

## ABSTRACT

Title of Document: SUSTAINABLE HERITAGE:  
RETROFITTING HISTORIC BUILDINGS  
FOR IMPROVED ENVIRONMENTAL  
PERFORMANCE

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Masters of Architecture, 2009

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Building materials outlive people. What we build is left for the next generation as a resource and as an artifact of our own time. This thesis explores how we can alter our existing building stock to become more environmentally sustainable. By examining the common ground between the conservation of the built world and the conservation of the natural world, we can redefine stewardship for the present age. Let our built legacy express that we value history, culture, and consideration for the prosperity of future generations.

As a case study, the practice of sustainable retrofitting will be implemented at an abandoned building campus in Silver Spring, Maryland. Designed in 1927 for the National Association of Dyers and Cleaners, these buildings retain their dignity despite years of poor stewardship. The site has the potential to exemplify how historic buildings can become a sustainable resource for the future of an expanding, diverse community.

SUSTAINABLE HERITAGE: RETROFITTING HISTORIC BUILDINGS  
FOR IMPROVED ENVIRONMENTAL PERFORMANCE

By

Sara Goldfarb Langmead

Thesis submitted to the Faculty of the Graduate School of the  
University of Maryland, College Park, in partial fulfillment  
of the requirements for the degree of  
Master of Architecture  
2009

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## Preface

Public awareness of the benefits of “green building” has grown significantly over the last decade. Evidence of man-made climate change has reached the general public through increasing media coverage, through widely-viewed documentaries such as Al Gore’s *An Inconvenient Truth*, and through witnessing the devastation caused by Hurricane Katrina in 2005. Approximately 40% of nationwide greenhouse gas emissions can be traced to coal-burning power plants that produce electricity<sup>1</sup>, and approximately 72% of electricity consumption in the United States occurs in buildings.<sup>2</sup>

Public agencies as well as private developers have begun to acknowledge that designing buildings to use less energy can lower costs in the long term for the benefit of building owners and the environment alike. The increasing prominence of the LEED standards for new building projects and an ever-growing market of “green” products encourages people to believe that a solution to sustainable living is achievable through building. However, making new “green” buildings does nothing to reduce the environmental impacts of the buildings that we already use.

As municipal recycling programs have expanded, many Americans have become accustomed to recycling glass, metal, plastic, and paper waste, so why not recycle buildings? By continuing to use the buildings we have and adapting them both to

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<sup>1</sup> U.S. Environmental Protection Agency: [Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990–2006](#).

<sup>2</sup> USGBC website (accessed 4/6/09): <http://www.usgbc.org/DisplayPage.aspx?cmspageID=1718>.

meet our current needs and to use fewer resources and produce less waste, we stand a much better chance of achieving a truly sustainable way of life.



**Figure 1. The existing structure of a building in Brewers Hill in Baltimore is prepared for reuse.**

While some segments of the population have excitedly embraced sustainable technologies, groups advocating historic preservation are struggling to balance the values of preserving history with the task of responding to environmental concerns. The installation of solar panels and high-performance double-glazed windows seems to threaten the integrity and appearance of historic facades, creating some “green” resistance within the preservation community. The interests of historic preservation and sustainable building are not so divergent, as I will discuss herein, and more significantly, they are critically intertwined. The whole human environment encompasses both the natural and the built environments and so should our notion of

stewardship. Adjusting practices on both ends is the key to advancing both interests. “*How do we preserve?*” should not be a question of maintaining a building’s original condition but of sustaining a healthy usable condition. “*How do we build?*” should be an issue of carefully regarding the future while remaining connected to our past.

For this thesis, I will examine the standards currently applied to both historic preservation and sustainable building in the United States. I will analyze several case studies of historic buildings that have been retrofitted to improve environmental performance, and I will distill a set of strategies for creating a Sustainable Heritage. Finally, I will implement these strategies as a design proposal for the sustainable retrofit and adaptive reuse of an abandoned building complex in Silver Spring, Maryland.

## Acknowledgements

*The author wishes to thank the following people for their contributions toward and assistance during the production of this thesis:*

B.D. Wortham-Galvin, University of Maryland

Madlen Simon, University of Maryland

Carl Bovill, University of Maryland

Sonja Duempelmann, University of Maryland

Margaret McFarland, University of Maryland

Dave Jones, University of Maryland

Roger Chang, Westlake Reed Leskosky

Jerry McCoy, Silver Spring Historical Society

Jorgen Punda and Ron Kruse, Gables Residential

John Marcolin, Montgomery County Planning Office

Bill Landfair, VIK A Engineering

Steve Ziger, Ziger/Snead

Carl Elefante, Quinn Evans Architects

Ray Cho

Özgem Örnektekin

Library of Congress Prints and Photographs Division Staff

*and*

Benjamin Langmead

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## Chapter 1: Background on Historic Preservation

### 1.1 A Brief History of Historic Preservation in the United States

The idea of preventing the demolition of old buildings emerged in the nineteenth century as a means of saving buildings that were associated with significant people and events from history. In 1856, the Mount Vernon Ladies' Association was formed by Virginia women who wished to prevent the sale of George Washington's estate to a hotelier. In 1859, the razing of John Hancock's house in Boston galvanized the preservation movement in New England. The Society for the Protection of New England Antiquities, founded in 1910 by William Sumner Appleton, began to promote not just a historic but also an architectural interest in older buildings.

After the Civil War, historic preservation was used as a means of reclaiming and defining a national identity. By celebrating the places where significant events had taken place and where significant people lived, the young nation started to record its history. During the waves of immigration in the late nineteenth and early twentieth centuries, historic preservation was used as a means of educating and assimilating the new population as to what it meant to be an American. In the 1920s, the Rockefeller family financed the first large-scale restoration and reconstruction of a historic site in Williamsburg, Virginia. "Colonial Williamsburg" was envisioned as a tourist destination designed for education and profit.<sup>1</sup>

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<sup>1</sup> For a good source on historic preservation, see Giving Preservation a History edited by Max Page and Randall Mason

Despite growing interest in historic resources, threats of large-scale demolition peaked in the mid-twentieth century. The construction of the federal highway system and the urban renewal programs of the 1950s and 60s resulted in the destruction of many historic buildings. In response, Congress passed the National Historic Preservation Act (NHPA) in 1966. NHPA states that:

“[T]he preservation of this irreplaceable heritage is in the public interest so that its vital legacy of cultural, educational, aesthetic, inspirational, economic, and energy benefits will be maintained and enriched for future generations of Americans.”<sup>2</sup>

## 1.2 The Secretary of the Interior’s Standards

### **Content of the Standards**

NHPA directs the Secretary of the Interior to develop and propagate “information concerning professional methods and techniques for the preservation of historic properties.”<sup>3</sup> The result is The Secretary of the Interior’s Standards for the Treatment of Historic Properties.<sup>4</sup>

The Secretary of the Interior’s Standards define four levels of intervention into historic building fabric. In order of increasing intervention, they are Preservation, Rehabilitation, Restoration, and Reconstruction.

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<sup>2</sup> 16 U.S.C. §470 Section 1 Part (b) Paragraph (4).

<sup>3</sup> 16 U.S.C. §470a(i)

<sup>4</sup> See [http://www.nps.gov/history/hps/tps/standards\\_guidelines.htm](http://www.nps.gov/history/hps/tps/standards_guidelines.htm)

## The Secretary of the Interior's Standards for the Treatment of Historic Properties

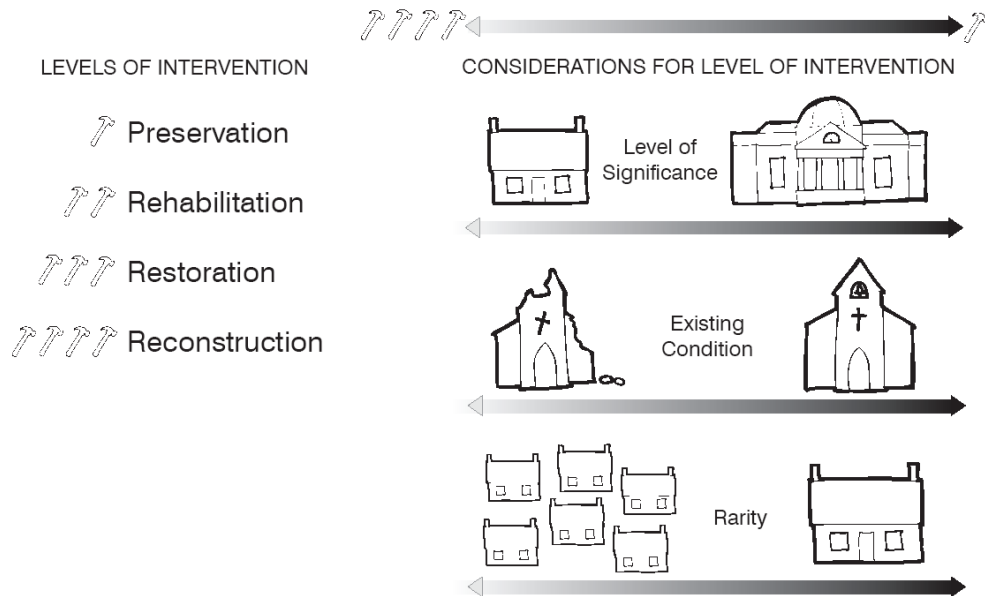


Figure 2. The Secretary of the Interior's Standards: Levels of Intervention.

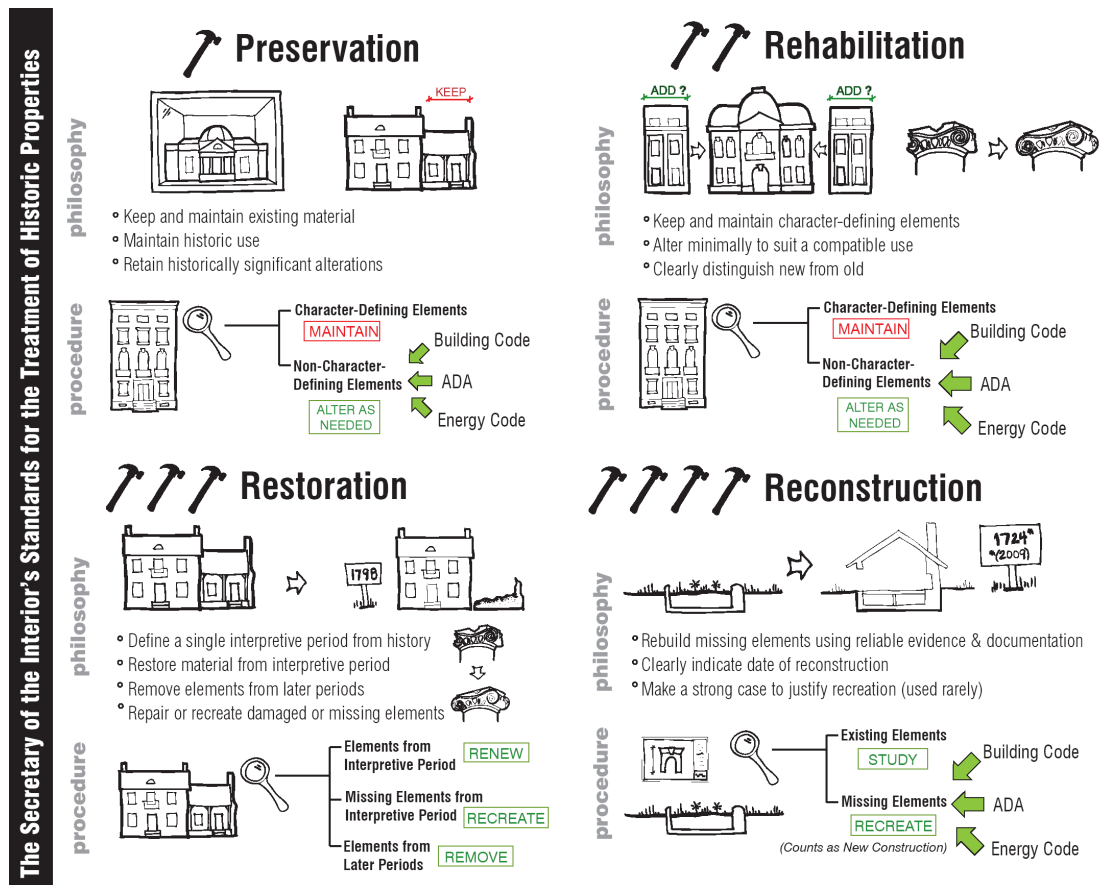


Figure 3. The Secretary of the Interior's Standards: Detailed Levels of Intervention.

**Preservation** is used for structures of high historic significance that are in relatively good condition. Preservation involves maintaining as much of the existing building materials as possible, including alterations to the building that can also be considered historical although from later time periods. Where modifications to the building are required, such as to meet modern building and energy codes and the Americans with Disabilities Act (ADA), those changes are only permitted to elements of the structure that are deemed to be *non-character defining*.

**Rehabilitation** is the most commonly used level of intervention because it is the only method which allows for contemporary alterations and additions. The Standards wish to encourage the continued use of historic buildings as long as those uses are compatible, which means that they require a minimal amount of changes to the historic fabric. Like preservation, rehabilitation requires that building elements be distinguished as *character-defining* or *non-character-defining*. Modifications are permitted to a greater degree than in preservation, in order to meet modern codes and serve the new use, but only to non-character defining elements. Character-defining elements are to be repaired rather than replaced. New elements, including any additions, should be clearly distinguishable from historic ones so that historic authenticity can be easily determined.

**Restoration** is used for buildings whose historic significance is associated with a particular period in history, referred to as the *interpretive period*. The goal of restoration is to return the building to the way it appeared during the interpretive period. Building elements are categorized according to when they were added. If added after the interpretive period, the element is removed. If added during or prior

to the interpretive period, the element is restored to its appearance during that era based on reliable evidence. Replacement is permitted for missing elements or those which are in condition too poor to be repaired. All changes to the building and elements to be removed are to be documented for future scholarship. Restoration is the methodology used for house museums.

**Reconstruction** is the most drastic level of intervention because it involves using new materials to replicate a structure that no longer exists. Reconstruction must be based on reliable evidence, such as archeological findings, photographs, drawings, and descriptions from the time period. Reconstruction is rarely used and must be justified. The actual date of construction must be clearly indicated. Since reconstruction is essentially new construction, buildings are required to meet modern building and energy codes and ADA requirements.

### **Regulation of the Standards at the Federal, State, and Local Levels**

Although the NHPA established the framework for historic preservation regulation nationally, most regulation regarding the treatment of historic buildings occurs at the local level. Many counties and municipalities have established historic preservation commissions which have some degree of authority over alterations made to buildings which have been designated as individual landmarks or part of a historic district. In many jurisdictions, the approval of the historic preservation commission is required before a construction permit will be issued by the municipality. The Secretary of the Interior's Standards have been adopted by most local historic preservation commissions and state historic preservation officers as the standard to which all alteration projects are held. These agencies also consider the Standards when



administering the tax credits that are available to historic preservation projects. Effectively, the Standards have both regulatory and financial authority in the U.S.

### **Limitations and Failings of the Standards**

Of the four levels of intervention described by the Secretary of the Interior's Standards, only Rehabilitation accommodates modifications that support the continued use of historic buildings. The rehabilitation standard is the one most commonly considered by historic preservation commissions. Since nearly all projects fall into this category, more differentiation in the standard may be warranted in order to accommodate a broader range of circumstances.

The Standards do not offer specific recommendations for what alterations should or should not be permitted in specific cases. This leaves a great deal of decision-making up to the judgment of the historic preservation commission. The vagueness of the Standards is intentional because each situation must be considered individually, but vagueness can make the decisions of committees appear arbitrary.

The Standards tend to privilege appearance over other values. Restoration is defined as “the act or process of accurately depicting the form, features, and character of a property as it appeared at a particular period of time.”<sup>5</sup> To that end, missing features from the interpretive period are to be reconstructed so that the building will *look* like it did during that time. Materials that were added later are to be removed without consideration for their value.

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<sup>5</sup> Secretary of the Interior's Standards for Historic Preservation, *ibid.*

The Standards attempt to but fall short of recognizing the value of the traditions that our buildings represent. If an operable wood-framed transom window ceases to open, should it be maintained or replaced? Do we value the original wood and glass materials over the tradition of opening and closing the window? Where humans use buildings to express their identity, such as through the selection of paint colors, should preservationists value the continued use of a “historic” palette over the tradition of personal expression?

The Secretary of the Interior’s Standards refer to historic buildings as cultural resources but they do not explicitly acknowledge that these buildings are material resources as well. The brick, the stone, the wood, the glass, the adobe, the metal and the concrete are valuable for the feats they are able to perform: transferring loads, shedding water, retaining or conducting heat, blocking or transmitting light. The *integrity* of a structure is a measure of its ability to perform these functions. Where integrity is retained, regardless of historic association, shelter is possible without the expenditure of additional energy and material resources. Those savings have a significant environmental impact that the Secretary of the Interior’s Standards fail to address.

## Chapter 2: Background on Sustainable Design

### 2.1 Goals and Methods

The overarching goal of sustainable design is to minimize the detrimental impacts of building on the quality of the natural and human environment so that our civilization can continue to enjoy the Earth's resources indefinitely. In theory, this comes down to two basic principles: minimizing the amount of resources (including energy) consumed and minimizing the amount of waste produced during the construction and operation of a building. Measuring the actual environmental impact of a building project is extremely complicated, so various sustainability rating systems have been established to help place building projects within a spectrum of estimated environmental impact. Though rating systems cannot be relied upon to determine the absolute impact or efficacy of a design, they are useful in providing guidance for the types of strategies that can be employed to improve environmental performance. In practice, any design claiming to be "sustainable" should be thoroughly analyzed to estimate effectiveness prior to construction.

### 2.2 Leadership in Energy and Environmental Design (LEED)

The Leadership in Energy and Environmental Design (LEED) Green Building Rating System is a third-party evaluation system that seeks to measure the performance of a building in terms of its environmental impact and the safeguarding of occupant health. LEED was developed and is administered by the U.S. Green Building Council (USGBC), which is a non-profit group that was founded in 1993.<sup>6</sup> The

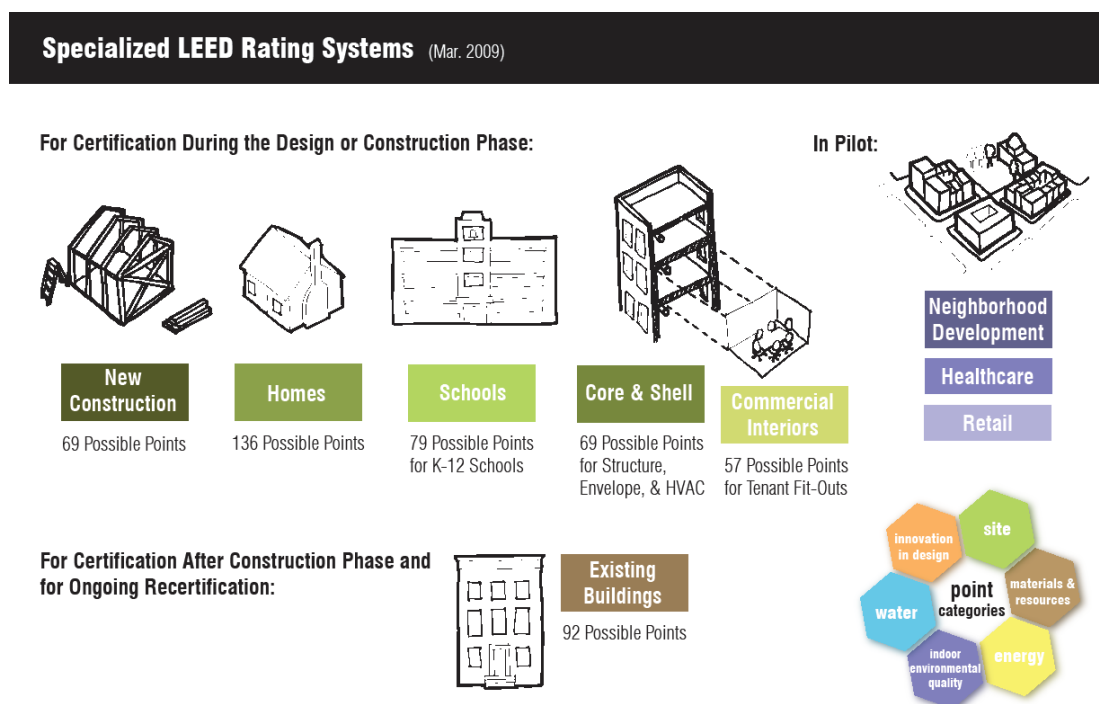
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<sup>6</sup> U.S. Green Building Council website: <http://www.usgbc.org/>

LEED Rating System is currently the most prominently used means of measuring the sustainable performance of a building. Several governmental and private agencies have recently begun to adopt a particular LEED score as a required baseline for new construction.

### Content of the Standards

As of March 2009, USGBC had issued or proposed nine different LEED rating systems, each specialized for a particular building use or situation. Buildings in the design or construction phase can become LEED certified under the systems for New Construction, Homes, Schools, Core & Shell, or Commercial Interiors. LEED rating systems for retail and healthcare uses were in pilot stages as well as a system for rating neighborhood development. At any point after construction, a building may be

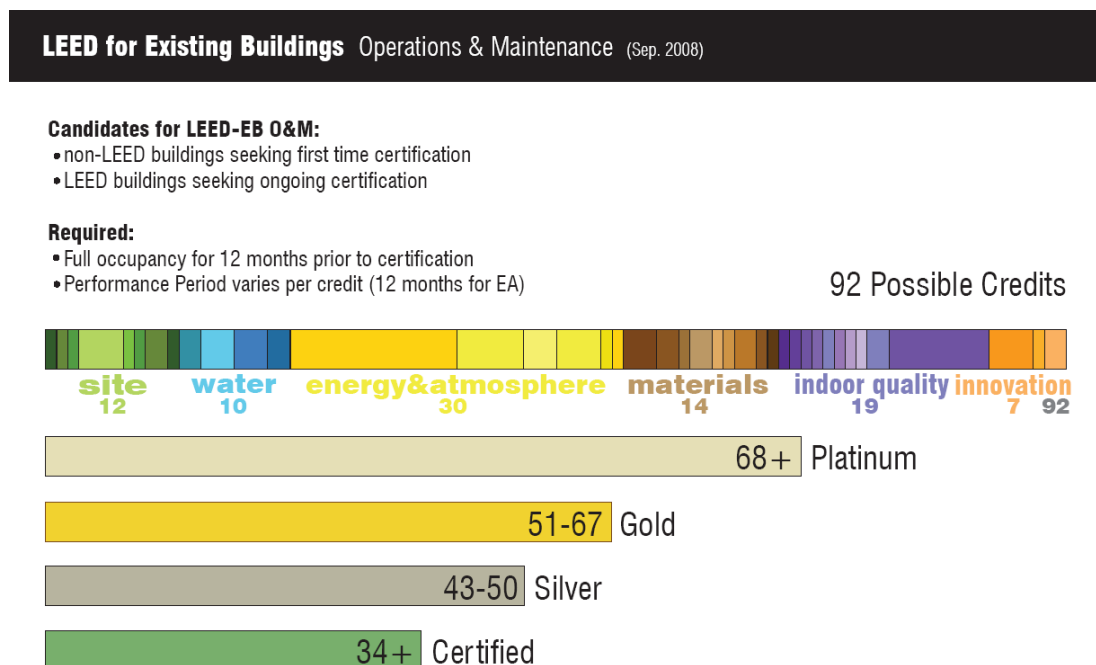


**Figure 4. LEED Rating Systems as of March 2009.**

certified under the LEED for Existing Buildings: Operations and Maintenance rating system. Each of the LEED rating systems award credits for accomplishment in six areas: site design, water efficiency, energy efficiency, material and resource usage, indoor environmental quality, and innovation. Achievement is measured by the total number of credits awarded. From lowest to highest, the levels of achievement are distinguished by the titles LEED Certified, LEED Silver, LEED Gold, and LEED Platinum. The number of credits required to earn each title varies by rating system.

### LEED for Existing Buildings

The LEED for Existing Buildings rating system is applicable to any building seeking first-time certification or any previously certified building looking to recertify to acknowledge continuing superior environmental performance. Therefore, any historic building seeking certification today would be measured by the LEED-EB standard.



**Figure 5. LEED for Existing Buildings Rating System.**

## O&M Strategic Framework:

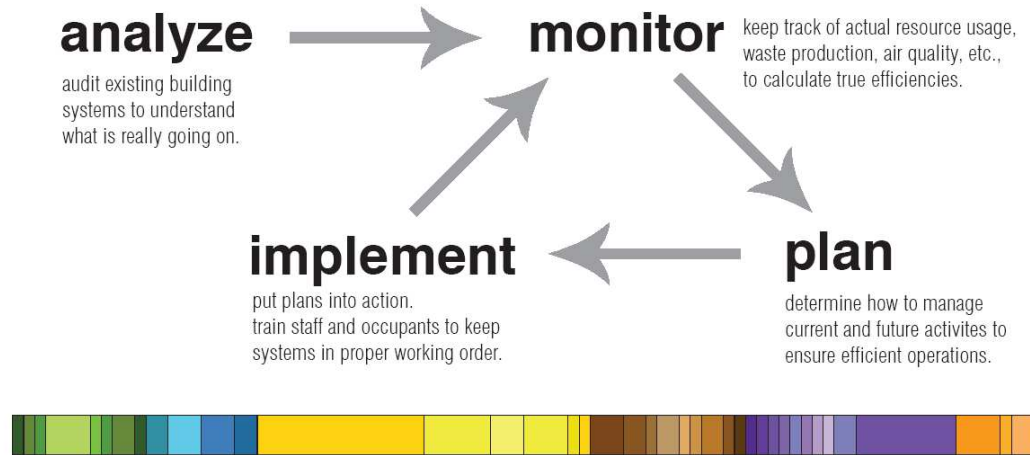


Figure 6. Strategic Framework for assigning credits under LEED-EB.

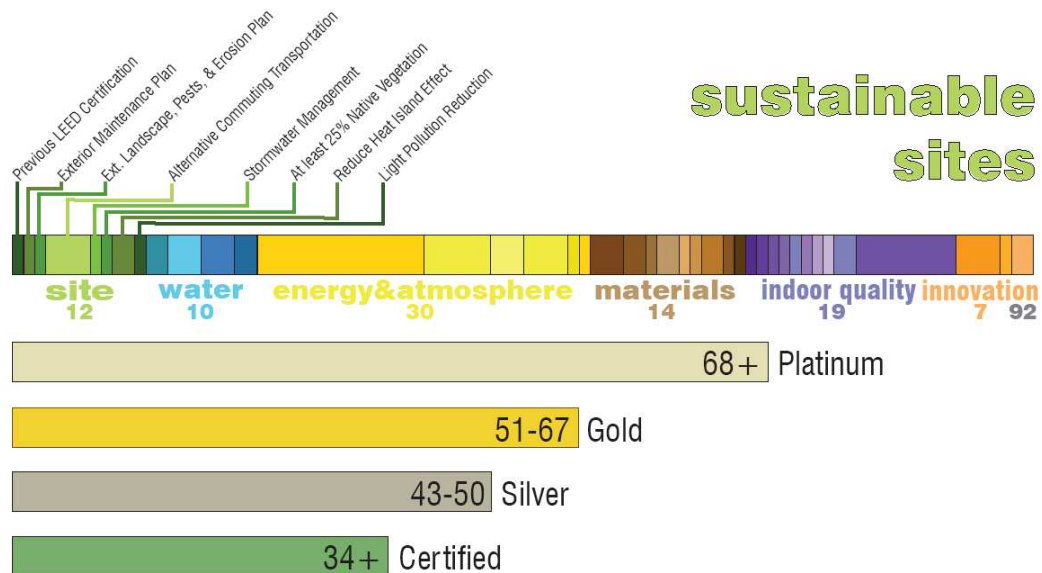


Figure 7. Credits in the category of Sustainable Sites under LEED-EB.

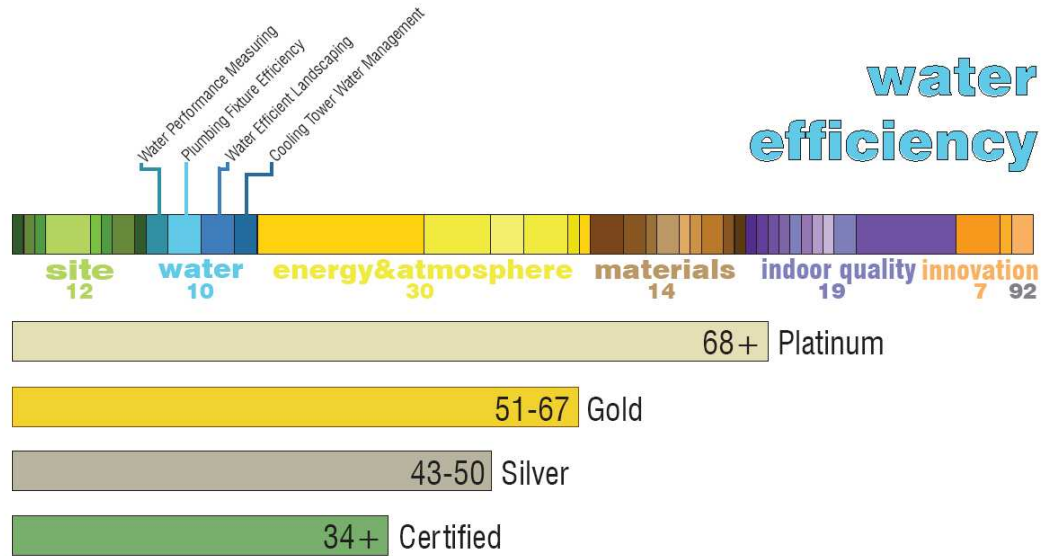


Figure 8. Credits in the category of Water Efficiency under LEED-EB.

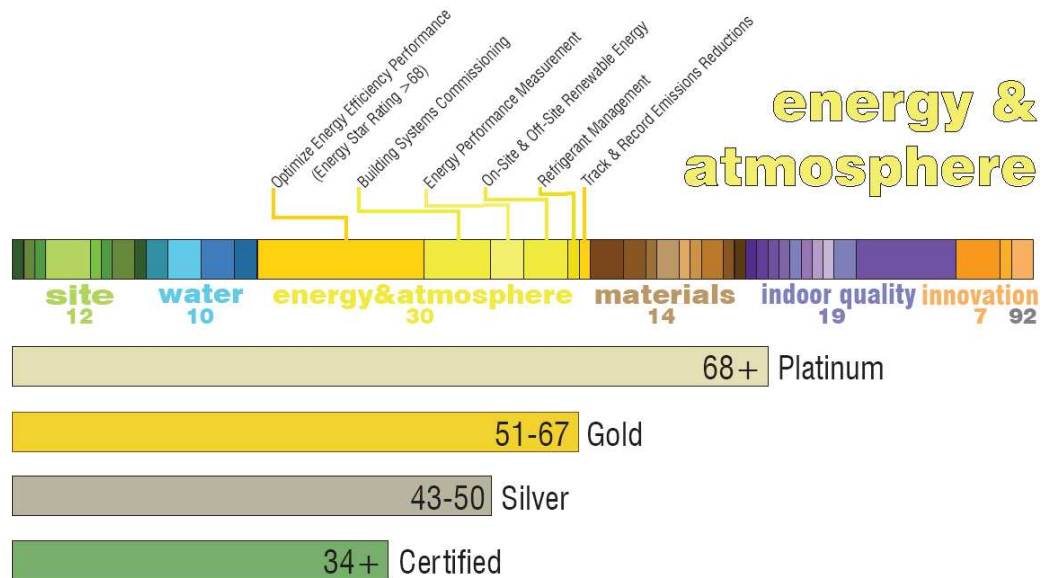


Figure 9. Credits in the category of Energy and Atmosphere under LEED-EB.

