Opportunity to increase connection and collaboration between people, systems and history
The purpose of the Tate Physics Laboratory Renovation and Addition is to create an **ADAPTABLE** classroom building that forms a **LIVING LABORATORY** while connecting the greater university community. Essentially a conversation between the **HISTORIC** wing and an **INNOVATIVE** addition, the building should **INTEGRATE SYSTEMS** and user groups in a way that creates a **COLLABORATIVE LEARNING ENVIRONMENT**.

**Adaptability**
Ability to change over time to suit different programs or environmental needs

**Campus Connection**
Creating a connection between the Mall and Church Street that provides access while engaging the public

**Indoor Environmental Quality**
Providing a healthy, comfortable, and productive environment

**Flexibility**
Multifunctional learning space that suits a variety of user groups

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**Historical Dialogue**
Finding the balance between preserving a historic icon and creating a new icon

**Collaboration**
Encouraging conversation between faculty, students, and the larger community

**Systems Integration**
Holistic approach to systems, using their relationships to increase effectiveness
## INTRODUCTION

### Strategy Matrix

<table>
<thead>
<tr>
<th>Scale</th>
<th>Collaboration</th>
<th>Adaptability</th>
<th>Systems Integration</th>
<th>Campus Connection</th>
<th>Historic Dialogue</th>
<th>Indoor Environmental Quality</th>
<th>Flexibility</th>
</tr>
</thead>
<tbody>
<tr>
<td>East Bank Neighborhood</td>
<td>access for multiple user groups</td>
<td>respond to LRT, campus changes</td>
<td>utilize campus systems</td>
<td>relationship to neighborhoods</td>
<td>academic icon</td>
<td>effective open space</td>
<td>development of new programs</td>
</tr>
<tr>
<td>Church Street + Northrop Mall</td>
<td>positive outdoor spaces</td>
<td>ability to change over time</td>
<td>manage stormwater</td>
<td>bridge between Church and Mall</td>
<td>bridge between new and historic</td>
<td>engaging environments</td>
<td>place of movement and destination</td>
</tr>
<tr>
<td>Building</td>
<td>welcoming entry</td>
<td>envelope can adapt to seasons</td>
<td>integrate water and energy systems</td>
<td>enhances campus environment</td>
<td>both historical and performative</td>
<td>responsible materials</td>
<td>ability for program to change</td>
</tr>
<tr>
<td>Interior</td>
<td>collaborative spaces</td>
<td>movable walls</td>
<td>living laboratory</td>
<td>transparent</td>
<td>both traditional and collaborative</td>
<td>daylight and air exchange for labs</td>
<td>open plan</td>
</tr>
</tbody>
</table>
GREEN DISTRICT:
- East Bank of the University of Minnesota campus
- Associated residential areas (i.e. Marcy Holmes + Stadium Village)
- Bounded by the Mississippi River, the rail line, 35W, and I-94

EAST BANK NEIGHBORHOOD:
- All East Bank academic buildings + University housing on the East Bank
- The neighborhood includes 6 nice ride stations

CHURCH STREET + NORTHROP MALL:
- Northrop Mall + the Science Corridor along Church Street
- Bus Routes and the Future Central Corridor Light Rail Line are within 1/4 of a mile
Tate Laboratory is currently home to the University of Minnesota Physics Department.

In the future the geology department will occupy the space.

The building needs to be flexible to accommodate changes throughout the years.

**Systems Theory**
- From parts to whole
- From objects to relationships
- From structure to process

Helping our Process: Providing a way of thinking and designing that incorporates relationships and scales across the building and University

**Bioregionalism**
- Local connections
- Learn possibilities of place
- Acting responsibly at home

Critical to educate the University campus with their natural surroundings and community through the design
Historic Dialogue Flow Diagram

**Scale**
- Goals

**East Bank**
- Academic Icon

**Northrop + Church**
- Campus Connection

**Building**
- Historical + Performative

**Interior**
- Traditional + Collaborative

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**Plan View**
- High Efficiency
- Lights
- Daylight
- Traditional Plan
- Open Plan
- Permanent
- Flexible

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**Strategies**
- Icon of Academic Tradition + Innovation

**View Corridors**
- Determining how much of the historic facade is kept

**Bioregional Facade Design**
- View corridors from the Mall

**Balance of Public and Private**
- The exterior and interior of the building reflect a University that values its academic tradition while embracing innovative ways of building and learning

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**Historic Dialogue**

*Flow Diagram*
There have been several additions to Tate Hall throughout the years, which has decreased the amount of daylight to many of the interior spaces. Pedestrian access has also decreased.

