The Greener Facility: Going Beyond LEED

Thursday, October 27, 2011

SHOWMAN FABRICATORS

BROADWAY green alliance

BARBIZON LIGHTING COMPANY
www.barbizon.com

NEWLIGHT INITIATIVE

Introductions

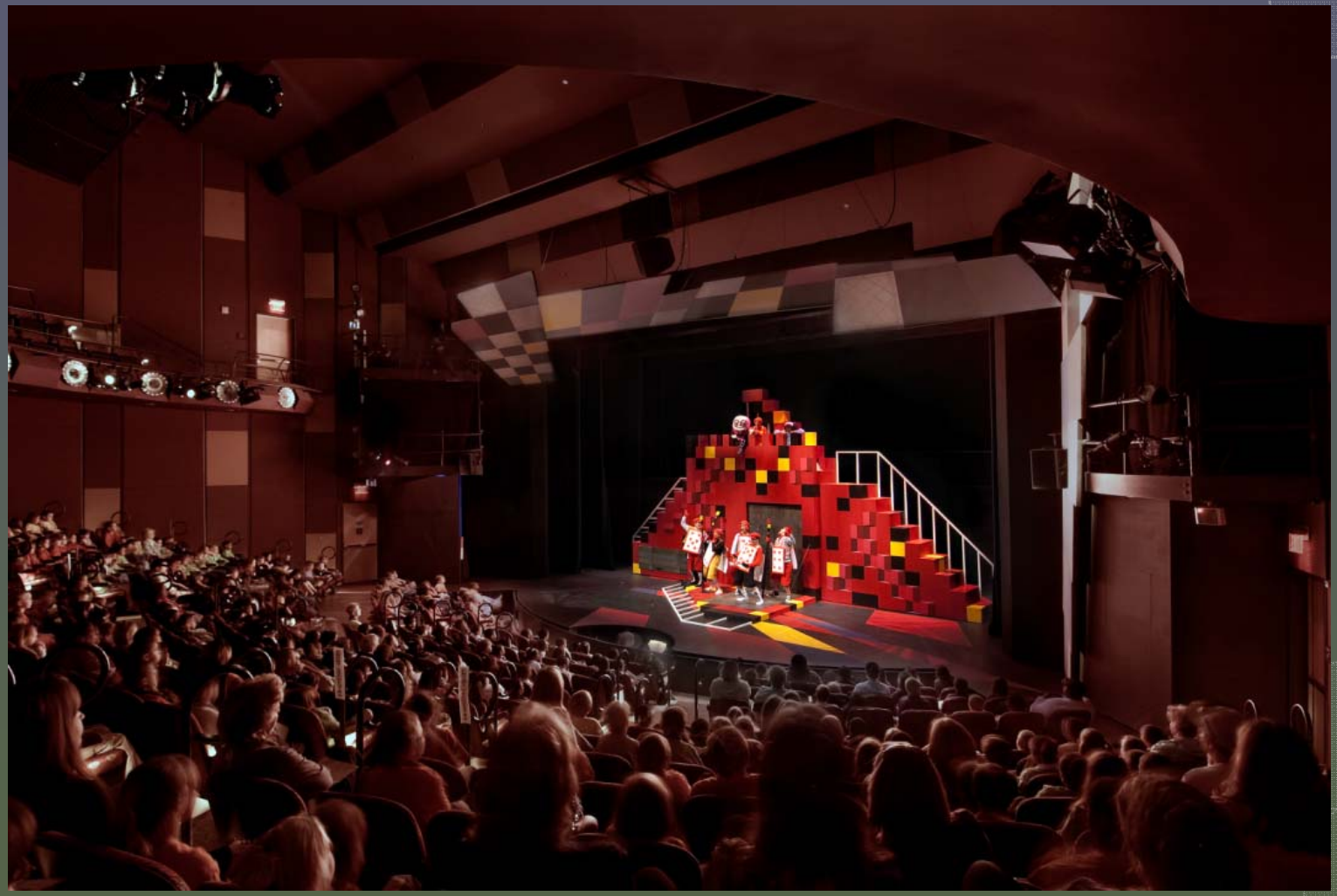
- Matt Welander, Theatre Projects Consultants
- Katie Oman, LEED AP, Fisher-Dachs Associates
- John Shorb, LEED AP, AIA, Opsis Architecture
- Denis Blount, ARUP

The Greener Facility

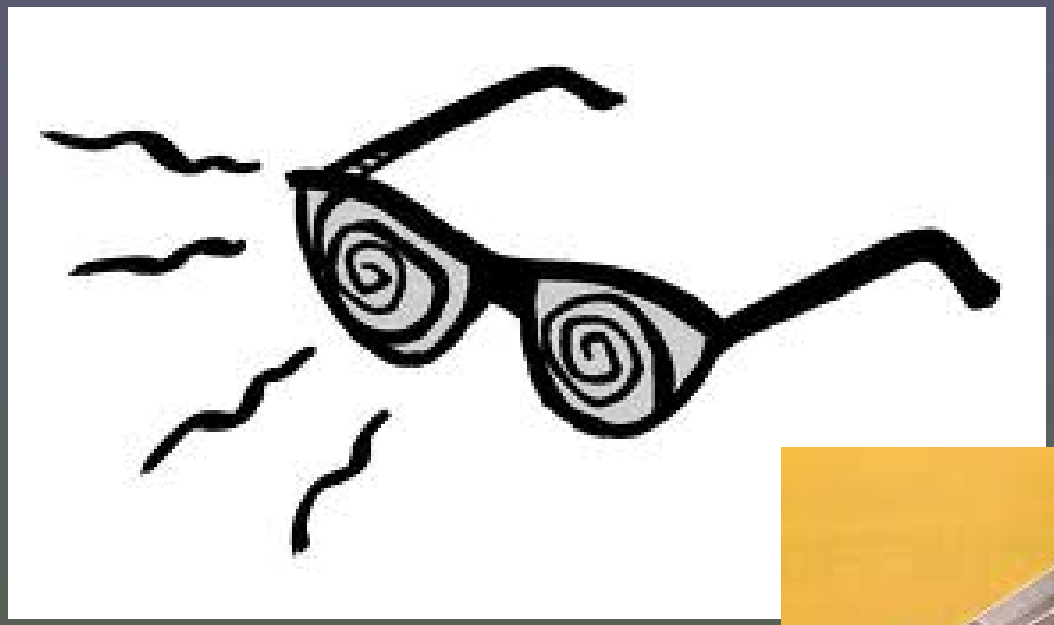
What's LEED got to do with it?

LEED, follow, or …

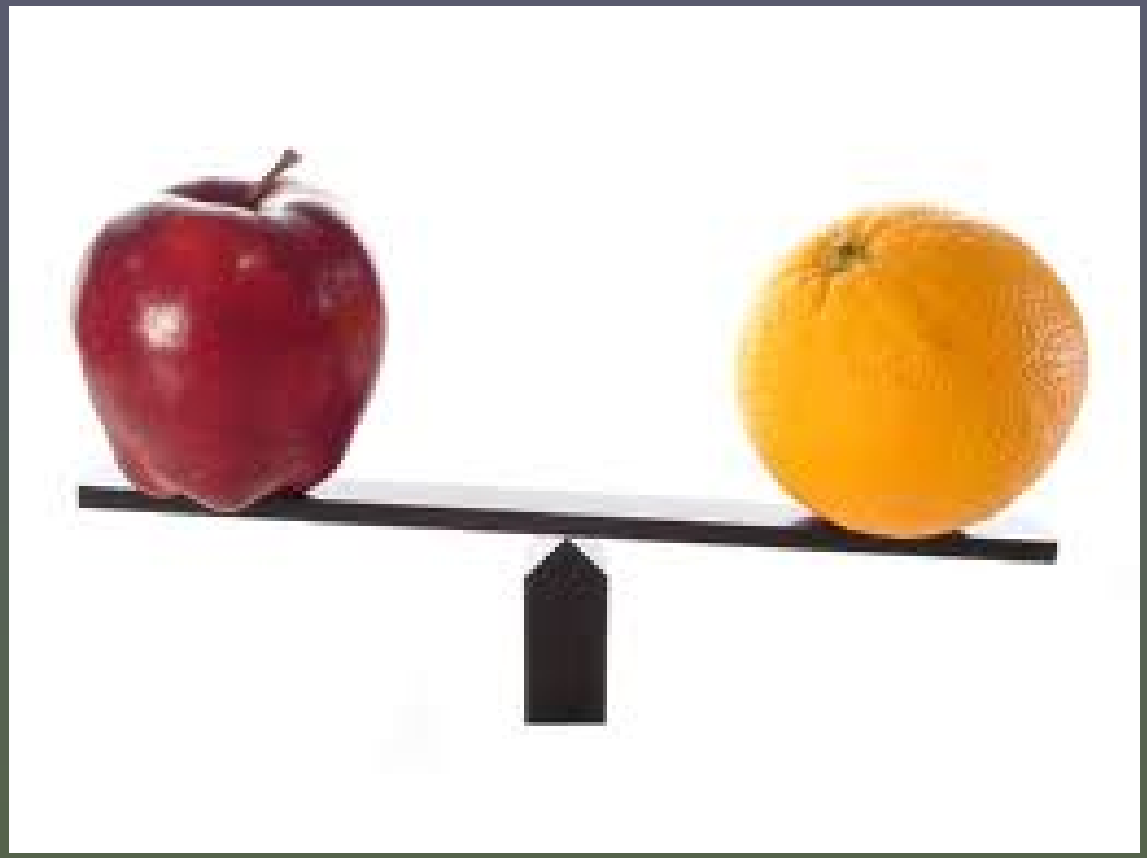
Pros and cons of LEED



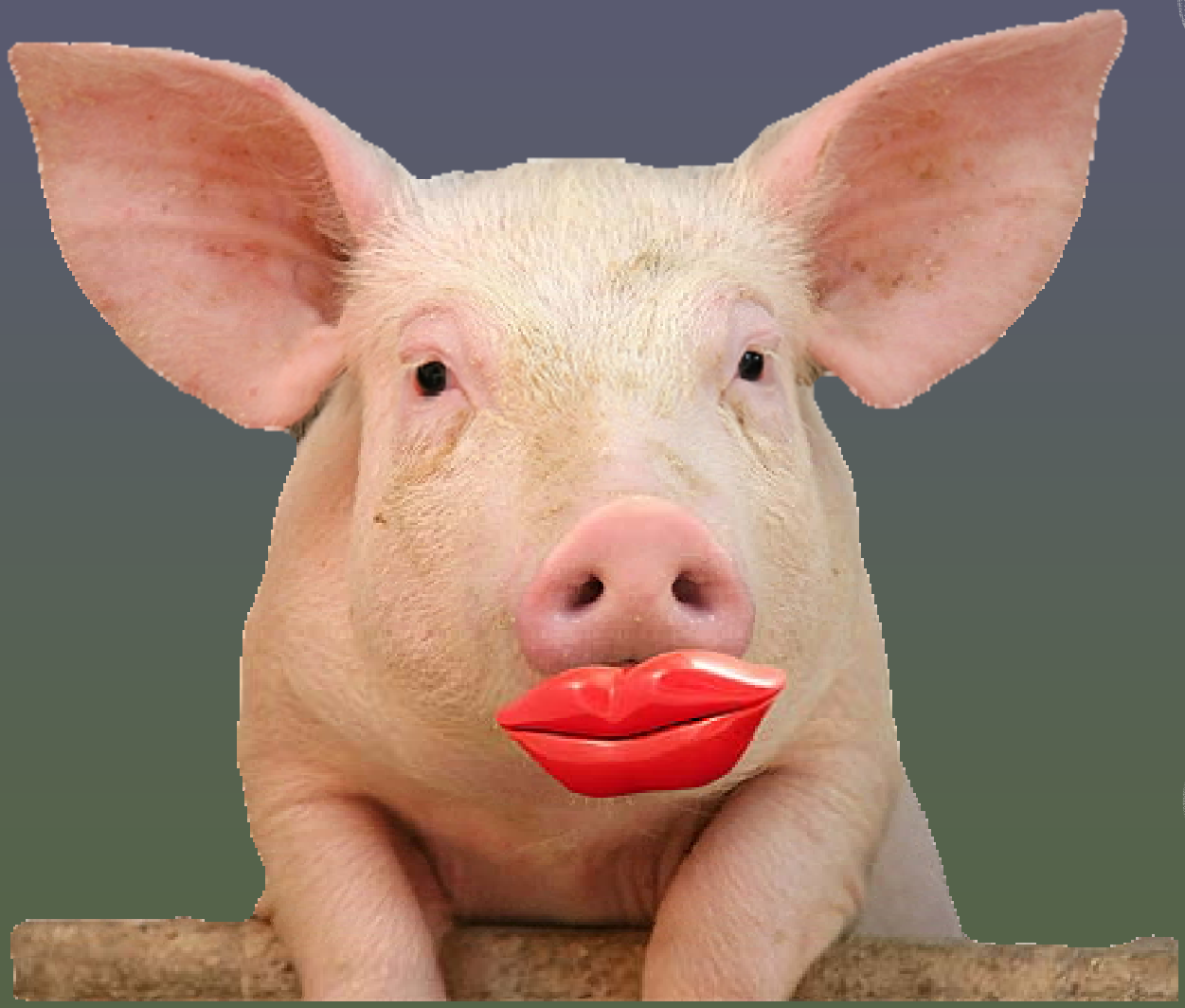
LEED Brain



The bike rack argument



Greenwashing



LEED and theaters

Do we really need a LEED rating?

SHOES
I MAY WEAR A SIZE 7 SHOE, BUT I LEAVE A SIZE 14 CARBON FOOTPRINT.

LEED EBOM

Existing Buildings: Operations & Maintenance

LEED EBOM

Sustainable Sites

Water Efficiency

Energy and Atmosphere

Materials and Resources

Indoor Environmental Quality

Innovation in Operations

Regional Priority

FDA

LEED EBOM

Measurement & Reporting

-Water and Energy Performance Measurement

-Emissions reduction reporting

-Energy sub-metering

-Waste auditing

Policy and Planning

-Landscape, Hardscape, Pest Management plans

-Purchasing and Waste Policies

-Green Cleaning Policies

-Alternative Commuting Policy

-Planning for building upgrades & expansion

Best Practices

-Commissioning

-Energy- and water-efficient equipement & practices

-IAQ best practices

-Systems control

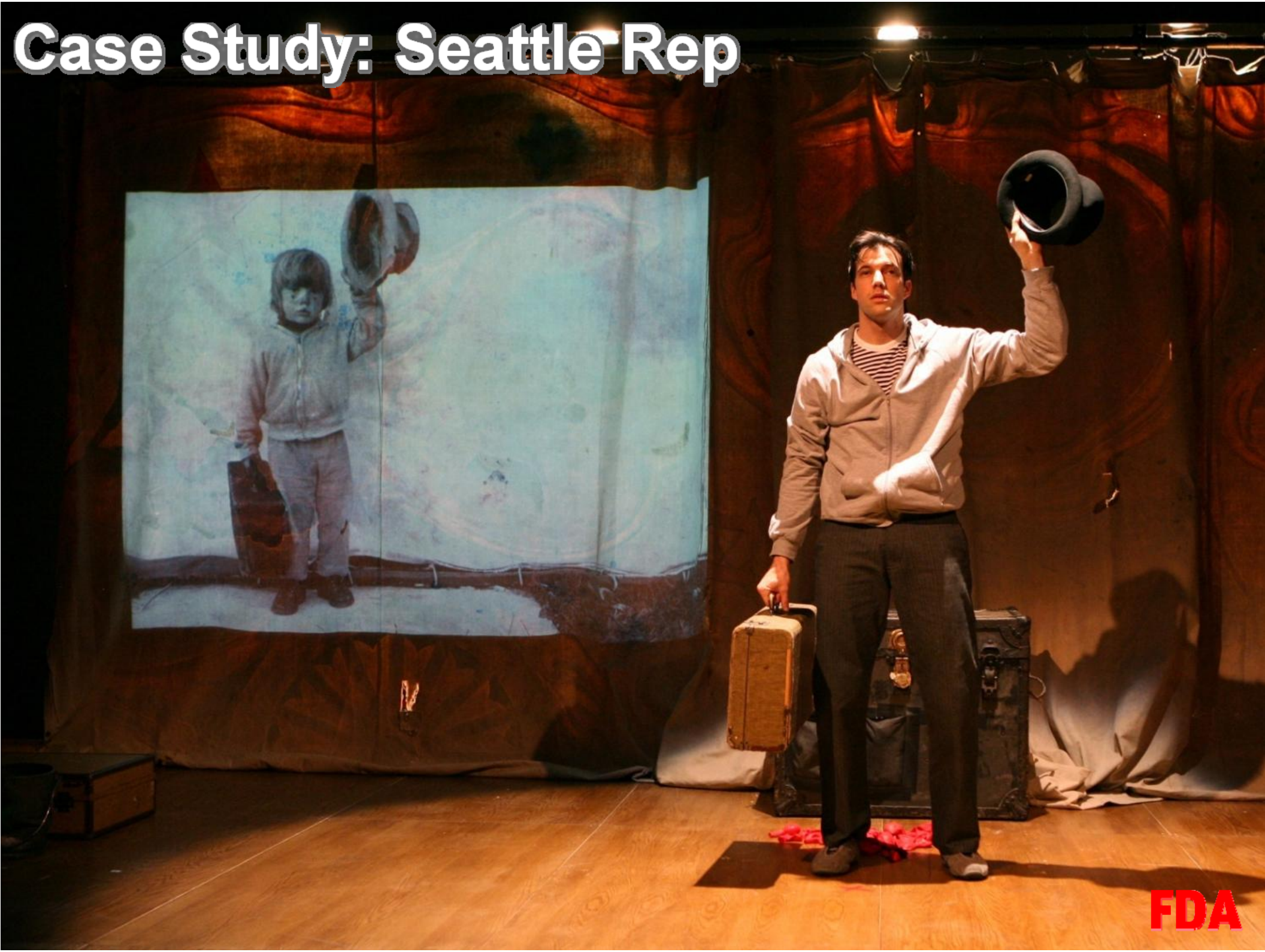
-Sustainable site management and design

-Renewable Energy

-People-friendly design

FDA

Case Study: Seattle Rep



Case Study: Seattle Rep

1) Document Baseline

What's being done now?

How does this affect the bottom line (to ID savings)

How are we communicating to our patrons about sustainability?

2) Identify Areas for Improvement

What can we do to improve?

How much will it cost?

What impact will it have?

Can we leverage any partnerships?

