CHANGING MINDSETS: SUSTAINABLE DESIGN IN HISTORIC PRESERVATION

A Thesis

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by

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ABSTRACT

At a time of rapid resource depletion and world population growth historic preservation rests at a pivotal point in the advancement of sustainable development and design. Historic preservation is inherently sustainable. Unfortunately, current green building practices focus more on the ever-growing technological innovations that can be applied to new construction. A lack of education and collaboration amongst historic preservation and sustainable design practitioners, scholarly research and publications that join the two fields, and building research, pose additional roadblocks in greening historic preservation in the United States.

The question is whether or not historic preservation and green building practice can effectively work together. They can and they do. The key to integration is the changing of mindsets. Educating industry stakeholders as to how and why this linkage can be made is a vital component to effectively taking green building and historic preservation to higher elevations of outreach and implementation. This paper investigates this statement in two ways, by [1] providing a theoretical and evolutionary framework of sustainable design and the inherent role that historic preservation plays within it, and [2] comparing the two sets of standards that guide the two practices: in historic preservation it is *The Secretary of the Interior's Standards for Rehabilitation* and in green building it is the widely used Leadership in Energy and Environmental Design (LEED™) rating system.

The methodologies used to substantiate these points are varied. They include a literature review of sustainable development publications, a brief survey of the 'green' education of State Historic Preservation Officers (SHPO), an analysis of the LEED New Construction (NC) and Existing Building (EB) rating systems and their considerations of historic preservation, and a case study analysis of the green

rehabilitation/renovation of the Jean Vollum Natural Capital Center in Portland, Oregon. Combined, this analysis proves that historic preservation is inherently sustainable in the most basic sense, and as a result lends itself to green building rating systems.

However, it also proves that there are many kinks to be worked out on both sides before a full integration is a reality. The rules and regulations surrounding *The Secretary of the Interior's Standards for Rehabilitation* and LEED can be cumbersome, and this paper is a reminder that while both systems are worthy tools in the stewardship of natural and cultural resources, they are not hard and fast rules. They are basic guidelines, and the fusion of the two holds the potential to more closely align the fields of historic preservation and environmental conservation, and to allow the field of historic preservation to assert itself as a viable and integral means to promoting sustainability.

BIOGRAPHICAL SKETCH

Jennifer Lynn Buddenborg was raised in the Great Lakes State in metropolitan Detroit. She attended Wayne State University in Detroit where she earned a Bachelor of Arts in History with a minor in Anthropology. After two and a half years working as a Research Development Coordinator for a social anthropologist at Wayne State University's Institute of Gerontology, and as a last hurrah before beginning graduate studies, Jennifer set off on a five month thru-hike of the Appalachian Trail from Georgia to Maine. Already possessing a deep interest in the ties between historic preservation and environmental conservation, it was the simple living amongst nature over this 2,174 mile footpath that first introduced her to a sustainable way of life. She tailored this new perspective to her studies at Cornell University and life in Ithaca, New York, where she became involved in the burgeoning field of sustainable design in historic preservation.

ACKNOWLEDGMENTS

After completing my thru-hike of the Appalachian Trail I was told by a number of people that I could accomplish anything in life. I knew, however, that writing a Master's thesis would present me with a formidable task. This proved true. Hence, I have many people to thank for providing guidance and motivation throughout the thesis writing process.

First and foremost I would like to give gratitude to my advisor and friend, Michael Tomlan. He kept me afloat in any number of ways, always with the bright light of knowing that we were "moving right along." Jack Elliott, my second Committee Member, provided the yin to the yang, offering the valuable insight of a LEED accredited professional and, more importantly, the perspective of a like-minded sustainable-living advocate. I could not have asked for a better pairing of minds.

My Cornell preservation colleagues: My time in Ithaca would not have been the same without the close ties I made with Alec Bennett, Liz Blazevich, Jayme Breschard, Jess Evans, and Matt Gundy. Sara Shreve, a late installment in our initial group of six, became my compatriot in the world of thesis, and good friend. In addition, all of the amazing friendships made during my extra year in Ithaca, and those friendships that followed me to Ithaca, provided much needed support and, oftentimes, mind-clearing distraction.

A certain gap-toothed friend, who shall remain somewhat anonymous, deserves special thanks for never giving up faith in me. And of course my family, who ever so gently poked and prodded, providing unceasing support. It is my parents, I believe, who deserve the accolades for this thesis, for without their love and encouragement, I may never have landed where I have today.

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INTRODUCTION

In an age when natural resources are becoming scarcer by the minute, perhaps even the second, the conservation and preservation of the existing built environment becomes a basic priority. The concept of sustainability in all of its various forms and definitions has become common to our everyday vocabulary. In the world of architecture it takes on various monikers, including 'high-performance design,' 'integrated design,' 'sustainable design,' or 'green building.'

Buildings negatively impact people and the environment through the over-consumptive use of virgin materials like wood and minerals, energy resources, and water, and the production of waste and unhealthy indoor air. They account for one-sixth of the world's freshwater withdrawals, one-quarter of its wood harvest, and two-fifths of its material and energy flows.[1] Such significant resource use wreaks havoc on our environment, causing deforestation, air and water pollution, stratospheric ozone depletion, and the risk of global warming.[2] And within the construction of most modern buildings about half of the energy used in the building construction and operation is expended in creating an artificial indoor climate in heating, cooling, ventilation, and lighting systems, a climate that often leads to sick building syndrome.[3] These numbers alone should encourage the preservation and green retrofit of our existing built environment to reduce resource use and health threats, as opposed to the wasteful enterprise of demolition and new construction.

In fact, in the United States, 48 percent of the waste stream, or 65 million tons per year, comes from building demolitions, 44 percent or 60 million tons per year,

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[1] David Malin Roodman and Nicholas Lenssen, *A Building Revolution: How Ecology and Health Concerns are Transforming Construction,* Worldwatch Paper 124 (Washington, D.C.: Worldwatch Institute, March, 1995), 5.
[2] Ibid.
[3] Ibid., 33.

results from building renovations, with another eight percent, or 11 million tons per year, leaving construction sites.[4] Much of this waste can be reused or recycled instead of being abandoned in a landfill. And, to add insult to injury, the average home size has risen since World War II even as family size has shrunk. Floor space per person more than doubled in new single-family houses in the United States between 1949 and 1993.[5] Continuing urban sprawl only worsens the situation. We are outpacing our available resources.

Sustainable design has become an answer to halting this apparent disregard for our natural and cultural environments. One form of sustainable design is building reuse where the embodied energy of the original structure is kept intact. The field of historic preservation in the United States began recognizing the inherent ties between sustainable design and historic preservation during the Energy Crisis of the 1970s when what was then known as energy-conscious design entered the architectural arena. A period of general silence concerning this topic ensued in the 1980s, to be reinvigorated in the early 1990s with a newly intensified approach to sustainable design in architecture, most commonly referred to as green building. Since then a good deal of discussion and burgeoning research has begun swirling around in this area of study, with a particular focus on how green building and historic preservation complement one another and the technical building means of achieving a fusion between the two.

Our building stock places such a significant strain on the environment with its current footprint that to build anew without taking into account the re-use of existing buildings is foolhardy, even if the design is 'sustainable' or 'green.' The first consideration in sustainable design should be the preservation, and retrofitting if

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[4] U.S. Environmental Protection Agency, "Characterization of Building-Related Construction and Demolition Debris in the United States," Report No. EPA 530-R-98-010, June 1998.
[5] Roodman and Lenssen, 8-9.

necessary, of existing building stock. Unfortunately, current green building practices in the United States focus more on the ever-growing technological innovations that can be applied to new construction, thereby effectively ignoring the inherent sustainable benefits of historic preservation.

As definitions and theories of sustainable design have developed over the past two decades so too have guidelines and standards for green building application. The attempt to standardize green building practices for widespread application has resulted in numerous green building rating systems. In the United States the most widely applied rating system is the Leadership in Energy and Environmental Design (LEED™) rating system designed by the U.S. Green Building Council (USGBC).

The LEED rating system and other rating systems established at state or local levels are increasingly being applied to historic preservation projects. In the eyes of trained historic preservationists, some of these projects are deemed successes and others failures in regard to preserving the historic integrity and character of a building while retrofitting it with green building elements. But what is found through historical research is that the green building and historic preservation movements followed very similar evolutionary patterns, both guided by a set of standards and promoted by federal, state, and local regulations and financial incentives. However, despite their similarities of development, they often act as two separate camps of historic preservation and environmental conservation. A fusion of these two ways of thinking, accomplished through the greening of historic buildings, could potentially strengthen the stewardship of entire landscapes and that protected within their bounds.

One of the main roadblocks in bringing together historic preservation and green building is the lack of education in the professional realm. Both green building advocates and historic preservationists need to possess a shared knowledge in order for a fusion to take place. Many professionals on both sides are not educated as to the

benefits of both practices and how they can work together, particularly from a policy standpoint, in regard to standards, regulations, and incentives. As a result, standards like LEED do not adequately recognize historic preservation. Likewise, the *Secretary of the Interior's Standards for Rehabilitation* (Standards)[6] have not yet been broadly applied in instances of green historic retrofits and so are ambiguous and ill-defined in this form of application.

Indeed, a survey used to gauge the level of awareness of the application of green building practices to historic preservation projects across the United States, sent to the State Historic Preservation Officers (SHPO), sheds light on the current status of this problem.[7] With a 20 percent return rate from states across all regions of the United States, the survey shows that all respondents are aware of the LEED rating system, which is quite positive. However, only three of the eleven respondents have worked on rehabilitations/renovations that were LEED certified. Of those that have not, two states, New Jersey and North Carolina, anticipate working on these project types in the future. These two states have also worked on rehabilitation projects that were considered 'green' but that did not follow the LEED standards. For instance, the New Jersey office has worked with the State's Green Homes Funding that uses the New Jersey Energy Star program, although the respondent did mention that these retrofits are generally not sympathetic to the historic fabric of a building.

Only two of the eleven respondents have undergone some type of LEED training and/or accreditation. The Kansas SHPO works with LEED accredited

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[6] See Appendix A for the Secretary of the Interior's Standards for Rehabilitation.

[7] See Appendix B for the survey template. This survey was sent to the National Conference of State Historic Preservation Officers (NCSHPO) e-mail list-serv that reaches all 51 SHPOs in the fall of 2005. Responses were received from the following states: Delaware, Kansas, New Jersey, New York, North Carolina, North Dakota, Pennsylvania, Texas, Virginia, and Washington. Although the small number of respondents places an obvious limitation on the results, the regional spread of respondents provides a good sense of the awareness of this topic across the U.S. Further surveying is necessary to gain a more comprehensive understanding of the awareness and application of green building in the state offices.

architects but none of the preservation staff has been trained. And even though some of these states administer LEED regulations and incentives at the state level, like Texas and Washington, only North Carolina identified itself as being part of a statewide 'green government initiative.' These results show an obvious hole in the practice of green building application and its associated benefits to historic preservation.

In addition, green building advocates, although having made significant impacts over the past decade, are still trying to make a convincing case for building green, particularly when cost benefits are taken into consideration. This is further hindered by the lack of building-related research in the United States. While the design, construction, and operation of buildings comprises 20 percent of the U.S. economy and consumes more than 40 percent of energy used and pollution generated, less than one percent of the federal research budget is directed towards buildings. In comparison, the European Union allocates six times more building research funding than the United States.[8]

Research in historic preservation and green building is very much in its nascent stage. A literature review reveals that little has been published regarding this topic since the 1970s energy-conscious design phase. No National Park Service (NPS) Preservation Brief on sustainable design has been written since the 1978 publication of *Preservation Brief No. 3: Conserving Energy in Historic Buildings*. Short articles have been written on the importance of this matter and the need for more research, and annual conferences held by the National Trust for Historic Preservation and the Association for Preservation Technology are now bubbling with green building sessions, but there still exists a dearth in published materials.

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[8] April Smith, "Building Momentum: National Trends and Prospects for High-Performance Green Buildings," (Washington, D.C.: U.S. Green Building Council, 2003), 2.

It is this shortcoming that motivates the research contained herein. The intended reader will possess a basic knowledge of historic preservation practice. This thesis serves to define sustainable design in the realm of historic preservation within the United States. Broadly, the goal is to introduce a new way of thinking about and implementing historic preservation and to strengthen the ties between the natural and built environments; in other words, to change mindsets. More specifically, it attempts to answer the question of whether or not the LEED rating system can be applied to historic preservation, rehabilitation, and restoration without compromising the historic integrity and character of a building or site. The hypothesis is that historic preservation is inherently sustainable in the most basic sense, and as a result lends itself to these rating systems, just as LEED and other rating systems lend themselves to historic preservation.

This is proven in a systematic manner, by [1] defining sustainable development and design, [2] understanding the evolution of sustainable design and green building in relation to historic preservation, [3] analyzing the LEED rating system, [4] comparing LEED and the Standards to see how well the green building rating system complements the regulations set forth for historic rehabilitations in respect to the Standards, and [5] dissecting one of the more well-known case studies that involved the greening of an historic building to provide an example of the physical application of sustainable theory and green building to an historic preservation project: the Jean Vollum Natural Capital Center in Portland, Oregon, a LEED Gold certified project.

This approach involves various types of methodologies, with the goal of providing a conceptual and physical understanding of sustainable design in historic preservation for preservation and green building practitioners, government officials and advocates. To gain a good sense of where green building currently stands and how it arrived there, a literature review of sustainable-related publications was

conducted. An initial search selected writings that addressed both historic preservation and green building, but, upon realizing the dearth of such materials, aside from several recent journal articles and conference presentations and 1970s energy-conscious sources, a broader search was conducted that largely rested on more well-known sustainable design publications that outlined the basic tenets of sustainability and sustainable design, many of which tangentially addressed historic preservation.

A review of pertinent internet sources such as the USGBC and Building Green websites was also undertaken to gain up-to-date information. Oral interviews of preservationists at the federal, state and local levels were conducted to get a sense of the current awareness of this topic, in addition to the survey that was sent to the SHPO offices. In most cases these preservationists were interviewed, along with architects and project managers, because they were linked to a particular historic green retrofit project.

The LEED New Construction (NC) and Existing Buildings (EB) rating systems were analyzed point by point to see how well they complement historic preservation practice and the regulations set forth for historic rehabilitations in respect to the Standards. Analytical pieces on LEED provided a window to the faults and successes that reside in the system. In addition, ongoing email communication with the USGBC offered constant updates on statistical and project-based information.

Initially, three case studies were to be analyzed: the Marmaduke Forster House in Pleasantville, New York; the S.T. Dana Building in Ann Arbor, Michigan; and the Jean Vollum Natural Capital Center (more commonly referred to as the Ecotrust building) in Portland, Oregon. Site visits, field research, and oral interviews of the project players were conducted for each of these case studies. Upon further investigation, the Ecotrust building proved to be the most representative in regard to the thesis goals. The Marmaduke Forster House was still in the early stages of

completion with too many question marks attached to the intent of the project, and the S.T. Dana Building forsook the Standards for more ease with green building applications; therefore, they were not model studies. The Ecotrust building is one of the earliest green renovation examples of an historic building and the first historic renovation to attain LEED Gold certification and, because it is located in a city that prides itself on progressive, sustainable-minded thinking, is an ideal model for future like-minded projects.

To fully appreciate the Ecotrust project requires a firm footing in sustainable thought and process. Chapter One introduces the concept and theory of sustainable development in an attempt to ease the ambiguity of this fuzzy term. It is defined in its broadest sense, in its design application, and finally in its relation to historic preservation. Key characteristics of sustainable design are gathered and synthesized from leading thinkers in architecture, planning, urban design, historic preservation, ecology, and human health.

Chapter Two offers background in the genesis and definition of sustainable development and design, providing an evolutionary context for the current application of green building and its connection to historic preservation. It attempts to prove that history does indeed repeat itself and that the history of sustainable development is no exception to this rule. Three eras in this evolution are identified as shaping modern sustainable thought: the Industrial Revolution and the machine age, post-World War II development, and 1960s and 1970s environmentalism. An examination of the people, policies, and practices within each of these phases leads to a discovery of a similar alignment between the growth of the historic preservation and green building movements, providing a clear vision of how modern sustainable design has come to be.

Chapter Three discusses the development of the LEED rating system, its design and make-up, and its criticisms. The LEED-NC and LEED-EB rating systems are closely analyzed as they are the oldest, most widely applied, and currently the most applicable of the LEED systems to historic preservation projects. The purpose of this chapter is to inform the reader of the workings of LEED in preparation for the following chapters that explain how it and the Standards can be fused together.

Chapter Four compares LEED and the Standards in a critical context to clearly pinpoint their parallels and disjunctions. The inherent parallels between historic preservation and green building identified in Chapter Two are placed in a context of design standards. A listing and partial dissection of LEED certified historic preservation projects completed to date provides a broader understanding of the success of joining the two sets of standards. What becomes apparent is that these standards share a similar set of values and goals and, thus, have the great potential to further coalesce the historic preservation and environmental conservation movements.

Chapter Five brings together the previous chapters in an in-depth analysis of the green renovation of the Ecotrust building in Portland, Oregon. Located in a rapidly developing neighborhood known as the Pearl District in downtown Portland that was a former industrial area of warehouse buildings and rail yards, this LEED Gold certified project combines the use of green building and historic preservation standards to successfully marry old and green. A look at the progressively minded Portland setting with its many green policies and regulations, the project site, and the innovative strategies utilized to emphasize the historic integrity and integrated design of the renovation of this former warehouse, and the greening of historic preservation is brought to reality.

The results of this analysis will clarify the theoretical and practical role of historic preservation in sustainable design. Conceptually, it will allow the field of

historic preservation to assert itself as a viable and integral means to promoting sustainability. Awareness of this new identity at the professional and non-professional level is of the utmost importance in redefining historic preservation in this sustainable age—to change mindsets.

CHAPTER I

Sustainable Design: A Fuzzy Concept or a Concrete Goal?

Sustainability is the buzzword in development circles across the globe. It sounds promising. To sustain means to prolong or nourish,[9] to follow a long-term path of viability, but this definition becomes vague when applied to development. The ambiguity surrounding the definition and applications of sustainable development is perhaps its largest criticism. This chapter attempts to bring greater understanding to the term 'sustainability,' its connection to design, and its meaning and application to historic preservation.

Sustainability is what Ann Markusen, Director of the Project on Regional and Industrial Economics at the Hubert H. Humphrey Institute of Affairs, calls a "fuzzy concept." It is one that "posits an entity, phenomenon or process which possesses two or more alternative meanings and thus cannot be reliably identified or applied by different readers or scholars."[10] Markusen identifies several reasons for this lack of clarity, including [1] the idea that all new concepts are fuzzy while they are in the process of being defined, [2] they may be addressed to different audiences or forums and thus take on different meanings, or [3] they are used as an umbrella term to pull together various concepts, particularly in connection to political organizers. It is the last that Markusen ties to sustainability. The following section proves this to be true, particularly in respect to the most widely known definition of sustainability presented in the past two decades.[11]

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[9] Merriam-Webster Editorial Staff, ed., *Merriam-Webster's Collegiate Dictionary*, 11th ed. (Springfield, MA: Merriam Webster, Inc., 2003).

[10] Ann Markusen, "Fuzzy Concepts, Scanty Evidence, Policy Distance: The Case for Rigour and Policy Relevance in Critical Regional Studies," *Regional Studies* 33, no. 9 (1999): 870.

[11] It would be remiss to not note that the first two of Markusen's reasons certainly weigh in on the ambiguity of the term as well.

Definition of Sustainability

The World Commission on Environment and Development, also known as the Brundtland Commission, set forth the first broadly accepted definition of sustainability in its 1987 publication, *Our Common Future*. The General Assembly of the United Nations requested the Commission to formulate "a global agenda for change" to promote and enhance global sustainable development. The Commission concluded that developing in a sustainable manner is "to ensure that it meets the needs of the present without compromising the ability of future generations to meet their own needs."[12]

The focus of the Commission's agenda was attaining global sustainable development—in all of its social, political, and economic manifestations—through policies and institutions that recognize and respect the symbiotic relationship between the economy and the environment. This is often referred to as the triple bottom line, a sustainable measure for economics, environment, and social equity. It is this relationship that Dr. Gro Harlem Brundtland, chair of the Committee, notes as being the nucleus of sustainable development.[13] Sustainable development is more than just meeting the needs of present and future generations, however. It is the basic understanding that the environment (both natural and cultural) provides the foundation for all human *and* non-human efforts, and thus should be conserved, preserved, and used in a respectful fashion.

The Commission's term 'sustainable development' is ambiguous in part because it encompasses a multitude of disciplines, such as industry, commerce, human health, ecology, planning, and design, each with its own language and literature. If this is a term that can be characterized as an overarching umbrella, then it is indeed a

[12] World Commission on Environment and Development, *Our Common Future* (Oxford: Oxford University Press, 1987), 8.
[13] Ibid, xi.

'soaking wet umbrella.' The intention is at issue here, for the Commission's definition is purposely left open to interpretation to fit the needs of various social, political, and economic institutions found within the United Nations.[14]

Despite the ambiguities, identifiable characteristics that help define such development do exist, that expand upon the Commission's human point of view. These characteristics, in many senses, are basic and inherent. As previously mentioned, to sustain is to ensure long-term viability. In a world that thrives on short-term achievement, particularly in the economy of industrialized nations, recognizing the importance of both short-term and **long-term outlooks** necessitates a **change in mindset** in reference to growth. It also requires a **holistic view**, a **multidisciplinary** approach, and one that **starts at the regional level** with global implications.

These terms may have broad definitions but they carry with them significant meaning in the conceptual and practical application of sustainability. Sustainable development involves the consideration of many parts that make a whole. It is a cyclical process that takes into account all of the factors that comprise a complete system, in any decision making process. Several disciplines must collaborate in order to effectively address these factors, with the understanding that any decision will impact a vast number of people. To accomplish this, we must move away from selective planning to collective planning; in other words, move away from individual-minded to group-minded thinking.

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[14] In relation to Markusen's fuzzy concept theory, there is a strong political emphasis in respect to Gro Harlem Brundtland's background and interests that played a serious role in the shaping of *Our Common Future* and its definition of 'sustainability'. A medical doctor and Master of Public Health, Dr. Brundtland became a public activist at a young age in the Norwegian Labour Movement and entered public life as Norway's Minister of the Environment in 1974. She also served three terms as Norway's Prime Minister in the 1980s and 1990s. Her main focus during this time was the linkages between human health and the environment. Her professional and political background provided an expansive political agenda that, coupled with the broad goals of the Commission, led to such a fuzzy term.

Architect, author and renowned sustainable design guru William McDonough, addresses these characteristics from a design perspective in his "Hannover Principles," a set of principles prepared as a guideline for the design competition at the EXPO 2000 World's Fair in Hannover, Germany.[15] These can be considered the first comprehensive set of principles that introduce design into sustainable development. Written eight years prior to the fair, they provided a framework for the fair's "Man, Nature, Technology" theme that expanded on the United Nations' *Agenda 21* principles—the final product of the 1992 international conference held by the United Nations in Rio de Janeiro, Brazil. Dubbed the "Earth Summit," it provided strategies for implementing sustainable development principles at all scales, from an individual, regional, national, and global level.

The underlying goal for EXPO 2000, which McDonough emphasizes in the Principles, was to move beyond the failures of past world fairs that espoused the blind promotion of the latest technological innovations that would thrust the world into the future, without consideration of the impacts on living organisms and the environment, and instead focus on how technology can contribute to sustainable development. McDonough's Principles was one of the lasting successes of EXPO 2000. Although a bit ambiguous because of the mere fact that these are guidelines and not rigid rules, the Principles successfully set forth a solid conceptual framework for the application and definition of sustainable design. It is a reminder of the sustainable successes of simpler, more organic societies that do not rely so heavily upon technological innovation.

This conceptual framework was also being formulated in the 1980s and 1990s by noted architect, author and founder of the Congress for the New Urbanism,[16] Peter

[15] See Appendix C for the Hannover Principles.
[16] New Urbanism is an urban design movement that began in the late 1980s and early 1990s, immediately following the rise of global concern for sustainable development. It stresses the

Calthorpe, in collaboration with Sim Van der Ryn, an early leader in sustainable architecture and also author, educator, and researcher. They compared the term 'sustainability' with that of 'appropriate': "Like the word 'appropriate,' 'sustainability' is qualified by its context."[17] In other words, sustainability can only be effectual through understanding the uniqueness of a given setting. The word 'appropriate,' in its very definition, is easier to conceptually grasp, although it does provide confusion when considering the merits of better versus worse. It can, however, provide the needed evaluative means in the definition of sustainable design. In relation to the goals of EXPO 2000, for instance, it eludes to the appropriate uses of technology.[18]

The term 'efficiency' is also considered synonymous with sustainable development. 'Eco-efficiency' is a related term used as a guiding principle of sustainable development. Officially coined by the Business Council for Sustainable Development at the 1992 Rio Earth Summit, and drawing from the tenets of *Our Common Future*, eco-efficiency refers to efficient resource use in industries and industrial operations, resulting in less pollution and waste generated, use of renewable resources, and minimization of adverse impacts to human health and the environment.

This term, along with many others used synonymously with sustainable development, only conflate and further confuse the meaning of sustainability, therefore inviting more criticism and weariness. For instance, sustainable purists like William McDonough and his chemist-partner Michael Braungart, argue that eco-

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revitalization of urban centers and towns by strengthening their economy, environment, and community character. For more information visit the Congress for New Urbanism web site at www.cnu.org.

[17] Sim Van der Ryn and Peter Calthorpe, *Sustainable Communities: A New Design Synthesis for Cities, Suburbs, and Towns* (San Francisco: Sierra Club Books, 1991), ix. Calthorpe's work relies on understanding the contextual framework of a site prior to making any design considerations. This is referred to as 'bioregionalism,' also referenced as 'living in place,' or being aware of the ecology, economy, and culture of a place where one lives, and working to enhance those elements. His designs and plans are further touched upon in Chapter II.

[18] Editorial note from Michael Tomlan, 30 January 2006.

efficiency does not quite hit the sustainable mark. In their widely acclaimed book *Cradle to Cradle*, the two consider eco-efficiency to ultimately be a failure because "it works within the same system that caused the problem in the first place, merely slowing it down with moral proscriptions and punitive measures."[19] They offer a more radical alternative that advocates a stricter set of standards that surpasses efficiency: "The goal is zero: zero waste, zero emissions, zero 'ecological footprint.'"[20] Moving past the overarching definition of sustainable development set by the Commission, designers and planners like McDonough, Braungart, Calthorpe, and Van der Ryn work to incorporate sustainable principles into the design of the built environment. They accomplish this by following sustainable development concepts, expanding upon them with design principles based on time-tested architecture and design along with complementary technological innovations.

Definition of Sustainable Design

Similar to the general concept of 'sustainability,' 'sustainable design' also suffers from lack of a standard definition. It has become synonymous with 'green building,' 'designing with nature,' 'environmentally sensitive design,' and 'high-performance design'. Sustainable design principles, however, allow for more clarity in defining sustainable design, witnessed in the application of these principles to design projects.

This paper defines sustainable design as a specialized sector of sustainable development, focusing on the preservation of natural and cultural resources in the built environment through design solutions that promote the continuation of a healthy

[19] William McDonough and Michael Braungart, *Cradle to Cradle: Remaking the Way we Make Things* (New York: North Point Press, 2002), 62.
[20] Ibid., 67.

ecology over time.[21] It encompasses architecture, landscape architecture, urban design, historic preservation, regional planning, and interior and industrial design.

Although often synonymously used, it is important to note the fundamental difference between 'sustainable design' and 'green building.' The former is the conceptual understanding of design in sustainable development whereas the latter refers to the physical application of 'green' or 'sustainable' elements to a design. Distinguishing between these two terms is imperative to understanding how they apply to historic preservation.

In sustainable design that encompasses the built environment, zero negative environmental impact should be stressed. Canadian architect and green building advocate Jason McLennan agrees with McDonough and Braungart's cradle to cradle concept of zero impact. McLennan, who has recently created a splash in the sustainable design world with his 2004 publication *The Philosophy of Sustainable Design*, one of the few publications that delves into the evolution of sustainable design, believes that "a truly sustainable building is one that has no negative operational impacts on the environment and few embodied ones."[22]

The familiar mantra of 'reduce, reuse, and recycle' forms the ecological background of sustainable design and green building practice. Moving beyond these physical applications, however, sustainable design is viewed as a philosophy. Both McDonough and McLennan reinforce the notion of sustainability as a philosophy, not merely physical components of green design, stating that it is not about features but is "a design philosophy that seeks to maximize the quality of the built environment,

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[21] In order to avoid any ambiguity with the definition of 'design,' we will use McDonough and Braungart's characterization of design taken from *Cradle to Cradle*, as being "based on the attempt to fulfill human needs in an evolving technical and cultural context."

