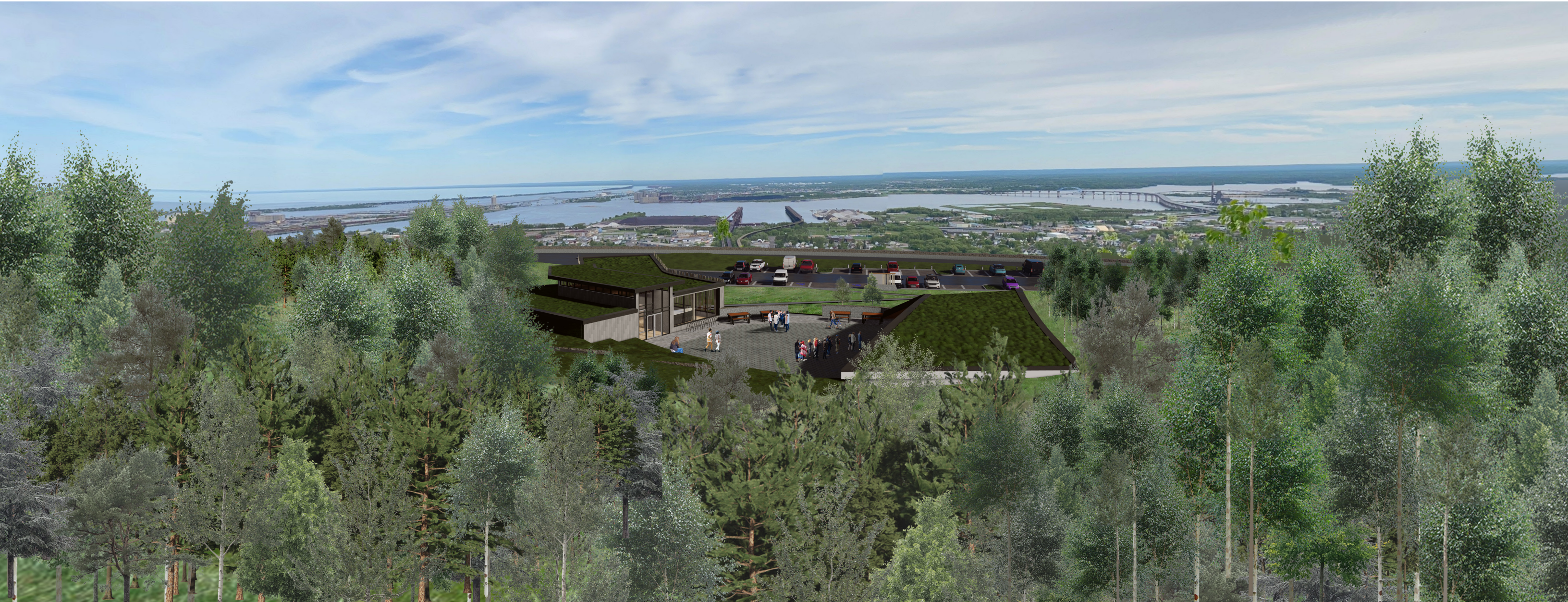


A Trail Center Reimagined: An Intrinsic Relationship Between Architecture and the Natural Environment

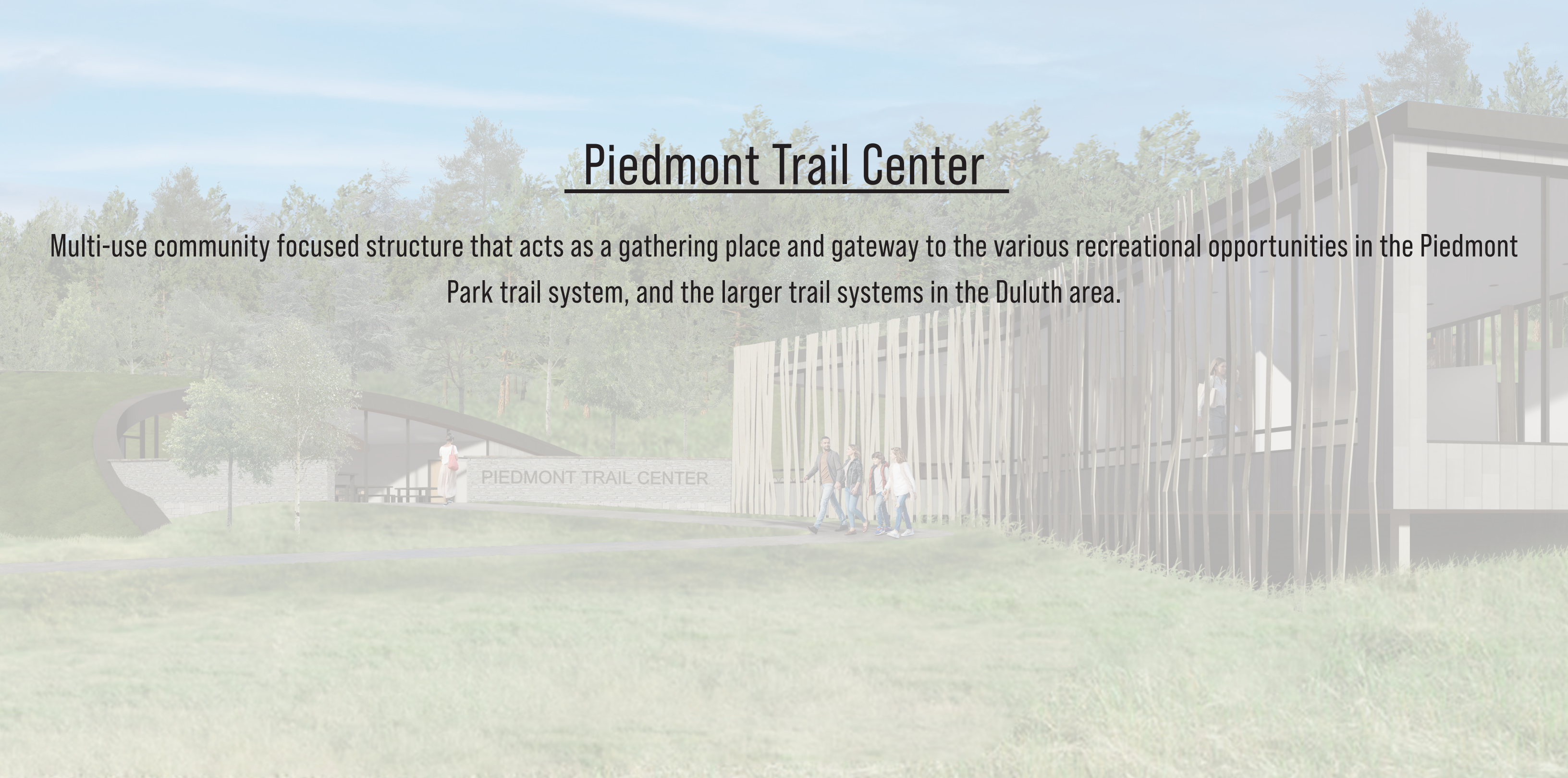


Joseph Berens
NDSU 2022

Utilizing the natural landscape as a primary design influence enable a more connected, built architecture that is deeply intertwined with its surrounding environment.

Piedmont Trail Center

Multi-use community focused structure that acts as a gathering place and gateway to the various recreational opportunities in the Piedmont Park trail system, and the larger trail systems in the Duluth area.





a Pelican Book

Before Philosophy

The Intellectual
Adventure
Of Ancient Man

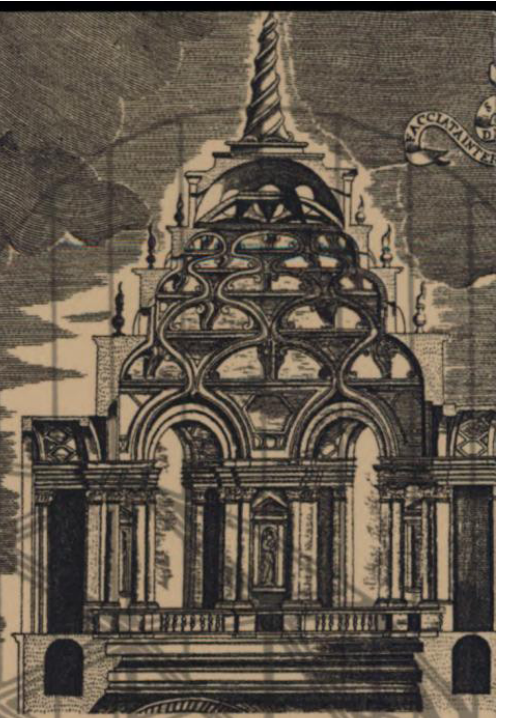
Henri Frankfort
Mrs H. A. Frankfort
John A. Wilson
Thorkild Jacobsen



CHORAE THREE

INTERVALS IN THE PHILOSOPHY OF ARCHITECTURE

Edited by
Alberto Pérez-Gómez
and Stephen Parcell



...inches by the creek, pale, more
branches with straight thorns, not
other brambles, and with larger
...it is wild, darker and incli
a sort of pod. A decoction of t
water makes a drug called
brings away the after-birth. Th
d, is more astringent, cooling, an
ie treatment of gath...ings and
either kind, raw...ed, are n
ent with oil.
A superior lyci... be ma
ich is also c... n "a bo
sties of whic... bided
for Indian... idered
ie pounded... roots
ie bitterne... in wa
for three... woody pi
ay and the... again unt
y of honey... luterated wi
with lees of... oil and with
hich may be called the flower
an ingredient of remedies for t
he juice is used for clearing spe
l for the cure of itch, chroni
nd corroding sores in their corn
re tonsils and gums, cough and



Native American Communities

Fon Du Lac Band of Lake Superior Chippewa

Lac Courte Oreilles Band of Lake Superior Chippewa

Grand Portage Band of Lake Superior Chippewa

Lac du Flambeau Band of Lake Superior Chippewa

Red Cliff Band of Lake Superior Chippewa

Grand Portage Band of Lake Superior Chippewa

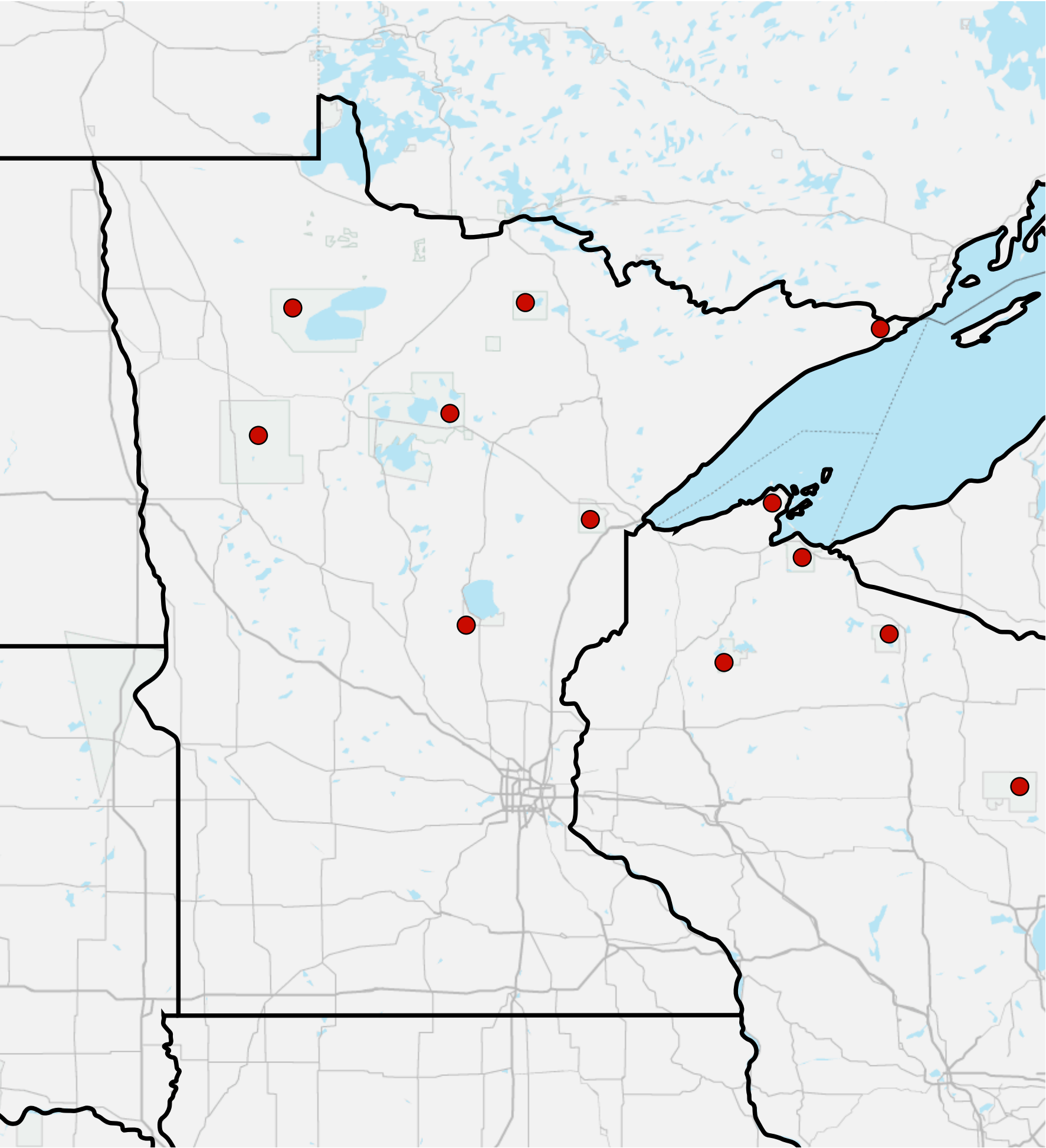
Bad River Band of Lake Superior Chippewa

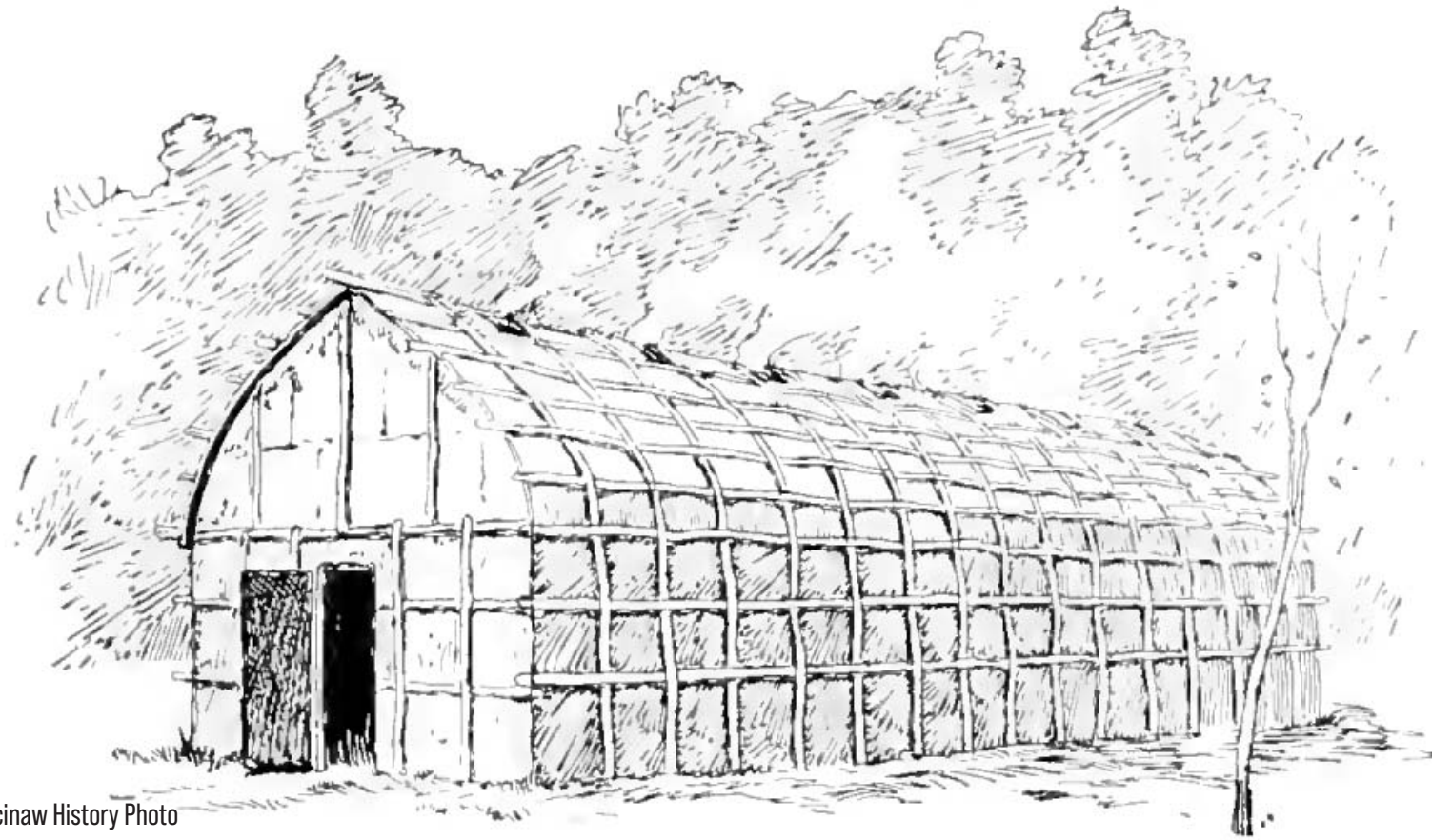
Bois Forte Band of Chippewa

Leech Lake Band of Ojibwe

Mille Lacs Band of Ojibwe

White Earth Band of Ojibwe





Macinaw History Photo



Grand Portage Band of Lake Superior Chippewa Photo



Legends of America Photo



National Museum of the American Indian - Smithsonian Institution Photo

“Contemporary practices of Indigenous design are distinct and unique from the general practice of architecture because of its regenerative purpose. Buildings become the narrative of a community. The building becomes a metaphor for stories that are invested in place and time.” - Cynthia E. Smith



Zenith City Online Photo



Perfect Duluth Day Photo

COPY: DETROIT PUBLISHING CO.



