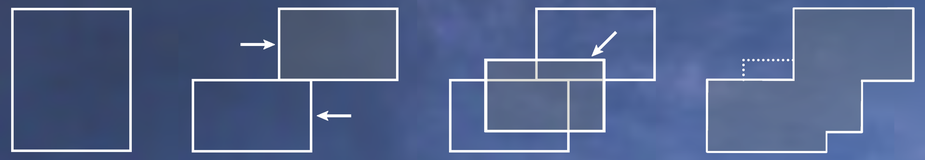
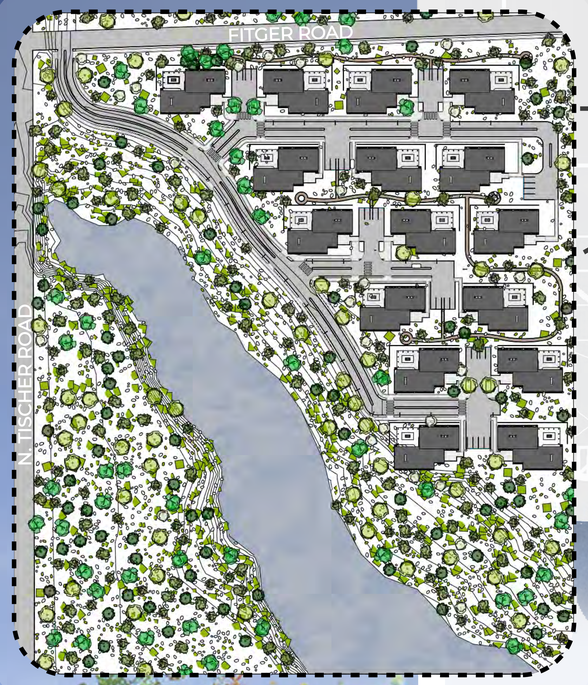
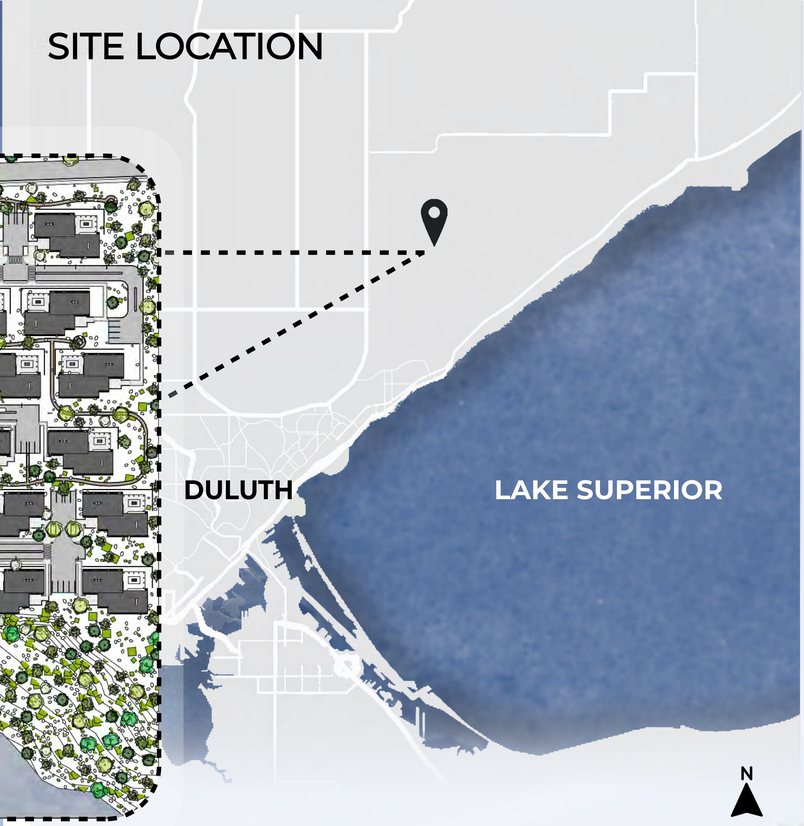
# HEALTHIER HOMES

## INTEGRATING EMERGING DESIGN STRATEGIES INTO AFFORDABLE HOUSING






The different kinds of materials used within homes can have a significant impact on a person's health. At least half of a person's life is spent inside their house, meaning the materials used to construct housing should be healthy. It is especially important to note the types of materials being used when designing affordable housing. Many users of affordable housing belong to vulnerable groups such as children, people with disabilities, and the elderly. It is important that healthy and sustainable housing is accessible to people of all income levels.