[22] Jason F. McLennan, *The Philosophy of Sustainable Design* (Kansas City, Missouri: Ecotone Publishing Company, 2004), 6.

while minimizing or eliminating negative impact to the natural environment."[23] He identifies six principles that guide sustainable design by respecting natural systems, people, place, the cycle of life, energy and natural resources, and process, all of which are addressed in the "Hannover Principles."

The National Park Service (NPS) bases its philosophy of sustainable design on McDonough's Principles in its 1993 publication, "Guiding Principles of Sustainable Design." Intended to direct park management philosophy in its park and eco-tourism areas, the initiative was prompted by the NPS Vail Symposium in October 1991 where Park employees gathered to identify stresses and problems in the park system. Solutions included incorporating a sustainable design approach. Two years later the NPS publication was released, defining sustainable design as:

> A concept that recognizes that human civilization is an integral part of the natural world and that nature must be preserved and perpetuated if the human community itself is to survive. Sustainable design articulates this idea through developments that exemplify the principles of conservation and encourage the application of those principles in our daily lives.[24]

Such a philosophy is implemented through bioregionalism and a changing of mindsets, according to the NPS, embracing global interdependence, environmental stewardship, social responsibility, and economic viability.

Defining sustainable design as a philosophy is all well and good, especially since one of the key means of implementation is the changing of mindsets, but we must consider how we go about physically implementing this philosophy in the built

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[23] McLennan, 4.

[24] National Park Service, "Guiding Principles of Sustainable Design" (Denver: National Park Service, 1993). The scope of this publication is severely limited, merely providing "principles" and no standards for sustainable design implementation. Two more publications from the NPS Midwest Regional Office cover essentially the same information: (1) "An Alliance for Sustainable Practices" published in 2000 and (2) "Sustainability: A Vision for the Midwest Region," unknown publication date. The "Guiding Principles" publication is the most often cited piece in relation to the NPS and sustainable goals, but is sorely outdated at 13 years old. Certainly, there is no NPS publication that addresses sustainable design in historic preservation in regard to application of green building elements.

environment. Sustainable design of the built environment requires physical expression. Green building relies on energy savings, careful siting, the conservation and preservation of natural and cultural resources, and quality of life considerations. These elements extend to the level of urban design and planning. Design at this level relies on an awareness of nature and its systems, identity and place, controlled growth and land use planning, and natural building and vernacular architecture.

Nature and Its Systems

Sustainability finds many of its roots in biology and ecology.[25] Nature and its systems provide the most excellent blueprint for design. It is safe to say that nature is the ultimate design, a continually regenerative, cyclical system. Everything feeds off of the next thing; life and death are a continual cycle. Why not apply this design concept to the built environment? Instead of designing and constructing a building or structure that will eventually be demolished, why not design a building that mimics this continual cycle through such elements as designing for disassembly or zero impact.

Applying such a concept involves a positive and respectable interaction with nature and its systems. Simply put, without a healthy ecosystem, we would not exist. As the world continues to move from an industrial base to an information base, we are finally starting to see the forest through the trees, or, at least, what remains of it. And this only because our resources are being so quickly stripped that one cannot ignore the impending crisis.

The problem is that many cultures approach nature as an entity to be controlled by man or woman, as opposed to one that should be respected. But it is not ours to control, it is ours to dance with, according to Donella Meadows**,** a systems analyst and

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[25] Timothy Beatley and Kristy Manning, *The Ecology of Place: Planning for Environment, Economy, and Community* (Washington, D.C.: Island Press, 1997).

founder of the Sustainability Institute who wrote and taught sustainability from a systems viewpoint. Meadows is referring to a symbiotic relationship with complex systems, not just in relation to nature, but also to each other and to institutions that we create in an attempt to grasp the workings of these systems not as an "omniscient conqueror" but as an integral part of the system(s) itself.[26]

The theory of 'biomimicry' takes this idea one step further by providing examples of actual design implementation. Biomimicry, developed by life sciences writer Janine Benyus and expanded upon in her book of the same name, is described as "the conscious emulation of life's genius. Innovation inspired by nature."[27] Viewing nature as "model, measure, and mentor" provides the context and an ecological standard for such innovation. Benyus points out how all human inventions already mimic the more elegant forms of nature at slight cost to the ecosystem: "Our most clever architectural struts and beams are already featured in lily pads and bamboo stems. Our central heating and air-conditioning are bested by the termite tower's steady 86 degrees Fahrenheit…"[28] One example of this design type could be a solar cell inspired by a leaf.

Biomimicry makes such sense that it seems like a "no-brainer." However, it is important to remember that merely emulating nature in design does not always provide positive results. Benyus notes the dangers of designing biomimetically by using the Wright Brothers as an example. They designed their airplane based on the nuances of drag and lift as studied in vultures, and although this invention is considered one of the greatest in our history, it also led to darker intentions, as Benyus goes on to say: "We flew like a bird for the first time in 1903, and by 1914, we were

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[26] Donella Meadows, "Dancing with Systems," *Whole Earth* (Winter 2001).
[27] Janine Benyus, *Biomimicry: Design Inspired by Nature* (New York: William Morrow and Company, Inc., 1997), 2.
[28] Ibid., 6.

dropping bombs from the sky."[29] By staying on the path of respecting nature and humanity, however, this course can be avoided.

Other applications of designing with nature are found in such creations as 'bioshelters.' These greenhouse-like structures marry together biology and architecture. They are self-sustained structures that involve micro farming of fish, vegetables, fruits, flowers and seedlings.[30]

This type of design is intended to reintroduce a balance between culture and the living world, something that internationally-recognized biologist and ecological designer John Todd, along with land use planner George Tukel, espouse in their book, *Reinhabiting Cities and Towns: Designing for Sustainability*. Todd and Tukel believe that designing a built environment according to the systematic methods of nature requires wholeness, cooperation, and dynamism—a "homecoming:"

> If a window box is inoculated with a few handfuls of forest soil, and has flowers and herbs as well as vegetables, and if it is occasionally watered from a wild pond, it will unfold according to its own instructions. It will function as a magnet for unexpected forms of life and be delightful and informative as well as useful. There will be wildness in it. Something comparable happens when buildings, parks, and perhaps even towns are designed from ecological models and instructions. There is a qualitative difference which we can feel. Some might call it a homecoming.[31]

A similar design concept to bioshelters is the 'living building,' a building designed to account not only for its own wastes and impacts but those of others too, taking on a restorative role. McLennan offers the concept of a living building in comparison to the current green building standards and regulations that merely

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[29] Ibid., 8.
[30] John Todd, "Architecture and Biology: A Necessary Synthesis," in *Sustainable Communities: A New Design Synthesis for Cities, Suburbs, and Towns*, ed. Sim Van der Ryn and Peter Calthorpe (San Francisco: Sierra Club Books, 1995), 145.
[31] John Todd and George Tukel, *Reinhabiting Cities and Towns: Designing for Sustainability* (Flushing, New York: Queens College of the City University of New York, 1981), 9.

minimize environmental impact, instead of striving for zero impact.[32] McDonough and Braungart also stress copying nature's cycles in their cradle to cradle concept, where everything feeds off of the next thing; life and death are a continual cycle. As it is put in plainer terms in their book *Cradle to Cradle*, "waste equals food."[33]

Respecting nature and its systems in sustainable design is inherent. Nature provides the foundation for all development. It also lends to the sense of identity and place in any given environment. Calthorpe notes the connection between ecology and community in providing this vital element in sustainable design through the expression of and respect for nature in community design.[34] Without this indelible tie to one's environment, there is little draw or incentive to long-term investment.

Identity and Place

A strong identity and sense of place is what links humans to their built and natural environments. A constructed landscape, such as the built environment, holds a multitude of connections between person and place because of its embodied meaning to the creator and user. It is one reason why architecture is so often looked to as a representation of a certain culture or time period. It is what Jane Jacobs speaks of in her seminal book, *The Death and Life of Great American Cities,* when she refers to creating spaces and communities filled with vitality, so often found in historic urban fabric where mixed-use development, shared spaces, and foot-based traffic create a vibrant, thriving neighborhood. Hers was a call to arms as urban renewal and redevelopment swept the nation in the 1950s and 1960s.

Dolores Hayden also tackled the topic through her non-profit corporation "The Power of Place," based in Los Angeles. Organized in 1984 to address the dearth of

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[32] McLennan, 149.
[33] McDonough and Braungart, 92.
[34] Peter Calthorpe, *The Next American Metropolis: Ecology, Community, and the American Dream* (New York: Princeton Architectural Press, 1993), 25.

public recognition given to women's history and ethnic history in Los Angeles, Hayden's "The Power of Place" project brought together interdisciplinary teams of historians, designers and artists to interpret women's history and ethnic history in public downtown places of Los Angeles.

The power of place, equated to the power of ordinary urban landscapes, is what strengthens citizens' public memory, according to Hayden. This public memory or identity is tied to both the natural and built environments because that is what comprises a cultural landscape in the first place. She notes that identity is more often discovered in vernacular architecture and landscapes that hold greater meaning for working neighborhoods and women's and ethnic histories than grandiose architectural monuments.

Creating or maintaining a sense of identity and place is often successfully implemented through land use planning. According to Calthorpe, it is the combination of architecture, urban design, and planning that promote a "continuity of culture."[35] Peter Calthorpe uses these three disciplines to redefine the American Dream by creating what he calls a new 'American Metropolis.' He creates a design initiative based upon controlled growth patterns, believing that the current patterns of growth—largely suburban sprawl—have "become more and more dysfunctional" and that the problems surrounding these patterns "must be resolved by rethinking the nature and quality of growth itself, in every context."[36] He advocates neighborhoods called Pedestrian Pockets or Transit-Oriented Development (TOD) that rely on designing and building around alternative modes of transportation to the automobile.

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[35] Sim Van der Ryn and Peter Calthorpe, v.
[36] Calthorpe, 12.

Controlled Growth and Land Use Planning

Land use planning elements such as brownfield redevelopment, greenfield protection, and infill development provide a strategy for sustainable growth in an urban context.[37] Cultural identity and urban vitality are highlighted through the use and reuse of already existing infrastructure in this land use plan, allowing for a strong connection between sustainability and historic preservation efforts. Continuing sprawl thwarts compact development, thus squelching existing cultural identities and creating new ones centered on the automobile, promoting what journalist Joel Garreau refers to as "edge cities." Garreau describes these cities as the "new urban centers," containing all the functions of older downtowns but more dispersed in form. They cater to the suburban sprawl that began decades ago.[38]

The dense, compact urban form is not a new one. It has been historically applied for centuries, born out of necessity at a time when transportation and mobility were much slower and globalization did not exist. Compact community development is an alternative to sprawl, is often seen in historic developments,[39] and is a key element in sustainable urban design.

Natural Building and Vernacular Architecture

As technology and the automobile took hold post-World War II, sprawl and new building materials and operations machinery such as vinyl siding and heating, ventilating, and air conditioning (HVAC) systems reshaped our communities, steering them on an unsustainable path. Vernacular and natural building became a thing of the past. The notion of vernacular building had worn its welcome in the United States and other affluent, industrialized nations. No longer did people need to build in a

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[37] Joseph W. Dorsey, "Brownfields and Greenfields: The Intersection of Sustainable Development and Environmental Stewardship," *Environmental Practice* 5 (March 2003): 69-76.
[38] Joel Garreau, *Edge City: Life on the New Frontier* (New York: Doubleday, 1991).
[39] Beatley, 42.

regionally and climatically sensitive method; technological systems replaced vernacular architecture. HVAC systems were part of an architect's repertoire instead of using porches for natural sun shading and ventilation.

Yet vernacular architecture and natural building elements are basic components of sustainable design. They encompass not only more passive, environmentally friendly design fundamentals, they also strengthen cultural identity as a region's natural materials and traditions are visually manifested. In addition, most vernacular or historical architecture is durable. A recent article in *Environmental Building News* identifies durability as "a key component of green building," with an introduction by the author speaking of the durability of his 220-year-old house.[40]

The use of traditional building materials like cob and straw or traditional building practices such as timber framing and built in-ground designs are inherently sustainable. Utilizing locally or regionally available materials in building is often exemplified in vernacular styles. A return to this type of thinking has come about, and natural building practices invigorated. An interesting irony is that vernacular craftsmanship has become more expensive in "developed" regions because it can be labor intensive, whereas in areas where time and efficiency are not major concerns, it is inexpensive. The skilled labor for such practices dwindled with the dwindling vernacular building application.

Publications like *Built by Hand* reintroduce natural and vernacular architecture into the modern realm of thinking, looking at various natural materials and their applications to buildings and structures throughout the world. The goal of the book is to introduce a unique modern vernacular that draws on examples from the past.

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[40] Alex Wilson, "Durability: A Key Component of Green Building," *Environmental Building News* 14 (November 2005): 1, 11-18.

Beyond the positive environmental implications, a modern vernacular can also reintroduce positive group dynamics found amongst people working together.[41]

Vernacular styles are also very adaptable to re-use strategies, much more so than post-war buildings, because these older structures were not built for a preset function or to minimal space standards and ceiling heights.[42] It is why a 220-year-old house like the one mentioned above is still functional and habitable. Repaired, enlarged, plumbed, wired, gutted, remodeled, insulated, and restored by its many inhabitants, the building still performs.

Joining Historic Preservation and Sustainability

Historic preservation represents both the conceptual and physical application of sustainable design and green building. An awareness of nature and its systems, identity and place, controlled growth and land use planning, and natural building and vernacular architecture are all tenets of historic preservation, making it an ideal representation of sustainable design, and sustainability in general. In respect to the environment, two of the most important contributions of historic preservation to sustainable design is the embodied energy within each building or structure that is saved and the prevention of greenfield development.

The embodied energy includes the amount of energy required to produce materials used in building construction and to put them in place.[43] The Advisory Council for Historic Preservation's 1979 report on energy conservation in historic preservation showed that eight bricks embody the energy equivalent of a gallon of gasoline. In sustainable terms, it makes sense to preserve this embodied energy

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[41] Athena Steen, Bill Steen and Eiko Komatsu, *Built By Hand: Vernacular Buildings Around the World* (Salt Lake City, UT: Gibbs Smith, Publisher, 2003).
[42] Martin Muscoe, "Age Before Beauty: Is Long Life the Key to a Truly Green Building?," *The Construction Specifier* 57 (November 2004): 42.
[43] William I. Whiddon, "The Concept of Embodied Energy," in *New Energy from Old Buildings*, ed. National Trust for Historic Preservation (Washington, D.C.: The Preservation Press, 1981), 113.

instead of using more energy to demolish a building and construct a new one. In this way we are conserving natural resources and, ultimately, decreasing costs through long-term energy savings.

Figure 1.1 - National Trust for Historic Preservation, Preservation Week logo 1980

Historic building materials—wood, stone, brick, lime, sand, and earth—have low embodied energy to begin with.[44] This is proven in a chart showing the superior durability of historically used slate in comparison to modern fiberglass in a roof application. It details that four or more high-grade fiberglass shingle roofs would need to be installed in the time that a traditional slate roof performs.

Table 1.1 - Life Cycle[45] Costs of Slate v. Fiberglass Roofing Material*

	Slate	Fiberglass
Year 1	$299,400	$94,500
Year 40	23,400	207,900
Year 80	31,200	321,300
Year 120	39,000	434,700
Total	**$393,000**	**$1,058,400**

*Life cycle roofing cost comparison between S1 quality slate and high-quality (40 year) fiberglass shingles, calculated with a constant 3% inflationary factor. When shown over its expected performance lifetime, slate is economically superior.[46]

[44] Walter Sedovic, "History's Green Genes," Presented at the Greenbuild Conference (Pittsburgh, PA, 2003).
[45] The life cycle approach provides a measurement of the impact of a product on the environment through each stage of its life, from production and distribution, through use, possible reuse and recycling, and eventual disposal.
[46] Sedovic.

Many old buildings are inherently more efficient than any newer designs that would be economical to build because of this embodied energy and because of innate energy saving design features. They have been shown to use less energy for heating and cooling than buildings built between 1940 and 1975 because they were built with a seasoned understanding of physical comfort and a maximization of natural heating, lighting, and ventilation.[47] Common historic building features lend to energy control and saving features, as well as ease in retrofitting measures. Some such features are evidenced in building orientation used to capture solar energy; roof elements like bold overhangs that shield windows from the sun's rays in the summer and let winter rays in when the sun is lower; operable openings that can be fitted with awnings, blinds, shades, or shutters to keep out intruding elements and windows placed on the temperate east and west sides; porches that regulate temperatures; and landscaping that provides shade and wind shields.[48]

In addition, the massive walls of many historic buildings provide good insulation and high thermal inertia. Where heat loss[49] is notable, such as through a roof, remediation is simple in most older buildings because of the accessibility of the attic and openness of the joists, providing easy insertion of insulation.[50] Retrofitting measures such as this are outlined in more detail in *Preservation Brief No. 3: Conserving Energy in Historic Buildings.*

Any type of retrofitting measure to a historic property will more often than not find conflict with the Standards, and energy conservation retrofits are not an

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[47] Baird M. Smith, *Preservation Brief No. 3: Conserving Energy in Historic Buildings* (Washington, D.C.: U.S. Department of the Interior, 1978), 1.
[48] Nathaniel Palmer Neblett, "An Old-House Conservation Strategy," in *New Energy for Old Buildings*, ed. National Trust for Historic Preservation (Washington, D.C.: The Preservation Press, 1981), 75.
[49] Studies show that heat loss in a typical old frame house that has undergone no treatment for heat conservation and is two stories above a full basement, has double-hung windows with no weatherstripping and has no wall or attic insulation, averages 50% for doors and windows, 25% for ceiling, attic, and roof, 18% for walls, and 7% for floors and basement. Greatest attention should be paid to openings and ceiling, attic, and roof to enhance energy conservation. Neblett, 75.
[50] Ibid., 82.

exception. This was realized early on, when energy conservation retrofits of historic buildings were first widely applied in the 1970s, and in other retrofitting practices such as in ADA compliance and seismic control. The same stands true today in applying new green building elements to historic properties.

Conclusion

The complementary role of historic preservation to sustainable development and design becomes clearly evident with the understanding of the central doctrines. Although still a fuzzy concept, sustainable development, as defined above, plainly encompasses the preservation of our cultural heritage. The question to ask is why the current interest and surge towards sustainable design has surfaced within the past decade and a half? Examining the history leading up to current day green building thinking reveals the many similarities between the growth of the historic preservation and green building movements.

CHAPTER II

Reinventing the Wheel, With an Added Spoke

The oft-used phrase, "history repeats itself," is aptly applied to the history of modern sustainable thought, as is the phrase, "learning from our mistakes." With a seemingly unfaltering faith in technology, a massive population growth, and an urban expansion of the 20th century, the world managed to rapidly diminish its natural resources and to significantly taint those that remained, effectively compromising the health and future growth of societies. Now in the 21st century, people across the globe have found themselves in the midst of a mitigation effort to make up for past wrongdoings.

This cycle is nothing new. After depleting indigenous supplies of natural resources 2,500 years ago ancient Greeks turned to solar architecture as an alternative source of energy. They oriented their homes to the southern horizon and planned entire cities to allow citizens equal access to the sun. South-facing porticoes allowed homes to capture the low-lying winter sun and to be sheltered from cold, north winds. Overhanging eaves or roofs shaded the interior from the high, summer sun.[51] These passive design concepts were mirrored thousands of years later in the majestic plantation homes of the American South with their grand façade porches that provided natural ventilation and lighting, and in the saltbox style Colonial homes of New England with the low, rear roofs that thwarted the north winds.

Current green building and sustainable design tenets draw from thousands of years of vernacular architecture, built upon by today's technological rise in renewable building materials and practices. In a sense, we are reinventing the wheel, with an

[51] Ken Butti and John Purlin, *A Golden Thread: 2500 Years of Solar Architecture and Technology* (Palo Alto, CA: Cheshire Books, 1980), 4-5.

added spoke, represented by new technological innovation. The question is how we arrived at our present-day set of sustainable ideals and green thinking in the United States.

It was not until the late 20th century that the term 'sustainable design' as we know it today entered colloquial speech. And it did so as a result of a number of cumulative events, the most notable being the Industrial Revolution and the machine age, Post-World War II development, and the growing environmental consciousness of the 1960s and 1970s leading up to and following the Energy Crisis. The consequences of these three major eras vividly depicted the environmental ravages of a consumptive, industrial-based society. By the 1970s Energy Crisis the United States was forced to find alternatives to its negligent use of oil reserves. Unfortunately, it took such an event to open the eyes of government officials, policy makers, and citizens to the benefits of energy conservation.

The result in the building industry was increased awareness, research and application of energy saving design measures. The field of historic preservation, at this time strengthened by the recent passing of the 1966 National Historic Preservation Act (NHPA), quickly jumped on the bandwagon, extolling the virtues of historic preservation as an inherently sustainable medium in its embodied energy savings. A heightened awareness to energy savings in the building industry arose, until the 1980s when it began to cool.

A good deal of the history of sustainable design up to and immediately following the Energy Crisis has been researched and written about, but little has been documented on the period between the Energy Crisis and today and how 'modern' or current sustainable thought came to be. The Energy Crisis works as a historical divider in the growth of sustainable design thinking in the United States, ushering in ideas and concepts that would eventually lead to modern sustainable design. Whereas

the 1960s and 1970s era of environmentalism defined sustainability in terms of energy savings and human health parameters, encompassing the rise of historic preservation and environmental conservation in the American conscience, the subsequent era of modern sustainable thought sought to bring together elements that until this point had remained in separate camps: energy savings, indoor environmental air quality, building materials and resources research, water conservation, and site analysis. The combination of these signaled the rise of current green building thinking.

This chapter provides a brief history of sustainable thought in the United States, paying closer attention to the somewhat dormant period of the early 1980s and the resurgence of interest and growth of holistic sustainable thinking in the late 1980s until today. It is demarcated by the three eras that provided the impetus for the evolutionary thrust of sustainable thinking: the Industrial Revolution and the machine age, post-World War II development, and 1960s and 1970s environmentalism. Each of these eras shaped and defined modern sustainable development and design. Over these time periods architecture moved from vernacular, to machine inspired, to energy-conscious and, finally, to green. An examination of the people, policies, and practices within each of these eras leads to a discovery of a similar alignment between the growth of the historic preservation and green building movements, providing a clear vision of how modern sustainable design has come to be.

The Industrial Revolution and the Machine Age

The concepts of regionally based and passive energy design begin with vernacular architecture. It exemplifies the shaping of the built environment from the resources and conditions of the local, natural environment. This deep tie to the land is apparent in the use of locally available materials, the siting of buildings to take advantage of sun and winds, the use of natural systems of heating and ventilation, and the use of durable materials. Vernacular architecture was and still is (usually in less

affluent societies that still rely heavily on the land for survival) practiced out of necessity by the 'common' man, characterized by a strong regional and cultural sensitivity.

This architecture was widely practiced in the United States until the Industrial Revolution provided mass production of materials and expanded transportation means for their delivery, thus allowing for the procurement of various materials from distant suppliers. New ideas and patterns of architectural form were also more easily spread with this increased movement. Where vernacular architecture was once practiced out of necessity, its days became numbered, but not lost.

As the Industrial Revolution took hold of the nation, vernacular ideals faded as architecture began to be recognized as a profession in the late 19th century. A reliance on nature was still expressed, but in a more conceptual fashion, where natural systems became a muse for design. However, that being said, passive energy design elements were still widely employed to make-up for what technology could not yet artificially create.

John Ruskin, the 19th century architectural critic and writer, who represented a wave of thinkers in organic architectural design that emphasized natural form, expressed such conceptual thinking. In *The Seven Lamps of Architecture*, first published in 1849, Ruskin identified seven "lamps" that represented seven necessary conditions for great architecture: "Sacrifice" through extensive didactic ornament, "Truth" through the expression of materials and the exclusion of sham construction, "Power" through massing of forms, "Beauty" through observation of laws of nature, "Memory" through building for posterity, and "Obedience" through observance of various Gothic styles that portrayed all of the first six characteristics.[52] Although this

[52] Leland M. Roth, *A Concise History of American Architecture* (Boulder, CO: Westview Press, 1979), 133-4.

line of thinking is misleading in the sense that the ornateness and use of industrial building materials found in high style architecture is not necessarily considered vernacular or sustainable, the conditions of using "true" materials, observing laws of nature in design, and building for the long-term, are indeed sustainable in the modern sense.

Many architects during this time, however, were hostile towards building science and technology, largely because engineers began to usurp the role of the architect.[53] Reactions to the machine age began to develop in new architectural styles. The English Arts and Crafts movement, for example, eschewed ornate design and machine-made materials, instead relying upon simplicity and traditional craftsmanship. This movement influenced Frank Lloyd Wright, whose architectural style drew from an appreciation and understanding of nature's design. He introduced the Prairie Style, one of the few indigenous American styles that proliferated between 1900 and 1920 in the Midwest region of the United States, and based upon the low, horizontal prairie landscape.

The onset of the International style and Modernist thought in the late 1920s and early 1930s drew away from nature, creating artificial building environments that relied upon technology of materials and construction practices, signaling the decline of organic architecture. This was further fomented by rising technology and the expansive availability of natural resources in the post-war period, making vernacular architecture virtually obsolete, or at the very least, undesirable to the quickly growing affluent society. No longer were porches needed for shading the summer sun, electric fans and eventually air conditioners kept us cool. James Marston Fitch, a pioneer in modern historic preservation thought, noted the danger of abandoning vernacular

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[53] James Marston Fitch, *American Building: The Forces That Shape It* (Boston, MA: Houghton Mifflin, 1948), 143.

architecture elements and designing with nature as early as 1948 in his publication, *American Building: The Forces That Shape It*:

> There are, as we have seen, many specific situations in which our synthetic environments are superior to nature's. But this is no adequate basis for the mechanistic conclusion that we don't need nature any more, on the contrary, with the complexity of modern building we need nature more than ever before. It is not a question of air conditioning versus sea breezes, of neon tubes against the sun. It is rather the necessity for integrating the two at the highest possible level.[54]

Post-World War II Development

The post-war era in all its permutations significantly altered views of city and regional planning and thus the entire environment that it encompassed. Urban flight and the subsequent suburban boom introduced a new quandary for urban planners as downtown centers began to lose their economic viability at an astounding pace and housing shortages caused a massive construction boon that introduced a new form of pre-fabricated architecture. As suburbia and sprawl emptied urban centers of people and commerce cities began to take on new identities, creating what many people at the time considered to be areas full of residential slum and commercial blight.

A federally backed means of "cleaning up" urban areas deemed full of blight and slum, known as "urban renewal," was undertaken. Success became measured in the short-term, as opposed to the long-term, and economy and ecology lost their connection.[55] Urban renewal often left more destruction in its wake than it supposedly halted, however.[56] The slum clearance spurred by the Housing Act of 1949 proved this in the demolition of downtown core infrastructure that caused the relocation of thousands of residents, most of whom were low-income and minorities.

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[54] Ibid., 290.
[55] Sim Van der Ryn and Peter Calthorpe, v.
[56] Bernard J. Frieden and Lynne B. Sagalyn, *Downtown, Inc.: How America Rebuilds Cities* (Cambridge, MA: The MIT Press, 1991).

Around this same time the natural environment continued to be seriously taxed by wartime production of goods. The Korean War, Cold War, and atomic and space programs directed hundreds of billions of dollars to military hardware. In the process, the increased use of toxic chemicals and wasting of natural resources progressively worsened the state of the environment and created health hazards. This, combined with the widespread clearance of purportedly blighted areas and the rise of suburbia, would eventually give rise to many dissenting voices, from the public and governmental powers alike, leading to legislation that would move the regulation of the natural and built environments from solely private protective hands to federal protective hands.

1960s and 1970s Environmentalism

Jane Jacobs pioneered the public dissent with *The Death and Life of Great American Cities* in 1961, a book that simultaneously received much acclaim and scathing critique. In it she posits the idea that the vitality of cities is severely compromised by the loss of population and wiping clean of the cultural landscape. On her heels was Rachel Carson's *Silent Spring* published in 1962. Already an established nature writer, Carson tackled the environmental and human dangers of indiscriminate use of pesticides, allaying to the masses the imminent destruction of the environment and ultimately the human race. It is an important piece that linked the health of the natural environment to the health of the human race and, in general, increased public awareness for the need to sustain the natural environment for future generations.

Recognition and advocacy of environmental conservation and historic preservation continued in the form of publications with former Secretary of the Interior Stewart L. Udall's *The Quiet Crisis* in 1963. He opens by speaking of two events that came to his attention "which seemed to sum up the plight of modern man,"

one of which dealt with the loss of Robert Frost's old farm to an auto junk yard and the second being London's thick polluting air that left T.S. Eliot gravely ill. He speaks of historic preservation and environmental conservation as intricately intertwined, proceeding to recognize the need for collaboration between the two in a society of consumption.[57]

The sum of events that led to the 1960s —including, but not limited to, highway programs and urban renewal—awakened a need to publicize sustainable means of living. Years of industrialization and technological progress left people numb to the fragility of the environment. An awakening had occurred and with it a renewed sense of ideals.