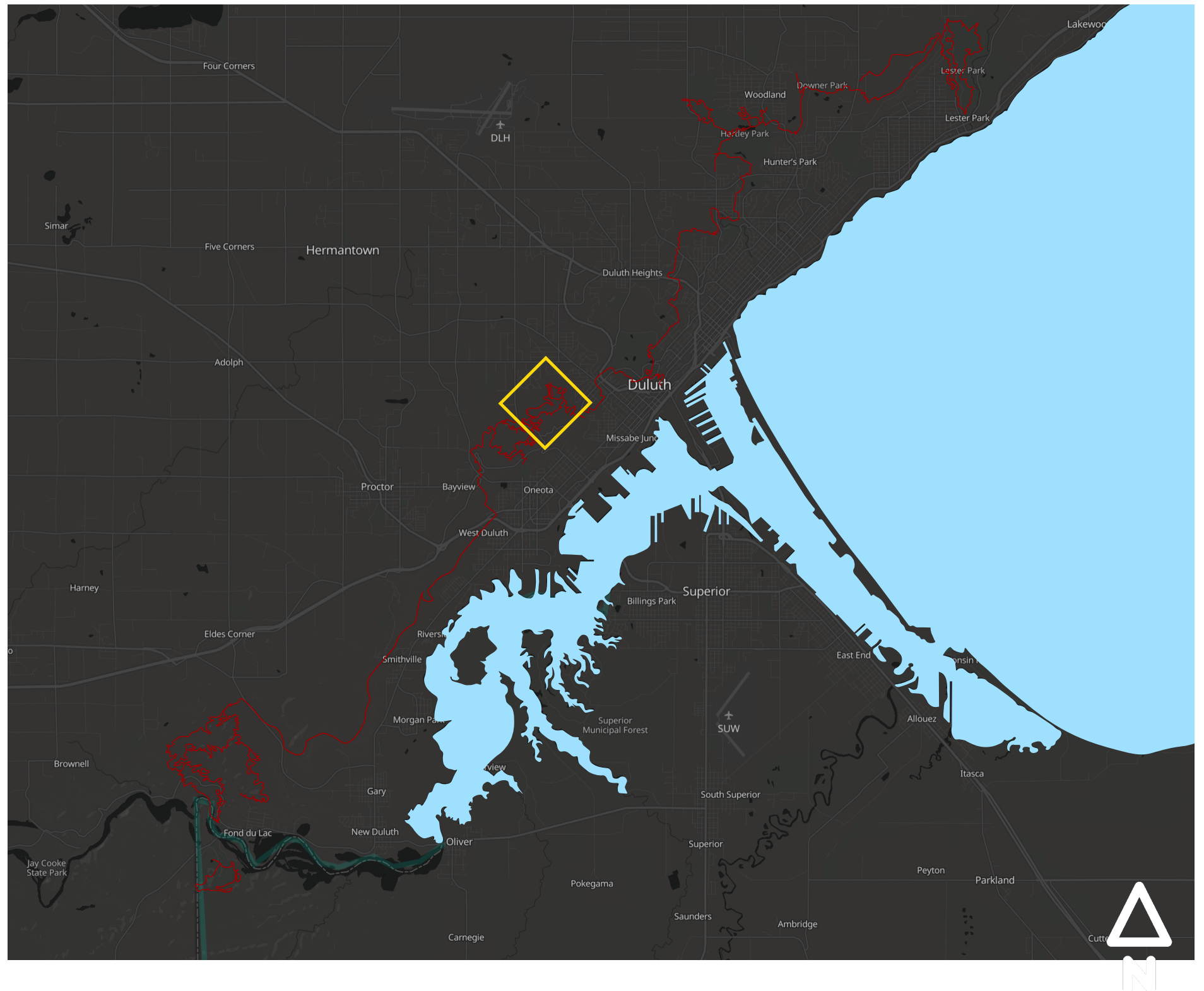
SHORPY
Perfect Duluth Day Photo

MOUNTAIN BIKERS



Statistics

- 600 registered volunteers with COGGS
- 115 miles of bike trails
- Connected by the 42.5 mile Duluth Traverse Trail

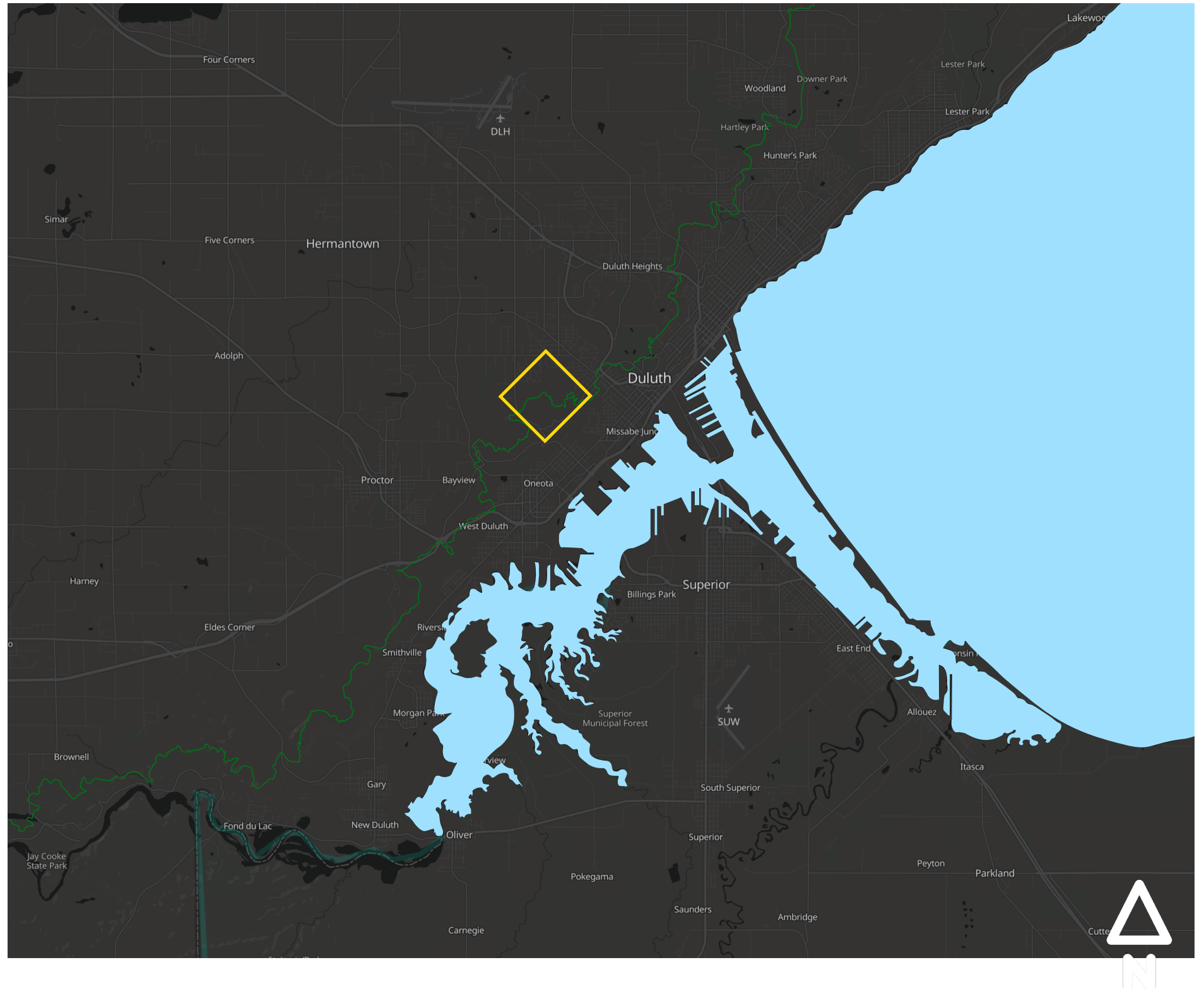


HIKERS



Statistics

- 150 miles of established trails
- 26 miles of handicap accessible trails
- Superior Hiking Trail | 340 miles of trail along the North Shore

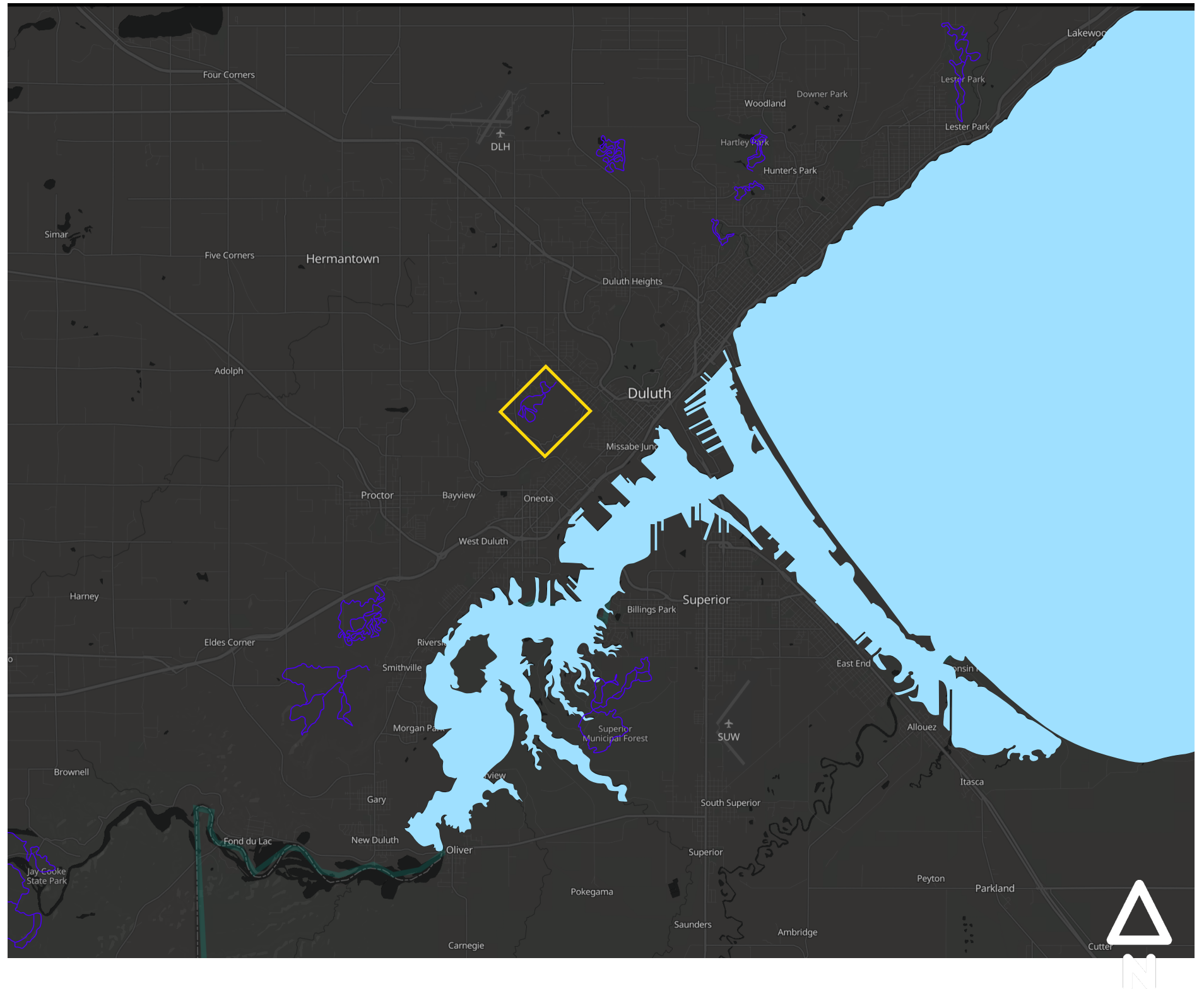


CROSS COUNTRY SKIERS

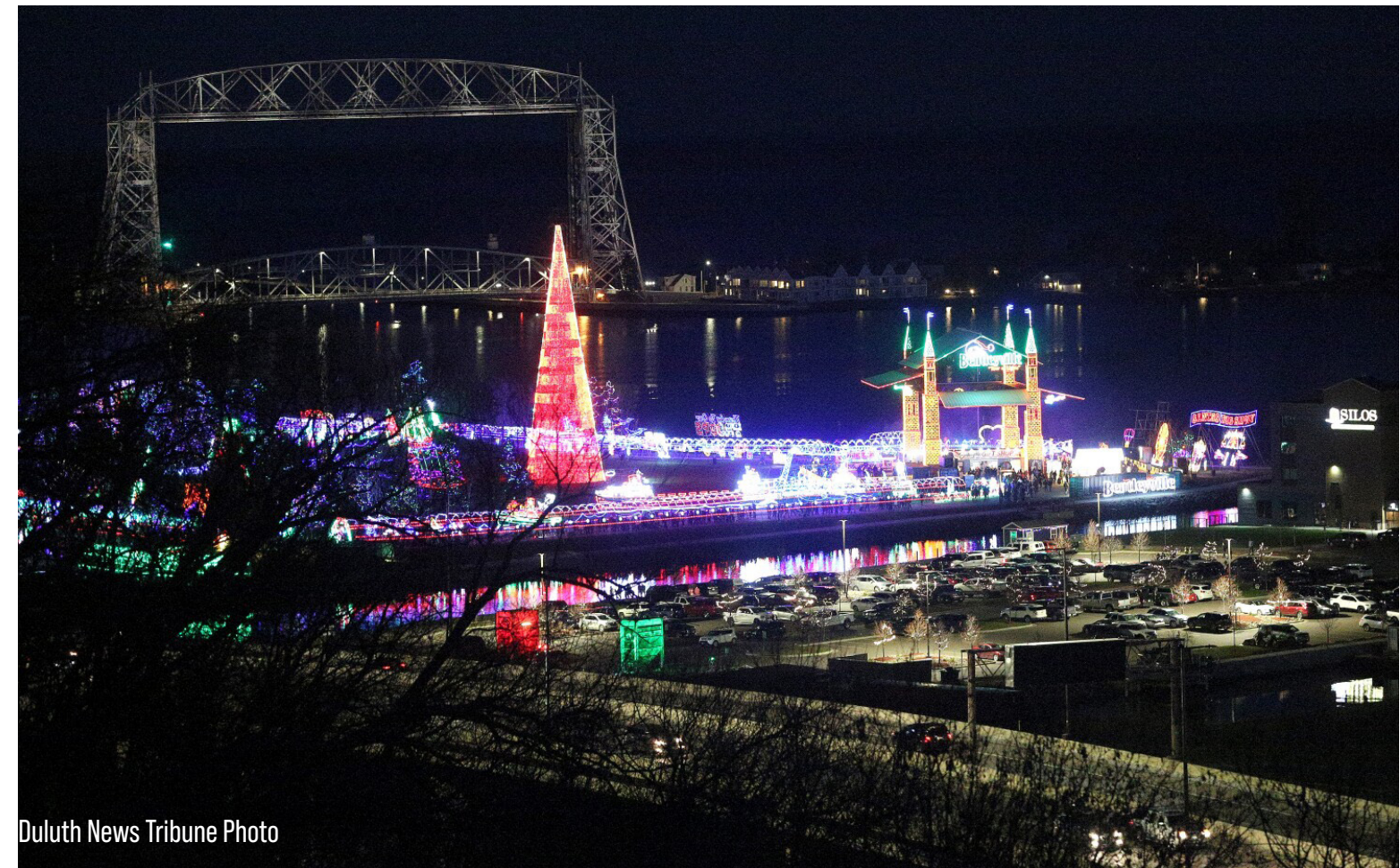


Statistics

- 35 miles of established trails
- 8 trail centers throughout the Duluth region



TOURISTS



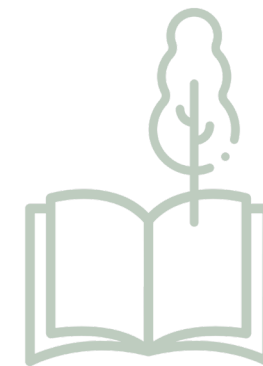
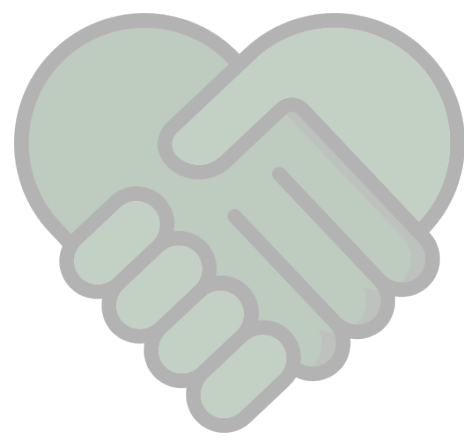
Statistics