3) Implement

Develop Environmental Action Plan

Harvest Low-hanging Fruit

Report on progress

FDA

Case Study: Seattle Rep

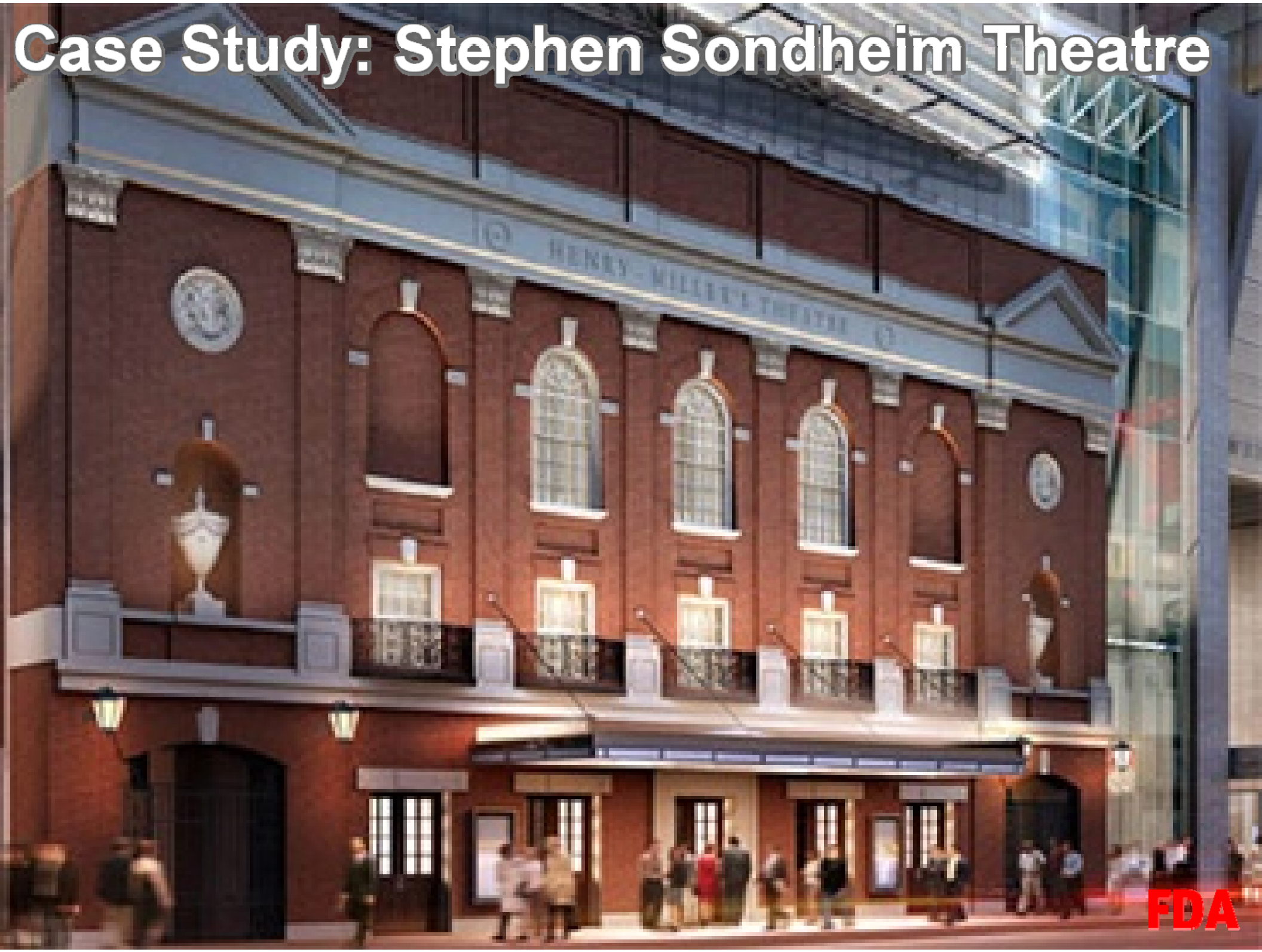
Case Study: Seattle Rep

Image courtesy Gustafson Guthrie Nichol ltd

Donnelly Gardens
Theater Commons at Seattle Center
Groundbreaking, September 2009
Opening, Spring 2010

FDA

Case Study: Stephen Sondheim Theatre



Case Study: Stephen Sondheim Theatre

Priority: Indoor Environmental Quality

FDA

Case Study: Stephen Sondheim Theatre

Indoor Environmental Quality

- HVAC system filters out 95% of particulate matter
- CO2 sensors help deliver 30% more fresh air than code requires
- Paints, sealants, and adhesives are low VOC
- Green Label Plus certified carpeting
- Wood products are low VOC and contain no added urea-formaldehyde
- All furniture is Greenguard Indoor Air Quality Certified
- Strict construction procedures prevented dust and debris from entering the theatre's ductwork system

Case Study: Stephen Sondheim Theatre

Materials

- Over 75% of project waste diverted from landfill
- Blast furnace slag replaces 45% of cement in the structural concrete
- Wood products FSC certified
- Sheetrock with high recycled content and mineral fiber acoustic ceiling tile is used throughout
- Lobby Carpeting is 100% wool
- Seating upholstery is 100% recycled polyester, and is fully recyclable.
- Drapery fabric is over 50% wool

Case Study: Stephen Sondheim Theatre

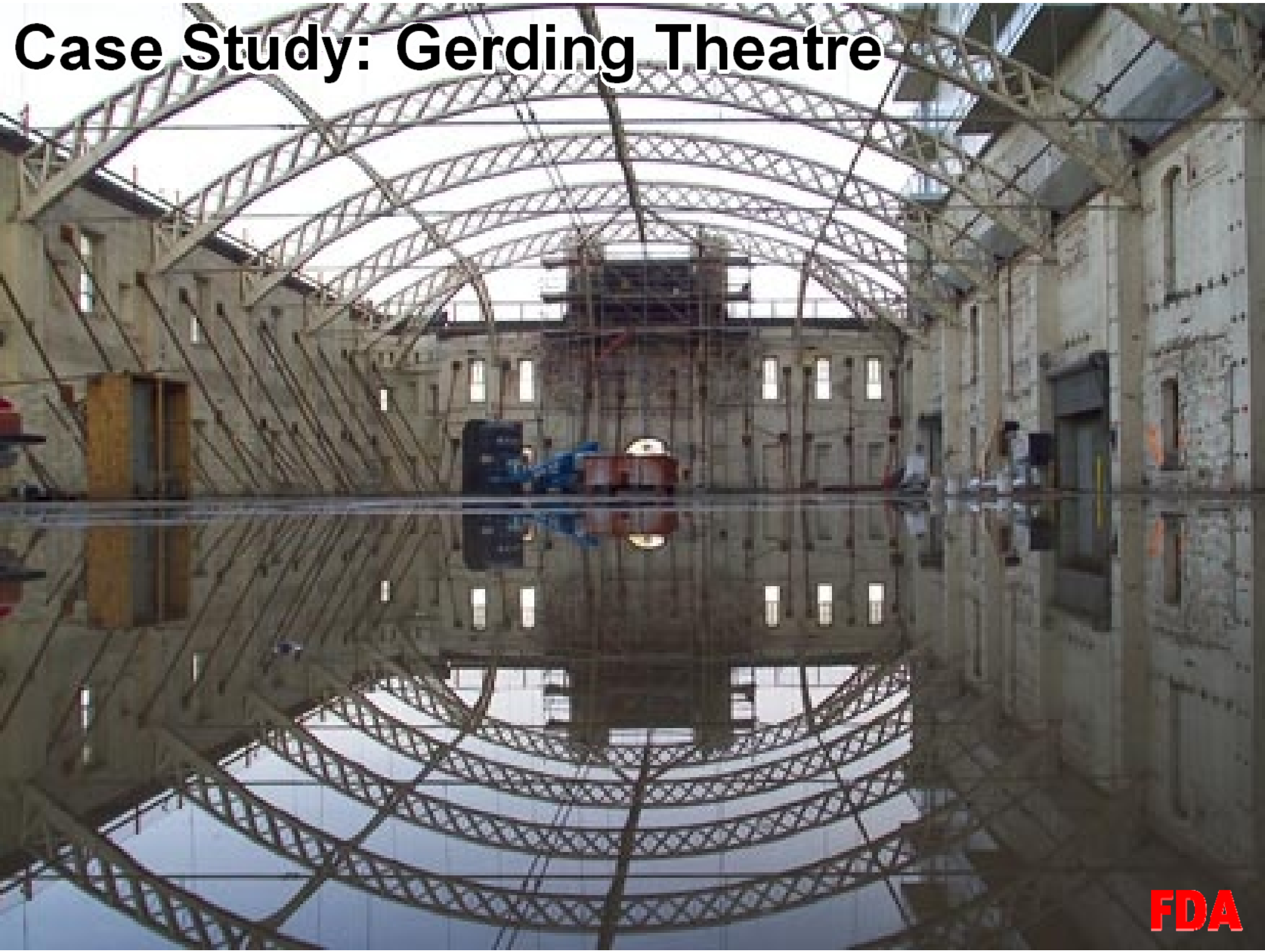
Water Conservation

- Waterless urinals reduce potable water consumption by 1/3
- Wastewater is reused for flushing toilets

Energy Efficiency

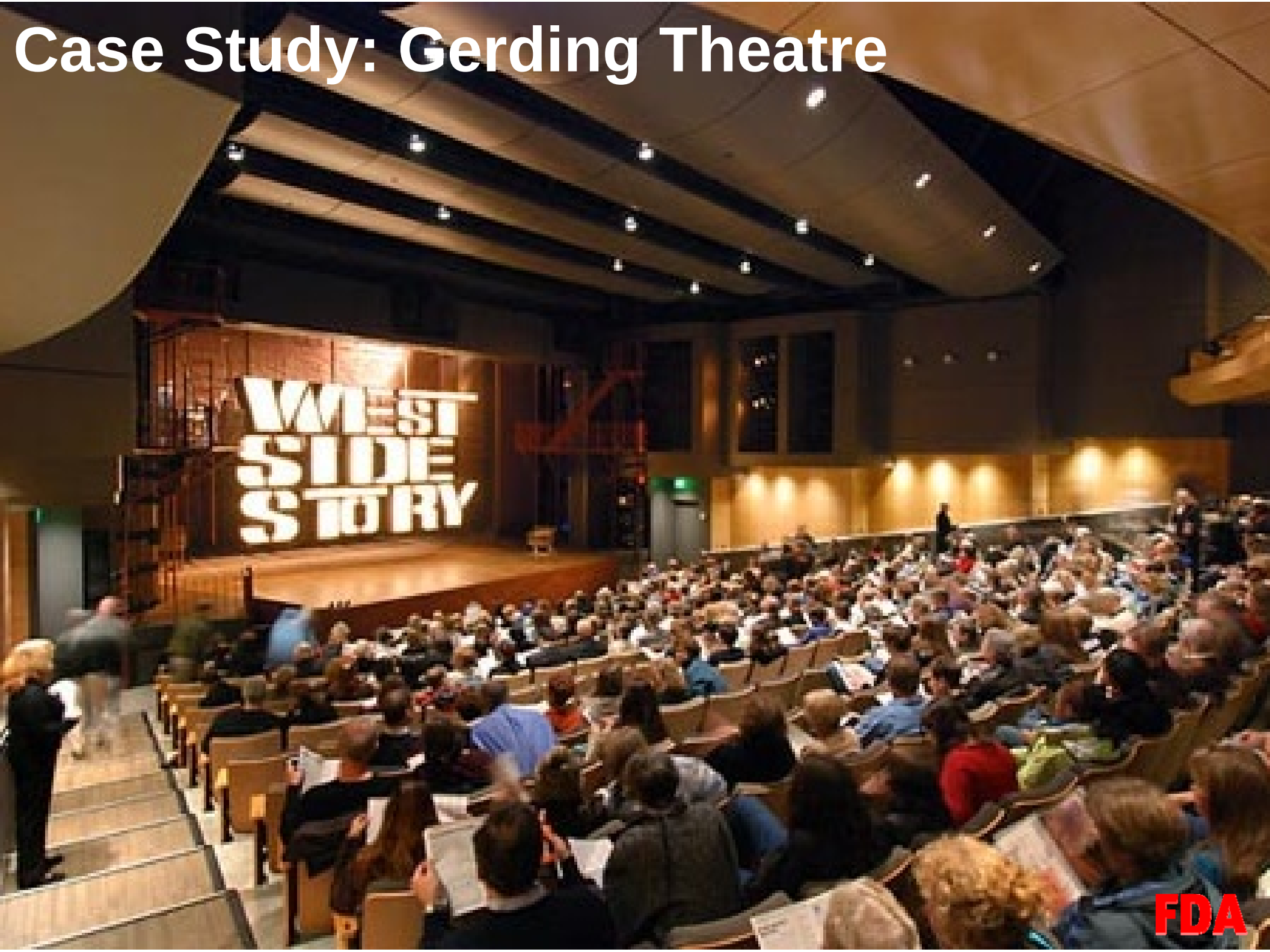
- Energy Star equipment and appliances
- Equipment and systems commissioning

Case Study: Gerding Theatre



Case Study: Gerding Theatre

Case Study: Gerding Theatre



Case Study: Gerding Theatre

Information provided by Green Building Services, Portland Family of Funds, Glumac Engineering, and Hoffman Construction. Silver Park model provided by Murase & Associates. Armory model and layout by GBD Architects.

Sustainable Design:

Reaching LEED Platinum for The Gerding Theater at the Armory

The Gerding Theater at the Armory is the first building on the National Register of Historic Places and the first building in Portland to achieve the highest benchmark in the U.S. Green Building Council Leadership in Energy and Environmental Design (LEED) Rating System.
This rating system addresses the environmental and human impacts of a building in six categories:
Sustainable Sites, Water Efficiency, Energy & Atmosphere, Materials & Resources, Indoor Environmental Quality, and Innovation & Design Process.

Energy

Using an energy model to estimate energy usage and test energy efficiency measures, the building is expected to achieve 30% energy cost savings over a similar code-compliant building.

Chilled beams provide office cooling instead of a fan-driven HVAC system. More efficient and comfortable than traditional systems, these overhead fixtures supply radiant cooling through chilled water pipes. Integrated with overhead lights they also work concert with the underfloor displacement ventilation

Dimming system reduces energy use in lobby; Integrated daylight sensors dim electrical lights in office spaces.

The minimum LEED threshold for daylight in 75% of regularly occupied spaces is met by locating office and rehearsal spaces on the top floor under numerous skylights.

Advanced glazing systems reduce electric light use and maximize daylight while minimizing winter heat loss, air infiltration, and summertime heat gains.

Indoor Environment

Displacement and underfloor ventilation is used in the lobby and main theatre. This system will deliver fresh air under every other seat, with lower energy use and less fan noise.

In the top floor administrative offices air is delivered under the floor to reduce the energy required for cooling and improve air quality, thermal comfort and user control.

A Green Cleaning Policy adheres to strict guidelines concerning any of the cleaning products, materials and processes used within the building.

All regularly occupied spaces have CO_2 monitors installed to increase fresh air supply when needed.

Interior materials were selected to preserve a high level of indoor air quality from paints, coatings, carpets, sealants, adhesives and composite wood products.

Natural ventilation is provided through operable windows and skylights.

Daylight is introduced into the building by carefully located skylights.

Materials & Resources

The architect and interior designers specified as many materials as possible that have a high percentage of recycled content and were locally manufactured or harvested. As a result 25% of materials have recycled content and 45% were manufactured within 500 miles.

The general contractor was diligent in recycling, reusing and diverting waste: 95% of construction waste was diverted from landfills.

FSC wood used throughout this project is certified by the Forest Stewardship Council as sustainably managed.

Recycling collection areas are located throughout the building, including shower/ changing rooms, offices and kitchens. In addition, PCS will provide ongoing training and education for staff on issues of recycling and sustainability.

79% of the existing structure is preserved.

Site Strategies

Space conserving 55,000 SF of interior programming is housed in a 20,000 SF footprint.

A "Silver Park" provides native vegetation and natural stormwater treatment as well as urban green space.

Pervious pavers in the sidewalk allow rainwater to infiltrate into the ground.

Light colored paving, a high-emissivity roof and shade trees help reduce "urban heat island effect"

Brownfield site mitigation practices were followed.

A FlexCar shared car is located adjacent to site.

Carpool drop-off area is in front of the theater.

30 bicycle parking spots and seven shower facilities make bike commuting easier for employees, visitors and patrons.

Chilled beams provide radiant cooling or heating

Rainwater harvested from roof drains

Water

A rain water harvesting system captures rainwater to flush toilets and urinals.

Many jurisdictions are reluctant to grant permits for rain water and grey water systems, the Armory is thus helping to set a new precedent.

On site stormwater capture and treatment (including bioswales in Silver Park) reduces stormwater runoff by 26%.

Total potable water use was reduced by 89% with rainwater harvesting. The 10,000 gallon cistern collects rainwater from the roof, filters and delivers it to toilets and urinals.

Innovation and Design Process

The Natural Step Principles were throughout the design and construction of the building.

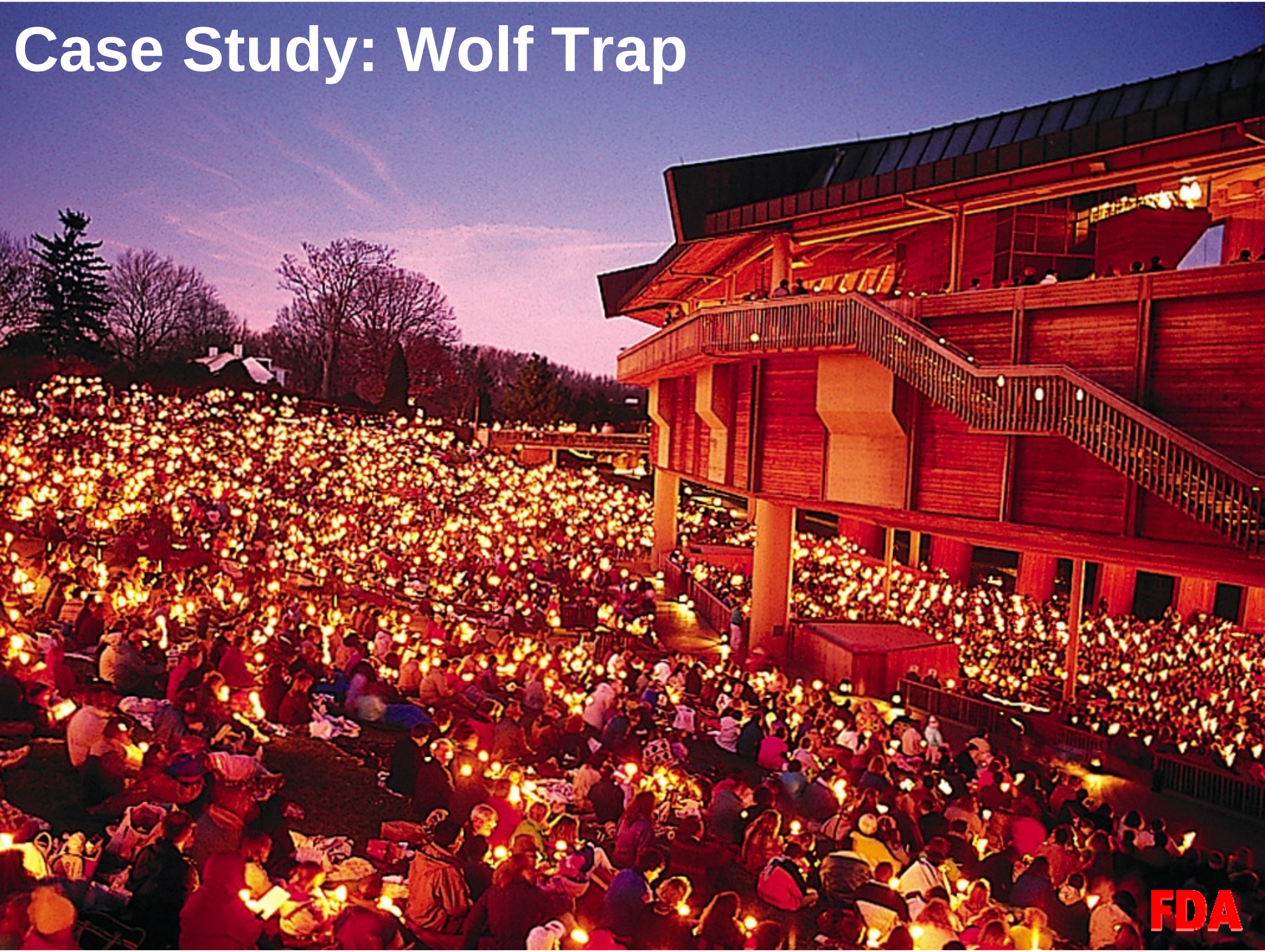
More than 45% of building materials were regionally manufactured or harvested, more than double the LEED requirement.