In 1966, historic preservation became a part of this awakening. The Special Committee on Historic Preservation published what can be considered a treatise of historic preservation under the auspices of the United States Conference of Mayors. The finished product was a book of essays and photographs that situated historic preservation in the context of the 1960s. The purpose of the report was to seek ways and means in which American heritage could be kept alive and thriving, culminating in a set of recommendations to be made at the federal, state, and local levels of government.

In the field of planning, Ian McHarg published a seminal book in 1969 called *Design with Nature*. McHarg for the first time introduced the environment to planning, integrating environmental sciences with biological sciences to address a theory of human adaptations. According to McHarg, at the time his book was published, the subject of the environment was not one concentrated on by scientists: "the mandarins were molecular biologists and physicists concerned with subatomic

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[57] Stewart L. Udall, *The Quiet* Crisis (New York: Hold, Rinehart and Winston, 1963), 160.

particles."[58] He notes that the field started with ecologists and environmental activists, not federal establishments like the Department of the Interior or the Department of Agriculture. They were to come later with the passage of federal legislation.

McHarg's work, alongside the collective voices of Jacobs, Carson, Udall, and the many others who cannot all be mentioned here, assisted in the culmination of a series of precedent setting federal laws and regulations in a society that had virtually no environmental or historic preservation regulations or standards in place. These included the NHPA in 1966, the Air Quality Act in 1967, and the National Environmental Policy Act (NEPA) in 1969. These provided a certain amount of protection for natural and cultural resources. More importantly, their very creation indicated that the federal government began to recognize the severity of the matter.

The NHPA built upon the already existing American Antiquities Act of 1906 and the Historic Sites Act of 1935, which provided minimal protection of cultural resources. The NHPA moved preservation from largely the private realm to the public realm, as stated in Section 1(b) of the Act:

> Although the major burdens of historic preservation have been borne and major efforts initiated by private agencies and individuals, and both should continue to play a vital role, it is nevertheless necessary and appropriate for the Federal Government to accelerate its historic preservation programs and activities, to give maximum encouragement to agencies and individuals undertaking preservation by private means, and to assist State and local governments and the National Trust for Historic Preservation in the United States to expand and accelerate their historic preservation programs and activities.[59]

It is the largest piece of federal historic preservation legislation and establishes a National Register of Historic Places, responsibilities of State Historic Preservation Officers, standards for state programs to create Certified Local Governments and

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[58] Ian McHarg, *Design with Nature*, 2d ed. (New York: John Wiley & Sons, Inc., 1992), iii.
[59] The National Historic Preservation Act, 16 U.S.C. 470(b), as amended through 2000.

receive grants-in-aid, compliance with Section 106 review standards, and the creation of the Advisory Council on Historic Preservation.[60]

The environmental movement witnessed federal action with the passage of the Air Quality Act in 1967, the first piece of federal legislation designed to control lead emissions. It was amended in 1970, following the 1969 passage of NEPA, with all environmental problems brought under the control of the Environmental Protection Agency (EPA). The EPA was created under NEPA, the first federal legislation in the nation's history committed to the protection of the American human and natural environment. The main element of NEPA is the requirement of an Environmental Impact Statement (EIS)[61] and a public hearing on any federal act that may have an adverse impact on the environment. Similar to the Section 106 review process established in NHPA, an EIS provides a certain element of protection of both natural and human resources.

The passage of NHPA and NEPA led to a flurry of other protective acts in the 1970s at both the federal and state levels. Despite this legislation, however, resource depletion and increased development continued at an accelerated pace. Over-consumption of natural resources made the building period between 1940 and 1970 the most unsustainable in terms of energy savings in any given period. James Marston Fitch was still able to note in his 1971 revision of his 1948 publication that architecture still ignored the basic tenets of natural, sustainable design:

> Indeed, in many respects, it must be admitted that American architecture today pays less attention to ecological, micro-climatic and psychosomatic considerations than it did a quarter of a century ago. Despite its visual novelty and purported modernity, our architecture is on the whole as formalistic in its main configurat-ions—and hence as unsatisfactory in its overall performance—as it

[60] The National Historic Preservation Act, 16 U.S.C. 470, as amended through 2000.
[61] Ian McHarg's proposed method in *Design with Nature* prompted the creation of the Environmental Impact Analysis and Statement.

> was half a century ago, before the appearance of the Bauhaus and the International Style.[62]

Two years after Fitch's revised publication, the Energy Crisis began the slow process of addressing the issues he was so critical of.

The oil crisis of 1973 was caused by the Arab response to Western aid to Israel during the Yom Kippur War, culminating in a decision by the Organization of Petroleum Exporting Countries (OPEC) to significantly reduce oil production. At this time energy consumption in commercial buildings and single-family homes was estimated to account for almost 40 percent of energy consumption worldwide.[63] Decreased oil availability and increasing energy usage in building operations led the United States and Western European governments to focus research on reducing this consumption through effective energy conscious design measures, largely relying on passive solar design and alternative sources. This government intervention, coupled with dissenting voices and public outcry (the first Earth Day occurred in 1970), led to a reawakening of concern for the planet and its ecosystems.

In the early stages, energy conscious design was not necessarily considered a multidisciplinary, holistic effort that focused on several key elements that reduced resource use and increased quality of life and well-being. Architectural journals of the day attest to this. The *Progressive Architecture* journal of the early to mid-1980s offered a myriad of articles on passive solar design and energy efficient design elements. Titles such as "Solar, Once Removed" and "Harvest the Sun" reiterated what our historic architecture had displayed for years. Nonetheless, sustainability initiatives began to be recognized in environmental planning and policy circles, emerging as a significant theme in the 1980s, but not yet closely aligned with

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[62] James Marston Fitch, *American Building II: The Environmental Forces That Shape It* 2nd ed. (New York: Schocken Books, 1972), Preface.
[63] David Gissen, *Big & Green: Toward Sustainable Architecture in the 21st Century* (New York: Princeton Architectural Press, 2002), 12.

architectural design. Following Ian McHarg's groundbreaking work was John Todd and George Tukel's, *Reinhabiting Cities and Towns: Designing for Sustainability,* published in 1981, which introduced new and innovative methods of implementing sustainable ideals into urban centers.

Two architectural 'cultures' were produced in the new design world of energy savings, that sometimes collaborated with one another. One was mainly concerned with reducing energy and took a high-tech approach to energy conservation. The second was more concerned with environmental impacts of development and took a 'back to nature' approach. A divide also existed between energy conservation (minimum fresh air) and improved indoor air quality (maximum fresh air and more energy).[64]

Figure 2.1 - Willis Faber and Dumas Headquarters (Photo credit: Gissen, *Big & Green*)

[64] National Audubon Society and Croxton Collaborative, Architects, *Audubon House: Building the Environmentally Responsible, Energy-Efficient Office* (New York: John Wiley & Sons, Inc., 1994), 44.

High-tech research in the aerospace industry, jumpstarted in the 1960s/1970s, provided new materials and machines for high-performance building construction. Solar cells, wind turbines, and mirrored glass were just a few of the inventions that lent to sustainable design. Countries like England merged basic passive designs with these high-tech inventions, as evidenced in Foster and Partners 1977 design of the Willis Faber and Dumas Headquarters in the United Kingdom (Fig. 2.1). Although not considered environmentally sustainable by today's standards because of its inoperable windows and full service air-conditioning plant, it was precedent setting in the late-1970s, using mirrored windows to reduce heat gain while providing large amounts of daylight, a large atrium that produced natural illumination, and a green roof.[65]

Early green architects focused primarily on single-family homes, with some work done on commercial buildings. During the late 1970s, some of the most innovative energy efficient buildings to be constructed in the United States were eight state office buildings commissioned by the Jerry Brown administration in California, including the well-known Gregory Bateson Building in Sacramento, designed by Sim van der Ryn, Office of the State Architect. He implemented features that utilized passive heating and cooling strategies such as rocks under the first floor that held cool air and released it into office spaces, called "rock stores." He also inserted roof photovoltaics for energy generation and allowed workers to adjust the climate to their needs. Van der Ryn's design is the flagship of California's Energy Efficient Office Building Program and the first of its kind in the nation, thereby setting the standard at the time for energy conscious office building design.[66]

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[65] Gissen, 13.
[66] Gissen, 12-13.

Figure 2.2 – The Gregory Bateson Building, Sacramento, CA (Photo credit: Sim van der Ryn Architects, www.vanderryn.com)

Of course, not all building design and construction in the 1970s followed energy conscious design measures. Many commercial buildings followed Modernist ideals in the form of glass-box offices that offered little in the way of sustainable design. However, to encourage environmental sensitivity in architecture, the newly created U.S. Department of Energy (1977), under the Carter administration, became the frontrunners in promoting and supporting 'energy-conscious' design through an effort called the Building Energy Performance Standards (BEPS). Unfortunately, under the Reagan administration, it was relegated to a "voluntary, information-based" program, as plentiful oil reserves once again returned and demand was satiated.

The change in priorities between Carter and Reagan's presidencies is one reason why new thought in sustainable design slowed between the late 1970s and mid 1980s. The 1970s represented an era of increased federal rules and expansion of regulatory agencies that resulted in greater government intervention in the private

economy. Carter's establishment of the Regulatory Council[67] in 1978 further spurred this movement. The creation of standards such as BEPS and the Standards are two such federal regulations set in place in the 1970s. In addition to these regulations, other Acts were passed that promoted sustainable resource use, including the 1974 passage of the Geothermal Energy Research, Development and Demonstrating Act, the Solar Heating and Cooling Demonstration Act, and the 1978 National Energy Act that provided conservation incentives, taxes, and limits for the use of oil and gas in electrical generation.

However, the early 1980s were not completely devoid of any forward progress, as some initiatives begun under the Carter administration continued into the Reagan administration. In connection with the creation of the DOE in 1977, the American Institute of Architects (AIA) formed a Committee on Energy as a joint effort with the department. Together, they spearheaded the Energy and Architecture continuing education program between 1978 and 1983. The program culminated in the "Line on Design and Energy" theme at the 1984 AIA national convention.

The establishment of standards through federal regulation provided necessary guidelines for the care and protection of natural and cultural resources. After the passage of NHPA and the nation's bicentennial in 1976, historic preservation grabbed the attention of a broader audience. The Tax Reform Act of 1976 and its provisions for a historic rehabilitation tax credit made such an endeavor a viable option for many income producing property owners.

The Standards that were prompted by federal regulation in 1977 to determine eligibility of rehabilitations for the federal tax credit finally provided a set of accepted

[67] The Regulatory Council was composed of representatives from twenty executive departments and eighteen independent agencies with major regulatory authority, responsible for preparing the semi-annual schedule of proposed regulations required by Executive Order 12044.

guidelines for the responsible care and maintenance of historic properties.[68] That same year, the General Services Administration (GSA), the nation's largest landlord, joined the Advisory Council on Historic Preservation in implementing the Public Buildings Cooperative Use Act of 1976. The Act encouraged the reuse and mixed use of federal buildings. Jay Solomon, GSA Administrator under the Carter administration, announced that the Agency's primary concern would be the consideration of old buildings first when looking for building space.[69] This step would be the first of many that the GSA would take toward combining sustainable design and historic preservation.

A year later, the Technical Preservation Services Division under the Department of the Interior published its Preservation Brief No. 3, providing guidance in conserving energy in historic buildings according to the guidelines set forth by the Standards. The Advisory Council on Historic Preservation quickly followed in January 1979 with a study that provided formulas to measure energy needed for the restoration and rehabilitation of existing buildings and, alternatively, the energy required for their demolition and replacement with new construction.[70] The purpose of the publication was to provide solid, numbers-based evidence for preserving historic properties as opposed to demolition. Interest in energy conservation of historic buildings continued to increase, and in 1981, the National Trust published a collection of articles to this effect.

The late 1970s and early 1980s witnessed a proliferation of research in energy conscious design, largely due to the Energy Crisis scare and high-tech research that

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[68] W. Brown Morton, III, et al., U.S. Department of the Interior, *The Secretary of the Interior's Standards for the Rehabilitation and Illustrated Guidelines for Rehabilitating Historic Buildings* (Washington, D.C.: Government Printing Office, 1992).
[69] Carleton Knight, III, "GSA Committed to Recycling," *Preservation News* 17 (August 1977): 1, 7.
[70] Booz, Allen and Hamilton, Inc., *Assessing the Energy Conservation Benefits of Historic Preservation: Methods and Examples* (Washington, D.C.: Advisory Council on Historic Preservation, 1979).

stemmed from the federal aerospace program. The field of historic preservation, in its new federally regulated role, began to actively promote the inherent energy saving benefits of historic buildings. A new mindset had been created, but just as quickly as it had started, it seemed to slow. Sustainable design continued to be practiced throughout the 1980s, but the return of plentiful oil reserves temporarily masked the impending problem in the first half of the decade. The Energy Crisis became a catalyst for change, however, and by the mid 1980s energy conservation became a component of a much larger movement towards sustainability, one that reached global proportions. The implications of this reinvigorated and reshaped the notion of sustainable development, moving sustainable design into a much more holistic realm.

Toward a Modern Sustainable Design

The relatively dormant first half of the 1980s led to a series of rapid fire events that began to shape modern sustainable design in the second half of the 1980s and early 1990s, setting the stage for modern sustainable design, or green building, as we know it today. A broadening global perspective on sustainable development, increased building materials research, a move towards holistic and multidisciplinary thinking, the adoption of a set of green building standards, and support at the federal, state, and municipal government levels, all were contributing factors in establishing sustainable design and green building in the modern era. Similar to the rise in acceptance of historic preservation in the United States, modern sustainable design followed a course that began at the grassroots level, slowly growing as its significance was realized.

The publication of *Our Common Future* in 1987 can be considered the genesis of modern sustainable development in a global context. Not only did it offer the first widely accepted definition of sustainable development through a certain level of consensus, it also asserted that sustainable living needed to be recognized at a global

scale in order to be effective. It finally opened people's eyes to the dire need for a new, "healthy" means of co-existing not only with one another, but with the Earth as well. The voices of decades past had finally culminated in a global call to arms. Certainly many others before had laid the foundation for sustainable development, and within that sustainable design, but until this point there had not been a cohesive gathering of minds.

In 1992, a few years after *Our Common Future* debuted, the "Earth Summit" produced *Agenda 21*. One of the key concerns of the Earth Summit was the human influence on global climate change. The Framework Convention on Climate Change was opened for signatures in Rio de Janeiro, with a commitment to stabilize greenhouse gases to prevent serious threats to the climate system.[71] The signatories agreed to create programs to mitigate the problem and to adopt national policies to return greenhouse gas emissions to their 1990 levels. Five years later the well-known Kyoto Protocol established emission targets for participating developed nations, relative to their 1990 emission levels, to be reached in the commitment period of 2008 to 2012. Eighty-four countries signed the protocol, thereby becoming legally bound to limit or reduce their greenhouse gas emissions. The United States is not a signatory. On February 16, 2005, the protocol went into effect.

Eco-efficiency was a solution introduced at the Earth Summit to address such problems as adverse climate change, and is one of the tenets of sustainable design introduced in Chapter One. As previously mentioned, to some environmental advocates and designers, like William McDonough and Michael Braungart, eco-efficiency is not a viable solution. Their interest centers on "eco-effectiveness," in this instance meaning eliminating the use of toxic building materials, promoting the use of

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[71] U.S. Department of Energy, "Executive Summary," 16 December 2005, http://www.eia.doe.gov/oiaf/kyoto/execsum.html.

materials that follow the mantra "waste equals food," whereby a product completes a regenerative life-cycle.[72]

In the mid-1980s, McDonough, Braungart, and other east coast architects like Croxton Collaborative and Fox & Fowle Architects, began forcefully voicing concerns about the toxicity of materials used in commercial buildings. They called for increased research by architects and builders into the examination of building materials and air systems used in commercial buildings; in effect, challenging American building practices. Similar research was simultaneously being conducted elsewhere, including the German architect Thomas Herzog of Herzog + Partner.[73] These pioneers can be credited with providing a new focus on physiological issues in environmentally sensitive architecture. At a time when fuel costs were once again cheap, this focus provided a renewed purpose in the world of green building.

This research brought life cycle assessment (LCA) of products and materials to the fore. The majority of the American society consumes materials that follow a cradle to grave life instead of the more sustainable cradle to cradle life. In industrial societies, products are manufactured, used, and then disposed of in landfills or incinerators. Products are designed to last only for a certain amount of time and then are disposed of in exchange for a replacement that is similarly manufactured.[74]

In terms of historic preservation, life cycle assessment results can be examined to compare the environmental impact of a salvaged product and a new product. This is most appropriate for salvaged materials that expend energy solely during their move from one site to another and needing little remanufacturing. Tools such as the Athena Environmental Impact Estimator[75] allow for this comparison. Results show that the

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[72] McDonough and Braungart, 61-67, 72.
[73] Gissen, 14.
[74] McDonough and Braungart, 27-8.
[75] The Athena Environmental Impact Estimator can be found at http://www.athenasmi.ca.

environmental impact is significantly reduced when salvaged materials requiring minimal re-manufacturing or preparation are selected instead of new materials.[76]

Bringing attention to the toxicity of building materials introduced a new consideration in sustainable design. Health concerns in relation to indoor environmental air quality became intertwined with the more traditional concept of energy-conscious design. Organizations like the Athena Institute provided practical tools, and documentary films like "Blue Vinyl," by filmmakers Judith Helfand and Daniel B. Gold, vividly portrayed the highly toxic production and manufacture of products like polyvinyl chloride (PVC). Vinyl siding, which contains PVC, is often used to replace rotting clapboard and is considered a sacrilegious replacement material by preservationists. More and more products like VOC-free[77] paints and carpets are being manufactured as a result of this heightened awareness, increasing indoor environmental air quality and educating the masses on the use of non-toxic building materials.

An interesting conflict between historic preservation and sustainability in regard to toxic materials is when such materials become part of the historical integrity of the building, site, or object. For instance, radioactive waste from an atomic bomb at the Trinity Site in New Mexico—site of the world's first atomic detonation on July 16, 1945—is part of the historic fabric of the site, involving an interpretation of the hazardous material as a significant feature.[78] Although this is certainly not a common

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[76] Mark D. Webster and Matthew B. Bronski, "Green Salvage Solutions: Reusing Roofing and Structural Materials," *The Construction Specifier*, vol. 58, n. 1 (January 2005): 58. Mark D. Webster is a senior staff engineer and member of the LEED MR Technological Advisory Group. Matthew B. Bronski is an engineer and architectural designer who is co-chair of the Boston Society of Architects Historic Resources Committee.

[77] VOC stands for volatile organic compound. VOCs are emitted as gases from certain solids and liquids and include a variety of chemicals, some of which have short- and long-term adverse health affects. Indoor VOCs are ten times higher than outdoor VOCs. Examples include paints and lacquers and building materials and furnishings. [Definition found on the EPA website: http://epa.gov/iaq/voc.html]

[78] National Park Service, *Guiding Principles*.

problem within historic preservation, it does remind us of other more common toxic materials found in historic buildings like asbestos, that require careful removal so as not to damage the historic fabric.[79]

The high-tech materials research initiated by the aerospace industry continued to push forward high-performance building construction in the 1980s. Tools for analysis and measurement increased, allowing for more detailed research of building performance and increased efficiency. Computational Fluid Dynamics (CFD) analysis is one example. The design of natural ventilation systems is now determined by a detailed analysis of the behavior of air within spaces.[80]

The move from low-tech to high-tech design in the building industry created a divide in architectural approaches, as previously mentioned. This split, that also produced a rift between focusing on energy conservation or improved indoor air quality, was a disjointed means of attaining sustainable design. By the mid 1980s, however, the various schools of architectural thought, as well as different disciplines, began to come together to orchestrate projects that undertook a more holistic and multidisciplinary approach, a necessary methodology for attaining true sustainable design. The reconciliation between the two architectural "cultures" is shown in the 1989 redesign of the National Resources Defense Council (NRDC) offices, located in a renovated loft in the Flatiron District of New York City. This project followed a holistic mode of thinking in incorporating various elements to align the built and natural environments in a mutually beneficial design, emphasizing natural lighting with the addition of a three-story atrium in the center of the space.

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[79] It is interesting to note the level of consideration that goes into 'life cycle thinking,' particularly in a society that promotes technological progress. If using straw from cereal grain, like wheat or rye, as a thatching material, it should be grown without the addition of nitrogen fertilizers, otherwise it is prone to early decay, and thus, unsustainable.

[80] The analysis involves a process of mathematically modeling the flow of air relative to temperature and pressure.

Following on the heels of the NRDC renovation, the AIA Committee on the Environment (COTE) formed in 1990, replacing the AIA Committee on Energy. The word 'environment' replaced the word 'energy' as holistic and multidisciplinary thinking became one of the central tenets of modern sustainable design. By the 1990s, the concept and labeling of sustainable development or sustainability was supported by European and American architects.[81] Indeed, by the time the USGBC introduced itself in 1993, many architects and designers understood the importance of sustainable design elements and therefore were able to easily understand the aim of the USGBC.[82]

The mission of COTE is "to improve and sustain the environment by advancing and disseminating environmental knowledge and values, and advocating the best design practices to integrate built and natural systems to the profession, industry, and the public."[83] Through COTE, the AIA continues its joint work with the DOE through such projects as the Top 10 Green Projects awards, announced each Earth Day since 1998; the Sun Wall Design competition for the south façade of the DOE's Forrestal Building; and the rapidly growing Solar Decathlon competition that takes place on The Mall in Washington, DC, every other year.

COTE also collaborates with the EPA to produce the annual publication, "Environmental Resource Guide." Begun in 1992, the publication provides a basis for comparing the environmental impact of building materials, products and systems, as well as providing a consistent format for assessing the environmental impacts of building materials from their original extraction and manufacture to their final disposal or reuse. COTE also acts as a conduit for disseminating this information to the building community at large.

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[81] Gissen, 15.
[82] David Gottfried, *Greed to Green: The Transformation of an Industry and a Life* (Berkeley, CA: WorldBuild Publishing, 2004), 106.
[83] The American Institute of Architects website, found on 30 November 2005 at: http://www.aia.org/print_template.cfm?pagename=cote_about.

The holistic and multidisciplinary approach found in modern sustainable design is infused in more than building design; it is also evident in the greater landscape, in planning and urban design concepts like Smart Growth and New Urbanism. These concepts borrow from the traditional design patterns of historic cities, towns and villages that stressed sustainable principles like walkability, importance of the civic realm, and a strong sense of place. What Peter Calthorpe termed the 'Traditional American Town' in *The Next American Metropolis.*[84]

Sprawl has been on the agenda of preservationists for quite some time. Since the 1960s, historic preservation in the United States has seen a move from high-style emphasis to a heightened appreciation for vernacular architecture and cultural landscapes. Preservation now emphasizes whole cultural landscapes as opposed to individual buildings.

Three commercial building projects in New York City in the late 1980s and early 1990s were the guinea pig projects that tested this new holistic, sustainable building design approach: the Environmental Defense Fund Headquarters building, the Natural Resources Defense Council building (NRDC), and the Audubon House. Together, they set the standard for modern sustainable design, introduced the term "green building," and included some of the most accomplished architects and designers in the green building industry.

Two of the three projects involved renovations of existing buildings, whereas the Environmental Defense Fund Executive Headquarters project was newly constructed. The two renovations were not certified historic rehabilitations. None of them have been LEED certified. Their importance lies in their precedent-setting project missions and goals that laid the foundation for modern sustainable design.

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[84] Calthorpe, 26.

They are all located in New York, New York, and are owned and operated by environmentally conscious organizations.

The first of these projects to be completed was the Environmental Defense Fund building. Architect William McDonough was commissioned to design the Fund's new executive headquarters building in 1984. The design goal was to create a healthy office environment; indeed, McDonough was warned that he would be sued if any of the staff developed health problems in response to his building materials.

Figure 2.3 - The Environmental Defense Fund Building Interior (Photo credit: Gissen, *Big and Green*)

McDonough's 20,000 square foot design initiated the "green office" response to sick building syndrome, introducing an alternative to the sealed spaces found in many of the suffocating Modern Style office designs. Elements like high ceilings, clerestory windows, and glazed exterior facades allowed for optimal use of natural daylight. Maximized ventilation provides 30 cubic feet of fresh air per minute per person, in comparison to the then national standard of five cubic feet. At the

building's completion in 1985, it was considered the model for modern sustainable design.

Figure 2.4 – Interior of the National Resources Defense Council Building (Photo credit: The National Resources Defense Council, www.nrdc.org)

The National Resources Defense Council (NRDC) building project, undertaken by the Croxton Collaborative architectural firm, another leading sustainable design firm, was completed in 1988. The project consisted of the renovation of the three top floors of a 12-story lower Manhattan Art Deco loft in the Flatiron District that housed the offices of the Natural Resources Defense Council, a New York-based environmental group. The renovation combined energy efficiency and environmental performance with an emphasis on maximizing natural light, similar to the Environmental Defense Fund project. Ribbons of windows, open-ended hallways, and an open interior staircase allowed for this infusion. Highly efficient fluorescent tubes, occupancy sensors, polymer film within the double-paned windows (works to

moderate changing temperatures), and small air-conditioning unit, combined with the increased natural lighting, cut the building's energy consumption by 70 percent compared to conventional offices.[85]

Following on the heels of the NRDC project, and also a Croxton Collaborative design, was The Audubon House. Formerly known as the Schermerhorn building, this century old eight-story, Romanesque Revival building (ninth floor conference room added during renovation) comprises a little less than 198,000 square feet of space. Originally constructed in 1891 and designed by George W. Post, architect of both the New York Stock Exchange and the Williamsburg Bank in Brooklyn, the Audubon House is considered the first example of a green building project that also included an historic restoration and renovation (although not a certified historic rehabilitation).

Figure 2.5 – The Audubon House (Photo credit: National Audubon Society)

[85] National Resources Defense Council, "NRDC's New York Office," found at http://www.nrdc.org/cities/building/fnyoffice.asp, on 14 January 2006.

Load-bearing walls and below-ground masonry pillars with an exterior of glazed masonry brick, brownstone, and terra-cotta support this cast-iron framed building. Its façade is separated into three segments: a solid two-story base, the middle four stories, and the top two stories. The building sat vacant for more than ten years, except for retail establishments on the ground floor. When purchased by the National Audubon Society it was structurally sound with a need for major interior renovation. Between 1989 and 1992, the National Audubon Society purchased and renovated the building with green elements for a cost of $14 million.

Competing at a competitive market rate was of the utmost importance to this project. The basic renovation and redesign cost $122 per square foot, within the market rate of $120 to $128 per square foot, for a project of comparable size, location, and time. A few anomalies pushed the total cost to $142, the most significant being a New York City law that stipulates fire trucks must be able to drive onto the sidewalk; requiring Audubon to replace the century-old vaulting beneath the sidewalk in front of the building.[86]

In addition to considering the economics behind such a project, the Audubon House also stressed the importance of taking into account the project's affect on the environment and looking for alternatives to traditional methodologies.[87] The four major areas of environmental concern were energy conservation and efficiency, direct and indirect environmental impacts, indoor air quality, and resource conservation and recycling. The use of the existing building as an energy saving and urban redevelopment measure played a role in this concern, although the tie to historic preservation was not yet fully recognized.

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[86] Ibid., 49-50.
[87] Ibid., xix.

By the completion of these projects, the application of green building was beginning to become firmly rooted in the design and building industry. The looming question, however, was what did it really mean to be green? What made these three buildings more environmentally sensitive and energy efficient than the next and how could the next project be guided?

In 1993, a group of building industry professionals gathered to answer these questions by forming the non-profit USGBC. Their first task: creating a set of standards or guidelines for green building. Similar to historic preservation, green building could not be effectually implemented without a set definition and articulated application methodology. Thus, the LEED rating system was introduced in 1998 to provide a national standard for developing high-performance, sustainable buildings.[88]

The creation of the USGBC and its LEED rating system is the culmination of years of activist efforts and technological innovation in building materials in the quest for sustainable design. The organization and system have, in effect, defined modern sustainable design in the United States by providing for the first time a roadmap for green building. Effective marketing and successful implementation of the LEED rating system have allowed green building to enter into the minds of the layperson, and to grab a very vital foothold in the American conscience.

Since 1979, many local governments, architectural review boards, private preservation organizations, and individual property owners and developers have adopted the Standards across the United States as their own set of guidelines. Just as many public and private institutions and entities have adopted the LEED standards since 1998 to guide their future development, as well as provide a set of guidelines for administering tax incentives. For instance, the U.S. Army created its own green building rating tool in 2001 based on LEED called the Sustainable Project Rating Tool

[88] Chapter Three provides a more detailed account and description of the LEED rating system.

(SPiRiT). It differs from LEED in its operations and maintenance issues and flexibility in design to allow for future building modifications.

Programs like the General Services Administration (GSA) and the EPA both require at least a Silver LEED rating for new building construction. Other programs, like the NPS, use LEED as a tool in design and construction of its buildings but do not require certification. For example, all NPS construction projects valued at more than $500,000 must submit a LEED checklist to the NPS Design Board.[89] Green Energy Parks, established in 1999, was the NPS's first major green program, implemented in the 7,600 square foot Zion National Park Visitor Center in Springdale, Utah, and the Thoreau Center for Sustainability in San Francisco, California.