**Campus 1940**

**Campus 1955**

**Proposed Massing: Enhanced connection through building**
The majority of Tate that can be seen from the Mall should be preserved and respected.
The west (mall) wing is most important to preserve.
The facades that are visible from the Mall are the most important to maintain. Depending on the distance and visibility from the Mall, previous examples have incorporated modern elements in massing and pattern that respect the history of the area.
COLLABORATION
Flow Diagram

TATE LABORATORY | Towards a Sustainable Future 12
Church Street redesign separates transit modes and encourages collaboration

- Safer pathways for bikers and pedestrians
- Edible landscaping and stormwater filtration creates pockets of gathering space
Church Street redesign separates transit modes

Maintains 20’ minimum width for vehicle access
- Includes areas of 26’ width for emergency access
- Edible landscape + stormwater filtration + native plants separate the bike and pedestrian paths
Program Arrangements - Second Floor

1 Existing Arrangement: Currently Tate’s second floor is characterized by a double-loaded corridor which feeds primarily into classrooms and two office clusters

2 More Circulatory/Open Space:
   • Expanded floorplate
   • Increased public work space

3 Lab Integration:
   • Existing and incoming labs integrated throughout
   • Forms a vertical service core increases visibility

4 Breakout Spaces:
   • Work space paired with classrooms
   • Allows for flexible yet focused appropriation
Chosen Arrangement - Second Floor

**Service Space**
Expanded, with breakout class spaces/public work areas.

**Classrooms**
Flexible, with moveable partitions, to allow for differing sizes/environments.

**Labs**
Celebrated, visible to the public and integrated with student functions.

**Offices**
Open, focused upon collaboration and a reduction of hierarchical barriers.
Collaborative, Flexible Spaces - Labs and Offices

Flexible Offices:
Our clients expressed an interest in offices which feature open spaces or work pools rather than the existing individual, closed-off spaces.

Flexible Labs:
Lab spaces are collaborative environments as well, so open arrangements, with flexible equipment locations, would integrate with the overall building system.
### Collaborative, Flexible Spaces - Classrooms and Work Space

<table>
<thead>
<tr>
<th>CLASSROOM</th>
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<th>CLASSROOM</th>
</tr>
</thead>
<tbody>
<tr>
<td>461sf</td>
<td>420sf</td>
<td>630sf</td>
</tr>
</tbody>
</table>

#### Flexible Classrooms:
The current classrooms are traditional, and while desks are potentially moveable they likely aren’t or are only rarely. The spaces are also confined, and the integration of moveable partitions as dividers rather than immobile walls would allow for collaborative classes which break apart or come together during certain activities.

#### Flexible Work Space:
Public spaces with variable seating arrangements and appropriately elements would be more conducive to a public environment, in which the act of learning and working together is celebrated.
Systems Integration: Flow Diagram - Water

Scale goals:
- Restore natural cycles

Northrop + Church:
- Operate within natural budget

Building:
- Living laboratory

Strategies:
- Edible landscape
- Collect and treat runoff
- Stormwater filtration
- Reuse as irrigation
- Green roof
- Water treatment
- Low-flow fixtures
- Water storage trombe wall

Precipitation and irrigation:
- Potable water
- Water filtration
- Water storage
THE LABORATORY | Towards a Sustainable Future

**SYSTEMS INTEGRATION**

**Flow Diagram: Energy**

- **NORTHROP + CHURCH**
  - Utilize natural resources

- **BUILDING**
  - Use active + passive systems

- **INTERIOR**
  - Living laboratory

**Strategies**
- Geothermal heat pump installations under church street
- Daylighting (passive heating)
- Solar thermal (evacuated tube) on courtyard roof
- Evacuated tube
- Piezoelectric installation on floor of first floor passageway
- Enthalpy wheel

**SCALE**
- Goals
Managing Stormwater Runoff

Stormwater runoff from the Mall and Church Street can be filtered in subsurface treatment wetlands that line Church Street.