## materials & resources

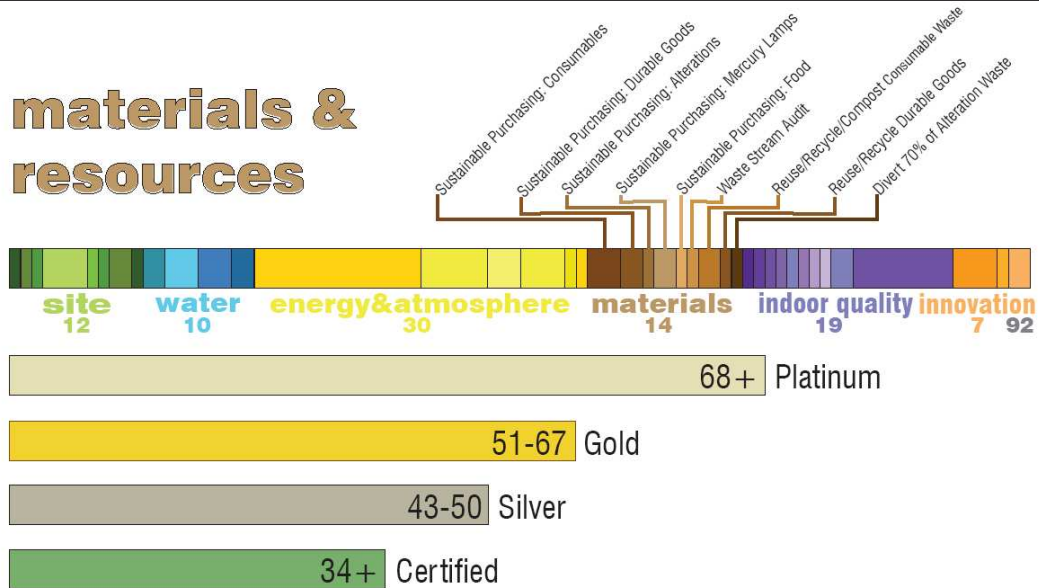


Figure 10. Credits in the category of Materials and Resources under LEED-EB.

## indoor environmental quality

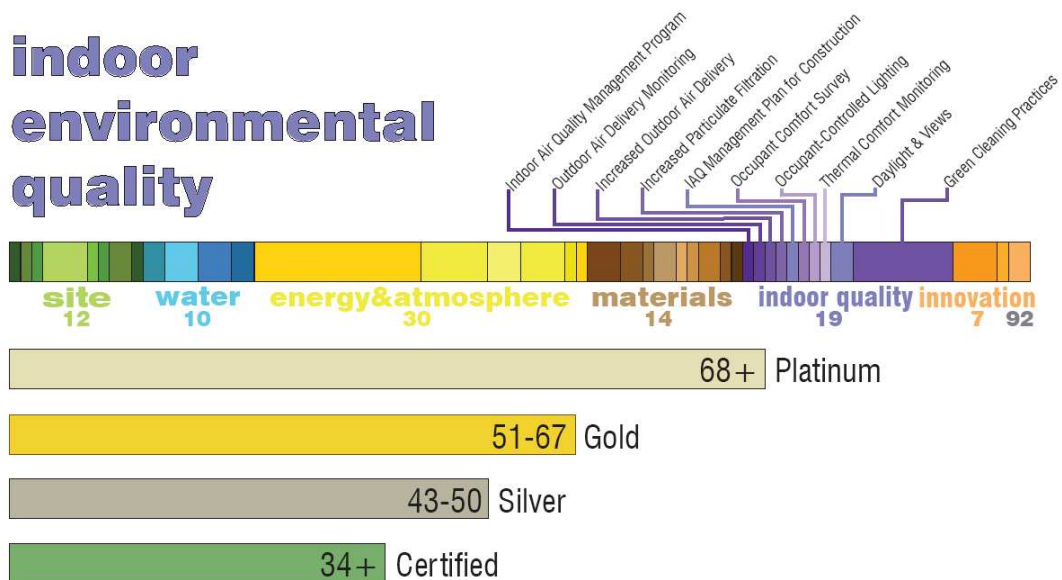


Figure 11. Credits in the category of Indoor Environmental Quality under LEED-EB.



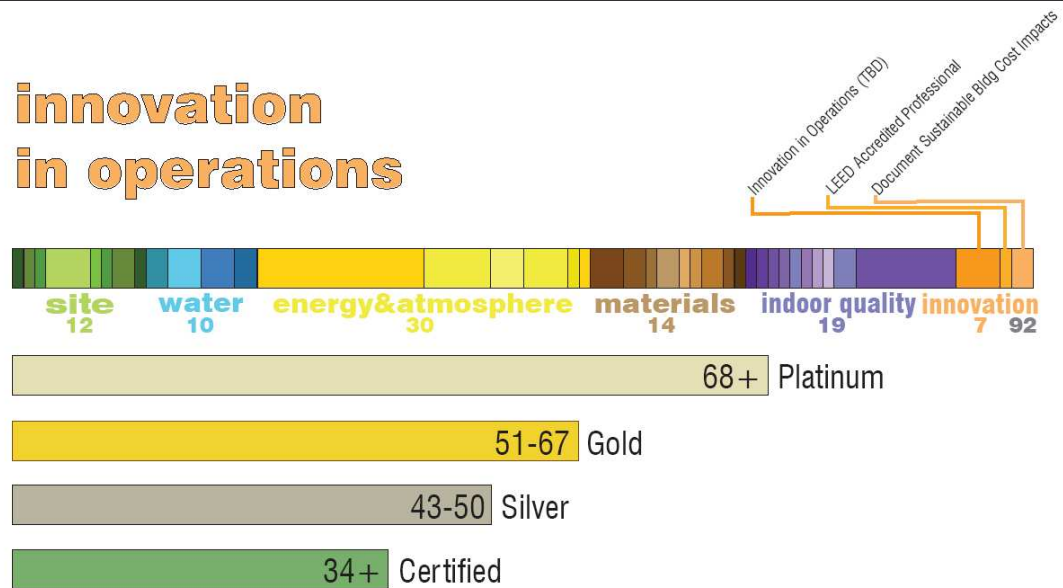


Figure 12. Credits in the category of Innovation in Operations under LEED-EB.

### Limitations and Failings of the Standards

The LEED-EB standard was developed in part as a response to critics who accused the LEED system of failing to acknowledge the environmental benefits of reusing existing buildings over constructing new ones. LEED-EB awards most credits for operation and maintenance practices which all occupied buildings require in order to broaden the applicability of the system.

However, new construction is rated in part by the materials out of which it is made, but existing buildings are given no credit for the energy embodied in their materials. Some critics have also noted that the energy performance benchmarks are out of reach for most historic buildings. Although new construction projects are awarded points for reusing a certain percentage of material from the site, they are not penalized for the demolition and disposal of the remaining material.

### 2.3 Other Sustainability Standards

#### **The Living Building Challenge**

The Living Building Challenge (LBC) is a system developed by the Cascadia Region Green Building Council that defines a series of goals which raises the bar on systems like LEED. Rather than acknowledging degrees of accomplishment in environmental performance, LBC requires that any building certified under its standard meet all 16 prerequisites.

No building has achieved LBC certification so far, but the main intention of the system is to define a series of goals toward which designers should strive. The ultimate goal is to design buildings that cause *no additional harm* to the environment, rather than *less harm*, so that humans can establish a method of building that is truly sustainable in the long-term. The Cascadia Green Building Council acknowledges the practical difficulties of achieving all of the prerequisites at once, but warns that settling for LEED accomplishment will only slow environmental degradation rather than stop or reverse it.

Both existing and new buildings are eligible for LBC certification, but some of the credits are particularly problematic for historic buildings. For example, Prerequisite 5 defines a materials “red list” that includes many materials commonly found in historic buildings, such as lead.

## Sustainability Standards: LEED v. The Living Building Challenge

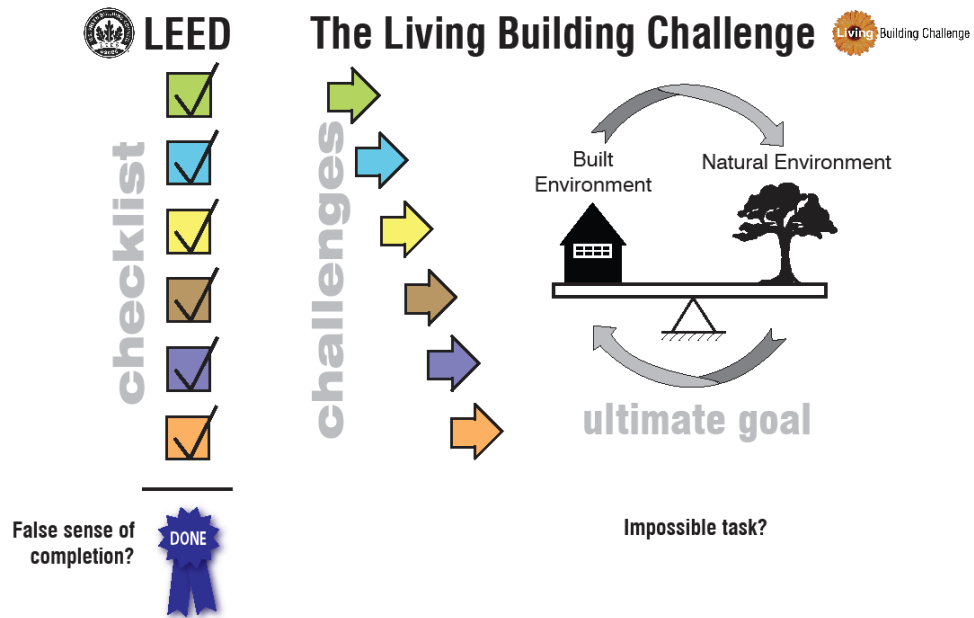


Figure 13. Difference in philosophy between LEED and The Living Building Challenge.

## Sustainability Standards: LEED v. The Living Building Challenge

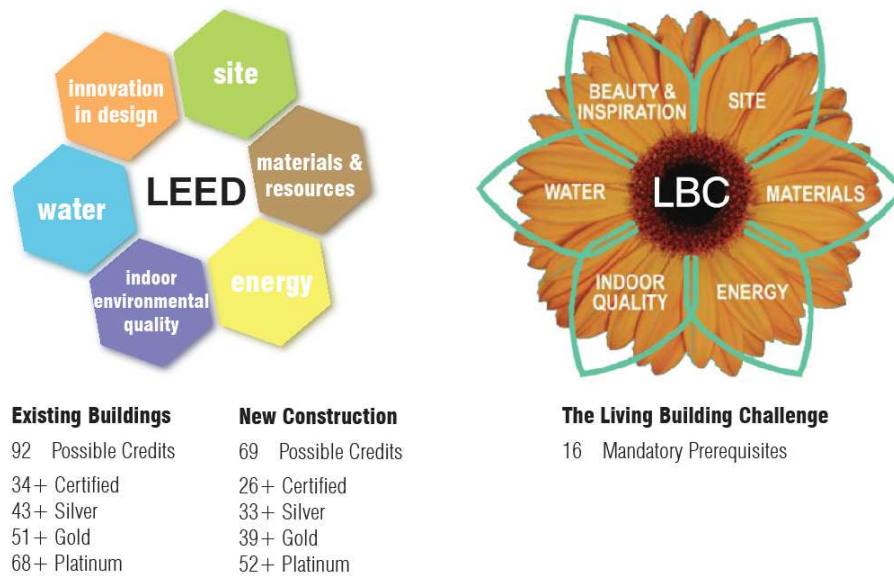


Figure 14. Differences in structure between LEED and The Living Building Challenge.

## The Living Building Challenge (Apr. 2007)



- 16 Mandatory Prerequisites
- Existing or New Buildings Eligible
- 12 Month Occupancy Required

### site

- 1: Responsible Site Selection
- 2: Limits to Growth
- 3: Habitat Exchange

### energy

- 4: Net Zero Energy

### materials

- 5: Materials Red List (*Do Not Use*)
- 6: Construction Carbon Footprint (*one-time carbon offset*)
- 7: Responsible Industry (*FSC Certified or Salvaged Wood Only*)
- 8: Appropriate Materials/Services Radius
- 9: Leadership in Construction Waste

### water

- 10: Net Zero Water
- 11: Sustainable Water Discharge

### IEQ

- 12: A Civilized Work Environment (*operable windows*)
- 13: Healthy Air--Source Control
- 14: Healthy Air--Ventilation (*CA Title 24--15 cfm/person*)

### beauty & inspiration

- 15: Beauty and Spirit
- 16: Inspiration and Education

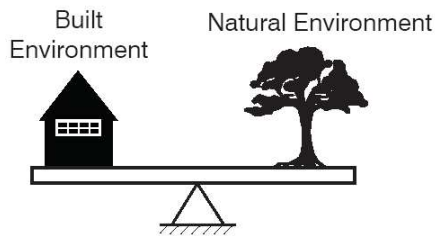
Figure 15. Outline of The Living Building Challenge.

## The Living Building Challenge (Apr. 2007)

### site

Prerequisite 2

## Limits to Growth



Q: How to achieve?



A: Define Boundaries

Figure 16. Prerequisite 2 of the Living Building Challenge.

## The Living Building Challenge (Apr. 2007)

**materials**  
Prerequisite 5

### Materials Red List

Examples of materials that may not be used:

#### PVC

found in:



Piping

#### Lead

found in:



Historic Paint

#### Mercury

found in:



Compact Fluorescent Light Bulbs

#### CFCs

found in:



Refrigerants

#### Arsenic

found in:



Pressure Treated Lumber

#### Polyurethane

found in:



Sealants

Figure 17. Prerequisite 5 of The Living Building Challenge.

## The Living Building Challenge (Apr. 2007)

**materials**  
Prerequisite 8

### Appropriate Travel Distances for Materials & Services



250 miles  
Heavy Materials



500 miles  
Medium Weight Materials



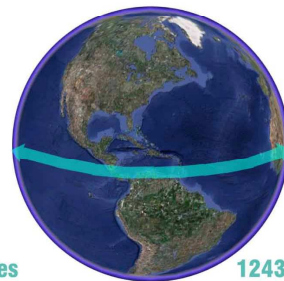
1000 miles  
Lightweight Materials



1500 miles  
Consultant Travel



7000 miles  
Renewable Energy Technologies



12430 miles  
Ideas

Figure 18. Prerequisite 8 of The Living Building Challenge.

**materials**  
Prerequisite 8

## Appropriate Travel Distances for Materials & Services

Important Considerations  
for the Environmental Impact  
of "Local" Materials



**Figure 19. Important Considerations for the Environmental Impact of "Local" Materials.**

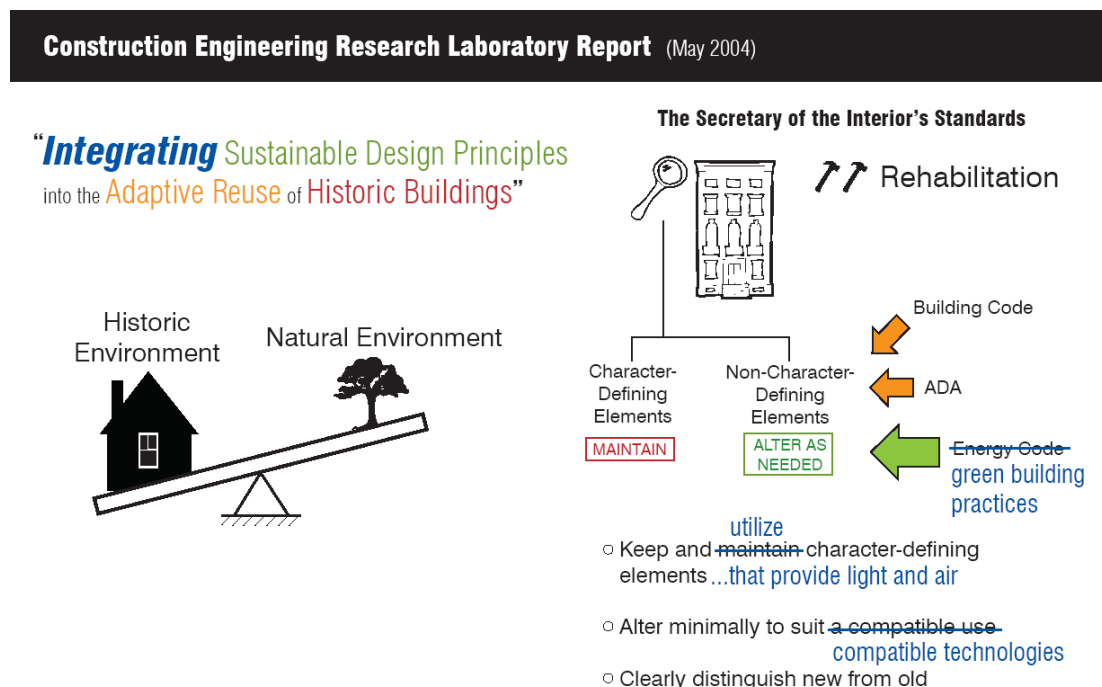
## BREEAM

The Building Research Establishment Environmental Assessment Method (BREEAM) was established as a sustainable project rating tool similar to the LEED system. BREEAM publishes standards for buildings by type. As of April 2009, there are systems for Courts, Homes, Healthcare, Industrial, Multi-residential, Prisons, Offices, Retail, Education, Communities, and a Miscellaneous category.

BREEAM was developed in the United Kingdom and is tailored for that area, but they also publish guidelines for the development of standards in other parts of the world. New buildings and existing buildings are eligible for certification within each use category.

## Construction Engineering Research Laboratory

In 2004, the U.S. Army Corps of Engineers commissioned a report from the Construction Engineering Research Laboratory on the topic of integrating sustainable design and historic preservation practice. The result is “Integrating Sustainable Design Principles into the Adaptive Reuse of Historical Properties.”<sup>7</sup> The U.S. Army maintains many historic properties on their bases. The report attempts to locate the appropriate middle ground between the Secretary of the Interior’s Standards and the LEED rating system. The result is a tipping in favor of preservation over sustainability. It is essentially a version of the standard for Rehabilitation that includes sustainable design measures as acceptable alterations in addition to building code, energy code, and accessibility requirements. One of the salient points in the



**Figure 20. General principles of the report published by the Construction Engineering Research Laboratory.**

<sup>7</sup> Fournier, Donald F. and Karen Zimnicki. “Integrating Sustainable Design Principles in the Adaptive Reuse of Historical Properties.” US Army Corps of Engineers, 2004.

report is that many historic buildings contain architectural features such as cupolas, shutters, and clerestory and transom windows that were designed as passive means of providing ventilation, daylighting, and solar shading. The report recommends that these types of features be restored to working condition rather than sealing the building envelope and providing mechanical air-conditioning.



## Chapter 3: The Relationship Between Historical and Environmental Conservation

### 3.1 The Greenest Building Is The One That's Already Built

New construction requires a significant investment of resources and energy. Building materials must be extracted as raw material, processed into the desired form, transported to the site, and assembled. The use of salvaged materials eliminates the first two steps and their related expenditures of resources and energy. The reuse of material from the building site itself eliminates the latter two steps as well. Hence the phrase, “the greenest building is the one that’s already built.” Preservationists also advocate reusing as much of the historic fabric as possible. Here, the interests of sustainable design and historic preservation are aligned.

### 3.2 No Such Thing As Waste

New construction and demolition also create a substantial amount of waste that needs to be handled. In their book Cradle to Cradle, William McDonough and Michael Braungart explain that there really is no such thing as waste because we can’t ever really throw anything away. They challenge the concept of “away” as a relative and ultimately meaningless term, since all material remains on the planet that we all occupy.<sup>8</sup> Throwing something “away” means moving it elsewhere for other people to deal with down the line. Lifecycle costs continue after disposal, even if they are not paid by those who did the disposing, and the environmental consequences are shared

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<sup>8</sup> McDonough, William and Michael Braungart. Cradle to Cradle. New York: North Point Press, 2002.

by everyone. The reuse or continued use of a building rather than replacing it means that all of that material is effectively diverted from landfills.

### 3.3 Embodied Energy and Material Integrity

*Embodied energy* is the amount of energy that has already been consumed in the extraction, processing, and transportation of a material. It is essentially a measure of the lifecycle costs of a material up to that moment. In practice, measuring embodied energy helps us assign value to each material when an existing building is being evaluated for reuse.

In theory, this is similar to the concept of historic integrity. In order for a property to be eligible for listing on the National Register of Historic Places, it must have demonstrable historic significance in one of four categories as well as possess historic “integrity.”<sup>9</sup> Integrity is a subjective term, but in its evaluation lies the question: is the object in good enough condition to express its significance and therefore be worth preserving? A historic building that is structurally unsound to the point where it could not be safely reinforced or a building that has been altered so often that only a minimal amount of historic material remains are examples of buildings that do not possess adequate integrity. Conversely, integrity is a measure of the inherent historical value of a material. Embodied energy can be considered a measure of the inherent natural resource value of a material. Both concepts recognize that building materials possess value beyond their replacement costs.

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<sup>9</sup> See “National Register Bulletin: How to Apply the National Register Criteria for Evaluation” or the National Register website at <[http://www.nps.gov/nr/national\\_register\\_fundamentals.htm](http://www.nps.gov/nr/national_register_fundamentals.htm)>

### 3.4 Smart Growth

The Smart Growth movement seeks to minimize the detrimental environmental effects of sprawl by encouraging additional density around existing development centers rather than greenfield development. The goals are the preservation of habitat, the reduction of fuel consumption and emissions from automobile travel, and the more efficient use of public utility networks.

In the state of Maryland, Smart Growth principles are promoted by offering financial incentives to build within the boundaries of specific population centers.<sup>10</sup> Since modern population centers have frequently grown around historic downtowns, this promotes development in areas that may have a higher concentration of historic resources. Although this may threaten historic buildings by increasing development pressure in the area, if implemented properly, the interests of Smart Growth and historic preservation could be achieved simultaneously.

Creating livable urban environments in which automobile use is not necessary depends upon access to amenities, including retail establishments. Whereas preservationists advocate the continued use of central business districts in order to spur investment in the historic built fabric, Smart Growth advocates would support their continued use because walking or taking public transportation to a local store reduces the need to drive to a suburban shopping mall. It also eliminates the need to continually expand public utilities such as power, water, and sewer systems. The

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<sup>10</sup> Cohen, James R. "Maryland's 'Smart Growth': Using Incentives to Combat Sprawl" Urban Sprawl: Causes, Consequences, and Policy Responses. Ed. G. Squires. Washington, D.C.: Urban Institute Press, 2002.

challenge is to create policies that promote the continued use or reuse of historic downtowns over replacement.

### 3.5 Common Values

The landmark pieces of legislation for the historic preservation and the environmental conservation movements were both products of the same time period in United States history. The National Historic Preservation Act (“NHPA”) was passed in 1966 and the National Environmental Policy Act (“NEPA”) was passed in 1969. In their preambles, both laws cite similar factors as threats to the respective resources and justify government intervention in similar terms. The NHPA cites the “ever-increasing extension of urban centers, highways, and residential, commercial, and industrial developments”<sup>11</sup> and the NEPA cites the “profound influences of population growth, high-density urbanization, industrial expansion, [and] resource exploitation”<sup>12</sup> as the impetus for the legislation. Both laws mention the responsibilities of each generation to steward resources for future generations. The NEPA even offers specific additional protection to historic resources.<sup>13</sup> Both laws can be considered a reflection of the increased social awareness of the 1960s and share the values of communal welfare, collective responsibility, and public activism.

### 3.6 Shared Risks

The images below were published by the British preservation advocacy group English Heritage to show that preservationists should be just as interested in mitigating the

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<sup>11</sup> 16 U.S.C. §470 Section 1 Part (b) Paragraph (5).

<sup>12</sup> 42 U.S.C. §4331 Part (a).

<sup>13</sup> 42 U.S.C. §4331 Part (b) Paragraph (4).

effects of climate change as advocates of sustainable design are. One flood event can negate years of the finest preservation efforts.<sup>14</sup>



Figure 21. Flooding at historic sites in the United Kingdom, from English Heritage.

### 3.7 Responsibility to Future Generations

The preservation of historic buildings can be used as a sustainable design tool because the physical evidence of what previous generations of people created reminds us that what we build will outlive us and become our legacy to future generations. Ideally, this realization will inspire and motivate us to prioritize quality design over short-term financial gain. Perhaps it will also remind us that the act of destruction is final and irreversible. The historic and natural resources we enjoy today are not only our inheritance from the past but also part of our inheritance to the future.

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<sup>14</sup> English Heritage. “Climate Change and the Historic Environment.” Jan. 2006.

## Chapter 4: Case Studies in Sustainable Retrofitting

Each case study below has been analyzed in terms of:

- The historical significance of the building.
- The **strategies** employed to improve environmental performance
- The **efficacy** of each strategy, if known
- The **implications** that the strategy has for the architecture and for the preservation of the existing building materials.

Strategies are categorized according to the types of credits available under the LEED

Rating Systems, including:

- Site Strategies
- Strategies to reduce potable water usage
- Strategies used to improve energy efficiency
- Strategies used to reduce the consumption of materials and resources
- Strategies used to improve indoor environmental quality
- Examples of innovation in design and operations.

#### 4.1 Audubon House

Prior to the release of the LEED rating system, the National Audubon Society set out to build a new headquarters that would minimize the detrimental impact to the environment of building construction and occupancy and improve occupant health. The indoor environment of the former headquarters building had not successfully mitigated occupant comfort. Poor heating, cooling, ventilation, and lighting created conditions in which “[e]mployees frequently complained of headache, fatigue, foul odors, and respiratory discomforts.” In addition to alleviating these ills, the Society hoped that its new headquarters would serve as a model of environmentally conscientious design. Since the mission of the National Audubon Society is “to conserve and restore natural ecosystems, focusing on birds and other wildlife for the benefit of humanity and the earth’s biological diversity,” the building was designed to minimize the destruction of habitat worldwide.

In 1991, the Society rehabilitated an existing 1891 commercial building in New York City to serve as its new headquarters. The design team performed extensive research into the upstream and downstream environmental impacts of material and energy source selection. The health, comfort, and productivity of the building’s occupants was also a priority. The National Audubon Society and Croxton Collaborative Architects published a book documenting their experience in order to share the information learned throughout the process. According to the book, the owner considers the project to have successfully met its design goals.<sup>15</sup>

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<sup>15</sup> National Audubon Society and Croxton Collaborative. Audubon House: Building the Environmentally-Responsible, Energy Efficient Office. New York: Wiley, 1994.



## Case Study: Audubon House



*"[R]euse of an existing structure amounted to a gesture of respect toward the community. Instead of imposing a new aesthetic on an architecturally rich section of New York City, Audubon conserved a building of great character and an integral piece of the overall architectural fabric."*

- from *Audubon House: Building the Environmentally Responsible, Energy-Efficient Office*

**Location:** 700 Broadway, New York, NY

**Owner:** National Audubon Society

**Program:** Offices of the National Audubon Society

**Constructed:** 1891 as a department store

**Renovated:** 1991 (predates the LEED rating system)

**Architects:** Croxton Collaborative

**Size:** approximately 72,000 SF on 8 stories

### strategy

Gut renovation.  
Extensive material and equipment research aimed at minimizing detrimental effects to environmental and human health.

### efficacy

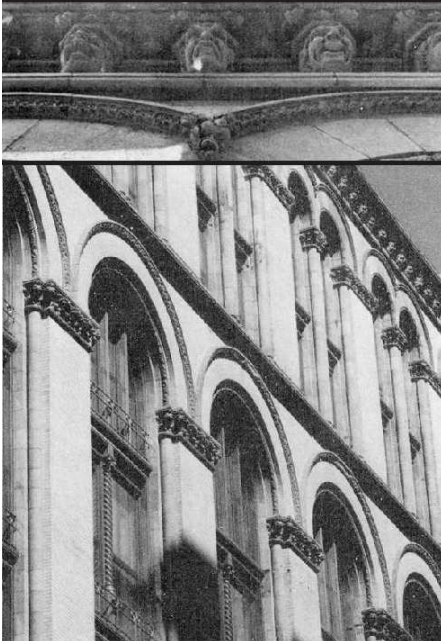
Increased employee comfort.  
62% reduction in energy use; 75% for lighting.  
Higher upfront costs with a 5-year payback period.

### implications

Historic exterior was preserved except for windows.  
Only traces of historic character from interior are window shapes and proportions; otherwise, interior finishes are modern.

Figure 22. Audubon House - Introduction.

## Case Study: Audubon House



### historic significance

**1891** Built as a department store after a design by architect George B. Post. During his career, Post worked with many prominent American architects and produced several major works.

**american architecture** Post had been a student of Richard Morris Hunt. Later, he worked with Burnham and Root on the 1893 World's Columbian Exposition. Post served as the sixth president of the American Institute of Architects in the 1890's.

Post designed 700 Broadway during the period of his most significant contribution to American architecture. In those years, he also designed the New York Stock Exchange building and the Wisconsin State Capitol building.

**local economic history** 700 Broadway is architecturally significant as a classic example of late 19th century warehouse/department store design, bearing similarities to the Marshall Fields Wholesale Store and the work of Louis Sullivan. It also contributes to a prominent retail district in New York.

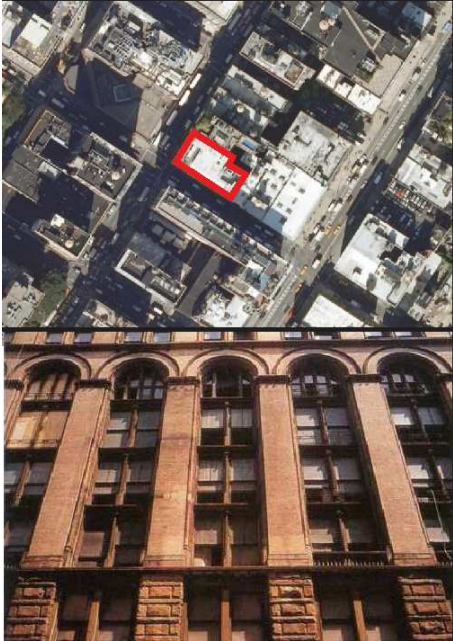
**contributing structure in a district** Period materials such as brownstone, brick, and decorative terra cotta represent fine craftsmanship.



Figure 23. Audubon House - Historic Significance.



## Case Study: Audubon House



### strategy



### site

### efficacy

Location in Manhattan ensures that nearly all occupants and visitors will primarily use public transportation.

### water

### implications

Consistent with the neighborhood.

Figure 24. Audubon House - Site and Water Strategies.

## Case Study: Audubon House



### strategy



### energy

### efficacy

Air-Krete insulation installed inboard of masonry walls for 3x code required R-value.

Replacement of all windows with new double-glazed, Low-E, R=3.7 type.

Lowers HVAC demand IF system is set to shut off.

High-efficiency gas-fired absorption heater/chiller cost \$102,000 more upfront but paid off in 3-5 years.

Extensive analysis of the environmental effects of electricity vs. natural gas weighed in favor of gas.

Attractive, open stair between floors discourages frequent elevator use.

### implications

Cannot expose brick on interior.

Loss of historic windows.

Requires access to windows; maintain in operable condition.

Requires more space than other HVAC systems. Loss of historic steam radiators.

Removal of oil tank.

Opportunity for architectural expression through stair, use of stair opening as light well.

Figure 25. Audubon House - Strategies to reduce energy use (I).

