# Department of Defense
# Legacy Resource Management Program

PROJECT NUMBER 09-452

## STRATEGIES FOR GREENING HISTORIC PROPERTIES

VAN CITTERS: HISTORIC PRESERVATION, LLC

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# STRATEGIES FOR GREENING HISTORIC PROPERTIES


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# Acronyms

| | |
|---|---|
| ACHP | Advisory Council on Historic Preservation |
| ASHRAE | American Society of Heating, Refrigeration, and Air Conditioning |
| BRAC | Base Realignment and Closure |
| C&D | Construction Waste or Demolition Debris |
| CCI | Conservation Consultants, Inc. |
| CFC | Chloroflourocarbon |
| CFR | Code of Federal Regulations |
| CRM | Cultural Resource Manager |
| DDC | Direct Digital Control |
| DoD | Department of Defense |
| EPA | Environmental Protection Agency |
| gpm | Gallons Per Minute |
| HEPA | High Efficiency Particulate Air |
| HVAC | Heating, Ventilation and Air Conditioning |
| IAQ | Indoor Air Quality |
| IEQ | Indoor Environmental Quality |
| IPM | Integrated Pest Management |
| LEED | Leadership in Energy and Environmental Design |
| MBTU | Million British Thermal Units |
| Mgal/d | Million Gallons Per Day |
| National Register | National Register of Historic Places |
| NHPA | National Historic Preservation Act |
| NIBS | National Institute of Building Sciences |
| NMHPD | New Mexico Historic Preservation Division |
| NPS | National Park Service |
| OSHA | Occupational Safety and Health Administration |
| PCB | Polychlorinated Biphenyls |
| PENREN | Pentagon Renovation |
| psi | Pounds Per Square Inch |
| SHPO | State Historic Preservation Office |
| UOS | University Operations Services |
| USGBC | United States Green Building Council |
| VCHP | Van Citters Historic Preservation, LLC |
| VOC | Volatile Organic Compounds |
| WBDG | Whole Building Design Guide |

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# 1. Introduction

In January, 2009, Van Citters: Historic Preservation, LLC (VCHP) entered into an agreement with the U.S. Army Corps of Engineers, Huntsville Center, to undertake Legacy Project number 09-452, funded by the Department of Defense, Legacy Resource Management Program. The project team consisted of staff from VCHP and Cherry/See/Reames Architects, LLP, both firms are located in Albuquerque, New Mexico. The project was originally designed to consist of three tasks: (1) identify Department of Defense (DoD) projects that have incorporated sustainability with the rehabilitation of historic buildings; (2) analyze data of these DoD green projects and similar non-DoD rehabilitation projects; and (3) provide information to assist DoD personnel in applying sustainability principals to historic properties.

Using this analysis, the project goal was to use DoD and private sector historic buildings to highlight design and construction processes, building systems upgrades, building modifications and alterations, and other practices that could enhance a building's sustainable design, while maintaining its historic character. The original intent of the project was to pair a DoD building with a private sector building to compare the two with regard to sustainability upgrades. However, it was problematic to obtain a sufficient number of DoD historic buildings to include in the case study analysis: some had gone through Base Realignment and Closure (BRAC) and were now in the private sector, others had insufficient data to support the study, and some installations declined participation. While buildings in the private sector were found and the owners did participate, their building types and sustainability factors did not pair well with the DoD properties. As a result, the project team determined the best way to meet the project goals to "identify design and construction processes, buildings systems upgrades, alterations, and practices that can enhance sustainable design elements while maintaining historic character" was to develop case studies of the best examples that could provide enough sustainability data to support the goals. The eight buildings chosen for the study included DoD, BRAC properties, and private sector buildings. These sites and buildings demonstrate the incorporation of a variety of sustainability measures, while at the same time maintaining historic architectural characteristics. The VCHP team visited seven of the nine case study properties to interview the designers, owners, and others who were involved in the building renovation and to document the elements of sustainability that were included in the project. Data on the other two buildings were obtained from online sources and telecommunications.