The filtered water can be reused for irrigation on the Mall.

http://www.modularwetlands.com/mws-linear
Existing Water Budget: Too much runoff

- 26% Vegetation
- 74% Hardscape

Abundance of impervious surfaces → High stormwater runoff → Water pollution

Design Water Budget: Balance between supply and demand

- 66% Vegetation
- 34% Hardscape

Greenroofs and Water filtration → High evapotranspiration and clean runoff → Water management

calculated with rainxchange design calculator and LEED Water Use Reduction worksheet
Subsurface Wetland Water Treatment: Surface Area for Stormwater and Greywater Treatment

Integrated Greenroof/Water Treatment

Stormwater + Greywater Treatment

Greywater Treatment Only

15,500 sf

4,000 sf

600 sf

Water Treatment

Tate’s site easily has the capacity to treat greywater and stormwater on site. One innovative solution that may be viable where land is valuable, would be to integrate water treatment into a greenroof.

calculated with an equation from Stecher, Weaver, & McInnes, 2001.
Reducing annual water use by 48%

Water saving strategies include:
- low-flow lavatories
- dual-flush toilets
- waterless urinals

Through native plantings, irrigation water use stays constant even though vegetated area is doubled due to the green roof.

Base
- 745,667 gallons

Design
- 390,161 gallons

Calculated with rainxchange design calculator and LEED Water Use Reduction worksheet.
CONCLUSIONS
Southeast Exterior Rendering

Integrated PV Panels
Edible Vegetative Wall
Photovoltaics
Bike Paths (Large Permeable Pavers)

Pedestrian Paths (Medium Permeable Pavers)
Solar Tubes
Edible Landscape Planters
Native Reed Grass

TATE LABORATORY | Towards a Sustainable Future
The wholistic design proposals will allow for sustainable systems, small and large scale collaboration and encouraging spaces to propel the University into the future.

**Historical Dialogue**

The building and landscape form a gradient from the traditional Northrop Mall to an innovative Church Street Corridor. Gradients include:

- Symmetrical historical facade to Bioregional approach to facade design
- Efficient lighting to Daylighting
- Fixed classroom space to Flexible classroom space
- Turf grass to Edible Landscape

**Collaboration**

Our design brings a variety of user groups together through:

- connections to public transit
- separated streetscape for easy access
- outdoor gathering spaces around edible landscapes
- a clear and inviting entry on Church Street
- indoor gathering spaces
- flexible classroom and office design

**Systems Integration**

Our design integrates systems across scales, including:

- water cycle at building and neighborhood scale
- passive and active heating and cooling
- daylighting
- habitat creation
- food production

The Systems Theory and Bioregionalism approaches informed and deepened designs such as the water cycle, integrating the edible landscape and positive outdoor spaces, and many more.

The redesign of Tate Laboratory provides many opportunities to connect people, systems, and history throughout the building, the Church Street Corridor, and the greater University of Minnesota campus.
Calculators:
- 2030e² Tool
- ACEEE Job Calculator
- bioplex.co.uk
- Building Water Use - LEED 2.2 calculator
- Energy Star Target Finder
- freehotwater.com
- Living Wage Calculator
- New Jobs Calculator
- Rain Xchange calculator
- Solar-estimate.org

Solar and Temperature Charts:
- solardat.uoregon.edu/SunChartProgram.html
- weatherspark.com/#
- www.solar-noon.com/
- www.wcc.nrcs.usda.gov/climate/windrose.html

Other Resources
- deBritto, Vince, Caleb Nelson, and Emily Stover. Church Street Context & Conditions. 2010.
- Commercial Fruit Production in Minnesota, http://fruit.cfans.umn.edu/FruitsForGardens.htm


Photos:
- ifood.tv, http://www.ifood.tv/recipe/plum_rasam
- The Mary Sue, http://www.themarysue.com/apples-are-good/
- http://www.designaddict.com/design_addict/blog/index.cfm/2009/7/16/Award-for-Inspiring-Design
- http://www.allcountries.org/photos/united_states/united_states_photos_95.html
- http://www.landscapeonline.com/research/article/15100
- http://www.jacco.com/media/AAONaire65.html
LIVING WAGE AND EXPENSES
The charts show the comparison between University of Minnesota students as compared to the living wage necessary for a Minneapolis resident. The different populations provide a comparison to the expenses that students are encountering as related to a full-time working resident.
JOB CREATION OPPORTUNITIES
The initial installation and maintenance of photovoltaic panels on 1/3 of the current existing roof space of Tate Lab would create a total of 3.8 jobs.

Using government stimulus money on the construction of Tate Lab would create 27 jobs in the first year, and 22 in the 10th year.