- 6.7 million tourists a year
- \$950 million dollars in economic impact per year



DIVERSITY AND INCLUSION

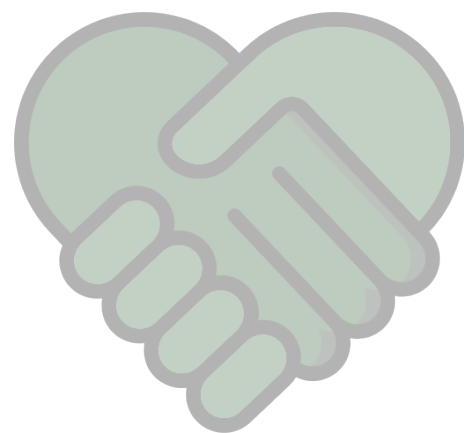




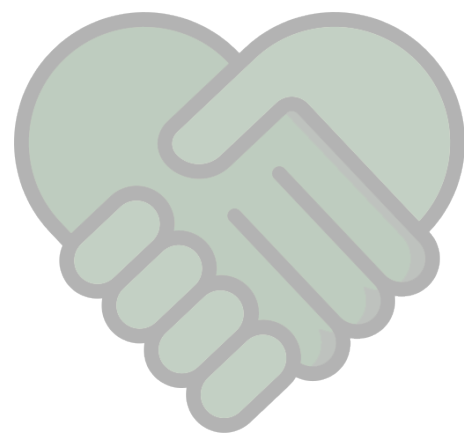
INTEGRATIVE DESIGN



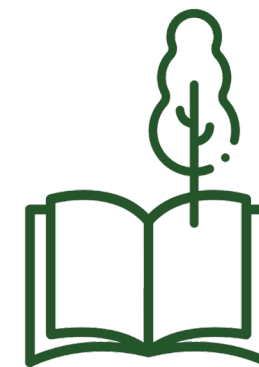
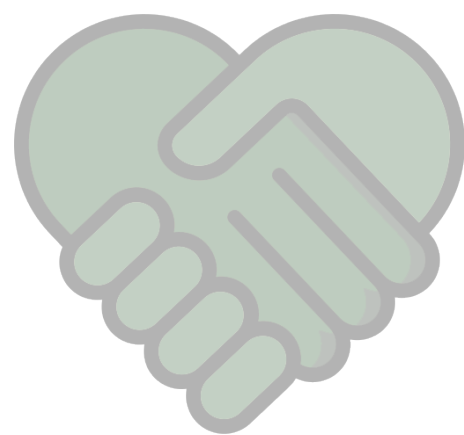
COMMUNITY GATHERING SPACES



