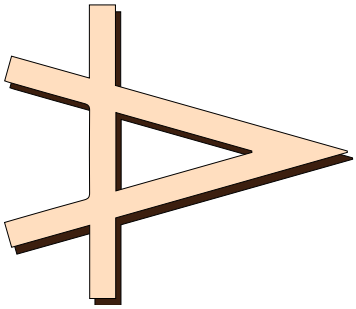
MUSKEGON RIVER
RESIDENCE

BACK ROW STUDIO
SINGLE FAMILY SUBURBAN
FERRIS STATE UNIVERSITY



NATIVE AMERICAN ROCK ART SYMBOLISM
"TIME TO CHANGE"

VITALITY:
PROVIDING POWER AND ENERGY TO THE CONTINUANCE OF LIFE

LOT 40, FOXGLOVE CIR.
BIG RAPIDS, MI 49307
$298,088 w/o Renewables
Construction Cost: $200/SF

3 Bed | 2.5 Bath
1789 SF | 1.59 Acres

$366,790

PROJECT DATA
- HERS Index Score: 30 | w/ Renewables: -3
- R-Values: Wall R-37 | Foundation R-36 | Attic R-75
- U-Values: Triple-Paned Windows U-0.23
- SHGC: 0.45 South | 0.24 Other
- Ground Source Heat Pump: SEER 22 | EER: 20-30
- Solar Array: 25 kWh/day | 9,125 kWh annually | 20 Panels
- Hydroelectric: 28.8 kWh/day | 10,512 kWh annually
- Hot Water: 30% Solar |16% Desuperheater | 54% Electric

PROJECT SUMMARY

Back Row Studio is one of three teams competing from Ferris State University, a public institution located in Big Rapids, Michigan. Team members include Ian Wardowski, Brooke Mehney, Tanner Fein, and Jacob Hudson, all aspiring to receive a Bachelor of Science degree in Architecture. By choosing to design a single-family, suburban home centered around sustainability, the project will hopefully help enhance team member's abilities to implement environmental strategies in future professional careers.

The Muskegon River Residence, located in Big Rapids, MI, allows access to affordable and sustainable design solutions in a middle-class market. By keeping costs around a target of approximately $200/SF, the 2 story, 1,789 SF home provides an attainable option for sustainable living in a challenging climate. The project is slated to stand the test of time and adapt to current and future owners' needs. Highly efficient and innovative design strategies are powered by renewable energy to display the potential of the residential built environment per requirements specified in the DOE Zero Energy Ready Home standards and the HERS Index. Muskegon River Residence will consist of the following: 3 bedrooms, 2.5 bathrooms, a basement (finished and insulated) with laundry and utility space, a kitchen with dining accommodations, a living room, a carport, a greenhouse, and ample storage spaces.

DESIGN CONCEPT

The Muskegon River Residence begins with the concept of vitality, providing power and energy to the continuance of life. Vitality is met by creating a strong centralized space that represents and supports a family environment. This concept is complimented with a parti pris rooted in Native American rock art symbolism meaning "time to change." The meaning of the symbol is that success can only become possible through change; sustainable living can only be achieved through changing the way residences are designed. Sustainable design approaches building orientation with innovative planning and passive strategies in mind, and develops massing using sustainability as a form giver. Environmental strategies, including solar arrays, geothermal space conditioning, and rainwater collection, bolster the goal of a net zero home and generate the resources needed to fuel the continuance of life.

PROJECT HIGHLIGHTS

Architecture
The Native American rock art symbol meaning “time to change” inspires the utilization of indigenous beliefs while fueling the progression of life. Indigenous people believe all things are related; this translates into the built environment’s need to be one with the natural world. This idea can be met through promoting minimal waste by using modular construction techniques and implementing passive energy strategies. All these tactics ease environmental impact and create a comfortable family environment providing vitality to life.

Engineering
The structure’s engineering systems will reduce energy consumption while maintaining a comfortable and affordable home. To keep the building comfortable, a ground source heat pump will be utilized to heat and cool the building. To reduce resource consumption, rainwater will be collected, filtered, and reused by the occupants for irrigation. The geothermal desuperheater and solar hot water system pretreat water to reduce energy consumption and operation of the water heater.

Market Analysis
Nurturing a family environment is of the utmost importance. Open concept planning and proximity to lifelong education institutions help supply vitality to the family environment. Construction costs have been set to approx. $200/SF achieving the total cost of $366,789.17. A reduced total cost can be achieved using modular construction techniques which lessen material cost and lessen job site waste.

Durability & Resilience
A high-performance building envelope, paired with air and moisture barriers penetrated solely by high performance openings, will efficiently seal the home against adverse climate conditions found in IECC Climate Zone 6A. To ensure the building’s performance during a grid failure, the home will rely on stored energy sources to sustain the building. Additionally, engineered drainage will combat the minimal flood risk due to the site’s adjacency to the Muskegon River.

Embodied Environmental Impact
Reduction to the building’s embodied environmental impact can be achieved through in depth, research, extraction, production, transportation, and use of a material. Minimal embodied energy can be accomplished by local sourcing, market ready alternatives, or recycled options. The project executes this through utilization of local industries as well as stock materials and fixtures.

Integrated Performance
The passive and active renewable energy strategies, and the engineering they require, will be combined seamlessly with the architectural design. This integration exploits passive architectural strategies, like building orientation and solar gain, with engineered mechanical solutions, such as a rainwater collection and irrigation system. Additionally, a ground source heat pump will pretreat water for heating and provide space conditioning requirements.

Occupant Experience
The occupants’ experience is enhanced by the project’s open concept plan which focuses on the hierarchy of spaces and the interaction between them. Additionally, the project is enriched by the surrounding thick wooded areas and views of the Muskegon River. To further improve the occupants’ experiences, low maintenance equipment and cost-effective materials alleviate user expense by reducing initial and operational cost.

Comfort and Environmental Quality
To successfully achieve occupant comfort, the building’s HVAC system and passive design strategies will respond to the building’s heating and cooling needs. To ensure acceptable noise levels in occupied spaces, the home will contain acoustical materials that reduce noise transmission between spaces.

Energy Performance
The home will reach net-zero energy consumption by achieving a HERS rating below 0 through passive and renewable strategies. The required energy reduction will be achieved through high performance glazing and a tight thermal envelope. Remaining energy will be generated through photovoltaic panels and a hydroelectric generator that provides clean power to the home.