Sustainability Goals
Jones Library
Sustainability Goals Schematic Design Package
The Jones Library was built in 1928 and has since had only one major renovation in 1993. The proposed project would create a 3-story addition at the rear of the building and renovate the existing historic building to meet the contemporary needs of the facility. Among the goals of this project are a series of sustainability goals as outlined in the memo dated October 28th, 2019. Finegold Alexander Architects appreciates the clear goals of the Sustainability Committee and its strong commitment to sustainable design. The design team has performed an investigation of the design goals as reflected in the proposed Schematic Design. As a Schematic Design report, the findings enumerated within this report are to inform a baseline which can be studied and improved upon at each subsequent phase. The findings are presented below and in the attached documents.

**EUI Goal/ Net Zero**

Based on email correspondence from the Jones Library, the current site EUI of the existing library building is 73.2 kBtu/sf/year. This is consistent with data collected by the 2012 Commercial Building Energy Consumption Survey (CBECS) which lists the Median site EUI for library buildings in the United States as 71.6 kBtu/sf/year. An analysis of the proposed design based off the schematic energy model (Attachment A) indicates a predicted Energy Use Intensity (pEUI) of 34.4, showing a 52% decrease in energy performance over the median site EUI for library buildings. The pEUI does not assume the use of any on site renewable energy sources which could further decrease the EUI. The design team has developed an alternate low carbon composite wood and CLT structural system.

1 An alternate low carbon composite wood and CLT structural system was also developed.
enumerated additional energy conservation measures (ECMs) that could further decrease the site EUI at the discretion of the client (Attachment B). With the implementation of selected ECM’s, Net-Zero Energy could be achieved through purchased off-site renewable energy.

<table>
<thead>
<tr>
<th>Energy Savings</th>
<th>Total Cost Savings</th>
<th>Total EUI Savings</th>
<th>Budget Implications</th>
</tr>
</thead>
<tbody>
<tr>
<td>Electric Savings</td>
<td>Natural Gas Savings</td>
<td>$</td>
<td>$</td>
</tr>
<tr>
<td>ECM #1</td>
<td>HVAC Insulation</td>
<td>4,446</td>
<td>$880</td>
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<tr>
<td>ECM #2</td>
<td>Existing Wall Insulation</td>
<td>21,012</td>
<td>$5,412</td>
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<tr>
<td>ECM #3</td>
<td>Triple Pane Window Glazing for All Windows</td>
<td>12,152</td>
<td>$3,430</td>
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<tr>
<td>ECM #6</td>
<td>High Performance Glazing for New Windows (Option to ECM #5)</td>
<td>72</td>
<td>$14</td>
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<tr>
<td>ECM #8</td>
<td>Window Overhang</td>
<td>3,084</td>
<td>$517</td>
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<tr>
<td>ECM #17</td>
<td>Lighting Controls</td>
<td>20,159</td>
<td>$4,032</td>
</tr>
<tr>
<td>ECM #20</td>
<td>Geothermal Heating/ Cooling</td>
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<td>$2,730</td>
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<tr>
<td>ECM #25</td>
<td>HVAC Occupancy Controls</td>
<td>1,540</td>
<td>$240</td>
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<tr>
<td>ECM #30</td>
<td>HVAC Demand Ventilation Controls</td>
<td>10,414</td>
<td>$2,043</td>
</tr>
<tr>
<td>ECM #35</td>
<td>Plug Load Controls</td>
<td>8,650</td>
<td>$1,300</td>
</tr>
<tr>
<td>ECM #40</td>
<td>Photovoltaics</td>
<td>12,314</td>
<td>$2,448</td>
</tr>
</tbody>
</table>

Note: Assuming all Energy Conservation Measures are implemented, it is possible for the project to achieve a pEUI of 24.4 kBTU/sf/year

The above highlighted Energy Conservation Measures would indicate a predicted Energy Use Intensity of approximately 29 kBTU/sf/year

Investigation of On-Site Renewable Source Options

The proposed design currently includes a high efficiency VRF space conditioning system. Under the current design, the yearly cost of space conditioning would be $27,255.09. An investigation of an alternative geothermal system shows that, the yearly cost of space conditioning with a geothermal system would be $19,559.45. Due to the current moratorium on limiting gas usage to the current installed capacity, information on possible rebates is not currently available. Without rebates, the simple payback period for a geothermal system would be 148 years (Attachment C).