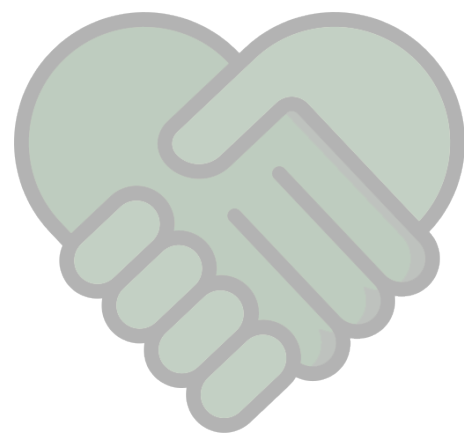
RESPONSIBLY SOURCED MATERIALS



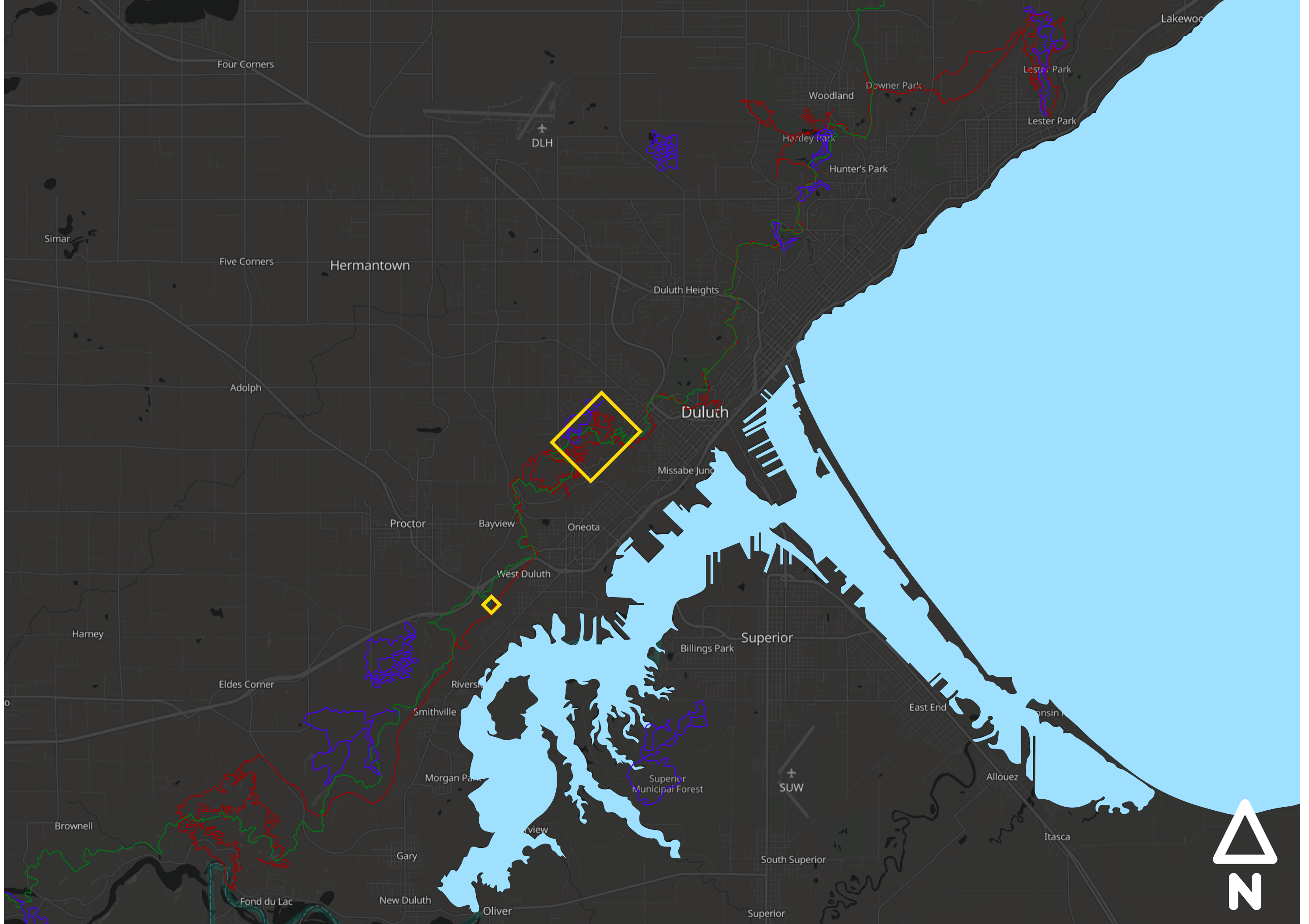
ENVIRONMENTAL PERFORMANCE

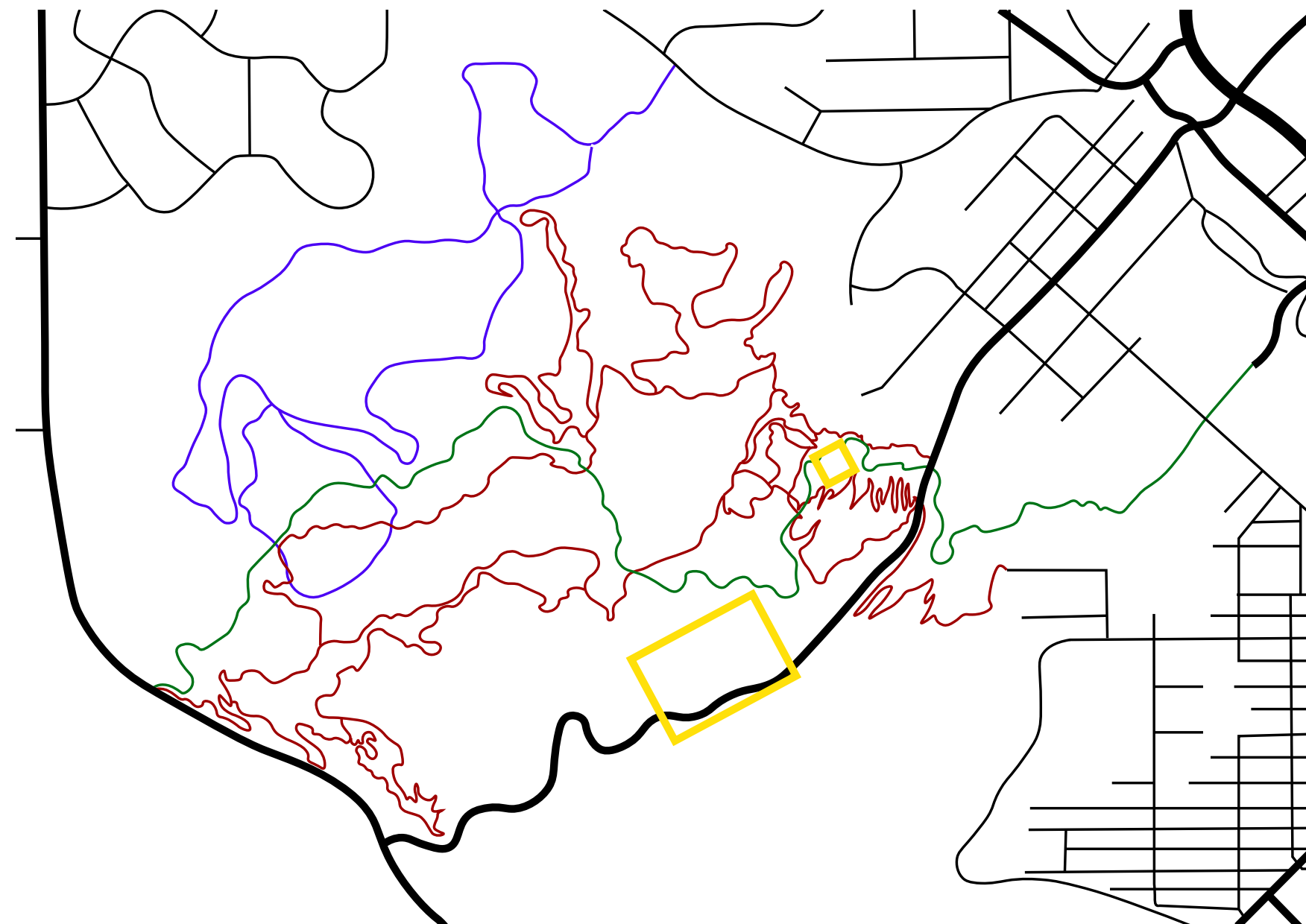


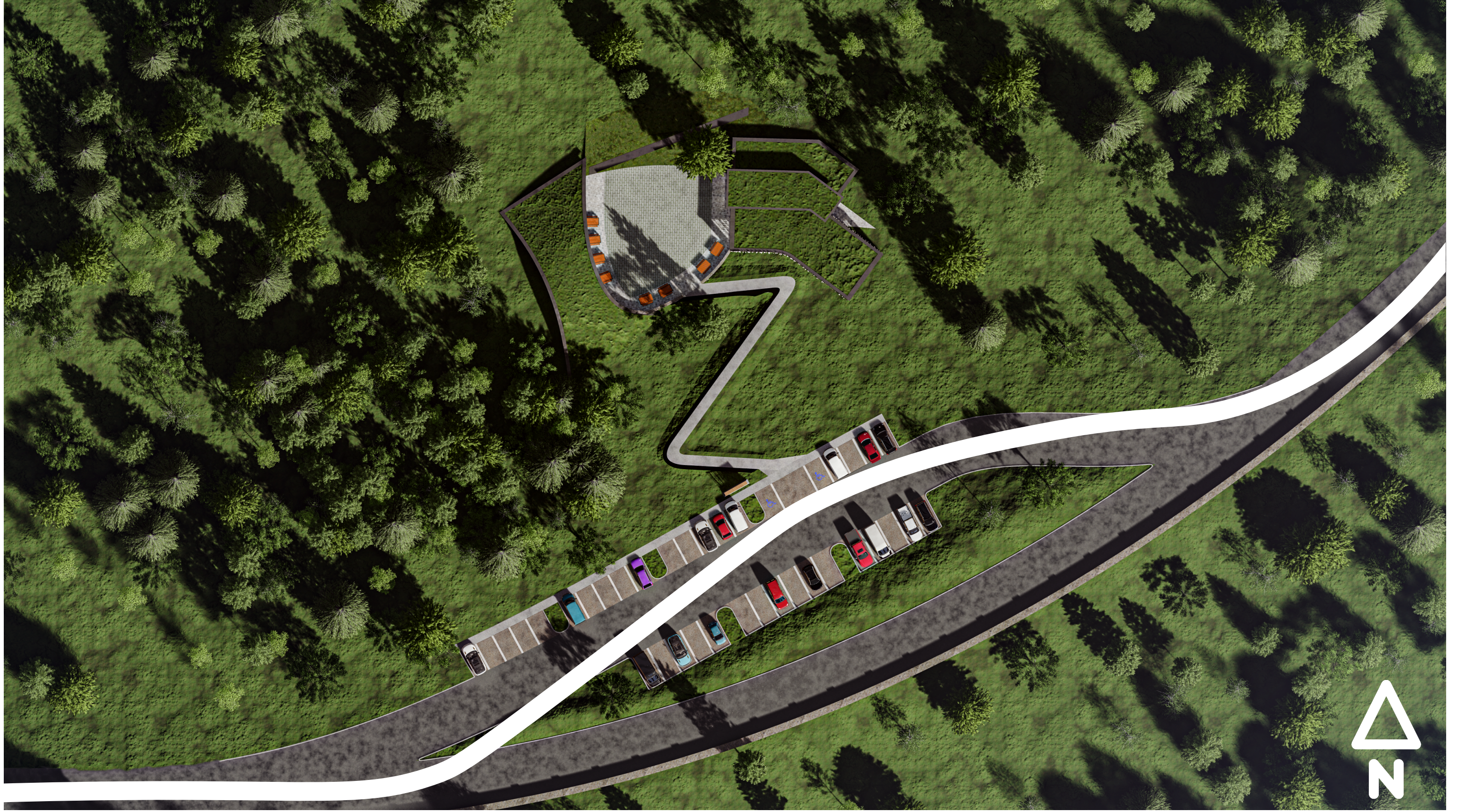
EDUCATIONAL OPPORTUNITIES



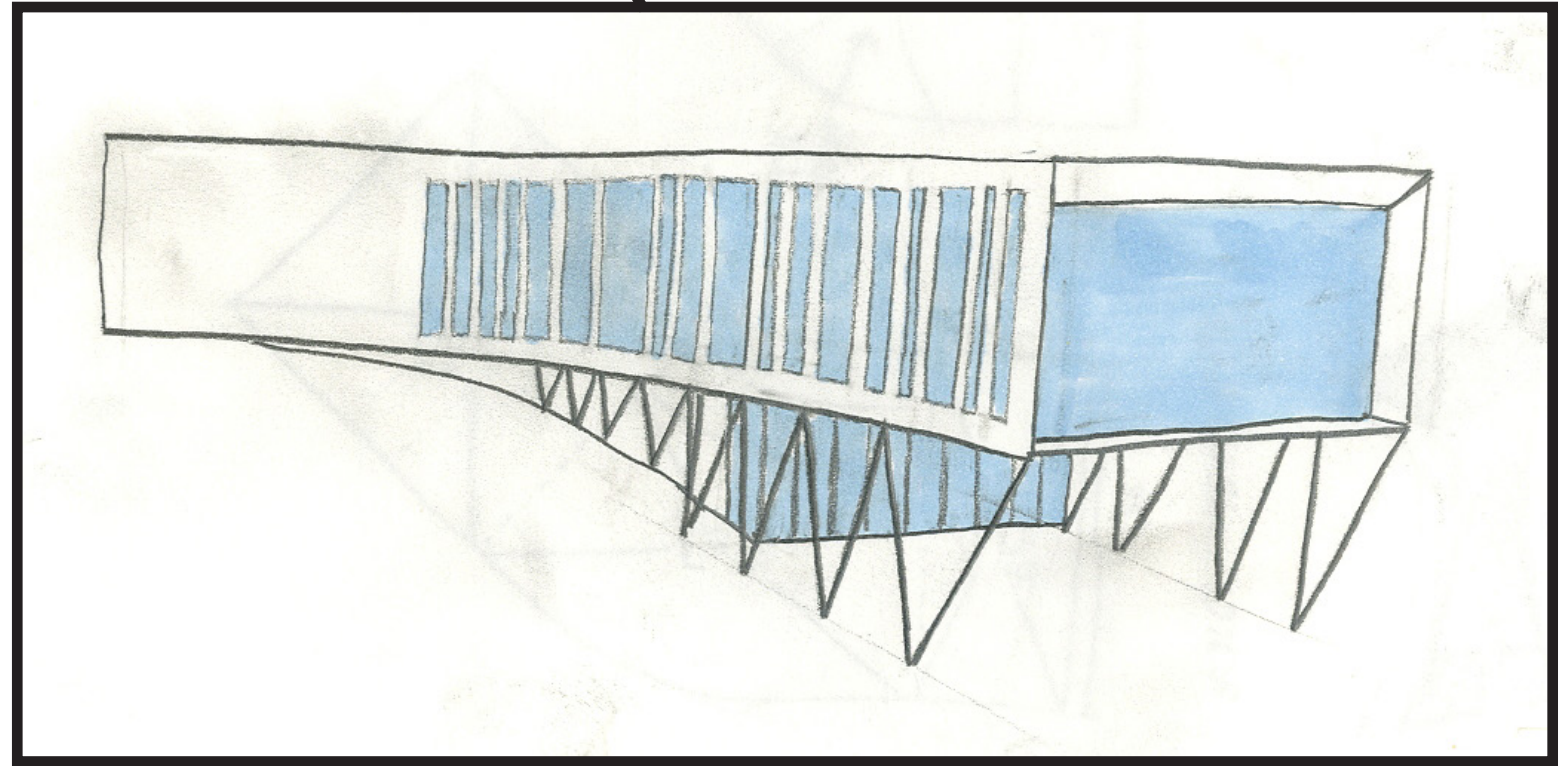
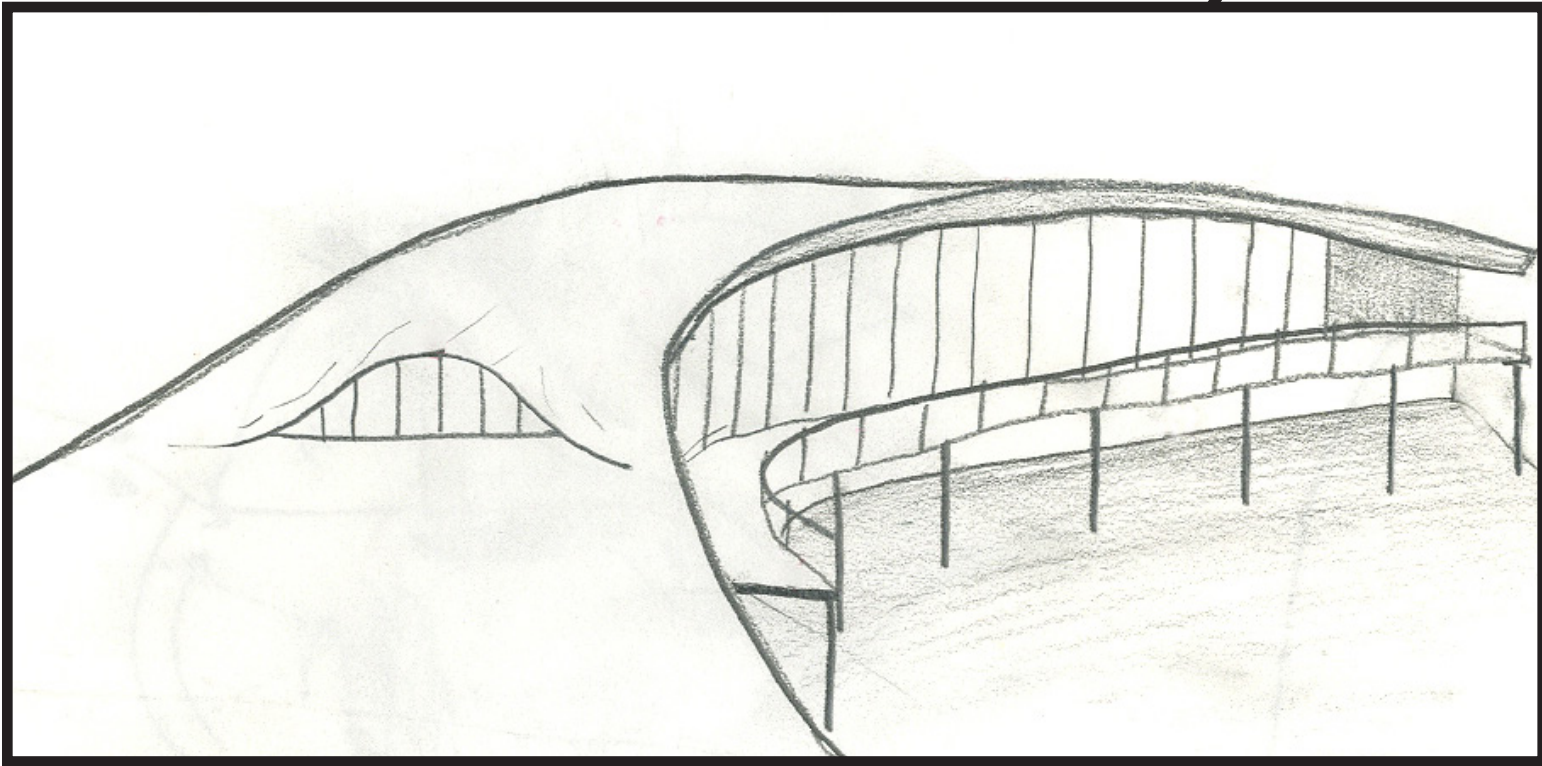
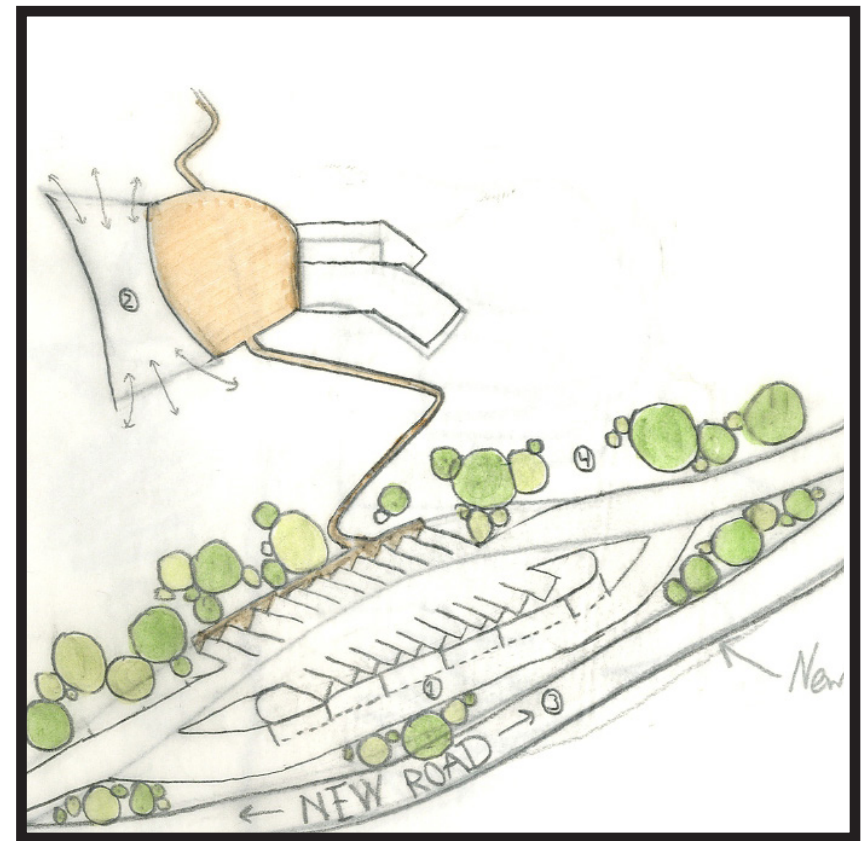
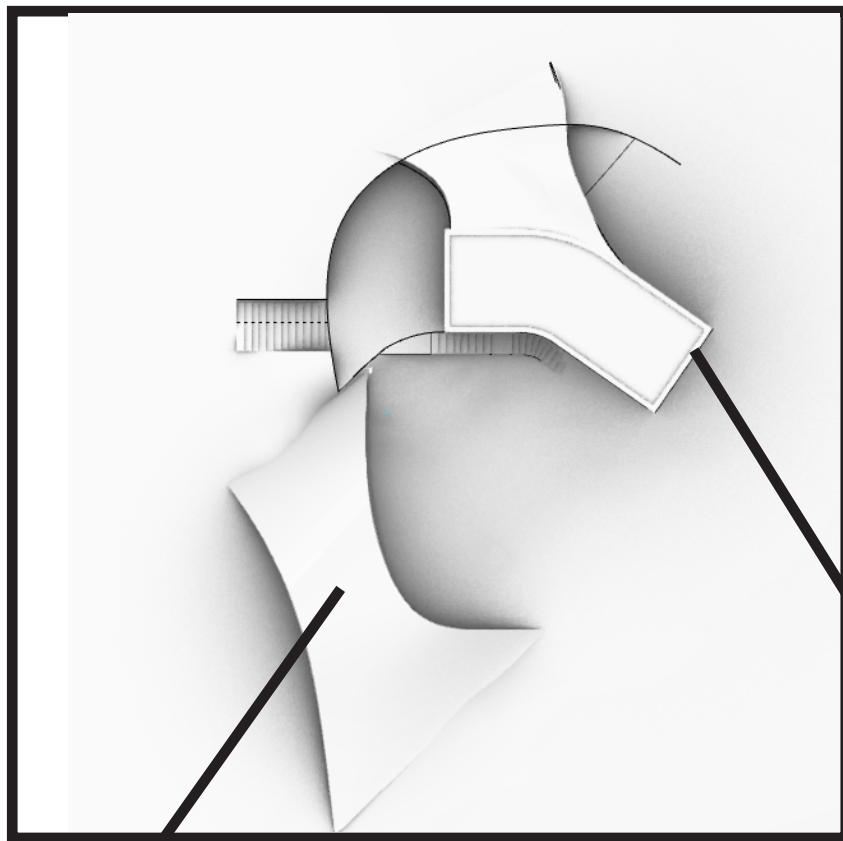
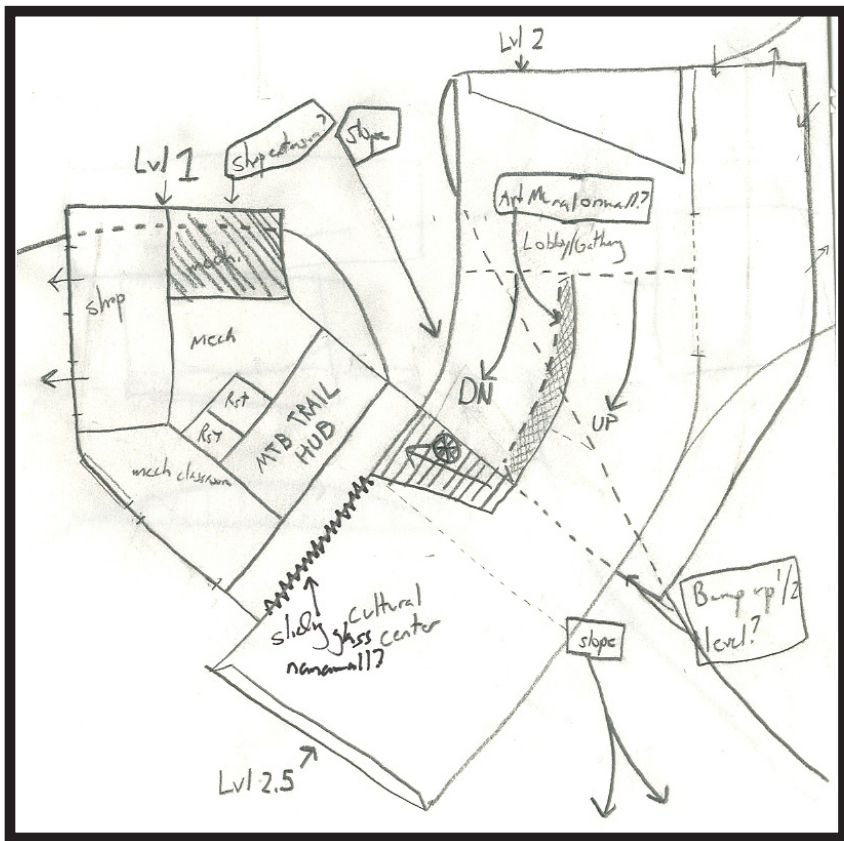
ACCESSIBILITY AND CODE COMPLIANCE











FORM

The arch building pulls the visitor into the ground plane, while the Canopy Building elevates the visitor in the trees.



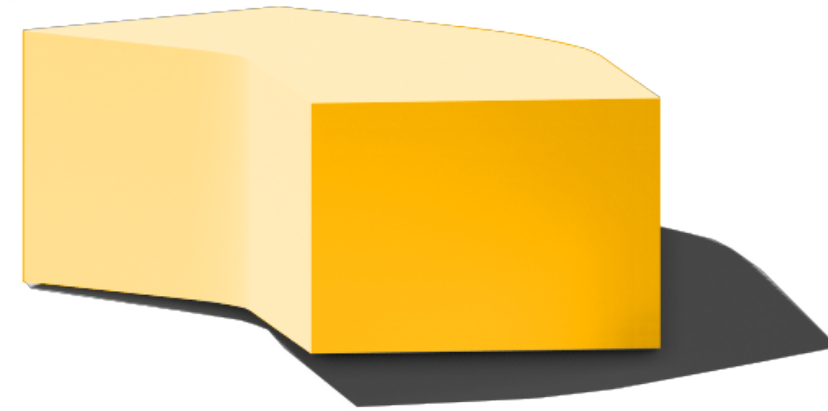
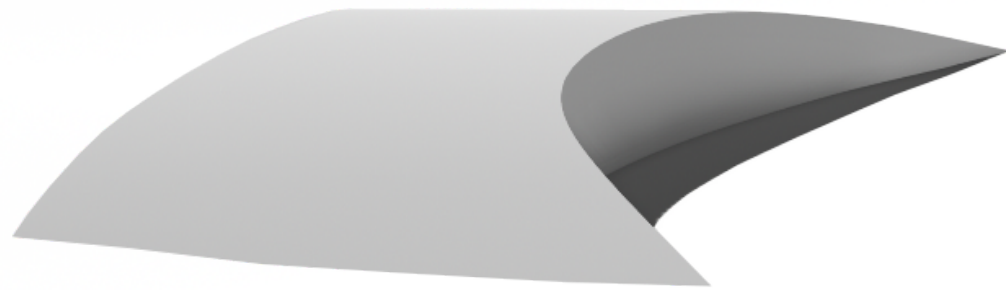
Arch Building