Implementation of green building practices outside of the federal realm is more challenging without a form of financial incentive. Unfortunately, it has been difficult to dispel the belief that building green is always more expensive than building conventionally, despite research and study that have proven otherwise. And while the ultimate goal of sustainable design is (or should be) changing mindsets in the building industry, the bottom line is often still about profit and not environmental and health benefits.

David Gottfried, one of the founders of the USGBC, realized this in his early years of trying to sell green building to partners and shareholders, where "the underlying ethic of all business is profit," and trying to fight such thinking is "like trying to move a mountain with a shovel."[90] The answer to such reluctance is found in the form of financial incentives. Although this "solution" can be argued for its overall effectiveness, providing financial incentive for historic preservation projects through the Federal Historic Preservation Tax Incentives Program and Standards has

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[89] Office of the Federal Environmental Executive, *The Federal Commitment to Green Building: Experiences and Expectations*, 2002, Appendix B.
[90] Gottfried, 105.

tremendously pushed forward rehabilitation efforts and brought historic preservation into mainstream building practice. Several states also provide their own preservation tax incentives programs in addition to the federal program. In much the same way, state and local governments use the LEED rating system or other similar "homegrown" green building rating systems as guidelines to determine eligibility for earning green building incentives.

Oregon and New York are two of the earliest states to provide tax credits for buildings that meet green standards. New York State's Green Building Tax Credit, approved in 2000, was the first state-offered incentive package to developers who build environmentally sound commercial and apartment buildings. The state of Oregon began offering tax incentives for energy conservation shortly after the 1970s Energy Crisis with its Business Energy Tax Credit, enacted in 1980. In 2001, sustainable buildings became eligible for the tax credit, provided it met an established standard set by LEED.

To further promote green building, states and municipalities are also creating LEED based and non-LEED based sustainable design regulations. Portland, Oregon, for example, adopted the LEED rating system in January 2001 and completed local application of Portland LEED in the summer of 2002. Any new construction and major renovations receiving city funding or private sector funding incentives are required to obtain LEED certification. To ensure the promotion of such a system, the Portland Development Commission is required to adopt the Portland LEED system.

Like the preservation tax incentives, green building incentives only apply to income-producing, commercial properties. However, there are sustainable design regulations that are required of both commercial and residential property owners. The Hugh L. Carey Battery Park City (New York) Authority Residential Environmental Guidelines, published in 2000, are some of the first green building residential

guidelines in the nation, responsible for the first "green" residential tower in the U.S.: The Solaire.

Unlike historic preservation, however, green building incentives and regulations follow a set of standards that have been created by a non-profit governed by its members, with no equivalent to the National Park Service, Department of the Interior, or Secretary of the Interior to oversee their application. This can be seen as a flaw or as a benefit. To date, the federal government has not provided a piece of legislation equivalent to that of the Federal Historic Preservation Tax Incentive program that provides tax incentives for LEED certified buildings.

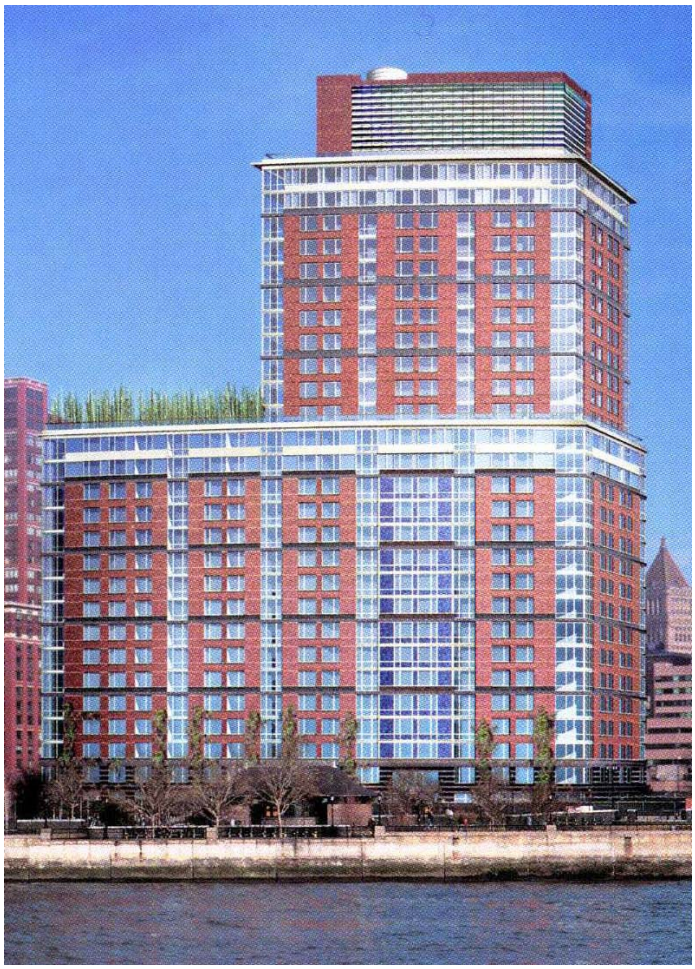

Figure 2.6 - The Solaire (Photo credit: Gissen, *Big and Green*)

The late 1990s into the new Millennium saw modern sustainable design, or green building, firmly rooted in the building industry and beginning to make its way into the American conscience. Global awakening, coupled with increased building materials research, brought a more holistic and multidisciplinary perspective to sustainable design. Early case studies emphasized this new approach, becoming models of green building. This new building label could not sustain itself, however, without a set of guidelines or standards for effective implementation, as well as financial incentives to make it more economically feasible. The result is a sustainable design movement that evolved in a fashion similar to the historic preservation movement that it is no wonder why the two are considered so closely aligned.

Conclusion

One of the most fascinating aspects of history is its pattern of repetition. For all our modern day studies of the classic Greek and Roman cultures one would think we would have learned many things, including the importance of sustainable living. Admittedly, in the United States, it didn't take long to discover the negative effects of dwindling natural resources in comparison to much older countries. After all, this nation has only been a nation for 220 years and settled by Europeans for 399 years. Yet, somehow, within those 400 years we managed to destroy much of what we depend on for a viable existence.

The Industrial Revolution, post-World War II development, and 1960s and 1970s environmentalism gradually opened our eyes to the destruction. By studying the growth of sustainable design in the course of these periods one is able to understand green building in the United States today. It is the activists that provided the call to arms, the global awakening that spoke to all nations, and the proactive solutions from all levels of government and the private sector alike that continue to

forge together an awareness of the symbiotic relationship of the built and natural environments through sustainable design.

CHAPTER III

A Look at LEED

Since the introduction of the first pilot version in late 1998—LEED Version 1.0—the Leadership in Energy and Environmental Design (LEED) Green Building Rating System® has become the standard measure for green building practice in the United States. Its mission is to "encourage and accelerate global adoption of sustainable green building and development practices through the creation and implementation of universally understood and accepted standards, tools and performance criteria."[91] It is by no means the only existing measure for sustainable building, but its relative ease of use, national scope, and acceptance in the building and design industries has led to its widespread adoption by private organizations as well as local, state and federal government bodies.[92] U.S. Green Building Council (USGBC) statistics as of May 2005 show a total of 1,936 LEED registered building projects, with an additional 216 certified projects already completed. LEED projects are found in all fifty states and twelve countries with registered or certified commercial buildings alone comprising 229 million square feet of building space. The USGBC itself has 5,475 member organizations, including corporations, governmental agencies, and nonprofits; a 1000% increase over the past four years.[93]

Given the success of LEED, it is time for the field of historic preservation to earnestly jump on the bandwagon and assert its presence in the world of green building. The many inherent parallels between the two fields—for instance, long-term payback in the form of increased property values, safeguarding cultural and

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[91] U.S. Green Building Council, "LEED Policy Manual," (Washington, D.C.: U.S. Green Building Council, January 2006), 3.
[92] C.W. Scheuer and G.A. Keoleian, *Evaluation of LEED Using Life Cycle Assessment Methods* (Ann Arbor: University of Michigan, Center for Sustainable Systems, 2002), 16, NIST, GCR 02-836.
[93] U.S. Green Building Council, "Green Building Fact Sheet: May 2005," 1.

environmental values, prestigious recognition, etc.—only furthers the argument for creating a strong linkage. A clear sequential understanding of the rise of the LEED rating system, its design and make-up, and its analysis and criticisms is necessary in order for this fusion to take place.

A History of LEED

The LEED rating system developed as one of the earliest efforts of the USGBC, a national green building coalition incorporated in 1993. Following the mantra of being "the nation's foremost coalition of leaders from across the building industry working to promote buildings that are environmentally responsible, profitable and healthy places to live and work," the USGBC established the creation of a sustainability rating system as its first goal. This coalition found its genesis much earlier than the early 1990s, however.

In the mid 1980s David Gottfried, a construction manager and real estate developer, and Michael Italiano, an environmental lawyer, met while working on the Environmental Defense Fund project in New York City and created a vision that included harnessing the knowledge, expertise and support of like-minded professionals to create a national organization to promote sustainable building practices. Partnering with Terry Bevels, a high-powered lobbyist with the Wexler Group—a full-service government affairs firm—and former Senate Appropriations committee member, the three men envisioned a demonstration green building program. The goal was to develop a method based on LCA for selecting green products under a newly formed non-profit that supported Congressional demonstration projects that Bevels promoted. The non-profit was originally named the U.S. Green Manufacturers Council. Due to a conflict of interest with the proposed project, Bevels pulled out and Gottfried and Italiano moved forward with the non-profit, now with the

opportunity to broaden the base of members that represented the entire building industry.[94]

Following a multidisciplinary approach, they collaborated with Robert Berkebile, former chair of the AIA Committee on the Environment; William Browning and Amory Lovins of the Rocky Mountain Institute (a nonprofit organization devoted to the research and education of resource issues); industry firms like Herman Miller, Inc.; and Federal Agencies such as the Department of Energy, the National Institute of Standards and Technology, and the Naval Facilities Engineering Command.[95] By 1993 the group incorporated itself under its current name, holding its first conference in conjunction with the Union of International Architects and the American Institute of Architects (UIA/AIA) convention in Chicago. It was here that the seed of creating a sustainability rating system was planted.

Initially working with the American Society of Testing and Materials (ASTM), the USGBC soon found the slow-moving consensus-based process of the older organization to be incongruous to its goals and, in 1995, created an independent rating system under the USGBC name. The new group looked to several other existing rating systems in the United States and abroad in the creation of its own system, including Austin, Texas', Green Builder program; Canada's Building Environmental Performance Assessment Criteria (BEPAC); the Green Building Challenge (an international effort to create an international assessment tool that weighs regional and national environmental, economic and social equity conditions); and the United Kingdom's Building Research Establishment Environmental Assessment Method (BREEAM). However, they all fell short of USGBC expectations and goals.

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[94] David Gottfried, 85-90. The original name of U.S. Green Manufacturers was given because it was originally thought the council would be mostly manufacturers, architects and engineers affiliated with the projects.

[95] Building Design & Construction, *White Paper on Sustainability* (Oak Brook, IL: Building Design and Construction, November 2003), 6-7.

Drawing from these existing rating systems, the USGBC approved LEED for New Construction and Major Renovations (LEED-NC) Version 1.0 in late 1998, followed shortly by a pilot program supported by the Federal Energy Management Program. It was designed to guide the greening of new construction and renovations of commercial and institutional buildings.[96] What had been created, as the USGBC characterizes it, was a voluntary, consensus-based national standard for developing high-performance, sustainable buildings that:

- define "green building" by establishing a common standard of measurement
- promote integrated, whole-building design practices
- recognize environmental leadership in the building industry
- stimulate green competition
- raise consumer awareness of green building benefits
- transform the building market[97]

Following these core principles and the prescriptive guidelines of the reference guides, buildings totaling more than a million square feet were registered in the first year. Eventually, seven buildings became certified under LEED-NC 1.0.[98]

The pilot program quickly highlighted several shortcomings. According to then chairman, Rob Watson, two major faults were found with the 40-credit program: (1) some of the 40 credits were either too rigid or were already standard practice and, (2) the energy-related credits did not relate enough to performance.[99] An overhaul of the program was undertaken and the result was the release of LEED-NC Version 2.0 in March 2000. The overall scope and range of the program was significantly broadened, including the increase of maximum credits to 69, expanding the range of

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[96] U.S. Green Building Council, "LEED for New Construction," 16 May 2006, http://www.usgbc.org/DisplayPage.aspx?CMSPageID=220.
[97] U.S. Green Building Council, "LEED: Leadership in Energy and Environmental Design," 28 September 2005, http://www.usgbc.org/DisplayPage.aspx?CategoryID=19.
[98] U.S. Green Building Council, "Certified Project List, Version 1.0 Certified Projects," 21 July 2005, http://www.usgbc.org/LEED/Project/project_list.asp.
[99] Building Design & Construction, 7.

the Certified, Silver, Gold and Platinum categories, and revising the resource guide. By late 2002, more than 600 private and public buildings, comprising 86 million square feet, had registered for LEED certification.[100]

LEED-NC Version 2.0 was further upgraded to LEED-NC Version 2.1 in early 2003. It recently underwent another transformation, with LEED-NC Version 2.2 released upon completion of its pilot phase at the Greenbuild conference in October 2005.[101] Since LEED-NC Version 1.0 was first introduced in 1998, the USGBC has created six more rating systems, for a total of seven rating systems, each of them in varying stages of usability and with specific construction applications (see Table 3.1).

The LEED-EB rating system, used to implement operations, maintenance and upgrade strategies for existing buildings, began development in 2001, with the pilot version launched in January 2002. Ninety-nine buildings registered in the pilot, amounting to 31.5 million square feet, located in 28 U.S. states, two Canadian provinces and Brazil. Five LEED certifications were announced by October 2004: the National Geographic Headquarters (Washington, DC), the California Environmental Protection Agency Headquarters (Sacramento), Johnson Diversey Global Headquarters (Sturtevant, WI), the Brengel Technology Center (Milwaukee, WI), and the King Street Center (Seattle, WA).[102]

The widespread use of the LEED rating system is marked, and attests to USGBC achievement. One of the earliest proponents of the LEED program was the executive branch of the federal government. Today, the federal government, combined with state governments, own 22 percent of LEED-registered and certified

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[100] U.S. Green Building Council, "Building Momentum: National Trends and Prospects for High-Performance Green Buildings," February 2003.
[101] See Appendix D for an explanation of the changes found in NC Version 2.2. Because all of the projects discussed in this paper used earlier versions, and Version 2.2 is still in its early stage of application, Version 2.1 is looked at more in-depth within the text.
[102] USGBC web site, 3 April 2005.

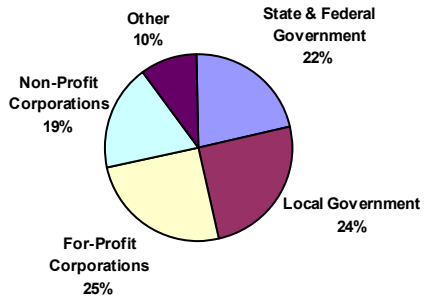
projects. Local governments have also utilized this system, representing 24 percent of LEED-registered and certified projects. For-profit corporations comprise 25 percent and non-profit organizations represent 19 percent of the industry (see Table 3.2).[103]

Table 3.1 - Current LEED Rating Systems & their Applications[104]

Rating System	Application
LEED for New Construction **(LEED-NC)**	Covers the design and construction process for new construction and major reconstruction of buildings. LEED-NC addresses the whole building and building site.
LEED for Existing Buildings **(LEED-EB)**	Used for rating existing building operating performance and building upgrades. Because existing building upgrades are a normal part of ongoing existing building operation, LEED-EB includes standards for construction and site protection as well as building and site operation.
LEED for Core and Shell **(LEED-CS)**	Addresses buildings being developed where the developer is responsible for the core and shell of the building and has no responsibility for the design and decisions concerning the interior space fit outs. LEED-CS covers the site, the building core and shell, but not the interior space fit outs.
LEED for Commercial Interiors **(LEED-CI)**	Covers tenant improvements of interior spaces in single- and multi-tenant buildings. LEED-CI should be used for fit outs of interior spaces in buildings that do not include whole building or system upgrades. It is anticipated that LEED-CI will be used concurrently or in addition to LEED-NC, LEED-EB and LEED-CS.
LEED for Homes **(LEED-H)**	Will address single-family homes, detached and attached, and multifamily residential buildings with up to three stories, developed on a single lot.
LEED for Neighborhood Development **(LEED-ND)**	Under development and will address the design and location of new, multi-lot residential, commercial, or mixed-use developments. The evaluation will take place at the block or neighborhood scale and not evaluate the buildings themselves. A developer who wishes to certify both the homes and the development or subdivision itself will need to pursue both certifications.

[103] USGBC, *Green Building Fact Sheet*, 1.
[104] U.S. Green Building Council, "LEED-EB Green Building Rating System: For Existing Buildings, Upgrades, Operations and Maintenance," version 2, updated July 2005, 6-7.

Table 3.2 - Owners of LEED Registered & Certified Projects, May 2005



Government-owned projects represent nearly half of all LEED registered projects to date. Agencies such as the General Services Administration (GSA), considered the nation's landlord of federal buildings, began requiring all new building projects to meet the criteria for basic LEED certification (encouraging Silver status rating) under its Sustainable Design Program starting in Fiscal year 2003.[105] To date, ten GSA buildings have been LEED certified, with many more projects registered and in the process of attaining certification.[106]

State governments are also taking strides. In June 2005, Nevada Governor Kenny Guinn signed into law a bill requiring all new state-funded projects to meet LEED certification or equivalent standards, effective immediately. The legislation also promotes green building in the private sector by providing a ten-year real estate tax abatement to buildings that attain a Silver rating or higher. Following in the footsteps of Washington, which adopted similar standards in April 2005, Nevada is only the second state to adopt such a codified sustainable-building standard.

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[105] The GSA owns, operates and manages over 330 million square feet of space in 8,000 owned and leased buildings in 2,000 American communities. Fifty-five percent is government-owned while the remaining 45 percent are privately-owned, leased facilities.

[106] U.S. General Services Administration website, "LEED Projects," found at http://www.gsa.gov, 16 May 2006.

Other state and local green initiatives, including financial incentives, LEED-based regulations, and design regulations, can be found in a number of states and municipalities, including Oregon, California, New York, and Texas. The city of Austin, Texas was one of the first municipalities to instate green building initiatives with its Commercial Green Building Program, approved by city council in 1995, which allows owner participants to gain financial incentives from the city's Smart Growth Matrix credit. Administered by Austin Energy, the program offsets costs of developing in urban areas, waiving development fees and public investment in new or improved infrastructure, and offering up to $6,000 to design teams whose buildings attain a four-star rating in the city's Green Builder sustainable rating system. The City Council also passed a resolution in June 2000 that requires municipal projects built under future bond issues to meet LEED Silver rating standards. Other cities, like Portland, Oregon, have chosen to adopt the LEED rating system into their own green building initiatives; in this case, the Portland LEED Green Building Rating System.

Green building initiatives are being continually adopted at all levels of government, and this widespread use is causing many industries to pause and consider their options. This includes the agencies in government that work in the field of historic preservation. The inherently sustainable building elements of historic buildings make them a natural fit for sustainable building rating systems such as LEED.

How LEED Works

The LEED rating system is a third party, performance-based tool. Each of the six existing rating systems is divided into six categories, with varying points for each rating system. For instance, LEED-NC Version 2.1 awards a maximum of 69 points whereas LEED-EB Version 2.0 awards a maximum of 85 points. These differences

reflect the intent and purpose of each given rating system, which place emphasis in different areas of sustainable design.

The six categories are related to siting, water conservation, energy, materials, indoor environmental quality, and innovation and design. Each credit carries one or more possible points, including some categories with prerequisite credits that must be earned before any other points can be captured. The number of points earned determines whether or not a project becomes LEED certified, and at what level. The idea is that the more points a project attains the more sustainable or efficient is its design and operating systems, thus leading to greater environmental savings in the form of energy, water, materials, etc. And because it is performance-based, each project has the option of applying as many or as few credits as it sees fit.

Table 3.3 – LEED-NC Version 2.1 & LEED-EB Version 2.0 Certification Levels

Rating	NC	EB
Certified	26-32 points	32-39 points
Silver	33-38	40-47
Gold	39-51	48-63
Platinum	52-69	64-85

Of the 69 possible points in LEED-NC Version 2.1, the Energy and Atmosphere category is the largest, representing 25 percent. The Water Efficiency and Innovation and Design categories are the smallest, each garnering 7 percent of the total point system. The Sustainable Sites, Materials and Resources, and Indoor Environmental Quality categories fall in-between, representing 20 percent, 19 percent, and 22 percent respectively (see Table 3.4).[107] LEED-EB Version 2.0 has a similar

[107] This point allocation represents the areas deemed of more importance by the USGBC in sustainable design, leading to one of the criticisms of the system. In other words, when considering design in a regional context, water efficiency is a more vital concern in areas of the Southwest than the Northeast,

breakdown, with the Energy and Atmosphere category representing 27 percent of the total points, Water Efficiency and Innovation and Design garnering the least at 6 percent each, and Sustainable Sites, Materials and Resources, and Indoor Environmental Quality wedged in-between, with 16 percent, 19 percent and 26 percent respectively.

Table 3.4 – Point Distribution of LEED-NC Version 2.1 & LEED-EB Version 2.0 Categories

Category	***NC* Possible Points/ % of Total**	***EB* Possible Points/ % of Total**
Sustainable Sites	14 (20%)	14 (16%)
Water Efficiency	5 (7%)	5 (6%)
Energy & Atmosphere	17 (25%)	23 (27%)
Materials & Resources	13 (19%)	16 (19%)
Indoor Environmental Quality	15 (22%)	22 (26%)
Innovation & Design	5 (7%)	5 (6%)
	69 (100%)	**85 (100%)**

The LEED rating system guidelines present a set format for each attainable credit, providing a description of its intent, requirements, submittals, and potential technologies and strategies. Each credit must follow a LEED Letter Template (introduced in LEED-NC Version 2.1), which verifies that the project has attained the credit and is submitted by the project team as part of the complete LEED certification submittal. This paper trail consists of data collected by the LEED practitioners, providing documentation of successful fulfillment of credit requirements for the project's initial submittal.

Commercial buildings as defined by standard building codes are eligible for certification under LEED. LEED-EB requires the existing building to be at least two years old. The first step toward LEED certification is project registration. In sustainable design it is important to implement green building strategies early in the

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so perhaps more points should be allotted for this category in the Southwest than the Northeast. This point will be discussed further in the following section on LEED criticisms.

design process, to establish an integrated approach. Hence, it is recommended to register a project during this early phase to reap the highest rewards.

Registration is followed by documentation preparation, to satisfy the prerequisites and credit submittal requirements. This is where a LEED accredited professional becomes an asset as credit interpretations can be confusing. The documentation preparation leads to the certification review process, which includes the application submittal, review, awards, and appeal, if applicable. Certified buildings receive an award letter, certificates and a metal LEED award plaque. Projects that are not certified possess the option of appealing the final review, at a cost of $500 per appealed credit denied in the Final LEED Review. And here is a sticky point: the cost of LEED certification.

For good reason, one of the major concerns of green building is the possibility of higher costs. With the LEED rating system, this is a concern not only in the actual building construction, but also with the fees involved in LEED registration and certification. In the grand scheme of things, the fee is small in comparison to commercial project costs, but it is an added cost nonetheless.

Table 3.5 - Fee Summary for NC, EB, & CI

Charges	Less than 25,000 ft^2 Fixed Rate	75,000-300,000 ft^2 Based on ft^2	More than 300,000 ft^2 Fixed Rate
Registration			
Members	$750	$0.01/$ft^2$	$3,000
Non-members	$950	$0.0125/$ft^2$	$3,750
Certification*			
Members	$1,500	$0.02/$ft^2$	$6,000
Non-members	$1,875	$0.025/$ft^2$	$7,500

*Certification fee for projects registered under NC Version 2.0 (prior to November 15, 2002) is $1,200 (members) or $1,500 (non-members).
(Source: USGBC Website, http://www.usgbc.org/DisplayPage.aspx?CMSPageID=64&#fee, 5 November 2005)

So what does one earn by becoming LEED certified? After all the paper work and additional fees, is it really worth it? Broadly and idealistically, LEED certification provides a fantastic advertisement for sustainable living. What it also does is decrease operating costs, decrease a building's overall footprint on the environment, and increase wellbeing.

Analysis and Criticism

To create a national green building standard is a lofty goal, one that the USGBC has found both success and minor failure. The group and its rating systems have been placed under the microscope in any number of ways, yet their apparent strength shows through the continually growing application of the rating systems. The question remains, however, as to why LEED rises above any other existing rating system. Through trial and error, and numerous revisions, LEED has arrived where it is today. General criticism and analysis of the LEED rating system development, design, and bureaucracy/logistics provide a window to identifying its faults and successes.[108]

One general criticism is that the LEED rating system lacks in its reach and extent as a measurement of sustainability. Jason McLennan, the Canadian architect and author of *The Philosophy of Sustainable Design*, acknowledges the many virtues of the LEED rating system and its surge into mainstream green building application, but notes that it is "an imperfect judge of the true levels of sustainability,"[109] because it does not necessarily promote the idea of a "living building" that accounts for both its own wastes and impacts and those of others too, thereby taking on a restorative role. Widespread application of this design concept is not yet realistic, but it is something to strive for and a mantra to which the USGBC should consider basing its rating systems.

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[108] Many of these criticisms were addressed in the recently released LEED-NC Version 2.2 rating system. The arrived at solutions of these criticisms are detailed in Appendix D.
[109] McLennan, 147.

Development

Aside from the theoretical and conceptual design of LEED, there are also faults found within its development. Calling itself "consensus-based," the USGBC initially excluded trade associations from joining the group for fear that they would leverage their financial resources and lobbying capacities in a controlling fashion. In August 2005, the USGBC amended its bylaws to accept trade associations as full members. This allows the Council to become formally accredited by the American National Standards Institute (ANSI), an important step as federal agencies are encouraged by the Office of Management and Budget to use accepted industry standards instead of developing their own.

However, the USGBC is already swayed by personal agendas as a member-run organization. Pushing a voluntary program with the hopes of changing the building industry has led the organization to attempt to placate everyone involved, in many ways leaving too much flexibility in the system and opening it to manipulation.[110] This, in turn, provides a fundamental flaw in the design process, including a serious lack of scientific rigor.

One of the few scientific studies of the LEED rating system identified this missing component. In a study conducted by the Center for Sustainable Systems at the University of Michigan in 2002 entitled "Evaluation of LEED Using Life Cycle Assessment Methods (LCA)," individual LEED credits were analyzed by utilizing a life cycle approach based on a case study—the Sam Wyly Hall on Michigan's Ann Arbor campus. LCA was found to be largely absent in the LEED rating system.

This study points out that LEED was not created using a scientific process, but instead was created by voluntary industry stakeholder committees who developed

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[110] Ted Smalley Bowen, "LEED green-building program confronts critics and growing pains," *Grist Magazine*, 26 October 2005, www.grist.org.

program features. It is precisely this non-technical basis that leads to industry favoring and "watering down of environmental standards." Standards are what architects rely upon. Standards are necessary to create consistency so they can be used within the context of many competing factors in building design, like aesthetics and economics.[111]

LEED attempts to become the standard of environmental impact measurement in buildings, to be compared with other standards such as the American Society of Heating, Refrigerating, and Air-Conditioning Engineers (ASHRAE), the Institute of Electric and Electronics Engineers (IEEE) and the National Research Council (NRC), but, according to the University of Michigan study, "it has not been developed with the scientific rigor of other important standards in architecture and as such is in danger of undermining its own goals."[112]

The USGBC also misleadingly used the term "market-driven" to describe LEED when in fact most of the early, and current, practitioners were government agencies, schools, foundations, and environmental organizations—practitioners that are not market-driven. This label was most likely used to provide a means of attracting a wide variety of users by flaunting the potential for financial gain. Since its early days, the USGBC breached the private market and has become more market-driven as it has become mainstream.[113]

Design

LEED is viewed by some as a better marketing tool than a scientific measure, with the public relations benefits of certification driving the design process, what has been humorously termed, "LEED brain."[114] When considered in a life cycle

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[111] Scheuer and Keoleian, 19-20.
[112] Ibid.
[113] Building Design and Construction, 9.
[114] Auden Schendler and Randy Udall, "LEED is Broken; Let's Fix It," *Grist Magazine*, 26 October 2005, www.grist.org.

perspective LEED "does not provide a consistent, organized structure for achievement of environmental goals," because of its lack of comparability between LEED ratings and LCA results.[115] It also lacks integration because of its disaggregation into individual credits, leading "to so much variation in total building environmental performance that a building's rating may not align with its actual performance."[116] This performance, or lack thereof, does not provide a good standard of measure for green building. The University of Michigan authors suggest that a much greater and more integrative approach must be taken to provide an adequate and reliable assessment tool, one that also combines elements of LCA.