The project provided tours of the building during construction and has continued to do so after the project was completed. The goal is to share the knowledge learned from the project and educate the general public, staff and school children about the principles of sustainable building through theatre performance, articles written, tours and using this project as a case study.

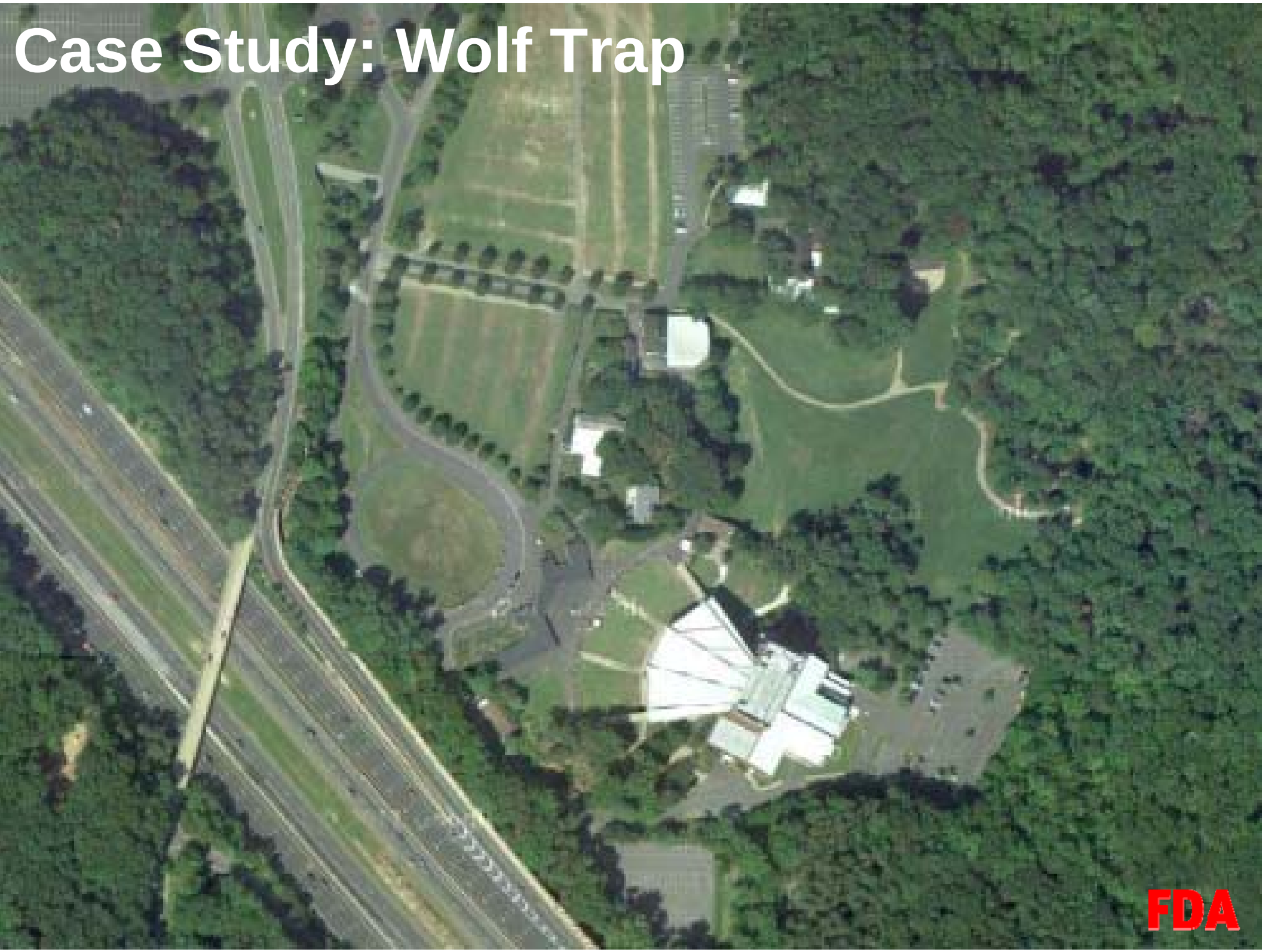
image & info courtesy GBD Architects

GBD ARCHITECTS · MURASE ASSOCIATES · GLUMAC · Green Building Services

Case Study: Wolf Trap

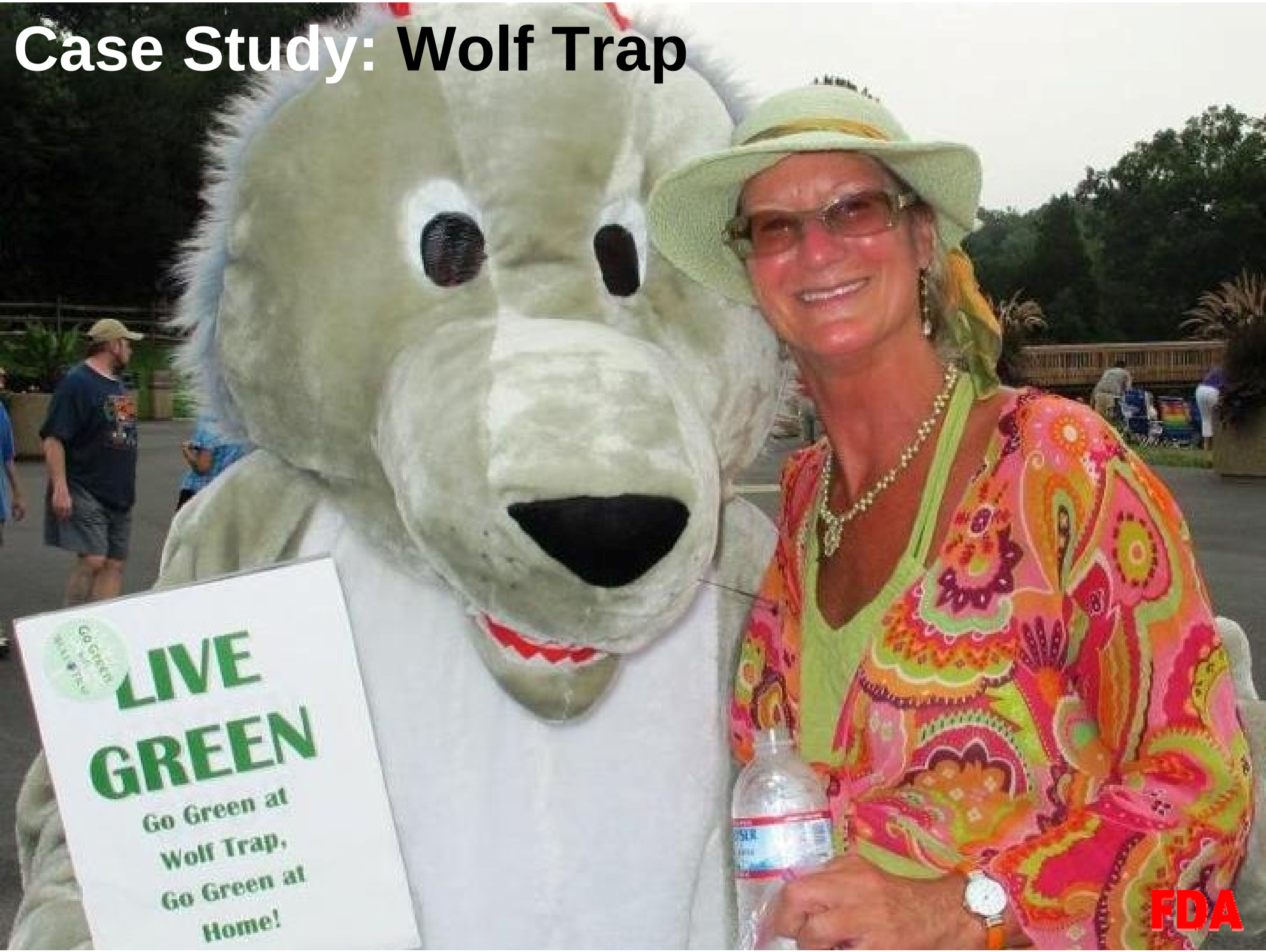


Case Study: Wolf Trap



Case Study: Wolf Trap

Case Study: Wolf Trap



Pierce College Arts and Allied Health
Common Ground

Connection

Approach to Sustainability is influenced by…

Who	Client, Campus Culture, Program User Group
Where	Climate, Specific Site, Slope, Views, Response to Existing Buildings, Native Vegetation
What	Program Requirements, Acoustics, Air Quality, Light, Public Access Needs, Local Resources & Programs

Program Related Sustainability Drivers

Arts & Allied Health

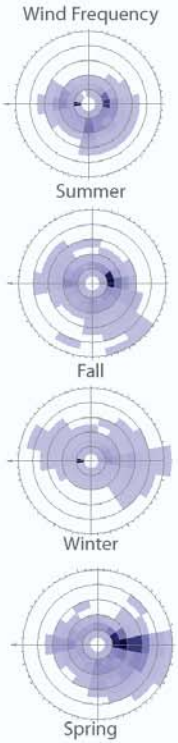
Offices Lobby Art Studios	Natural Ventilation & Tempered Air
Theatre Vocal Recital Hall	Displacement Ventilation
Recording Studio Practice Studio Computer Labs Classrooms	Mechanical Air
Offices, Lobby Project Rooms, Art Studios	Radiant Heating & Cooling

LEED-NC GOLD 2006 U.S. GREEN BUILDING COUNCIL LEADERSHIP IN ENERGY & ENVIRONMENTAL DESIGN

architecture 2030 CHALLENGE

SMALL FOOTPRINT

Tucked into the site, a more compact building uses less materials and saves forest.

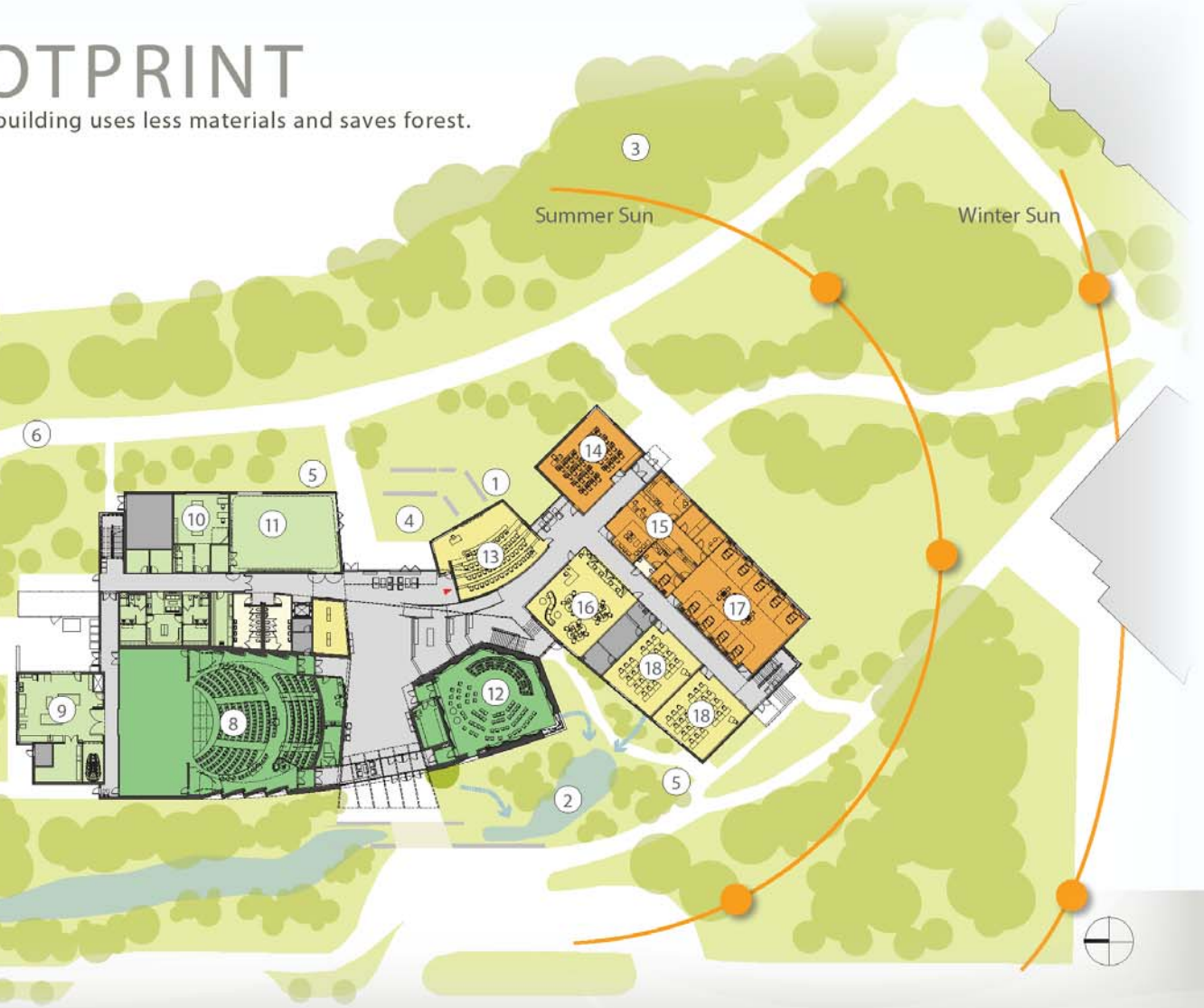


SITE FEATURES

1 Green Roof
2 Stormwater Runoff Garden
3 Existing Tree Preservation
4 Outdoor Seating
5 Bike Parking
6 Reflective/Open Grid Paving
7 Stormwater Infiltration Basin

FLOOR ONE PLAN

8 Theatre
9 Scene Shop
10 Costume Shop
11 Rehearsal/Drama Classroom
12 Vocal/Instrumental Recital Hall
13 Tiered Classroom
14 Computer Classroom
15 Medical Office
16 Multi-Media Lab
17 Nursing Skills Lab
18 Classroom



RESOURCE SAVINGS

Efficient, sustainable systems save water and energy compared to a baseline building.