## Case Study: Audubon House

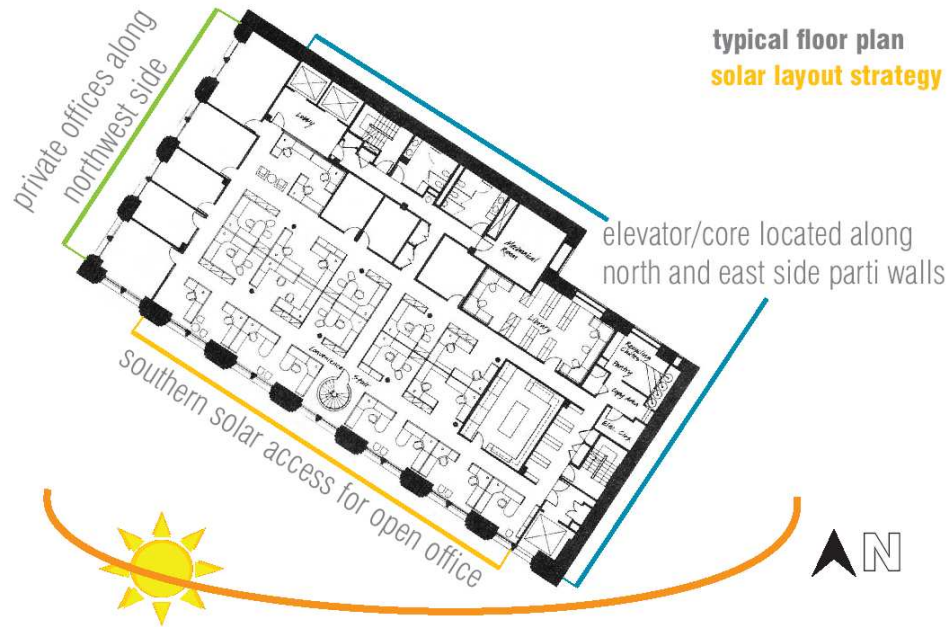


Figure 26. Audubon House - Typical floor plan.

## Case Study: Audubon House

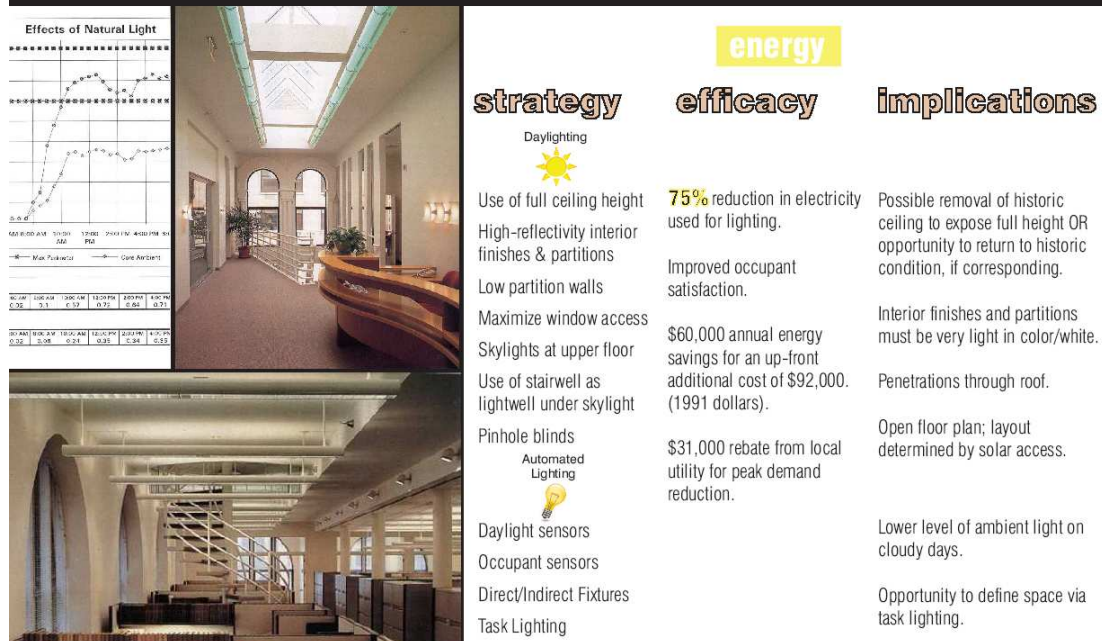


Figure 27. Audubon House - Strategies to reduce energy use related to lighting.

## Case Study: Audubon House



### strategy

Life-Cycle  
Environmental  
Impact Analysis



Certified  
Wood



Recycled  
Building  
Materials



Waste Diversion  
from Landfill



Waste  
Recycling



Garbage  
Audit



### material

### efficacy

Upstream and downstream environmental costs were weighed over up-front cost; also for consumable goods.

Sustainably-grown wood furniture certified by the Rainforest Alliance.

Recycled content gypsum wall board, plastic counter tops, and floor tiles used.

Iron, steel, tin, and wood window frames diverted.

Four separate garbage chutes cost \$185,000 additional.

Waste stream is analyzed for reduction potential.

### implications

Complicated decisions require extensive research and value judgments; substantially limits choice of finishes, furniture.

Limits choices; may eliminate ability to match historic wood.

Limits choices.

Requires space-consuming/expensive job-site sorting.

Additional space required on each floor and in basement sorting area.

Cost.

Figure 28. Audubon House - Strategies to reduce the consumption of materials and resources.

## Case Study: Audubon House



### strategy

Low VOC  
Materials



Green Cleaning  
Practices



Increased  
Ventilation



High Air  
Intake



Operable  
Windows



Daylighting



### IEQ

### efficacy

Improved occupant health and productivity.

Less accumulation of toxins from cleaning practices.

24cfm outside air/occupant 6.2 air changes/hour

Maximizes intake air quality in an urban environment. Dual filter creates 5% up-front cost increase.

Energy savings if HVAC system is set to shut off.

Improved occupant health and productivity.

### implications

Limited selection of interior finishes and furnishings. Eliminates inexpensive pressed-wood and foam furniture.

None.

More effective for open plans.

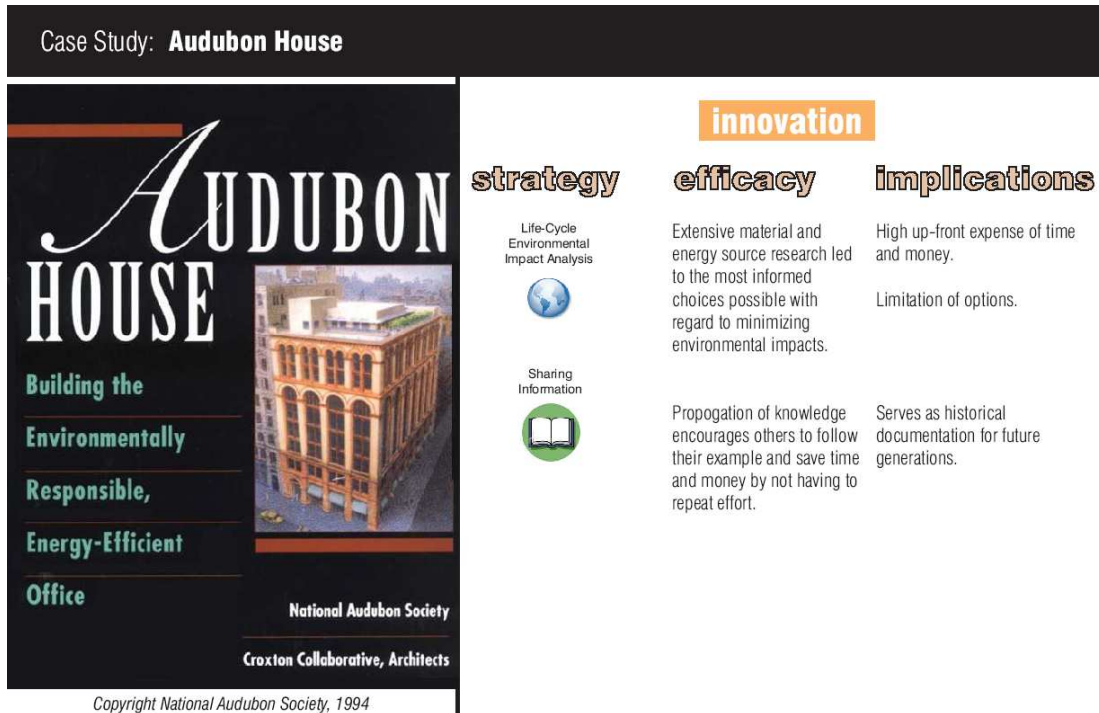
Air intake must be located as high and far away from street level as possible.

Historic windows may be expensive to restore to operable condition.

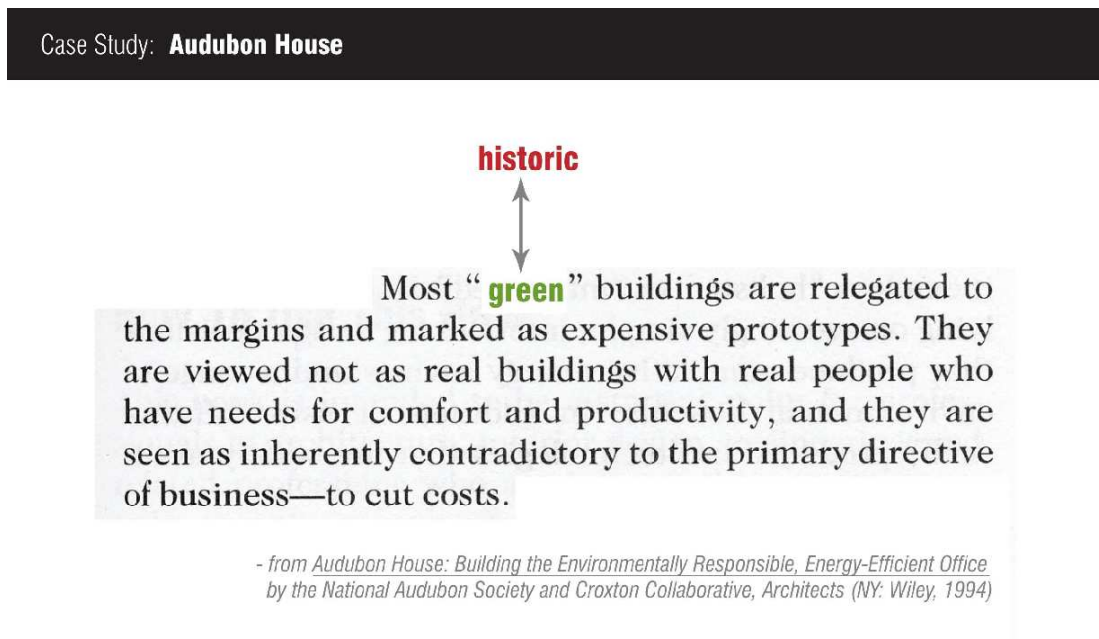
Layout dependent upon solar access.

Figure 29. Audubon House - Strategies to improve indoor environmental quality.





**Figure 30. Audubon House - Innovative design strategies.**




**Figure 31. Audubon House - Similarity between "green" buildings and "historic" buildings.**

#### 4.2 Gerding Theater at the Armory

This 1891 armory building in Portland, Oregon was renovated in 2006 as the new home of Portland Center Stage. It is named the Gerding Theater after the developer who spearheaded the project and much of the redevelopment of the surrounding area. The armory building was basically a double-height, one-hundred by two-hundred foot shell which was designed for National Guard unit training. In order to accommodate the height of the theater space without altering the distinctive rounded roof shape, the floor of the building was excavated down an additional thirty feet. The exterior of the armory is essentially unchanged, except for the addition of skylights in the roof which are not visible from the street, and the armory shell now houses the new building within. The project was rated LEED for New Construction platinum.

Case Study: **Gerding Theater at the Armory**



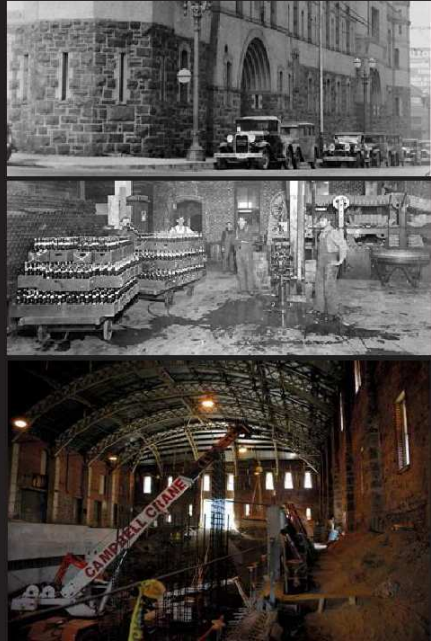
**1891 Armory listed on the National Register of Historic Places  
Certified as LEED Platinum for New Construction**

*Location:* Portland, OR  
*Owner:* Portland Historic Rehabilitation Fund (for-profit)  
*Program:* Portland Center Stage (non-profit)  
Theater and administrative offices  
*Constructed:* 1891 for the Oregon National Guard  
*Certified:* 2006 as LEED for New Construction Platinum  
*Size:* 55,000 SF on 3 stories  
*Occupancy:* 30 persons full-time, 650 visitors weekly

<b>strategy</b>	<b>efficacy</b>	<b>implications</b>
Construction of a new building within the large-span shell of the historic structure; Prioritization of sustainable design.	Estimated 30% reduction in energy use (below baseline) 79% of the original structure was reused 88% reduction in municipal potable water use	Historic exterior was preserved with minimal alteration. Shell-within-a-shell design creates intermediate spaces that contrast the historic exterior wall with contemporary interior design.

**Figure 32. Gerding Theater - Introduction.**

## Case Study: Gerding Theater at the Armory



### historic significance

**1891** Armory constructed as a facility for the Oregon National Guard. Guardsmen trained for deployment in the Spanish American War, WWI and WWII.

**military**

In peacetime, the building was used for various events such as tennis matches, hockey games, roller derby, championship wrestling, the Chicago Symphony, and public and private celebrations.

**local culture**  
**pro wrestling**  
**roller derby**

**1968** Armory purchased by local brewer Blitz-Weinhard as a storage warehouse.

**local history**  
**local economy**  
**beer brewing**

**1999** Blitz-Weinhard brewery closes after 130 years.

**2000** "Brewery Blocks" neighborhood redeveloped by Gerding Edlen Development as a sustainable mixed-use urban community.

In order to accommodate the height of the theater space without compromising the distinct curved roof shape, the ground inside the armory was excavated 30 feet below (photo left).

**2006** Gerding Theater opens.

Figure 33. Gerding Theater - Historic Significance.

## Case Study: Gerding Theater at the Armory

### 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.

The rating system addresses the environmental and human impacts of a building in six categories:

Sustainable Sites, Energy Efficiency, Energy & Atmosphere, Materials & Resources, Indoor Environmental Quality, and Innovation & Design Process.

**Energy**

The theater's energy system is a key element of its sustainable design. The system includes a combination of solar panels, wind turbines, and a geothermal system to provide clean energy for the building.

Advanced lighting systems, including LED lighting, are used throughout the building to reduce energy consumption.

Smart lighting controls are used to optimize energy use, ensuring that lights are only on when needed.

Smart lighting controls are used to optimize energy use, ensuring that lights are only on when needed.

Smart lighting controls are used to optimize energy use, ensuring that lights are only on when needed.

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### Indoor Environment

The theater's indoor environment is a key element of its sustainable design. The system includes a combination of solar panels, wind turbines, and a geothermal system to provide clean energy for the building.

Advanced lighting systems, including LED lighting, are used throughout the building to reduce energy consumption.

Smart lighting controls are used to optimize energy use, ensuring that lights are only on when needed.

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### Materials & Resources

The theater's materials and resources are a key element of its sustainable design. The system includes a combination of solar panels, wind turbines, and a geothermal system to provide clean energy for the building.

Advanced lighting systems, including LED lighting, are used throughout the building to reduce energy consumption.

Smart lighting controls are used to optimize energy use, ensuring that lights are only on when needed.

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### Site Strategies

The theater's site strategies are a key element of its sustainable design. The system includes a combination of solar panels, wind turbines, and a geothermal system to provide clean energy for the building.

Advanced lighting systems, including LED lighting, are used throughout the building to reduce energy consumption.

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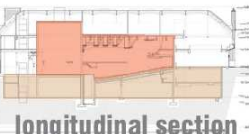
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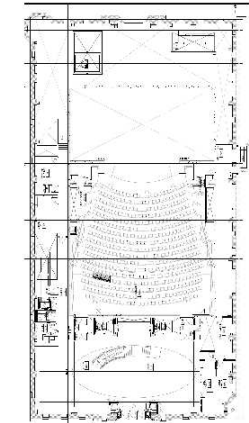
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### longitudinal section



### ground floor plan

Drawings this page courtesy of David Posada, GBD Architects

Figure 34. Gerding Theater - Summary of design strategies.



## Case Study: Gerding Theater at the Armory



### strategy



### site

### efficacy

Streetcar and bus access, designated carpool drop-off space, and bicycle racks and shower rooms encourage employees and visitors to use alternate forms of transportation.

No parking spaces are dedicated to the building, discouraging car use.

The minimal open space on site is developed as a "sliver park" with seating areas, a pervious ground surface, and bioswales.

Light-colored roofing reflects solar radiation to reduce cooling costs and urban heat island effects

### implications

Need space for 30 bicycles and a shower room for employees.

Historic fabric does not need to be altered to support on-site parking requirements.

Public space is formed along a street facade with an essentially blank wall at street-level.

Requires replacement of historic roofing material. Roof line is unaffected; otherwise, the roof is not visible from the street.

Figure 35. Gerding Theater - Site Strategies.

## Case Study: Gerding Theater at the Armory



### strategy



### water

### efficacy

10,000 gallon cistern collects rainwater to use for toilet flushes. No cost savings at present water rates but possibly at future rates.

Indoor Potable Water Use: 1.93 gallons/SF/year

Outdoor Potable Water Use: None

Reduced stormwater entering municipal system by 26%.

Overall potable water use reduced by 88%.

### implications

Space for 10,000 gallon cistern located under the sidewalk. All new modern fixtures required.

Design requirements of greywater system TBD.

Rainwater capture takes advantage of vaulted roof profile. Existing roof drains are re-routed to feed cistern and overflow to bioswales.

Enhanced connection to place.

Site space required; opportunity to integrate into landscaping plan. Overflow pipes may require new penetrations through the historic exterior wall.

Figure 36. Gerding Theater - Strategies to reduce potable water consumption.

## Case Study: Gerding Theater at the Armory



### strategy

Thermal Mass



Radiant Cooling



Displacement Ventilation



CO<sub>2</sub> Sensors



Daylighting



Automated Lighting



Green Power



### energy

### efficacy

Thick masonry exterior walls reduce thermal swings in mild climates

Combination chilled panel/light fixtures and under-floor ventilation systems reduce energy use for mechanical systems by **40%**. Good for cooling and ventilating, not as effective for heating.

Good for spaces with variable occupancy.

Skylights provide daylight to **75%** of regularly-occupied spaces. (25% of bldg)

Sensors control lights where occupancy varies.

**100%** of power purchased from renewable sources.

**30%** below baseline overall.

### implications

Masonry can be exposed on the interior without being covered by additional insulation.

Design opportunity for hung ceiling elements that are distinct from historic fabric.

Require low supply and high return vents (possibly from skylights or clerestory).

None (mechanical equip. only).

Regularly-occupied spaces must be located on upper floor near skylights. No new penetrations in exterior wall/facade.

None.

Poor solar access prevented cost-effective PV installation.

Figure 37. Gerding Theater - Strategies to reduce energy consumption.

## Case Study: Gerding Theater at the Armory



### strategy

Waste Diversion from Landfill



Recycled Building Materials



Certified Wood



Local Materials



Minimal Finishes



### material

### efficacy

**95%** of construction waste diverted from landfill.

**79%** of the existing structure is reused.  
**25%** of new materials have recycled content.

**58%** of wood used is FSC Certified.

**45%** of materials come from within a 500mi radius.

Less material used.

### implications

None.

Historic material is largely maintained. Flexibility of large-span armory space minimized necessity of alteration.

Limited selection of species. Potentially difficult to match existing if desired.

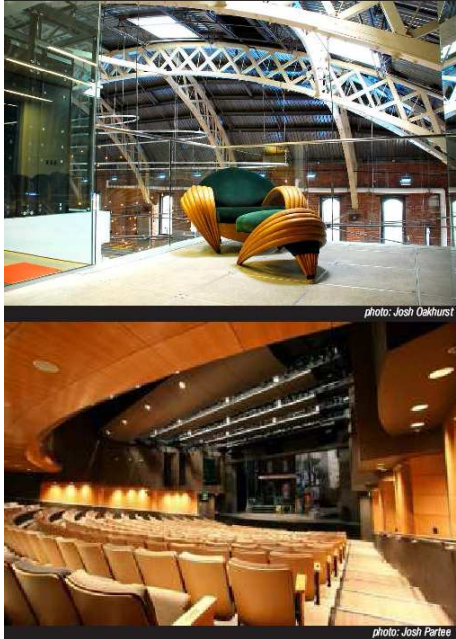
Local materials are closer in nature to certain historic materials.





Opportunity to express the nature of the historic materials and reveal structural elements.

Figure 38. Gerding Theater - Strategies to reduce the consumption of materials and resources.



## Case Study: Gerding Theater at the Armory




IEQ		innovation
strategy	efficacy	implications
<p>Low VOC Finishes</p> 		Limited selection of interior finishes, especially floor coverings (carpet).
<p>Green Cleaning Practices</p> 		None.
<p>Displacement Ventilation</p> 	Minimizes fan noise; good for quiet/performance spaces.	Each space must accommodate low supply and high venting (skylights, clerestory). Sufficient floor height required.
<p>CO<sub>2</sub> Sensors</p> 	Responds to varying levels of occupancy; good for an assembly building.	None.

**Figure 39. Gerding Theater - Strategies to improve indoor environmental quality and innovative design strategies.**

### 4.3 The Christman Building

This 1928 office building in Lansing, Michigan was renovated in 2008 as an early LEED Core & Shell project. The building owner is the construction company Christman, which performed the rehabilitation and which occupies the building along with a law firm. The building was rated LEED Core & Shell platinum and the offices of Christman were rated LEED platinum for Commercial Interiors. It is the first project to obtain that dual rating. The building is on the National Register of Historic Places, and since the project utilized federal Historic Rehabilitation Tax Credits, it was required to adhere to the Secretary of the Interior's Standards with respect to character-defining elements. The distinctive facade, entry hall, main stair, and first floor were restored according to the Standards. The interiors of the floors above, where minimal historic fabric remained, are designed in a more contemporary style.

Case Study: **The Christman Building**



**1928 Office Building listed on the National Register of Historic Places  
Certified as LEED Platinum for Core&Shell and Commercial Interiors**

*Location:* Lansing, Michigan  
*Owner:* Christman construction company  
*Program:* Offices for two tenants: Christman Headquarters and a Law Firm  
*Constructed:* 1928  
*Certified:* 2008 as LEED-CS Platinum and LEED-CI Platinum for the Christman offices  
*Size:* 60,000 SF on 6 stories  
*Cost:* \$12,000,000  
*Architects:* SmithGroup

<b>strategy</b>	<b>efficacy</b>	<b>implications</b>
Restoration of historic character-defining elements to the Secretary of the Interior's Standards with more extensive alterations in other areas.	Estimated 34% improvement in energy performance over ASHRAE standard. 92% of the original structure was reused.	Collaboration with the National Park Service and the SHPO led to receipt of historic preservation tax credits. Street facade is substantially unaltered from historic condition.

**Figure 40. Christman Building - Introduction.**

## Case Study: The Christman Building



### historic significance

**1928** Building constructed as the headquarters of the Michigan Millers Mutual Insurance Company.

The Mutual Building displayed numerous examples of fine craftsmanship and Art Deco design:

- A well-proportioned red brick and limestone facade.
- An elaborate main entry door with Art Deco details
- An elaborate main entry hall and stair case featuring period tiling and iron work.
- Interior wood paneling and trim

local  
economic  
history

building craft

Art Deco  
architecture

The Mutual Building was placed on the National Register of Historic Places.

The Christman company, a construction firm founded in 1894, began renovation of the building. LEED certification was established as a design goal. Consultation with the National Park Service and the State Historic Preservation Office was required in order to obtain federal tax credits.

**2008** Building reopens as The Christman Building.

Figure 41. Christman Building - Historic Significance.

## Case Study: The Christman Building



### site

#### strategy

Public  
Transport



Bicycle  
Racks



No New  
Parking



Light  
Control



High-Emissivity  
Roofing



#### efficacy

Urban site across the street from the State Capitol has access to local bus lines.

Bicycle racks and shower rooms encourage employees to ride or walk.

No new parking provided; preferred parking for fuel-efficient vehicles.

Exterior light fixtures were designed for minimal light pollution but did not meet LEED standard.

Reduces heat island effect and lowers internal cooling costs.

#### implications

Contributes to downtown revitalization.

Space required for bicycles and showers. Need to protect historic entrance from bicycle traffic.

No additional site space required.

Reduced exterior lighting is more similar to historic experience.

Replacement of historic roofing materials.

Figure 42. Christman Building - Site Strategies.



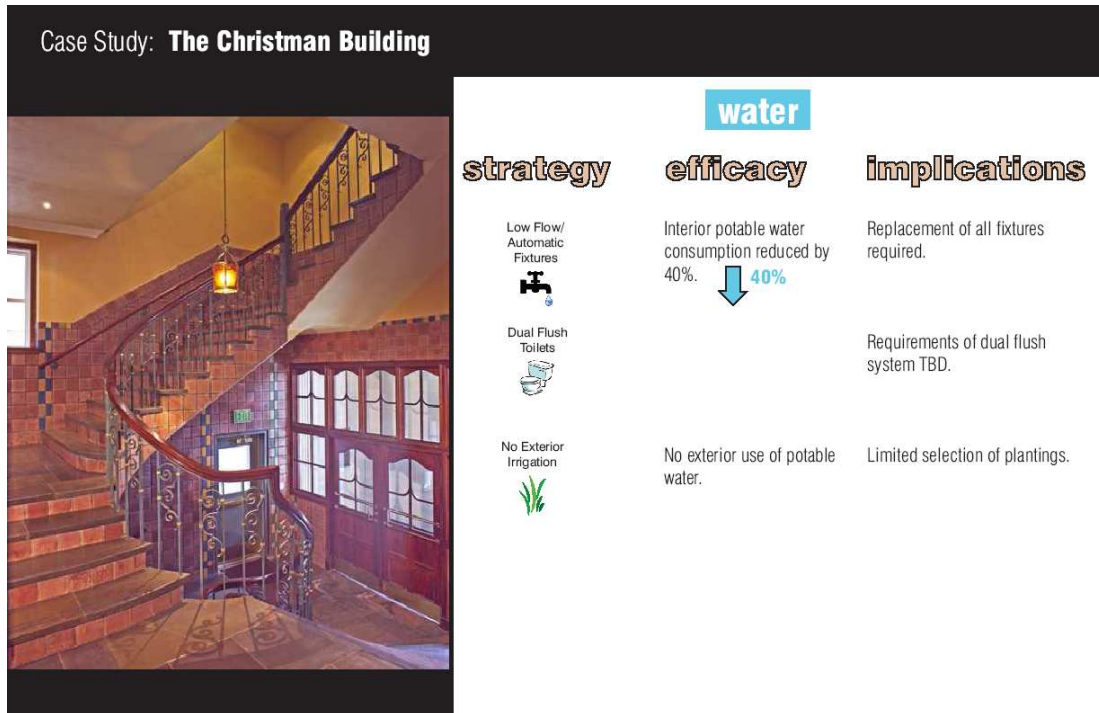
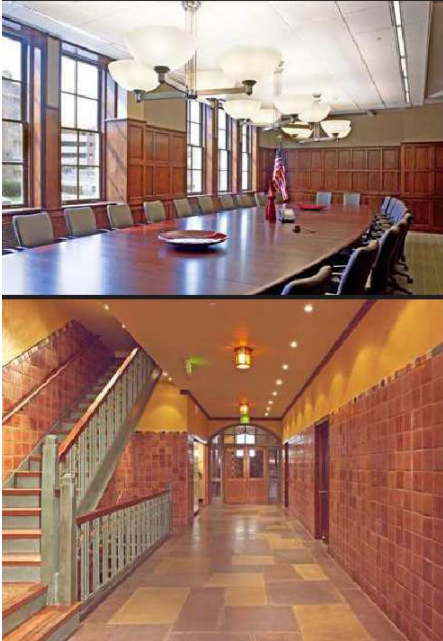


Figure 43. Christman Building - Strategies to reduce the consumption of potable water.



Figure 44. Christman Building - Strategies to reduce energy consumption.

## Case Study: The Christman Building



### material

#### strategy

Waste Diversion from Landfill



Recycled Building Materials



Certified Wood



Local Materials



Waste Recycling



#### efficacy

**77%** of construction waste diverted from landfill.

**92%** of the existing structure was reused. **20%** of new core & shell materials and **25%** of new comm. interior materials have recycled content.

**100%** of wood used is FSC Certified.

**37%** of commercial interior materials come from within a 500mi radius.

#### Implications

Structure and character-defining features are largely maintained. Historical integrity maintained by using bricks salvaged from one part of the building in another.

Limited selection of species. Potentially difficult to match existing if desired.

Local materials are closer in nature to certain historic materials.

Space requirements for sorting and storage.

Figure 45. Christman Building - Strategies to reduce the consumption of materials and resources.

## Case Study: The Christman Building



### IEQ

#### strategy

Green Cleaning Practices



Low VOC Finishes



Entryway Filtration



CO<sub>2</sub> Sensors



Occupant Controls



Views



#### efficacy

Commitment to long-term sustainable practice.

Improved indoor air quality.

Reduced particulates in indoor air.

Responds to varying levels of occupancy.

Allows occupants to control lighting and temperature, improving comfort and productivity.

Increased occupant satisfaction.

#### Implications

None.

Limited selection of finishes.

Filtration mat installed over historic floor finish in entry hall.

None.

Requires additional switches and electrical wiring.

Greater connection to site; times of day.

Figure 46. Christman Building - Strategies to improve indoor environmental quality.

Case Study: **The Christman Building**



**innovation**

**strategy**

Flexible Design



Informative Signage



Open for Tours



**efficacy**

Design for multiple uses and future changes minimizes the expense of future alterations in terms of money and materials.

Shares knowledge gained about sustainable building practice with the public.

**implications**

Open plan office, shared workstations, and temporary partitions.  
Fewer permanent installations may minimize damage to historic finishes.

Can also explain historic significance.

**Figure 47. Christman Building - Innovation in design.**



#### 4.4 California EPA Building

The headquarters of the California Environmental Protection Agency was constructed in 2000 with superior environmental performance as a design goal. Its original design predates the release of the LEED rating system. Following adjustments made to building systems in 2004, after an audit revealed some inefficiencies, the building became the first to be certified Platinum under the newly released LEED for Existing Buildings Rating System.<sup>16</sup>

Although the existing building material would not be considered historic, Cal EPA is included as an example of a LEED-EB Certified building and as an example of recent sustainable design.

Case Study: **California EPA Building**



**1st Building Certified Platinum under the LEED-EB Standards**

*Location:* Sacramento, CA  
*Owner:* City of Sacramento  
*Program:* Offices of the California State Environmental Protection Agency  
*Constructed:* 2000  
*Certified:* 2004 as LEED for Existing Buildings Platinum  
*Size:* 950,000 SF on 25 stories  
*Occupancy:* 3,000 persons  
*Efficiency:* 316 SF/occupant

strategy	efficacy	implications
Audit existing building systems and operations and make changes to improve environmental performance.	\$500,000 spent on efficiency upgrades yielded \$610,000 in annual savings. 200 tons of garbage per year diverted from landfills.	Changes to the existing building fabric are minimal since the building was originally constructed only four years earlier and intended for high level environmental performance.




**Figure 48. Cal EPA - Introduction.**

<sup>16</sup> Email to author from Cal EPA building staff member Walter Drane.

Case Study: **California EPA Building**






**Figure 49. Cal EPA - Site strategies.**

site		
strategy	efficacy	implications
 Native Planting	Cost savings for landscaping and grounds management	Enhanced connection to the region, sense of place
 Bicycle Racks	Bicycle storage room encourages employees to use alternate forms of transportation.	Bicycle entrance required. No other changes to exterior appearance.
 Public Transport	Urban site places building near public transportation.	None.