ACCESSIBILITY EQUITY
The current entrances to Tate Lab are not accessible to all. There is one side handicap entrance, which puts these users at a disadvantage by not entering in the same place and decreasing chances for the same interactions as other users. The other important aspect is that there is no entrance to Tate directly from Church Street. The new design should have an entrance on Church Street that is accessible to all.

calculated with the ACEEE Jobs Calculator and the New Jobs Calculator
SEATING IN RELATIONSHIP TO ENTRANCES AND ACCESSIBILITY
The amount of seating relates to the number of people using the corresponding entrances. The interior and Church Street areas need the most improvement.
**GREEN DISTRICT:**
This area encompasses the East Bank of the University of Minnesota campus, along with its associated residential area like the Marcy Holmes and Stadium Village neighborhoods. This district is bounded by the Mississippi River, the rail line, 35W, and I-94.

**EAST BANK ACADEMIC NEIGHBORHOOD:**
This neighborhood scale includes all of the academic buildings on the East Bank and housing within the University system. Within this neighborhood there are 6 nice ride stations.

**TATE NEIGHBORHOOD:**
The immediate neighborhood of Tate Hall includes Northrop Mall and the Science Corridor along Church Street. Bus Routes and the Future Central Corridor Light Rail Line are within 1/4 of a mile.
04 site+habitat

Regional Influence Plan and Climatic Data

SITE: TATE AND CHURCH ST.
STADIUM VILLAGE
HISTORIC MALL AREA
DINKYTOWN

<table>
<thead>
<tr>
<th>Month</th>
<th>Precipitation</th>
<th>Temperature</th>
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<tbody>
<tr>
<td>JAN</td>
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<td>FEB</td>
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<tr>
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<tr>
<td>OCT</td>
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<td>NOV</td>
<td>1.94</td>
<td>09.8</td>
</tr>
<tr>
<td>DEC</td>
<td>1.00</td>
<td>09.3</td>
</tr>
</tbody>
</table>
HARDCAPSE AND VEGETATION
There are many areas for improvement in the site area, such as reducing the amount of impervious pavement and collecting stormwater.

EDIBLE LANDSCAPE
There are many opportunities for edible landscape options in Minnesota. The east-facing facade provides the best opportunity for successful plant growth since it has minimal shade from surrounding buildings and the highest amount of pedestrian traffic. Common fruits used in edible Minnesota landscapes are plums, apples, and strawberries.

data from the Minnesota Edible Landscape website
Building Massing:
Tate Laboratory is a U-shaped building with one and two-story infill in the center. The U opens to the east, providing more southern and northern exposures for daylight penetration. Though the building’s eastern facade along Church Street features the only major indentation, this side does not currently provide access to incoming students.

The eastern facade also features reduced glazing in comparison with the north and south, as early morning (and late afternoon) light is difficult to control in terms of glare.

Design Opportunities:
South-facing daylight opportunities are somewhat limited in winter due to the height of the neighboring Murphy Hall (in relation to the southern wing) and the southern wing (in relation to the northern wing) but the imposition is minor (shadows are cast on the lower half of the facades during the winter).

Positive outdoor space would most easily be created to the east, in both redesigning Church Street as a green street and Tate’s connection to it through supplementation with living systems.
06 energy optimization

1 Energy Star Metric Key Data:
- Energy use of average building this size (K-12 school) is \(>13\) million kBtu.
- A 50% reduction in energy use would save \(~\$86,000\) per year.

2 2030e² Metric Key Data:
- The baseline EUI for a similar building is 67 kBtu/sf; a 60% reduction to 26.8 kBtu/sf would fulfill the 2030 Challenge.

3 Solar-Estimate.org Key Data:
- Achieving net zero (eliminating the remaining 40%) through PV would cost \(~\$6.7\) million with a payback of \(~22\) years and require about 4 times the existing roof area.

4 Other Metrics:
- Luckily, other options for reduction are available. Solar Hot Water has a ROI of 7.38 years, and an Anaerobic Digester would be effective if the occupancy increased or Tate collected biomass from satellite structures.

5 General Design Guidelines:
- We need to balance energy use by looking at climate conditions (daylighting may hurt us in areas by reducing insulation, for example).

6 We plan to examine the actual energy use data as well as expand upon model-based metrics and reductions found in previous student work.
Material Catalog

Insulation
Polyisocyanurate Board

Framing
FSC-Certified Lumber

Countertop
Richlite (Paper)

Flooring
Linoleum

Paint
Sherwin Williams
Latex Low-VOC Paint

CFMU
Pentstar Two-sided Block with Insulation Insert

data from Minnesota Building Materials Database