Project Summary

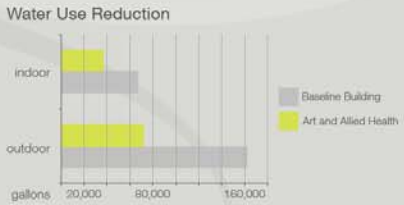
Location: Puyallup, Washington

Gross Sf: 61,500 Sf

Building Footprint: 38,969 Sf

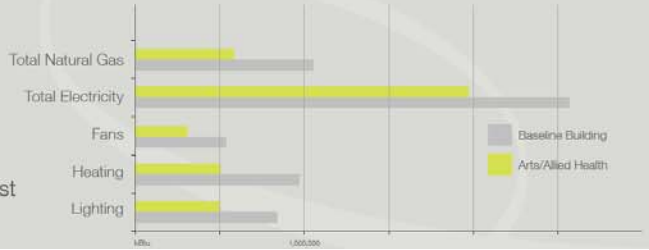
Cost: $17M

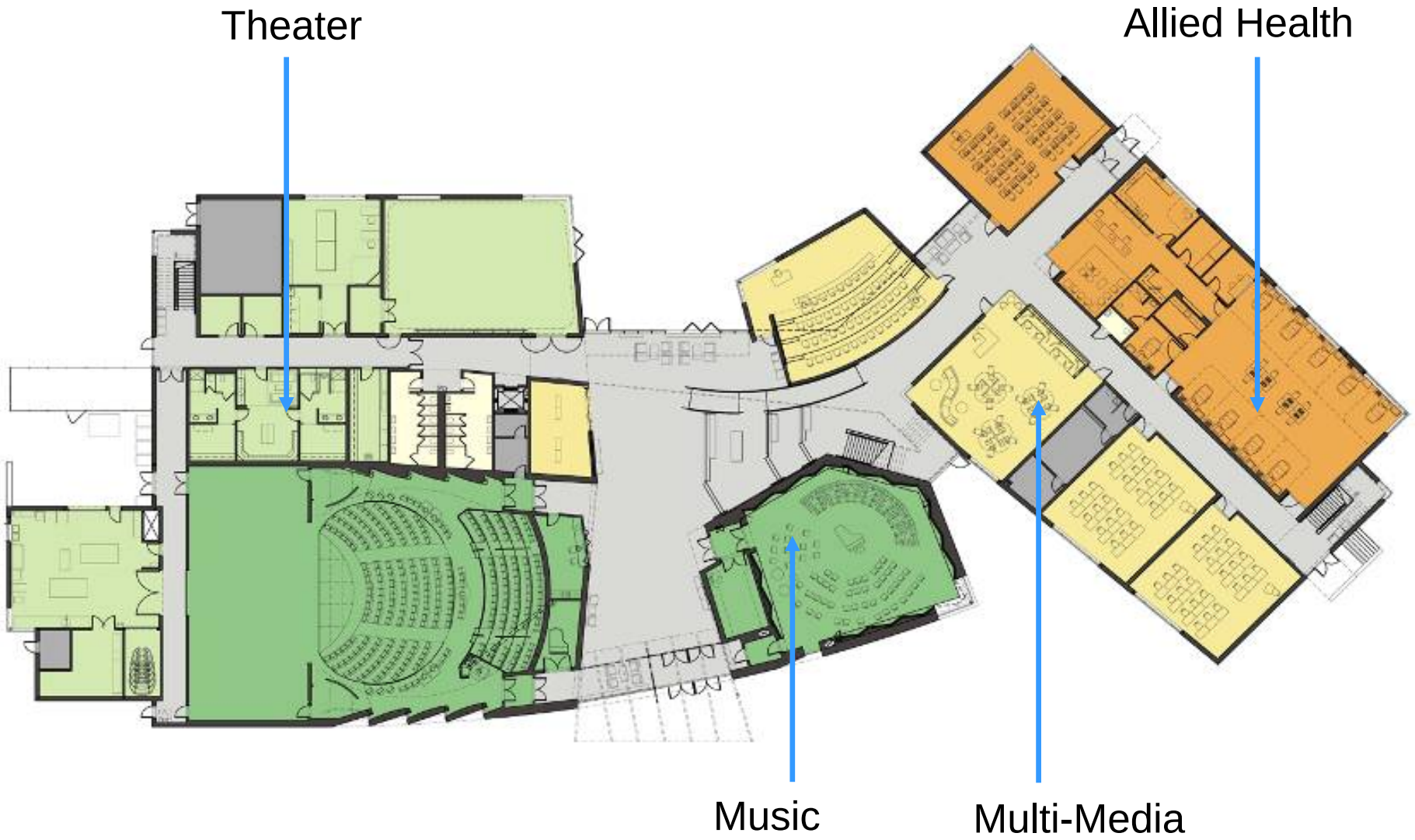
Completed: September 2010



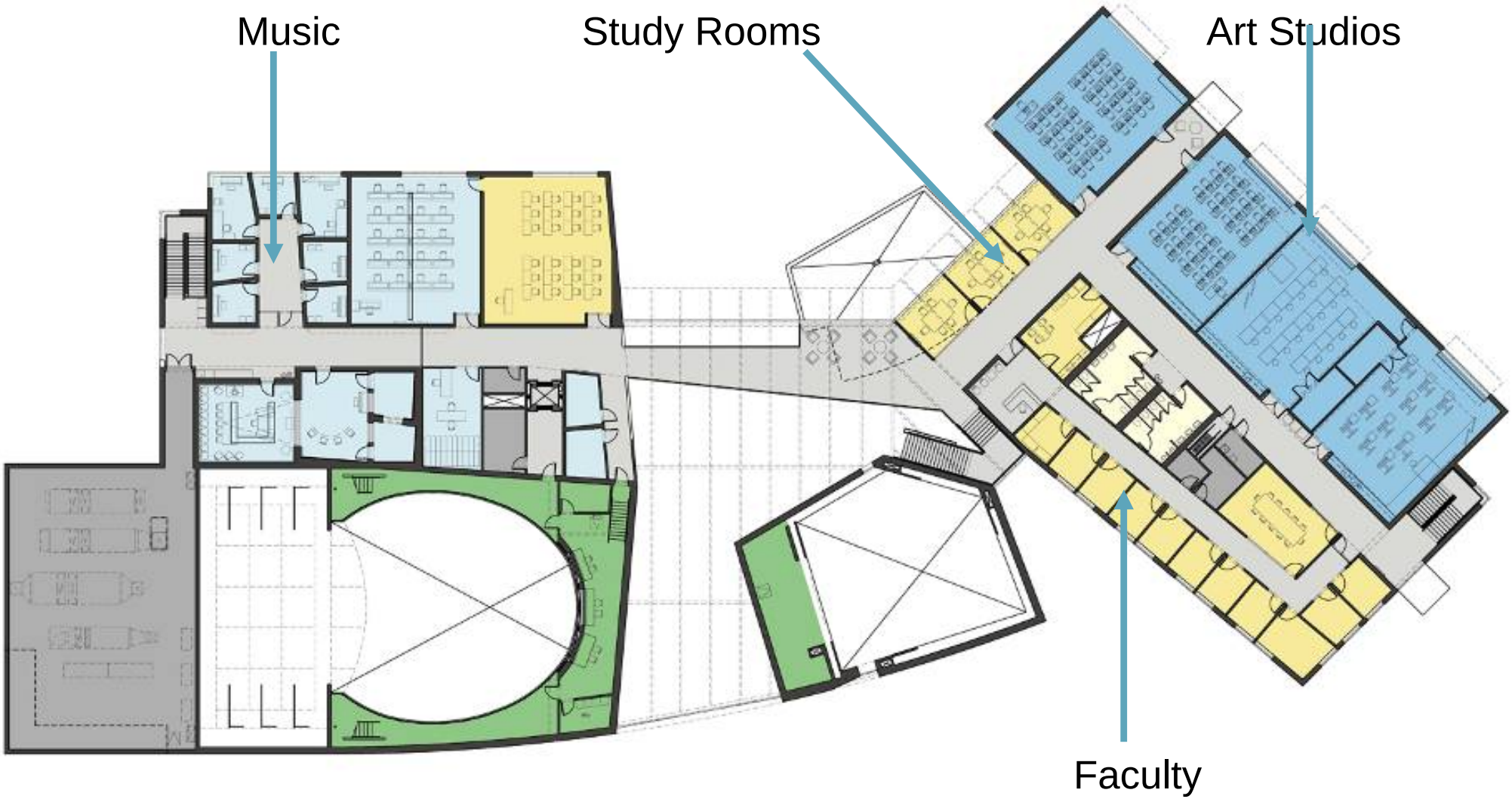
60%
CO_2 Emissions Reduction

30.4%
Annual Energy Cost Savings



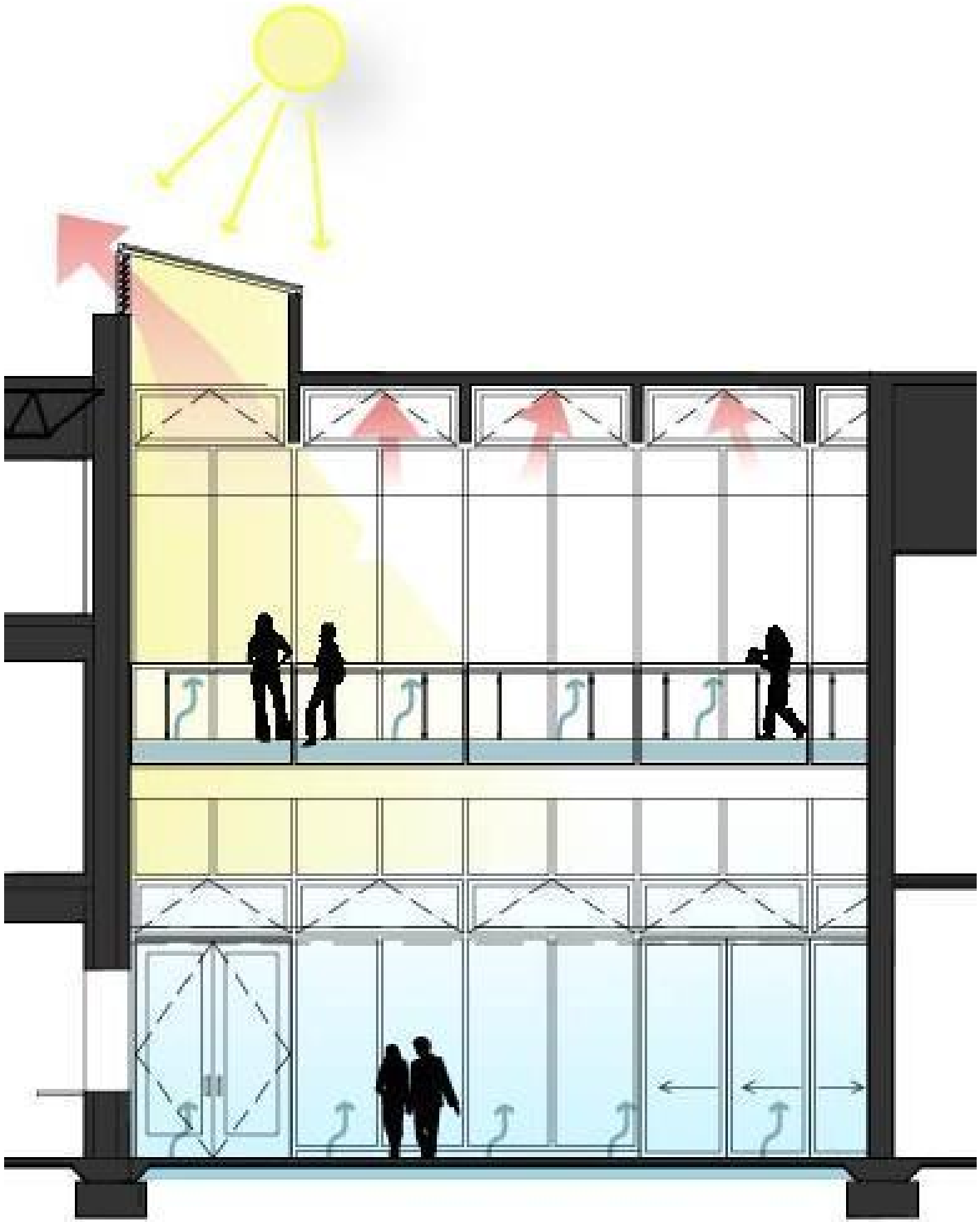


First Floor Plan


Music
Study Rooms
Art Studios
Faculty

Bridging

Lobby



Natural Ventilation Modeling

Step 0: Plan modeling strategy

How is the building best simulated?

Identify objectives

Establish comfort parameters

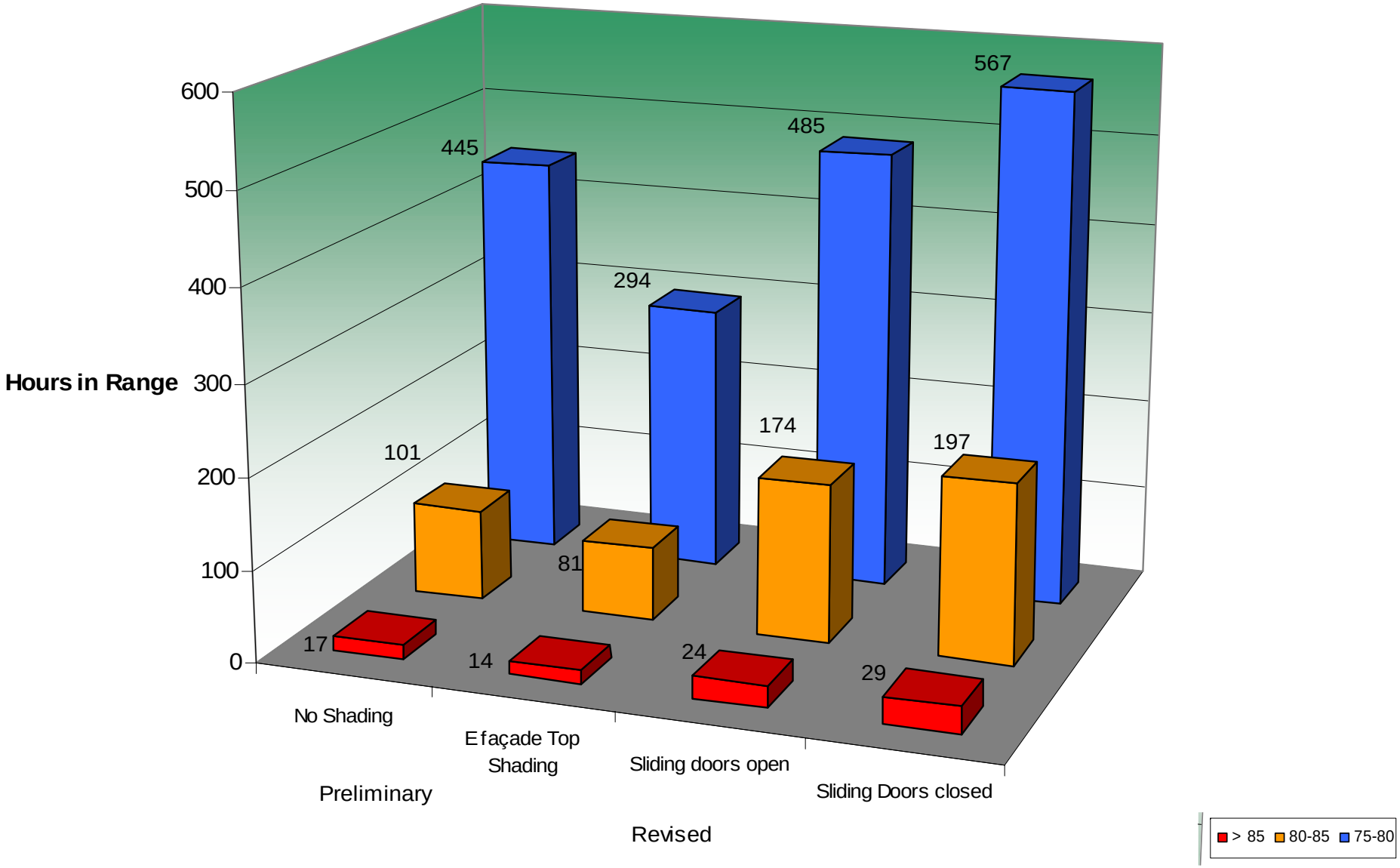
Determine acceptable levels of comfort

LEED Comfort Parameters

Temperature	Acceptable Hours Annually
75-80 ºF	150 Hours
80-85 ºF	50 Hours
>85 ºF	20 Hours

Natural Ventilation Modeling

Lobby Analysis

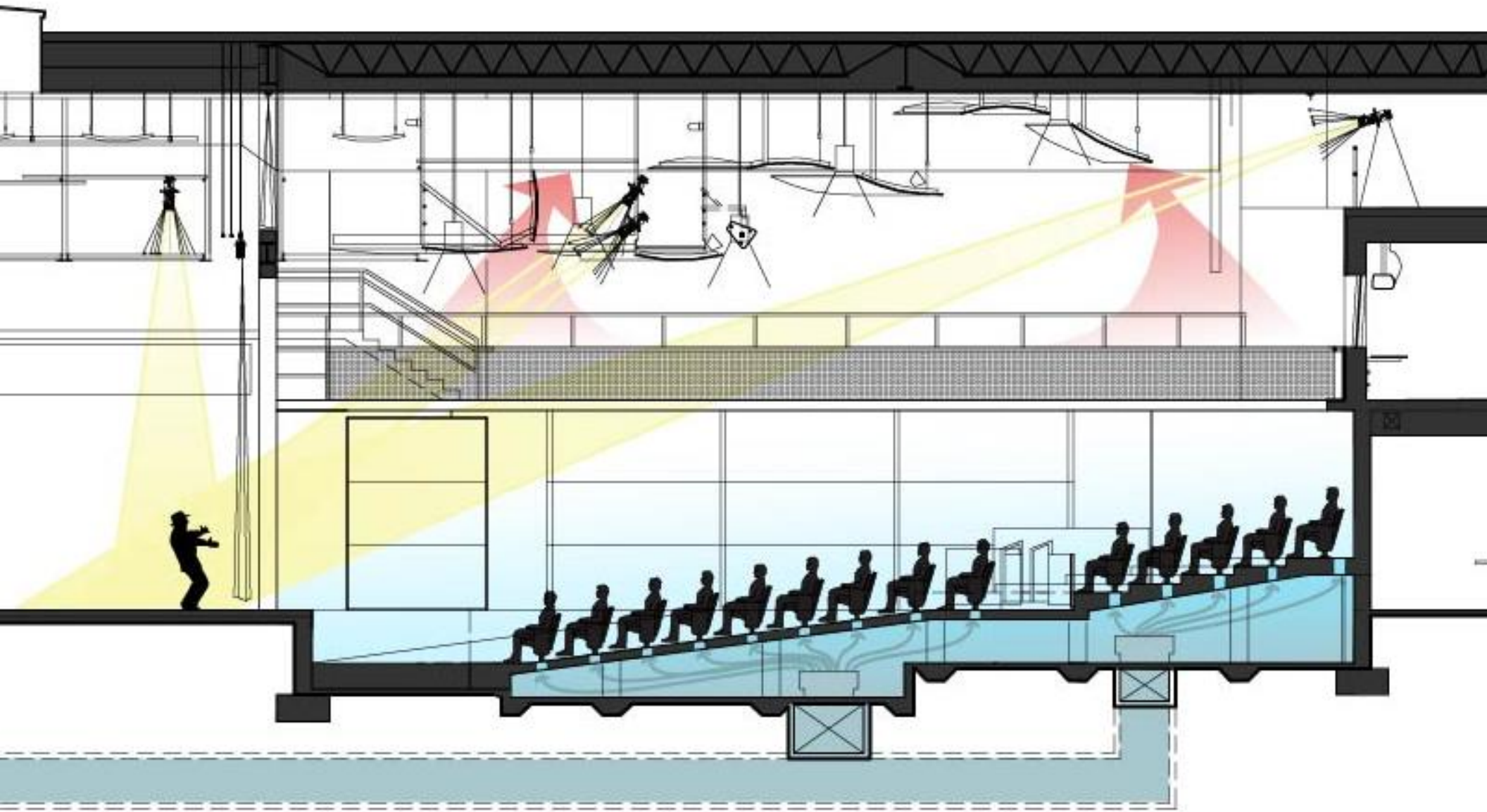


Discovery

HEATRE

Theater Arts

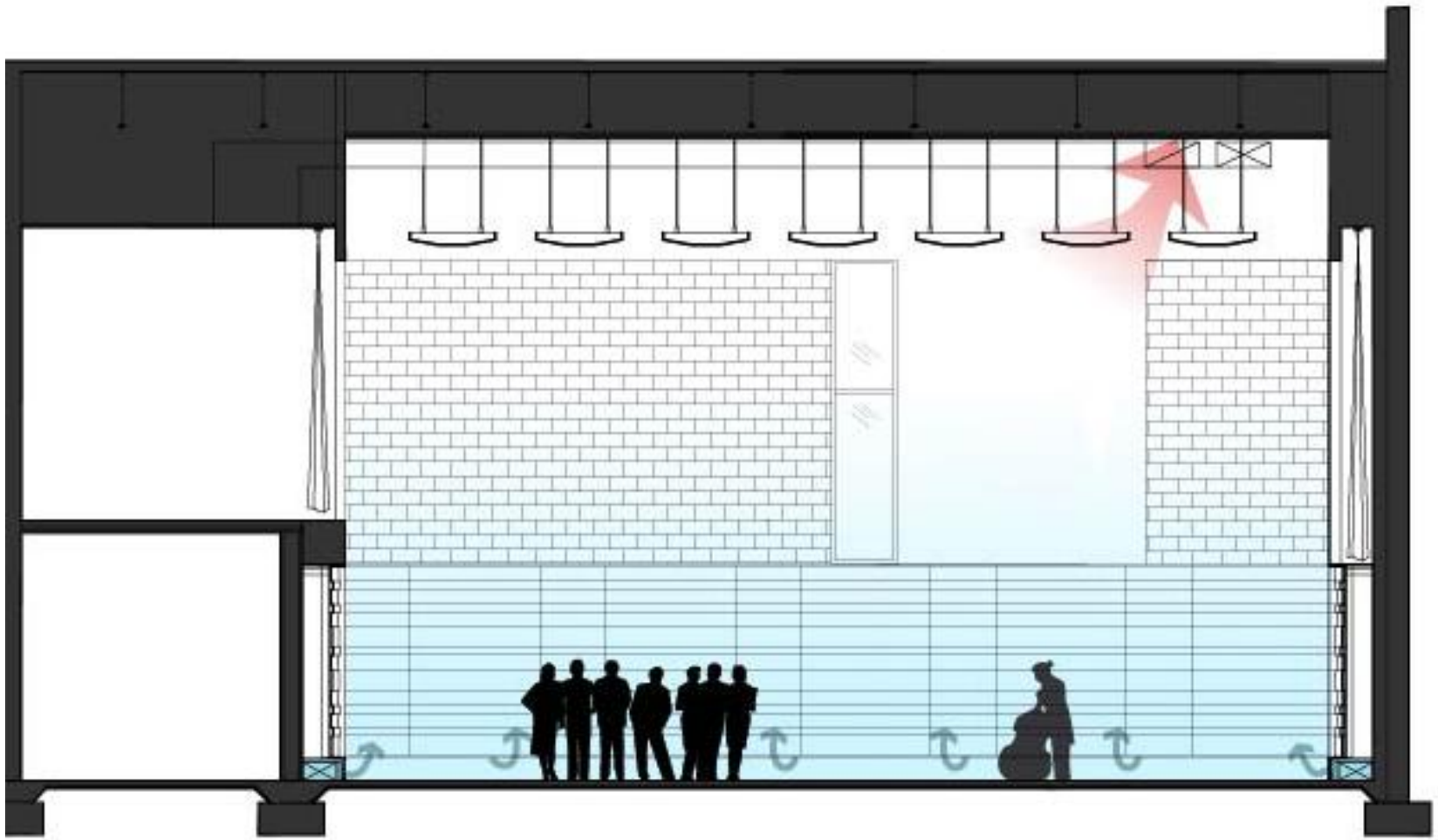
Theatre



Music

Touch and Feel

Recital Hall



Reuse

Create

Green Roof

plant pallete

sedum spirium 'fuldaglut'