Canopy Building

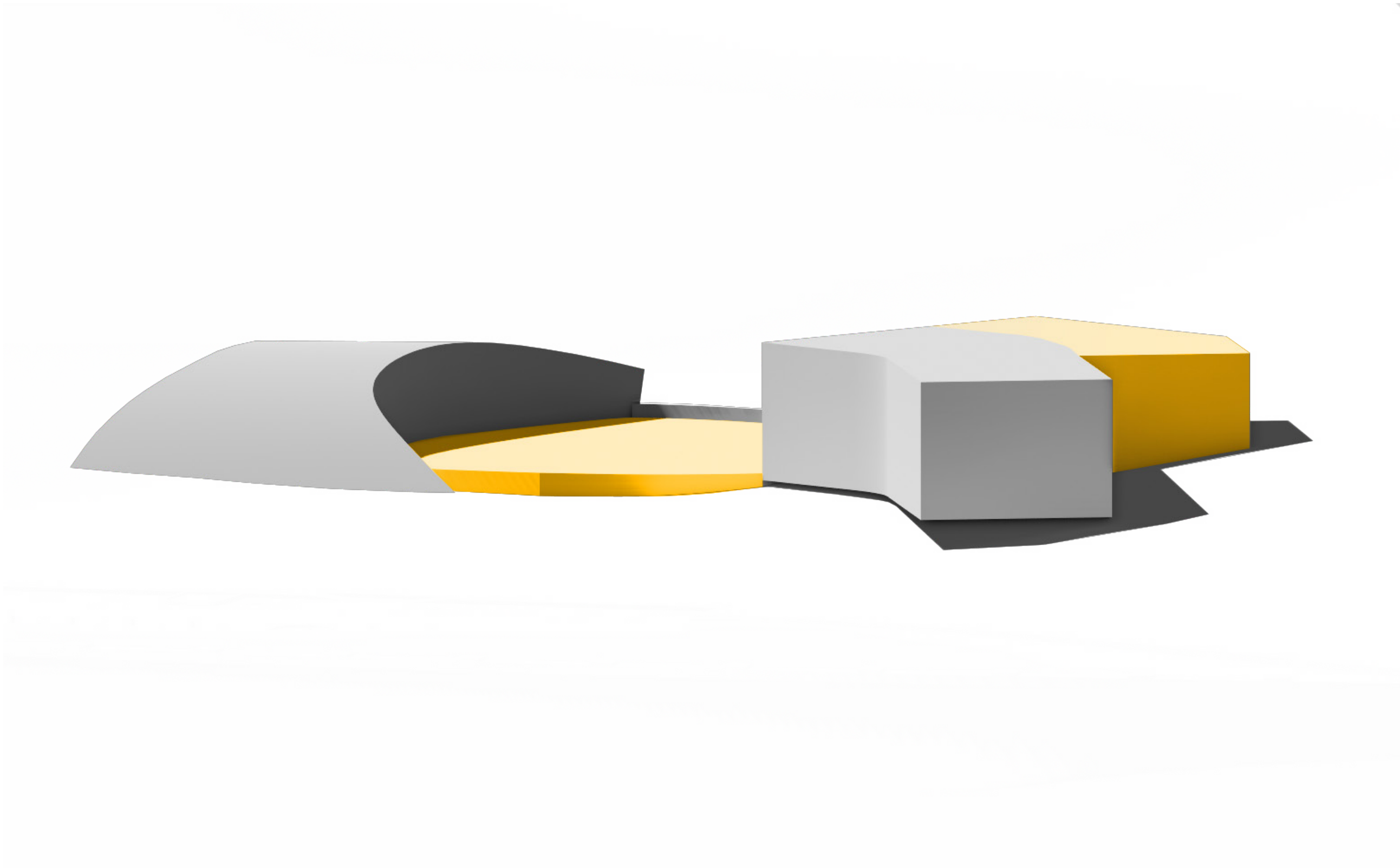
VIEWS

Bending the canopy building towards the St. Louis River Valley reveals impactful views from the bluff.



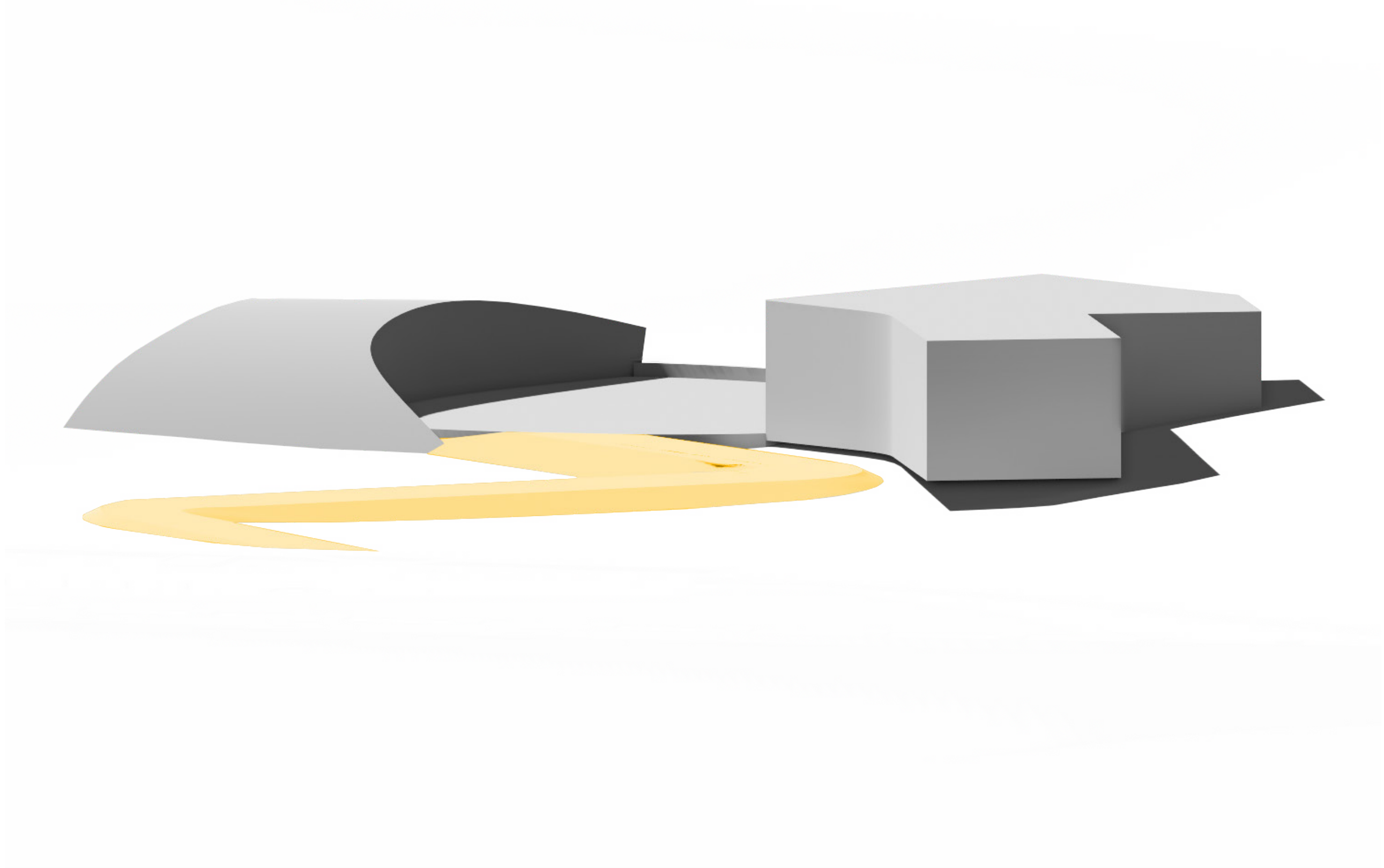
GATHERING

Large interior and exterior gathering spaces make places for visitors to come together and relax.



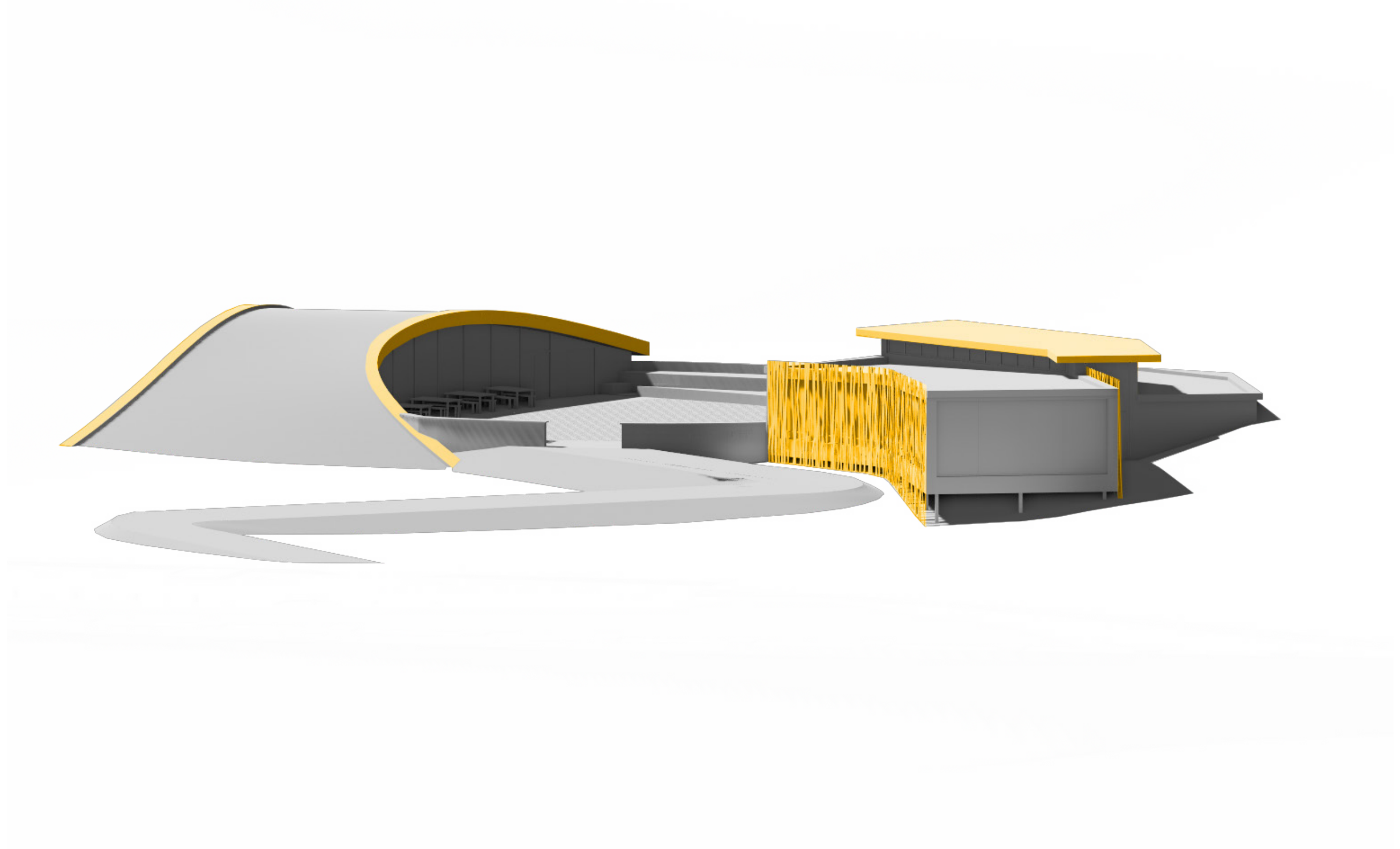
ENTRY PATH

A handicap accessible path pulls visitors up and across the building exteriors.



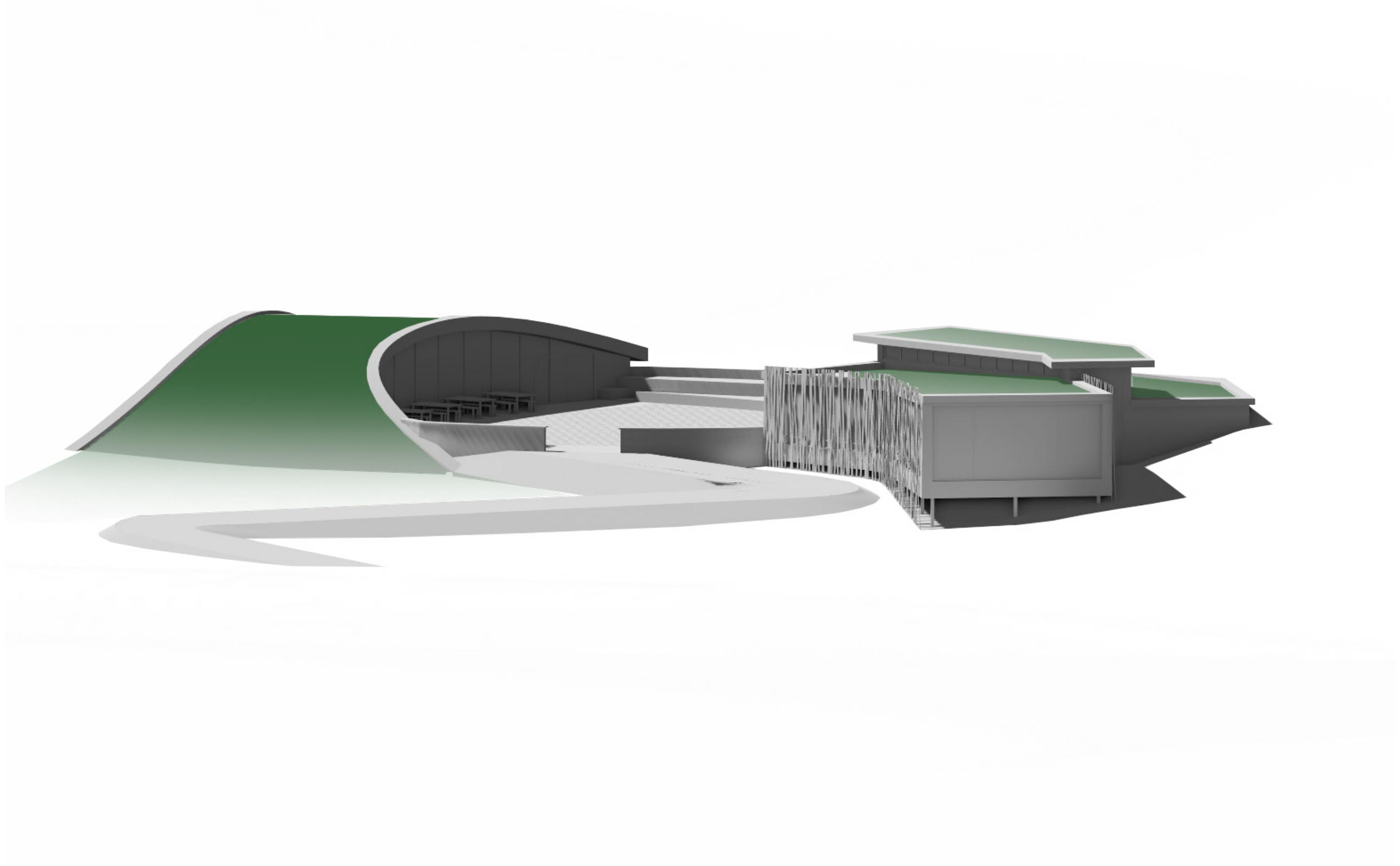
SHADING

Crafted shading systems pay homage to the buildings forested location, while still providing outwardly views.