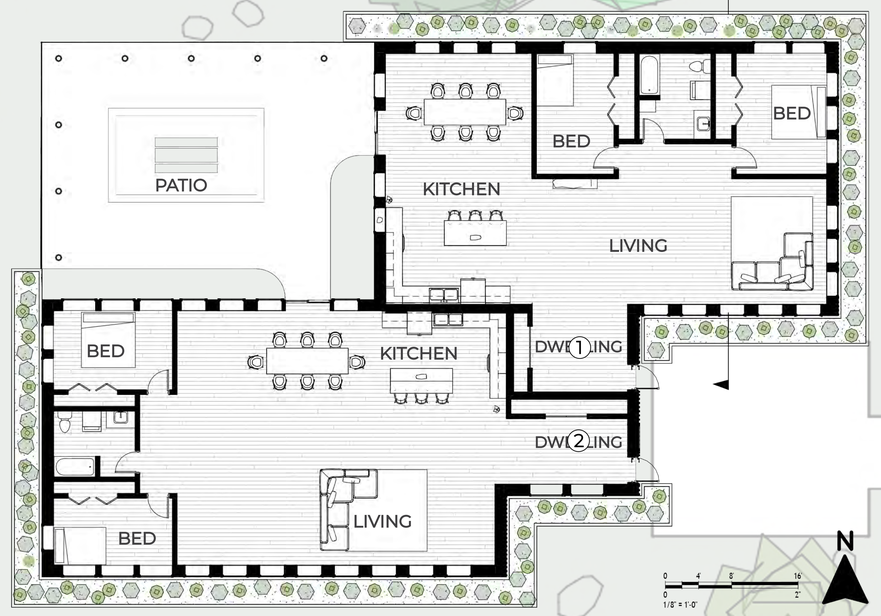
This thesis explores different sustainable materials and practices and how to integrate those practices into an affordable housing development in Duluth, Minnesota. As the need for affordable housing grows, integrating healthier building materials and sustainable design into affordable housing must become a more common practice. It is important that sustainable design be inclusive to people of all income levels, as it is the architect's responsibility to help protect the health, safety, and welfare of the public regardless of socioeconomic status.

SHARED OUTDOOR SPACE




# FLOOR PLAN

Each dwelling shares the same floor plan and has access to the same amount of southern sunlight. The sharing of walls saves costs on plumbing, heating/cooling, and materials.




# AFFORDABLE STRATEGIES

1. **PREFABRICATED CONSTRUCTION** is when parts of a building are manufactured in advanced off site, and brought to the site afterwards to be assembled into a building. Using prefabricated construction helps make home building more efficient and affordable, reduces waste, and is environment-friendly.

*PREFABRICATED HEMPCRETE WALL PROCESS*

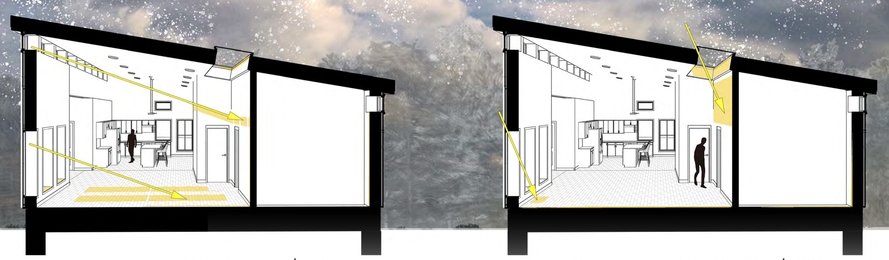
2. The **MASS CONSTRUCTION** of the same dwelling type helps lower costs and increase efficiency. Since a large amount of dwellings will be constructed, buying materials in bulk will help lower material cost.

3. The **REUSE** of wood from the excavated trees will create pathways and garden beds out of mulch. The wood from these trees is also used to construct the fencing surrounding each of the dwellings.

4. **SLAB-ON-GRADE FOUNDATION** is a type of foundation in which the concrete is poured directly into a mold in the ground. This foundation type reduces the amount of $CO_2$ produced during production and delivery of materials, as well as provides good insulation.