bloom color: red
bloom time: fall
mature height: 5-7"
drought tollerance: v. high

sedum cauticola 'bertram anderson'

bloom color: purple
bloom time: fall
mature height: 6-8"
drought tollerance: v. high

sedum kamtschaticum

bloom color: yellow
bloom time: summer
mature height: 4-6"
drought tollerance: v. high

sedum album 'coral carpet'

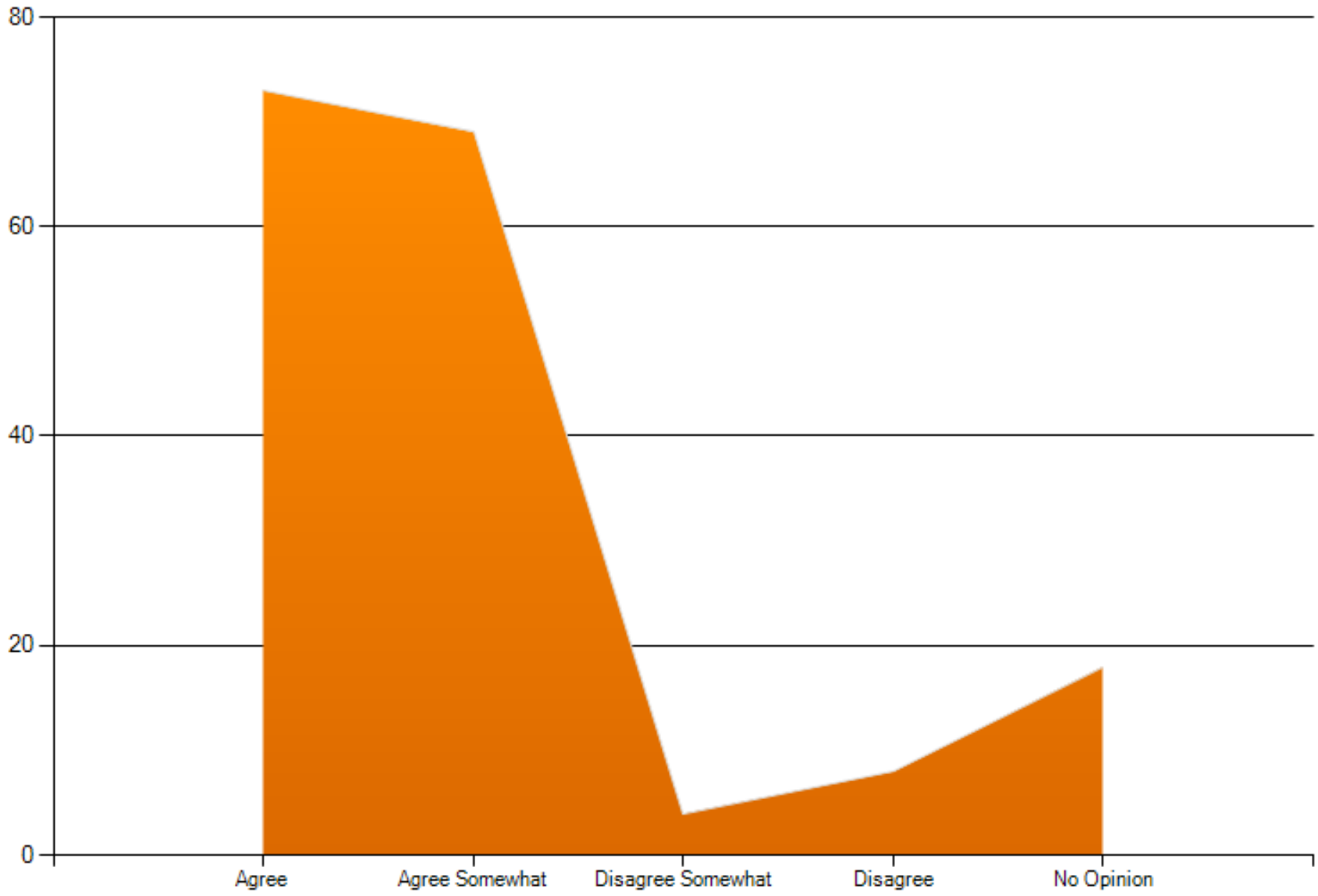
bloom color: white
bloom time: summer
mature height: 4"
drought tollerance.: v. high

sedum fabaria

bloom color: purple
bloom time: fall
mature height: 12-16"
drought tollerance.: v. high

MUSIC

The AAH Building creates something greater than the sum of the individual pieces

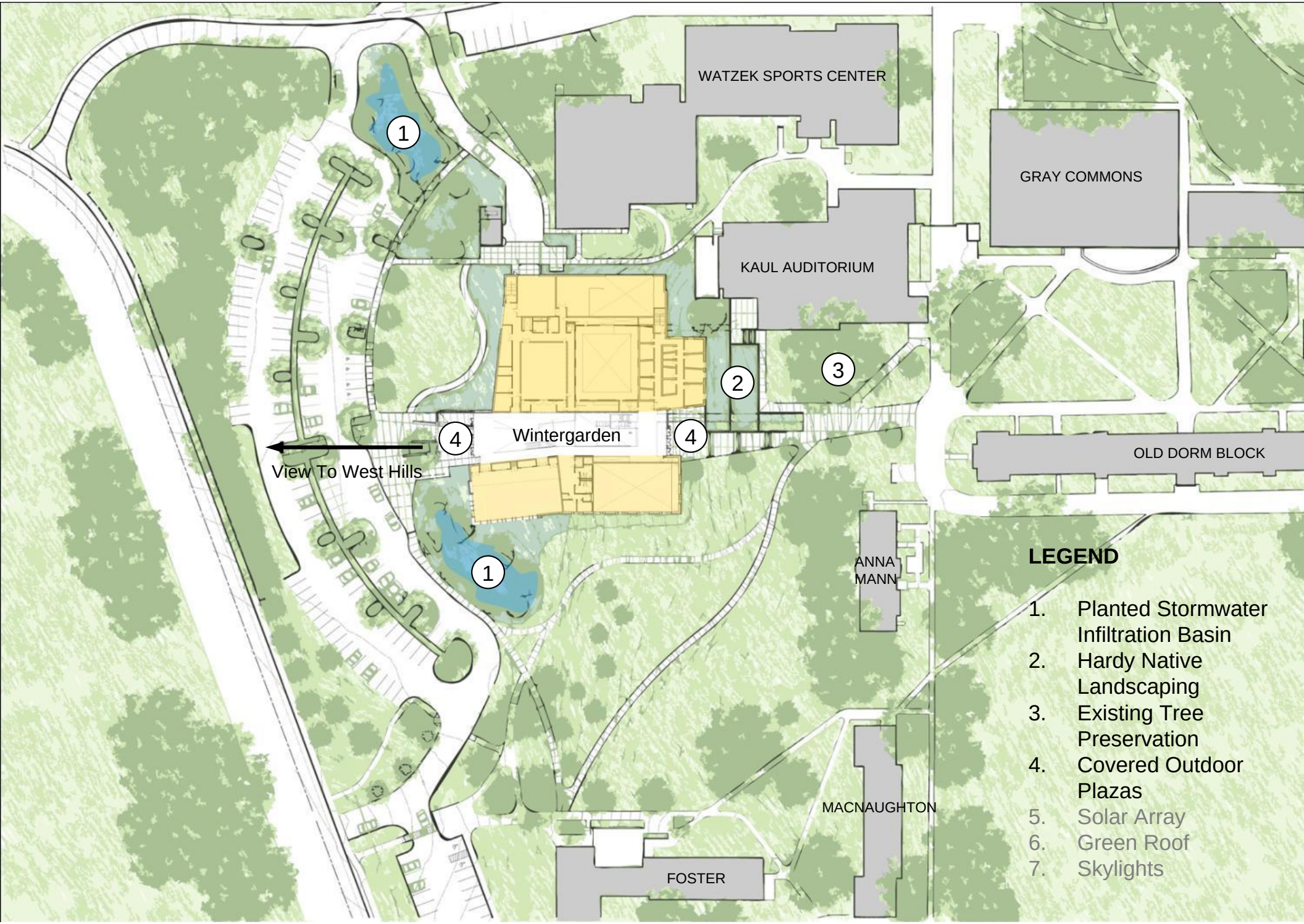


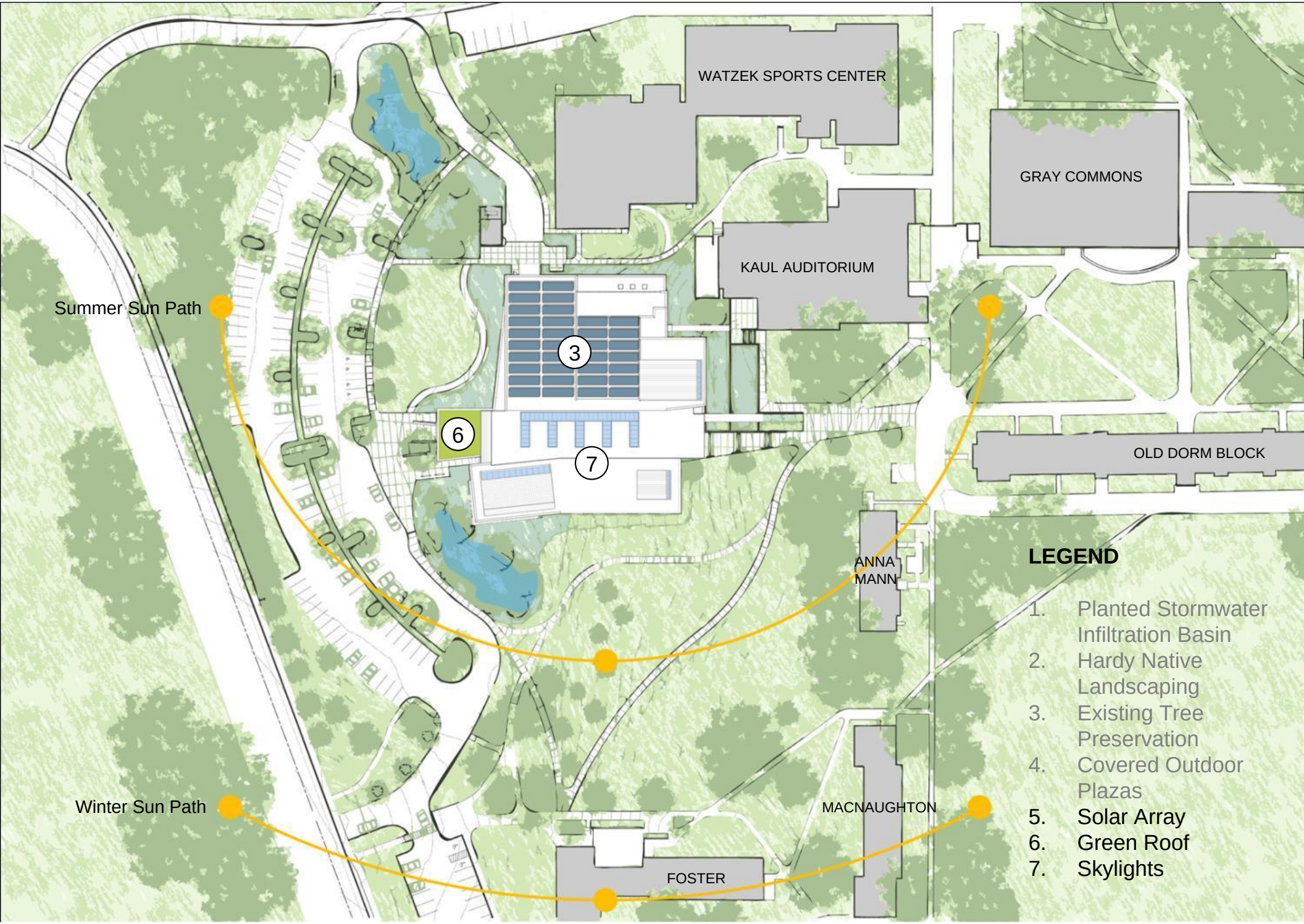
Lasting outcomes…

- Began “sustainable” campus identity discussion
- Users played an active role in sustainability decisions
- Enhanced recycling program in the City of Puyallup
- Sustainable landscaping plan campus-wide at Ft. Steilacoom
- Development of sustainable curriculum in conjunction with other area colleges.

Reed College Performing Arts Building

west perspective


WATZEK SPORTS CENTER
GRAY COMMONS
KAUL AUDITORIUM
OLD DORM BLOCK
ANNA MANN
MACNAUGHTON
FOSTER
Wintergarden
View To West Hills
1
2
3
4
4
1
LEGEND
1. Planted Stormwater Infiltration Basin
2. Hardy Native Landscaping
3. Existing Tree Preservation
4. Covered Outdoor Plazas
5. Solar Array
6. Green Roof
7. Skylights


WATZEK SPORTS CENTER
GRAY COMMONS
KAUL AUDITORIUM
OLD DORM BLOCK
ANNA MANN
MACNAUGHTON
FOSTER
Summer Sun Path
Winter Sun Path
3
6
7
LEGEND
1. Planted Stormwater Infiltration Basin
2. Hardy Native Landscaping
3. Existing Tree Preservation
4. Covered Outdoor Plazas
5. Solar Array
6. Green Roof
7. Skylights