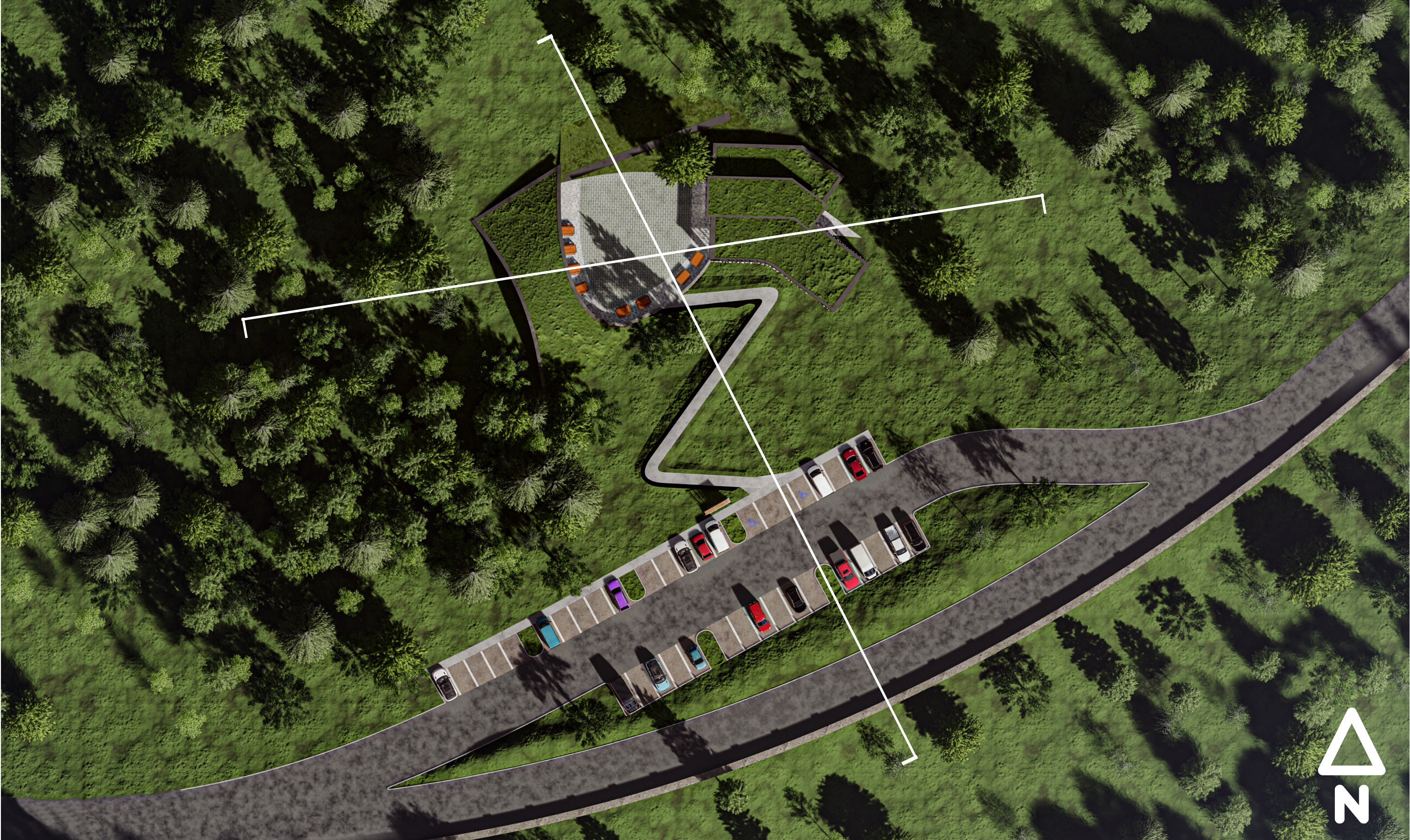


GREEN ROOF

Green roofs on both the Canopy and Arch building blend the buildings into the site, while reducing visual impact.

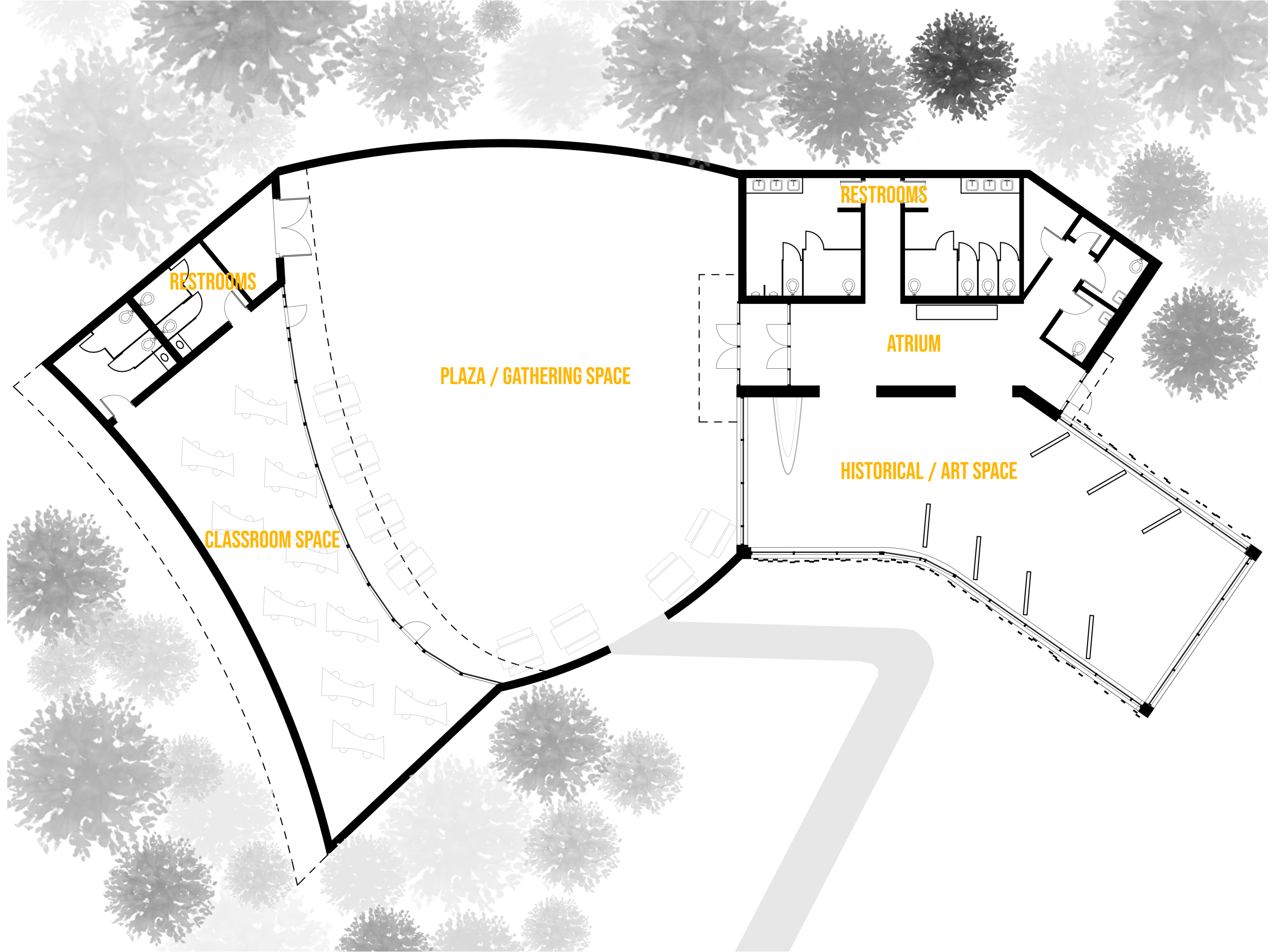


















Seedum Green Roof

CLT Structural Panel Arch

Glue-Lam Structural Arches

Triple Paned Low-E Windows

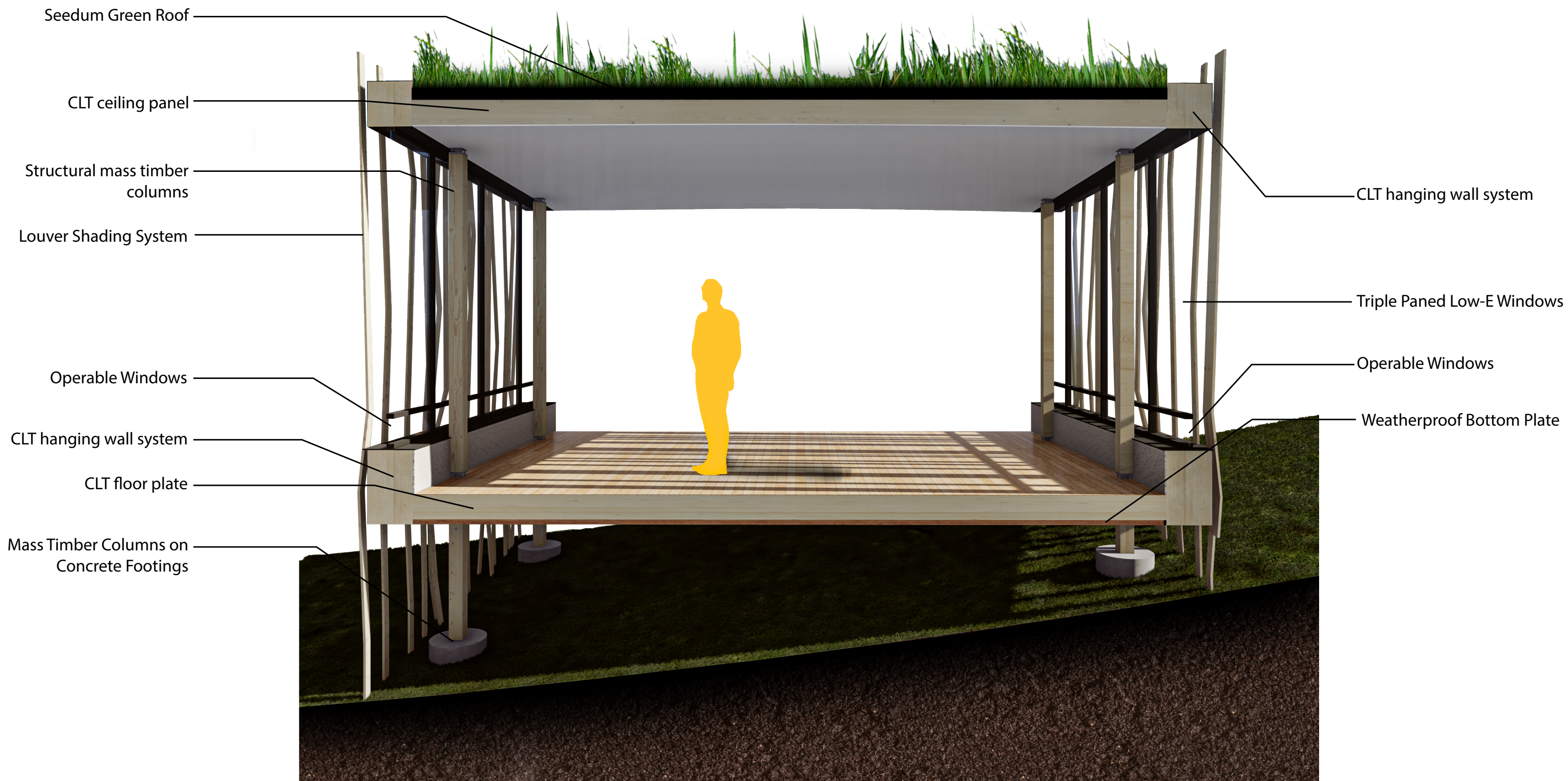
Triple Paned Low-E Windows

Eco Concrete Paver system



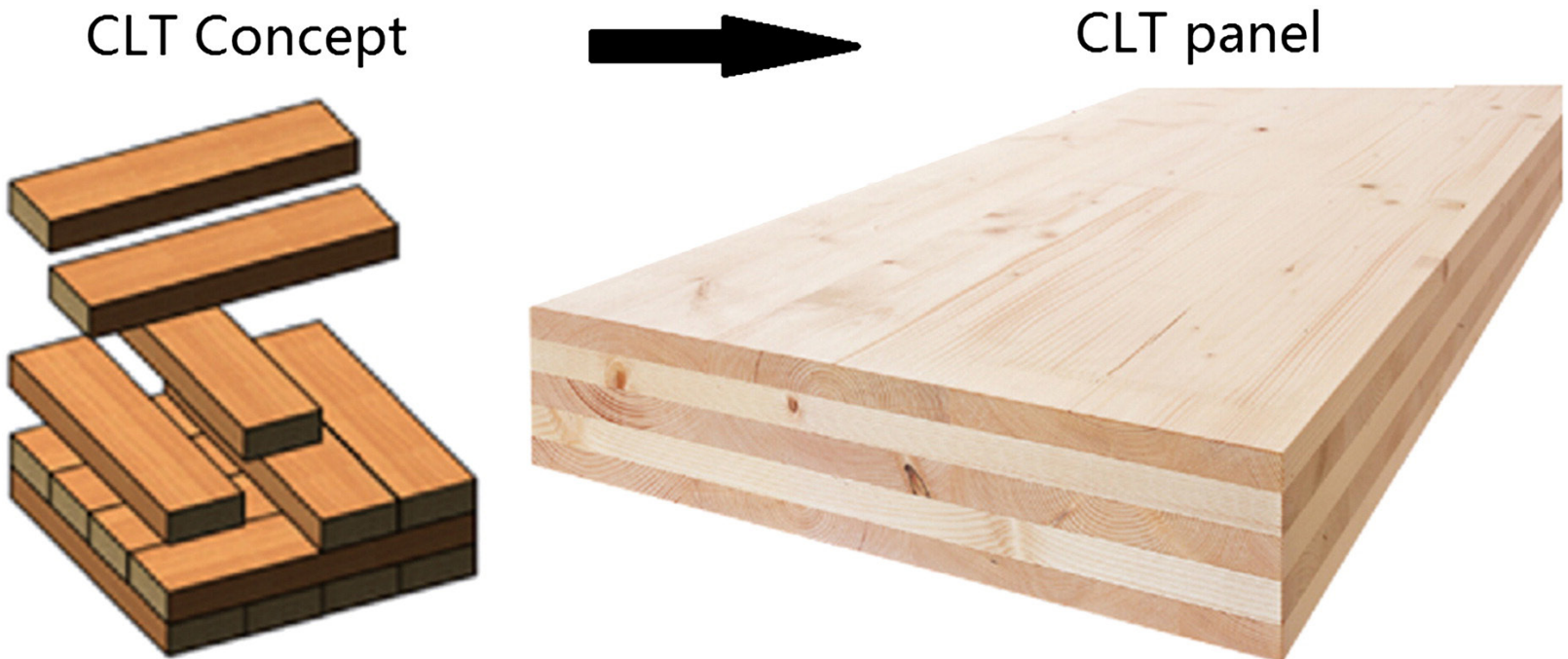






CLT PANEL SYSTEM

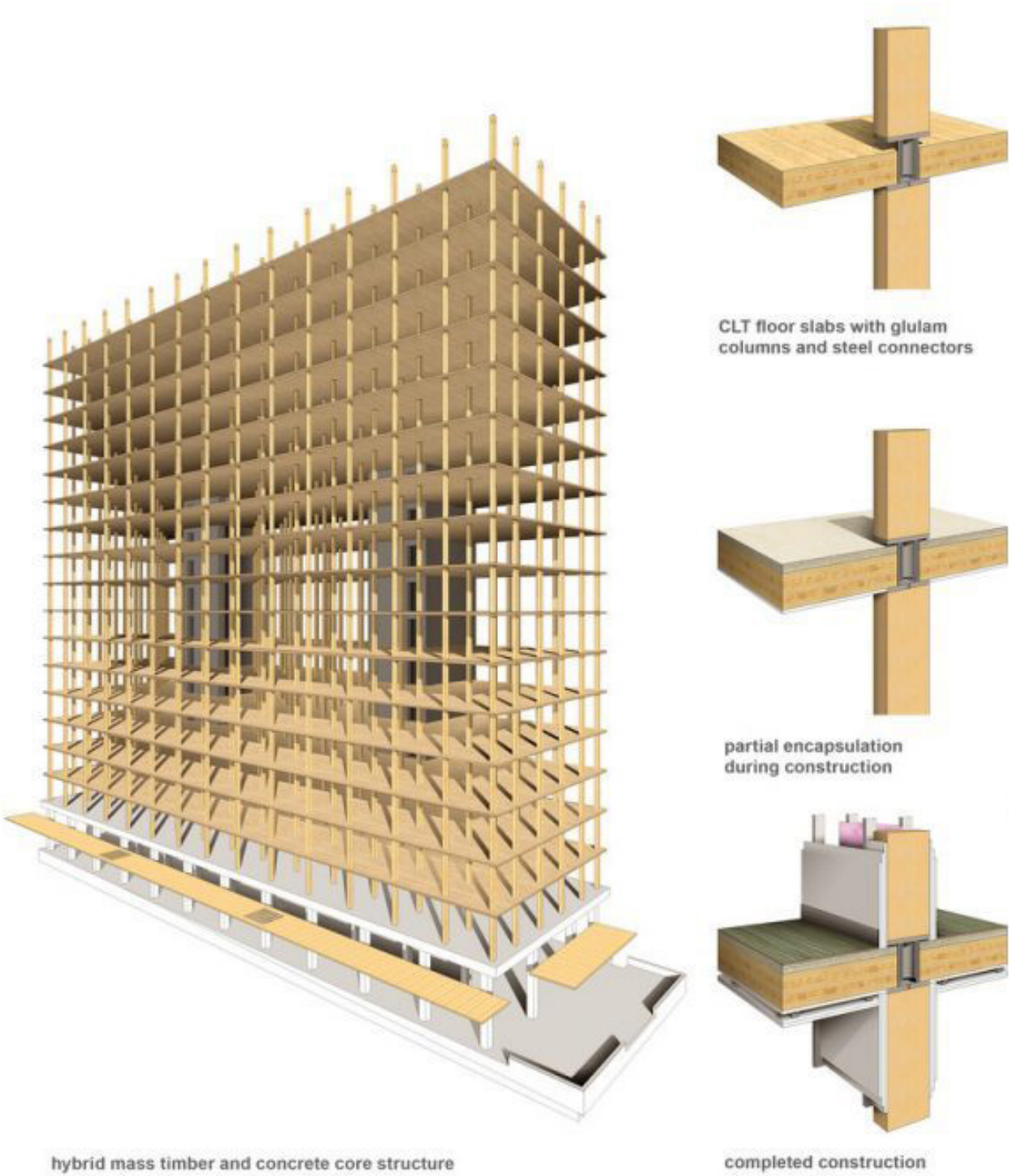
Cross Laminated Timber, or CLT, is a prefabricated solid wood panel that can be built into a wide variety of forms. IT saw its beginnings in Europe in the early 2000's, and has exploded in popularity in the northern europe, where timber is plentiful. Its uses in North America are sparse, but it has a huge growth opportunity in the continent. CLT is created by overlapping strands of dimensional lumber and bonding them together. The panels are structurally supportive and can span further distances with less beams to support the floor load. CLT panels can be created as large as needed, pending the availability of transportation. They are commonly ~10 feet wide, and up to 60 feet long.