Case Study: **California EPA Building**



**Figure 50. Cal EPA – Strategies used to reduce potable water usage.**

water		
strategy	efficacy	implications
 Native Planting	Exterior potable water use reduced by 50% ↓ 50%	Enhanced connection to the region, sense of place
 Low Flow Toilets	Interior potable water use reduced by 20% ↓ 20%	Change in non-contributing plumbing fixtures.
 Waterless Urinals		Design requirements of waterless urinals TBD.
\$19,000 in annual savings		

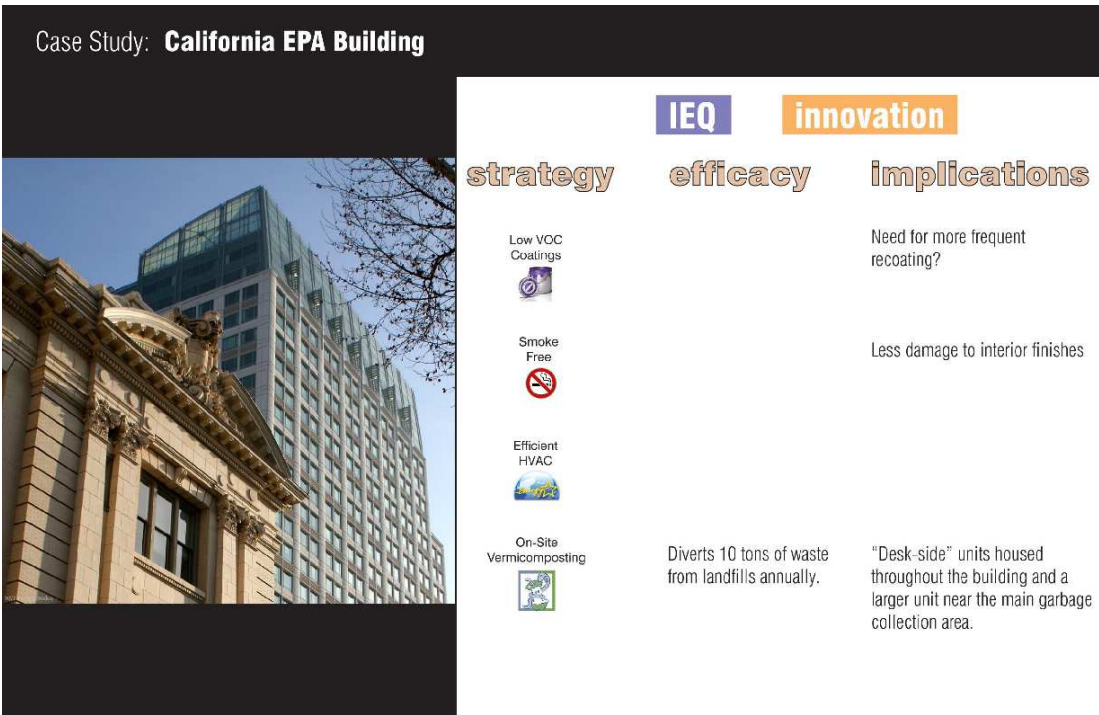




**Figure 51. Cal EPA – Strategies used to improve energy efficiency.**



**Figure 52. Cal EPA – Strategies used to reduce the consumption of materials and resources.**



**Figure 53. Cal EPA – Strategies used to improve indoor environmental quality and examples of innovative operations.**

## Chapter 5: Case Study Implementation: Existing Building Analysis

**West Facade**



**North Facade**



**East Facade**



**South Facade**



south facade detail



west facade detail

**Figure 54. Exterior views of 8021 Georgia Avenue.**

Both historic preservation and sustainable design practice require a thorough analysis of the specific site to inform an intervention. Below, the chosen case study site is analyzed in terms of its history and its existing conditions and context.

### 5.1 History

#### **Summary Description**

The site selected for use as a case study is located at 8021 Georgia Avenue in Silver Spring, Maryland. The property contains two buildings which were originally constructed in 1927, expanded in 1944, and modified several times since.<sup>17</sup> The buildings are currently vacant but are owned by Gables Residential, a developer which had intended to partially preserve the existing buildings while adding a residential tower to the site. Due to the collapse of the residential housing market and credit crisis in the fall of 2008, plans for development of the site were put on hold indefinitely.<sup>18</sup>

The buildings are unique for their green and yellow terra cotta mission style roof tiles. The exterior of both buildings is a tan range of brick with simple decorative brickwork details, carved limestone at the Georgia Avenue entrance, limestone window sills, and large metal window frames. The south building is two stories tall above grade and the north building is two stories tall including a partially submerged basement story. Each building is approximately 10,000 square feet. The entire site

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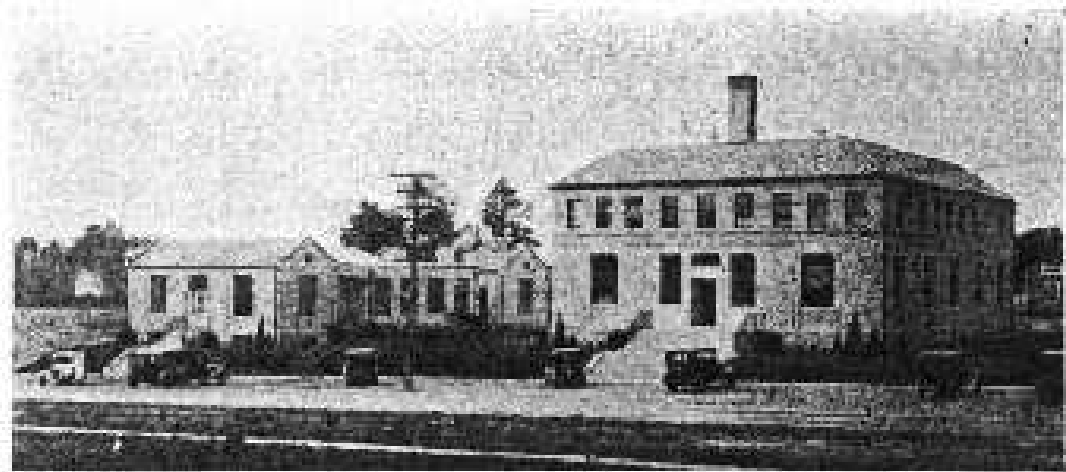
<sup>17</sup> Original dated design drawings are located at the Arthur Heaton archive at the Library of Congress.

<sup>18</sup> Phone interview with Jorgen Punda of Gables Residential.



measures approximately 50,000 square feet, just less than half of which is paved open space to the east of (“behind”) the buildings.

### Narrative History



October 1927. Left, Institute Cleaning Plant. Right, school lecture room and laboratory; offices of National Association of Dyers and Cleaners.

**Figure 55. 1927 Photograph of the campus showing Building B (left) and Building A (right), from Remembering the Years.<sup>19</sup>**

The buildings located at 8021 Georgia Avenue were originally designed by Arthur B. Heaton as the headquarters of the National Association of Dyers and Cleaners (“NADC”). Heaton was an architect of some local renown at the time. Heaton was born in 1875 and opened his own architectural practice in Washington in 1900. From approximately 1908 to 1922, he served as the supervising architect for the construction of the National Cathedral. Heaton went on to design the headquarters of the National Geographic Society on 16<sup>th</sup> Street NW in 1930 and the Cleveland Park “Park N’ Shop,” an early prototype of a suburban shopping center. Heaton also

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<sup>19</sup> Remembering the Years: 1907-1957 is a history of the National Institute of Drycleaning, published by the Institute, written by its longtime registrar Edna M. Michelsen in 1957.

designed numerous houses in the Washington metropolitan area. There is an archive dedicated entirely to his work at the Library of Congress.<sup>20 21</sup>

Heaton was an active member of the community and was dedicated to the cause of historic preservation. During the Great Depression, he started a campaign called “Renovise Washington” to encourage the renovation of old buildings in the area. The intention was both to create work for building craftsman and to retrofit Washington’s older buildings for the needs of the time. He later founded the Washington Building Congress, a trade organization dedicated to advocating for skilled building craftsmen. Heaton served as a fellow and president of the Washington chapter of the American Institute of Architects, was a member of the Washington Architectural Club, and served on the Board of Examiners and Registrars of Architects.

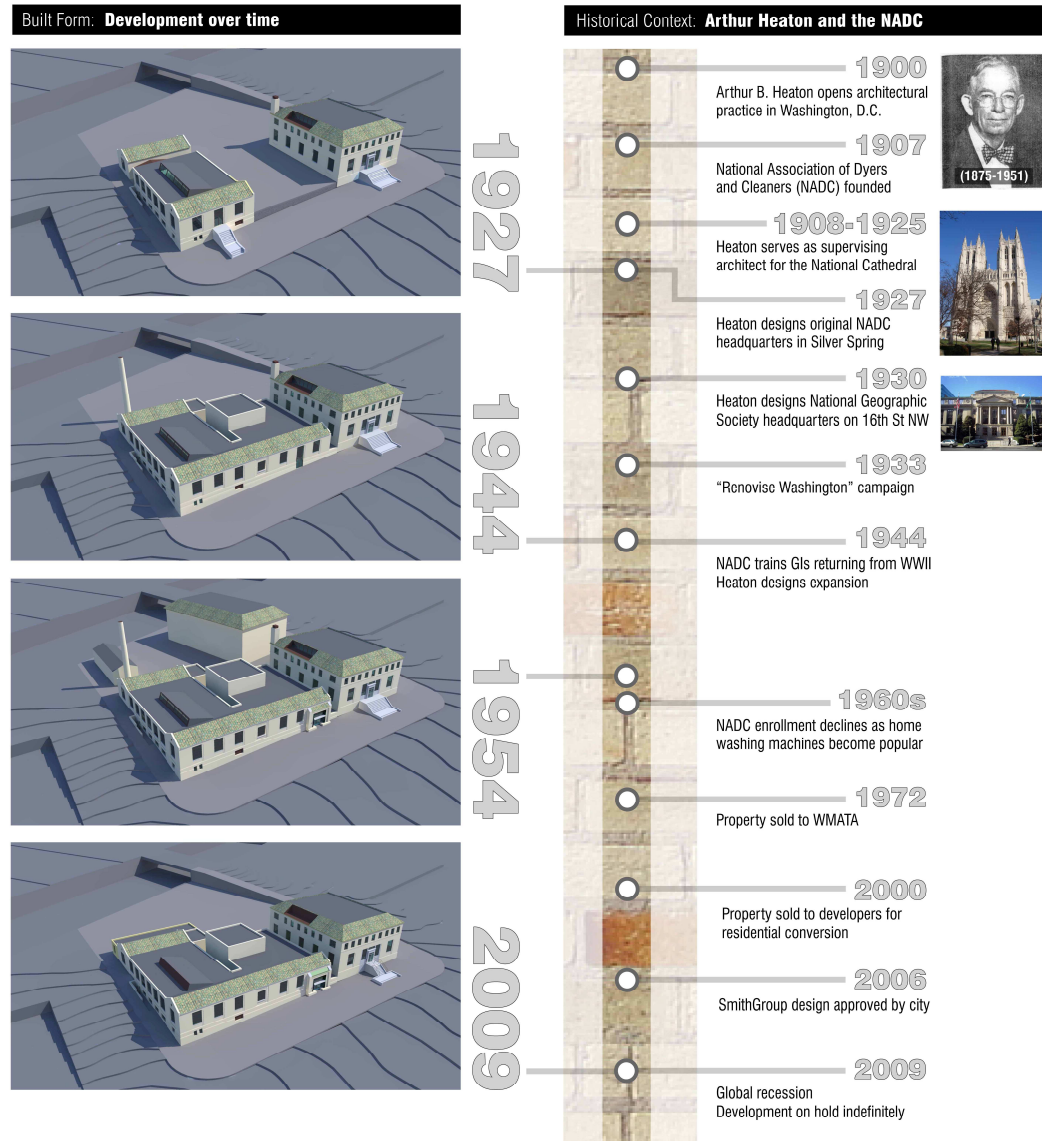
The NADC was founded in 1907 as a trade organization for dry cleaners and garment care professionals. The association hired Heaton in 1926 to design its new headquarters in Silver Spring. Heaton’s original design consisted of what he refers to as “Building A” at the southwest corner of the site and “Building B” at the northwest corner of the site. Building A contained classrooms, laboratory spaces, and administrative offices. Building B contained a model cleaning facility which was used for instructional purposes and to highlight the latest garment care technologies. In order to separate wet spaces from dry spaces, the dry cleaning space is detached from the rest of Building B. The two sections of Building B were originally

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<sup>20</sup> The archive is located in the Prints and Photographs Division and contains 9,220 items. It can be searched online at < <http://lcweb2.loc.gov/pp/pphome.html>>, search term: “Arthur Heaton.”

<sup>21</sup> The “Narrative History” section draws heavily on the Maryland Inventory of Historic Properties Form for the property prepared by David C. Berg and various other materials from the files of the Silver Spring Historical Society which are referenced in the bibliography.

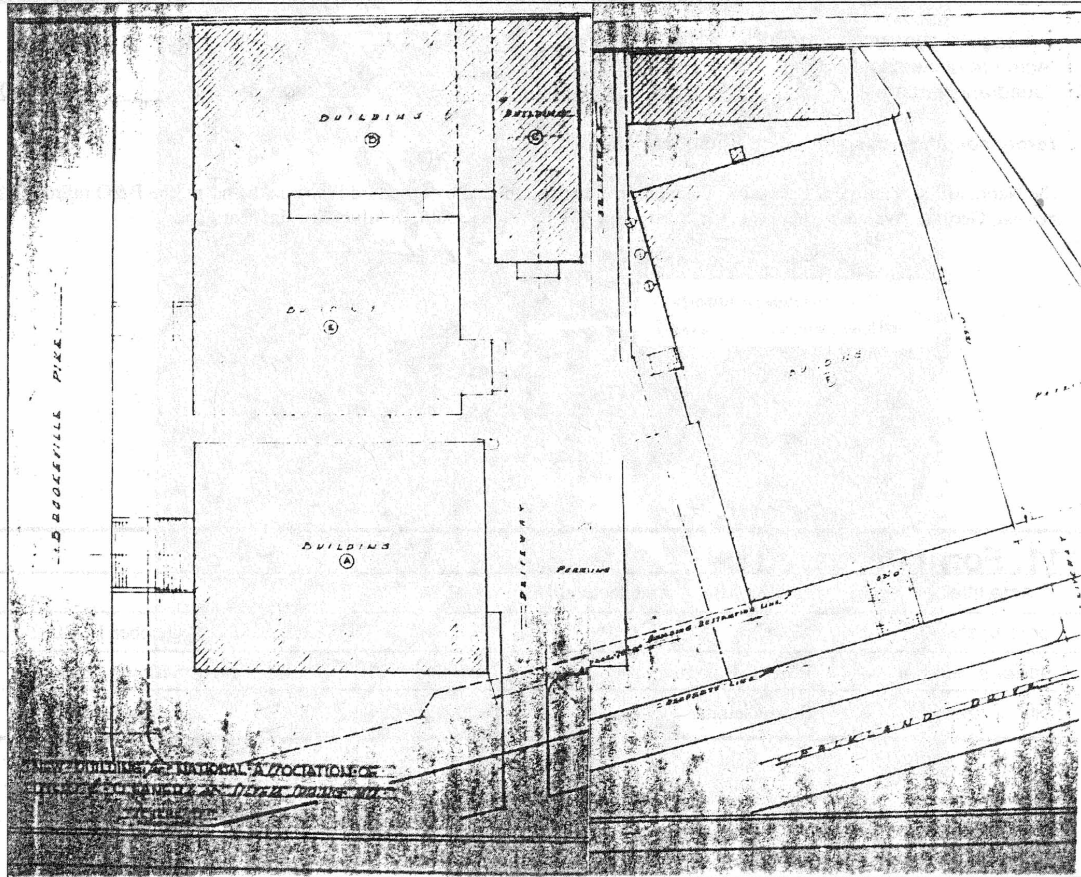
connected by a tin gable roof. The edge of the basement corresponds to the edge of the original wet building.



**Figure 56. Timeline of the development of the site.**

The NADC participated in the GI Bill after World War II, and in 1944, called Heaton to design an expansion to the campus. Heaton connected the wet and dry spaces in Building B and designed a large addition to the south, which he refers to as Building E. From Georgia Avenue, Buildings B and E appear to be one long building. There

is a seven foot gap between these and Building A. Several other buildings were constructed on the rear of the site which have since been demolished.



Source: Arthur B. Heaton Archive, Library of Congress Prints and Photographs Division

**Figure 57. Heaton's site plan for the 1944 expansion, from the Arthur B. Heaton Archive.**

The entrance to Building E was reconfigured sometime between 1944 and 1954, probably by someone other than Heaton, who died in 1951. The entrance was shifted to the end window bay and redesigned to reflect a mid-century Modern aesthetic, including a projecting plane canopy and the use of green marble trim. Most of this marble is damaged or missing at present.





**Figure 58. 1954 Photograph of the campus showing Building E (*center left*), the smokestack, and Building F (*right*), now demolished, from the Arthur B. Heaton Archive.**

The National Association of Dyers and Cleaners became Institute of Cleaning and Dyeing and later the National Institute of Drycleaning. In 1972, the organization merged with the American Institute of Launderers to form the International Fabricare Institute and moved to a new headquarters elsewhere in Maryland. The property at 8021 Georgia Avenue was sold to the Washington Area Metropolitan Transit Authority (WMATA) which was planning to extend Metrorail's Red Line to Silver Spring along the train tracks which ran behind the site. WMATA used the buildings for a repair shop, storage, and offices. The property has been largely abandoned since the mid-1980s.<sup>22</sup>

In 2000, the residential real estate market in Silver Spring was thriving, spurred by the mixed-use development of "Downtown Silver Spring" along Georgia Avenue half a mile to the north of the site. WMATA sold 8021 Georgia Avenue to a developer, Union Realty Partners, which hired SmithGroup to design a residential tower on the site. Local advocates of historic preservation campaigned to place the buildings on

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<sup>22</sup> Phone interview with Jerry McCoy, longtime Silver Spring resident and president of the Silver Spring Historical Society.

the Montgomery County Locational Atlas of Historic Sites in order to trigger a review by the county Historic Preservation Board prior to demolition. In 2006, the Montgomery County Planning Board approved plans to develop the site while retaining the shell of Building A and a small amount of the 1927 portion of Building B.<sup>23</sup> By 2008, construction had not yet begun and Union Realty Partners sold the property and the SmithGroup design to Gables Residential. As of December 2009, development plans for the property are on hold indefinitely due to the global financial recession.<sup>24</sup>

### **Historic Significance**

The buildings located at 8021 Georgia Avenue, henceforth referred to as the “Dyers and Cleaners Building,” meet the National Register of Historic Places criteria A and C for historic significance. Criteria A relates to events of local, state, or national importance. The Dyers and Cleaners buildings are closely related to the history of the dry cleaning trade in the United States since they were one of few facilities nationwide dedicated to such training. Significance is also derived from the facility’s participation in the GI Bill following World War II.

Criteria C relates to architectural significance.<sup>25</sup> The Dyers and Cleaners Building is one of very few historic resources in Silver Spring and so can be considered a rarity. The Silver Spring Historical Society was founded in 1998 partially in response to the

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<sup>23</sup> Montgomery County Department of Park and Planning memorandum dated 14 July 2006 re: Site Plan Review, Case No. 820060380.

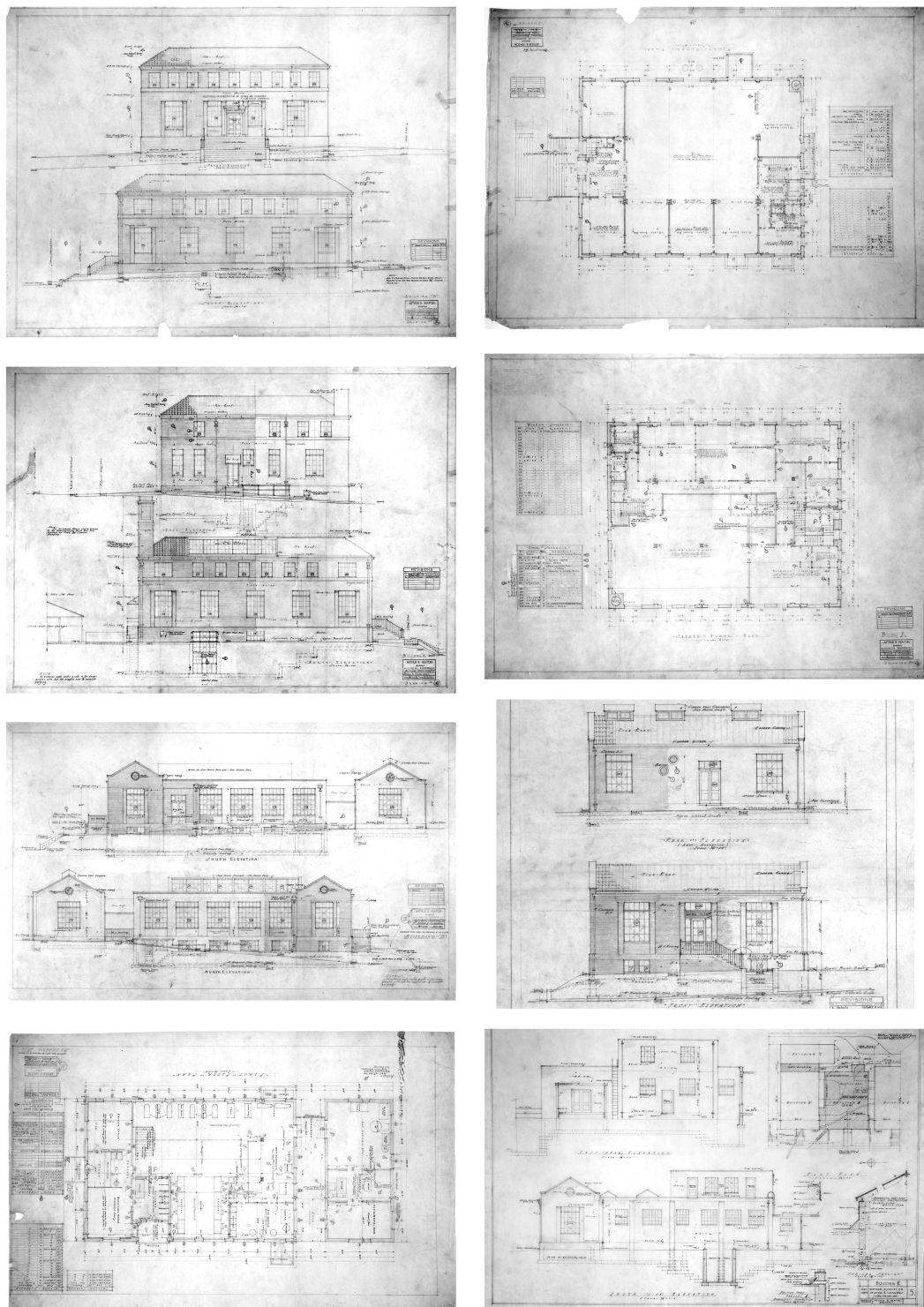
<sup>24</sup> Phone interview with Jorgen Punda.

<sup>25</sup> National Register Bulletin: How to Apply the National Register Criteria for Evaluation.

demolition of the Maryland National Guard Armory, also built in 1927.<sup>26</sup> The design of the Dyers and Cleaners Buildings themselves provide an informative display of the transition between nineteenth century Beaux-Arts Classicism and twentieth century Modernism. The proportioning of elements, particularly the window arrangement, is Classical, yet the transition toward Modernism can be seen in the minimalist detailing surrounding the windows. The local prominence of architect Arthur Heaton is described above and is further evidenced by the presence of an archive of his work at the Library of Congress. Heaton's efforts to promote building craftsmanship and the renovation of old structures make the selection of one of his built works as a case study for historically-sensitive sustainable retrofitting particularly appropriate.

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<sup>26</sup> Silver Spring Historical Society website <<http://silverspringhistory.homestead.com/>>

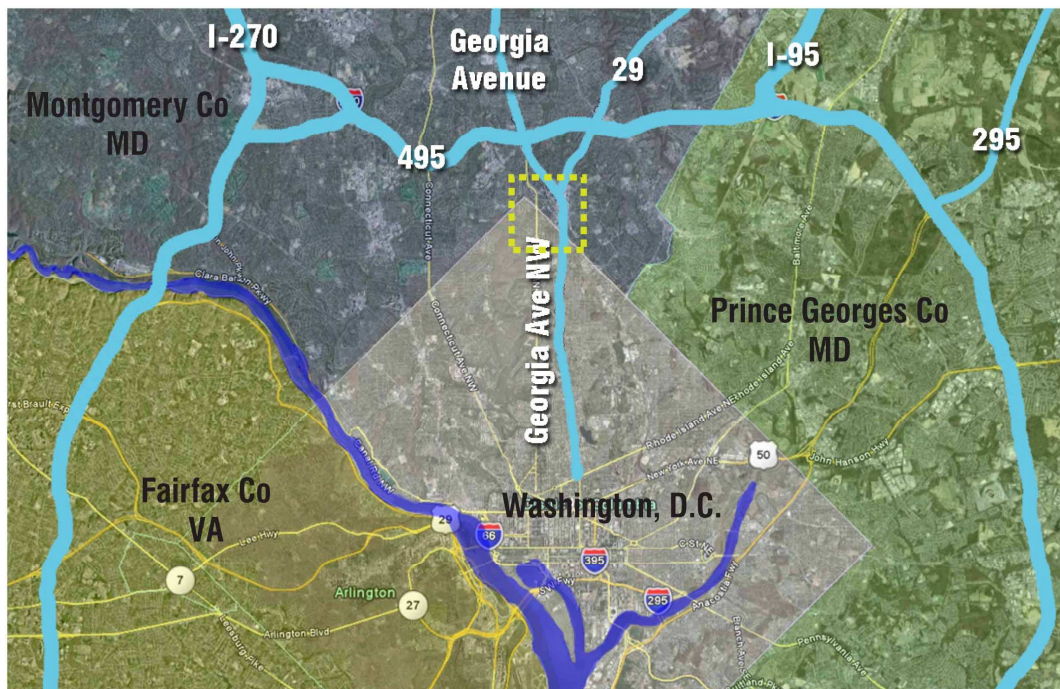


**Figure 59. Heaton's original drawings from the Arthur B. Heaton Archive at the Library of Congress.**

## 5.2 Site

### **Urban Context**

The case study site is located half a mile south of the center of the recently redeveloped “Downtown” Silver Spring. The new downtown occurs along the same stretch of Georgia Avenue that was a popular retail district in the 1960s when it became one of the first retail centers to feature expansive vehicle parking. The area began to decline as larger shopping centers opened farther into the D.C. suburbs, such as up the road in Wheaton.<sup>27</sup>



**Figure 60. Map of the Washington, D.C. region highlighting Downtown Silver Spring.**

In the 1990s and early 2000s, capitalizing on the proximity to the Silver Spring Metro station, a new town center was built at the corner of Georgia Avenue and Colesville

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<sup>27</sup> Silver Spring Historical Society website.



Road. The new town center includes a pedestrian street lined with shops and restaurants, big-box retail, a multiplex movie theater and an independent cinema. At the end of the street, a new civic center is planned including a town hall and a library. The new town center development is used heavily by local residents and appears to be very successful.

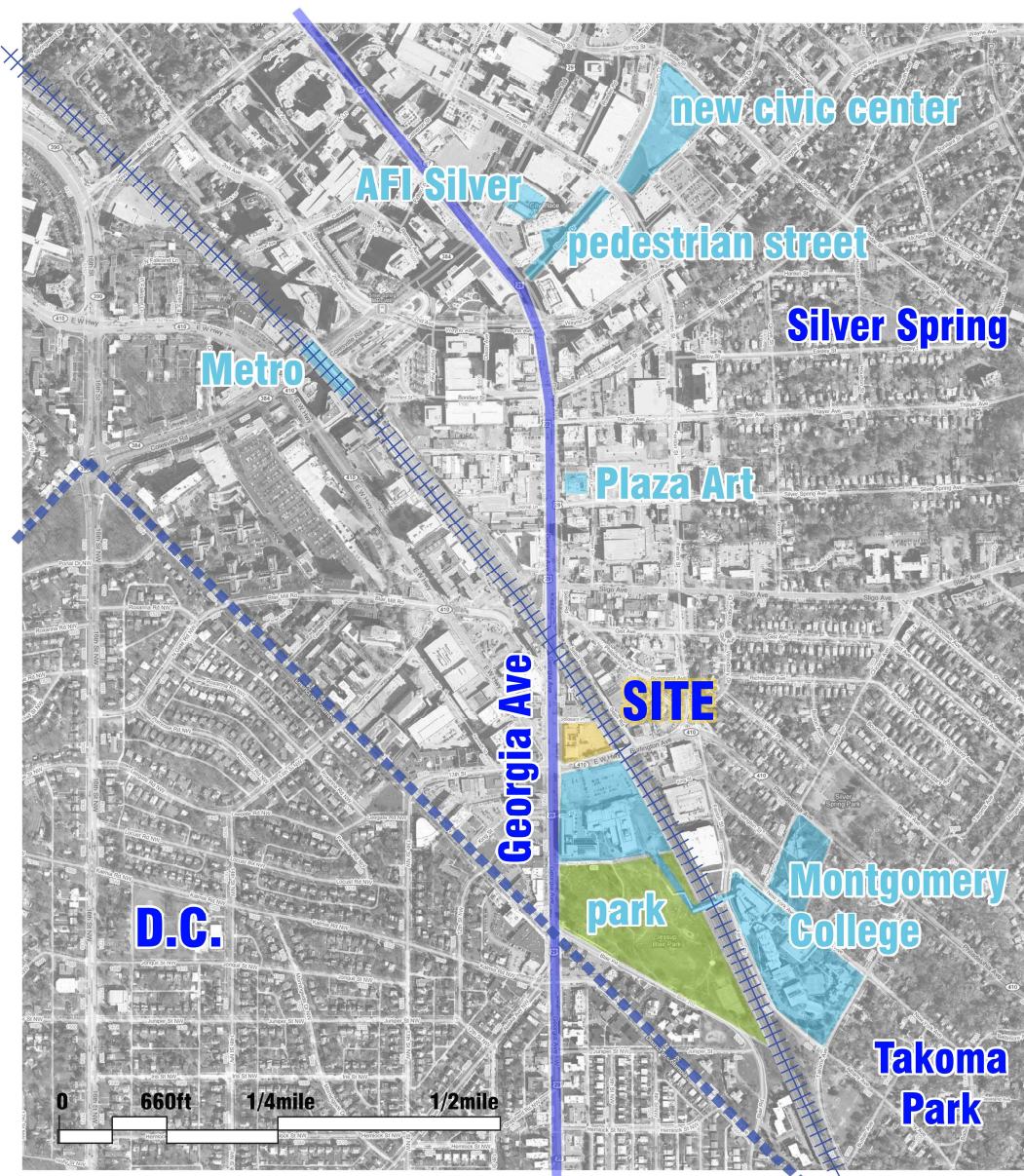
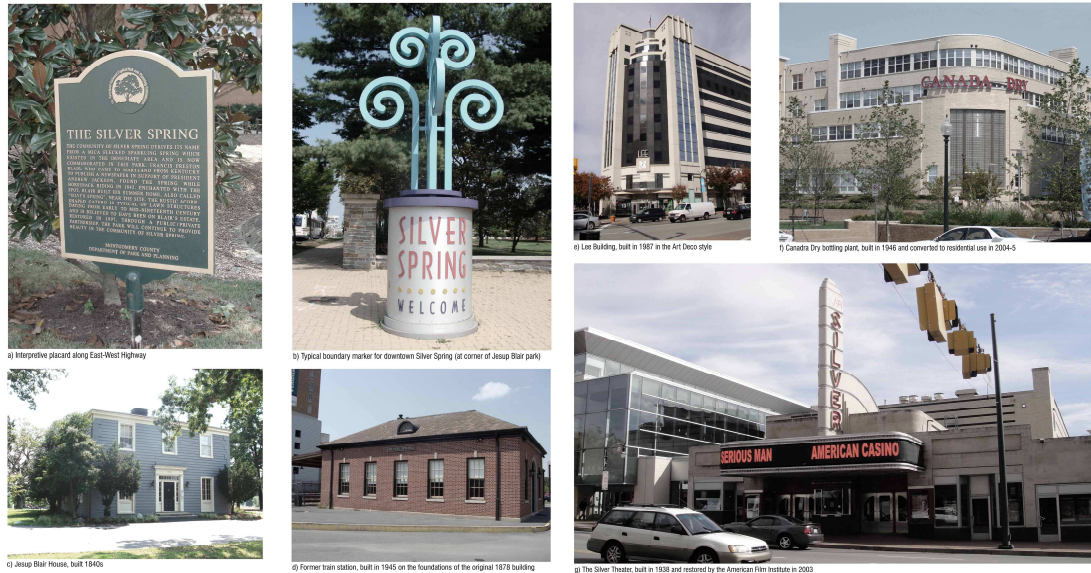


Figure 61. Map of Downtown Silver Spring highlighting case study site.