The exclusion of LCA in LEED is one of its main criticisms, especially given the importance of LCA in sustainable design. A LEED certified building could very well contain a considerable amount of toxic polyvinyl chloride (PVC) materials, and could theoretically be awarded a credit if that PVC was manufactured within a 500-mile radius of the project site and comprised a minimum of 20 percent of building materials and products, according to the criteria for recognizing Regional Materials credit. And, because the LEED rating system does not deduct points for 'non-green' materials or systems, the use of such a material would not have an effect on the overall point earnings.

This is startling. The process by which LEED points are awarded is the target for criticism, for obvious reasons. In addition to the possibility of allowing the use of, and potential credit for, toxic materials, a building can also become certified without earning any points for energy conservation—the largest point category. Energy conservation is further aggravated by the lack of regionally climactic design considerations.

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[115] Scheuer and Keoleian, 93.
[116] Ibid.

A LEED certified project by the Aspen Skiing Company in Aspen, Colorado proves this point. The Sundeck Restaurant on Aspen Mountain was one of the first LEED-certified buildings at the Bronze level in the United States. It earned its certification by essentially being built to code, and including the required LEED commissioning component and "a few modest upgrades" (this in the words of the professionals that worked on the project).[117]

LEED points are equally weighted, meaning that diverting 50 percent of construction waste earns a project the same single point as does installing an electric vehicle recharging station as an alternative form of transportation, even if there are no electric vehicles to recharge. According to the On-Road Electric Vehicle Inventory, there are less than 2000 on-road EVs in North America.[118] This hardly seems equitable. But, in fact, there is evidence showing that many early projects went after easy points.[119] For example, a project earns a point for employing a LEED accredited professional.[120]

The most mind-boggling of all the credits, in relation to historic preservation, lie in the Materials and Resources (MR) category. Of the 13 possible points in the NC Version 2.1 rating system, only a maximum of five points can be earned for the use of salvaged materials.[121] If two points are awarded for diverting construction waste from the landfill, this leaves six points awarded for the use of new or recycled materials.

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[117] Schendler and Udall.
[118] Building Design & Construction, 12.
[119] Ibid., 10.
[120] Initially, this point was difficult to earn as very few LEED accredited professionals existed. It encouraged people to become accredited, however, and now that many people have reached such status, it has become an easy point to earn.
[121] Because LEED-EB is designed for building operations and maintenance upgrades, the MR category focuses on different material considerations than that of LEED-NC. For instance, alternative materials in LEED-EB, including salvaged, recycled, rapidly renewable, and certified, refer to office equipment, furnishings, furniture, and building materials used in the building and on site. A scale of one to five possible points is used for this MR credit and, with a possible two more points for construction waste diversion, the total seven points for material reuse still represents less than half of the total possible 16 points in the LEED-EB MR category.

Theoretically, a building can become certified without using or producing any salvaged materials. This means that a building project that uses 100 percent salvaged materials could receive fewer MR points than a project using all new materials, even though the 100 percent salvaged building would have substantially less environmental impact.[122] Certainly, this contradicts the very definition of sustainable design and does nothing to promote historic preservation.

In addition, there is no added advantage to using materials salvaged onsite rather than bringing them from off site. For instance, a new building that requires demolition of an old building on the same site does not earn any extra points for reusing the salvaged material from the on site demolition as opposed to bringing in salvaged materials from another site. Using onsite salvaged materials should be rewarded because it eliminates the negative impacts surrounding the transportation of the materials.

The MR credits that refer to building reuse in both the NC and EB systems are not compatible with the purpose of the Standards. They apply when materials are salvaged for new use in their original capacity or in a different function, with the exclusion of window assemblies and non-structural roofing materials because they are often replaced during a major renovation to improve energy performance.[123] Window replacement, as preservationists know, should be avoided at all costs in the rehabilitation or renovation of a building. Windows are considered a character defining feature and, if they are reparable, should not be replaced.

However, one of the first considerations in increasing energy performance is the application of "efficient," in other words, new, window systems, along with insulation and non-structural roofing materials. A recent example provided by the

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[122] Webster and Bronski, 62.
[123] Ibid.

Housing and Urban Development (HUD) agency illustrates this. In January 2005 it released a monthly e-mail update through its Public Housing Energy Conservation Clearinghouse News that included a feature news article entitled "Choose Wisely: Efficient Windows Collaborative Announces New Tool for Choosing Energy-Efficient Windows." This collaborative emphasizes new, manufactured windows. Through this email, HUD effectively instructed homeowners to do away with historic windows, as opposed to making them energy efficient through such methods as weatherstripping or installation of storm windows; and this despite the fact that HUDs Housing Rehabilitation Guidelines were the predecessor to the Standards.

Further LEED design criticism has been directed towards its reliance on ASHRAE Standards. Used as benchmarks for such credits as the Energy & Atmosphere Pre-requisite and Credit 1 in the NC rating system, many of the ASHRAE Standards are not considered rigorous enough. For instance, the Indoor Environmental Quality Pre-requisite 1 requires compliance with ASHRAE 62-1999, considered a code minimum.[124]

ASHRAE and the American Society for Testing and Materials (ASTM) do not apply many green building standards. This has been noted as one of the obstacles in the greening of buildings—the major voluntary consensus standard developing organizations are not rigorously taking part in green building.[125] For the federal government to adopt or adapt for its use a set of standards to create a single, unified Federal policy is difficult because these major standard developing organizations have not provided a viable model. Thus, many federal agencies are encouraging the use of LEED as the accepted standard, despite its many flaws. Herein lies the irony of the

[124] Office of the Federal Environmental Executive (OFEE), Appendix B; Schendler and Udall.
[125] OFEE Report.

aforementioned criticism of LEED lacking scientific rigor yet the accepted scientific standard setting organizations are not answering the call for such a standard.

LEED is blossoming, continually being adopted at all levels of government, and in conjunction with many types of financial aid. And, although many federal agencies, like the GSA, have adopted its guidelines and indeed are requiring many federal buildings to achieve LEED certification, there is still no formal federal policy that accepts LEED standards in conjunction with federal tax relief. As the bugs continue to get ironed out, however, LEED may finally hit the mark.

LEED design also exercises exclusivity. It only recognizes Forest Stewardship Council (FSC) certified wood; no other forest certification systems are accepted. Forest certification systems provide a means of promoting responsible forest management, and many more exist aside from the FSC (although not considered by LEED to be as rigorous as the FSC), such as the American Tree Farm System and the Canadian Standards Association. Indeed, Canada's Green Globes system was created in opposition to LEED and recognizes all of the mainstream forest certification systems. Green Globes also does not hold projects accountable for inapplicable strategies, allowing for point variations within individual projects.[126]

One of the more interesting criticisms of the LEED design concerns its durability.[127] For example, what will it mean to be LEED-NC Version 2.1 Platinum certified in the year 2050. The NC system has been revised three times during a period of eight years. Already, buildings certified under LEED-NC Version 1.0 can be considered outdated in comparison to their Version 2.1 counterparts.

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[126] Nadav Malin, "Green Globes Emerges to Challenge LEED," *Environmental Building News* 14, no. 3 (2005): 4-6. The Green Globes program was introduced as an alternative in the U.S. market. Released in Canada in 2002, it has been licensed by the Green Building Initiative (GBI) to be used in the nonresidential building market in the U.S.

[127] Scheuer and Keolian, 100.

Bureaucracy/Logistics

Understanding the design of LEED and how the point system works is small potatoes in comparison to the certification application. Very few of the LEED registered buildings have reached certification, largely because of the time lag involved in the submittal and review process, as well as the cost, which can be considered more of a disincentive than the cost of greening the building itself. By May of 2005, 216 projects had reached certification, while another 1,936 projects waited in the registered ranks. This averages out to 27 certified projects a year.

The recently released NC Version 2.2 addresses these issues by swapping the archaic method of collecting pounds of paper templates with a sleek online application, and a readjusted fee scale, but NC Version 2.1 and EB Version 2.0 projects were left to suffer through the old process. In addition, the awarding of points is quite inflexible and unforgiving; there is no sliding scale. Given the many different types of projects, not to mention the regional requirements due to climate, building codes, etc., one would think LEED would be more adaptable. A humorous outpouring of frustration from Auden Schendler, a LEED-accredited professional and director of environmental affairs at Aspen Skiing Company, and Randy Udall, director of the Community Office for Resource Efficiency in Aspen, Colorado, in their *Grist Magazine* article, "LEED is Broken; Let's Fix It," illustrates this point:

> LEED reviews feel like Navy SEAL boot camp, where the goal is to fail as many applicants as possible. Credit reviews are humorless, severe, even confrontational. Green building is hard, and the USGBC should be aiding and abetting green projects, not crushing them with a faceless technocracy. Credit interpretations should be constructive, not infer that the applicant is a criminal violating parole.[128]

LEED can certainly be used as a guideline without a project actually undergoing the entire certification process. LEED is not required to build green. The

[128] Schendler and Udall.

only drawback is not receiving financial incentives for LEED certification. However, incentives for energy savings have existed for quite some time, and do not require a LEED certification component. Portland, Oregon, for instance, has an Office of Energy's Small Scale Energy Loan Program that offers low-interest loans to developers to fund energy-reduction measures in new or existing buildings. On the other hand, the underlying goal is decreasing a building's ecological footprint, not fiscal savings. It is this type of mindset that has the potential to revolutionize the building industry.

Conclusion

A careful look at the history, design and criticism of the LEED rating system unveils its strengths and weaknesses as a green building standard. Similar to the historic preservation movement, LEED began at the grassroots level, gaining broad attention and wider use when it began to be adopted by government bodies that in turn promoted its worth through tax incentives. Despite the many criticisms that can be made of LEED, it is a powerful tool; in its concept of guiding sustainable design and its national and international growth. Like many standards and guidelines LEED is a work in progress, and as it continues to grow it will continue to re-shape itself to address the current and ongoing concerns of sustainable design and development. A close look at how LEED and the Standards can work together as tools sheds light on the application of this green building rating system to historic preservation.

CHAPTER IV

Standard v. Standard

Now with a firm footing in how LEED works by itself, we can turn to an analysis of how well the central tenets of LEED and the Standards complement one another; a pitting of standard versus standard. The two sets of standards possess several similarities and differences within their purpose, use and structural design. A detailed look at these highlights shared elements and how LEED does or does not actively engage historic preservation and the Standards in its design.

Similarities

Many of the similarities and differences between LEED and the Standards have been identified and scattered throughout previous chapters, but it is worth noting some of the major points again in a single, cohesive chapter for ease in comprehension. First, it is plain to understand that both the LEED rating system and the *Secretary of the Interior's Standards for Rehabilitation* provide guidelines and standards in the design, operation and management of buildings and structures and, in the case of the Standards, of sites, objects and districts, as well. They both act as guiding tools; not prescriptive in nature. They offer a common language in green building and historic preservation. Both can be used without a required review process, but in so doing, do not allow for financial incentives.

It is important to remember that standards should act as guidelines and not as rules. In historic preservation, this is a difficult task as the Standards are administered at the state and federal level where their application has the potential of being swayed by bureaucratic fiat. The LEED system, on the other hand, is controlled by a consensus-based committee under a non-profit organization that is not directly

regulated by any federal agency or department, but most certainly can be swayed by deeply invested and powerful members.

Secondly, both sets of Standards are ideally used to guide the stewardship of natural and cultural resources. Economic motives may have played a strong role in the creation of the USGBC and the LEED rating systems; however, one of the underlying motives, according to the LEED mission, is to promote sustainable design principles, which includes the stewardship of natural resources. While it can be argued that the Standards provide a stronger stewardship role, it cannot be argued whether or not both share this role to varying degrees.

Thirdly, both LEED and the Standards provide guidelines for financial incentives. This, perhaps more than anything, has intensified the acceptance and use of both. Adopted due to federal legislation in respect to the Standards, and adopted voluntarily in respect to LEED, these standards are implemented at all levels of government and by private institutions and entities.

Differences

One of the major differences between LEED and the Standards lies in the type of user that is targeted, specifically when speaking of LEED-NC and LEED-EB. LEED targets the designer while the Standards target the owner. The origins of the two systems differ considerably as well.

LEED was created, and is run, by a non-profit group of industry professionals who envisioned the need for a set of green standards and set about devising these on their own merit. The Standards were created by a request to the Advisory Council on Historic Preservation and the National Park Service from the Department of Housing and Urban Development (HUD) to assist HUD in defining the nature and scope of a program for low interest loans for rehabilitating historic houses, under provisions of

the 1974 Emergency Home Purchase Act.[129] The different origins created two very different design-oriented sets of standards. This is plainly seen in the vastly different design structures.

For instance, LEED-NC consists of a 69 point system that encompasses six green building categories described in a manual consisting of over sixty descriptive pages that explain each individual point in its intent, requirements, submittals, and potential technologies and strategies. LEED-EB consists of an 85 point system described in more than 100 pages of text. The Standards are simply ten fairly descriptive, but not inclusive, rules for the preservation, rehabilitation, restoration and reconstruction of historic properties—that can fit onto a single page.[130]

This disparity can be explained in part by the difference in what can be termed the value systems of the two standards, where LEED takes a more quantitative approach and the Standards a more qualitative approach in their application. LEED works on a point system, where the more points you get the more green the building or structure is supposed to be. In many ways it is quite cut and dry, based on objectivity, and the review process is done off-site, with only mounds of paperwork to prove the earning of points; there is no individual site analysis.

The Standards are not as cut and dry, based on subjectivity and working on a case-by-case basis with ten rules that are flexible, depending upon the given project. There is no point system. A project earns financial incentives under federal or state preservation incentive programs if it adequately addresses the Standards in its preservation, rehabilitation, restoration, or reconstruction process, determined by the National Park Service.

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[129] W. Brown Morton III, "The Secretary of the Interior's Standards for Historic Preservation Projects," (Fredericksburg, VA: Mary Washington College, 22 October 1993): 2.
[130] See Appendix A.

It is interesting to think of assigning points for the Standards and the reverse for LEED. The Standards offer a certain amount of flexibility when used as guidelines but they could do more to adopt green building strategies and considerations of natural resource and ecological system protection. Similarly, LEED needs to be more flexible and work on a case-by-case basis, moving away from rigid rules and point allowances, and give more consideration to the sustainable component of saving cultural and historical meanings.

Herein lay another central difference between the two. Although both standards provide a level of resource stewardship, LEED plays a more tangential role in such guardianship, where its rating systems do not necessarily center on the protection of natural resources in a direct way but, rather, focus more on resource efficiency. The Standards, however, do directly steward cultural resources.

Shared Elements

Several of the Standards are to some extent mirrored in LEED, and vice versa. It is worthwhile to investigate the shared elements between historic preservation and sustainable design based upon LEED's six categories. Within each of the six LEED categories lie the following elements shared by historic preservation and LEED:

- **Sustainable Sites:** Reduced site disturbance, sensitive site selection that emphasizes urban and brownfield redevelopment, proximity to mass transportation, development density, and permeable surfaces with native or adapted vegetation.
- **Water Efficiency:** Reuse of stormwater; i.e. cisterns, and native or adapted, climate-tolerant plantings.
- **Energy & Atmosphere:** Passive solar design features, natural ventilation, radiant heating, and displacement cooling.
- **Materials & Resources:** Building reuse, salvaged materials, and regional materials.
- **Indoor Environmental Air Quality:** Natural ventilation, daylighting, views, and toxic material removal or encapsulation; e.g., asbestos (applicable to LEED-EB).

- **Innovation & Design Process:** Variable[131]

Each of these elements within the six LEED categories represent inherent qualities characteristic of historic buildings and sites. Each of the shared elements also represents one or more possible points that can be earned for certification. They are not the only points available to historic preservation projects, but they are the most compatible. The Sustainable Sites, Materials & Resources, and Indoor Environmental Quality categories provide the most natural opportunity for an historic building to earn credits in the LEED structure.

A point by point comparative structural analysis of LEED and the Standards is challenging given the vast differences in structural design, intent and meaning of the two sets of standards. The comparison merely becomes a more detailed listing of the shared elements. This is because most of the Standards do not directly address the LEED credit topics. For example, there is not an equivalent Standard to the LEED-EB 'Credit 3.1 Alternative Transportation: Public Transportation'. A connection between green building and historic preservation can be identified within that credit, in that historic commercial buildings were generally found in dense, urban areas that may have had a public transportation system, but there is no Standard that addresses public transportation. The addition of public transportation to an historic site would possibly need to follow Standard Two in the retention and preservation of the historic character of the property, and with Standard Ten when considering the form and integrity of an historic property and environment with a new addition and adjacent or related new construction, but this can be true when considering many of the LEED credits.

Appendix E attempts a comparison by individually breaking down the LEED-NC and LEED-EB credit systems and identifying how each credit fits into the Standards and historic preservation practice. What is discovered is that it is difficult to

[131] Walter Sedovic, "History's Green Genes," Greenbuild Conference presentation, Pittsburgh, PA, November 2003.

compare individual LEED credits and Standards in a hypothetical situation. When more variables and particulars of a project exist, the easier it is to determine a relationship. Despite the challenge, the comparison is a worthwhile task to determine what connections do exist, and where commonalities can be expanded upon to create a stronger tie between the two standards.

Rules of Engagement

Despite the shared characteristics between LEED and historic preservation LEED still does not do enough to promote the preservation of historic buildings. The main criticisms are threefold: [1] new construction and the use of new technology are stressed more than preservation and passive design solutions, [2] life cycle analysis of materials is not a strong enough consideration, and [3] no credit is given to preserving cultural meaning. The first two criticisms were previously addressed in Chapter III, and the third refers to one of the abstract tenets of sustainable design, which emphasizes viable living environments that not only reduce ecological footprints, but that also exude a sense of place and meaning for all inhabitants.

Since the introduction of LEED-NC in 1998, only six historic buildings have been LEED certified in new construction (see Table 5.1). The LEED-EB rating system, seemingly more compatible with historic preservation given its application to existing buildings, is nearly three years out of its pilot phase and still has not been used to certify an historic building. This can be due to the fact that it is relatively new in application and/or many of the LEED certified projects involving historic buildings also involve some element of new construction, therefore lending themselves more to the NC rating system.

Of the six LEED certified rehabilitations two were certified historic rehabilitations that took advantage of the full 20 percent Federal Historic Preservation Tax Credit. The remaining four projects either received the 10 percent tax credit or

none at all. The S.T. Dana Building on the University of Michigan - Ann Arbor campus, for example, although part of the Central Campus Historic District listed in the National Register, did not apply for the incentive program because it was not required, and therefore chose not to adhere strictly to the Standards. This project had little to no involvement with the Michigan State Historic Preservation Office.

Figure 4.1 - S.T. Dana Building (Photo credit: Author)

The S.T. Dana building presents an interesting case study when considering LEED and historic rehabilitations. Here we have a project that preserved an historic building for all of its inherent sustainable features yet did not follow the Standards to the fullest extent in order to have more leeway in the design, particularly with the fourth floor addition that most likely would have caused an issue with the Standards. Yet, despite this conflict, the building exterior was rehabilitated to its original 1903 appearance, with restored parapets, and re-pointed and refinished stone and brick.

And many interior elements, even with the renovations, highlight the original building character, like the courtyard infill that retained the exterior brick wall.

Figure 4.2 - S.T. Dana Building Interior Infill (Photo credit: Author)

Table 4.1 – LEED-Certified Historic Buildings (October 2005)

Name	Location	Year Completed	Certification Level	Rating System	National Register Status	Certified Historic Rehabilitation
KSBA Architects Office Building	Pittsburgh, PA	1998	Certified	NC-1 Pilot	Eligible	N
Jean Vollum Natural Capital Center	Portland, OR	2001	Gold	NC-2	Eligible	N
Balfour-Guthrie Building	Portland, OR	2003	Silver	NC-2	Listed, 2003	Y
Snowcroft Building	Ogden, UT	2004	Silver	NC-2	Listed, 1978	Y
S.T. Dana Building Renovation	Ann Arbor, MI	2005	Gold	NC-2	Listed, Central Campus Historic District, 1978	N
Cambridge City Hall Annex	Cambridge, MA	2005	Gold	NC-2	Eligible	N

Figure 4.3 - Balfour-Guthrie Building (Photo credit: Thomas Hacker Architects Inc.).

In direct contrast to the S.T. Dana Building is the green renovation of the Balfour-Guthrie building in Portland, Oregon. Here is a project that took advantage of LEED and the Standards, garnering a Silver LEED certification while undergoing a certified historic rehabilitation. This 1913 commercial building now provides office space for Thomas Hacker Architects Inc., the design team for the renovation, and the non-profit Energy Trust of Oregon. Learning from the mistakes of the Jean Vollum Natural Capital Center rehabilitation and renovation, where steps for a certified historic rehabilitation were addressed too late in the design process, and which will be discussed in detail in Chapter V, the Balfour-Guthrie building provides an ideal example of how efficient and early planning can make greening of an historic property work.

Nevertheless, the fact that only six historic buildings have been LEED certified to date attests to a disconnect between LEED and historic preservation. Yet LEED

obviously can be successfully applied to historic rehabilitations. This moves the question beyond whether or not the two sets of standards can be conjunctively used to a question of what level of consideration does LEED provide historic buildings that follow the Standards. And to what extent are preservationists and green building advocates educated on the ways to marry the two.

LEED does not give enough consideration. Not in respect to the historic integrity and character of a building nor to many of the inherent sustainable characteristics of historic buildings. Any type of retrofitting measure to a historic property will more often than not find conflict with the Standards, and green building retrofits are not an exception. Such difficulties were realized when energy conservation retrofits of historic buildings were first widely applied in the 1970s, and in other retrofitting practices such as American Disabilities Act (ADA) and seismic control compliance.

To be fair, it can be argued that the Standards do not give enough credence to preserving ecological systems in that they are not directly addressed in the ten standards. But, there are at least two arguments here: one being that historic preservation as followed in the Standards, in its inherent sustainable nature, indirectly preserves natural systems both in the preservation of buildings and sites and, two, historic preservation focuses on the stewardship of historic buildings, sites, objects and districts, encompassing a select field in sustainable design. LEED, on the other hand, encompasses the entire palette of sustainable design which should include historic preservation, according to the central tenets of sustainable development.

This is not to say that the field of historic preservation should turn a blind eye to environmental conservation. On the contrary, one of the main points of bringing attention to the connection between green building and historic preservation is to increase such awareness. The absence of a more enlightened attention to historic

preservation in LEED, however, is a much more egregious missing component in the so-called green building rating system than the indirect acknowledgement of ecological conservation in the Standards. It is also all the more remarkable considering that the early green building projects emphasized the importance of preserving the existing built environment in sustainable design. This is seen, for example, in the renovations of the Audubon House and the Natural Resources Defense Council. Granted, neither of these projects was a certified historic rehabilitation, but they both respected the sustainable qualities of an historic building and its setting.

Collaborative efforts amongst green building and historic preservation advocates to work out the kinks in joining the two systems have already begun. The Association for Preservation Technology's Technical Committee on Sustainable Historic Preservation is forging links with the USGBC to assert the presence of historic preservation in the world of sustainable design and green building and to harness an understanding of how the two systems can work together. Indeed, the July 2005 updated version of LEED-EB Version 2.0 includes an added section in its introduction on the applicability of LEED-EB to historic buildings:

> The flexibility afforded by the LEED Rating System allows for the applicability to historic buildings. LEED-EB is a performance not prescriptive standard. Provided the building meets all LEED-EB Prerequisites, certification can be achieved by demonstrating achievement of any combination of 32 credits (40% of the 85 points). During the development of LEED-EB, the U.S. Department of the Interior's Standards for Treatment of Historic Properties were reviewed and no direct conflicts were identified.[132]

However, although there are no direct conflicts between the two sets of standards, this does not mean that LEED-EB emphasizes the preservation of a building and its

[132] U.S. Green Building Council, "LEED-EB Green Building Rating System: For Existing Buildings, Upgrades, Operations and Maintenance," version 2, updated July 2005, 4.

materials as a basic tenet of sustainable design. This is seen in the manner by which the minimal number of points can be awarded within this version.

To some, the answer lay in the creation of a LEED rating system designed to specifically guide historic preservation projects. New York City based preservation architect Walter Sedovic proposed just that at the USGBC annual Greenbuild conference in Pittsburgh, Pennsylvania in 2003. Through convincing theory and numbers-based evidence on life cycle cost comparisons between high-performance building materials versus traditional building materials, Sedovic agrees that LEED can be a worthy tool for historic preservation, but he also points out that it tends to focus more on new rather than existing buildings. Thus, he calls for a LEED-HB system that recognizes the inherent sustainable qualities of historic buildings.

The USGBC has not yet adopted this approach. It is a viable option, but perhaps is not the ultimate goal. While this approach would undoubtedly further the awareness and rightful place of historic preservation in green building, it would in some ways exclude it as a special, selective approach to sustainable design. In other words, new construction could still be exercised as a highly acceptable means to achieving green, when the ultimate goal should be the initial addressing and full integration of passive, regionally-based designs that historic buildings inherently possess. It is the education and collaboration amongst historic preservation and green building advocates that is key. The USGBC must give more credibility to how LEED addresses sustainable design, and within that historic preservation, if it is truly to be considered a measurement of green building.

Conclusion

In government monitored preservation a historic building can be retrofitted in any number of ways as long as it follows the Standards. The problem with LEED is that it doesn't always adhere to the basic tenets of sustainable design, with the reuse of

an existing building as a core feature of these tenets. The LEED system and the current mode of sustainable design stress new construction and high technology. LEED can be used in a historic rehabilitation, but it may not be as easy to attain a high level of certification in comparison to a new construction project.

W. Brown Morton III, co-author of the Standards, defines the Standards as "a code of ethics—as general statements that apply to all preservation work and which articulate an attitude or set of values against which a specific action or plan can be evaluated."[133] LEED does not give enough weight to the characteristics of historic buildings, despite the many shared elements between the two, and it offers a very strict set of standards with its rather unbending rules and point accumulations. But, at the heart of it is a set of values similar to the Standards. It works so that the wheel does not have to be reinvented. This is what makes the linkage between the two so compelling and full of opportunity in the union of environmental conservation and historic preservation practice. The Jean Vollum Natural Capital Center case study, described in detail in the following chapter, proves that this link can be forged.

[133] W. Brown Morton III, "The Secretary of the Interior's Standards for Historic Preservation Projects" (Ithaca, NY: The National Council for Preservation Education, 1993), 2.

CHAPTER V

A Case Study

The Jean Vollum Natural Capital Center, Portland, Oregon

The Jean Vollum Natural Capital Center in Portland, Oregon—a LEED-NC Gold certified project—is considered the first historic rehabilitation to attain LEED Gold certification. It is an ideal model for this study because it is an historic renovation, is located in a city that prides itself on progressive, sustainable-minded thinking, and is used as a tool to open people's minds to sustainable design. Named for its philanthropic benefactor and founding board member, it is also known as the Ecotrust Building after its main tenant. This historic warehouse is located in the River District, or Pearl District, in northwest Portland, an old industrial area of warehouse buildings and 34 acres of rail yards.[134] The River District is currently undergoing rapid redevelopment into high-density urban residential neighborhoods with art galleries, retail shops, restaurants, and green spaces, serviced by new Portland Streetcar lines. It is this setting, along with the site and the green renovation of the Ecotrust building, which successfully illustrates the marriage of old and green.