The report on Legacy Project 09-452 begins with brief sections on identifying historic properties on DoD installations, and a summary of the historic preservation and other regulations that pertain to energy conservation and sustainability. Following this introductory material, the report is structured to provide a brief introduction to each case study for which sustainability principles were used on that project. The case study summaries are followed by specific sections centered on the five guiding principles for high performance and sustainable buildings, as developed by the National Institute of Building Sciences and included as part of the online Whole Building Design Guide (WBDG). These principles include: (1) Integrated Design Principles, (2) Energy Performance, (3) Water Conservation, (4) Indoor Environmental Quality, and (5) the Environmental Impact of Materials. In each section, the reader is provided details on the sustainability measures that were carried out for each case study to which the section applies and any impacts or potential impacts of these sustainability measures on the historic character of the buildings.

Not every modification or upgrade described in the case studies involved a complicated undertaking. Several green solutions that were relatively easy to implement were completed as part of the projects. The easier things to implement are often referred to as "low hanging fruit". Like low hanging fruit, they are within reach, take little to acquire, and have immediate benefits.

The low hanging fruit symbol is used in the case studies to identify strategies that were relatively easy to implement and had little impact on the historic character of the building.

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# 2. Who Can Benefit from This Guide?

This guide is intended to be used by planners, architects, designers, engineers and other DoD staff involved in making alterations to historic properties (buildings, structures, or landscapes) located on DoD installations. Any proposed federal project that can affect an historic property is, in the language of the National Historic Preservation Act (NHPA), an "undertaking." Such projects may have direct federal funding, be carried out by or on behalf of the agency, or require a federal permit, license or approval.

If your project falls under the category of an undertaking (and virtually any construction project does), and you are working with an "historic property," your project is subject to review under Section 106 of the NHPA. Section 106 states that,

> *The head of any Federal agency having direct or indirect jurisdiction over a proposed Federal or federally assisted undertaking . . . [shall] take into account the effect of the undertaking on any district, site, building, structure, or object that is included in or eligible for inclusion in the National Register. The head of any such Federal agency shall afford the Advisory Council on Historic Preservation . . . reasonable opportunity to comment with regard to such undertaking.*

This simply means that before you finalize your design plans or begin construction, you need to contact the proper authorities (usually the State Historic Preservation Officer [SHPO]) to get their comments as to how your plans will affect the historic significance of the property you are working on. The actual steps for obtaining these comments are detailed in the Code of Federal Regulations (CFR), 36 CFR Part 800, "Protection of Historic Properties."

While all this may seem confusing right now, we hope that by the time you finish reading this guide you will have a better of understanding of:

1. What makes a property "historic";
2. Why do we need to care about historic properties;
3. What are "adverse effects";
4. How can we avoid adverse effects; and
5. What can be done if we can't avoid them.





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# 3. Is the Building, Structure, or Landscape Historic?

Prior to making any design decisions for your project, your first question should be: Am I working with an historic property? Be aware that "historic properties" can include a wide variety of property types, including buildings, structures, and landscapes – all of which can be affected by a sustainability project. As defined by the National Park Service (NPS), "buildings" function to shelter human activity, and "structures" function for purposes other than human shelter:

"Landscapes" (often called "cultural landscapes") are outdoor areas that are used or have been modified in a significant fashion by human cultures. Cultural landscapes, according to the NPS, are geographic areas that encompass "cultural and natural resources and the wildlife or domestic animals therein, associated with a historic event, or person or exhibiting other cultural or aesthetic values."

According to the NPS, there are four types of cultural landscapes, which are not necessarily mutually exclusive: historic sites, historic designed landscapes, historic vernacular landscapes, and ethnographic landscapes. These types of cultural landscapes are briefly defined below. Cultural resource managers (CRMs) are urged to study the full definitions in greater detail at the National Park Service website, Preservation Brief 36, at www.nps.gov/history/hps/TPS/briefs/brief36.htm.).

**Historic Designed Landscape**--a landscape that was consciously designed or laid out by a landscape architect, master gardener, architect, or horticulturist according to design principles. Examples include parks, campuses, and estates.

**Historic Vernacular Landscape**--a landscape that evolved through use by the people whose activities or occupancy shaped that landscape. Examples include rural villages, industrial complexes, and agricultural landscapes.