**Figure 62. Images of Downtown Silver Spring, including historic resources.**

The case study site is located on the opposite side of the Metro tracks from the new downtown redevelopment. Georgia Avenue descends under the tracks just to the north of the site. Brightly colored mosaics attempt to liven up the pedestrian passageway under the bridge, but it remains somewhat too long and dark to be comfortable.



**Figure 63. View looking north on Georgia Avenue showing Metro tracks crossing over the street.**

To the north and east of the site, there are many one and two-story commercial buildings, including many auto repair shops. To the south of the site is the Silver Spring/Tacoma Park campus of Montgomery College, which is a public county community college. Its new performing arts complex and health sciences buildings are located along Georgia Avenue, and a math and science campus is accessed via a pedestrian bridge over the Metro tracks. To the northwest of the site along East West Highway are multiple high-rise residential buildings, several of which opened in 2009. The offices of the National Oceanographic and Atmospheric Association (NOAA), a large employer of federal workers, is located approximately one-quarter mile up East West Highway. To the east and west of the site are low- to medium-density residential neighborhoods in Tacoma Park and the District of Columbia, respectively.

### **Immediate Context**

The Dyers and Cleaners building sits at the northwest corner of the intersection of Georgia Avenue and Route 410 (called East West Highway, Philadelphia Avenue, and Burlington Avenue all within the course of three blocks). The intersection is characterized by heavy vehicular traffic along Georgia Avenue and moderate vehicular traffic along 410. Cars tend to wait at the traffic light for a minute and then quickly speed down the road. Light pedestrian traffic occurs along Georgia Avenue.





Figure 64. Land uses in the surrounding area.



**Figure 65. Map of the existing site and ground level plan.**

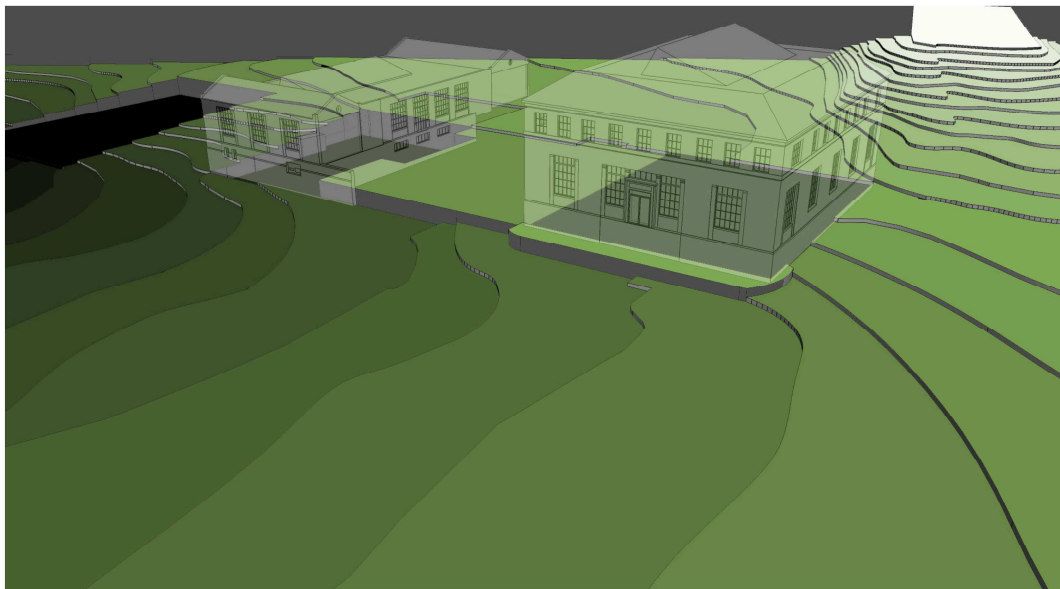
The train tracks back up to the east edge of the site, and the surrounding streets weave over and under them. Philadelphia Avenue rises steeply to cross over the tracks, and Georgia Avenue descends quickly past Stoddard Place to dip under the tracks. (see Topography diagram below) Stoddard Place, to the north of the site, essentially

functions as an alley between the Dyers and Cleaners building and the building to the north, which contains the offices of a construction company and street level retail.

The new Montgomery College performing arts center is a strong presence at the southeast corner of the intersection and helps hold the street edge along the east side of Georgia Avenue. Across the street, set-back auto repair shops and a car wash with parking lots leave the street edge less well defined. The Mayorga Coffee Shop to the north provides a precedent for adaptive reuse in the neighborhood.

### **Topography**

The weaving of the adjacent streets above and below the train tracks results in a sidewalk level that is steadily descending from the southeast corner of the site around to the northwest corner. The site itself is mostly level with some rise toward the east boundary, where a retaining wall borders the track level approximately 30 feet below.



**Figure 66. Perspective view of the existing topography.**



## Existing and Native Vegetation

Existing vegetation at the site is limited to a strip of grass and trees along Philadelphia Avenue. Two evergreen trees at the southwest corner of Building A can be seen as saplings in the 1954 photograph (see “History” above) and today nearly overtake the building.



Figure 67. Trees at the southwest corner of Building A in 2009.

## 5.3 Climate

### Solar Access

The existing first floor windows measure 6 feet wide by 9 feet tall on average and are one of the buildings’ greatest assets in terms of daylighting potential. Windows are distributed evenly on the south, west, and north facades without regard to solar orientation. The buildings’ greatest liability in terms of solar access is their

arrangement in a north-south bar. Full south sun access is afforded only to Building A, and half of the facade is shaded by a dense evergreen tree (above). The south facing windows of Buildings B and E are blocked by buildings to the south. The windows on the north facade of Building B receive ample northern light, but the north facing windows of Buildings E and A are blocked by buildings to the north. The west facade contains large windows that lack any means to mitigate direct afternoon glare.

## SUN



Figure 68. Sun path diagram and solar access analysis.

## Wind Access

During the warmer months, the prevailing winds come from the south and from the north-northwest. This creates the potential for natural ventilation through the buildings if the south and north facades can be exposed. During inspection in May 2009, a pleasant breeze was felt on the second floor of Building A simply due to the

large number of broken window panes. At the first floor level, however, the three buildings are situated too close together to facilitate much air flow.

## WIND

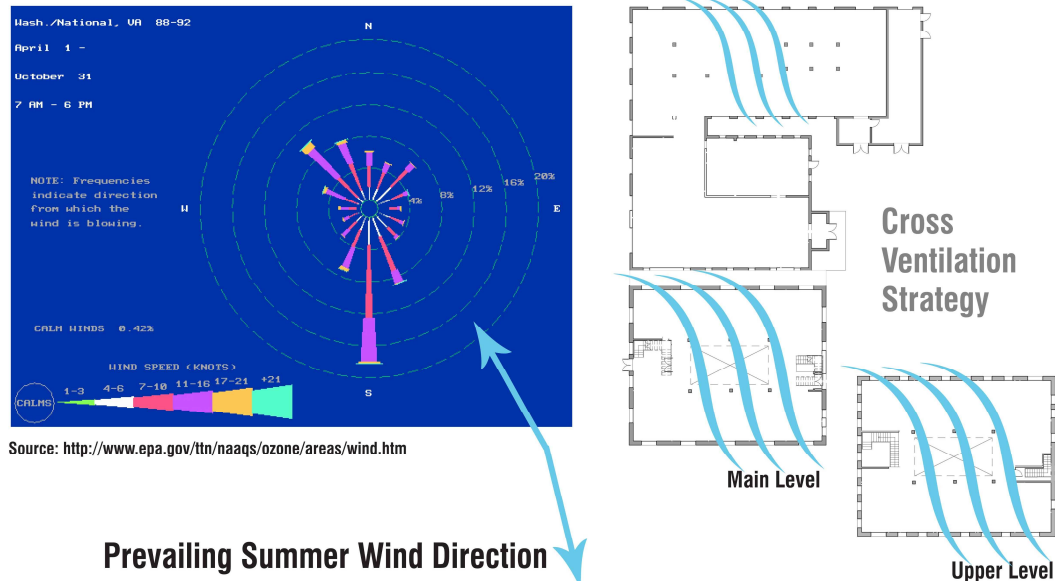


Figure 69. Wind rose and access analysis.

### 5.4 Existing Building: Big Picture

#### Daylighting Potential

The size and placement of windows in Building A currently provides adequate daylight to the spaces along the entire perimeter. There are four obstacles to providing daylight to the entire building: the south windows are blocked by dense vegetation, the north windows at the first floor are blocked by Building E, the drop panel ceilings on the interior cut off the tops of the windows, and the arrangement of rooms cuts off sun access to the center of the building. By removing the external obstacles, raising the ceiling, opening up the floor plan, and introducing light into the



core—perhaps via skylights—ample daylight could potentially be provided to all spaces within Building A.



**Figure 70. Existing daylight inside Building A on an overcast day. (Top row: Second floor, Bottom row: First floor)**

The 1944 extent of Building B is currently one single space, punctuated by an irregular column grid. The space has particularly large windows along the north and south sides, providing adequate light despite the presence of Building E to the south. There is a saw tooth skylight extending across the four middle bays which has been painted over. The skylights are shown in Heaton’s original drawings and appear to have been subsequently used for mechanical venting, judging from the presence of equipment on the roof which connects to the blackened panes.

The windows on the north, east, and south facades of Building E are made of glass block rather than vision panels, which somewhat reduces the interior light levels. The



**Figure 71. Existing daylight inside Building B (top) and Building E (bottom row).**

glass block windows are not large enough to provide sufficient daylight to the interior spaces, and the largest space, at the southeast corner, is quite dark. Note that the photograph of that space above has been adjusted to increase brightness in order to show the condition of the interior space.

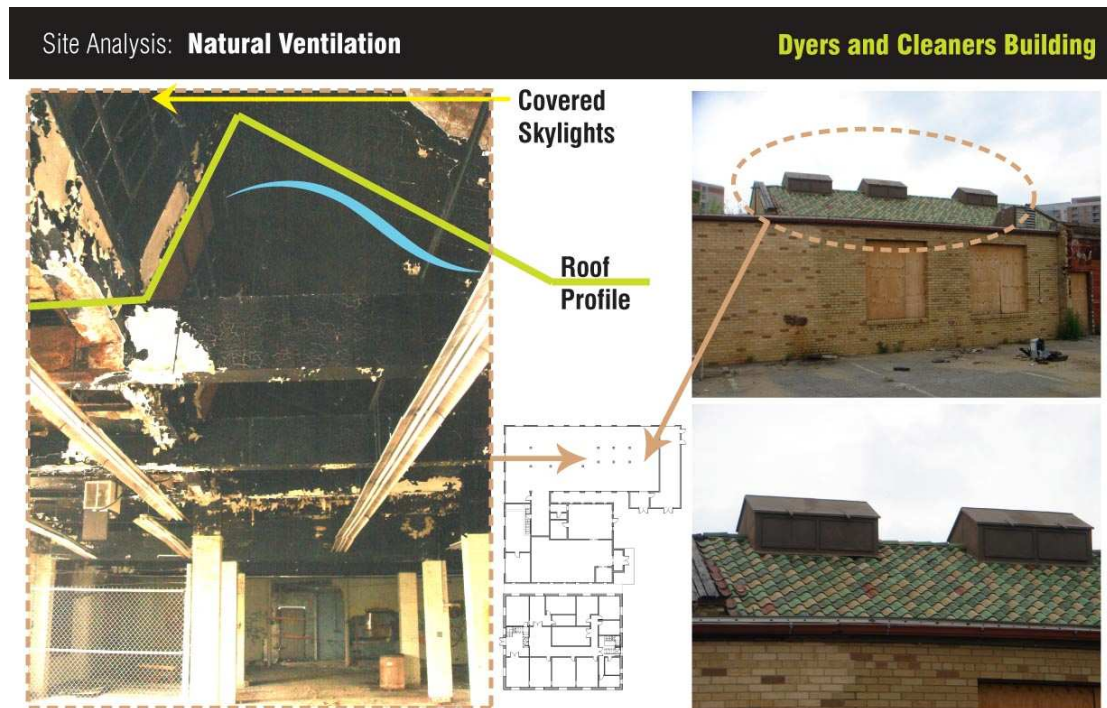
### **Natural Passive Ventilation Potential**

Natural passive ventilation requires intake openings on the windward faces of the building and outlet openings either on the opposite exterior wall or at a higher location within the space.

All of the large first floor windows have tilting sashes that were originally operable but do not function properly at present due to a lack of maintenance of the steel

frames. Restoring the operability of the north- and south-facing windows, where the prevailing winds hit, would provide the necessary intake openings.

Restoring the operability of the saw tooth skylight in Building B would provide a high outlet for the main space, and there are also existing outlet vents at the ridge of the pitched tile roof at the rear of Building B.



**Figure 72. Existing passive ventilation systems in Building B.**

Heaton's original drawings show that the portion of the mansard roof on the north facade of Building A where the tiles are missing was originally a skylight. The skylight was located over what had been a laboratory space on the second floor. The skylight is not currently visible above the drop ceiling and appears from the exterior to have been painted over. If operability were restored, this skylight could potentially serve as a high outlet for spaces with direct access to it. Providing that access is a design challenge given its location along the edge of the second floor of the building.

There are no existing high vents in Building E, but since its south and north facades are blocked by Buildings A and B, respectively, it is not likely that natural passive ventilation would be successful in this space.

### Suitable Programmatic Uses

In order to minimize alterations to the historic fabric, the Secretary of the Interior's Standards for the Treatment of Historic Properties recommends finding a compatible new use for rehabilitated buildings. The Dyers and Cleaners Building expresses an institutional character that suggests a civic use. Its 10,000 square foot size makes it too small to be converted to multi-family residential or commercial office use, and its plinth-like relationship to the street makes it less than ideal for retail use. Together, these factors suggest that a medium-sized civic institution would be an ideal new use.

Program		Dyers and Cleaners Building	
original	proposals		
Offices	<b>New American Cultural Center</b>	<b>Teen-focused Community Center</b>	<b>Community Atelier</b>
Classrooms	Offices	Skateboard Park	Artist-in-residence Studios (ala Torpedo Factory)
Laboratories	Classrooms (ESOL, Art)	Basketball Courts	Community Use Art Studios
Demonstration facilities for Dry Cleaning	Immigration Counseling/Recent Immigrant Services	Classrooms (Art, Music)	Professional Audio Recording Studios (Limited Community Use)
	Gallery	Vocational/Educational Counseling	Classrooms (Art, Music)
	Heaton/NADC Exhibit	Psychological Counseling	Galleries
	Event Space / Catering	Gallery	Heaton/NADC Exhibit
	Daycare / Playground	Heaton/NADC Exhibit	Event Space / Catering
	Vocational/Educational Counseling	Event Space / Catering	Gardens
	Lounge	Offices	“Landscape Gallery”
	Gardens	Gardens	
		Food	

Figure 73. Proposals for suitable programmatic uses.

After consulting with the Montgomery County Planning Office, three possible programmatic uses were considered.<sup>28</sup> Silver Spring has a large, diverse immigrant community, as evidenced by the large number of local businesses that cater to and are run by immigrants. Many of these businesses are located within walking distance of the site. A multi-cultural facility which provides services specifically geared toward “New Americans” could be a considerable asset to the community.

The multiplex movie theater and shopping mall in the downtown redevelopment area attract groups of teenagers who wander the streets, particularly in the evenings. Groups of pre-teen skateboarders tend to gather around the entrance to the Metro, where an urban plaza has become a de facto skateboarding park. This is considered somewhat of a nuisance. Besides skateboarding, there are not many activities for these teens that do not involve spending money. Therefore, a community center focused on teen activities could be useful. The availability of open space on the site could be developed into a proper skateboarding park. The primary disadvantage of this proposal is that the site’s location half a mile south of the downtown area and beyond the Metro track crossing may be too far off the beaten path for children to access in the evenings.

The third programmatic proposal considered builds on the idea that the area south of the Metro tracks could be developed as an arts district. The Montgomery College performing arts building to the south and the Gallery restaurant, Mayorga coffee shop, and photography studios to the north could become active players in the district. The Dyers and Cleaners Building, with its high ceilings and large windows, could

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<sup>28</sup> Interview with John Marcolin of the Montgomery County Planning Office.



house studio and exhibit spaces. The biggest drawback of this proposal is uncertain economic viability. It is also the least interesting proposal since converting historic buildings, especially industrial spaces, into art centers has become somewhat commonplace.

The proposal for a “New American Cultural Center” was selected for this case study because of its strong connection to the unique identity of Silver Spring and its potential for facilitating sustainability in the cultural sense. The cultural center would contain spaces for the practice, instruction and exchange of art, music, dance, language and cuisine. In contrast to the efforts at the turn of the twentieth century to assimilate new immigrants to the United States,<sup>29</sup> the New American Cultural Center could exemplify a new paradigm for the twenty-first century in which adaptation to the new culture is assisted at the same time as the traditions of the home culture are sustained and shared. Assistance would come in the form of English language classes, vocational training, and counseling about the immigration process.

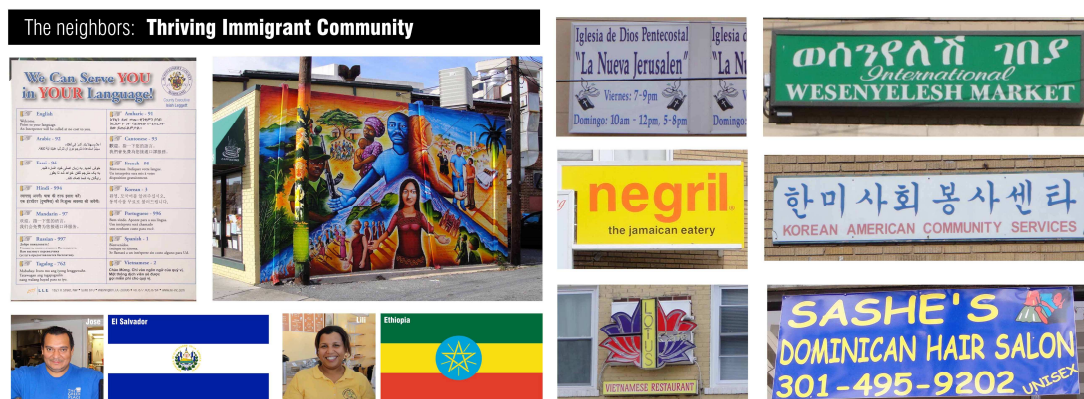


Figure 74. Local businesses in Silver Spring run by/catering to the immigrant community.

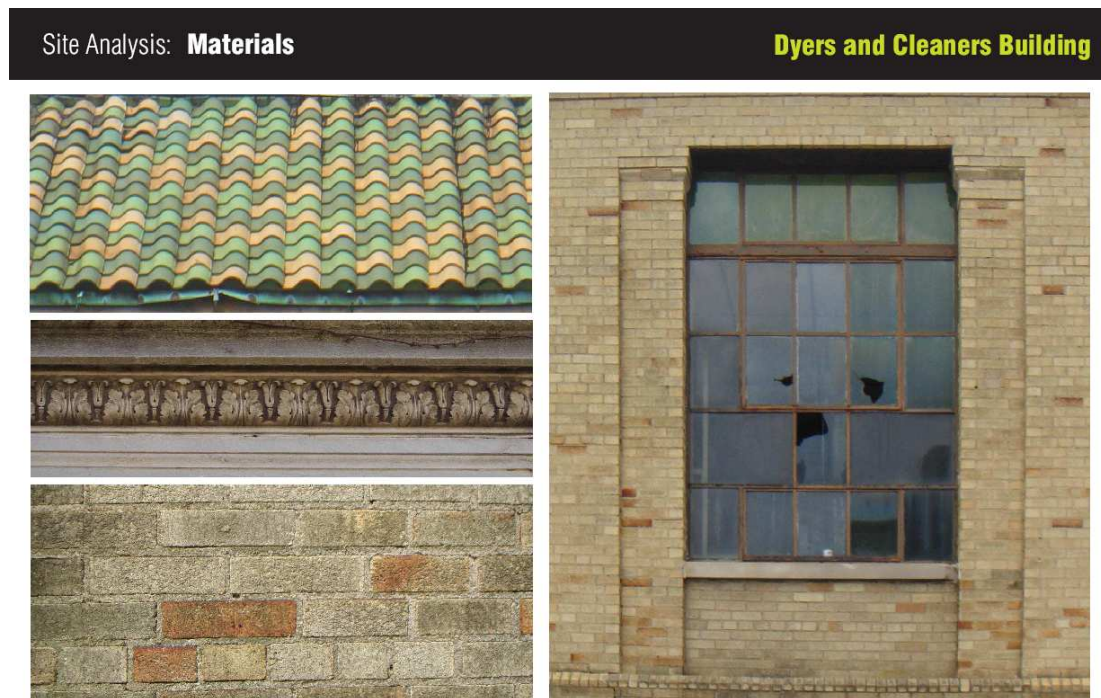
<sup>29</sup> Cranz, Galen. The Politics of Park Design. Cambridge: MIT Press, 1982.



### 5.5 Existing Building: Materials

#### **Material Palette**

The exterior of the Dyers and Cleaners Building is a load-bearing brick wall with large openings for single-pane steel-framed windows. Pitched sections of the roof are covered in terra cotta mission tile and flat sections are covered by a built-up roof membrane system. The exterior, except for much of the window glazing, is largely intact.



**Figure 75. Exterior material palette.**

#### **Potential for Integration in a Sustainable System**

The large windows create the potential for daylighting and natural ventilation throughout Buildings A and B. The windows themselves are also a liability due to their poor insulating characteristics. The glass is single-pane and the thin metal

frames create a thermal bridge to the exterior. In order to facilitate the exchange of light and air inside Building A, the maze-like arrangement of enclosed interior spaces should be altered to increase openness.

In order to maximize the efficacy of natural passive systems within Buildings A and B, sun and wind exposure to the north facade of Building A and the south facade of Building B should be restored. That plus the challenges of providing daylight and natural ventilation to the interior of Building E suggest that it should be demolished. Building E is in the poorest condition of the three buildings. Standing water on the roof has infiltrated the building envelope creating active leaks and the erosion of interior materials.

### **Potential for the Expression of Historic Significance**

The Dyers and Cleaners Building derives its historic significance from and retains material integrity in its exterior materials and appearance. The existing arrangement of interior spaces is not the same as it was originally designed by Heaton, and the condition and quality of the interior finishes are poor. The walls have a simple plaster finish, there is an acoustical drop panel ceiling, and the floor is covered in worn green carpet. With the exception of the entry hall in Building A, which contains a staircase designed by Heaton, none of the interior materials or spatial arrangements appear to be historically significant.

Building E, though designed by Heaton, is the least successful in terms of the quality of the interior spaces. The interiors of some spaces are quite dark, and their arrangement is awkward. The layout is presumably based on a specific usage pattern,

but it is difficult to appreciate what this may have been, and it has been altered since its original construction in 1944. Therefore, the decision to demolish Building E results in the loss of a historically significant exterior facade but not much else of historical value.

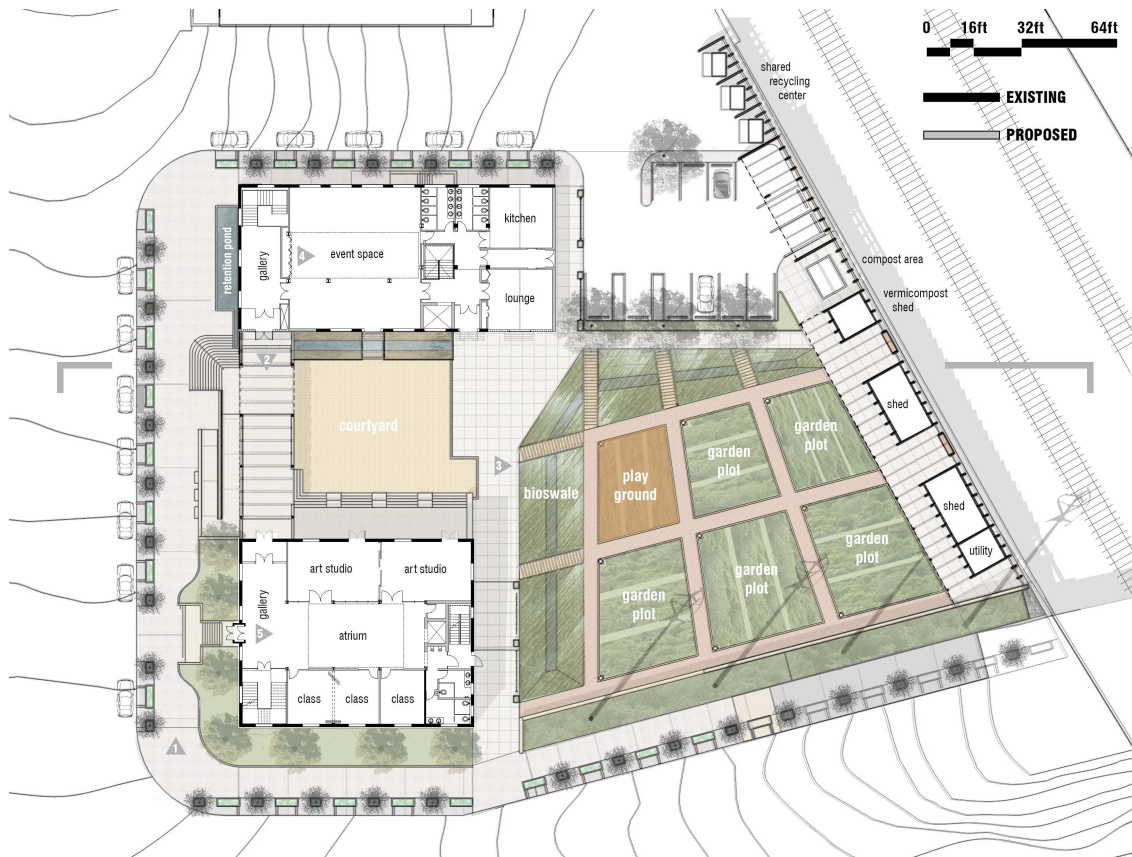
## Chapter 6: Case Study Implementation: Design Proposal

### 6.1 Program: New American Cultural Center

Arts Building (“A”)		Total Net = 8,300 SF
Lower Level		
Atrium		1,075 SF
Gallery		550 SF
Art Studios		2 @ 630 SF
Classrooms		3 @ 280 SF
Bathrooms		2 @ 120 SF
Upper Level		
Conference Room		300 SF
Offices:	Administration	840 SF
	Counseling	160 SF
Music Library		380 SF
Practice Rooms:	Individual	4 @ 90 SF
	Piano	1 @ 140 SF
	Group	1 @ 265 SF
Bathrooms		2 @ 120 SF
Basement		
Mechanical		1,725 SF
Storage		1,000 SF
Event Building (“B”)		Total Net = 7,100 SF
Upper Level		
Event Space		2,200 SF
Lounge		500 SF
Gallery		600 SF
Kitchen		450 SF
Bathrooms		2 @ 160 SF
Lower Level		
Daycare		1,900 SF
Daycare Office		140 SF
Bath/Shower Rooms	2 @ 170 SF	
Laundry		150 SF
Mechanical		500 SF
Shed Building		Total Net = 960 SF
Garden Sheds		2 @ 320 SF
Utility Shed		160 SF
Vermicompost		160 SF

## 6.2 Design

### Site



**Figure 76. Proposed site plan.**

A close relationship between indoor and outdoor space can be a powerful catalyst for sustainable design by reminding occupants of their relationship to the natural world.

At the Dyers and Cleaners Building, the development of the outdoor space is also important for the expression of historic character. Since the building exteriors are the key character-defining elements, giving people a reason to be outside allows them to appreciate the historic fabric.

The removal of Building E creates an outdoor room enclosed on the south and north sides by Buildings A and B. This new space becomes a courtyard that can be accessed directly from the interior of both buildings and from the sidewalk. The semi-enclosed nature of the space makes it suitable for both larger public events and smaller internal events.

The rear (east side) of the site is designed to be a shared garden space that can be planted as users of the Cultural Center see fit. The plots could be used to grow herbs and spices that are used in the cuisines of other cultures but are difficult to find in the United States. The plots could also be cultivated as landscape art. One of the plots is dedicated for use as a playground to service children who attend the daycare and families visiting the site. One of the plots could be set aside for a Children's Garden, where children learn to how to care for plants and develop an understanding of natural processes. This experience can lay the foundation for a greater understanding and appreciation of the importance of sustainable environmental practices.

#### **Site Section**



**Figure 77. Proposed site section.**

The shed building at the rear of the site is designed to provide service spaces for the garden plots and to mitigate the noise and view of the train tracks beyond. The building is similar typologically to a Classical stoa. It consists of a long, linear



canopy supported by columns, with enclosed spaces nestled underneath. The tectonics of the shed building are derived from the train tracks themselves. Regularly spaced wooden columns define a rhythm which is punctuated by openings between sheds that provide visual and audible glimpses of the Metro. Since public transportation is an example of sustainable development, it is appropriate that the Metro tracks would be celebrated rather than hidden.

### **Buildings**

Heaton's Building A is now called the Arts Building and houses a new program similar to its historic program. The biggest proposed modification is the opening of the central space into a double height atrium topped by a new light scoop skylight. This move introduces light into the core of the building which, along with the perimeter windows, provides daylight to each space. Operable sashes in the light scoop also provide high outlets for natural passive ventilation.

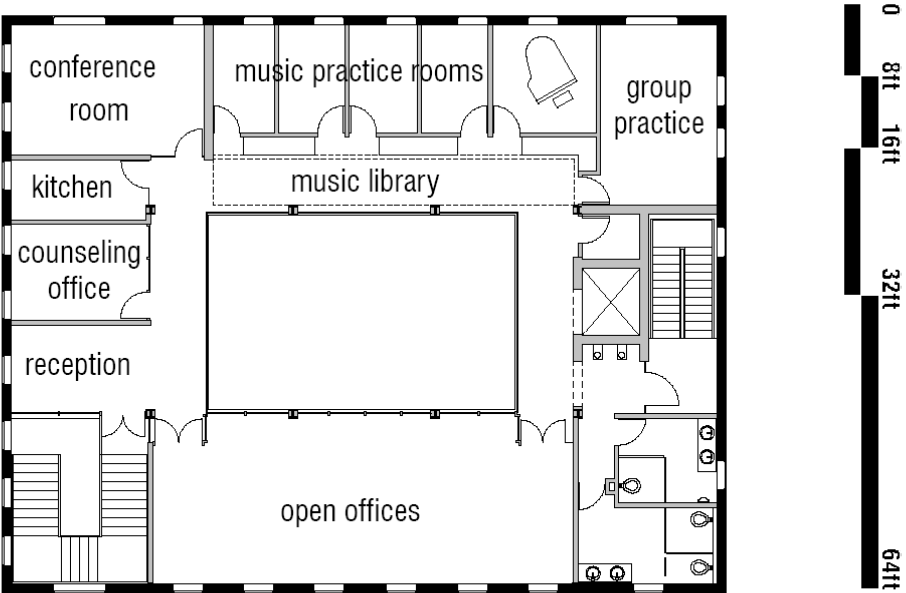
The second benefit of the atrium is the creation of a central shared space that provides a spatial and visual connection between the various program elements. On the first floor, the atrium is lined by art studios to the north and classrooms to the south. On the second floor, circulation occurs around the atrium. The second floor contains open office space for the administration of the Cultural Center, a closed office for private counseling, and the Music Library and practice rooms. Since musical instruments are expensive and since some instruments used in the music of other cultures can be difficult to find in the United States, a permanent collection of instruments could be kept at the site and loaned out.