earthadvantage®
commercial

001 PREFACE

Introduction to EA and the EA Commercial Program

005 CATEGORY 1: ENERGY

Save Energy, Systems Performance, Measure & Manage Energy

039 CATEGORY 2: WATER

People, Plants and Stormwater

057 CATEGORY 3: HEALTH

Pollution Source Control, Toxic Reduction and Occupant Comfort

077 CATEGORY 4: MATERIALS

Environmental, Minimization, Durability & Waste Reduction

105 CATEGORY 5: LAND

Site Ecology, Transportation and Connectivity & Placemaking

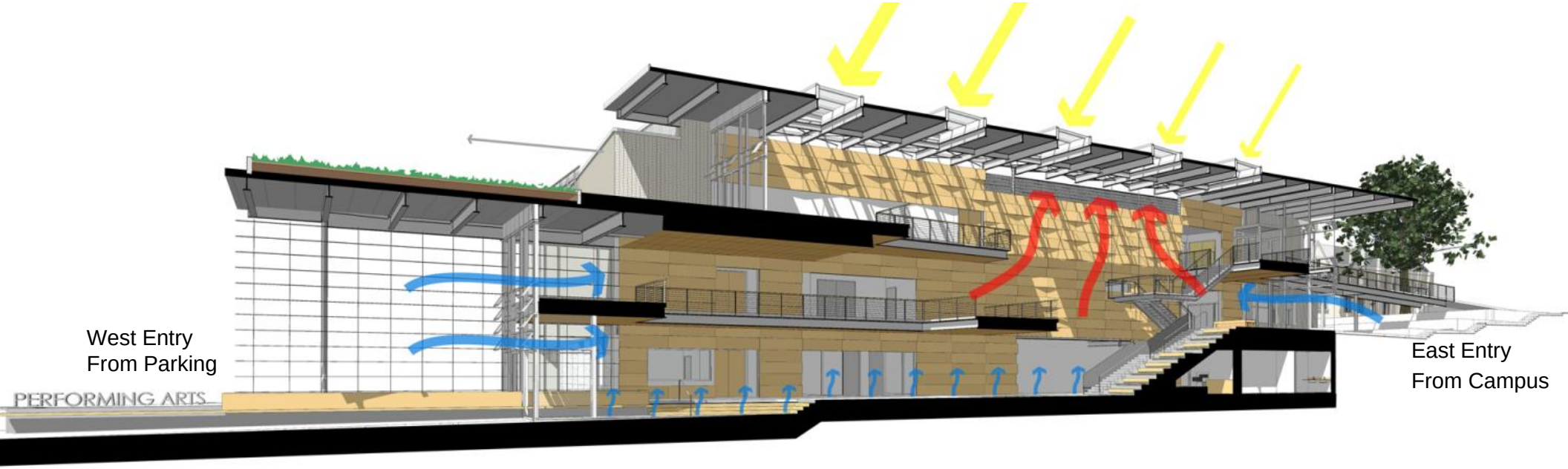
127 RESOURCES

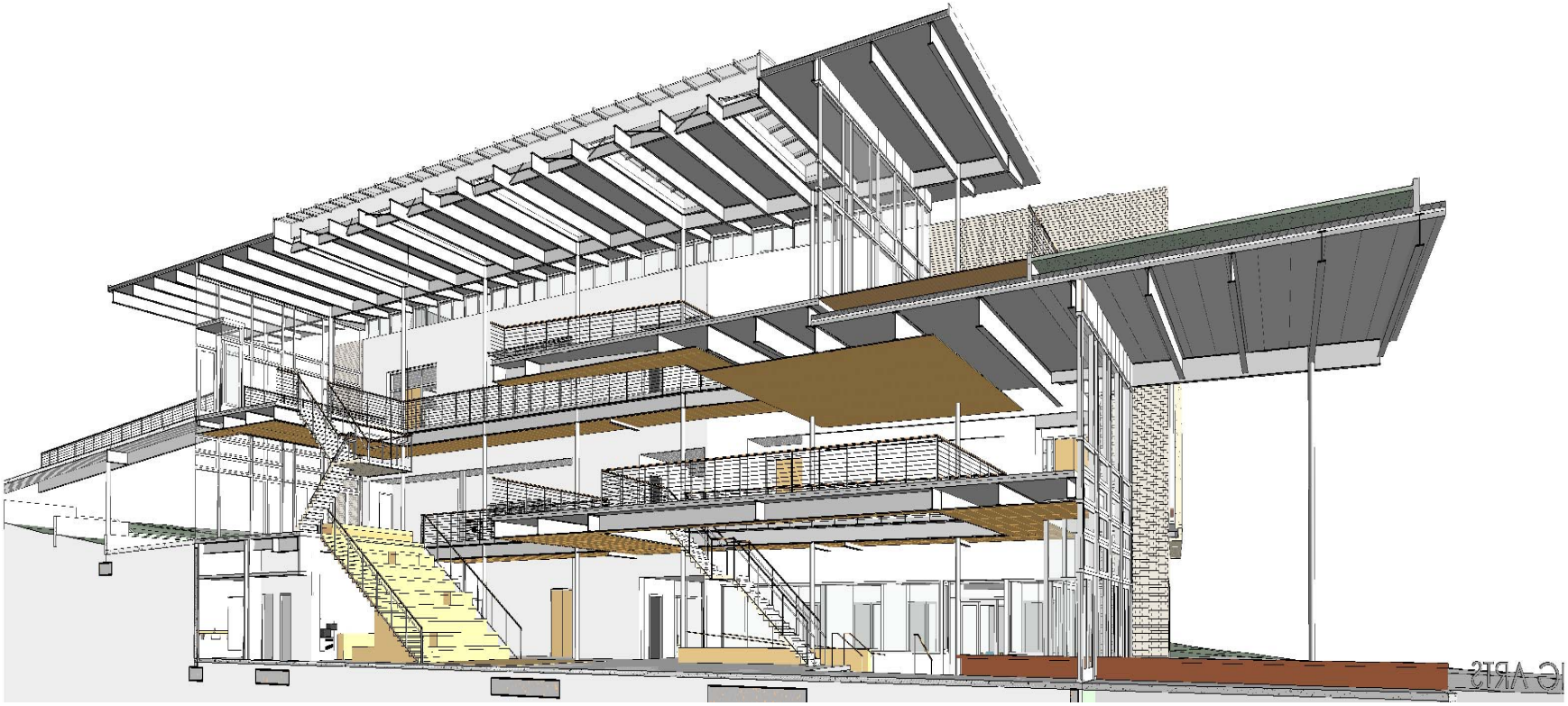
Under Development

east perspective

level 1

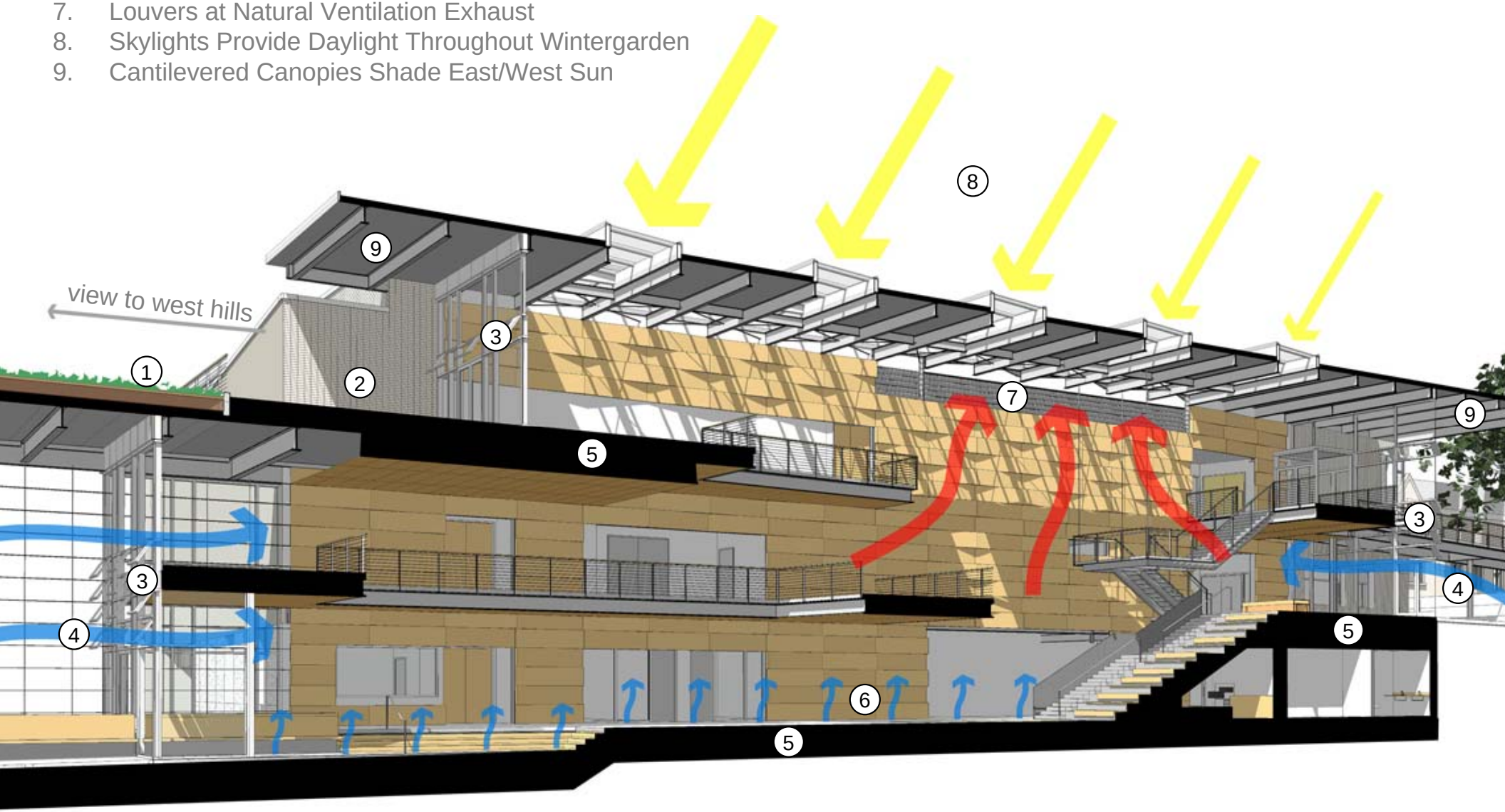
TRASH / RECYCLING
WATZEK SPORTS CENTER
KAUL AUDITORIUM
RECEIVING
COSTUME STUDIO
DYE
TD OFFICE
LAUNDRY
SCENE STUDIO
TOOLS
UP
ELEV
ELEV MACH.
COSTUME STOR.
CROSSOVER
DRESSING
DRESSING
STUDIO TH. STORAGE
ELEC
STUDIO THEATRE
FIRE RISER
MAINT / DDC
AV OFFICE
GREEN ROOM
MDF / IT
JANITOR
BOX OFFICE / BLDG MANAGER
CLASSROOM
CLASSROOM
WOMEN
WINTERGARDEN
STOR.
MEN
WEST ENTRY TERRACE
UP
STOR.
ELEV
ELEV MACH.
RECEPTION
COPY
CONF.
PERFORMANCE LAB
CONF/ CLASS


West Entry
From Parking
PERFORMING ARTS
East Entry
From Campus

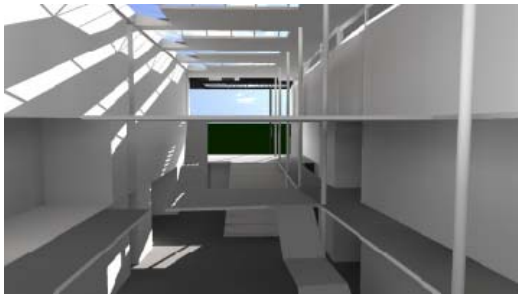


LEGEND

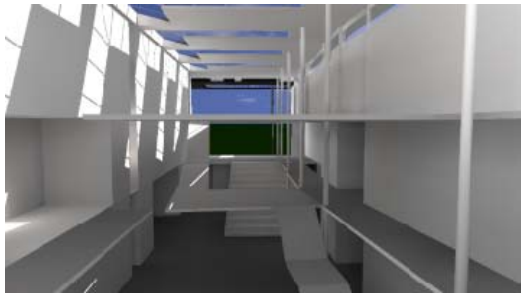
1. Extensive Green Roof
2. Roof Terrace
3. Automated Windows – controlled by mechanical DDC system
4. Cooling Through Natural Ventilation
5. Thermal Mass Regulates Temperature Swings
6. Heated and Chilled Radiant Floor
7. Louvers at Natural Ventilation Exhaust
8. Skylights Provide Daylight Throughout Wintergarden
9. Cantilevered Canopies Shade East/West Sun



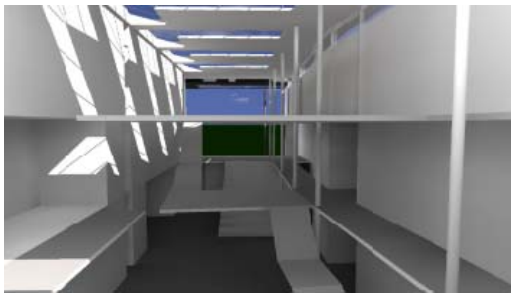
Daylight Analysis



SEPT 21, 9AM



SEPT 21, NOON



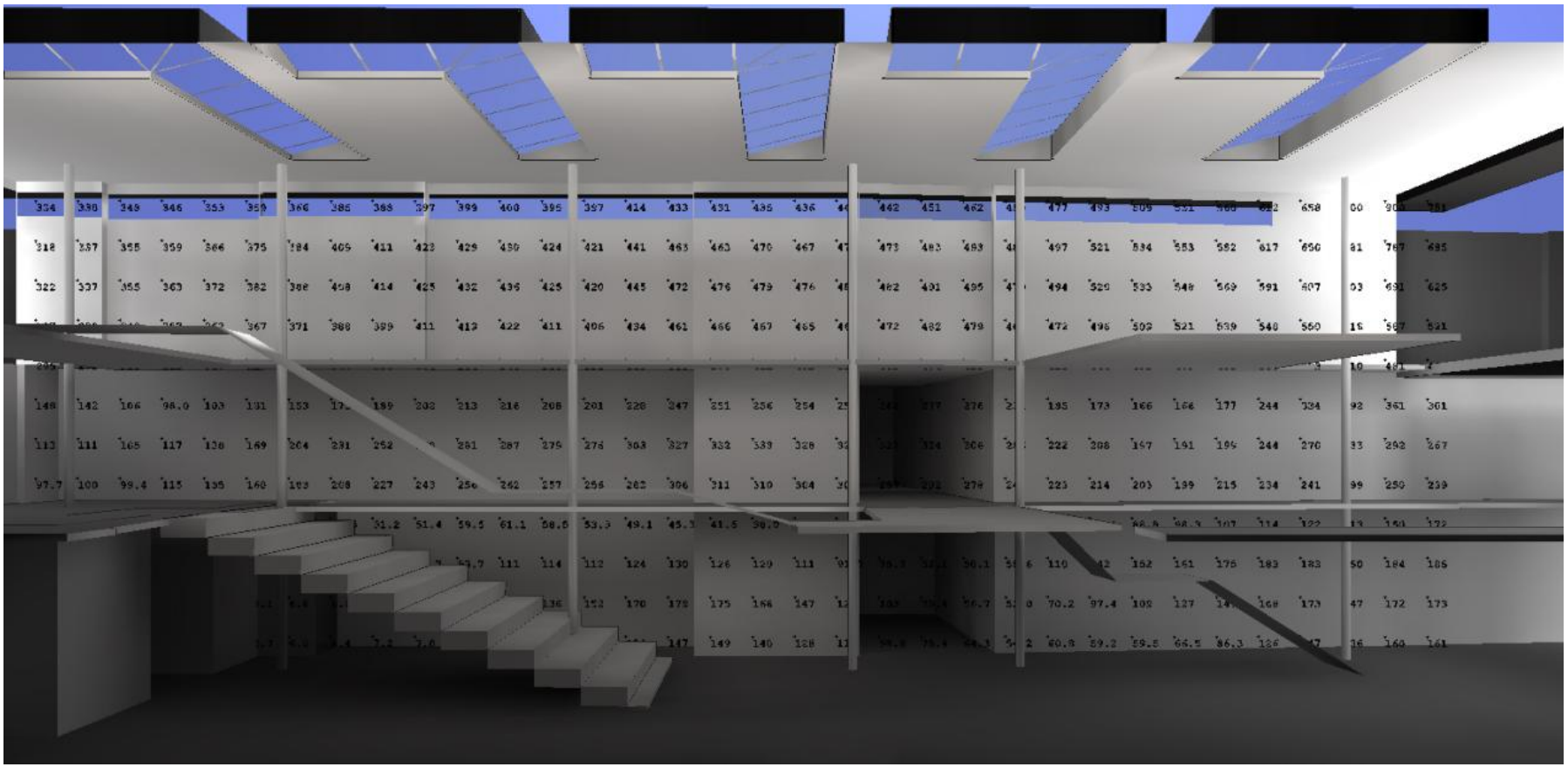
SEPT 21, 3 PM

Daylight Factor Averages

1st Floor: 5%

2nd Floor: 7.3%

3rd Floor 15%



SOUTH WALL

studio theater

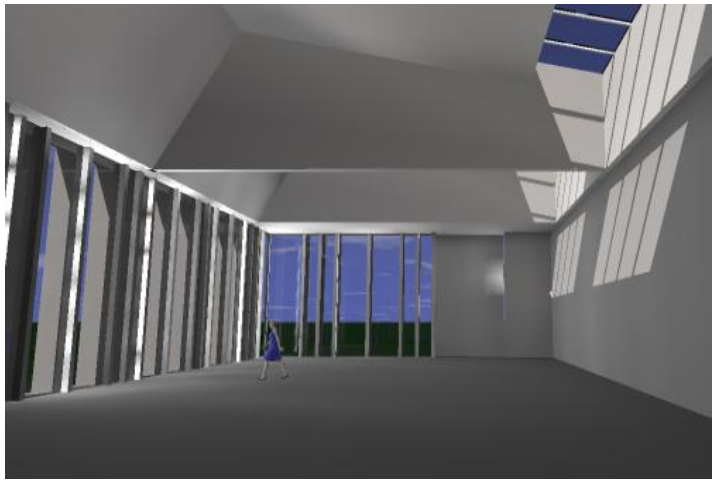
level 2

WATZEK SPORTS CENTER
KAUL AUDITORIUM
BLACK BOX REHEARSAL
SCENE STUDIO LOFT
SCENE STUDIO
OPEN TO BELOW
ELEV
DRESS
DRESS
BB STOR.
BLACKBOX THEATRE
STUDIO THEATRE
OPEN TO BELOW
ELEC
IDF
PROP STORAGE
CONTROL
LIFT
PRACTICE ROOMS
WINTERGARDEN
EAST ENTRY TERRACE
STOR.
STOR.
STOR.
STOR.
ELEV
WOMEN
MEN
DANCE STUDIO
JANITOR
LOCKER
LOCKER
PERFORMANCE LAB
OPEN TO BELOW