**Historic Site**--a landscape significant for its association with a historic event, activity, or person. Examples include battlefields and president's house properties.

**Ethnographic Landscape**--a landscape containing a variety of natural and cultural resources that associated people define as heritage resources. Examples are contemporary settlements, religious sacred sites, and massive geological structures.

Regardless of their property type, the common denominator of historic properties is that they have to be recognized by the DoD, the SHPO, the Advisory Council on Historic Preservation (ACHP), and the NPS as historically significant properties that are worthy of special consideration – that is, they are in or eligible for inclusion in the National Register of Historic Places (National Register). Their historical significance must be considered before making any alterations to them. The authority for this special designation is the NHPA.

So, how do you know if your project involves an historic property? The quickest and easiest way to answer this question is to contact the CRM for your installation. This staff person is usually assigned to the installation's public works, engineering or environmental group. The CRM will have a list of historic properties located on your installation. It is important to note that it does not matter whether the property is formally listed or has only been determined eligible for listing, since both categories have the same protection under historic preservation law.

There are three potential answers to whether or not a property is considered historic: 1) No; 2) Yes; or 3) It has not yet been determined. If the answer is "No," you are not working with a federally recognized historic property and your project can proceed without further consultation under historic preservation law. If the answer is "Yes," the effects of your project on the property's historic characteristics must be considered before you can proceed. If the property has not yet been determined eligible or ineligible, then the property must be evaluated for National Register eligibility before project plans progress further. You should discuss this situation with the installation CRM to determine what steps to take next. Also see the decision chart on the following page.

It is best to work with your CRM in the earliest planning stages to determine whether a property is considered historic. If you move the project forward before the determination of eligibility is made or without understanding the architecturally significant features of your property, you risk running into costly and time-consuming delays which could have been avoided.