The spaces in the Arts Building are specifically designed for the practice, instruction, and sharing of music, art, and knowledge in order that the home culture may be sustained and the new culture may be enriched.

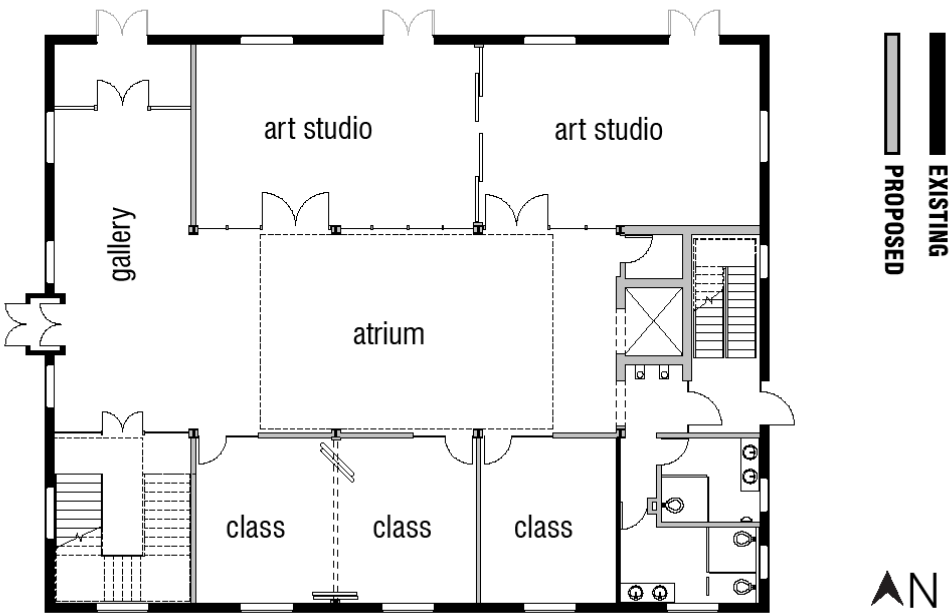
Heaton's Building B is now called the Event Building. It contains several gathering spaces including a large event space with direct access to the courtyard, an informal lounge with views out onto the courtyard, and a large kitchen which can be used for group cooking as well as event catering. On the lower level, there is a day care space that is intended to serve the needs of working parents, since finding childcare can be a major obstacle for immigrant families. The day care would not need to be restricted, however, and could be promoted as an amenity that serves the nearby residential and commercial neighborhoods as well. The lower level of the Event Building houses shower and locker facilities that can be accessed from the rear entrance, closer to the bicycle racks to the east of each building.

***A note regarding representation:*** In each of the rendered images below, the existing building fabric and in some cases reclaimed material from Building E are shown in color. All new material is shown in grayscale. The intention is twofold: to clearly distinguish my intervention from the existing conditions, and to express that the existing buildings possess a life and an identity that is retained despite their neglect. The purpose of my proposal is to make the most of what exists and allow that life to come through, which is what I have attempted to reflect in the drawings.

**Arts Building “A”**



**Second Floor Plan**

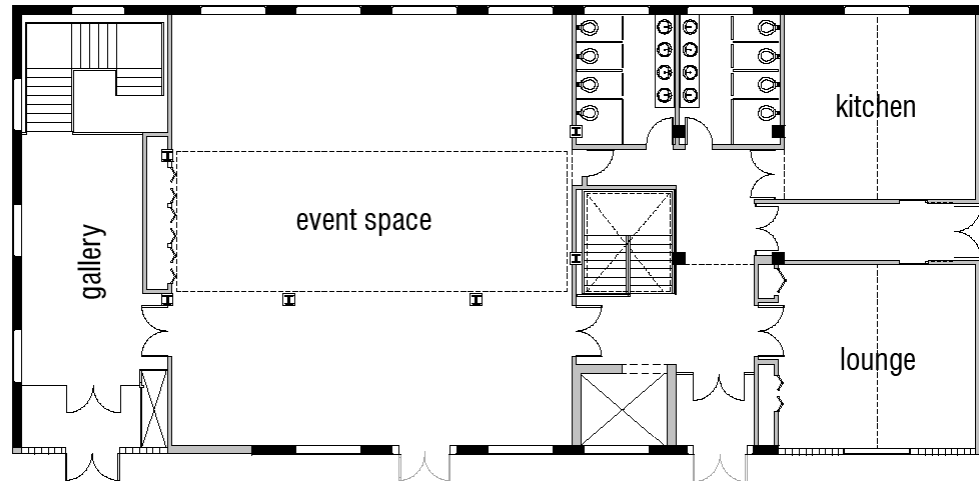


**First Floor Plan**

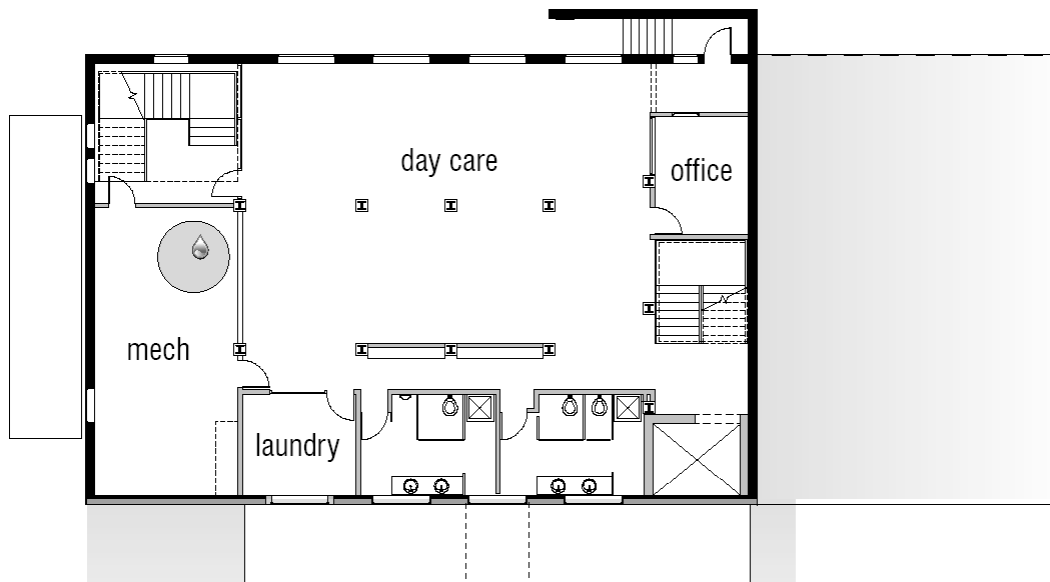
**Figure 78. Proposed floor plans of Building A/Arts.**



## Event Building “B”



**First Floor Plan**



**Basement Plan**

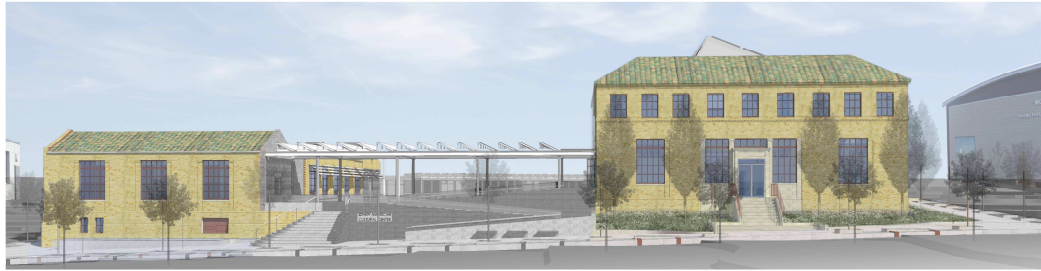
**Figure 79. Proposed floor plans of Building B/Event.**

A major challenge of the site was to mitigate the differences in elevation between the main floor of each building, the courtyard, and the sidewalk level. The first floor level of the Arts Building is three and a half feet above the second floor level of the Event Building, which is, in turn, six feet above the sidewalk level at its entry. The sidewalk itself rises seven feet from the northwest corner of the site to the southwest corner. The design proposal locates the courtyard six inches above the second floor level of the Event Building such that only a short ramp is required between them. The change in elevation to the first floor level of the Arts Building is mitigated by a longer ramp and steps which lead to a terrace that is level with the floor inside that building. The steps and terrace create several possibilities for staging performances in the courtyard space.

Along the Georgia Avenue street facade, the presence of the site's new identity is expressed by the entry portico. The portico serves several functions. It literally connects the two buildings and provides shelter for this transition. The portico is covered in translucent solar panels which both collect solar radiation and provide shade to the space below. The portico serves as a threshold between the public space of the sidewalk and the more private (though not entirely private) space of the courtyard. By limiting the extent of new fabric along the street facade to the space between the buildings, the individual identities of the historic buildings are preserved. The transition between old and new is unambiguous. The portico is not completely independent of its context, however, and refers back to the buildings in two ways. Its width corresponds to the gabled roof of the Event Building and its columns are spaced according to the bay structure of the demolished facade of Building E.

### West Facade

EXISTING PROPOSED



**Figure 80. Proposed Georgia Avenue street facade.**

The design of the south facade of the Event Building is intended to express the act of infilling the gaps in the historic facade left by the removal of Building E. Infill materials are limited to reclaimed exterior brick and glass block from Building E. The facades under each gable are infilled with glass block, which permits diffuse light but provides thermal insulation far superior to glass windows. Since glass block is also a form of masonry, it furthers a tectonic consistency to the construction of the exterior walls. After dark, light emitting diodes (LEDs) can illuminate the glass block walls from the interior to celebrate an event being held on the campus.

### South Facade Event Building

EXISTING PROPOSED



**Figure 81. Proposed south facade of Building B/Event.**

Since each change to the building through time is a significant part of its story, the seam between the existing and reclaimed exterior brick walls is expressed and



celebrated by creating a 4-inch setback and using contrasting header bricks as a metaphorical zipper.

### **Images**

The sidewalk vignette on the next page shows a wider zone of circulation and the planter filtration system on the left. The vegetation surrounding the building is reduced to a more appropriate scale. The existing vegetation can either be trimmed back or relocated to the rear of the site along the Philadelphia Avenue sidewalk. The large evergreen tree will be relocated to shade the new parking lot.

The portico vignette on the following page shows the connecting sequence between the two buildings, as well as the flow of people between the sidewalk and the courtyard and the Arts Building and the courtyard. Here, the function of the portico as threshold can be seen. The reclaimed brick surface of the courtyard shines as it reflects the late morning sun.



## ① Street Life

Figure 82. View of proposed sidewalk condition.



Figure 83. View of existing sidewalk condition.





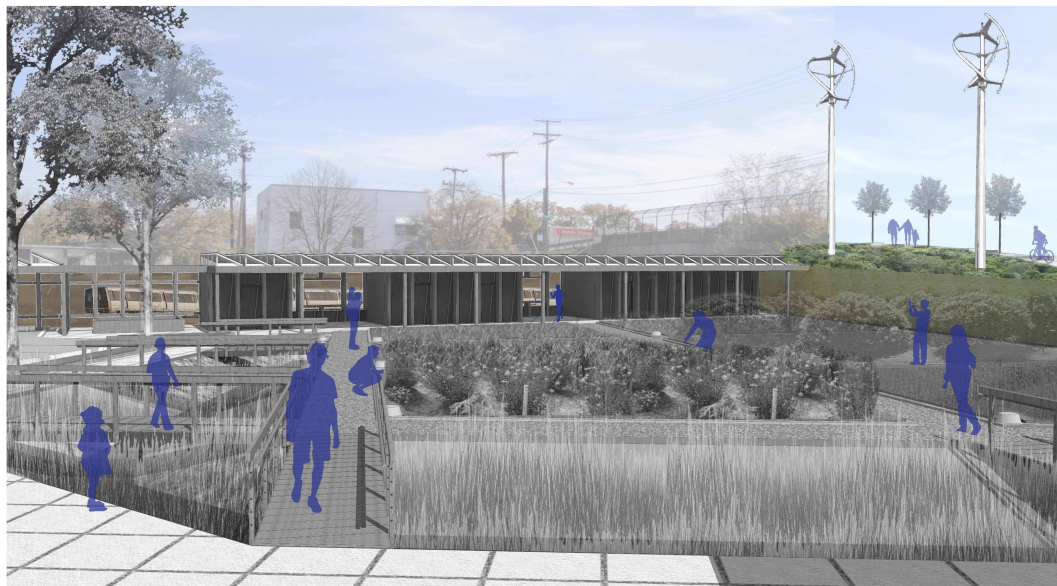
## 2 Connecting Space

Figure 84. View of proposed portico and courtyard.



Figure 85. Comparable view of the interior of Building E, taken from Building B, as it exists today.

This vignette shows how the open space at the rear of the site can be developed into a porous landscape and an active garden. The experience of crossing over the bioswale is used as a metaphor for the experience of crossing over the border to a new country. The rhythm of the shed building at the rear of the site is also shown, punctuated by glimpses of the Metro train beyond.



### 3 Border Crossing

EXISTING PROPOSED

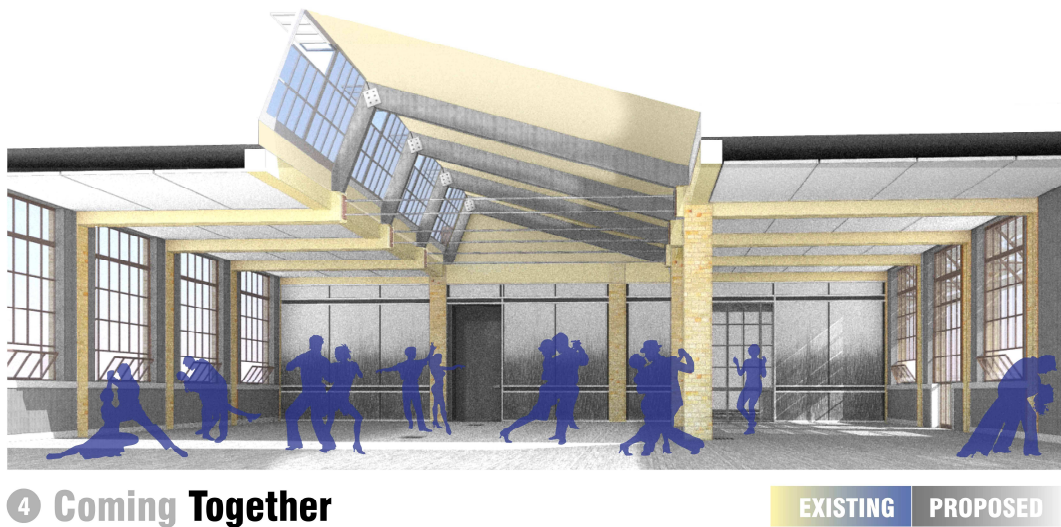
Figure 86. View of proposed garden area at rear of site.



Figure 87. Same view of the rear of the site, as it exists today.



In the photo below, the existing saw tooth skylight is just barely visible above the heavy beams which transverse the space, but the existing north and south facing windows give a sense of the potential for daylighting in this room. The large space is easy to imagine being filled with people. The vignette shows how the application of light-colored interior finishes and the removal of Building E can maximize the impact of daylight within. The section of the beams directly below the skylight is replaced



**Figure 88. View of proposed event space in Building B/Event.**



**Figure 89. Same view of Building B interior, as it exists today.**

with a simple frame structure in which the tension of the bottom chord is carried by thin steel rods. This move opens the space and draws attention to the skylight, which is the most important feature of the room.

The most significant change proposed to either building is the opening up of the central space of the Arts Building and the addition of a light scoop above. As discussed in the previous chapter, the intention is to introduce light into the core of the building which is now almost completely cut off from natural light, and to create a central space that visually and physically connects the spaces around it. The wall between the art studios on the left and the atrium is a screen made from reclaimed metal window frames. The same type of screen is used to make operable transom panels which facilitate natural ventilation from the spaces along the perimeter up through the atrium and out operable sashes in the skylight. The skylight faces north to permit steady light and block direct glare. The profile of the light scoop is designed to reflect light to the spaces below.

In the image below, the columns are rendered in color because the structural columns are existing, but they are steel I-beams that are currently encased in interior walls. For fireproofing reasons, the columns are shown as clad, but the cladding is designed to express the steel within.





## 5 Sharing Light

EXISTING PROPOSED

Figure 90. View of proposed atrium in Building A/Arts.



Figure 91. Same view of Building A interior, as it exists today.

### 6.3 Implications for Historic Preservation

The intention of the design proposal is to express the new identity of the campus as yet another layer in the historic collage. Not to “renovate,” or to make new, but to update or add a new chapter in its history. The 1927 exterior spatial condition is restored, but traces of the changes made in the intervening years are still expressed in the facades. The addition of new material is minimal and clearly delineated. As will be discussed below, the majority of the materials currently at the site are preserved by either being maintained or repurposed.

The proposed interiors of the buildings do not closely resemble either the 1927 condition or the present day condition, but this is a consequence of developing the site for a new use. The decision to intervene as liberally as shown on the interior was also based on an assessment of its historic significance. Neither the existing materials nor the spatial conditions possessed historic integrity, supporting the decision to alter the space to suit the needs of the new program. However, an effort was made to express the existing structure by exposing and highlighting the existing columns. Where columns align with a partition wall, such as in the event space, the columns are distinct from the wall plane in terms of materiality and dimension.

From the exterior, the buildings will be clearly recognizable as historic structures, and the development of the outdoor spaces on the site will allow those exteriors to be appreciated more fully. The visibility of solar panels may concern some advocates of historic preservation, but they are simply an additional layer that expresses the new identity of the campus as a sustainable site.

#### 6.4 Implications for Sustainable Design

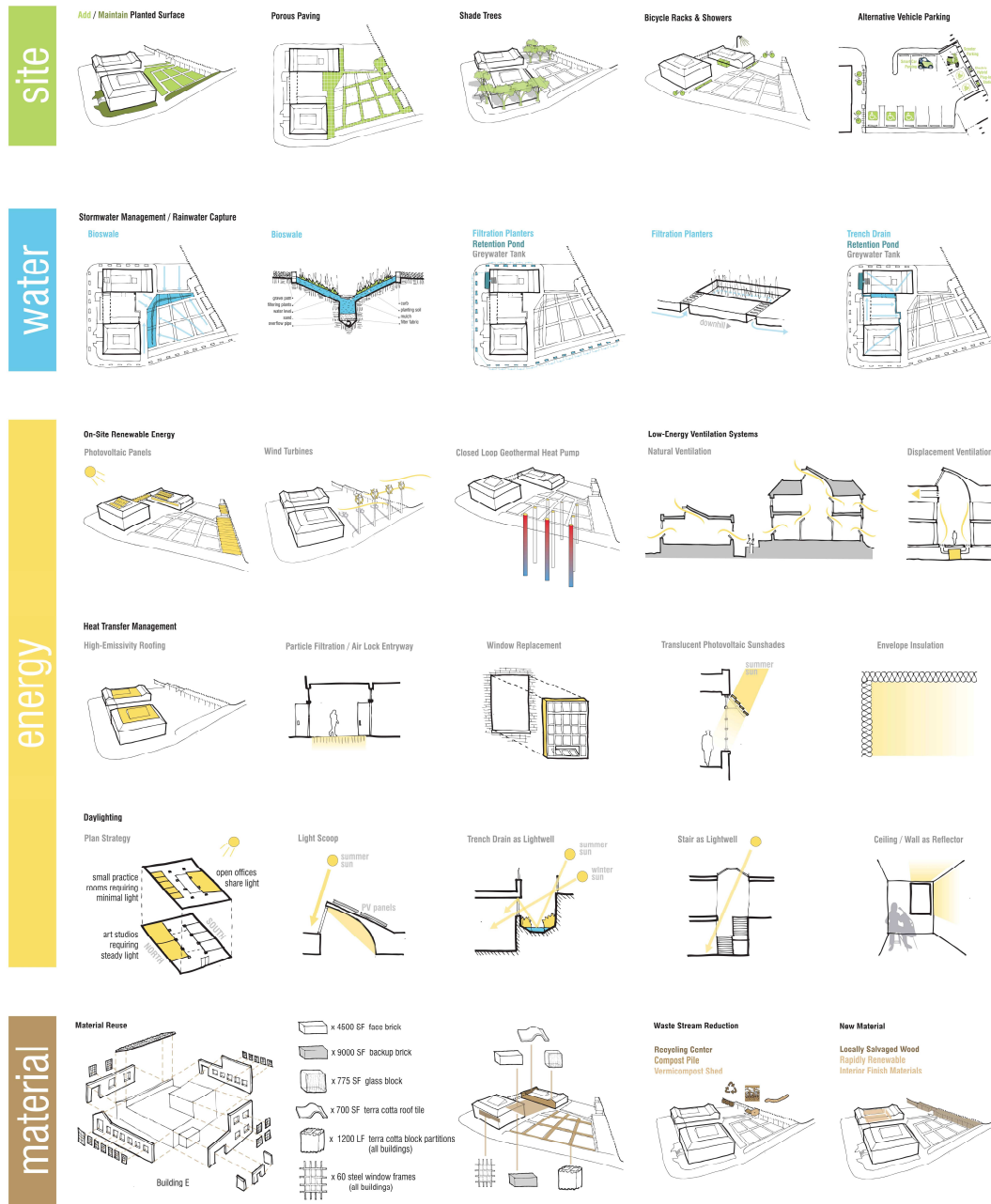
The strategies employed to improve the environmental performance of the building will be discussed in detail in the following chapter. Overall, priority was given to providing daylight and natural ventilation to as many spaces as possible. Since the buildings originally relied upon similar passive systems when they were built in 1927, that strategy can be considered as a means of restoring that tradition as well. In the Mid-Atlantic climate, with winter temperatures around freezing and hot, humid summer conditions, it is nearly impossible to eliminate the need for mechanical conditioning according to our modern standards of comfort. During the spring and fall, however, moderate outdoor temperatures make natural ventilation a viable alternative. Here, the positive psychological impact of providing fresh air and views to the occupants and creating a strong connection to the outdoors were as important to the design as the potential energy savings.

In order to minimize the need for future alterations, the spaces were designed to be flexible and adaptable. A variety of meeting spaces of differing sizes are provided, including the 2,000 square foot event space, the 1,000 square foot atrium, the 500 square foot lounge, the 300 square foot conference room, and the courtyard. Interior partitions are designed as modular insertions which could be reconfigured as needed without major demolition. The interior finish materials of the event space are panelized so that they can be replaced easily as they become worn or as fashions change. The extensive reuse of material from the site, as will be discussed below, substantially reduces the amount of resources and energy required for the conversion of the site from its present condition into the proposed condition.



**Figure 92. Section perspective summarizing the sustainable and preservation strategies used.**

## Chapter 7: Summary of Strategies to Improve Environmental Performance



**Figure 93. Summary of strategies employed to improve environmental performance.**

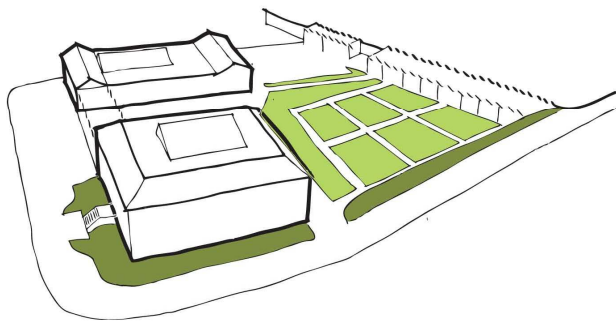
Technological innovation in the design of sustainable systems has led to a growing market in products that can help reduce energy use by maximizing the efficiency of building systems. These include daylight sensors and occupant sensors which

automatically control electric lights, carbon dioxide sensors that automatically adjust ventilation based upon occupancy, and low-flow plumbing fixtures that reduce indoor water use. The use of such monitoring and automating devices has the potential to effect substantial energy and resource savings. For an architect, the integration of these systems into a building is more a matter of specification than design. Therefore, for the purposes of this thesis, I have chosen to focus on sustainable strategies that have direct architectural implications. They are described below.

### 7.1 Cultivating the Site and Reducing Water Use

#### **Restoring Site Ecosystems**

##### **Add / Maintain Planted Surface**



**Figure 94. Site Strategy: Add/Maintain Planted Surface.**

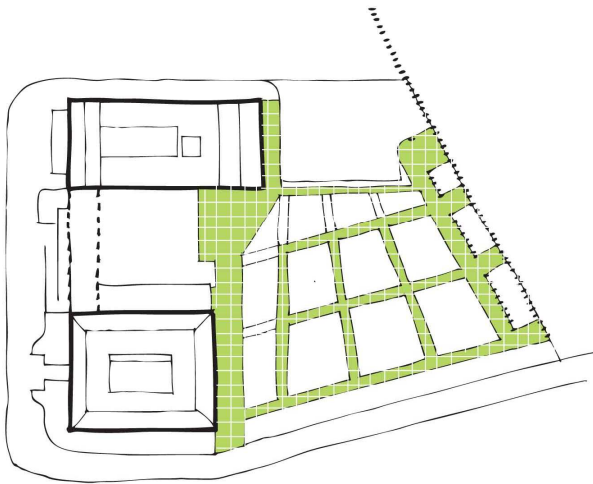
Increasing the amount of vegetated surfaces and trees on site introduces oxygen-producing plants, creates habitats for plants and animals, and helps connect people to nature. As a stormwater management strategy, increasing the permeable surface reduces the burden on the municipal sewer system. During a storm event, rainwater that cannot be absorbed by the ground is directed to the municipal sewers which must



be designed to accommodate the maximum possible amount of runoff in order to prevent flooding. This is referred to as the *peak direct runoff*. Increasing the amount of planted and therefore permeable surfaces reduces the peak direct runoff, thereby requiring less capacity of the municipal sewer system and less resource usage during filtration.

## Stormwater Runoff Control and Aquifer Recharge

### Porous Paving



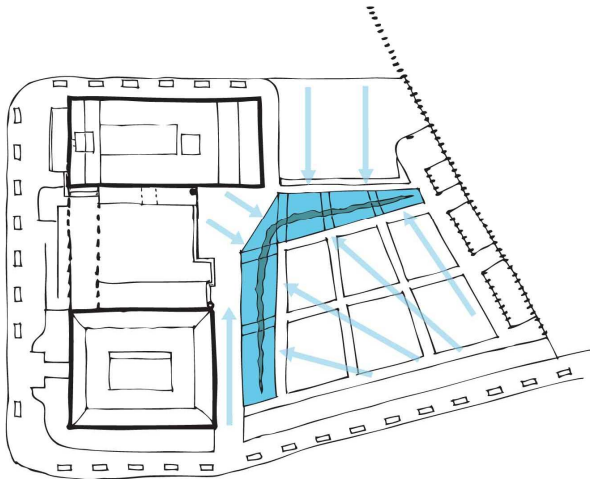
**Figure 95. Site Strategy: Porous Paving.**

In addition to the benefits of reducing the peak direct runoff, allowing rainwater to penetrate the ground surface enables water to percolate through the ground layers and refill the aquifer. An *aquifer* is a stratified subterranean layer of porous material, such as sand or rocks, through which water travels horizontally. Aquifers are an important part of the water cycle because the water is filtered naturally as it moves, enabling well water to be potable fresh water. Wells draw water out of the aquifer.

When rainwater is absorbed by the ground and makes its way down to the aquifer, it is called *aquifer recharge*.<sup>30</sup>

Continuous, impervious paving prevents water absorption into the ground. Installing individual pavers with permeable spaces between them can enable aquifer recharge and reduce the peak direct runoff as long as water is allowed to be absorbed into the ground. Drainage mats only redirect water flow. In this case, porous paving is installed at the rear of the site, directly on top of permeable ground, and the surfaces are pitched such that direct runoff is channeled toward the bioswale.

### Bioswale



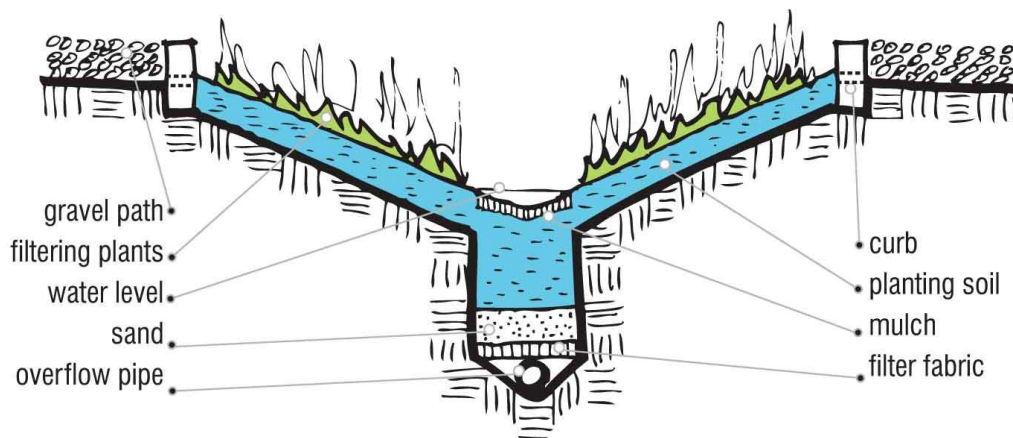
**Figure 96. Water Strategy: Bioswale.**

A *bioswale* is a negative landform that retains stormwater runoff for a limited period of time during which natural processes filter pollutants from the water. Natural processes include sedimentation, filtration, adsorption, and microbial action.<sup>31</sup> In the detail below, water that is not directly absorbed by the ground surface (shown as a

<sup>30</sup> Bedient, Philip B. and Wayne C. Huber. Hydrology and Floodplain Analysis, 2<sup>nd</sup> Ed. Reading, MA: Addison-Wesley, 1992.

<sup>31</sup> Margolis, Liat and Alexander Robinson. Living Systems. Balen: Birkhäuser, 2007.

thick line for graphic clarity, but intended to be permeable) collects at the center of the swale and slowly percolates downward. During the time required for percolation, plants and microbes in the soil absorb and metabolize pollutants from the water. The filtered water is then collected in the overflow pipe and directed to a greywater system used for on-site irrigation, toilet flushing, and other permitted uses for non-potable water. On this site, the bioswale watershed consists of the open spaces at the rear of the site.