The Setting

Much of Portland's redevelopment is green. Portland leads all other U.S. cities in numbers of LEED registered projects, many of them historic renovations. By mid-October 2005, Portland boasted 53 LEED-NC registered projects and four LEED-EB registered projects. The state of Oregon had the fifth highest number of LEED-NC registered projects at 103, behind California, Washington, New York, and Pennsylvania, as well as the fifth highest number of LEED-EB registered projects,

[134] It sits directly above the Downtown, bounded on the north by the Williamette River, to the south by West Burnside Street, to the east by Northwest Broadway Avenue, and to the west by the 405 Freeway.

numbering seven, trailing California, Colorado, Missouri, and New York.[135] By July 2006, Portland had sixteen LEED certified projects, and Oregon thirty-three.[136]

Portland set an early precedent for Smart Growth development in 1972 by realizing its urban renewal mistakes and creating a revolutionary Downtown Plan that curbed sprawling development. Among the Plan's many considerations were zoning code amendments that limited parking lots and spaces, the design of pedestrian-friendly buildings, the creation of a downtown transit mall that introduced light-rail trains and streetcars, the adoption of an urban growth boundary, and the establishment of new historic districts and the nation's first state-level historic preservation tax incentive program: the Special Assessment of Historic Property Program that freezes a property's assessed value for 15 years.[137]

Portland's progressive city planning emphasizes sustainability through private and public support. Public agencies and organizations like the Portland Office of Sustainable Development (OSP), the Portland Development Commission, and the Bureau of Environmental Services create and administer supportive regulations and measures such as the City of Portland Green Building Policy, [138] the Green Investment Fund, Portland LEED (referred to as PDX LEED, based on NC 2.1, the first local adaptation of LEED approved by the USGBC), and the state of Oregon Business Energy Tax Credit. The local utility, Portland General Electric, provides a green building program for commercial and residential development and started a for-profit, green building consulting firm. The OSP also created G/Rated, an official City

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[135] Based on USGBC statistics from October 2005.
[136] USGBC website, "Certified Project List", www.usgbc.org, 7 July 2006.
[137] Donald Watson, Alan Plattus and Robert G. Shibley, "The 1972 Downtown Plan" (Portland, OR: City of Portland, 1972).
[138] The Portland city council strengthened its Green Building Policy in mid-2005 after four years of implementation. Among the new requirements: all new municipal facilities must achieve LEED Gold certification; major retrofits and existing occupied buildings are required to meet LEED-EB Silver standards, and tenant improvements and leased facilities must achieve LEED-CI Silver or certification through Portland's G/Rated Tenant Improvement Guide; and all private-sector development projects larger than 10,000 ft^2 must meet LEED Silver in order to receive municipal funding.

program that provides a portal for green building information to educate building industry professionals and the public on the many benefits of sustainable design.[139]

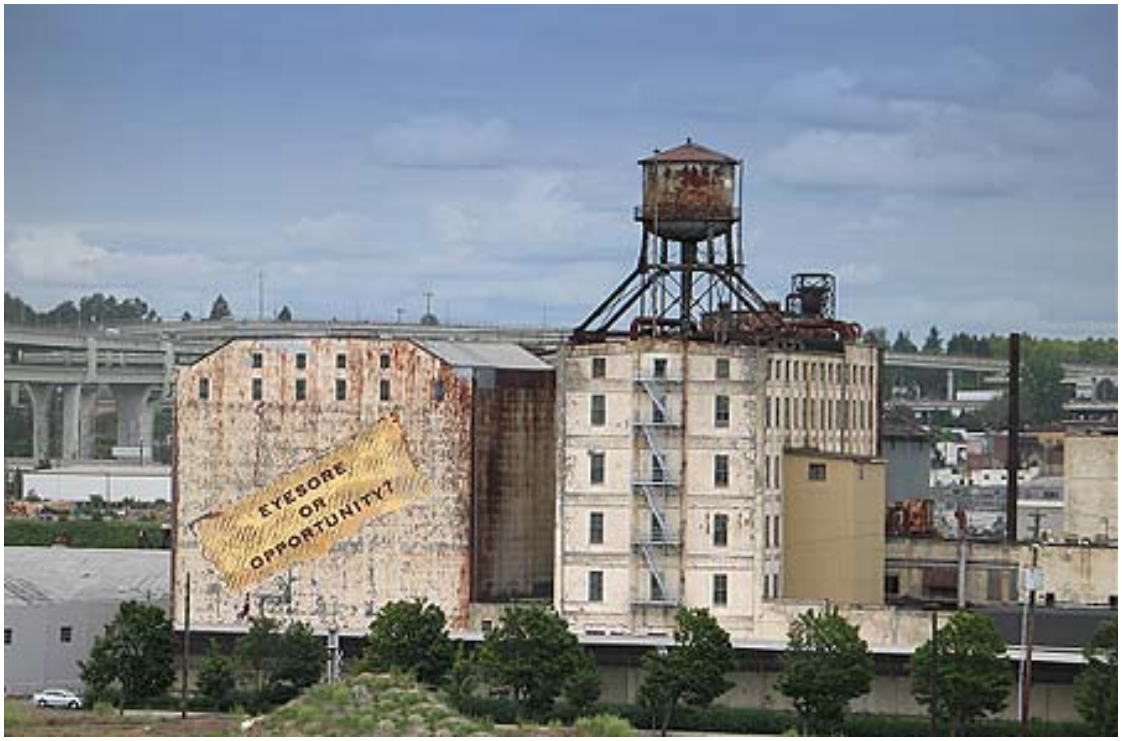

Figure 5.1 - Pearl District Redevelopment *(Photo credit:: Pearl District Neighborhood Association Web site, http://www.pearldistrict.org)*

Private architectural and development firms provide the design expertise and financial backing for implementing sustainable design projects. This, combined with public level support, provides the ideal environment for spreading sustainable design. Within the Pearl District alone there are several examples of green historic renovations. In addition to the Ecotrust building, there is the five-block Brewery Blocks mixed use urban redevelopment project that combines new construction and historic renovation, including the rehabilitation/renovation of three historic buildings: the Weinhard Brewhouse, the Oregon Armory, currently being renovated into an arts

[139] The G/Rated website can be found at http://www.green-rated.org.

facility (attempting the first Platinum certification of an historic renovation), and a 1929 automotive dealership that replaced an original nine-story brewhouse building.

Figure 5.2 - The Brewery Blocks in Portland's Pearl District *(Photo credit: The Brewery Blocks Web site, http://www.breweryblocks.com)*

Each of these buildings is listed on the National Register as part of the Blitz-Weinhard Brewery Complex, or individually, in the case of the Armory. The entire collection of buildings is pending a National Historic Landmarks designation. Just south of the Pearl District, Downtown Portland boasts the heralded green rehabilitation of the LEED Silver certified Balfour-Guthrie building, a 1913 office building listed on the National Register, and the proposed green mixed use rehabilitation/renovation of the 1909 National Register listed Meier and Frank building, the flagship store and former headquarters building of the Meier and Frank department store chain.

The Site

All of this provides the ideal setting for the greening of historic preservation, and the developers of the Ecotrust building capitalized upon this. Originally known as the McCraken warehouse, the Ecotrust building was built in 1895 by John McCraken of the J. McCraken Company, a wholesale building supplies distributor. This Richardsonian Romanesque style warehouse occupied a full city block and was strategically located between two freight yards—the Southern Pacific-Northern Pacific and the Spokane-Portland-Seattle—within a short distance of the Union Pacific's freight yard. On-site transportation consisted of short rail spurs, or team tracks, that ran parallel to the building's loading docks. Concrete ramps that fed through the building center allowed for the teams of horses to move through the building.[140]

The warehouse construction occurred at a time of expansive development and population growth in Portland's history, largely due to the rail growth and improved shipping capabilities at the port. The city became a center for transportation and distribution. The McCraken warehouse shows a long history of use by storage and distribution companies that benefited from this location. In the early 1930s the warehouse was known as the Central Truck Terminal and had as many as 30 trucking companies occupying the address. Rapid Transfer and Storage was the last owner, occupying the warehouse until 1997, while the rest of the block was leased as a commercial parking lot. At the time it served as a warehouse as well as a studio for area businesses and artists.[141]

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[140] Bettina von Hagen, Erin Kellogg, and Eugenie Frerichs, eds., *Rebuilt Green: The Natural Capital Center and the Transformative Power of Building* (Portland, OR: Ecotrust, 2003), 39-45.
[141] Ibid., 42.

Figure 5.3 - Rapid Transfer & Storage Company *(Photo credit: Bettina von Hagen, et al., "Rebuilt Green;" originally from the Oregon Historical Society)*

In 1998, Ecotrust, a 15-year-old nonprofit conservation organization based in Portland, purchased the warehouse.[142] The building was structurally sound when acquired but did suffer from years of neglect and partial vacancy in the form of peeling paint, boarded windows, and damage from water leakage. It was located in

[142] Ecotrust was created in 1991 to raise awareness of conservation efforts for the threatened coastal temperate rain forest of North America's Pacific coast. The organization initially worked in rural, coastal communities from Prince Edward Sound in Alaska to San Francisco, helping to promote a conservation economy (in other words, a restorative economy that sustainably operates to restore its natural systems), whose activities always led back to urban markets, thus the reason for moving to an urban area. Projects include financing sustainably-managed forests, cleaning up and redeveloping toxic brownfield sites, and restoring watersheds. Their overall mission is to create a Salmon Nation, where the health and abundance of endangered Pacific salmon is equated to the health of its natural environment, and thus the health of others that dwell there. Pertinent to the Ecotrust building, Salmon Nation focuses on the adverse effects of building construction and operation on this Pacific Northwest icon. These adverse effects include polluting stormwater runoff exacerbated by impervious surfaces, energy use, unsustainable forest management, and toxic substances used in construction or building materials that leak into groundwater or streams.

the middle of a considerable amount of new development that posed a threat to its preservation. As the warehouse rehabilitation was undertaken, a turn-of-the-century warehouse to the south was demolished and replaced with an apartment building.[143]

Figure 5.4 - The Ecotrust Building, 1998 *(Photo credit: Bettina von Hagen, "Rebuilt Green")*

Portland was once the repository of the largest collection of 1890s cast-iron architecture west of Chicago, but very little remains after years of demolition, much of which took place during urban renewal. By 1998, the majority of buildings in downtown Portland dated from 1950 or later. In a survey of 163 downtown buildings, nearly half of the buildings dated from the latter half of the 20th Century, with only five built before 1900.[144]

The River District revitalization efforts continue to threaten historic preservation to an extent as development pushes on at a rapid and sometimes unforgiving pace as evidenced by the demolished warehouse south of the Ecotrust building. This former industrial neighborhood began its redevelopment process in

[143] Bettina von Hagen, et al., 42, 52-3.
[144] Ibid., 42.

1991 when an ad hoc group of business leaders capitalized upon an opportunity to create a new vision for the area. The idea was to develop a high-density urban residential neighborhood to house a resident population of 15,000 and provide jobs, services and recreation for Portland's central city. Historic warehouse renovations and new residential construction would provide both subsidized and market rate rentals and condos, all of which would be serviced by new, extended Portland Streetcar lines.[145]

Ecotrust, in a quest to find a suitable building and location for its new headquarters, settled on the McCraken warehouse in the Pearl District. Upon the recommendation of Jane Jacobs, one of the organization's board members, Ecotrust began looking for a site that had a strong urban presence that would create positive economic, environmental and social returns. The building selection was based on three criteria: [1] an historic building to provide a cultural tie to the area, [2] a central location to reduce transportation, support the vitality of the city center, and maximize building access, and [3] a large enough site to house a variety of non-profit and for-profit organizations and retailers.[146]

The McCraken warehouse offered all three of these criteria, addressing economic returns in the cost savings surrounding preservation versus demolition in regard to using existing infrastructure and helping property values increase, attaining environmental returns through reuse of materials, and social returns in the historic and cultural connectivity of the building to the area. Such characteristics allow Ecotrust to play an integral role in the Smart Growth development of downtown Portland. After two years of program development, building team selection, financial analyses, and fundraising, the warehouse rehabilitation/renovation began in the spring of 2000.

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[145] Ibid., 48.
[146] Ibid.

The Project Plan

Ecotrust set about rehabilitating and renovating the warehouse in a "community-friendly and environmentally sound" manner that was sensitive to the historic integrity of the building. The project objectives stressed sustainable development through the combination of environmental conservation, interdisciplinary collaboration, historic preservation, green building, and long-term growth. This is achieved through the creation of a center for a conservation economy that involves like-minded tenants who provide an educational and inclusive environment prompted by public spaces created within the building, promoting collaboration amongst the tenants themselves with shared spaces, retaining the historic character and space of the warehouse, incorporating green building elements in the rehabilitation/renovation, and building a permanent headquarters for Ecotrust that emphasizes a long-term outlook.

The overarching design goal was to use "practical, low-tech, and no-tech solutions" for the green renovation. This not only curbs costs but also exemplifies a basic, passive design approach to green building as opposed to a high-tech approach, the latter of which is often unnecessary to receive substantial economic and environmental rewards. Some rehabilitation elements, such as the historic wood window restoration, cost more than replacement energy efficient windows, but was deemed a worthy expenditure and was offset by more simple energy saving techniques such as the installation of an atrium to provide natural light.[147] The decision to attempt LEED certification was made after the original design was already in place.

The 79,000 square foot warehouse was renovated for a mix of office, retail and restaurant space. The project involved the warehouse rehabilitation and renovation with a 10,000 square foot penthouse addition and two steel towers with stairs constructed on the west side of the building to meet current seismic codes. It also

[147] Ibid., 45.

involved the deconstruction[148] of an adjacent building on the remaining half of the 40,000 square foot block that had significant structural damage. The newly created space now serves as a parking lot and area for stormwater management and a weekend market. Zoning codes at the time limited buildings to a 4:1 FAR and required construction of a minimum of 14 housing units, prohibiting projects like the Ecotrust building from adding a larger addition, until the city codes were later amended to increase density by allowing building floor area and height bonuses, doubling maximum height from 75 feet to 150 feet and increasing the floor area that could be built on the remaining half block.

An integrated design methodology, whereby the design was determined well ahead of construction with collaboration amongst the architect, engineer, and energy modeler, was used to reduce any potential additional costs and confusion amongst the players. A negotiated bid process was used to select the general contractor at the start of the design phase. Among the players were Naito Development; Holst Architecture, consisting of a design team of veteran principals of other warehouse conversions in the River District, like the Pacific Northwest College of Art and the RiverTec office building; Walsh Construction, general contractor; Gregory Acker, the local architect who specialized in sustainable design and was hired as a green building consultant; Ralph DiNola of Green Building Services who coordinated the LEED certification as a LEED accredited professional and trained historic preservationist; Edelman Soljaga Watson who coordinated the interior design; and Heritage Consulting Group who worked as the historic consultant.

The rehabilitation and renovation of the Ecotrust building amounted to $12.8 million ($183.29 per square foot). Hard costs equaled $10.9 million and soft costs

[148] Deconstruction, as opposed to demolition, involves the careful disassembly of a building for material salvage, reuse or recycling, as opposed to complete material disposal.

equaled $1.9 million. The property acquisition cost $2.5 million, or $35.71 per square foot. A combination of grants, contributions, loans and tax incentives provided the necessary financing.[149]

Grants and contributions provided nearly half, or $6 million, of the total cost. A conventional construction loan from the Bank of America financed the redevelopment, paid off after building occupancy with a $3.7 million construction loan from the Bank of the West, a $200,000 loan from the Portland Development Commission, and a $2 million loan from the Ford Foundation. The Ford Foundation loan is at a below-market interest rate that offsets Ecotrust's rent, allowing for rent-free occupation. Additional equity was gained by selling the 10 percent federal historic tax credit and the LEED state tax credit through Oregon's Office of Energy BETC program. A $75,000 ecoroof grant and a $20,000 LEED grant were received from the City of Portland Bureau of Environmental Services and Office of Sustainable Development, respectively.[150]

Ecotrust's charitable and public benefit purposes boosted its financial assistance package. These preferential financing terms can benefit a number of projects, particularly in green building, where loan-to-value and debt service coverage ratios improve through lower operating expenses, lower vacancy rates, faster recruitment of tenants, and lower risk of indoor air quality or hazardous materials issues.[151] It is a solid investment that many investors will find attractive.

Ecotrust further solidified its financial success by choosing tenants that espouse similar sustainable missions; thereby creating a convivial work atmosphere

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[149] Bettina von Hagen, et al., 54-5.
[150] Ibid., 54-6; Ralph DiNola, Project Manager, interview by author, phone interview, Portland, Oregon, 9 July 2005.
[151] Bettina von Hagen, et al., 56. *Loan-to-value ratio* is the amount of the loan as a percentage of the appraised value of the completed building. *Debt service coverage ratio* is the annual cash flow generated by the building divided by principal and interest payments.

that promotes collaboration and radiates a common purpose to its patrons. Having the outdoor clothing retailer Patagonia as its retail anchor, alongside tenants like the Sustainable Harvest Specialty Coffee Importers, the USGBC Cascadia Chapter, and The Conservation Fund, elicited strong support. Portland's G/Rated and Office of Sustainable Development are also housed in the Ecotrust building, providing a dedicated municipal presence.

The Greening

Groundbreaking of the Ecotrust project began on February 11, 2000. A little over a year and a half later, on September 6, 2001, the building rehabilitation and green retrofit was completed. The project earned 41 LEED points under the NC 2.0 version, enough to gain Gold certification, the first rehabilitation in the nation to receive this level of distinction.[152] To date, no other historic greening project has surpassed Gold certification, by earning Platinum certification.

The reliance on low-tech green building elements and sensitivity to retaining the historic integrity of the building followed both the Standards and LEED standards, with some compromises made on both sides in the name of retaining the historic character of the building while implementing green elements. For instance, the addition of wall insulation and replacement of historic windows to increase energy savings was foregone in order to retain the historic integrity of the interior and exterior; therefore, the historic windows and exposed interior brick were preserved. The rooftop addition and external steel staircase added to meet seismic codes, however, prevented the building from being listed in the National Register of Historic Places (NR), even though both of these additions were approved by the Oregon SHPO and Advisory Council prior to being sent to the National Park Service for review.

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[152] See Appendix F for the Jean Vollum Natural Capital Center LEED scorecard that details each of the points earned.

Both additions were deemed by the NPS to compromise the historic character of the warehouse as the rooftop addition is clearly visible from the street and the steel staircase design is not complementary to the historic design.[153]

Figure 5.5 - The Ecotrust Building, 2005 *(Photo credit: Author)*

Unfortunately, the decision to apply for National Register status with the possibility of receiving the 20 percent rehabilitation tax credit available to certified historic rehabilitations came later in the project process, just as construction was to begin, thus making it more difficult to fit the Standards into the overall building design. The potential to undergo a certified historic rehabilitation was viewed as a means to increasing capital with the additional ten percent tax credit. However, in the end, only the ten percent federal tax credit available to non-historic, non-commercial

[153] Ralph DiNola, phone interview; Bob Naito, Developer, interview with author, phone interview, Portland, OR, 28 April 2006.

buildings not listed on the National Register was received due to the NR nomination denial.[154]

Not surprisingly, the majority of total LEED points captured were in the Materials and Resources section. The Ecotrust project was able to divert an astounding 98 percent of construction demolition and debris from the waste stream through reclaiming and recycling of materials. Innovative strategies implemented with salvaged and reused materials, along with locally manufactured materials, were infused into the new building.

Table 5.1 - Natural Capital Center LEED-NC v2.0 Point Earnings

Point Category	Points Earned	Possible Points
Sustainable Sites	*8*	14
Water Efficiency	*4*	5
Energy & Atmosphere	5	17
Materials & Resources	*10*	13
Indoor Environmental Quality	*9*	15
Innovation & Design Process	*5*	5
Total	**41**	**69**

The project also garnered 80 percent of the total Water Efficiency points. Storm water management was a main concern for Ecotrust given its organizational mission to preserve Salmon Nation, and the difficulty with which the city of Portland has in diverting its waste and storm water from the already polluted Williamette River and many tributaries that run throughout the City. This also lent to the credits awarded under the Sustainable Sites category.

Design and innovation creativity resulted in earning 100 percent of the possible points for the Innovation and Design Process category. In addition to the point earned for the inclusion of a LEED accredited professional, the project earned four additional points for the high percentage of construction waste management and recycled content

[154] Bob Naito, phone interview.

(100 percent), the reuse of an historic building, and the project's educational emphasis with its use as a green building demonstration project. Energy and Atmosphere credits were on the lower end because of consideration for the historic integrity of the building by reducing adverse retrofit impacts, like installing geothermal heating that would raise the flooring to such an extent that it would block portions of the windows. Indoor Environmental Air Quality credits benefited from reused and recycled materials like interlocking rubber flooring on the second floor that did not require sealants. The following sections provide project highlights for each of the point categories.[155]

Sustainable Sites

Alternative transportation and storm water management highlighted this category. Abundant bike parking, a bicycle-sharing program for tenants, on-site locker and shower facilities, two Flexcar[156] hybrid cars parked on-site, employee transportation stipends that promote mass transit use and walking, and two electric vehicle charging stations provide several alternative transportation options. The Portland Streetcar and TriMet bus both have stops at the Ecotrust building block within the Fareless Square, a 330-block area in which all rides on TriMet buses, MAX light rail trains and streetcars are always free.

The storm water management goal was to divert 100 percent of the site's storm water from the city's sewage system through a series of integrated strategies leading from the Ecotrust building to infiltration areas incorporated into the parking lot landscape design. A 6,000 square foot ecoroof on the exposed second story roof provides a permeable surface consisting of two inches of soil and native vegetation.

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[155] A more exhaustive list of the materials used in the Ecotrust project can be found in the "Materials Guide to the Jean Vollum Natural Capital Center," distributed by Ecotrust.

[156] Flexcar is a company that operates a car-sharing program that lends cars to members by the hour to reduce automobile use.

The roof weighs approximately 14 lbs per square foot when saturated, equal in weight to a conventional gravel roof, and thus required no additional structural, load-bearing upgrades to the historic shell.[157]

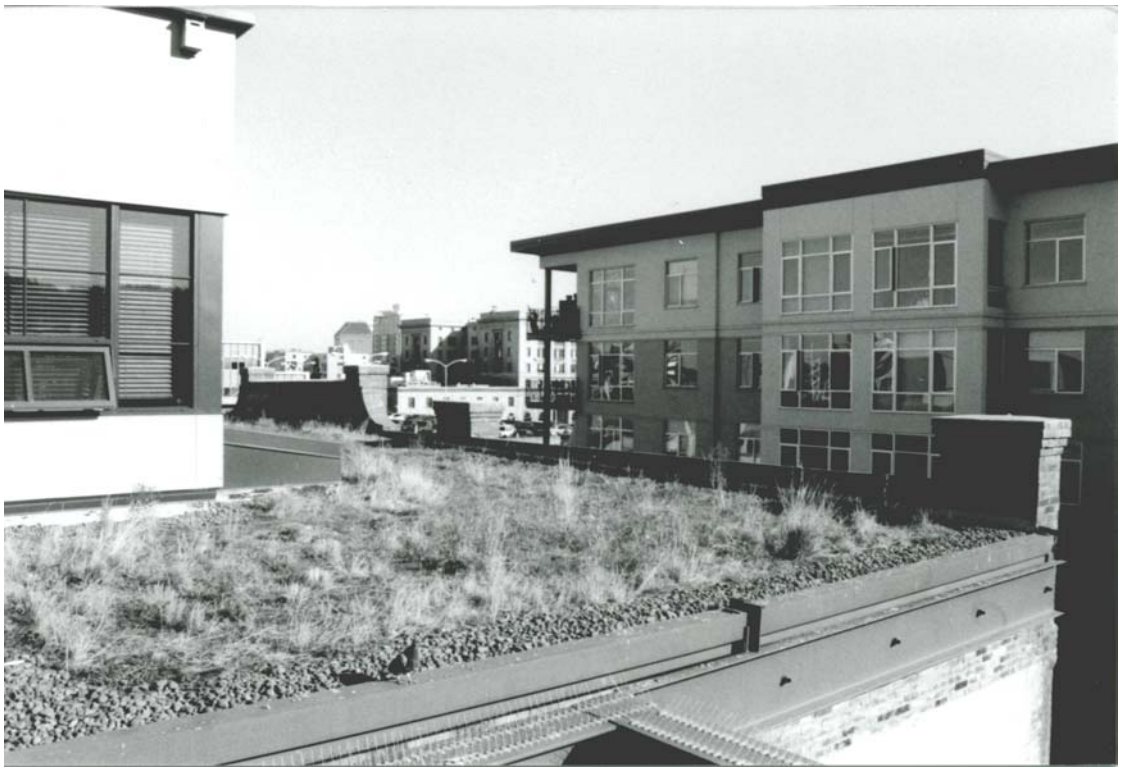


Figure 5.6 - Ecotrust Ecoroof *(Photo credit: Author)*

The water not absorbed by the ecoroof winds its way down the gutter and downspout system to the ground level landscaping made up of bioswales containing more native species plantings. The bioswales act as biofilters that flush out pollutants from surface runoff water. They consist of a swaled drainage course with sloped sides, filled with plantings, compost or rocks that filter the water and remove contaminants before releasing it to the watershed or sewer.

[157] Bettina von Hagen, et al., 78.

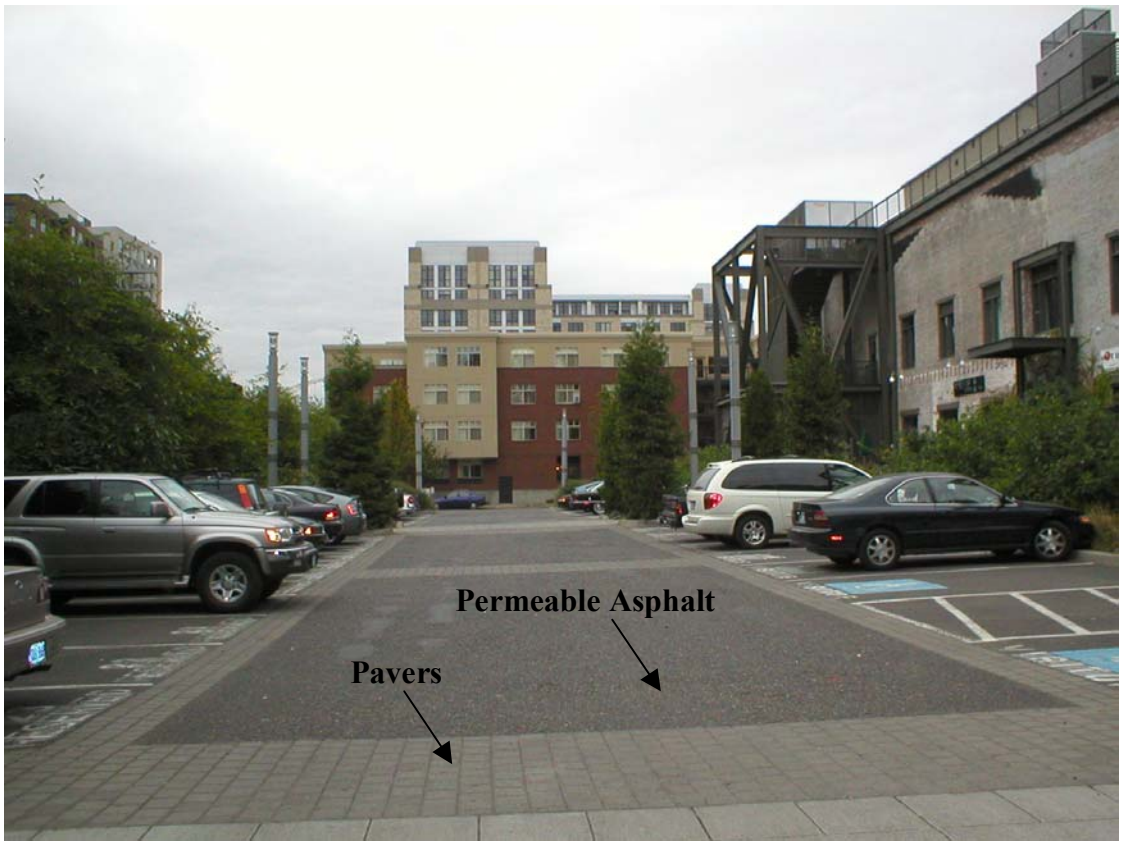


Figure 5.7 - Ecotrust Parking Lot *(Photo credit: Author)*

Parking lot storm water is directed by a gradual landscape slope towards two swales on the western edge of the lot, with notches cut into the curb along the western side to provide more direction. Overflow outlets connected to the city system are situated in each of the four swales. The parking lot itself is made of pavers and permeable asphalt. Pavers are small, square concrete bricks that allow water to seep through the cracks between the blocks and move naturally through the permeable sublayers to the groundwater. Ecotrust has found that this is not the best design solution for a small area that requires slow vehicular traffic because the permeable asphalt and pavers are easily moved from their spots, creating a messy and jumbled parking surface. However, these combined elements successfully divert at least 95 percent of the site's storm water from the city system.[158]

[158] Ibid., 79.

Energy & Atmosphere

Energy reduction in the Ecotrust building presented several challenges that new building constructions do not face, given its orientation, high ceilings, and historic features. However, by focusing on energy efficiency, embodied energy, green power, and transportation, significant energy savings were achieved. Regional climactic sensitivity was considered in the selection of energy systems in respect to energy efficiency.

Several heating and cooling mechanisms were analyzed in regard to their efficiency and impact on the historic structure with the aid of a computer modeling system. Natural gas-fired warm-up boilers provide the heat cycle, with the system preset for 78 degrees Fahrenheit for cooling and 68 degrees Fahrenheit for heating, and tenant comfort control through window operation. A conventional HVAC system controlled by a computerized energy management system that can bring 100 percent of outside air into the building provides the cooling system. Outside and inside air continually mix to maintain a comfortable temperature inside.

Indoor energy use is tempered through the installation of T-5 High Output bulbs, the most efficient available at the time; occupancy sensors in hallways, closets, restrooms, and meeting spaces that monitor light, heating and cooling usage; a Greenhouse Gas Reduction Initiative where tenants voluntarily commit to purchasing renewable energy and offsetting greenhouse gas emissions; and a heavy reliance on daylighting. The strategic interior design orients all workspaces and areas of high traffic around the perimeter of the building to capture the natural light from the windows. Areas that do not garner much use, like closets, were placed in the building interior and are monitored by occupancy sensors. A large skylight above the atrium and 24 smaller skylights scattered throughout the second floor provide ample daylighting, particularly in the center atrium that opens onto the first floor. Lights

equipped with photovoltaic sensors in the atrium detect lowering levels of daylight and adjust light levels accordingly.[159] The open, unobstructed interior also allows for ample diffusion of natural light from the windows and skylights.