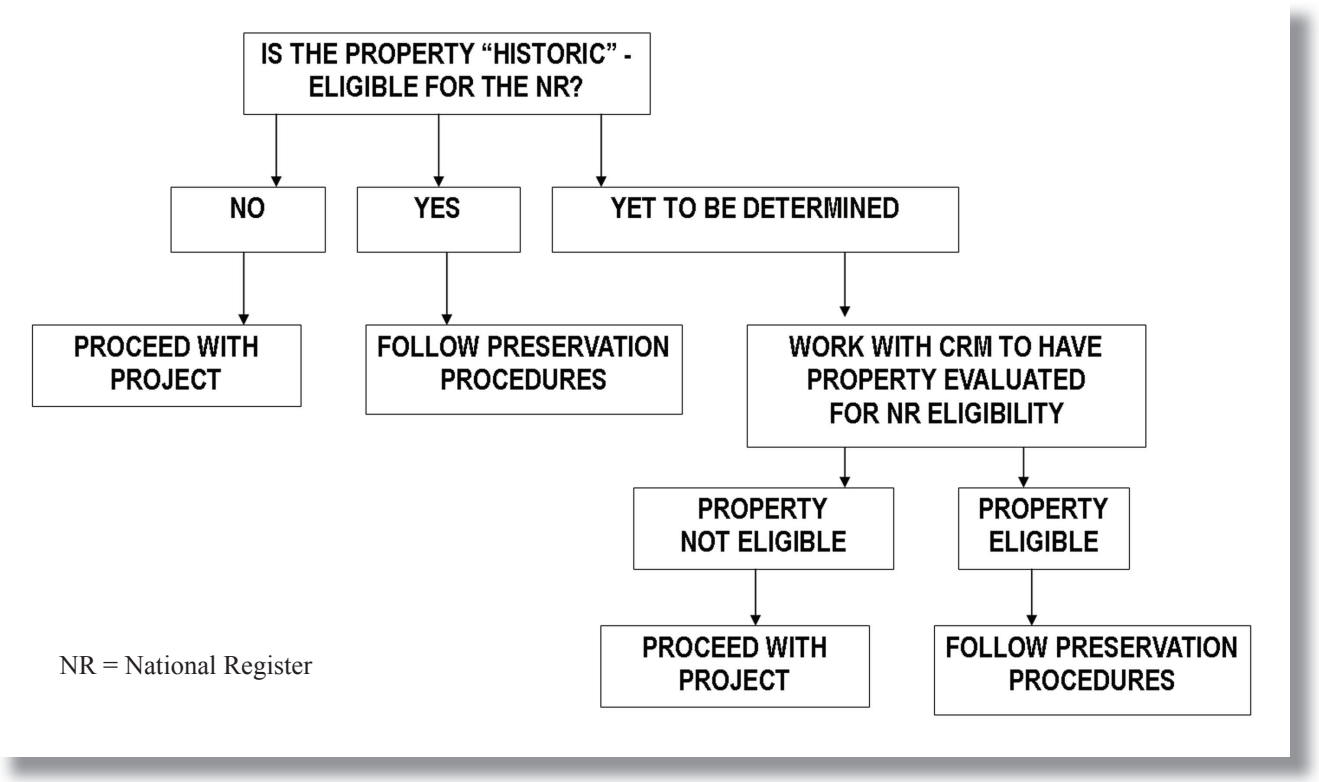


**Figure 1: Is the Property Historic**

# 4. Why Should I Care About Historic Properties?

Recent presidential Executive Orders and Acts of Congress have mandated that upgrades to historic properties provide not only greater sustainability for these buildings and structures, but also preserve their distinguishing historic characteristics. In addition, the DoD has established its own planning and regulatory processes to aid designers in meeting sustainability and preservation requirements. While both are mandated and processes have been put in place, there has been very little guidance as to how to actually integrate the concept of energy efficiency and sustainability with historic preservation principles. This study has been designed as a guide to achieve this integration. It includes basic information about the process of working with historic buildings and data about how others have successfully implemented sustainability designs for historic properties; in some cases achieving the highest levels of Leadership in Energy and Environmental Design (LEED) certification.

The following describes federal legislation applicable to sustainability projects on historic properties, all or some of which may be applicable to your project.

## *National Historic Preservation Act of 1966*

The act that is the guiding force behind federal historic preservation policy is the NHPA of 1966 (16 U.S. C. 470), as amended. Section 1(b) of the Act provides the philosophical underpinning for all subsequent legislation and regulatory requirements:

- *The spirit and direction of the Nation are founded upon and reflected in its historic heritage;*
- *The historical and cultural foundations of the Nation should be preserved as a living part of our community life;*
- *Historic properties significant to the Nation's heritage are being lost or substantially altered, often inadvertently, with increasing frequency;*
- *The preservation of this irreplaceable heritage is in the public interest so that its vital legacy of cultural, educational, aesthetic, inspirational, economic, and energy benefits will be maintained and enriched for future generations of Americans.*

## *Executive Order 13287: Preserve America (2003)*

Policy:

*It is the policy of the Federal Government to provide leadership in preserving America's heritage by actively advancing the protection, enhancement, and contemporary use of the historic properties owned by the Federal Government, and by promoting intergovernmental cooperation and partnerships for the preservation and use of historic properties. The Federal Government shall recognize and manage the historic properties in its ownership as assets that can support department and agency missions while contributing to the vitality and economic well-being of the Nation's communities and fostering a broader appreciation for the development of the United States and its underlying values. Where consistent with executive branch department and agency missions, governing law, applicable preservation standards, and where appropriate, executive branch departments and agencies ("agency" or "agencies") shall advance this policy through the protection and continued use of the historic properties owned by the Federal Government, and by pursuing partnerships with State and local governments, Indian tribes, and the private sector to promote the preservation of the unique cultural heritage of communities and of the Nation and to realize the economic benefit that these properties can provide. Agencies shall maximize efforts to integrate the policies, procedures, and practices of the NHPA and this order into their program activities in order to efficiently and effectively advance historic preservation objectives in the pursuit of their missions.*

Sustainability Goals:

- *Each agency shall ensure that the management of historic properties in its ownership is conducted in a manner that promotes the long-term preservation and use of those properties as Federal assets and, where consistent with agency missions, governing law, and the nature of the properties, contributes to the local community and its economy.*

## *Executive Order 13327: Federal Real Property Asset Management (2004)*

Policy:

*It is the policy of the United States to promote the efficient and economical use of America's real property assets and to assure management accountability for implementing Federal real property management reforms. Based on this policy, executive branch departments and agencies shall recognize the importance of real property resources through increased management attention, the establishment of clear goals and objectives, improved policies and levels of accountability, and other appropriate action.*

Sustainability Goals:

- *Prioritize actions to be taken to improve the operational and financial management of the agency's real property inventory;*
- *Make life-cycle cost estimations associated with the prioritized actions; and*
- *Incorporate planning and management requirements for historic property under Executive Order 13287 of March 3, 2003, and for environmental management under Executive Order 13148 of April 21, 2000*

## *Executive Order 13423: Strengthening Federal Environmental, Energy, and Transportation Management (2007)*

Policy:

*It is the policy of the United States that Federal agencies conduct their environmental, transportation, and energy-related activities under the law in support of their respective missions in an environmentally, economically and fiscally sound, integrated, continuously improving, efficient, and sustainable manner.*

Sustainability Goals:

- *Improve energy efficiency and reduce greenhouse gas emissions of the agency, through reduction of energy intensity by (i) 3 percent annually through the end of fiscal year 2015, or (ii) 30 percent by the end of fiscal year 2015, relative to the baseline of the agency's energy use in fiscal year 2003;*
- *Beginning in FY 2008, reduce water consumption intensity, relative to the baseline of the agency's water consumption in fiscal year 2007, through life-cycle cost-effective measures by 2 percent annually through the end of fiscal year 2015 or 16 percent by the end of fiscal year 2015;*
- *Require in agency acquisitions of goods and services (i) use of sustainable environmental practices, including acquisition of biobased, environmentally preferable, energy-efficient, water-efficient, and recycled-content products; and*
- *Ensure that (i) new construction and major renovation of agency buildings comply with the Guiding Principles for Federal Leadership in High Performance and Sustainable Buildings set forth in the Federal Leadership in High Performance and Sustainable Buildings Memorandum of Understanding (2006), and (ii) 15 percent of the existing Federal capital asset building inventory of the agency as of the end of fiscal year 2015 incorporates the sustainable practices in the Guiding Principles.*

## *Energy Independence and Security Act of 2007*

The major points of this Act were incorporated into Executive Order 13423:

- *Reduce total energy use in federal buildings (relative to 2005 level) 30% by 2015*
- *Federal energy managers conduct comprehensive energy and water evaluation for each facility every four years*
- *Major HVAC replacements use the most energy efficient design*
- *Leased buildings have Energy Star Label*
- *GSA Office of Federal High Performance Green Buildings developing standards for federal facilities, establishing green practices, review budget and life-cycle cost issues and promote innovative technologies*
- *GAO audits of budget, life cycle costing, contracting, best practices, and agency coordination*

DOE and GSA work jointly to form a Green Building Advisory Committee, develop guidelines conduct a, joint survey of green buildings, and identify benefits of green buildings for security, natural disasters and emergency needs of Federal Government.

### *Executive Order 13423: Strengthening Federal Environmental, Energy, and Transportation Management (2007)*

Policy:

> *The Federal government is committed to designing, locating, constructing, maintaining, and operating its facilities in an energy efficient and sustainable manner that strives to achieve a balance that will realize high standards of living, wider sharing of life's amenities, maximum attainable reuse and recycling of depletable resources, in an economically viable manner, consistent with Department and Agency missions. In doing so and where appropriate, we encourage the use of life cycle concepts, consensus-based standards, and performance measurement and verification methods that utilize good science, and lead to sustainable buildings.*

Sustainability Goals:

- *Reduce the total ownership cost of facilities;*
- *Improve energy efficiency and water conservation;*
- *Provide safe, healthy, and productive built environments; and*
- *Promote sustainable environmental stewardship.*

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# 5. Will My Project Have an Adverse Effect?

If you are working with an historic property, the next questions to ask are: Will my project have an effect on this property? And, if so, Will it have an adverse effect on it? By an "effect", your installation's CRM and the SHPO will want to know if the proposed project will affect the historic or architectural characteristics of the property that make it eligible for the National Register. If there will be "No Effect" upon these characteristics, then you can proceed with the project. If there will be an effect, the CRM and SHPO will determine if the effect is "Adverse," in other words, will the project destroy or permanently alter these characteristics.