**Figure 97. Bioswale detail.**

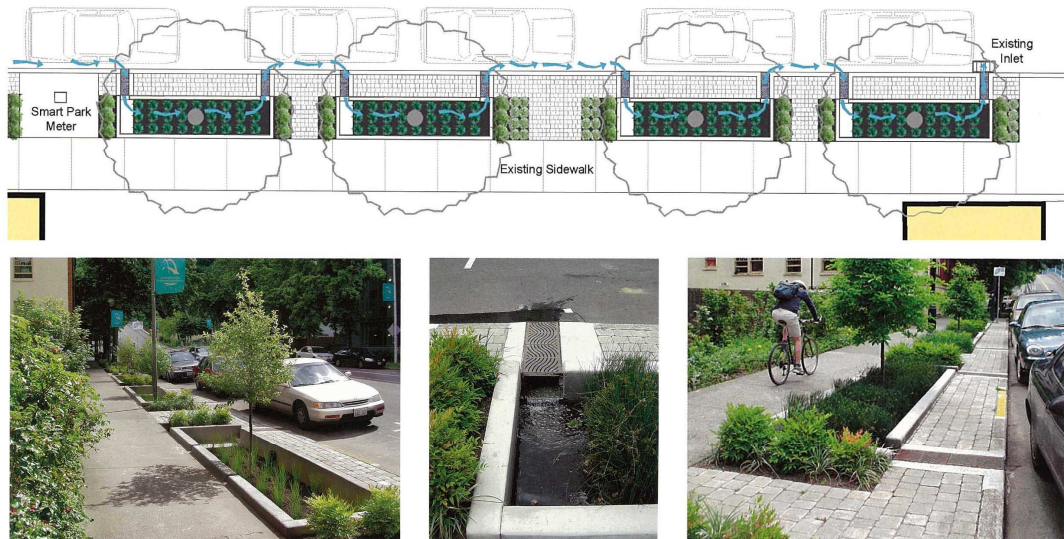
At the sidewalks along the perimeter of the site, a system of filtration planters is proposed for the purposes of naturally filtering runoff from the sidewalks and the street and beautifying the streetscape. This type of system has been installed in Portland, Oregon as part of their “Green Street” initiative.<sup>32</sup>

Taking advantage of the topography of the site, the planters work as a sequential filtration system processing runoff as it naturally flows downhill. An inlet channel allows water to enter the linear planter, which is filled with plant species and

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<sup>32</sup> Ibid.

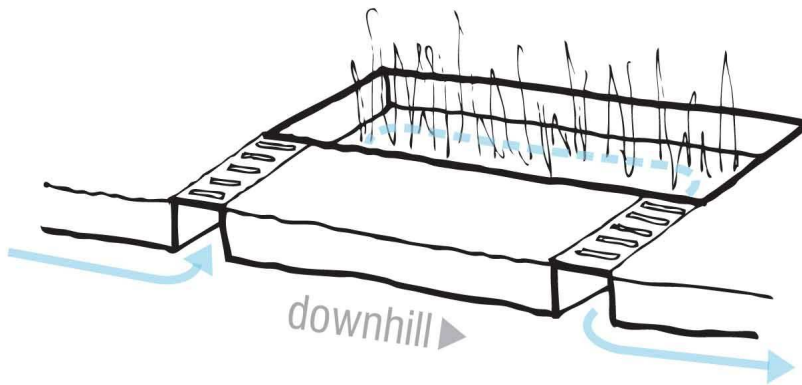
## Case Study: **Portland Green Street Program**



from *Living Systems: Innovative Materials and Technologies for Landscape Architecture* by Liat Margolis & Alexander Robinson, Birkhauser: 2007

**Figure 98. Sidewalk filtration planters employed in Portland, Oregon, from Living Systems.<sup>33</sup>**

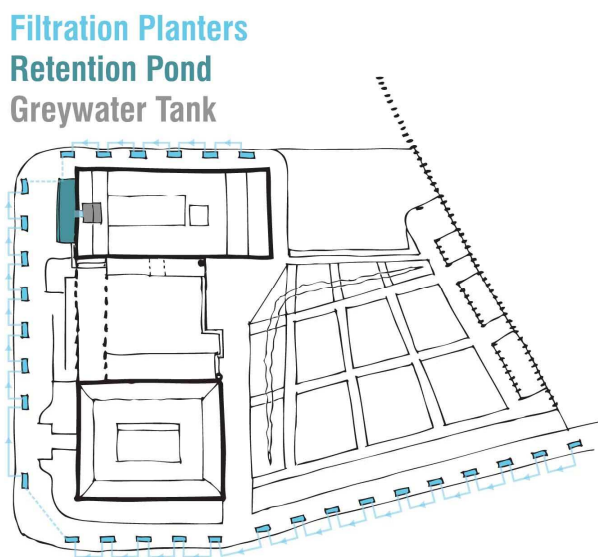
microbes that absorb and metabolize pollutants. The operation is similar to that of a bioswale. Excess water continues flowing through the planter to the outlet channel, which is at a lower elevation than the inlet. The overflow is directed into the next planter, located downhill, and so on.



**Figure 99. Sidewalk filtration planter detail.**

<sup>33</sup> Ibid.

Since the site has a steadily decreasing elevation from its high point at the southeast corner to its low point at the northwest corner, this type of system is well suited for application here. Excess water at the low point is directed to the retention pond, from which it enters the greywater tank. Based on the use of this system in Portland, the planters require some regular maintenance. Frequently loaded planters require some replacement of plants and soil a few times per year.<sup>34</sup>



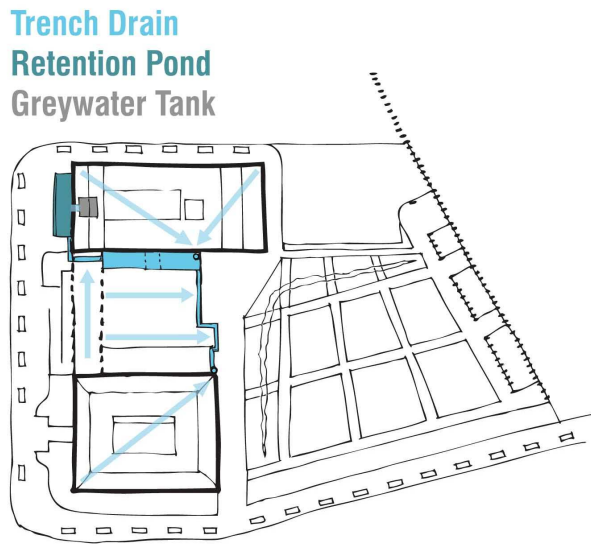
**Figure 100. Water Strategy: Sidewalk Filtration Planters.**

Stormwater that hits the roof areas and the courtyard is collected by the trench drain that marks the footprint of the demolished building. Water flows through the trench drain to the retention pond located along the Georgia Avenue sidewalk. The retention pond operates in a similar manner to the filtration planters and bioswale described above. After water has been retained and filtered for up to several days, it is piped into the greywater tank located in the basement level mechanical space of the Event

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<sup>34</sup> Ibid.

Building. Greywater is reused in the building for toilet flushes and heat transfer in the mechanical systems.



**Figure 101. Water Strategy: Rainwater Collection, Retention, and Reuse.**

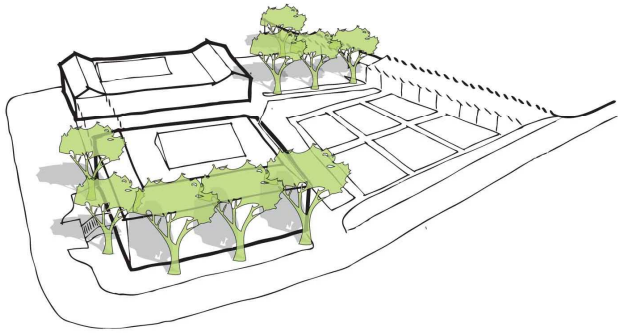
### **Heat Island Effect Reduction**

In developed areas, objects with high thermal mass such as pavement and buildings absorb solar radiation and release it as thermal radiation. This can lead to higher temperatures at ground level and inside buildings, called the *heat island effect*. In warm weather, this increases the required cooling load. By reflecting solar radiation from horizontal surfaces back toward the atmosphere, the required cooling load inside a building can be reduced.<sup>35</sup>

<sup>35</sup> USGBC “LEED for New Construction & Major Renovations. Version 2.2” October 2005.



## Shade Trees



**Figure 102. Site Strategy: Shade Trees.**

Planting trees that shade the building and paved surfaces is a simple way to reduce the amount of solar radiation that is absorbed, and it comes with the benefit of oxygen production and site beautification. Trees do not have high thermal mass and their leaves act as reflectors. Here, trees are used to shade the south facade of the Arts Building and the parking lot. Along the west facade of the Arts Building, tall skinny trees are placed between windows to act as vertical fins, blocking direct glare in the late afternoon. Deciduous trees naturally adjust for seasonal conditions since they provide more shade in the warm months when they have leaves and less shade in the cold months when their leaves have fallen.

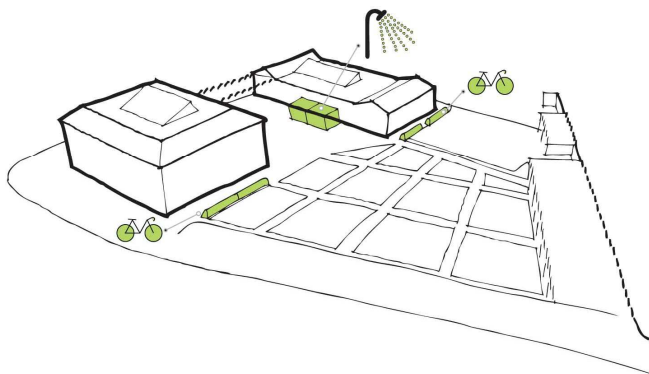
Light colored paving is used to reflect light off of those surfaces, and light-colored, high-emissivity roofing is used to reflect light off of rooftops. (shown below under “Heat Transfer Management”)

### **Facilitating Alternate Transportation**

The site is located approximately one half mile from the Silver Spring Metro station where there is also a large bus station. This is just within a comfortable walking

distance for most people. There is also a major bus stop three blocks south of the site at Georgia Avenue and Eastern Avenue which services areas in the District of Columbia. These proximities fall within the criteria to earn a point for access to public transportation under the LEED for New Construction system,<sup>36</sup> but they are not quite ideal for encouraging the use of public transportation over car travel. Hopefully, Silver Spring will respond to its recent population growth by making public transportation a more viable option. In the mean time, developing the site to facilitate the use of alternate transportation encourages building users to access the site by means other than private cars. Considering the proposed program, it is likely that many of the immigrant families that the Cultural Center is designed to serve do not have cars at all.

### **Bicycle Racks & Showers**



**Figure 103. Site Strategy: Facilitating Bicycle Use.**

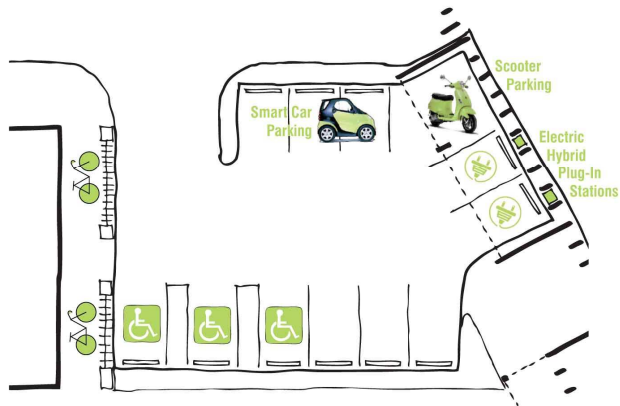
Bicycle racks are provided along the east side of both buildings where they are accessible from the sidewalk but less exposed than they would be along Georgia Avenue. Both buildings have rear entrances to accommodate bicycle travelers, and

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<sup>36</sup> Ibid.

showers and locker space are located in the basement level of the Event Building. A sweaty cyclist could use the eastern door of the Event Building and go directly downstairs to the showers without having to pass through any formal spaces.

### Alternative Vehicle Parking



**Figure 104. Site Strategy: Limiting Conventional Parking.**

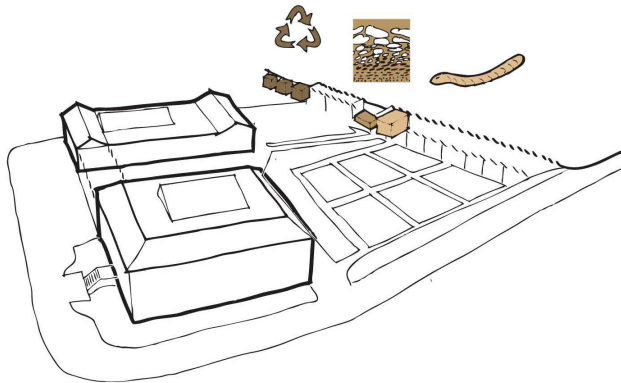
The simplest strategy to discourage private car use to those who have the choice is by limiting parking on site. This move may be controversial as we have become accustomed to using cars in American society, however, many users of the Center may come from cultures where car use is not as common. In this instance, it is perhaps better to discourage adaptation to new culture. In addition to a limited amount of street parking, there is a small parking lot with spaces designated for higher fuel efficiency vehicles. Shorter parking spaces along the north edge are dedicated for fuel-efficient two-seater cars and the covered area under the shed at the east edge of the site is dedicated to scooters and electric plug-in hybrid vehicles. The plug-in station is thus afforded a degree of shelter from rain.

## Waste Stream Reduction

As discussed in Chapter 3, everything that we throw “away” must be dealt with by other people down the line and for years to come. In order to reduce the waste stream generated by building occupants, part of the site is dedicated to recycling and composting. The shed structure creates spaces for three waste containers at the end of Stoddard Place. This “recycling center” could be shared with the building on the north side of the street. The three containers could be used for paper, commingled materials, and trash.

## Waste Stream Reduction

**Recycling Center**  
**Compost Pile**  
**Vermicompost Shed**



**Figure 105. Waste Reduction Strategy: Recycling and Composting.**

The volume of organic solid waste and paper waste can be substantially reduced by the process of composting. Two forms of composting are accommodated by the shed building. The first is a large bin exposed to the sun that can function the same way as a backyard compost heap. The second is an enclosed shed dedicated to

*vermicomposting*, the use of worms to metabolize and thereby reduce waste.<sup>37</sup> The enclosed shed can be customized to the light and temperature levels which best accommodate the worms. The leftover product, called *humus*, is a soil high in nutrients which can be used as fertilizer in the adjacent garden plots.

The use of composting toilets was also considered. Composting toilets come in self-contained (single fixture) and centralized (multiple fixture) models. The centralized fixture models direct waste into a compost tank, which can be either a single chamber tank where the composting process is continuous or a multiple chamber tank where composting occurs in batches.<sup>38</sup> Architecturally, this requires an accessible space below the bathrooms to locate the tank. Given the other constraints and priorities regarding layout, the idea of integrating composting toilets into this project was abandoned.

## 7.2 Reducing Energy Use

### **On-Site Renewable Energy**

Two forms of on-site renewable energy have been integrated into the proposal: solar and wind. Since the site is located in an urban setting, the renewable energy systems could be linked to the municipal utility grid so that production in excess of site demand can be shared rather than stored in batteries. Geothermal loops are employed here as a low-energy means of reducing the energy consumption of the mechanical

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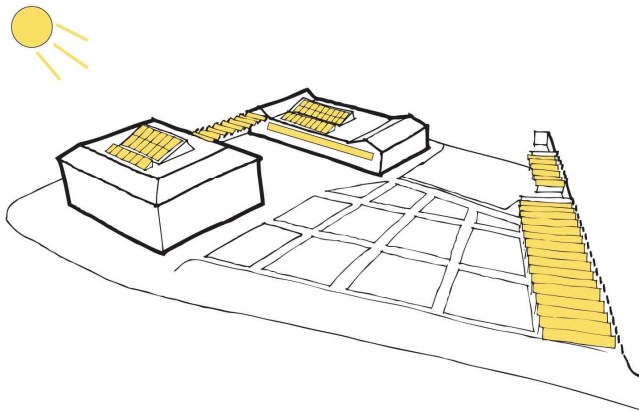
<sup>37</sup> For a good source on vermicomposting, see “Vermicomposting: A Better Option for Organic Solid Waste Management” by Asha Aalok, A.K. Tripathi and P. Soni.

<sup>38</sup> “What is a Composting Toilet System and How Does it Compost?” <<http://www.oikos.com/library/compostingtoilet/>>

system. Note that this is not the same as the use of geothermal wells for energy production.

Two forms of photovoltaic (“PV”) panels are employed on site. On rooftops, standard PV panels are installed either on metal frames or directly on the angled surfaces of the skylights. The skylight roofs tilt toward the south, positioning them well for collecting solar radiation in the northern hemisphere. The PV panels on the flat sections of the roof rest on frames that could be manually adjusted four times per year in order to optimize the collection angle.

### Photovoltaic Panels



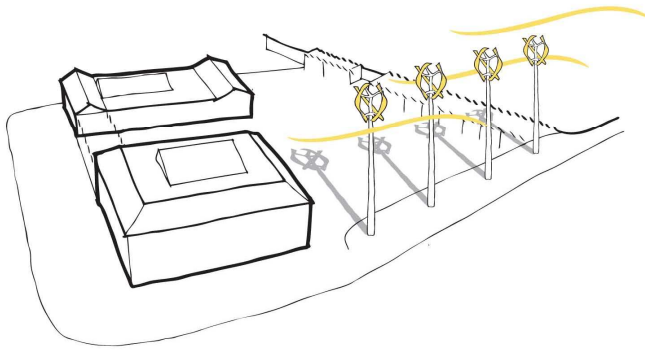
**Figure 106. Energy Strategy: On-Site Solar Collection.**

The other type of PV panel is translucent. Thin solar cells are set a small distance apart and cast into glass to create a panel which both collects solar radiation and acts as fritting to filter light to the spaces below. This type of PV panel is used at the two porticos—at the building entry and at the rear of the site—to provide shade for people walking underneath. The same type of PV panel is used to form a sunshades on the south facade as described below under “Heat Transfer Management.”



Wind turbines come in many shapes and sizes depending upon the application. Rather than the large, noisy type of turbine that can be found at an industrial wind farm, the installation of a smaller, more sculptural wind turbine is proposed for the rear of the site along Philadelphia Avenue. In order for wind turbines to operate efficiently, they must not be located within the wind shadow of any object or too close to the ground where friction creates turbulent air flow.<sup>39</sup> At present, the open space at the rear of the site is located along a break in the urban fabric along the train tracks. Locating the turbines on the hill exposes them to prevailing north-south winds. The proposed turbines are shown as approximately 40 feet tall and could also serve as advertisements for the Center since they would be visible from the Metro.

### Wind Turbines



**Figure 107. Energy Strategy: On-Site Wind Collection.**

The proposed closed-loop geothermal heat pump system reduces the load on the mechanical system by taking advantage of the steady temperatures beneath the ground surface. Water circulating through the heat pump absorbs excess heat from the air during the summer or has heat removed from it during the winter. This water

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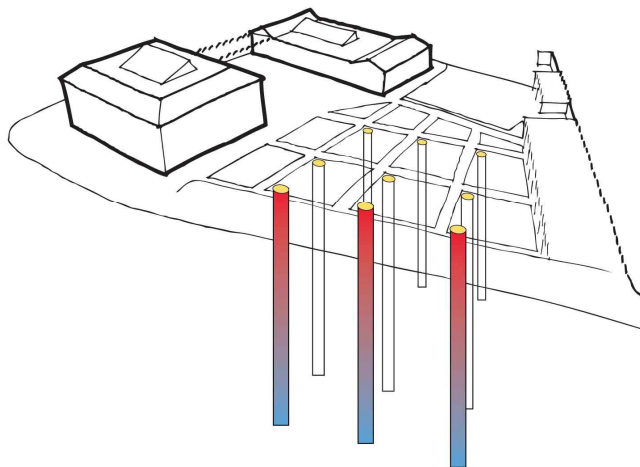
<sup>39</sup> American Wind Energy Association website <<http://www.awea.org>>

is then circulated, via gravity and hydraulic pressure, through a series of nine 300-foot-deep loops where the steady temperature of the ground brings the water to a temperature between 50 and 55 degrees Fahrenheit.<sup>40</sup> Water at this temperature requires less energy to be cooled in the summer or heated in the winter.



**Figure 108. Example of a translucent solar panel from Darmstadt's 2007 Solar Decathlon entry.**

### Closed Loop Geothermal Heat Pump



**Figure 109. Energy Strategy: On-Site Geothermal Circulation.**

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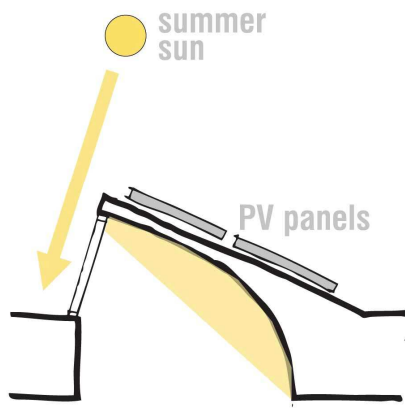
<sup>40</sup> Interview/design consultation with mechanical engineer Roger Chang.

## Daylighting

The daylighting strategies employed can be summarized as getting light into the building and getting light to move around the building. This involves the restoration of some existing elements, like the Event Building skylight and the windows, and the introduction of some new elements. The large windows in the existing exterior walls of the buildings introduce ample light at the perimeter. In order to maximize access to daylight throughout the building, skylights are used to admit light into the cores.

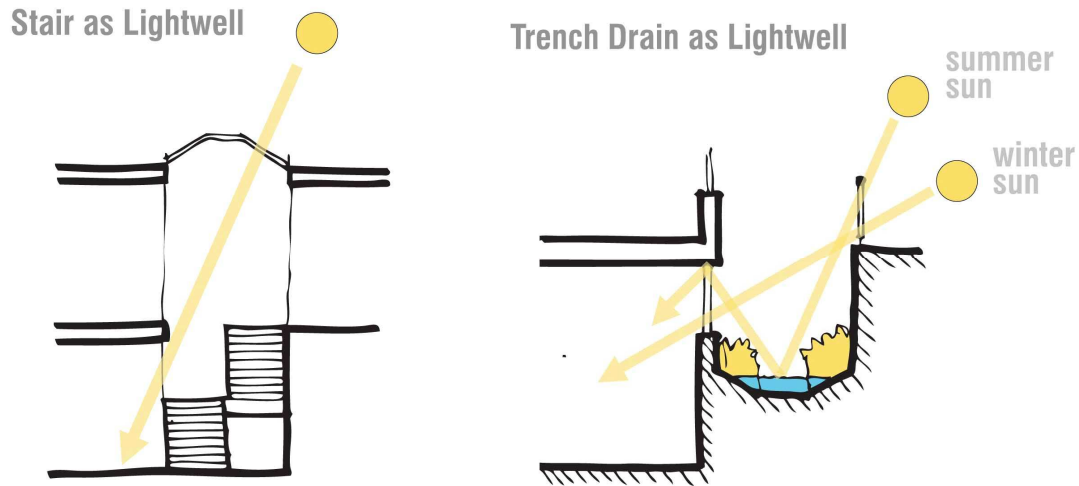
The light scoop above the Arts Building atrium is designed to permit steady light from the north sky while blocking direct glare from the south. Its curved profile maximizes the amount of light that is reflected down into the space.

### Light Scoop



**Figure 110. Daylighting Strategy: Light Scoop.**

In the Event Building, a skylight above the east stair allows light to illuminate not only the upper level corridor but also the basement level below. The basement currently has access to daylight only through clerestory windows, so both stairwells serve as light wells to bring light down below.



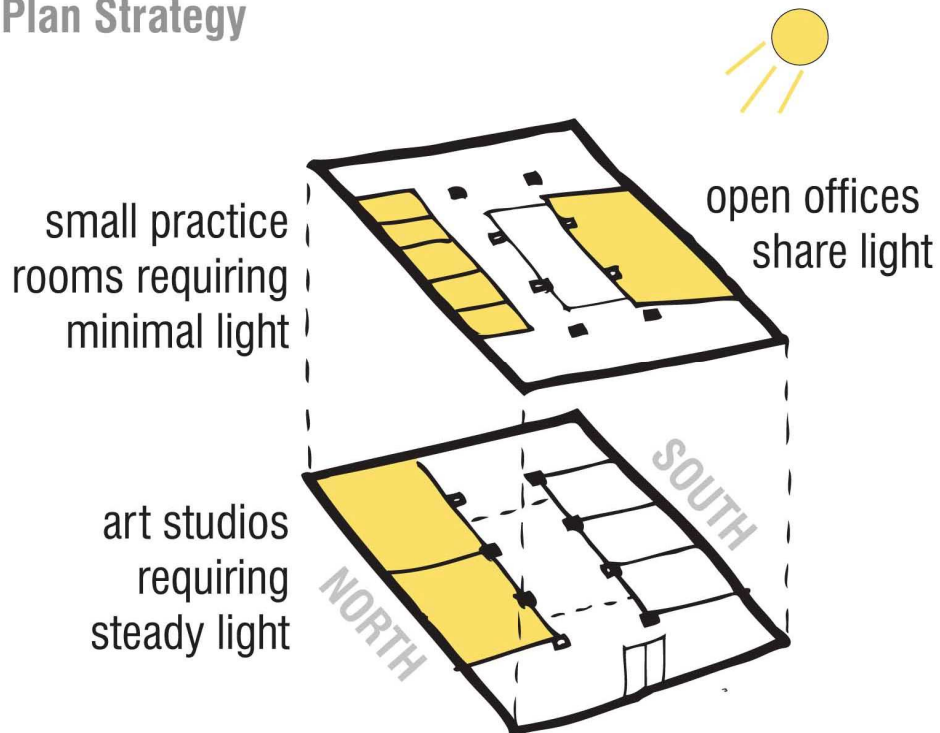
**Figure 111. Daylighting Strategy: Skylit Light Well.**

**Figure 112. Daylighting Strategy: Trench as Light Well.**

The width of the trench drain along the south side of the Event Building is sized to admit sunlight all year long, with shallow-angle winter sun penetrating the window directly and steep-angle summer sun reflecting off the surface of the water to illuminate the basement ceiling.

As a basic architectural strategy, pieces of the program were located in parts of the building that satisfied their daylighting requirements. In the Arts Building, the art studios are given access to the large north-facing windows in order to provide steady, diffuse light throughout the day. Located upstairs along the north wall are the small music practice rooms which have modest light requirements due to their size. The open offices are lit from both the north and the south by using low partitions within the space and a transparent partition between the office space and the atrium.

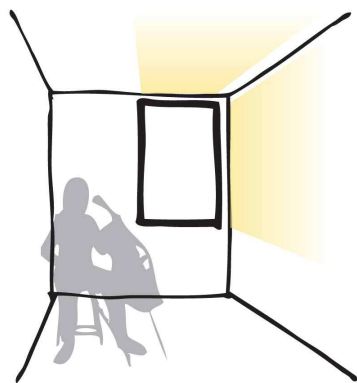
## Plan Strategy



**Figure 113. Daylighting Strategy: Plan Layout in Response to Light Requirements.**

Where possible, light-colored surfaces are located at the edges of windows so that they can reflect sunlight into the rooms. Illuminating a surface such as a wall or ceiling can be more effective than admitting direct sun because it creates diffuse light in the space rather than a differential between areas of light and shadow.

## Ceiling / Wall as Reflector

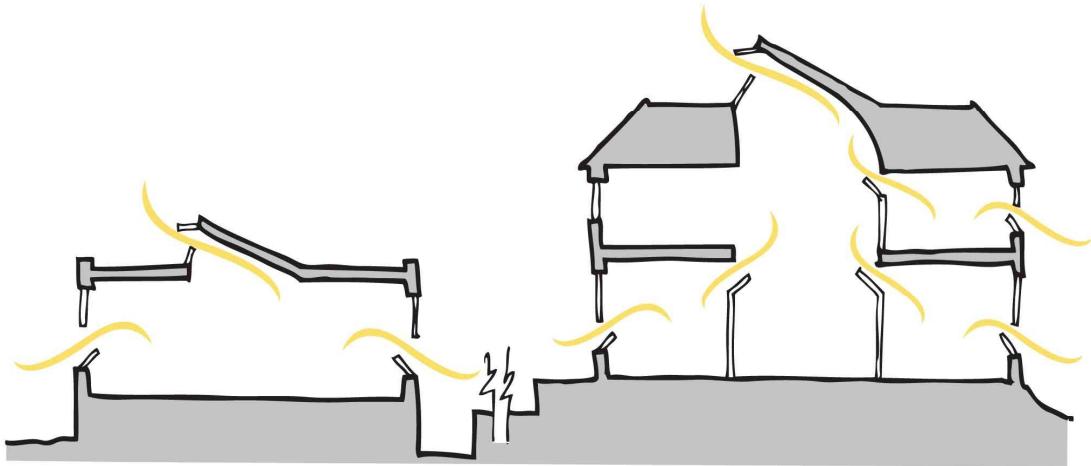


**Figure 114. Daylighting Strategy: Light-colored Surfaces as Light Reflectors.**

## Low-Energy Mechanical Systems

Natural passive ventilation is reintroduced to the buildings by restoring the operability of the lower window sashes and providing a path for air to circulate through the building via the stack effect. In the Event Building, the restored skylight provides the necessary high outlet in the event space, and existing attic vents above the gable roofs provide high outlets above the lounge and kitchen. In the Arts Building, operable sashes in the new light scoop provide the high outlet, and air flow between the exterior perimeter and the core is facilitated by operable transom panels in the walls surrounding the atrium.

### Natural Ventilation



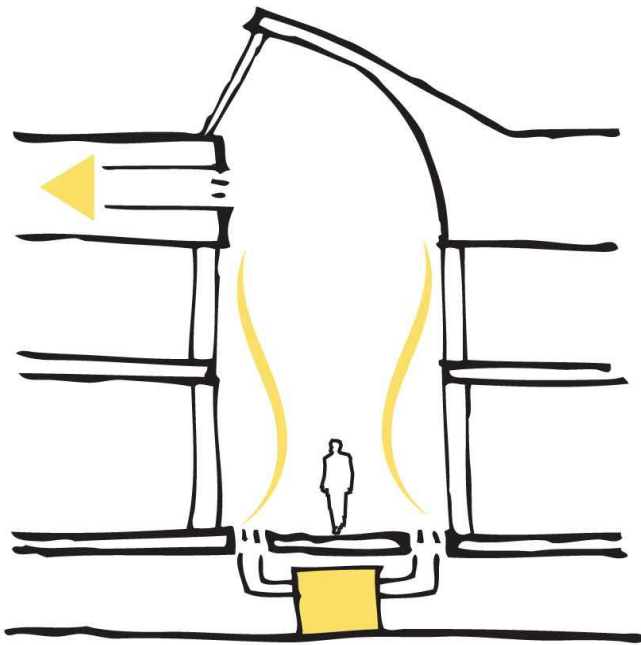
**Figure 115. HVAC Strategy: Natural Passive Ventilation.**

Displacement ventilation systems rely upon the heat of our bodies and building elements to induce stack ventilation. In the summer, cool air is introduced at the floor level at roughly ten degrees higher than in conventional cooled-air systems and using less fan energy. When the cool air at the ground reaches a warm object, such as a person or a structural element of high thermal mass, the cool air becomes warmer,



cooling the object, and rises, where it is recollected as return air. Displacement ventilation is ideal for large height spaces where it is only necessary to cool the lower, inhabited zone.<sup>41</sup>

## Displacement Ventilation



**Figure 116. HVAC Strategy: Displacement Ventilation.**

The use of radiant panels for heating and cooling was also considered and could easily be incorporated into the proposal. Radiant panels are surfaces, usually at the ceiling, which are heated or cooled by hot or cold water that flows through embedded pipes. The surrounding air is then heated or cooled convectively as it passes by the conditioned surface. Radiant panel systems require less energy than forced air systems and require small water pipes rather than large air ducts.

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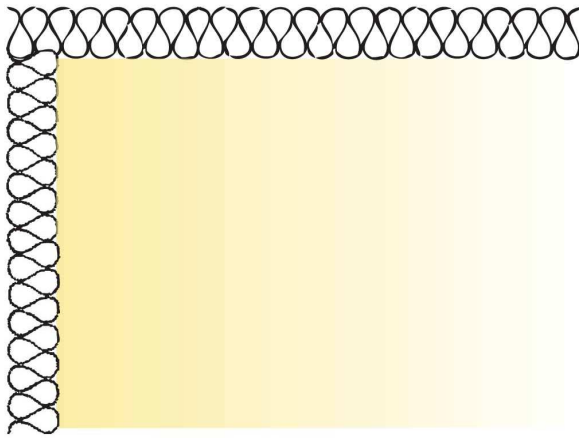
<sup>41</sup> Interview with Roger Chang.

## Heat Transfer Management

In order to reduce the heating and cooling loads on the mechanical systems, heat flow through the building envelope is minimized. The first strategy employed is adding additional insulation to the exterior walls and roof. A wall section detail is below.