Eliminate Use of Fossil Fuels

The existing building is serviced by natural gas that is powering the heating boilers and hot water heater. The proposed design eliminates all gas-powered systems and replaces them with systems that are powered by electricity (Attachment D).
Low Embodied Carbon Materials
The feasibility completed in 2016 and the revised schematic design focused on a conventional steel framed structural system that consisted of a composite concrete and metal deck slab on a structural steel column and beam system. In the interest of pursuing a building with low embodied carbon materials, we worked with our structural engineer (RSE) to prepare a schematic package with an alternative heavy timber hybrid structural system. The alternative proposes maintaining a conventional steel column system in the basement and a heavy timber structural on the upper floors. The heavy timber system consists of cross-laminated timber (CLT) floor slabs on glue laminated (glulam) columns and beams. The system alternates are detailed in the attached structural documentation (Attachment E). The design team performed a comparative Life Cycle Assessment (Attachment F) that examined the environmental impact of the structural systems as shown in attachment E. The results showed that the timber structure resulted in significantly less Global Warming Potential than the steel structure.

To fully understand the impact of the structural system options, the building estimate includes a cost comparison (Attachment G). This estimate shows that the hybrid heavy timber and steel system would result in a cost increase of $365,926.00. The full breakout of this cost is detailed in the attached cost estimate.
PSE Associates.
5/11/2020
Jones Library CLT Scheme

Scheme 1: Transfer Columns at 1st Floor
1st Floor Framing: 6.25" Concrete Slab on metal deck over steel beams. Steel Columns Supporting Steel beams

General Notes
1. Synchronize the receipt of utilities necessary to allow prior to 1st floor framing.
2. New concrete action poles as indicated.
3. Steel beam to be sectioned into 3 sections. (except sliding panel walls)
4. Steel beam to be sectioned into 3 sections. (except sliding panel walls)
5. 10% of existing concrete slab to be cut.
6. Tauten taut.
7. See sheet A601 for partition types.
8. Replace damaged or missing wood trim, paneling, and cabinetry.
9. Assume 100% Existing/Original wall to be exposed; Assume 10% repointing of existing masonry walls.
10. Provide New Ice and Water Cleaning and 10% repointing.

Geographic Key
- Existing G/A/F
- New G/A/F
- Ground Floor - Above
- Key Plan
- Finegold Alexander Architects

902 SF
- Burnette Art Gallery

1203 SF
- Restroom

838 SF
- Workroom

239 SF
- ESL Tutor Room

281 SF
- ESL Project

57 SF
- Head of Special Collection

52 SF
- Head of Tech Services

63 SF
- Tech Specialist/
Scheme 1:
2nd & Roof Framing: 2" Topping over 1'
Acoustic Layer over 5 Ply CLT (6.7")
& Glulam beams & Glulam columns
Whole Building Life Cycle Assessment (LCA) is the most widely accepted method for assessing embodied carbon. In addition to exploring alternative structural systems to reduce the embodied carbon of the new addition, the design team has prepared a Whole Building Life Cycle Assessment that explores the embodied carbon of the proposed addition. This number is listed as Global Warming Potential and the results are expanded upon below. The design team is prepared to continue to work towards lowering the embodied carbon of the building with comparative analyses in subsequent phases.