Adverse effects can result from such tasks as, replacing original, historic windows and doors; changing fenestration (wall opening) patterns, adding heating, ventilation, and air conditioning (HVAC) systems to the roof which alter the historic style or "look" of the building, etc. Your project may have a very beneficial effect on energy efficiency, but at the same time have a very detrimental effect on the building's historic character. Once again, it is best to talk "early and often" with your CRM during the project planning stage to ensure that your project meets the regulatory requirements. In addition, many installations have a formal set of rules for working with historic properties or have Programmatic Agreements with the SHPO to guide construction or maintenance projects – your CRM will know about these and can assist you with compliance.

Your ideal goal is to have a "No Adverse Effect" determination for your project. This can be done by looking for design solutions that integrate historic preservation and the "green" goals for the building.

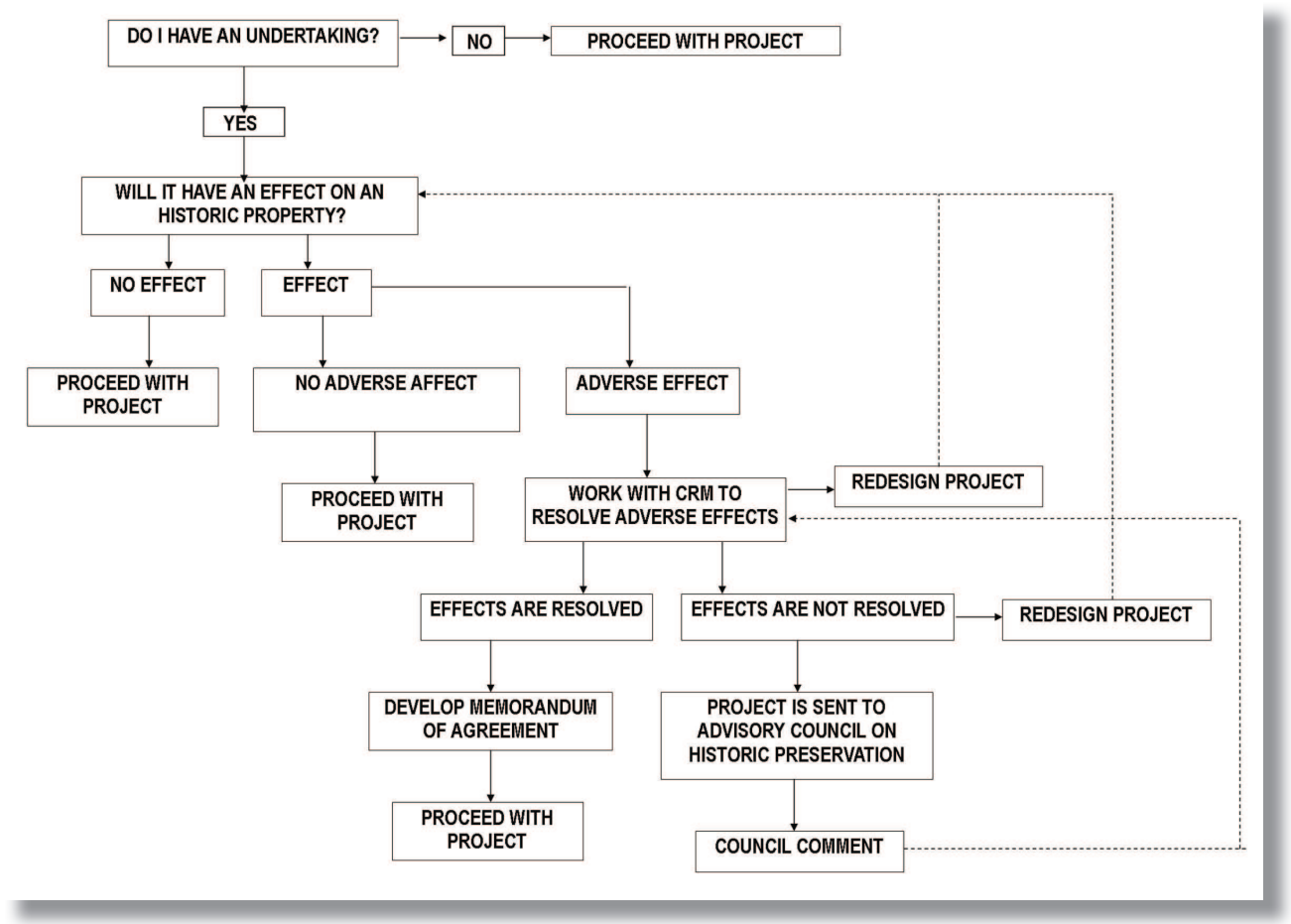


**Figure 2: Project Process**

## 5.1 How Do I Avoid Adverse Effects?

Avoiding an Adverse Effect is the best way to have your project run smoothly through the historic preservation consultation process. The best way to accomplish this is to understand the historic nature of the property by asking: (1) Why is the property eligible for the National Register; (2) What are the character-defining features of the building, structure, or landscape; and (3) Are there preservation standards that can guide my design and thus avoid or minimize any adverse effects. While these issues can get complicated, if you try to understand these three basic questions, and use the answers in your planning and design process, you will have a better chance of successfully communicating with your CRM and SHPO and thus achieving a No Adverse Effect determination.

### *The National Register Criteria for Eligibility*

The NPS has issued guidance, referred to as "National Register Bulletins," which assist those working with historic properties to better understand the criteria used in evaluating a property's historic significance. The primary criteria against which a property is evaluated include:

Criterion A: A property associated with events that have made a significant contribution to the broad patterns of our history. For example, within the DoD this pattern could include events such as World Wars I or II or the Cold War. It can also include thematic topics that took place during these historic periods such as: missile development, air defense, or specialized training areas.

Criterion B: A property associated with the lives of persons significant in our past. For example, Gen. John J. Pershing, Gen. Curtis LeMay, or other historically important military persons.