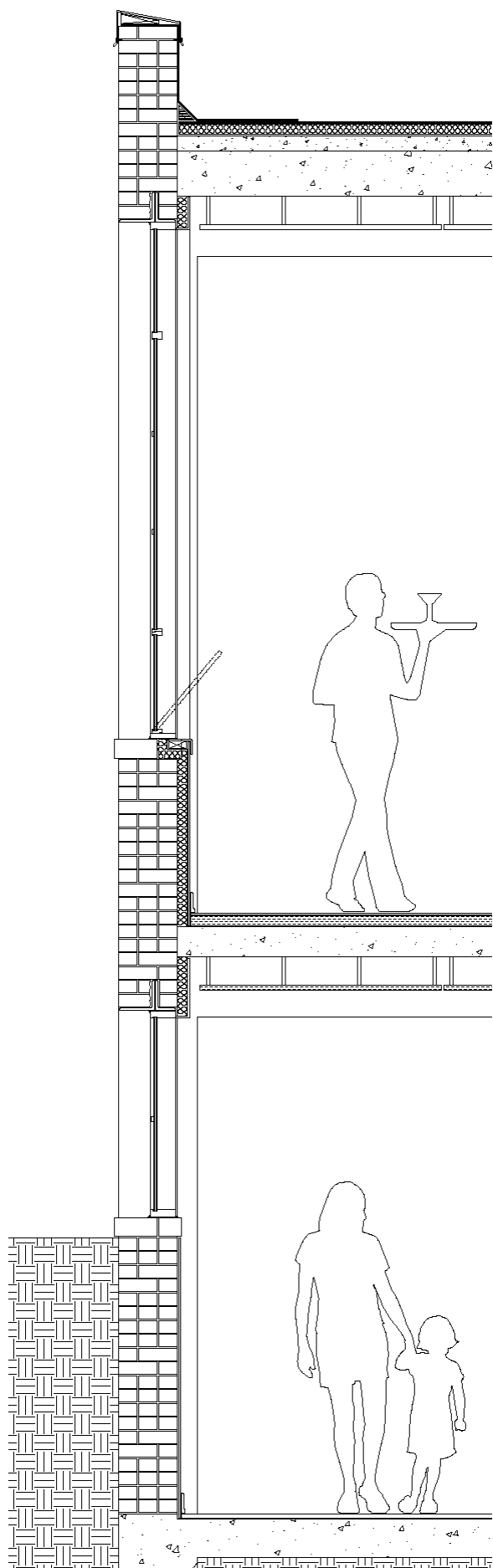
Insulation can be applied in sheets, such as batt insulation, or broadcast as a foam or cementitious material, depending upon the installation condition. Sheet insulation can be applied to a historic material and later removed without causing damage whereas foam and cementitious insulation will bond with the material and be difficult to remove.

## Envelope Insulation



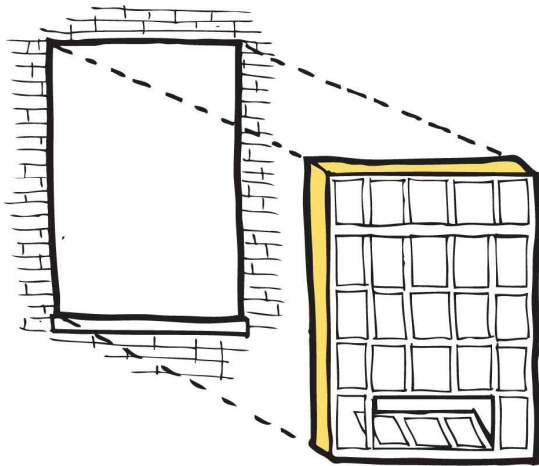
**Figure 117. Insulation Strategy: Envelope Insulation.**

**Figure 118. Event Building north wall section detail showing insulation and replacement window profile.**



Although a major sticking point for historic preservationists, the replacement of poorly insulating single pane glass windows can substantially decrease the amount of heat that is lost through the exterior walls. This is particularly important in the event space where the large windows constitute more than half of the exterior wall surface. Newer windows use double glass panes, inert gas-filled chambers, low-emissivity coatings, and thermal breaks to achieve an insulation value that is many times greater than a thin, steel, single-pane-glass window like those at the Dyers and Cleaners Building. In order to replicate the appearance of the historic windows from the exterior, replacement windows could be fabricated to the same dimensions and muntin spacing as the originals and the glass could be set toward the exterior side of the frame to hide the additional thickness.

## Window Replacement

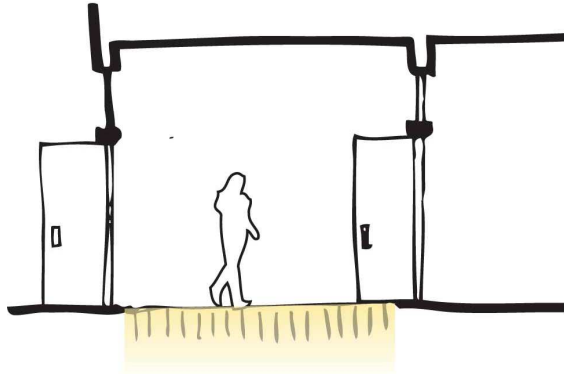


**Figure 119. Insulation Strategy: Thermal Insulating Window Units.**

Heat is lost when doors open and close, so each of the new exterior doors has been suited with an air lock double-door system. The floor of the air lock can also serve as

a means of filtering debris and particulates from outside before people enter the buildings, thereby improving the indoor air quality.

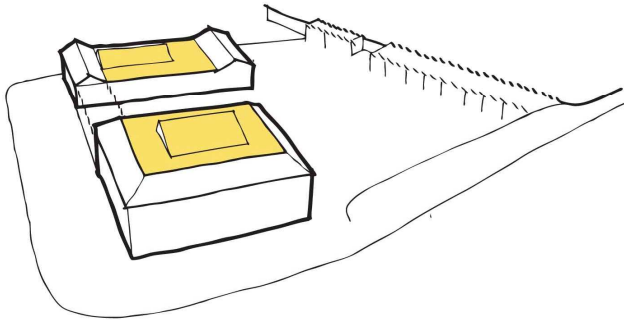
## Particle Filtration / Air Lock Entryway



**Figure 120. Insulation Strategy: Air Lock Entryways.**

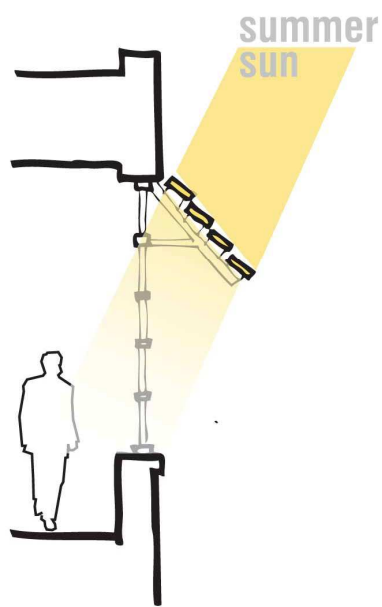
As discussed above, shading surfaces of the building and choosing reflective surfaces can reduce the amount of heat absorbed. This is especially important at south facing windows which are subject to direct sunlight throughout most of the day. Solar heat gain through the large windows along the south facade of the Event Building is mitigated by sunshades made of translucent photovoltaic panels. The sunshades are designed to block direct summer sun but permit low-angle winter sun. Since the windows are so tall, the sunshades do not block views to the exterior.

## High-Emissivity Roofing



**Figure 121. Solar Gain Management Strategy: High-Emissivity Roofing.**

## Translucent Photovoltaic Sunshades



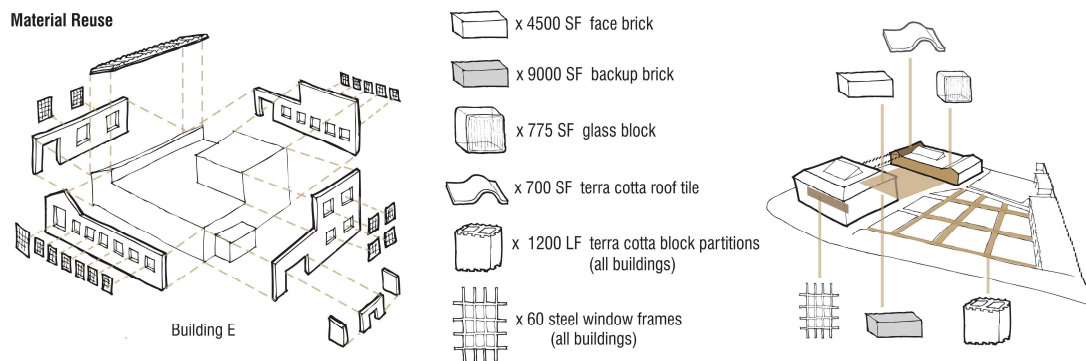
**Figure 122. Solar Gain Management Strategy: Window Shading.**



### 7.3 Treatment of Existing Materials

#### **New Uses for Old Elements**

In the interests of both preserving the historic fabric and minimizing resource consumption, new uses were found for the majority of material being removed from the buildings under this proposal. Most of this “excess material” comes from Building E and from the existing partition walls inside the Arts and Events Buildings. The interior partition walls are made of terra cotta block and plaster. The terra cotta could be crushed and used to pave the paths between garden plots.



**Figure 123. Material Strategy: Maximizing Material Reuse.**

The materials comprising Building E were surveyed and quantified. The 4,500 square feet of tan exterior face brick could be reused to pave the courtyard, fill in gaps in the Event Building facade, and reconstruct the retaining wall near the wind turbines. The 9,000 square feet of interior wythe brick could be crushed and used as infill under the courtyard, which had previously been excavated for the lower level of Building E. The 775 square feet of glass block could be used in the south facade of the Event Building and for the bridge over the trench that connects the event space to the courtyard. The green and yellow terra cotta roof tiles along the Georgia Avenue

facade were most likely removed from the back side of the gable roof of the Event Building. At present, the roof tiles are missing from this side of the gable, and the tiles above Building E appear to be of the same age and condition as those above Building B. The roof tiles could simply be restored to their original location.

There are a total of 60 windows at the site which would be replaced with thermal insulating window units under this proposal. The existing steel window frames could be melted down and recast to create new grillwork for the site, including drain covers, transom panels, and the screen wall inside the atrium.

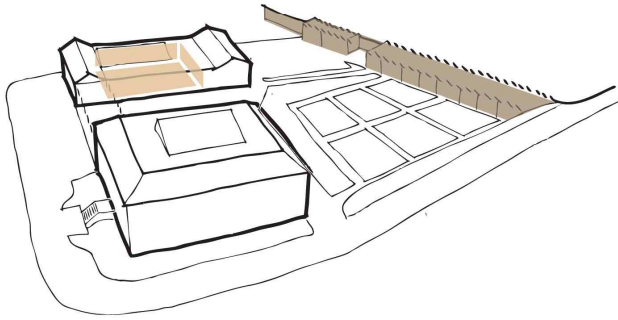
#### 7.4 Integration of New Materials

##### **Use of Salvaged and Rapidly Renewable Materials**

New materials being incorporated into the proposal are limited to interior partitions and finish materials and the components of the shed building at the rear of the site. These can easily be made of either salvaged, recycled, or rapidly-renewable materials. The shed building is wood, and although there is no wood on site to reuse, wood could be salvaged from another site in the area. Many of the interior finish materials are either wood, which could be bamboo or another rapidly-renewable species, or resin panels. As shown in the previous chapter, the east wall of the event space is a panel system that is made from bear grass that is cast in resin.

## **New Material**

**Locally Salvaged Wood**  
**Rapidly Renewable**  
**Interior Finish Materials**



**Figure 124. Material Strategy: Salvaged and Recycled Materials.**

## **Reversible Interventions**

One of the principles of the Secretary of the Interior's Standards is that any interventions should ideally be reversible so that a historic building may be restored to its condition prior to the addition of new material. Given the finality of the decision to demolish Building E, replace all of the windows, and recast the window frames for reuse, this proposal cannot honestly be regarded as reversible.

### 7.5 Improving Occupant Experience

## **Connection with the Outdoors**

As mentioned above, the value of providing daylight, views, and natural ventilation goes beyond the potential energy savings. Enabling building occupants to connect with the outdoors—that is, the sky, the sun, plants, fresh air, birds chirping—can substantially improve the occupant experience. This proposal provides building

occupants with both a visible and audible connection to the outdoors from inside and physical access to usable outdoor spaces.

### **Connection with History**

The linear spaces along the west side of both buildings are dedicated as gallery space. In addition to serving as a lobby/transition spaces and extensions of the portico/threshold, the galleries can be used to tell the story of the building. One of the conditions of the planning board's approval of the 2006 SmithGroup proposal for the site was that a permanent exhibit about Arthur Heaton and the National Association of Dyers and Cleaners be included in the new building.<sup>42</sup> The gallery spaces are sized to accommodate both exhibits about history—Heaton, the NADC, dry cleaning, the buildings, and Silver Spring—and about the site's current identity. Works of art made by users of the Cultural Center and information about their native cultures could be shared and celebrated. As people enter the buildings, they would be oriented to the palimpsest that defines this place.

### **7.6 Design for the Future**

#### **Flexibility**

As mentioned at the end of Chapter 6, the proposal is designed to be flexible both spatially and in terms of the materials used. Many of the spaces could be staged for meetings and performances of varying sizes. Certain spaces can be combined or spill out into each other. Retractable partitions in the classrooms and art studios allow two

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<sup>42</sup> Montgomery Country Department of Park and Planning memorandum dated 14 Jul. 2009.

spaces to become one. Both of those spaces can spill out into the atrium, and both the art studios and event space can spill out into the courtyard.

All interior partitions are designed to be modular insertions into the structural frame so they could be reconfigured as needed in the future without major demolition.

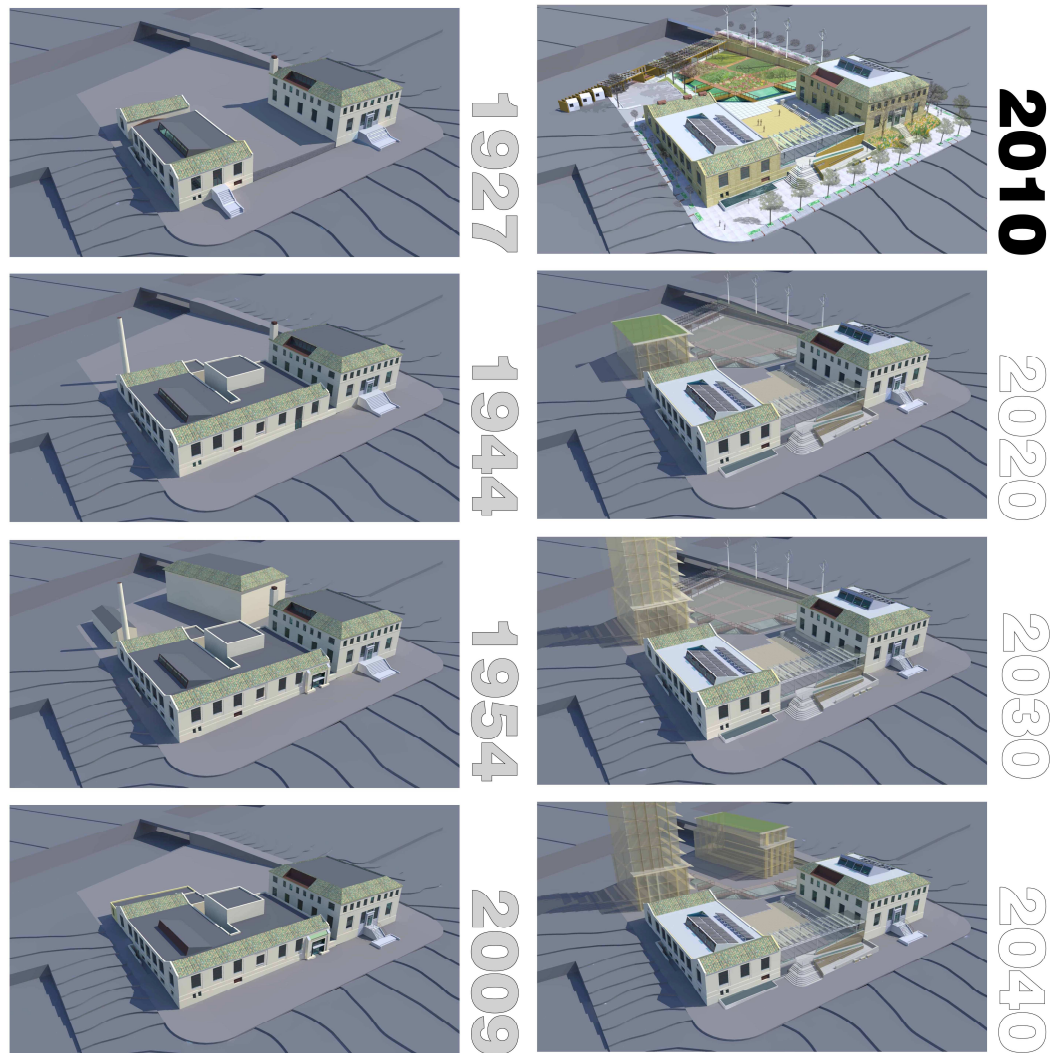
### **Operations and Maintenance**

In order for sustainable building systems to be truly effective, building users must be educated, trained, and reminded of how their actions contribute to making the building work as designed. The installation of monitoring devices and regular audits of building energy use and actual interior conditions are also necessary to ensure that the design intentions are achieved.

### **Planning for Future Growth**

In order to maintain the economic sustainability of the site in the future, a plan for adding density to the site over time was developed. This phased development plan assumes that the need for additional program space will increase steadily over time and that the owners of the New American Cultural Center, presumably a non-profit entity, would expand in phases due to the nature of fundraising. The potential of this proposal for immediate developer-financed development will be discussed below.

Note that the representation of new development in the timeline is intended to convey massing and scale only with some implication that solar shading would be integrated into the facades. The images are not intended to convey a certain architectural style or literal appearance.



**Figure 125. Timeline showing proposed phasing of future expansion.**

After the current proposal is realized, the next phase in the development of the site (“2020”) would be to add a new building of a height compatible with the historic buildings to the area occupied by the parking lot. The assumption is that increased population density in Silver Spring and the Washington, D.C. area will spur the development of adequate public transportation systems that will negate the need for using private cars to access the site.



During the next phase (“2030”), the new building would be extended upward as a tower in order to preserve the open, permeable space in the southeast quadrant. The tower would be set back slightly from the existing base to preserve the datum established by the roofs of the historic buildings. Anticipating this future vertical expansion, the structure of the first new building would be designed to accommodate the tower.

Should development pressure ever reach a point where maintaining open space is no longer economically viable, a second building could be erected along Philadelphia Avenue (“2040”). The massing of the second building is designed to maintain solar access to the south facade of the tower building. Once taller buildings are constructed at the rear of the site, the proposed wind turbines would be located within a wind shadow and no longer viable. Wind collection could then be moved to the roofs of the new buildings. The new buildings could also have photovoltaic panels integrated into their facades and roofs.

## Chapter 8: Conclusions

### 8.1 Public Review

This thesis was presented for public review on November 16, 2009 at the School of Architecture, Planning, and Preservation at the University of Maryland.



Figure 126. Layout for the public presentation.

Overall, jury comments at the public review focused on issues of urban design, program, and circulation in the design proposal rather than on the topic of this thesis. The selection of a program for the building was necessary in order to thoroughly develop this project, however, the design of a “New American Cultural Center” could be a thesis project in and of itself. The intention of this thesis was to explore how historic buildings (and really all existing buildings) could be adapted to become tools for the conservation of the environment rather than environmental liabilities.

Given the intention to preserve the historic buildings, one juror questioned whether the current extents of the Georgia Avenue facade should be maintained, even if the rest of Building E were demolished. The massing studies shown below document the process of determining how much of the existing buildings to keep and where to add new elements to the site. Based on those studies, I decided that creating a visual and

physical connection between the sidewalk and the courtyard was fundamental to expressing the courtyard as public space and welcoming visitors to the new campus.

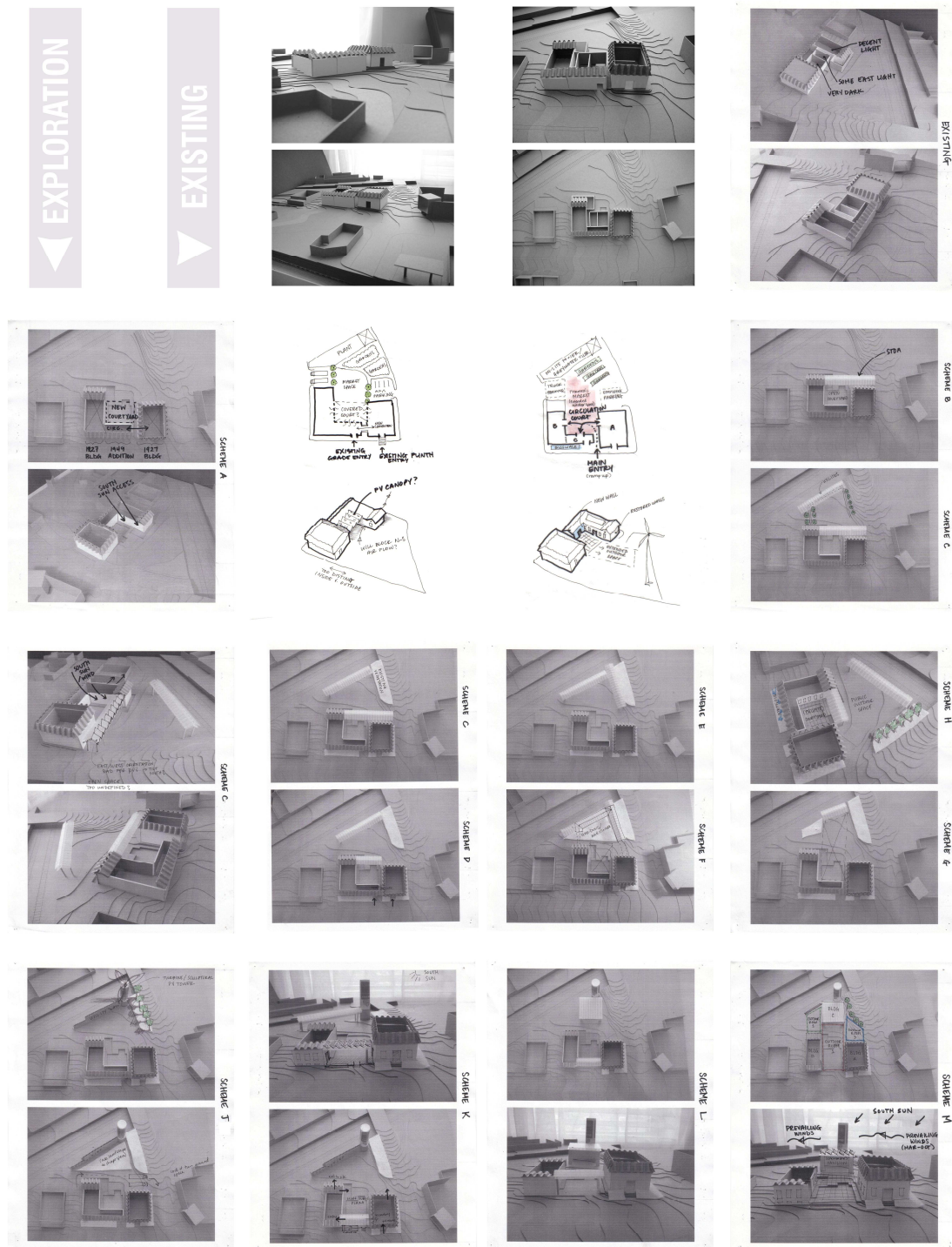


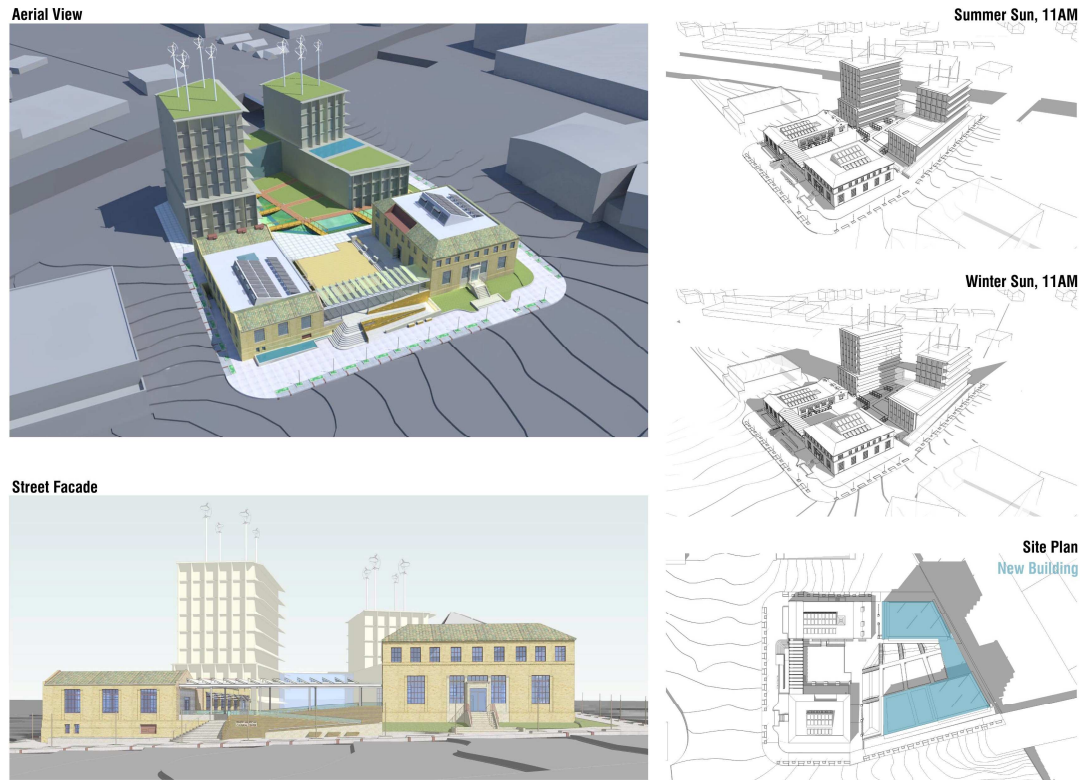
Figure 127. Documentation of massing exploration in model form.

One of the most interesting comments was offered by Margaret McFarland, the director of the Real Estate Development program. Ms. McFarland stated that, in her opinion, the design proposal had the potential to become a developable project in the near future if the full density shown in the 2040 timeline image were built at once. The idea was that income generated by the new construction could finance the rehabilitation of the historic buildings. After a follow-up meeting with Ms. McFarland, I explored the possibility of creating a higher density proposal that might be economically viable for a developer while also preserving the historic buildings and their proposed sustainable interventions.

## 8.2 Potential for Private Development

Margaret McFarland's comments expand the notion of sustainability to include economic sustainability and therefore warranted further exploration. The revised proposal below assumes that a new multi-family residential building would be constructed at the rear of the site while the front of the site and the historic buildings would be developed as previously described.

The SmithGroup proposal covers nearly the entire site with a 9-story tower, providing approximately 200 new dwelling units. Their proposed scheme preserves only the street facades of Buildings A and B while occupying their entire footprint. A revised site proposal which prioritizes sustainable development and maintaining the historic buildings is necessarily limited to far fewer units. Assuming that the SmithGroup proposed height of nine stories maximizes the zoning restriction, the new massing scheme proposes two east-west bar buildings, each with a narrow tower, connected by



**Figure 128. Proposal for sustainable high-density residential development on the site.**

a glass atrium. One goal of the new scheme is to provide solar access to as much of the new building as possible and to avoid shading the historic buildings. Other goals include maintaining a portion of the open space, maintaining the bioswale, and providing limited visual access to the Metro.

This scheme provides space for 75 new dwelling units. Developing the site in this manner results in the loss of the garden plots and viable access to sunlight at ground level. Introducing a new building with a separate program raises questions about the relationship of the two elements to each other and about ownership of the outdoor spaces. In the end, both elements are compromised. The lesson learned may be that the proposal is not viable for private sector development if the goals of sustainable

design and historic preservation are upheld. This indicates that public sector development may be required for this type of project.

### 8.3 Sustainable Design Legislation

Historic preservation legislation could potentially be studied as a prototype for the development of sustainable design legislation. Both interests mandate public sector involvement since they concern communal resources and the potential for either shared benefits or shared losses. Neither interest comes with the short-term financial incentives that would make it achievable through private sector action alone.

Sustainability rating systems such as LEED provide one method of legislating a baseline for environmental performance. However, if the ultimate goal is to find a way to build that either has a net zero impact or somehow enriches the condition of the natural environment, then the implementation of standards must constantly evolve.

### 8.4 Reflections

Though it is very commonly used, the term “renovation” is conspicuously absent from the Secretary of the Interior’s Standards for the Treatment of Historic Properties. The word “renovate” comes from the Latin prefix *re-* meaning “again” and the word *novare* meaning “to make new.”<sup>43</sup> What the Standards recognize is that attempting to make a historic building new again is to miss the point of preservation. Buildings, like everything else, change over time, and the evidence of time is what makes a historic building significant. The power of experiencing history through

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<sup>43</sup> The American Heritage Dictionary, 2<sup>nd</sup> College Edition.



buildings is that by occupying the same spaces and looking at the same objects we start to understand how our ancestors felt and experienced the world. This allows us to place ourselves in the context of human history and perhaps come to understand ourselves and each other better.

The ability to relate to people who lived at different points in time from oneself is a fundamental driving force behind the sustainable design movement. If we consider how our descendants will feel in the future and what they will need to thrive, then the mandate to develop a way of life that can be sustained on this planet is clear.

#### 8.5 Sustaining the Dialogue

The exploration of how existing buildings of all types can be retrofitted to improve environmental performance is ongoing. It requires the collaboration of many people with a variety of expertise and new ideas. For anyone who has read this thesis document and would like to continue the conversation, please contact me at [saralangmead@gmail.com](mailto:saralangmead@gmail.com).

*-Sara Goldfarb Langmead, December 2009*

## Glossary

<b>Aquifer</b>	Underground layer of porous sand or rock through which fresh water travels
<b>Bioswale</b>	Negative landform that retains stormwater for the purpose of natural filtration through plant and microbial action
<b>Character-Defining</b>	Feature of a building that contributes to its historical character
<b>Composting</b>	A controlled biological decomposition of organic wastes into a stable product that can be used as a natural soil amendment <sup>44</sup>
<b>Embodied Energy</b>	The amount of energy consumed to produce a product, including the energy needed to mine or harvest natural resources and raw materials and to manufacture and transport finished materials <sup>45</sup>
<b>Emissivity</b>	The ratio of radiation intensity from a surface to the radiation intensity at the same wavelength from a black-body <sup>46</sup> at the same temperature
<b>Heat Island Effect</b>	Increased temperatures at ground level in developed areas due to the absorption of solar radiation and subsequent release of thermal radiation by objects of high thermal mass such as buildings and pavement
<b>Integrity (historic)</b>	The ability of an object or material to express its historic significance in its present condition.
<b>Interpretive Period</b>	Limited period in history from which a building derives its historic significance (e.g. the years when a famous historical figure lived there or when a notable event occurred)
<b>Peak Direct Runoff</b>	The volume of rainwater in excess of what the ground can absorb during a storm event
<b>Vermicomposting</b>	The use of worms to ingest and metabolize organic wastes to reduce the overall volume and produce a stable product that can be used as a natural soil amendment

<sup>44</sup> EPA website <<http://www.epa.gov/greenhomes/TopGreenHomeTerms.htm>>.

<sup>45</sup> Ibid.

<sup>46</sup> The American Heritage Dictionary, 2<sup>nd</sup> College Edition.

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