5. **THERMAL MASS** is the ability of a material to absorb, store, and release heat. Thermal mass is used within the floors and the walls of the dwellings. Hempcrete walls will store energy and release it slowly for hours afterwards, making it an excellent product for thermal mass.

# SECTION PERSPECTIVES



WINTER SOLSTICE | 19°

SUMMER SOLSTICE | 62°

# HEALTHY BUILDING MATERIALS

CARBON NEGATIVE · NATURAL MATERIAL · RECYCLABLE · AFFORDABLE

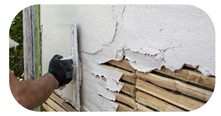
### HEMPCRETE - *INSULATION*

Hempcrete is created by mixing hemp, water, and lime. This material is a good insulator, fire proof, and absorbs a large amount of carbon from the atmosphere during its growth, production, and even while it is sitting in the wall.

Since this insulation breathes, it is not necessary to include a vapor barrier as long as the finishes on the interior and exterior are breathable as well to allow water to evaporate.

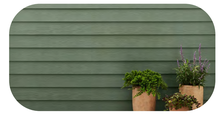
### LIME PLASTER - *INTERIOR FINISH*

Lime plaster is a natural and breathable finish material that is lightweight, flexible, and crack resistant. Lime plaster is also carbon-neutral as lime absorbs carbon dioxide as it sets. This material can be recycled to create new lime plasters and mortars.



### ENGINEERED WOOD - *SIDING*

Engineered wood is made from sustainable, biodegradable scrap wood. While it is not as sustainable as 100% wood, it is more sustainable than siding made from 100% plastic. This material choice is a good balance between sustainable and affordable.

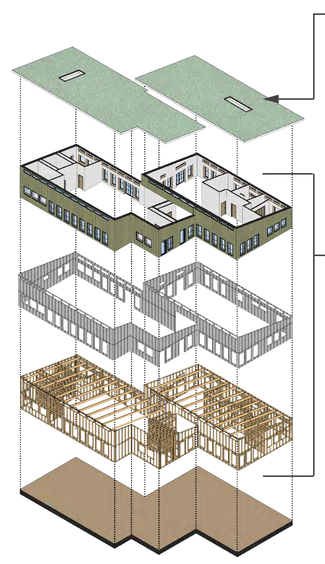


### CONCRETE - *MONOLITHIC SLAB-ON-GRADE*

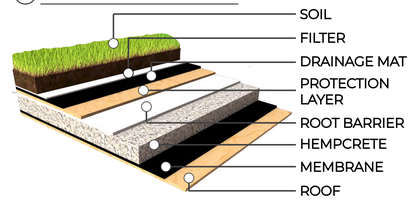
A monolithic slab-on-grade foundation is simple, quick, and cost-effective for construction. This concrete slab will also act as a thermal mass floor which will help to heat/cool the dwelling.

# BUILDING SYSTEMS

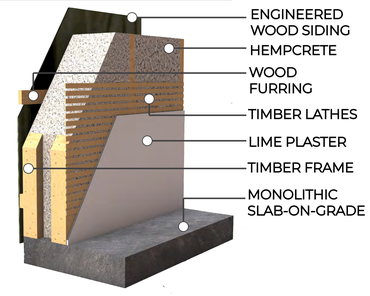
These are two sustainable systems used within the construction of the dwellings.



### 1 GREEN ROOF SYSTEM



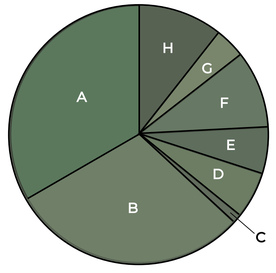

### 2 PREFAB MODULAR WALL WITH NATURAL MATERIALS




# COST ESTIMATE

Estimate includes materials and installation. The median price of each product was taken and multiplied by the amount of that material in the project

- A GREEN ROOF SYSTEM $108,495.00
- B GLAZING (DOUBLE PANE, LOW-E) $97,440.00
- C DOUBLE STUD WALL (2X4) $2,920.20
- D HEMPCRETE INSULATION $18,930.00
- E ENGINEERED WOOD SIDING $19,354.59
- F LIME PLASTER WALL $31,833.20
- G GYPSUM WALL BOARD $12,458.52
- H MONOLITHIC SLAB-ON-GRADE FOUNDATION $35,199.00




ROUGH ESTIMATE TOTAL:
$326,631.51
or
$163,315.75 / family unit