Criterion C: A property that embodies the distinctive architectural characteristics of a type, period, or method of construction; that represent the work of a master; or that possess high artistic value. For example, a typical World War II hangar that has not been significantly altered since its construction; or a Cold War administrative building that was designed in the International style.

Criterion D: A property that has the ability to yield information important to prehistory or history. This criterion usually applies to archeological sites and is normally not pertinent to the significance of buildings, structures, or landscapes.

In addition, a property usually needs to be 50 years old or older, to be considered eligible for the National Register. It should be noted that there is an exception (called Criteria Consideration G) that permits "exceptionally important" properties to be considered eligible to the National Register prior to reaching this 50-year mark. For DoD projects this could apply to certain Cold War buildings or structures, so it is again important to check with your installation's CRM.

The National Register criteria of significance must be supported by the property's significance; that is, its ability to convey its significance. Evaluation of a property's integrity is a subjective judgment; however, the National Register has provided guidance in the form of seven "aspects" or qualities of integrity: Location, Design, Setting, Materials, Workmanship, Feeling, and Association. Using these aspects, the evaluator must decide if the property's significant features are still extant and visible, how the property compares to similar historic properties and which of the seven aspects of integrity are most important to this particular property. The criteria of significance together with the aspects of integrity form the basis for making a determination of eligibility to the National Register.

### *Character-Defining Features*

It is very important to sit down with your CRM to identify an historic building's character-defining architectural or landscape features in order to try and preserve these significant elements, which will help result in a No Adverse Effect determination. At the same time, your project may rehabilitate or restore certain characteristic features that have been lost or damaged through weathering, previous remodeling, or improper maintenance. These features are integral to a building, structure or landscape's historic and architectural significance and its historical integrity. Character-defining features generally include those aspects pertaining to the physical appearance of the property, such as the overall shape, design, materials, craftsmanship, decorative features and expressions of the site layout or landscape context.

Avoiding adverse effects can be complicated, and will require consultation with your CRM and the SHPO, as well as perhaps some re-consideration of plans by the design team. However, if you start the project with an eye toward understanding the property's historic significance and character, this can help to integrate preservation with green building principles from the beginning.