Approximating R-Factor for Cross-Laminated Timber Walls - ASCE Library

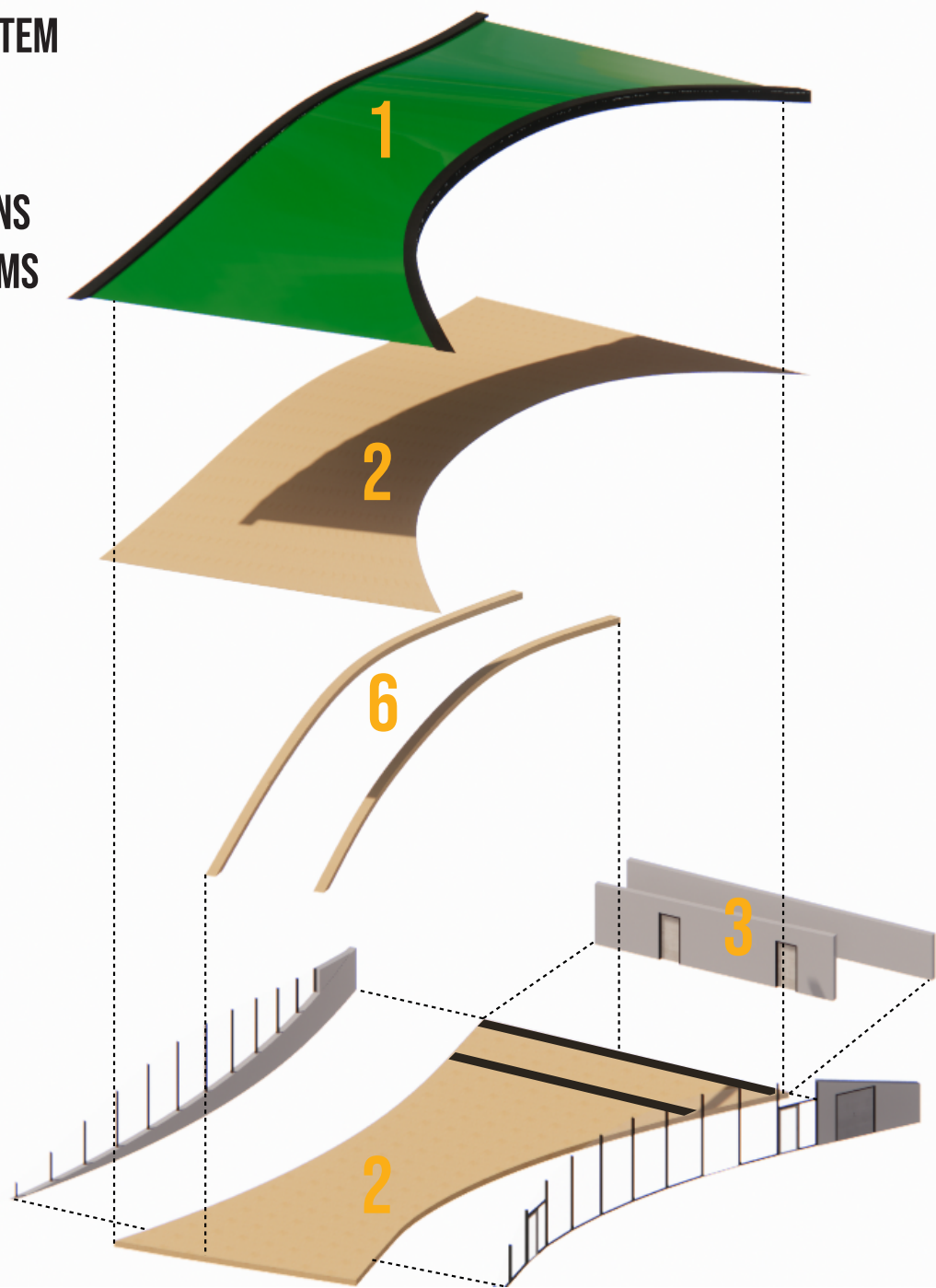
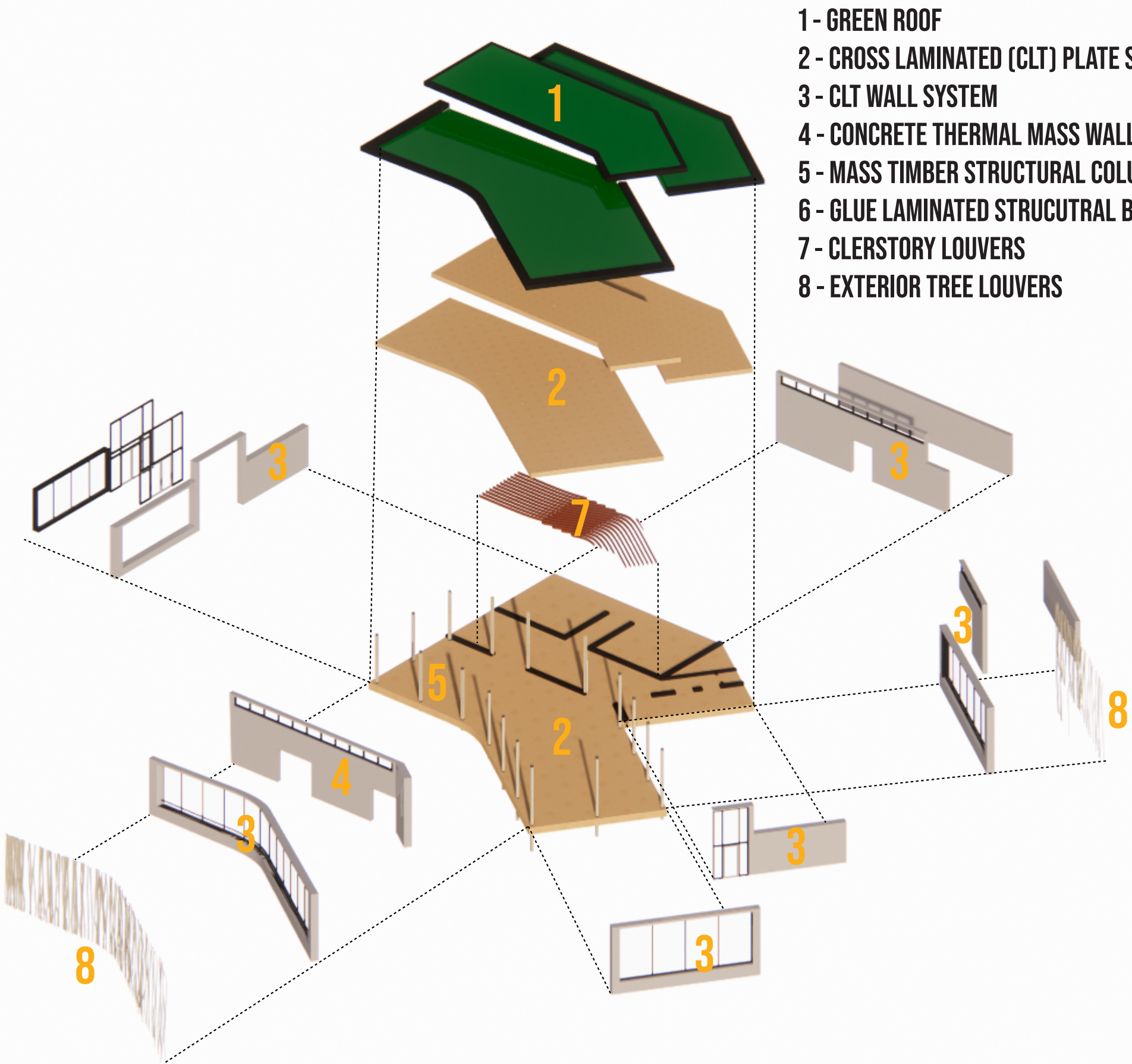


Brockcommons Study - Canadian Wood Council & Woodworks!

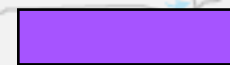
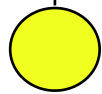
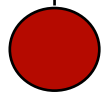
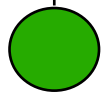
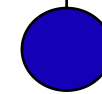
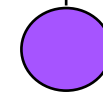
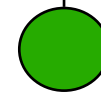
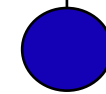
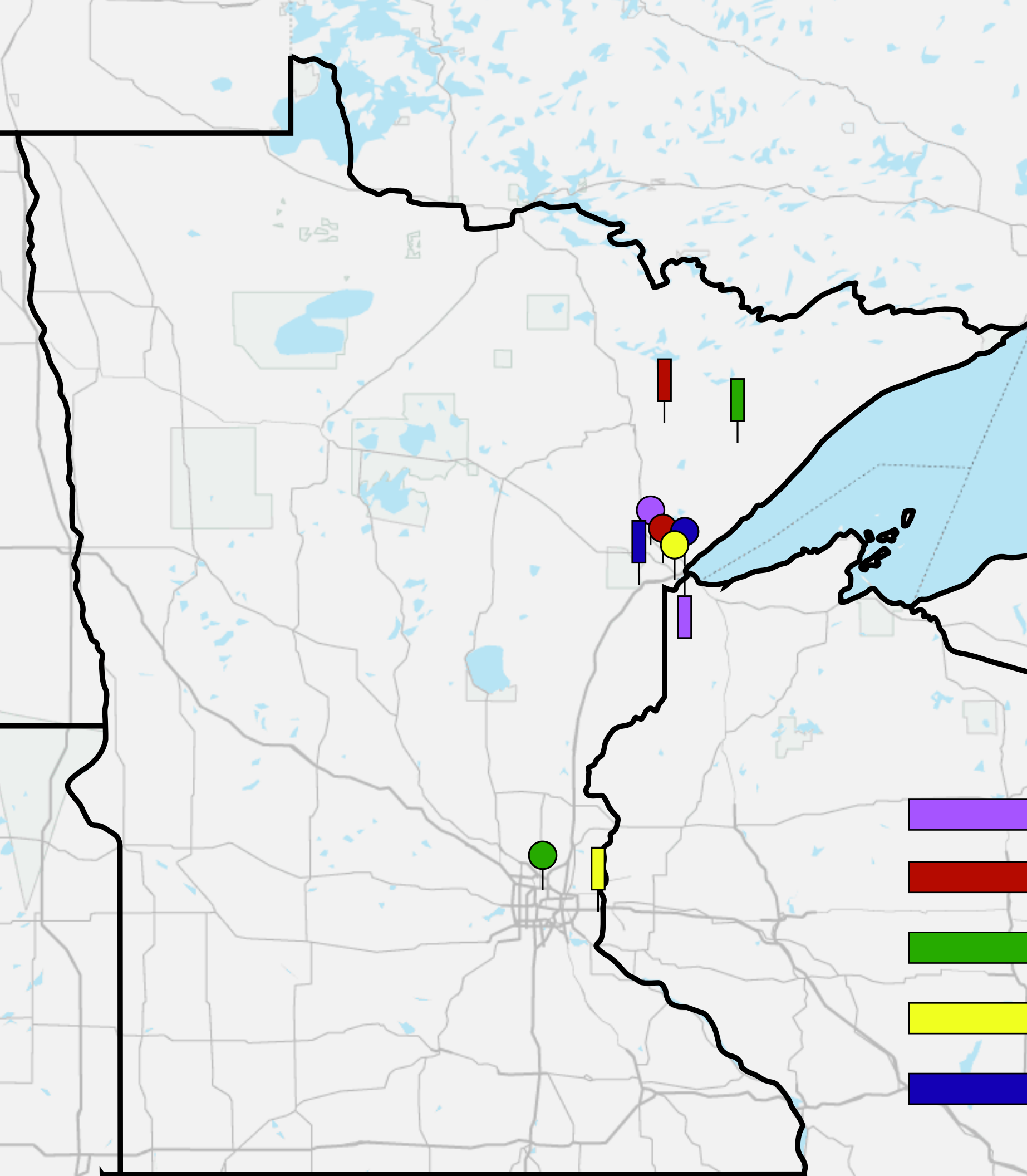


Brockcommons Study - Canadian Wood Council & Woodworks!

AXONOMETRIC CONSTRUCTION DIAGRAM



SOURCING / CARBON IMPACT



Concrete/Masonry - Arrowhead Concrete Works
Sourced from the Garfield Concrete Plant, Superior, WI



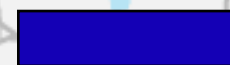
Steel - Russell Steel (Proctor, MN)
Sourced from the Mesabi Range, Northern MN



CLT Panel Systems - Bell Structural Lumber (New Brighton, MN)
Sourced from Superior National Forest (SFI certified)



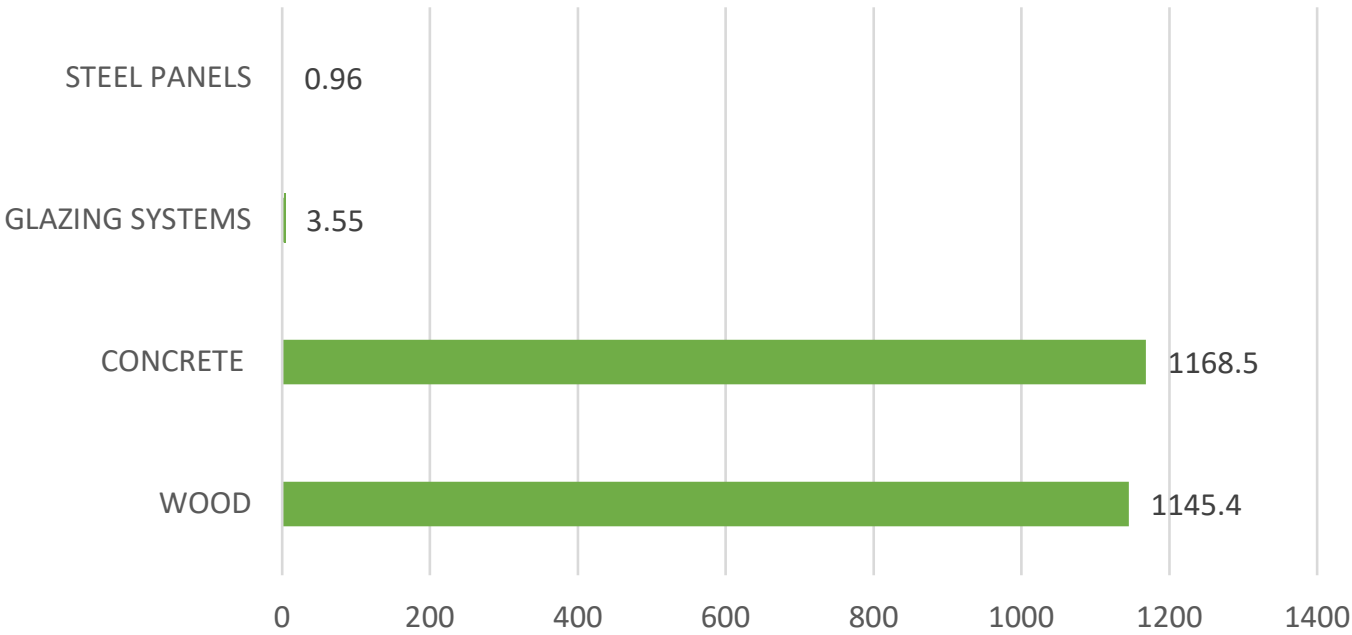
Windows - Mesabi Glass and Window (Duluth MN)
Sourced from Andersen Windows, Bayport, MN