Saving the embodied energy of the building through its restoration also falls into this category. The energy savings from reduced material extraction, manufacture and transport are vast. This component is perhaps the most significant in energy savings because it touches upon so many tangential factors, like daylighting and natural ventilation from existing windows, yet it finds no points in this LEED category.

More creative energy savings features are dotted throughout the building. For instance, the tenant Hot Lips Pizza devised a unique oven heat exchanger equipped in a bread oven as opposed to a typical pizza oven. The bread oven, twice the size of a conventional pizza oven, consumes half as much energy to bake larger volumes of pizza. The heat exchanger transfers waste heat from the oven through a series of pipes that lead warm water into the basement hot water heater. This hot water is then used in the restaurant for washing and cleaning.[160] Kitchen appliances are also shared by tenants.

Materials & Resources

By following the mantra "less is more," the Ecotrust project earned ten of the possible 13 Materials and Resources points. A low-finish aesthetic, coupled with ample use of salvaged, recycled, and local materials and resources, and a good dose of creativity, provided the means to success. Priority was given to the use and purchase of materials that were: [1] salvaged from the lot, [2] made with a high percentage of

[159] Ibid., 59-74.
[160] Ibid., 65.

recycled content, [3] easily recyclable, [4] regional, or [5] certified as sustainable, or manufactured by a company committed to sustainable design.[161]

The low-finish aesthetic involved leaving pipes, wires and mechanical equipment exposed, thereby allowing the historic interior of the warehouse to remain intact, and also decreasing additional material usage (see Fig. 4.7). The wooden posts, beams and trusses were in good condition and required only a minimal cleaning. The shared, open office plans contributed to this low-finish aesthetic, cutting material use for tenant improvements by half or more, while distributing natural light and fresh air more effectively.[162]

Figure 5.8 - First floor example of low-finish aesthetic, open design, and refinished Douglas-fir plank flooring *(Photo credit: Author)*

[161] Ecotrust, "The Jean Vollum Natural Capital Center Field Guide," (Portland, OR: Ecotrust), 7.
[162] Ibid., 94.

One of the savvy decisions made was to salvage the materials from the deconstruction of the adjacent onsite building to be used in the warehouse restoration. A storage area was created roughly ten blocks from the site, affectionately known as the "boneyard," to temporarily hold all of the materials before their reuse. Stone, wood, diamond plates, old gears and pipes, tongue and groove paneling, doors, hardware, posts and beams were all salvaged. Most of the third floor addition was built with these salvaged materials, including wood for its framing. Freight elevator gears form table bases. Wood, wire, old furniture and nails were used by fine furniture makers to build directories, coat racks, tables, benches, chairs, and other items. Other offsite salvaged materials like donated doors were used for office partitions and desks in the Office of Sustainable Development work space. Engraved benches on 10th Avenue were originally the granite curbs in between the sidewalk and street on NW Johnson. Surplus materials were donated or sold.[163]

The reuse of the building itself offers the most efficient means to conserving materials and resources. The original windows were rehabilitated, many still with their 1895 glass panes. Salvaged lumber from the warehouse demolition was used in the restoration and repair of several of the window sashes. To increase energy efficiency, the windows were weatherized with a ribbed-zinc interlock weatherstrip used in conjunction with neoprene compression pieces to provide a tight seal. The original Douglas-fir plank floor was refinished on the first floor and an environmentally safe floor finish was applied.

Recycled materials are found throughout the building as well. Due to seismic code restrictions, the second floor wood flooring had to be replaced with a plywood sublayer, overlain with interlocking rubber tiles made from post-consumer recycled rubber tires. The tiles did not need an adhesive to hold together, therefore eliminating

[163] Bettina von Hagen, et al., 89-102.

any toxic substances. The interior paint comes from a latex paint recycling program developed by Metro, Portland's regional government. The initial use and remixing of the paints releases many of the original VOCs.

FSC certified wood was used if salvaged wood could not be used. The third floor interior is laid with FSC certified guariuba flooring, a lesser known tropical wood chosen to promote forest diversity, while the third floor exterior deck is made of Ipe, an Amazonian hardwood from an FSC certified forest in Bolivia. Because of the strength and durability of Ipe, it does not require a protective finish. The selection of these two non-native species raises the question of sustainability in regard to using locally and regionally produced products. So many factors arise when choosing products in a sustainable manner, and oftentimes trade-offs are made, particularly in a globalized economy. In other words, there is not a definitive right or wrong answer to this question, but is one that must be analyzed on a case-by-case basis.

Indoor Environmental Quality

Nine of 15 points were earned in the Indoor Environmental Quality category. The restored windows and added skylights proved effective not only in energy and materials but also in providing ample daylight, views, and natural ventilation. Low VOC-emitting materials were used in the flooring, furnishings and upholstery, paint, walls and windows, like the use of Glitsa Infinity Non-Flat Water Based Finish on the refinished plank floors. Marbelized linoleum countertops, or Marmoleum, found throughout the building, are made of the following all-natural, non-toxic components: linseed oil, wood flour, pine rosins, and jute fiber. As mentioned in the Materials and Resources section, the recycled paint also had reduced VOC levels due to reuse. Monitoring of carbon dioxide levels and demand-controlled ventilation added to the healthy environment.

Innovation and Design Process

The Ecotrust project surpassed many LEED standards, including the percentage of diverted construction waste and recycled content. As a result, each of these accomplishments earned the project an additional two points within this category. The reuse of a historic building and the educational use of the project itself as a Green Building Demonstration Project garnered another two additional points. To round out the five out of five possible points in the Innovation and Design Process category, the project was also awarded a point for the use of a LEED Accredited Professional.

The fact that LEED awarded a point for the reuse of a historic building shows the recognition of the USGBC in the inherent benefits of preserving not just the embodied energy of a building but its cultural value as well. This point award does appear to be on a case-by-case basis however, as the green restoration of the S.T. Dana Building on the University of Michigan, Ann Arbor campus appealed to LEED for such a credit and was denied.[164]

Ecotrust makes a valiant effort to pass this message on to its tenants and visitors alike in its educational mission. The building is open to visitors to explore, with a Field Guide to lead one throughout the building's three floors. Creating a sense of community was an important, overarching goal of Ecotrust in the design and presentation of the building. It serves not only as a functioning work and retail space but as an educational space as well.

The Green Renovation

An emphasis on passive design, deconstruction and material reuse, and retention of historic character allowed the Ecotrust project to adequately follow the Standards, with the exception of the third floor penthouse and west side steel tower

[164] Maggie McInnis, Architect, interview by author, phone interview, Ann Arbor, MI, 9 August 2005.

additions that confront Standard Nine. Seismic code upgrades required the construction of the two towers that were structurally tied to the building. These provided seismic stability and stair access between the three floors, but their design was found by the NPS to adversely impact the building's historic integrity.

Figure 5.9 - Steel tower seismic code upgrades *(Photo credit: Author)*

Other rehabilitation/renovation measures that had to take the Standards into account were the exterior and interior paint stripping; parapet removal and rebuilding; addition of interior structural steel frame, skylights, mechanical and electrical systems, and passenger elevator; use of recycled and salvaged materials; and rehabilitation of wood flooring and windows. The old grey paint on the exterior facades and bases was stripped, returning the building to its original 1895 appearance. Power washing easily removed the paint from the roof trusses and interior brick walls; the paint chip waste

fit into three garbage bags. Sections of the parapet walls had advanced mortar deterioration and required their removal and rebuilding.

One of the more unique elements of retaining the historic character of the site is seen in the retention of a one-story piece of the deconstructed building, reinforced with metal, leaving a profile of the roof and visual record of what once stood there. It frames the west side of the lot, hugging the parking lot, creating what can be considered an art form. The preservation of this piece addresses Standard Two in the retention and preservation of the historic character inherent in this given space and environment.

Figure 5.10 - Portion of deconstructed building saved for historic provenance *(Photo credit: Author)*

Despite the late decision to forego a certified historic rehabilitation, the Ecotrust project respected the majority of the Standards, largely due to its low-tech

design approach that shirked major renovation. Such green building standards complement rehabilitation standards, particularly in the careful retention of historic elements and their gentle physical treatment (Standard Seven). Both provide respect for the treatment of cultural and natural resources.

Conclusion

The Ecotrust building sets a high standard for other similar projects implementing green building in historic preservation. The progressive Portland setting at the public and private levels, although not absolutely required for such success as can be proven in other case studies, does tremendously aid in promoting sustainable development. Collaboration and understanding amongst the project players is essential, however, as is a clearly defined project mission at the outset. It certainly helps when all those involved strongly believe in the project concept, particularly when dealing with sustainable design, because it should carry more than simple physical and economic goals—it should reflect a common belief and mindset in the stewardship of the built and natural environments. The Ecotrust team exemplified this collaboration and as a result attained relative success.

This is not to say that they did not confront problems or face compromises in the green rehabilitation/renovation of the Ecotrust building. Green building features were many times traded for retention of an historic element, and vice versa. The Ecotrust building was specifically selected because it provided an ideal palette for its new use due to its open warehouse design and suitable site for storm water management. Site selection is key in green retrofits of historic buildings.

The compatibility of Ecotrust's conservation and preservation goals provided a welcome setting for LEED and the Standards. Having professionals onboard in both high-performance design and historic preservation proved invaluable. More consideration could have been given to the third-floor addition and seismic upgrade in

regard to the historic character of the building, but this mistake only proves that historic preservation standards need to be considered in early design phases.

CONCLUSION

When dealing with green building and historic preservation we are often considering two things: certification and standards. In order to attain certification, a certain level of rules and regulations must be set in place to provide a measure. For green building, it is more than likely to be measured using the LEED rating system, and in historic preservation, it is the *Secretary of the Interior's Standards for Rehabilitation*.

The management of natural and cultural resources requires both an objective quantifiable approach and a subjective qualitative approach. It is plain to recognize the quantifiable losses to the natural environment caused by building construction, demolition and operation, and, perhaps less clearly defined, to the built environment in the form of economic losses caused by vacant and abandoned buildings and urban centers. Placing value on the worth and meaning of natural and cultural resources, however, is left to subjectivity, but is a shared, collective determination that affects a broad constituency.

Simply put, the green building and historic preservation movements are two sides of the same coin. Idealistically, both share the common goal of promoting an active stewardship of our nation's resources. Practically, they both provide tools for the determination of the appropriate management of these resources. The challenge is to bring the two together in such a way that the respective practitioners comprehend and appreciate the importance of the other. Preservationists, green building practitioners, developers, realtors, architects, planners, designers, municipal leaders, federal government officials, etc., need to assemble to facilitate the flow of knowledge.

Education is the answer. While sustainable development still remains a fuzzy concept, sustainable design and green building continue to grow in clarity through well-established principles and physical application. The concepts of nature as model, the importance of identity and place, and land use planning, find a commonality in green building and historic preservation. Add to this the embodied energy and passive energy design elements found in historic buildings and historic preservation becomes inherently understood as a form of sustainable development and design.

We also begin to understand that sustainable development and design as we know it today is in many ways a reinvention of the wheel: a return to vernacular design elements with the addition of new technology and innovation in building materials and systems, with a consideration of global implications. The social, economic and political influences manifested in design from the Industrial Revolution until today combine to define modern sustainable design. Historic preservation and green building grew out of this history in similar ways, both starting at the grassroots level.

As sustainable development gained momentum in the mid 1980s and early 1990s, LEED was created, and very quickly became a powerful tool in defining and shaping green building practice through its widespread application in both the private and public sectors. The more recognized it became, however, the more criticism that was launched against it. LEED certainly does have its limitations in many respects, yet it continues to thrive and gain recognition.

Unlike the Standards, it was not created at the federal level to provide guidelines for determining federal tax incentive eligibility. In some respects, this offers the rating system more flexibility in its design and administration because it is not under federal jurisdiction, but at the same time it limits its outreach since there is no financial reward yet assigned to its use at the federal level, which oftentimes tempts

more investment in such a project because of the financial return. For many projects with no connection to government LEED certification can be too costly. Whether such potential federal legislation would benefit the outreach of the LEED rating system is obviously open to criticism.

Yet, many developers and architects are realizing the benefits of LEED certification from a principle standpoint and, because the economics of a building project are rarely ever completely absent, for the long-term energy savings as well. State and local government energy incentives also boost the awareness of LEED as it can be used for its guidelines without necessarily undergoing a certification. In the greening of historic buildings there is the potential to capture a double dose of incentives if the building is eligible or listed on the National Register and undergoes a rehabilitation that follows the Standards. This can be a certified historic rehabilitation or not, with the former earning a 20 percent federal tax credit and the latter receiving a ten percent federal tax credit.

The number of projects that have captured this double dose of incentives is quite small, however. A comparison of the intent and structural design of LEED and the Standards shows various similarities and differences between the two sets of standards. Shared elements identified between the two prove that a synergy can take place. But, with only six historic buildings that have implemented the Standards and have been LEED certified since the green building system's 1998 introduction, we recognize that the integration is not integrated enough. On both sides of the so-called coin, more considerations can be made in the combination of the two sets of standards. The Standards should be more accepting of incorporating high-performance or green materials and systems in rehabilitations and LEED should give greater acknowledgement to the historic integrity and character of a building with its use of high-performance materials and systems.

The Jean Vollum Natural Capital Center, or Ecotrust building, case study shows that compromise is required when using both green building and historic preservation standards. The Ecotrust green renovation provides a model study for the integration of green building and historic preservation. Unfortunately, because the decision to undergo a certified historic rehabilitation was made too late in the design and construction process, the project was only able to receive the ten percent federal tax credit for its historic rehabilitation. This case study effectively proves the successful marriage of old and green, and also warns that a clear understanding of the requirements of the two sets of standards in the very early stages of design is essential for the most effective integration. It also shows that compromises will undoubtedly be made in the retention of the historic character and level of building performance.

The education of green building and historic preservation practitioners needs to be intensified to increase such effectiveness and compromise. In the field of historic preservation, green building and LEED training particularly needs to begin where the Standards and tax incentives are administered: the National Park Service, Advisory Council, and SHPO offices. Their knowledge and clout have the potential to create a trickle-down effect in local government, non-profit and private preservation practices.

The field of green building presents a more difficult situation in promoting historic preservation since it is not as regulated as historic preservation and includes a multitude of players. However, this is where the USGBC and LEED have the potential to play a pivotal role in this fusion. The LEED rating system manuals should clearly define the means by which historic preservation can be fully applied to green building projects and the LEED training workshops can expand upon this information.

The pertinent issue is an open dialogue amongst historic preservation and green building advocates. Groups such as the Association for Preservation Technology are already working with the USGBC to increase awareness and

understanding on both sides. This continued effort holds the potential to introduce innovative strategies to ensuring a common awareness.

With an open dialogue follows increased research and publications that allow for the dispersion and widespread familiarity of this topic. That being said, the limitations of this study are many given the vastness of this virtually unexplored topic. Disparate sources and lack of technical research in sustainable design as it links to historic preservation make for wading through very high waters. The saving grace is the timely relevance and deep interest in this topic.

Working with what amounts to a blank slate is frustrating but also invigorating in that there are many avenues to explore. If time would have allowed, more of an economic perspective could have been taken to determine whether or not historic green retrofits are more or less costly in comparison to new green constructions. In the development world this is a very serious consideration and one that has been little explored.

The building technicalities of integrating green elements into historic preservation practice are also addressed in a very limited fashion in this paper. A conceptual and philosophical framework is integral to pushing forward a mindset but so too is the physical means of integration. Green alternatives to traditional historic window rehabilitations that follow the Standards, for example, would be invaluable. The technical aspect of energy-conscious historic retrofits was explored following the Energy Crisis, but more can certainly be researched with today's new technologies. A National Park Service Preservation Brief and/or Technical Report that introduces the principles and application of green building to historic preservation projects is in dire need.

A global comparison of green building case studies would also be worthwhile. Scandinavian countries, especially, have taken great strides in implementing

sustainable design. Although their building and preservation systems certainly differ from those of the United States, their project successes and failures would undoubtedly benefit U.S. research. After all, sustainable development is for the global good.

For the sake of manageability, only two LEED systems were analyzed, but delving into the other LEED rating systems would open different avenues for comparison. LEED for Neighborhood Development (ND), currently in its pilot phase, is supposedly in closer alignment with historic preservation practice given its emphasis on smart growth, urbanism AND green building. In addition, looking at different rating systems like Green Globes in comparison to the Standards could also present an interesting analysis.

Lastly, a more in-depth comparison of green historic retrofit case studies within the United States can provide a clearer image of where the faults and successes lie in the use of LEED and the Standards. An analysis of the differing approaches utilized at the state level of government could also introduce interesting implementation models. It is no secret, for example, why there are more such projects in some states and municipalities than in others. Regulatory support is a powerful persuader.

All of the rules and regulations surrounding historic preservation, and green building, to a lesser extent, can be cumbersome. The point to remember is that projects can successfully follow LEED and the Standards without actually going through the review process, if there is no need or desire to gain financial incentive or a shiny LEED plaque. LEED and the Standards are basic guidelines to follow for the care and maintenance of natural and cultural resources. They are not hard and fast rules.

To preserve an historic building or site, whether or not the Standards are followed, is in itself a sustainable act. Historic preservation is inherently sustainable; that is the bottom line. This must be firmly understood to make the connection between historic preservation and sustainable design. If an historic resource is demolished its cultural meaning and physical embodied energy is lost forever.

At this time in history there is not the luxury to haphazardly throw around natural and cultural resources, there has never truly been such a time. With two sets of standards that provide workable guidelines, we are armed to create new policies and regulations to strengthen sustainable design in historic preservation. Awareness of this new identity at the professional and non-professional level is of the utmost importance in redefining historic preservation in this sustainable age—to change mindsets.

APPENDIX A

The Secretary of the Interior's Standards for Rehabilitation (36 CFR Part 67)

1. A property shall be used for its historic purpose or be placed in a new use that requires minimal change to the defining characteristics of the building and its site and environment.

2. The historic character of a property shall be retained and preserved. The removal of historic materials or alteration of features and spaces that characterize a property shall be avoided.

3. Each property shall be recognized as a physical record of its time, place, and use. Changes that create a false sense of historical development, such as adding conjectural features or architectural elements from other buildings, shall not be undertaken.

4. Most properties change over time; those changes that have acquired historic significance in their own right shall be retained and preserved.

5. Distinctive features, finishes, and construction techniques or examples of craftsmanship that characterize a historic property shall be preserved.

6. Deteriorated historic features shall be repaired rather than replaced. Where the severity of deterioration requires replacement of a distinctive feature, the new feature shall match the old in design, color, texture, and other visual qualities and, where possible, materials. Replacement of missing features shall be substantiated by documentary, physical, or pictorial evidence.

7. Chemical or physical treatments, such as sandblasting, that cause damage to historic materials shall not be used. The surface cleaning of structures, if appropriate, shall be undertaken using the gentlest means possible.

8. Significant archeological resources affected by a project shall be protected and preserved. If such resources must be disturbed, mitigation measures shall be undertaken.

9. New additions, exterior alterations, or related new construction shall not destroy historic materials that characterize the property. The new work shall be differentiated from the old and shall be compatible with the massing, size, scale, and architectural features to protect the historic integrity of the property and its environment.

10. New additions and adjacent or related new construction shall be undertaken in such a manner that if removed in the future, the essential form and integrity of the historic property and its environment would be unimpaired.

APPENDIX B

NCSHPO Survey

SUSTAINABLE DESIGN IN HISTORIC PRESERVATION

Jennifer Buddenborg
M.A. Candidate – Historic Preservation Planning
Cornell University

Please fill in the following information:

Name:	
State:	
Phone Number:	
E-mail Address:	

GOALS:

- To gain a sense of the general awareness of the application of sustainable design practices to historic preservation projects across the U.S.
- To create an interesting and vibrant topic of discussion amongst the SHPO offices in an effort to broaden the application and understanding of green building practices in the field of historic preservation.

1. Are you aware of the U.S. Green Building Council's Leadership in Energy and Environmental Design (LEED) rating system?

2. Does your state or any municipality within your state utilize an alternative green building rating system? If yes, please explain.

3. Has your office worked on certified historic rehabilitation projects that have attempted and/or attained LEED certification?

*If yes, please provide project name, parties involved, and any other information that provides insight into the scope of the project.

What sort of problems/issues arose in applying green building strategies to a certified historic rehabilitation?

**If no, do you anticipate working with the LEED rating system in conjunction with the SOI Standards in any proposed projects?

4. Has your office worked on projects that applied green building elements to certified historic rehabilitations but did not undergo LEED certification? If yes, please provide project name, parties involved, and any other information that provides insight into the scope of the project, including any problems/difficulties encountered.

5. Has your office and its employees been trained and/or accredited in the LEED rating system or any other green building system or application? If not, is this something planned for the future?

6. Have special concessions or considerations been made or are in the process of being made to deal with historic projects that involve green building strategies? e.g., will the SOI Standards be "tweaked" to provide for certified rehab eligibility? If yes, please explain.

7. Is your office involved in any statewide effort to create a "green government" initiative? If yes, please explain.

THANK YOU FOR YOUR TIME

Please send the completed questionnaire to the following e-mail address by <u>NOVEMBER 4, 2005</u>:

jlb252@cornell.edu

OR

By mail to:

Jennifer Buddenborg
210 West Sibley Hall
Cornell University
Ithaca, NY 14853-6701

APPENDIX C

The Hannover Principles[164]

1. **Insist on rights of humanity and nature to co-exist** in a healthy, supportive, diverse and sustainable condition.

2. **Recognize interdependence.** The elements of human design interact with and depend upon the natural world, with broad and diverse implications at every scale. Expand design considerations to recognizing even distant effects.

3. **Respect relationships between spirit and matter.** Consider all aspects of human settlement including community, dwelling, industry and trade in terms of existing and evolving connections between spiritual and material consciousness.

4. **Accept responsibility for the consequences of design** decisions upon human well-being, the viability of natural systems and their right to co-exist.

5. **Create safe objects of long-term valu**e. Do not burden future generations with requirements for maintenance or vigilant administration of potential danger due to the careless creation of products, processes or standards.

6. **Eliminate the concept of waste.** Evaluate and optimize the full life-cycle of products and processes, to approach the state of natural systems, in which there is no waste.

7. **Rely on natural energy flows.** Human designs should, like the living world, derive their creative forces from perpetual solar income. Incorporate this energy efficiently and safely for responsible use.

8. **Understand the limitations of desig**n. No human creation lasts forever and design does not solve all the problems. Those who create and plan should practice humility in the face of nature. Treat nature as a model and mentor, not as an inconvenience to be evaded or controlled.

9. **Seek constant improvement by the sharing of knowledge.** Encourage direct and open communication between colleagues, patrons, manufacturers and users to link long term sustainable considerations with ethical responsibility, and re-establish the integral relationship between natural processes and human activity.

[165] William McDonough & Partners, "The Hannover Principles: Design for Sustainability" (Charlottesville, VA: William McDonough Architects, 1992).

The Hannover Principles should be seen as a living document committed to the transformation and growth in the understanding of our interdependence with nature, so that they may adapt as our knowledge of the world evolves.

APPENDIX D

LEED-NC Version 2.2

The third revision of LEED-NC was introduced as Version 2.2 at the Greenbuild International Conference and Expo, the USGBC's annual green building conference, in Atlanta, Georgia in November 2005. In addition to revising the NC rating system, a series of changes were made to the LEED documentation and certification process for all LEED rating systems. The new version addresses some of the criticisms that have been directed towards the rating system, particularly regarding its ease of use.

The point system remains the same as Version 2.1, based upon a total 69-point accumulation. Most of the credits have been modified, however, purportedly to improve usability and technical merit.[166] It is indeed more user friendly in the more explanatory credit descriptions that often include easily comprehensible bulleted points. Terminologies have changed; for example, Sustainable Sites Prerequisite One requires what is now formally called an Erosion and Sedimentation Control (ESC) Plan that is regulated by the new 2003 EPA Construction General Permit. Neither the formal phrase nor the regulation was included in Version 2.1. And phrases like "Alternative Fuel Vehicles" are more descriptively defined as "Low Emitting and Fuel Efficient Vehicles" in the new version.

In some ways the new version has done a reversal in its sustainable design thinking. The Materials and Resources section attests to this. For instance, credit 1.2 Building Reuse went from maintaining 100 percent of existing walls, floor and roof to maintaining 95 percent of the building structure and shell. Likewise, credit 1.3 Building Reuse went from maintaining 100 percent of the structure and shell plus 50

[166] Nadav Malin, "LEED Gets User Friendly," *Environmental Building News* 14, no. 12 (2005): 3.

percent of the non-structural and non-shell elements to maintaining only 50 percent of interior non-structural elements. Recycled Content credits, however, have become more difficult to earn, with increased percentages of the total value of the materials in the project. The Regional Materials credits, although more rigorous because they apply to materials that are extracted, processed and manufactured within that distance, decreased the percentage of building materials and products used to ten percent for credit 5.1 and 30 percent for credit 5.2. The total value percentage for rapidly renewable materials used also dropped, by half. Certified wood and resource reuse credits remain the same.

These changes make it easier to earn certain credits, thereby increasing project certification numbers, and dissuade earning credits in categories like recycled materials that should come second in line from building reuse and material reuse when considering the hierarchy of types of materials used in a project. In other words, salvaged materials should be used before recycled materials because recycled materials take much more energy and resources than salvaged materials in the process of their reuse. While these changes offer greater ease in earning LEED certification, this very ease compromises the value of the certification. In addition, life cycle analysis and qualitative elements like preserving a sense of place or the meanings embedded in historic or cultural buildings and sites are still not adequately addressed. LEED remains largely quantitative in its application.

To make the system more user friendly a new LEED Online website was created to erase the cumbersome paper documentation submittal. Individual project players fill out their assigned forms and once the entire package is completed it s submitted in its entirety only once using an Adobe Acrobat program. Applicants can receive feedback on design-phase credits prior to submitting the full application to minimize missed points and increase application of green building elements at the

outset. Audits and multi-stage reviews have been eradicated and more direct one-on-one communication with project players increased. A new fee structure has also been established, now with a flat rate for registration and a slightly increased certification rate based upon square footage. The USGBC says that the money saved with the new, efficient submittal process offsets the increased fees.[167]

LEED-NC Version 2.2 best addresses criticisms regarding its usability and documentation procedures, but it still lacks in technical merit. Life cycle considerations and historic preservation issues are still not adequately addressed. The success of these revisions is yet to be seen as Version 2.2 certified projects begin to increase in number.

[167] Ibid., 5.

APPENDIX E

LEED and Secretary of the Interior's Standards for Rehabilitation Comparison Chart

The table that follows can be considered a working draft for further discussion among professionals, government officials and advocates. The comparisons are being made with the assumption that most LEED credits can be applied to historic rehabilitations—with a certain level of creativity and high level of sensitivity to retaining the historic character and integrity of an historic building or site—but only so many credits lend themselves in the truest sense to historic buildings. The Standards identified in the charts are considered the most obvious and applicable to the given LEED credit when considering its use in an historic preservation project. Three questions are asked to determine any relationship, in the following order: [1] Does the LEED credit hold any direct relation to historic preservation?, [2] How can the credit be applied to an historic preservation project?, and [3] What Standards must be considered?

Either there is no shared element(s), denoted by "no direct relation to historic preservation," or there is a shared element(s), described in limited depth. Individual Standards to be considered are identified if relevant to the application of the given credit and its potential effects to an historic building or site. Note, however, that the implementation of most of these credits requires the application of nearly all of the Standards, given the many variables of a project, with the exception of several of the LEED-EB credits that require metering or measurement. These, by their very nature, are not directly related to historic preservation and generally do not pose negative impacts to the historic character of a building or site. The Standards that have been pinpointed are the most overarching and general to suit a hypothetical situation.

LEED-NC Version 2.1, as revised in March 2003, and LEED-EB Version 2.0 are the systems compared to the Standards.