**Whole Building Life Cycle Assessment**

The attached Life Cycle Assessment (LCA) was performed using the Tally Life Cycle Assessment software (Attachments H, I and J). The scope of the assessment includes core, shell, footings, foundations, structural wall assemblies from cladding to interior finishes, structural floors and ceilings, interior non-structural walls and finishes, and finishes on structural floors and ceilings for the new addition and the existing portion that will remain. The assessment found that, among other environmental impacts, the proposed design had a total Global Warming Potential of 1,433,189 kgCO₂eq. This number is based on the schematic design and should be considered a baseline. To gain a fuller understanding of the impact of the new work being performed, the design team also produced a LCA that evaluated the new addition alone and an LCA that evaluated the portion being demolished. The report of the new addition found that it has a total Global Warming Potential of 1,274,228 kgCO₂eq. It can be assumed that for the purposes of this report, Global Warming Potential of the demolition portion of the project can be represented by the End of Life impact alone. The report of the demolished portion found an End of Life Global Warming Potential of 17,773 kg CO₂eq. The environmental impacts as quantified by the impact categories in the LCA can be improved through various measures such as adding fly ash to the concrete and reducing material usage throughout the design. The design team is prepared to present options to lower to the environmental impacts of the facility at the discretion of the client as the project progresses into later stages of design.
In addition to studying the environmental impacts of construction, the design team studied the impacts of operational energy. Based on the current EUI of the existing building (73.2 kBtu/sf/year) and assuming 22% of that energy is heating from natural gas, over 60 years the Global Warming Potential is 18,288,925 kgCO₂eq. In addition to the proposed project having an initial Global Warming Potential of 1,433,189 kgCO₂eq, the study showed an operational Global Warming Potential of 11,382,681 kgCO₂eq and a total Global Warming Potential of 12,815,870 kgCO₂eq.

**Attachments:**
Attachment A: Energy Model pEUI report
Attachment B: Potential Energy Conservation Measures
Attachment C: Summary of Renewable Energy Investigation
Attachment D: Summary of Proposed New Systems
Attachment E: Structural System Schematic Schemes and Narrative
Attachment F: Life Cycle Assessment Design Option Comparison
Attachment G: Structural System Estimate
Attachment H: Life Cycle Assessment Report (New and Existing)
Attachment I: Life Cycle Assessment Report (New)
Attachment J: Life Cycle Assessment Report (Demolition)
In summary, FAA will proceed into Design Development moving forward with the green highlighted ECM measures below and the schematic heavy timber alternate. Yellow highlighted items will be reviewed during Design Development.

<table>
<thead>
<tr>
<th>ECM #</th>
<th>Measure</th>
<th>Electric Savings kWh</th>
<th>Total Cost Savings</th>
<th>EUI Reduction</th>
<th>Initial Cost</th>
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<tbody>
<tr>
<td>ECM#7</td>
<td>Lighting Controls</td>
<td>20,159</td>
<td>$4,032</td>
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<td>ECM#9</td>
<td>HVAC Occupancy Controls</td>
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<td>HVAC Demand Ventilation Controls</td>
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<td>ECM#11</td>
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<td>ECM#12</td>
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<td>Total</td>
<td></td>
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<td>$20,142</td>
<td>-5.28</td>
<td>$290,650</td>
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</table>

✓ EUI for the expanded and renovated building would be reduced from 34.4 to 29.12 meeting the goal of 25-30.

<table>
<thead>
<tr>
<th>ECM #</th>
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<th>Electric Savings kWh</th>
<th>Total Cost Savings</th>
<th>EUI Reduction</th>
<th>Initial Cost</th>
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<td>ECM#4</td>
<td>Triple Pane Window Glazing *</td>
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<td>Window Overhang **</td>
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<tr>
<td>Total</td>
<td></td>
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<td>$38,207</td>
<td>-1.06</td>
<td>$1,563,198</td>
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</table>

*Limit to north facing windows. Cost to be included as a line item during design and development.
** Review during design development to determine cost/benefit analysis.

Schematic Alternate: Cross Laminated Timber Additional Cost: $365,926