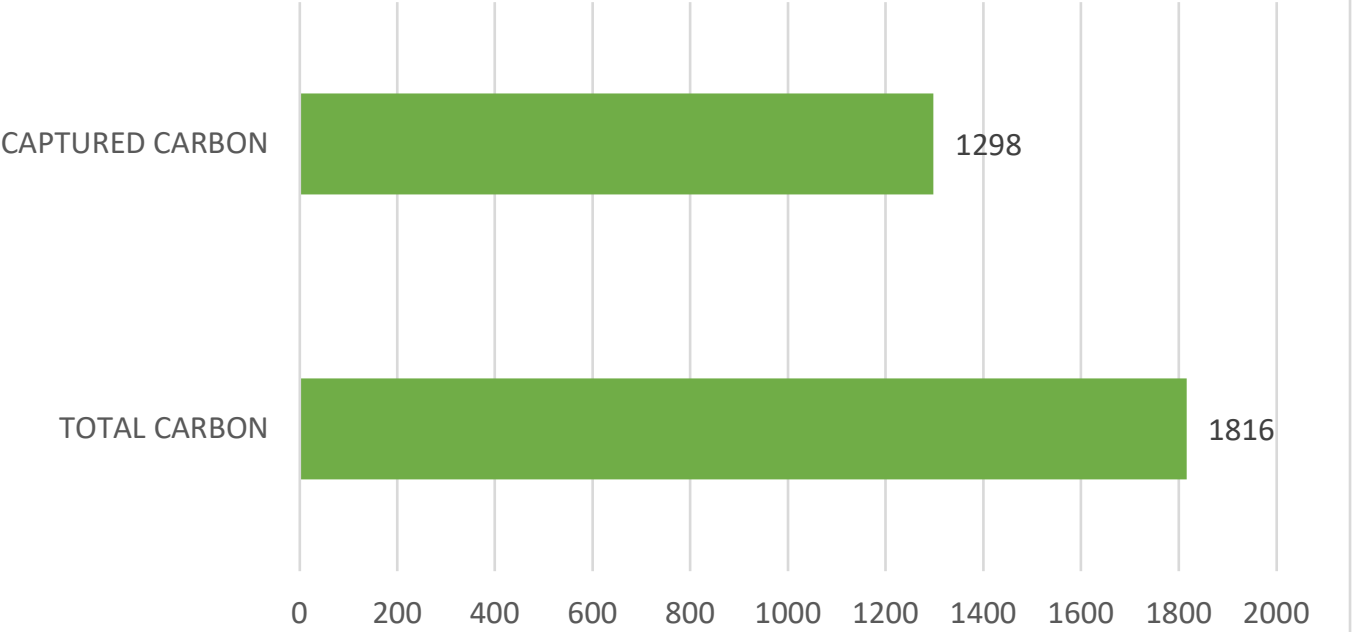
Green Roof - Rhino Roofing (Duluth MN)
Sourced from Cloquet Nursery

CARBON IMPACT

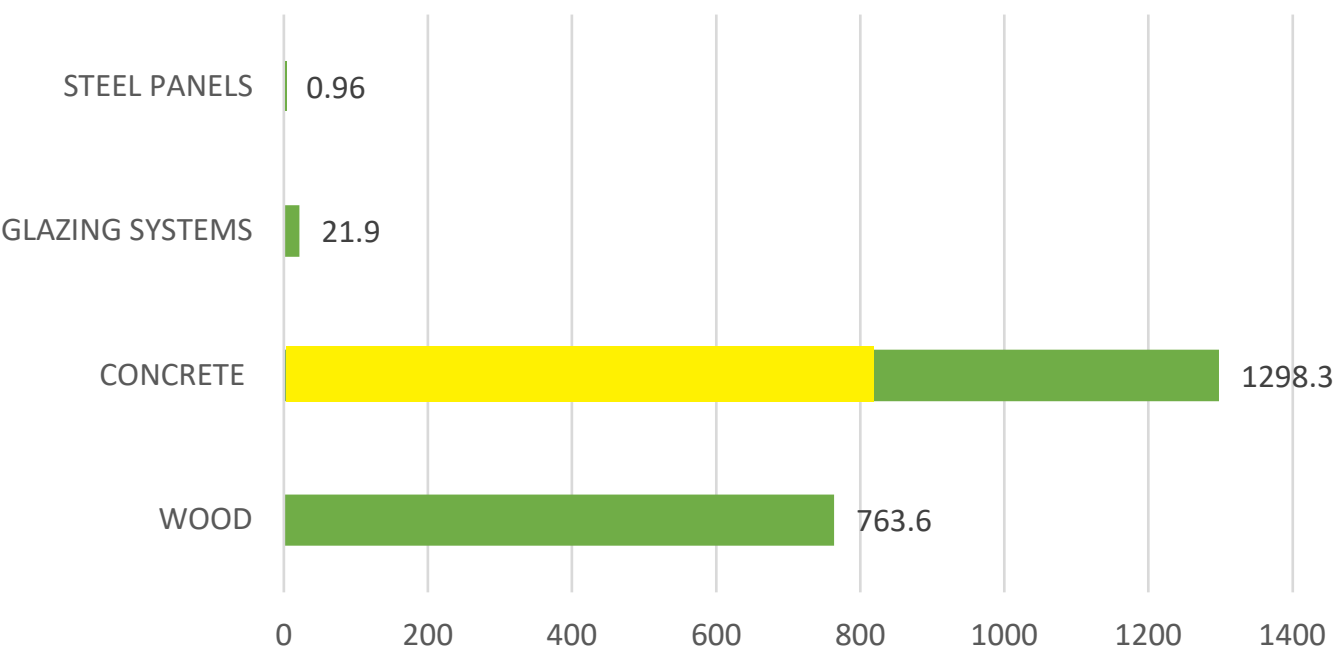
MATERIALS USED (PER TON)



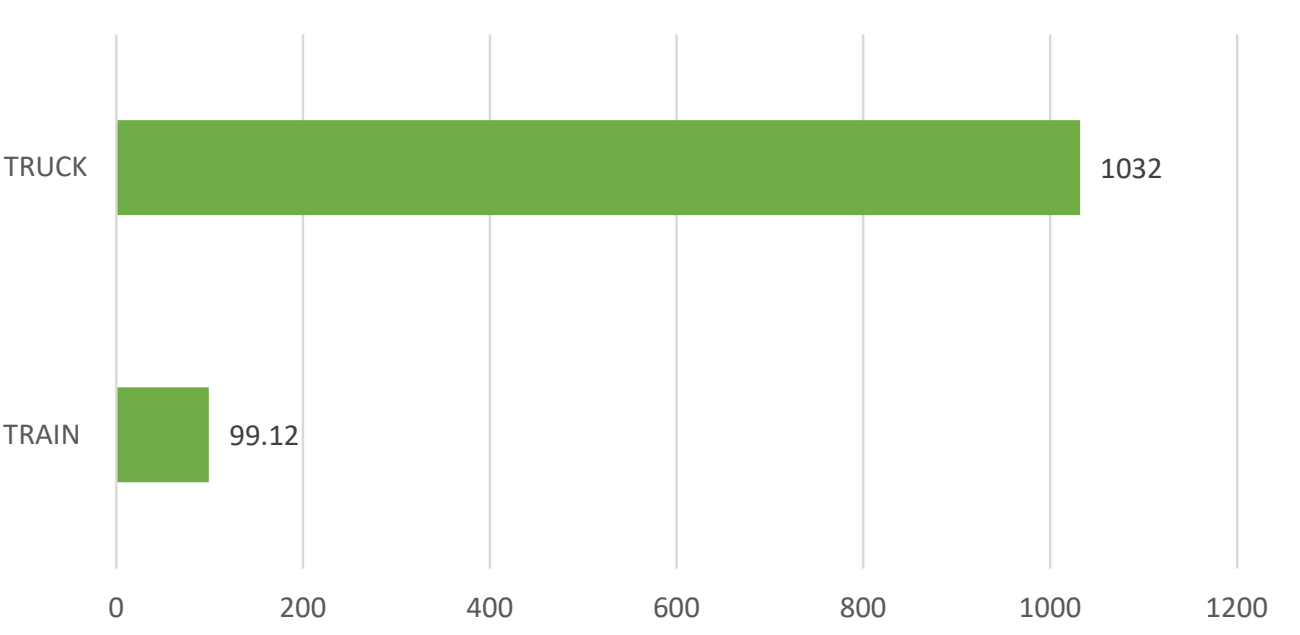
CARBON OFFSET FOR WOOD PRODUCTS (TONS)



EMBODIED CARBON (POUNDS PER TON)



SHIPPING CARBON USE (PER POUND)





| Y | ? | N |
|---|---|---|
| | | |

| 4 | 0 | 0 | Location and Transportation | | 16 |
|---|---|---|-----------------------------|--|----|
| | | N | Credit | LEED for Neighborhood Development Location | 16 |
| 1 | | | Credit | Sensitive Land Protection | 1 |
| | | N | Credit | High Priority Site and Equitable Development | 2 |
| | | N | Credit | Surrounding Density and Diverse Uses | 5 |
| | | N | Credit | Access to Quality Transit | 5 |
| 1 | | | Credit | Bicycle Facilities | 1 |
| 1 | | | Credit | Reduced Parking Footprint | 1 |
| 1 | | | Credit | Electric Vehicles | 1 |

| 9 | 0 | 0 | Sustainable Sites | | 10 |
|---|---|---|-------------------|--|----------|
| Y | | | Prereq | Construction Activity Pollution Prevention | Required |
| | | | Credit | Site Assessment | 1 |
| 2 | | | Credit | Protect or Restore Habitat | 2 |
| 1 | | | Credit | Open Space | 1 |
| 3 | | | Credit | Rainwater Management | 3 |
| 2 | | | Credit | Heat Island Reduction | 2 |
| 1 | | | Credit | Light Pollution Reduction | 1 |

| 11 | 0 | 0 | Water Efficiency | | 11 |
|----|---|---|------------------|-------------------------------|----------|
| Y | | | Prereq | Outdoor Water Use Reduction | Required |
| Y | | | Prereq | Indoor Water Use Reduction | Required |
| Y | | | Prereq | Building-Level Water Metering | Required |
| 2 | | | Credit | Outdoor Water Use Reduction | 2 |
| 6 | | | Credit | Indoor Water Use Reduction | 6 |
| 2 | | | Credit | Optimize Process Water Use | 2 |
| 1 | | | Credit | Water Metering | 1 |

| 33 | 0 | 0 | Energy and Atmosphere | | 33 |
|----|---|---|-----------------------|--|----------|
| Y | | | Prereq | Fundamental Commissioning and Verification | Required |
| Y | | | Prereq | Minimum Energy Performance | Required |
| Y | | | Prereq | Building-Level Energy Metering | Required |
| Y | | | Prereq | Fundamental Refrigerant Management | Required |
| 6 | | | Credit | Enhanced Commissioning | 6 |
| 18 | | | Credit | Optimize Energy Performance | 18 |
| 1 | | | Credit | Advanced Energy Metering | 1 |
| 2 | | | Credit | Grid Harmonization | 2 |
| 5 | | | Credit | Renewable Energy | 5 |
| 1 | | | Credit | Enhanced Refrigerant Management | 1 |

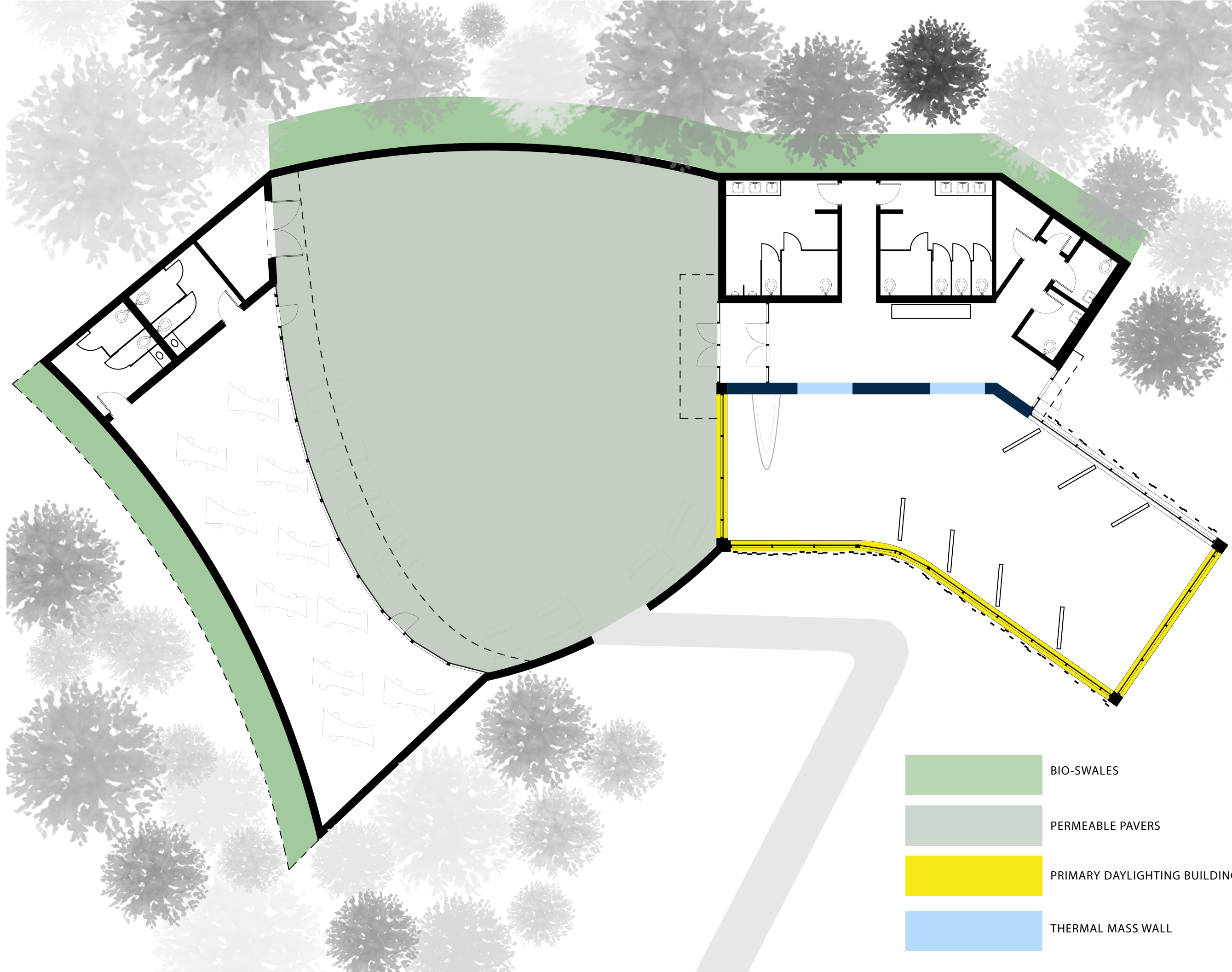
| 13 | 0 | 0 | Materials and Resources | | 13 |
|----|---|---|-------------------------|--|----------|
| Y | | | Prereq | Storage and Collection of Recyclables | Required |
| 5 | | | Credit | Building Life-Cycle Impact Reduction | 5 |
| 2 | | | Credit | Environmental Product Declarations | 2 |
| 2 | | | Credit | Sourcing of Raw Materials | 2 |
| 2 | | | Credit | Material Ingredients | 2 |
| 2 | | | Credit | Construction and Demolition Waste Management | 2 |

| 16 | 0 | 0 | Indoor Environmental Quality | | 16 |
|----|---|---|------------------------------|---|----------|
| Y | | | Prereq | Minimum Indoor Air Quality Performance | Required |
| Y | | | Prereq | Environmental Tobacco Smoke Control | Required |
| 2 | | | Credit | Enhanced Indoor Air Quality Strategies | 2 |
| 3 | | | Credit | Low-Emitting Materials | 3 |
| 1 | | | Credit | Construction Indoor Air Quality Management Plan | 1 |
| 2 | | | Credit | Indoor Air Quality Assessment | 2 |
| 1 | | | Credit | Thermal Comfort | 1 |
| 2 | | | Credit | Interior Lighting | 2 |
| 3 | | | Credit | Daylight | 3 |
| 1 | | | Credit | Quality Views | 1 |
| 1 | | | Credit | Acoustic Performance | 1 |

| 5 | 0 | 0 | Innovation | | 6 |
|---|---|---|------------|------------------------------|---|
| 5 | | | Credit | Innovation | 5 |
| | | N | Credit | LEED Accredited Professional | 1 |

| 0 | 0 | 0 | Regional Priority | | 4 |
|---|---|---|-------------------|------------------------------------|---|
| | | | Credit | Regional Priority: Specific Credit | 1 |
| | | | Credit | Regional Priority: Specific Credit | 1 |
| | | | Credit | Regional Priority: Specific Credit | 1 |
| | | | Credit | Regional Priority: Specific Credit | 1 |

| | | | | | |
|---|---|---|--------|------------------|-----|
| 91 | 0 | 0 | TOTALS | Possible Points: | 110 |
| ed: 40 to 49 points, Silver: 50 to 59 points, Gold: 60 to 79 points, Platinum: 80 | | | | | |



- BIO-SWALES
- PERMEABLE PAVERS
- PRIMARY DAYLIGHTING BUILDING FACES
- THERMAL MASS WALL