LEED-NC Version 2.1
Comparison Chart

Sustainable Sites (14 Possible Points)

Credit	Topic	Relation to Historic Buildings	Applicable Standards
Prereq 1	**Erosion and Sedimentation Control**	No direct relation to historic preservation (hp). More suited for new construction in regard to preventing loss of soil during construction, unless there is an addition to an existing building. Can create plan to prevent sedimentation of storm sewer or receiving streams and air pollution from dust and particulate matter.	2, 8
Credit 1	**Site Selection**	Preserving a building instead of constructing a new one reduces environmental impact by minimizing site disruption.	1
Credit 2	**Development Density**	Most historic commercial buildings are located in dense, urban settings. Preservation "channels development to urban areas with existing infra-structure, protects greenfields and preserves habitat and natural resources."	1

Credit 3	**Brownfield Redevelopment**	Historic industrial sites that are adaptively reused reduce pressure on undeveloped land. Hazard remediation methods must be sensitive to the historic character of of a building and site.	1, 2, 7
Credit 4.1	**Alternative Transportation:** Public Transportation Access	Historic buildings in urban areas were traditionally located near public transportation systems before the advent of the automobile. If not located near mass transit, constructing a transit system near the historic property must be sensitive to its historic character.	1, 2, 7, 10
Credit 4.2	**Alternative Transportation:** Bicycle Storage & Changing Rooms	No direct relation to hp. Addition of structures and facilities must be sensitive to the historic character of the building and site.	1, 2, 9, 10
Credit 4.3	**Alternative Transportation**: Alternative Fuel Vehicles	No direct relation to hp. Addition of refueling stations must be sensitive to the historic character of the building and site.	1, 2, 9, 10
Credit 4.4	**Alternative Transportation**: Parking Capacity	Works well with hp since many historic buildings were not serviced by parking lots.	2

Credit 5.1	**Reduced Site Disturbance**—Protect Or Restore Open Space	Geared more towards new construction. However, preservation of an existing building inherently protects open space because of its limited site disturbance. Another possible tactic is replacing impervious surfaces with native or adapted vegetation, an element historic sites traditionally possessed.	1, 2, 10
Credit 5.2	**Reduced Site Disturbance**—Development Footprint	Related to new construction. Difficult in traditionally dense historic areas with little adjacent open space.	2
Credit 6.1	**Stormwater Management**: Rate & Quantity	No direct relation to hp. Stormwater management systems can be built if sensitive to the historic character of the building and site.	1, 2, 9, 10
Credit 6.2	**Stormwater Management**: Treatment	No direct relation to hp. Stormwater treatment systems can be built if sensitive to the historic character of the site/landscape.	1, 2, 9, 10
Credit 7.1	**Heat Island Reduction**: Non-Roof	No direct relation to hp, although existing buildings and sites can already be well-vegetated.	2, 9, 10
Credit 7.2	**Heat Island Effect**: Roof	No direct relation to hp. Can be implemented with sensitivity to historic, character, particularly the vegetated roof,	2, 5, 9, 10

		which works better on some historic buildings than others, like flat-roofed warehouses.	
Credit 8	**Light Pollution Reduction**	Historic buildings traditionally did not have significant amounts of exterior lighting.	2, 9

Water Efficiency (5 Possible Points)

Credit	Topic	Relation to Historic Buildings	Applicable Standards
Credit 1.1	**Water Efficient Landscaping**: Reduce by 50%	Many historic buildings and sites used indigenous plantings and/or cisterns to capture rainwater.	2, 8
Credit 1.2	**Water Efficient Landscaping**: No Potable Use or No Irrigation	Many historic buildings and sites used indigenous plantings and/or cisterns to capture rainwater.	2, 8
Credit 2	**Innovative Wastewater Technologies**	Many historic buildings used cisterns to capture rainwater.	2, 8
Credit 3.1	**Water Use Reduction**: 20% Reduction	Many historic buildings used cisterns to capture rainwater.	2, 8
Credit 3.2	**Water Use Reduction**: 30% Reduction	Many historic buildings used cisterns to capture rainwater.	2, 8

Energy & Atmosphere (17 Possible Points)

Credit	Topic	Relation to Historic Buildings	Applicable Standards
Prereq 1	**Fundamental Building Systems Commissioning**	No direct relation to hp.	N/A
Prereq 2	**Minimum Energy Performance**	HP elements like passive solar design and natural ventilation aid in energy efficiency.	2, 6
Prereq 3	**CFC Reduction in HVAC&R Equipment**	No direct relation to hp.	N/A
Credit 1	**Optimize Energy Performance**	Passive design, natural ventilation, radiant heating and displacement cooling help here, although there is more of a reliance on high tech options to increase performance. Care needs to be taken to not adversely affect elements like original windows and building envelope.	2, 5, 6, 9
Credit 2.1	**Renewable Energy**, 5%	Wind and hydro energy sources were historically common on-site, particularly in rural developments and warehouse/factory buildings. If these and other renewable energy sources are added on-site, care must be taken in retaining the historic character of building and site.	2, 8, 9, 10
Credit 2.2	**Renewable Energy**, 10%	Wind and hydro energy sources were historically common on-site, particularly	2, 8, 9, 10

		in rural developments and warehouse/factory buildings. If these and other renewable energy sources are added on-site, care must be taken in retaining the historic character of building and site.	
Credit 2.3	**Renewable Energy**, 20%	Wind and hydro energy sources were historically common on-site, particularly in rural developments and warehouse/factory buildings. If these and other renewable energy sources are added on-site, care must be taken in retaining the historic character of building and site.	2, 8, 9, 10
Credit 3	**Additional Commissioning**	No direct relation to hp.	N/A
Credit 4	**Ozone Depletion**	Many older HVAC systems contain HCFCs or Halons. Their removal and replacement with new HVAC systems must be sensitive to the historic character of the building.	2
Credit 5	**Measurement & Verification**	No direct relation to hp.	N/A
Credit 6	**Green Power**	No direct relation to hp.	N/A

Materials & Resources (13 Possible Points)

Credit	Topic	Relation to Historic Buildings	Applicable Standards
Prereq 1	**Storage & Collection of Recyclables**	No direct relation to hp.	N/A
Credit 1.1	**Building Reuse**, Maintain 75% of Existing Walls, Floors and Roof	Reuse of existing building saves embodied energy of materials and construction and, potentially, open space.	All
Credit 1.2	**Building Reuse**, Maintain 100% of Existing Walls, Floors and Roof	Reuse of existing building saves embodied energy of materials and construction and, potentially, open space.	All
Credit 1.3	**Building Reuse**, Maintain 100% of Shell/ Structure and 50% Non-Shell/Non-Structure	Reuse of existing building saves embodied energy of materials and construction and, potentially, open space.	All
. Credit 2.1	**Construction Waste Management**, Divert 50%	HP discourages demolition and promotes salvaging of materials for reuse. Saves embodied energy of materials and energy and materials expended during construction.	2, 6
Credit 2.2	**Construction Waste Management**, Divert 75%	HP discourages demolition and promotes salvaging of materials for reuse. Saves embodied energy of materials and energy and materials expended during construction	2, 6

Credit 3.1	**Resource Reuse**, Specify 5%	HP discourages demolition and promotes reuse and salvaging of materials. Saves embodied energy of materials.	2, 3, 5, 6
Credit 3.2	**Resource Reuse**, Specify 10%	HP discourages demolition and promotes reuse and salvaging of materials. Saves embodied energy of materials.	2, 3, 5, 6
Credit 4.1	**Recycled Content**, Specify 5%	No direct relation to hp. Use of recycled materials must be sensitive to historic character of building.	2, 5, 6
Credit 4.2	**Recycled Content**, Specify 10%	No direct relation to hp. Use of recycled materials must be sensitive to historic character of building.	2, 5, 6
Credit 5.1	**Regional Materials**, 20% Manufactured Regionally	Historic buildings traditionally constructed using local, regional materials. However, this point cannot be awarded for materials used in the original construction. Added materials must consider historic integrity of the building.	2, 3, 5
Credit 5.2	**Regional Materials**, 50% Extracted Regionally	Historic buildings traditionally constructed using local, regional materials. However, this point cannot be awarded for materials used in the original construction. Added materials must consider historic integrity of the building.	2, 3, 5

Credit 6	**Rapidly Renewable Materials**	No direct relation to hp. Added materials must be sensitive to historic character of building.	2, 5
Credit 7	**Certified Wood**	No direct relation to hp. Added materials must be sensitive to historic character of building.	2, 5

Indoor Environmental Quality (15 Possible Points)

Credit	Topic	Relation to Historic Buildings	Applicable Standards
Prereq 1	**Minimum IAQ Performance**	No direct relation to hp.	N/A
Prereq 2	**Environmental Tobacco Smoke (ETS) Control**	No direct relation to hp.	N/A
Credit 1	**Carbon Dioxide Monitoring**	No direct relation to hp.	N/A
Credit 2	**Ventilation Effectiveness**	Operable windows & natural ventilation found in historic building envelopes.	2, 6
Credit 3.1	**Construction IAQ Management Plan**, During Construction	No direct relation to hp.	N/A
Credit 3.2	**Construction IAQ Management Plan**, Before Occupancy	No direct relation to hp.	N/A
Credit 4.1	**Low-Emitting Materials**, Adhesives & Sealants	No direct relation to hp.	2, 5
Credit 4.2	**Low-Emitting Materials**, Paints	No direct relation to hp.	2, 5
Credit 4.3	**Low-Emitting Materials**, Carpet	No direct relation to hp.	2, 5
Credit 4.4	**Low-Emitting Materials**, Composite Wood	No direct relation to hp.	2, 5

Credit 5	**Indoor Chemical & Pollutant Source**	No direct relation to hp.	2, 5
Credit 6.1	**Controllability of Systems**: Perimeter	Operable windows and natural light	2
Credit 6.2	**Controllability of Systems**: Non-perimeter	Operable windows and natural light.	2
Credit 7.1	**Thermal Comfort**, Compliance with ASHRAE 55-1992	No direct relation to hp.	N/A
Credit 7.2	**Thermal Comfort**: Permanent Monitoring	No direct relation to hp.	N/A
Credit 8.1	**Daylighting and Views**: Daylight 75% of Spaces	Historic buildings traditionally have generous sized windows and openings to allow copious amounts of daylight and views.	2, 6
Credit 8.2	**Daylighting and Views**: Views for 90% of Spaces	Historic buildings traditionally have generous sized windows and openings to allow copious amounts of daylight and views.	2, 6

Innovation & Design (5 Possible Points)

Section	Topic	Relation to Historic Buildings	Applicable Standards
Credit 1.1-1.4	**Innovation in Design**	Variable. Many argue that an innovation credit should be awarded for preserving a cultural resource.	All
Credit 2	**LEED Accredited Professional**	No direct relation to hp.	N/A

LEED-EB Version 2.0
Comparison Chart

Sustainable Sites (14 Possible Points)

Credit	Topic	Relation to Historic Buildings	Applicable Standards
Prereq 1	**Erosion and Sedimentation Control**	No direct relation to hp.	N/A
Prereq 2	**Age of Building**	Building only has to be two years old for EB certification. This obviously pertains to historic buildings.	N/A
Credit 1.1 & 1.2	**Plan for Green Site and Building & Exterior Management**	Many historic buildings and sites had native plant species and plantings to reduce heating and cooling needs.	2, 8
Credit 2	**High Development Density Building & Area**	Historic commercial buildings generally found in dense urban areas.	1
Credit 3.1	**Alternative Transportation:** Public Transportation	Historic commercial buildings traditionally located near public transportation. If not located near mass transit, constructing a transit system near the historic property must be sensitive to its historic character.	1, 2, 7, 10

Credit 3.2	**Alternative Transportation:** Bicycle Storage & Changing Rooms	No direct relation to hp. Addition of structures and facilities must be sensitive to the historic character of the building and site.	1, 2, 9, 10
Credit 3.3	**Alternative Transportation:** Alt Fuel Vehicles	No direct relation to hp. Addition of refueling stations must be sensitive to the historic character of the building and site.	1, 2, 9, 10
Credit 3.4	**Alternative Transportation:** Car Pooling & Telecommuting	Works well with hp since many historic buildings were not serviced by parking lots.	2
Credit 4.1	**Reduced Site Disturbance**—Protect or Restore Open Space: 50% of site area	Geared more towards new construction. However, preservation of an existing building inherently protects open space because of its limited site disturbance. Another possible tactic is replacing impervious surfaces with native or adapted vegetation, an element historic sites generally possessed.	1, 2, 10
Credit 4.2	**Reduced Site Disturbance**—Protect or Restore Open Space: 75% of site area	Geared more towards new construction. However, preservation of an existing building inherently protects open space because of its limited site disturbance. Another possible tactic is replacing impervious surfaces with native or adapted vegetation, an element historic sites generally possessed.	1, 2, 10

Credit 5.1 & 5.2	**Stormwater Management:** Rate & Quantity Reductions	No direct relation to hp. Stormwater management systems can be built if sensitive to the historic character of the building and site.	1, 2, 9, 10
Credit 6.1	**Heat Island Reduction:** Non-roof	Historic buildings traditionally used natural landscape elements to provide temperature control.	2, 9, 10
Credit 6.2	**Heat Island Reduction: Roof**	No direct relation to hp. Can be implemented with sensitivity to historic character, particularly the vegetated roof, which works better on some historic buildings than others, like flat-roofed warehouses.	2, 5, 9, 10
Credit 7	**Light Pollution Reduction**	Historic buildings traditionally did not have significant amounts of exterior lighting.	2, 9

Water Efficiency (5 Possible Points)

Credit	Topic	Relation to Historic Buildings	Applicable Standards
Prereq 1	**Minimum Water Efficiency**	No direct relation to hp.	N/A
Prereq 2	**Discharge Water Compliance**	No direct relation to hp.	N/A
Credit 1.1 & 1.2	**Water Efficient Landscaping -** Reduce Water Use	Many historic buildings and sites used indigenous plantings and/or cisterns to capture rainwater.	2, 8
Credit 2	**Innovative Wastewater Technologies**	Many historic buildings and sites had cisterns to capture rainwater.	2, 8
Credit 3.1 & 3.2	**Water Use Reduction**	No direct relation to hp.	N/A

Energy & Atmosphere (23 Possible Points)

Credit	Topic	Relation to Historic Buildings	Applicable Standards
Prereq 1	**Existing Building Commissioning**	No direct relation to hp.	N/A
Prereq 2	**Minimum Energy Performance**	HP elements like passive solar design and natural ventilation aid in energy efficiency.	2, 6
Prereq 3	**Ozone Protection**	Many older HVAC systems contain HCFCs or Halons. Their removal and replacement with new HVAC systems must be sensitive to the historic character of the building.	2
Credit 1	**Optimize Energy Performance**	Passive design, natural ventilation, radiant heating and displacement cooling help here, although there is more of a reliance on high tech options to increase performance. Care needs to be taken to not adversely affect elements like original windows and building envelope.	2, 5, 6, 9
Credit 2.1-2.4	**On-Site and Off-Site Renewable Energy**	Wind and hydro energy sources were historically common on-site, particularly in rural developments and warehouse/ factory buildings. Off-site sources are not directly related to hp.	2, 8, 9, 10

Credit 3.1	**Building Operations and Maintenance** Staff Education	Not directly related to hp.	N/A
Credit 3.2	**Building Operations and Maintenance:** Building Systems Maintenance	HP concerns the care and maintenance of historic buildings, but not necessarily through post-warranty equipment maintenance that this credit requires.	N/A
Credit 3.3	**Building Operations and Maintenance:** Building Systems Monitoring	HP concerns the care and maintenance of historic buildings, but not necessarily through automated monitoring systems and alarms that this credit requires.	N/A
Credit 4	**Additional Ozone Protection**	Many older HVAC systems contain HCFCs or Halons. Their removal and replacement with new HVAC systems must be sensitive to the historic character of the building.	2
Credit 5.1-5.3	**Performance Measurement:** Enhanced Metering	No direct relation to hp.	N/A
Credit 5.4	**Performance Measurement:** Emission Reduction Reporting	No direct relation to hp.	N/A
Credit 6	**Documenting Sustainable Building Cost Impacts**	No direct relation to hp.	N/A

Materials & Resources (16 Possible Points)

Credit	Topic	Relation to Historic Buildings	Applicable Standards
Prereq 1.1	**Source Reduction and Waste Management:** Waste Stream Audit	No direct relation to hp.	N/A
Prereq 1.2	**Source Reduction and Waste Management:** Storage & Collection of Recyclables	No direct relation to hp.	N/A
Prereq 2	**Toxic Material Source Reduction** Reduced Mercury in Light Bulbs	No direct relation to hp.	N/A
Credit 1.1 & 1.2	**Construction, Demolition & Renovation Waste Management**	HP discourages demolition and promotes material salvage and reuse. Saves embodied energy of materials and energy and materials expended during construction.	2, 6
Credit 2.1 2.5	**Optimize Use of Alternative Materials**	Use of salvaged historical materials reduces environmental impacts.	2, 6
Credit 3.1 & 3.2	**Optimize Use of IAQ Compliant Products**	No direct relation to hp.	2, 5
Credit 4.1– 4.3	**Sustainable Cleaning Products and Materials**	No direct relation to hp.	N/A

Credit 5.1-5.3	**Occupant Recycling**	No direct relation to hp.	N/A
Credit 6	**Additional Toxic Material Source Reduction:** Reduced Mercury in Light Bulbs	No direct relation to hp.	N/A

Indoor Environmental Quality (22 Possible Points)

Credit	Topic	Relation to Historic Buildings	Applicable Standards
Prereq 1	**Outside Air Intro and Exhaust Systems**	No direct relation to hp.	N/A
Prereq 2	**Environmental Tobacco Smoke (ETS) Control**	No direct relation to hp.	N/A
Prereq 3	**Asbestos Removal or Encapsulation**	Asbestos and lead are commonly found in historic buildings.	2
Prereq 4	**PCB Removal**	No direct relation to hp.	2
Credit 1	**Outside Air Delivery Monitoring**	No direct relation to hp.	N/A
Credit 2	**Increased Ventilation**	Operable windows and natural ventilation found in historic building envelopes.	2
Credit 3	**Construction IAQ Management Plan**	No direct relation to hp.	N/A
Credit 4.1	**Documenting Productivity Impacts:** Absenteeism and Healthcare Cost Impacts	Operable windows and natural ventilation and lighting have been proven to reduce absenteeism and health problems related to sick building syndrome.	N/A
Credit 4.2	**Documenting Productivity Impacts:** Other Impacts	No direct relation to hp.	N/A

Credit 5.1	**Indoor Chemical and Pollutant Source Control:** Non-cleaning—Reduce Particulates in Air Distribution	No direct relation to hp.	2, 5
Credit 5.2	**Indoor Chemical and Pollutant Source Control:** Non-cleaning—High Volume Copying/Print Rooms/Fax Stations	No direct relation to hp.	2, 5
Credit 6.1	**Controllability of Systems:** Lighting	Operable windows and natural light.	2
Credit 6.2	**Controllability of Systems:** Temperature & Ventilation	Operable windows and natural light.	2
Credit 7.1	**Thermal Comfort:** Compliance	No direct relation to hp.	N/A
Credit 7.2	**Thermal Comfort:** Permanent Monitoring System	No direct relation to hp.	N/A
Credit 8.1 & 8.2	**Daylighting and Views:** Daylight	Historic buildings traditionally have generous sized windows and openings to allow copious amounts of daylight and views.	2, 6
Credit 8.3 & 8.4	**Daylighting and Views:** Views	Historic buildings traditionally have generous sized windows and openings to allow copious amounts of daylight and views.	2, 6
Credit 9	**Contemporary IAQ Practice**	No direct relation to hp.	N/A

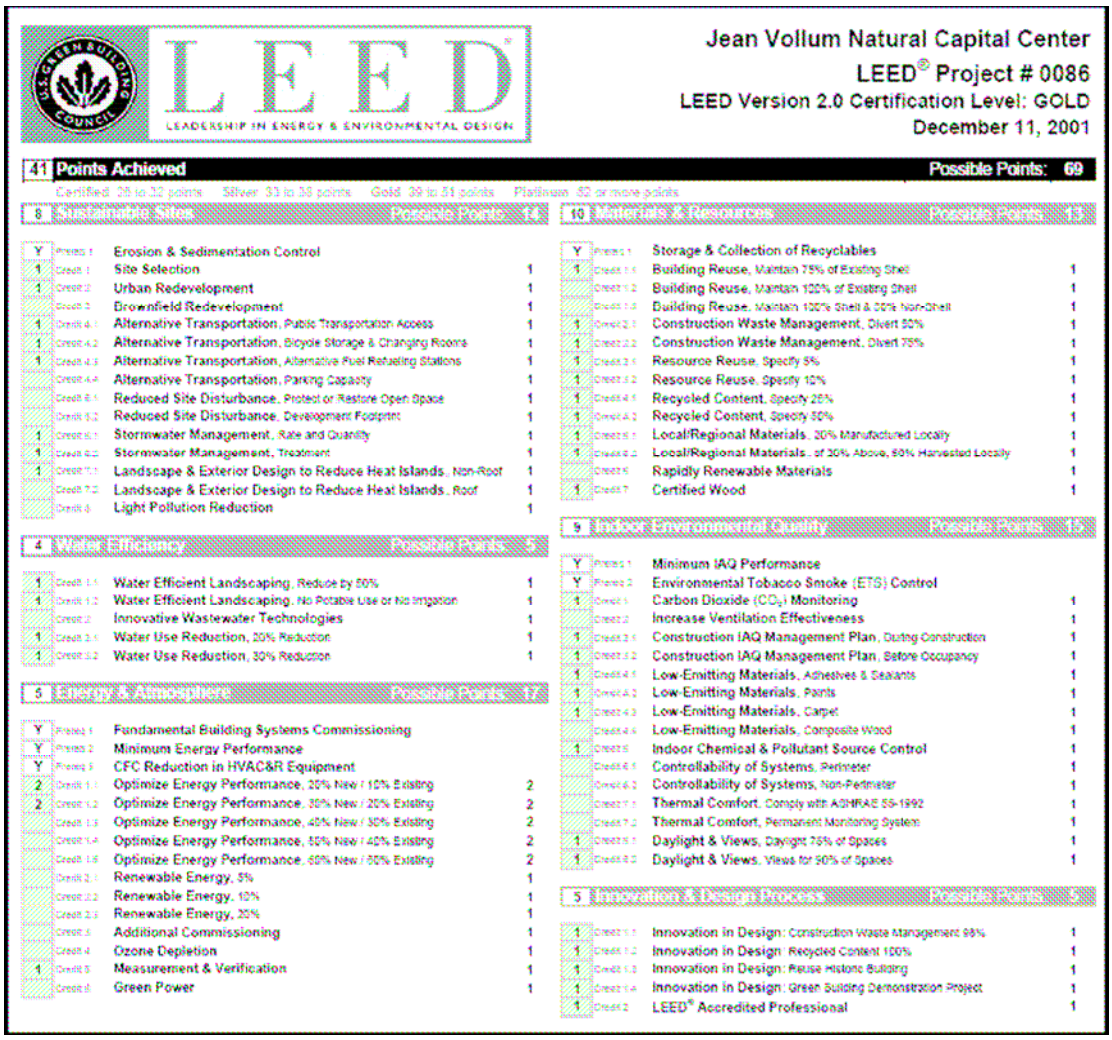
Credit 10.1	**Green Cleaning:** Entryway systems	No direct relation to hp.	5
Credit 10.2	**Green Cleaning:** Isolation of Janitorial Closets	No direct relation to hp.	2
Credit 10.3	**Green Cleaning:** Low Environmental Impact Cleaning Policy	No direct relation to hp.	N/A
Credit 10.4 & 10.5	**Green Cleaning:** Low Environmental Impact Pest Management Policy	No direct relation to hp.	N/A
Credit 10.6	**Green Cleaning:** Low Environmental Impact Cleaning Equipment Policy	No direct relation to hp.	N/A

Innovation in Upgrades, Operations and Maintenance (5 Possible Points)

Credit	Topic	Relation to Historic Buildings	Applicable Standards
Credit 1	**Innovation in Upgrades, Operations and Maintenance**	Variable	N/A
Credit 2	**LEED Accredited Professional**	No direct relation to hp.	N/A

APPENDIX F

The Jean Vollum Natural Capital Center LEED Scorecard



LEED®
LEADERSHIP IN ENERGY & ENVIRONMENTAL DESIGN

Jean Vollum Natural Capital Center
LEED® Project # 0086
LEED Version 2.0 Certification Level: GOLD
December 11, 2001

41 Points Achieved — **Possible Points: 69**

Certified 26 to 32 points Silver 33 to 38 points Gold 39 to 51 points Platinum 52 or more points

8 Sustainable Sites — Possible Points: 14

Y	Prereq 1	Erosion & Sedimentation Control	
1	Credit 1	Site Selection	1
1	Credit 2	Urban Redevelopment	1
	Credit 3	Brownfield Redevelopment	1
1	Credit 4.1	Alternative Transportation, Public Transportation Access	1
1	Credit 4.2	Alternative Transportation, Bicycle Storage & Changing Rooms	1
1	Credit 4.3	Alternative Transportation, Alternative Fuel Refueling Stations	1
	Credit 4.4	Alternative Transportation, Parking Capacity	1
	Credit 5.1	Reduced Site Disturbance, Protect or Restore Open Space	1
	Credit 5.2	Reduced Site Disturbance, Development Footprint	1
1	Credit 6.1	Stormwater Management, Rate and Quantity	1
1	Credit 6.2	Stormwater Management, Treatment	1
1	Credit 7.1	Landscape & Exterior Design to Reduce Heat Islands, Non-Roof	1
	Credit 7.2	Landscape & Exterior Design to Reduce Heat Islands, Roof	1
	Credit 8	Light Pollution Reduction	1

4 Water Efficiency — Possible Points: 5

1	Credit 1.1	Water Efficient Landscaping, Reduce by 50%	1
1	Credit 1.2	Water Efficient Landscaping, No Potable Use or No Irrigation	1
	Credit 2	Innovative Wastewater Technologies	1
1	Credit 3.1	Water Use Reduction, 20% Reduction	1
1	Credit 3.2	Water Use Reduction, 30% Reduction	1

5 Energy & Atmosphere — Possible Points: 17

Y	Prereq 1	Fundamental Building Systems Commissioning	
Y	Prereq 2	Minimum Energy Performance	
Y	Prereq 3	CFC Reduction in HVAC&R Equipment	
2	Credit 1.1	Optimize Energy Performance, 20% New / 10% Existing	2
2	Credit 1.2	Optimize Energy Performance, 30% New / 20% Existing	2
	Credit 1.3	Optimize Energy Performance, 40% New / 30% Existing	2
	Credit 1.4	Optimize Energy Performance, 50% New / 40% Existing	2
	Credit 1.5	Optimize Energy Performance, 60% New / 50% Existing	2
	Credit 2.1	Renewable Energy, 5%	1
	Credit 2.2	Renewable Energy, 10%	1
	Credit 2.3	Renewable Energy, 20%	1
	Credit 3	Additional Commissioning	1
	Credit 4	Ozone Depletion	1
1	Credit 5	Measurement & Verification	1
	Credit 6	Green Power	1

10 Materials & Resources — Possible Points: 13

Y	Prereq 1	Storage & Collection of Recyclables	
1	Credit 1.1	Building Reuse, Maintain 75% of Existing Shell	1
	Credit 1.2	Building Reuse, Maintain 100% of Existing Shell	1
	Credit 1.3	Building Reuse, Maintain 100% Shell & 50% Non-Shell	1
1	Credit 2.1	Construction Waste Management, Divert 50%	1
1	Credit 2.2	Construction Waste Management, Divert 75%	1
1	Credit 3.1	Resource Reuse, Specify 5%	1
1	Credit 3.2	Resource Reuse, Specify 10%	1
1	Credit 4.1	Recycled Content, Specify 25%	1
1	Credit 4.2	Recycled Content, Specify 50%	1
1	Credit 5.1	Local/Regional Materials, 20% Manufactured Locally	1
1	Credit 5.2	Local/Regional Materials, of 20% Above, 50% Harvested Locally	1
	Credit 6	Rapidly Renewable Materials	1
1	Credit 7	Certified Wood	1

9 Indoor Environmental Quality — Possible Points: 15

Y	Prereq 1	Minimum IAQ Performance	
Y	Prereq 2	Environmental Tobacco Smoke (ETS) Control	
1	Credit 1	Carbon Dioxide (CO_2) Monitoring	1
	Credit 2	Increase Ventilation Effectiveness	1
1	Credit 3.1	Construction IAQ Management Plan, During Construction	1
1	Credit 3.2	Construction IAQ Management Plan, Before Occupancy	1
1	Credit 4.1	Low-Emitting Materials, Adhesives & Sealants	1
1	Credit 4.2	Low-Emitting Materials, Paints	1
1	Credit 4.3	Low-Emitting Materials, Carpet	1
	Credit 4.4	Low-Emitting Materials, Composite Wood	1
1	Credit 5	Indoor Chemical & Pollutant Source Control	1
	Credit 6.1	Controllability of Systems, Perimeter	1
	Credit 6.2	Controllability of Systems, Non-Perimeter	1
	Credit 7.1	Thermal Comfort, Comply with ASHRAE 55-1992	1
	Credit 7.2	Thermal Comfort, Permanent Monitoring System	1
1	Credit 8.1	Daylight & Views, Daylight 75% of Spaces	1
1	Credit 8.2	Daylight & Views, Views for 90% of Spaces	1

5 Innovation & Design Process — Possible Points: 5

1	Credit 1.1	Innovation in Design: Construction Waste Management 95%	1
1	Credit 1.2	Innovation in Design: Recycled Content 100%	1
1	Credit 1.3	Innovation in Design: Reuse Historic Building	1
1	Credit 1.4	Innovation in Design: Green Building Demonstration Project	1
1	Credit 2	LEED® Accredited Professional	1

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