dance studio

Daylight Analysis

DANCE STUDIO

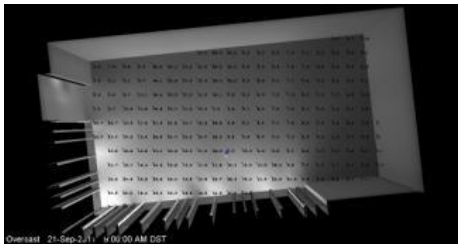


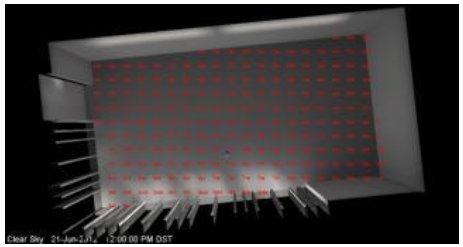
JUNE 21

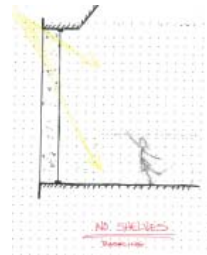
SUMMER SOLSTICE

CLEAR SKY

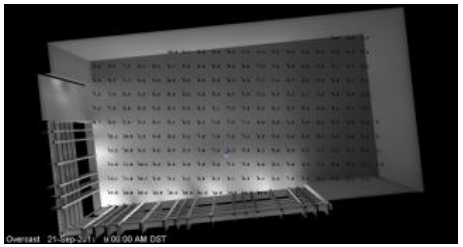
RGB

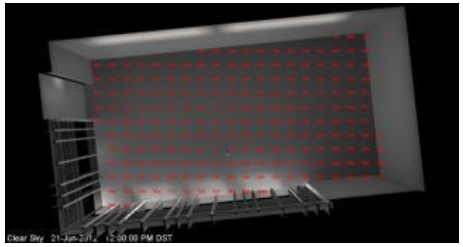


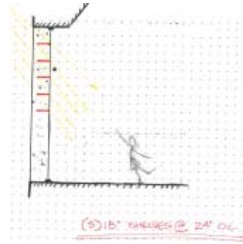




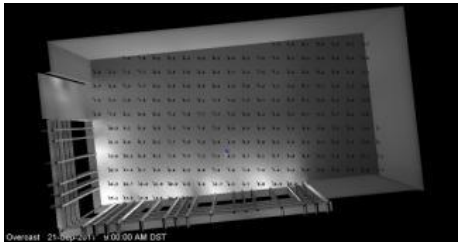
9.6% AVERAGE

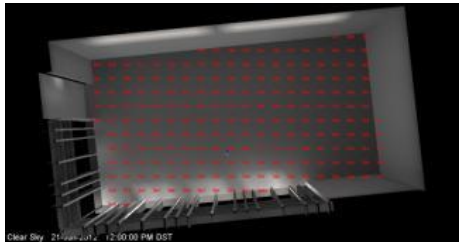


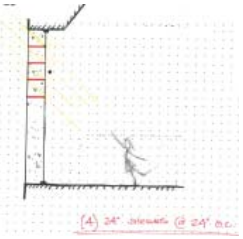




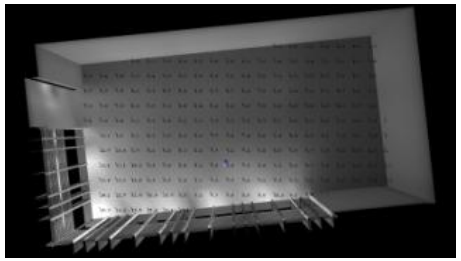
7.4% AVERAGE

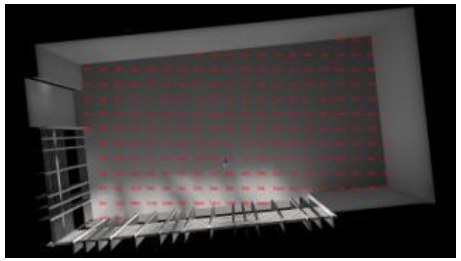


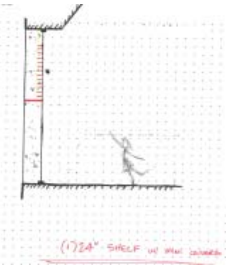




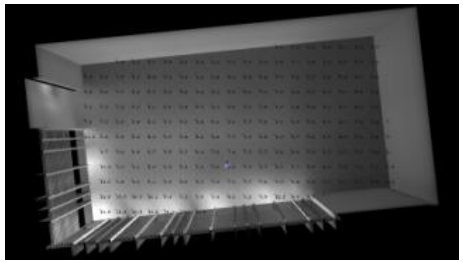
7.0% AVERAGE

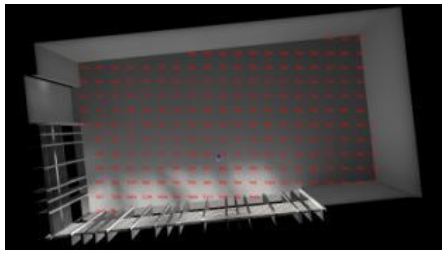


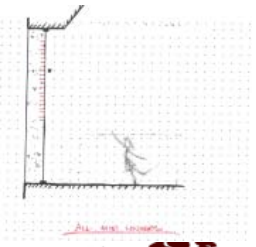




7.2% AVERAGE





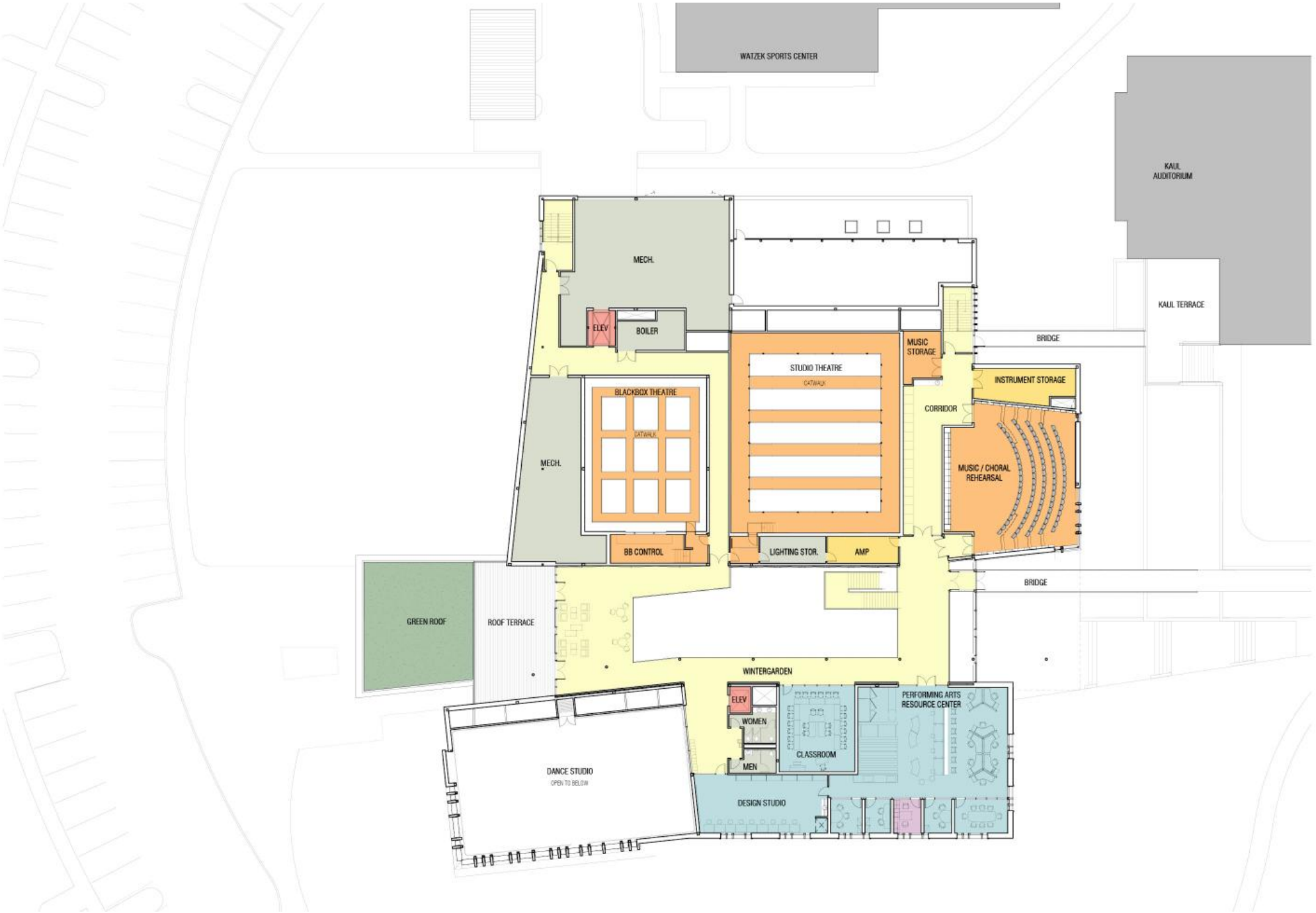


7.3% AVERAGE

Luma

blackbox theatre

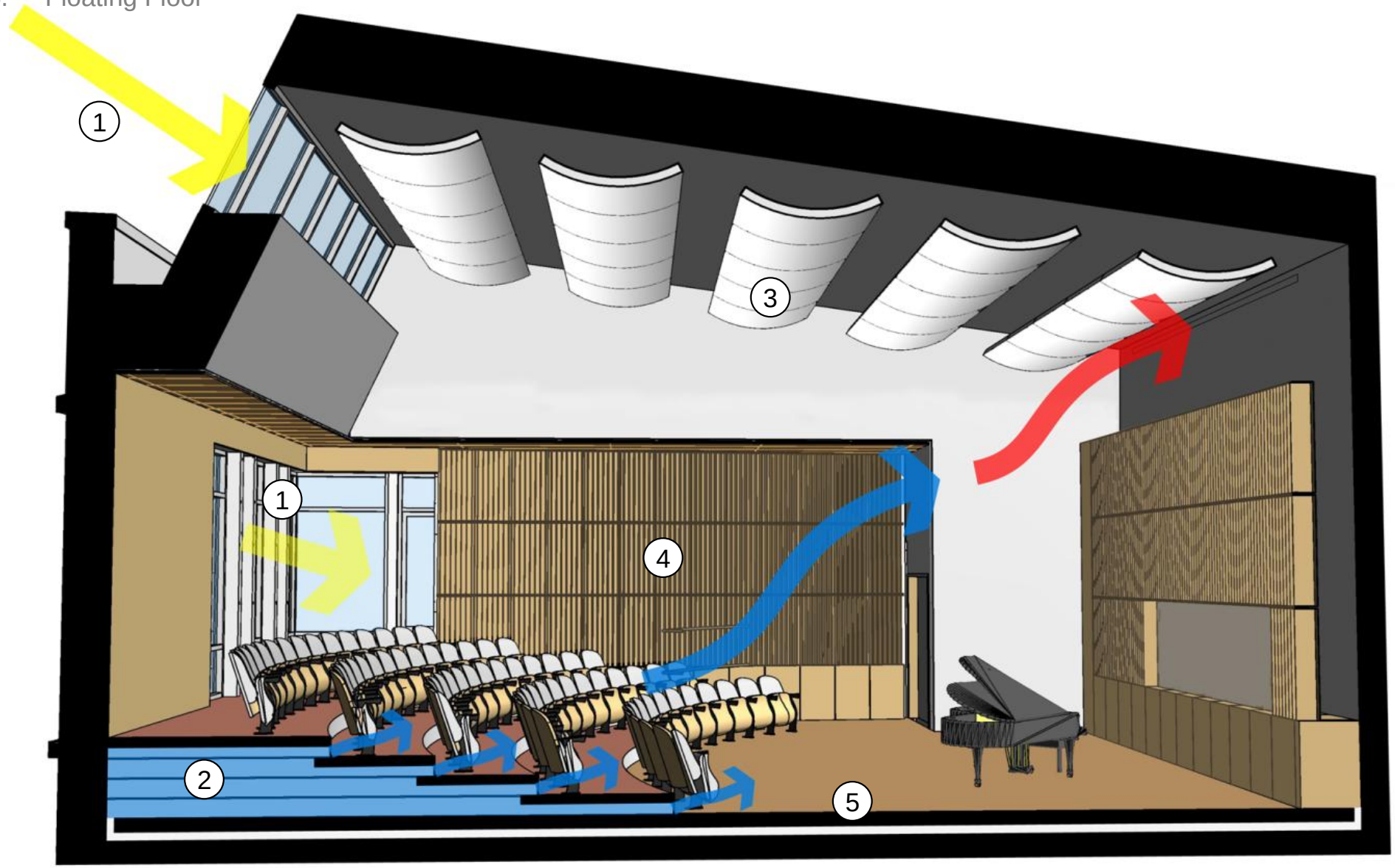
level 3


WATZEK SPORTS CENTER
KAUL AUDITORIUM
KAUL TERRACE
MECH.
ELEV
BOILER
BRIDGE
MUSIC STORAGE
STUDIO THEATRE
CATWALK
INSTRUMENT STORAGE
BLACKBOX THEATRE
CATWALK
CORRIDOR
MECH.
MUSIC / CHORAL REHEARSAL
BB CONTROL
LIGHTING STOR.
AMP
BRIDGE
GREEN ROOF
ROOF TERRACE
WINTERGARDEN
ELEV
WOMEN
MEN
CLASSROOM
PERFORMING ARTS RESOURCE CENTER
DANCE STUDIO
OPEN TO BELOW
DESIGN STUDIO

music/choral rehearsal

LEGEND

1. Daylighting
2. Displacement Ventilation
3. Acoustic Clouds
4. Diffusive Acoustic Wood Panels
5. Floating Floor



Going Beyond LEED

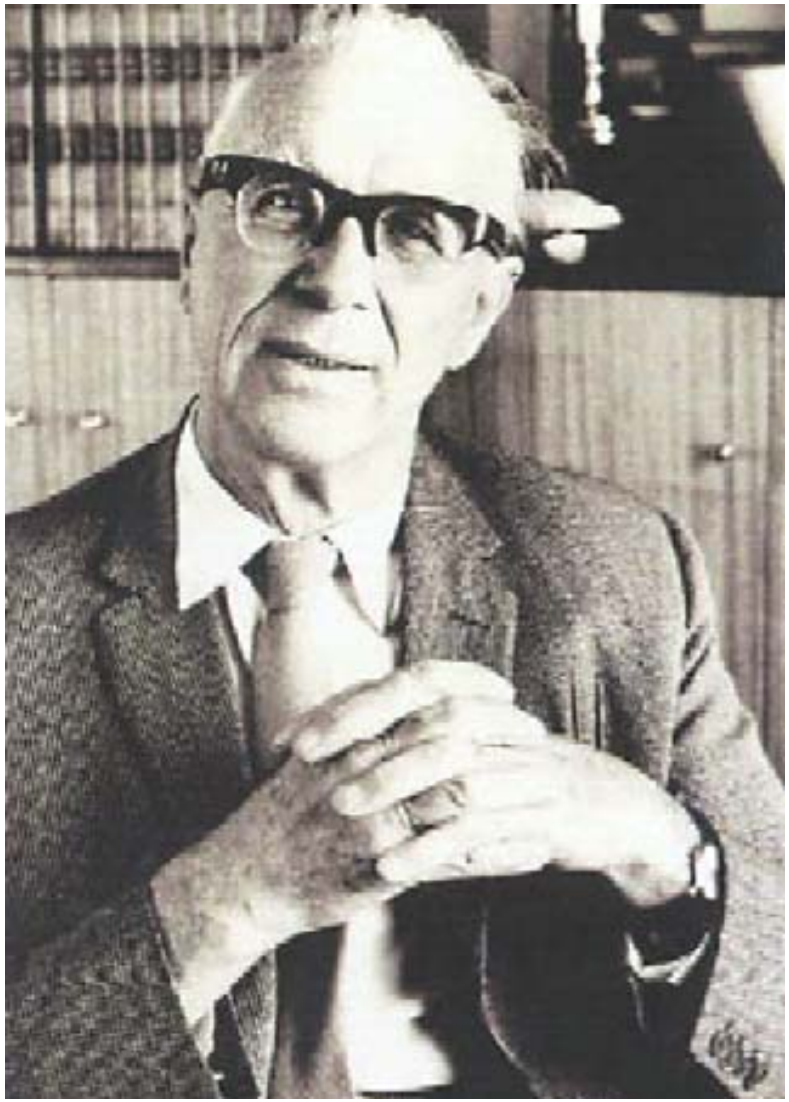
Denis Blount, Arup

ARUP

Arup and Sustainability

Sir Ove Arup founded his practice in London in 1946 based on a belief in ‘total design’ — the integration of the design process and the interdependence of all the professions involved, the creative nature of engineering, the value of innovation and the social purpose of design.

Today we understand this as a commitment to sustainability.

