL FZ (Flame Zone) Requirements which designs for direct exposure to flames as well as heat flux and ember attack.

We also envision the house to be part of a wider community response to bushfire threats; it will be equipped with sensors to provide information for fire warning and monitoring.
About the rating

NatHERS software models the expected thermal energy loads using information about the design and construction, climate and common patterns of household use. The software does not take into account appliances, apart from the airflow impacts from ceiling fans.

Verification

To verify this certificate, scan the QR code or visit hstar.com.au/QR/Generate?p=AsKmaROWz. When using either link, ensure you are visiting hstar.com.au.

National Construction Code (NCC) requirements

The NCC’s requirements for NatHERS-rated houses are detailed in 3.12.0(a)(i) and 3.12.5 of the NCC Volume Two. For apartments the requirements are detailed in J0.2 and J5 to J8 of the NCC Volume One. In NCC 2019, these requirements include minimum star ratings and separate heating and cooling load limits that need to be met by buildings and apartments through the NatHERS assessment. Requirements additional to the NatHERS assessment that must also be satisfied include, but are not limited to: insulation installation methods, thermal breaks, building sealing, water heating and pumping, and artificial lighting requirements. The NCC and NatHERS Heating and Cooling Load Limits (Australian Building Codes Board Standard) are available at www.abcb.gov.au.

State and territory variations and additions to the NCC may also apply.

* Refer to glossary.

Generated on 20 Feb 2022 using BERS Pro v4.4.1.5 (3.21) for 2964 Tathra Bermagui Road, Murrah, NSW, 2546 Page 1 of 7

### Compliance Requirements for New Single Dwelling in NSW

<table>
<thead>
<tr>
<th>HEATING LOAD</th>
<th>COOL LOAD</th>
<th>STAR RATING</th>
</tr>
</thead>
<tbody>
<tr>
<td>On-ground Concrete Slab</td>
<td>73.5</td>
<td>31.5</td>
</tr>
<tr>
<td>Off-ground Concrete Slab</td>
<td>78.4</td>
<td>34.6</td>
</tr>
<tr>
<td>Approximate for our Dwelling</td>
<td>75</td>
<td>32.5</td>
</tr>
</tbody>
</table>

Loads Achieved for New Single Dwelling in NSW

<table>
<thead>
<tr>
<th>HEATING LOAD</th>
<th>COOL LOAD</th>
<th>STAR RATING</th>
</tr>
</thead>
<tbody>
<tr>
<td>For our Dwelling</td>
<td>16.9</td>
<td>7.8</td>
</tr>
</tbody>
</table>

Energy performance was assessed using the Nationwide House Energy Rating Scheme (NatHERS). This allowed for the assessment of thermal comfort of the home without any other energy systems. Establishing the compliance energy targets that need to be met by each new single residential dwelling was done using the 2020 BASIX Thermal Comfort Protocol as the NCC 2019 Amendment 1 describes as necessary for all NSW, Australia dwellings. The assessment was carried out in BERS Pro v4.4.1.5 which is one of the approved NatHERS softwares and the modelling was done in accordance with the NatHERS assessor handbook and NatHERS technical notes.

Strategies used to reduce the overall heating and cooling loads were using high amounts of insulation in the walls, ceiling, roof as well as the floor, both suspended and slab on ground concrete. Also, the use of low u-values and varying SHGC values that is consistent with triple glazing provided great overall thermal performance for the building. Eave lines and shading devices were also considered based on the need for daylight to come through while still providing shading where needed.
To contextualise the building in its proposed environment, we uploaded a model into Cove Tool and benchmarked the design against the ASHRAE Residential 2018 Energy Code. We assumed that the house would be un-occupied between the hours of 8am and 4pm, and half occupied between 4 and 6pm to represent a typical school and work schedule for a 4-person family. Moreover, analysis was completed at a height of 1.5m above ground-level to achieve results relevant to the experience of occupants. As a unit, it performs exceptionally well in both its purpose to be a space for comfortable environmental living and a benchmark for sustainable single family home design.

The house boasts a People Outdoor Area Rate of 12.5 L/S/P, which exceeds the minimum requirements of the Passivhaus and Green Star Standards by 50%. Additionally, it being fitted with daylight and occupancy sensors understands when power usage can be reduced or stopped completely to minimise yearly CO2 emissions and electricity costs. According to figures provided by Ausgrid, the sum of wattage required for appliance use in our house during unoccupied hours is 310 kWh/yr (fridge) and 730 kWh/yr (Heat Pump hot water system). When occupied, assuming half the house is lighted at any one time during ALL occupied hours, we end up with an appliance use figure of 5.54 W/m² or 0.515 W/ft².
New South Wales has one of the most expensive housing markets in the world; according to The Urban Developer, the city of Sydney’s median house price is $1.3 million AUD, while the median house price for the region on the South Coast where our site is located is between $820,000 AUD and $830,500 AUD for a 3-bedroom house. Propelled by the pandemic and the population flight from the city, the South Coast has become a new lifestyle hot spot. Its idyllic locations in untouched native bush, near the coast, coupled with temperate climate, have made it extremely popular in the last two years.

The cost of a block of land on the South Coast varies but it is possible to purchase residential blocks for $200,000 AUD in the area where our site is located. Combined with our project construction costs of $150,000, this would make the total cost $350,000 plus any site work, which is within reach of the average resident. Weekly repayments would be about $255 - $280 AUD as opposed to average $711 AUD weekly mortgage repayments on an existing house. This means our design makes housing more easily attainable for the average Australian family.

Our proposal is even more attractive when the current state of the for-purchase market in our area is considered: there are very few existing houses for sale. Bermagui has only 4 houses for sale that are a comparable size at the moment and Tathra has 3. There is more vacant land for sale, especially when locations outside the towns are taken into account.