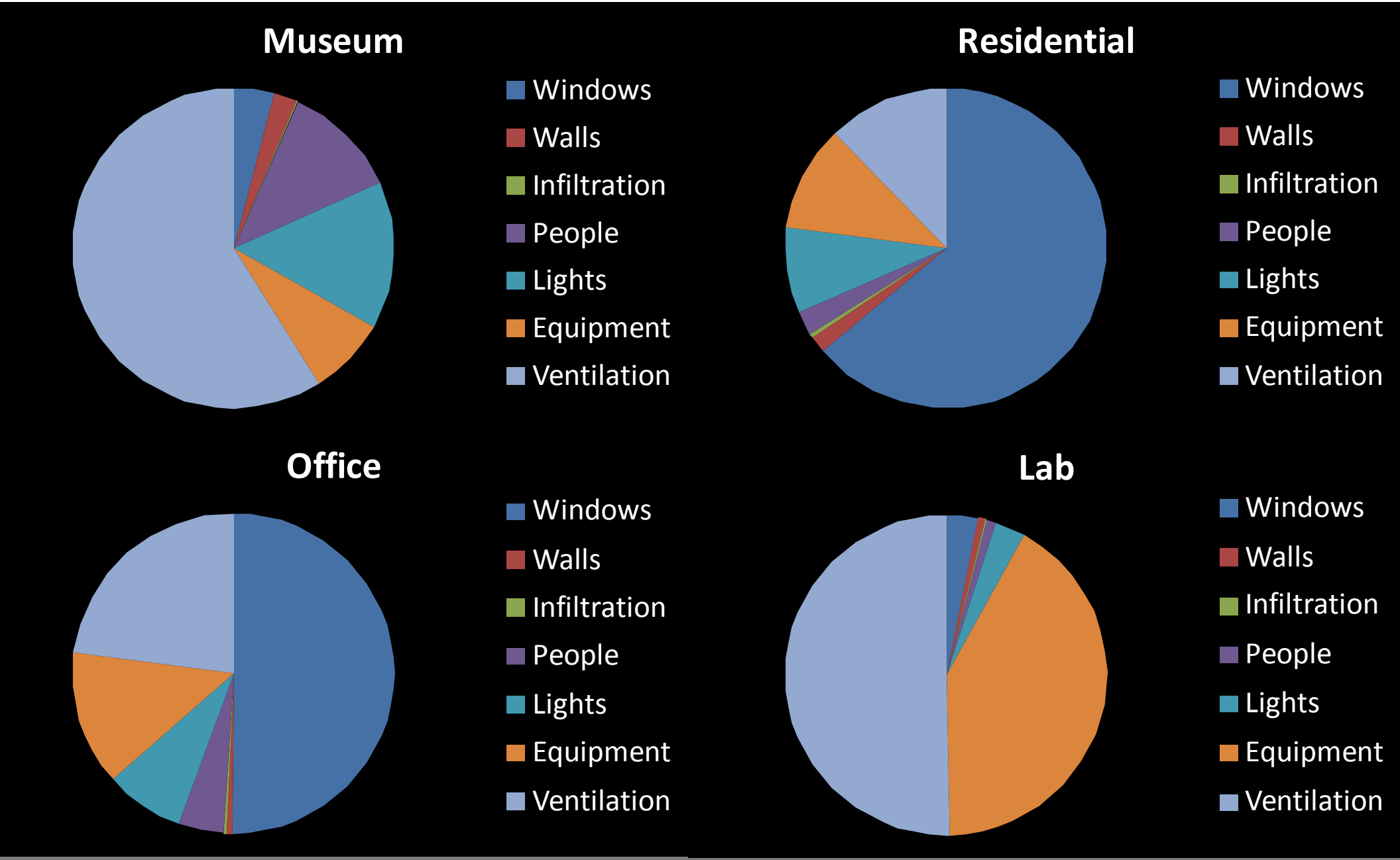


SULLAIR
BG 24 H

Technical Disciplines

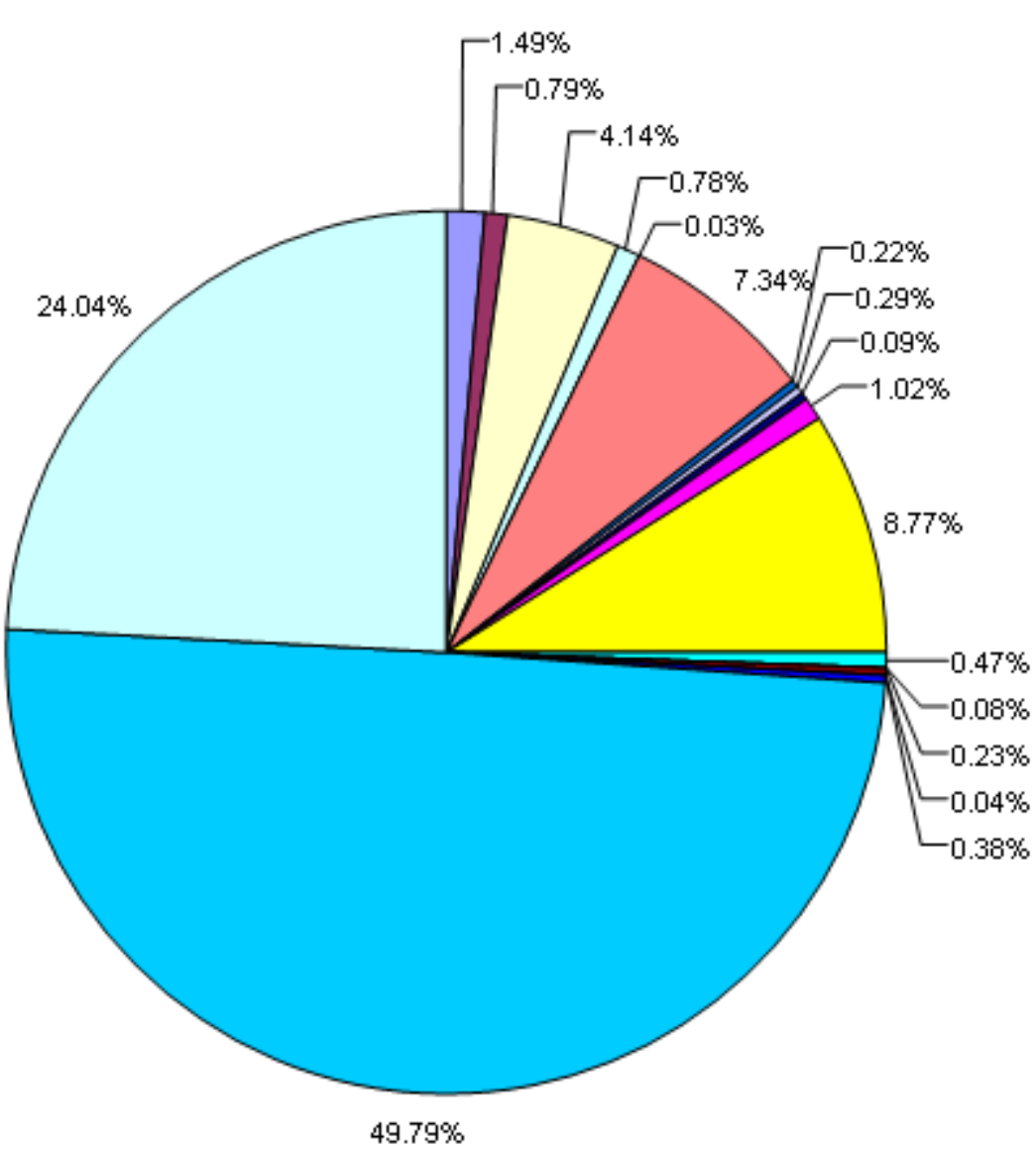
- **Acoustics**
- **Audiovisual Design**
- Bridges
- CAD/Drafting
- Civil Engineering
- Controls
- Commissioning
- Electrical Engineering
- Environmental Engineering
- Façade Engineering
- Fire Engineering
- Geotechnical/Tunnel Engineering
- Information Technology
- Lighting Design
- Logistics
- **Mechanical Engineering**
- Plumbing and Fire Protection Engineering
- Project Management
- Risk
- Security Design
- Structural Engineering
- **Sustainability**
- Transport Planning
- **Theatre Planning and Design**
- Urban Planning
- Visualization

Loads per Building Type



ARUP

Concert for Diana: Carbon Footprint



- Accommodation (artist and crew gas and electricity)
- Broadcast (transport)
- Catering (transport)
- Communication (courier, staff travel, office electricity use, printing and transport of programmes, manufacture and transport of bioplastic bags, transport of fabric banners)
- Electricity (Wembley Arena)
- Generators (transport and fuel used to supply Broadcast, Lighting, Sound System, Video Screens etc)
- Lighting (transport)
- Plant (transport)
- Sound System (transport)
- Temporary Structures (transport of sets, seating, dressing rooms, carpet)
- Transport (artist air and ground travel, transport of orchestra instruments)
- Video Screens (transport)
- Waste (transport and processing, recycling etc)
- Water (treatment, pumping etc)
- Wembley arena after party (Admirable Crichton transport only)
- Wembley Stadium gas use
- Wembley Stadium (house) electricity
- Visitor Travel (sample survey)

Additional Resources

JULIE'S BICYCLE

infoComm INTERNATIONAL

STEP Sustainable Technology Environments Program

BSI British Standards

BS 8901 – Sustainable Event Management

GREEN THEATER INITIATIVE

www.greentheatres.org

Project Examples

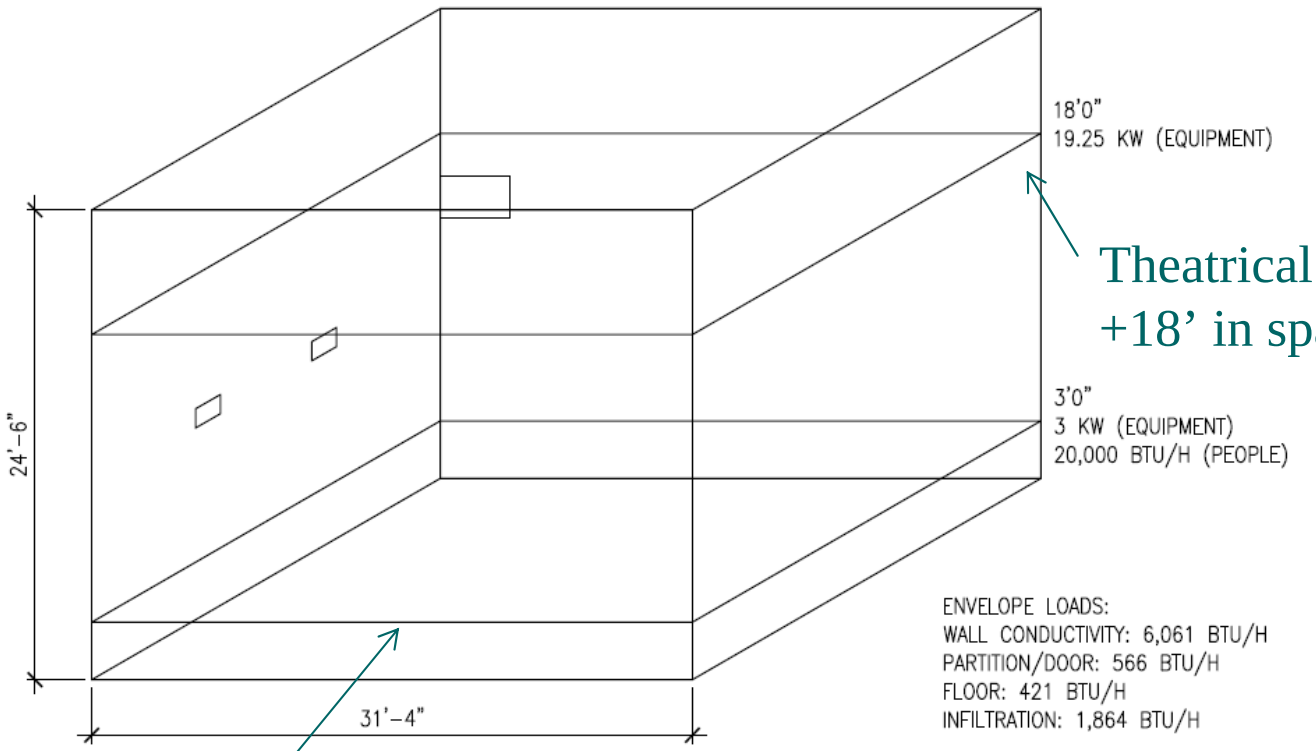
…for discussion…

ARUP

Brooklyn College Performing Arts Center

- **Program: Performing Arts Center**
- **Location: Brooklyn, NY**
- **Client: City University of New York (CUNY)**

Theatre Rehearsal Room



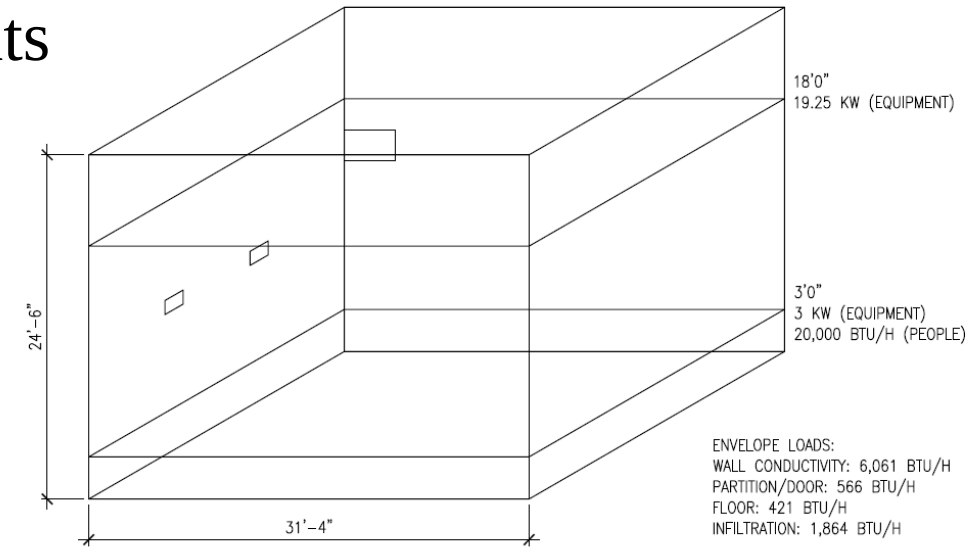
Theatrical lighting loads at +18' in space

Occupied zone with 80 people sitting in rafters

THEATER REHEARSAL ROOM – NORTH VIEW

Theatre Rehearsal Room

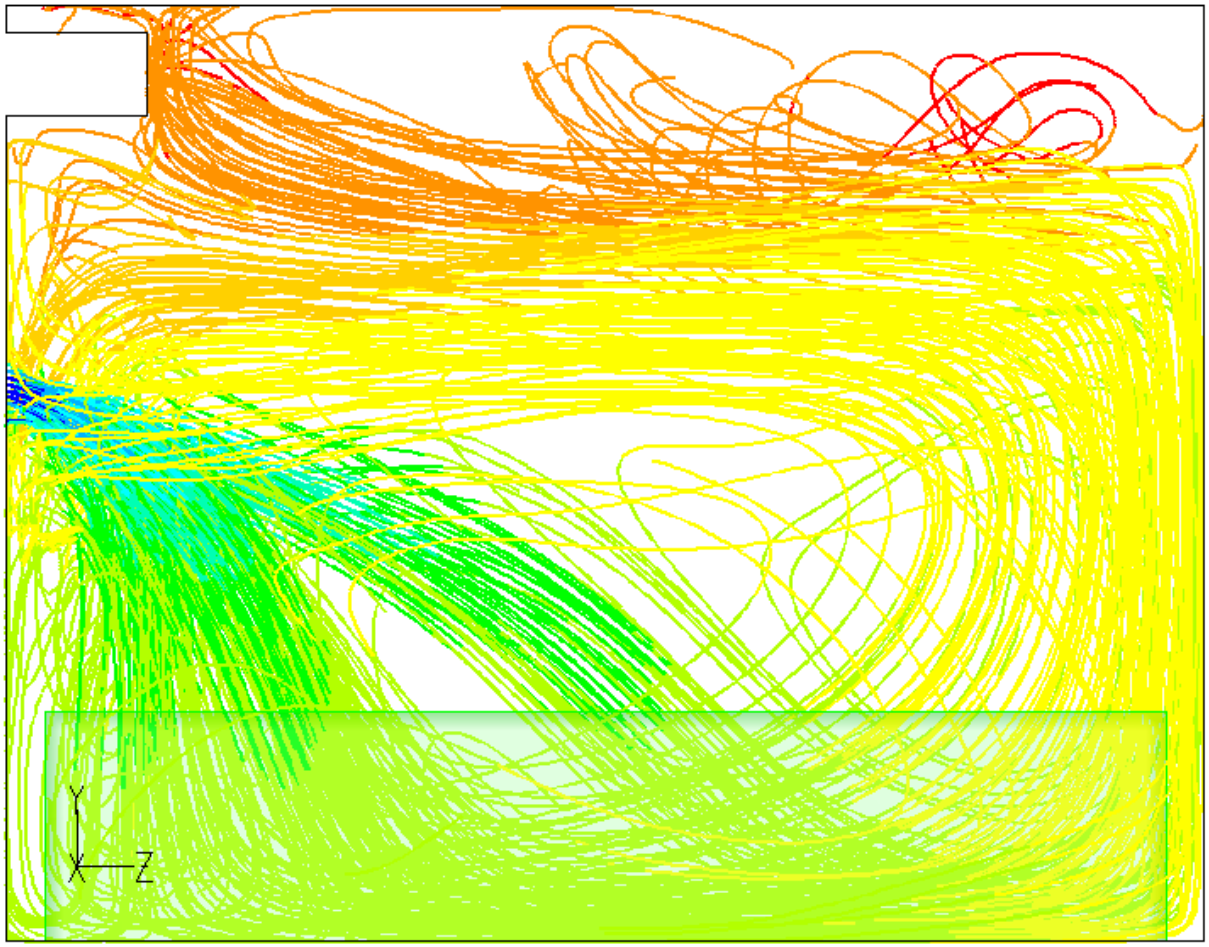
- **Design challenges:**
  - Reduce airflow by 50%
  - Minimize ductwork size
    - Reduces architectural impact
    - Reduces cost
    - Minimize energy consumption
  - Meet air velocity requirements
  - No draft on occupants



THEATER REHEARSAL ROOM – NORTH VIEW

Air Temperature/Flow

Solution: downward deflection angle of 15°

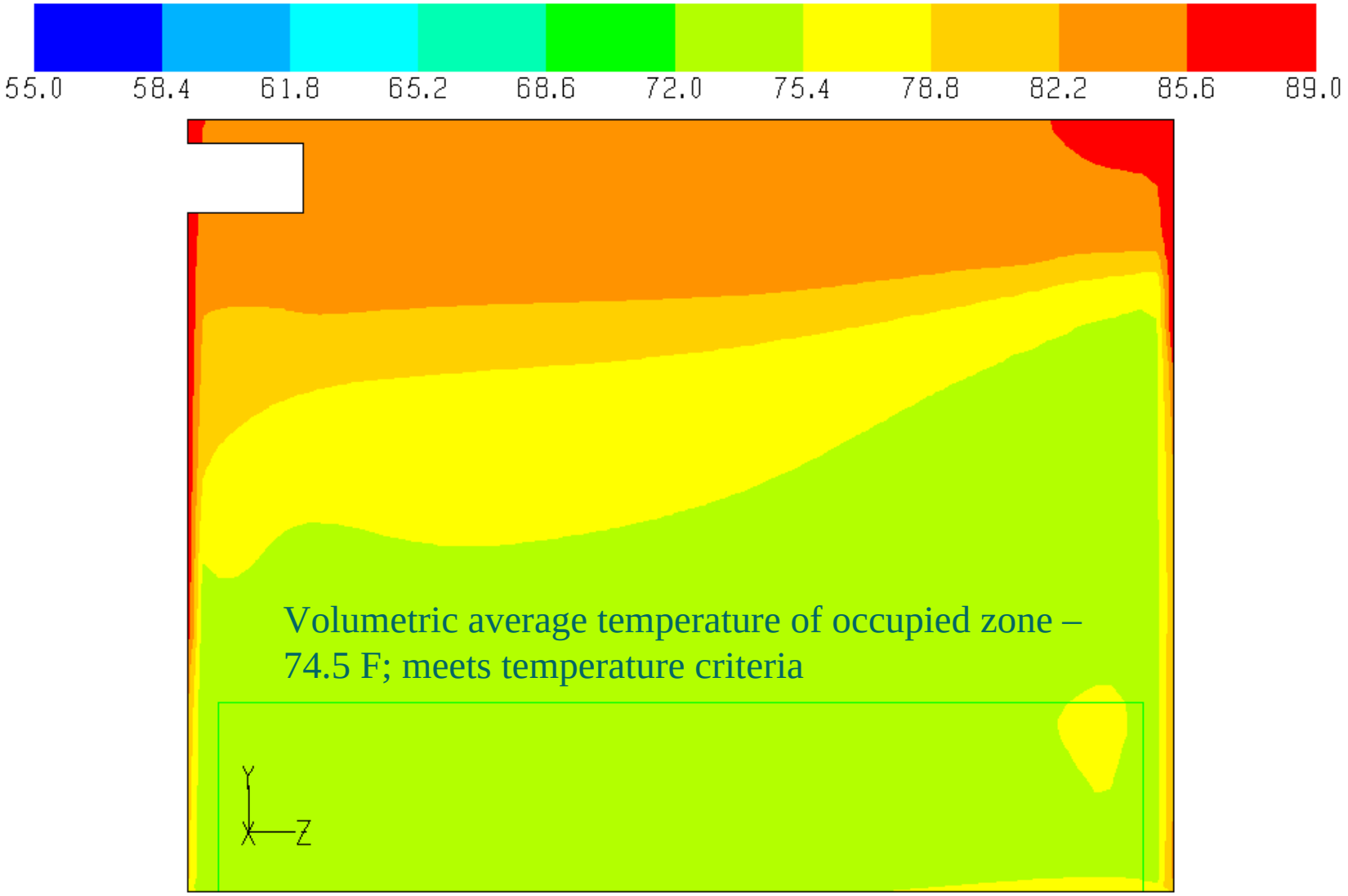


Pathlines Colored by Static Temperature (f)

Jan 21, 2010
FLUENT 6.3 (3d, pbns, S-A)

ARUP

Air Temperature Plot



Takeaways:

- **Temperature stratification: design approach that is simultaneously practical and energy-efficient**
- **CFD as a design validation tool**

Case study: Load driven design

- **Design challenges:**
  - 800 amp equipment electrical load and 400 amps for mechanical equipment allocated for performance space
  - Equipment specification and system design to meet loads
- **Solutions**
  - Distributed dimming
  - LED fixtures

Strand S21 Dimmer Strip

Elation LED Par Zoom MM

'Mighty Output' LED Batten

Going Beyond LEED

Denis Blount, Arup

ARUP