An additional tool your team can use in the early design stage is *The Secretary of the Interior's Standards for the Treatment of Historic Properties*. These standards outline

the appropriate preservation treatments for the following types of projects that can affect historic properties:

- Preservation: This type of project maintains the property's existing form and materials, with very minimal changes. Although upgrading mechanical, electrical, and plumbing systems are permitted, additions to the building are not usually allowed under this standard. The property usually retains its integrity by continuing its original use, e.g., an historic house continues to be used as a house. In general, the Preservation standard allows very little flexibility with regard to materials, use, and form.
- Rehabilitation: Projects of this type call for the compatible use of a property through repair, alterations, building code upgrades, and additions while preserving those character-defining features that convey its historical, cultural or architectural values. In general, the Rehabilitation standard recommends preserving distinctive materials, features, and building characteristics, repairing rather than replacing historic features, and permits building additions or exterior alterations so long as the character-defining features of the building are not destroyed or significantly altered.
- Restoration: These projects select a specific time period in the building's history and make the building look as it did at that time. This may include removing additions and features added later to the building and are historically inappropriate, and restoring significant architectural features that have been removed.
- Reconstruction: This is new construction for all or part of a building or structure that no longer exists. The new construction replicates the appearance of the property at a specific period of time and in its historic location.

During the project planning phase, the appropriate type of standard treatment should be discussed with your installation CRM and the SHPO. It is most likely that rehabilitation will be the standard used to guide sustainability projects.

## 5.2 What if I Can't Avoid an Adverse Effect?

If you cannot find a way to avoid an adverse effect, then you and your installation's CRM will have to come to some agreement with the SHPO and/or the ACHP on how to alleviate or minimize these unavoidable adverse effects. This is called a "mitigation plan." Such a plan may require modifications to the original design that avoids the adverse effects. If this is not possible, then it may be necessary to have an architectural historian document. Such plans may be as simple as an architectural historian documenting the original features of the building or structure with drawings or photographs before the features are demolished or altered, and then preparing a report that discusses these features in their historic context.

Be aware that redesigning a project to minimize the adverse effects or developing a mitigation plan normally takes hours of preparation and consultation time. While the parties can usually come to an agreement, it is often difficult to estimate how long this process will take. Ultimately, there may even be a failure of all parties to agree on a design change or mitigation plan. Although this is rare, it is possible for a project to proceed even if the adverse effects are not mitigated. The process for this is set forth in 36 CFR Part 800; however, we do not recommend this decision since it will cause extreme time delays and other potential problems for the DoD.

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# 6. Guiding Principles of Sustainability & Case Studies

The following case studies demonstrate how principles for high performance and sustainable buildings can be applied to real-life historic properties. The guiding principles used in this study have been adopted by the DoD to provide leadership in sustainability practices. A Memorandum of Understanding among federal agencies was developed by the National Institute of Building Sciences and was included as a part of the online Whole Building Design Guide (WBDG). The five guiding principles are also used in the DoD real asset database as real property codes to track sustainability of the DoD inventory. These principles provide the basis for analyzing the buildings found in these case studies and are examples for DoD staff of how sustainability principles have been successfully integrated into rehabilitation projects for historic properties.

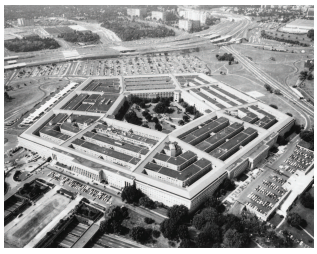
### *Five Guiding Principles for Sustainable Buildings*

- Employ Integrated Design Principles
- Optimize Energy Performance
- Protect and Conserve Water
- Enhance Indoor Environmental Quality
- Reduce Environmental Impact of Materials

## 6.1 Case Study Summaries

The eight case studies selected for this study were chosen for their diversity of style and location, and the availability of information on them. Each summary provides basic building statistics such as date of construction, National Register status, original and current use, and LEED rating. This is followed by a brief narrative of the property's historical significance, the sustainability approach used in remodeling the building, and the sustainability principles applied to the rehabilitation project. These approaches and principles will be detailed in Sections 7 through 11 of this study.

Washington Navy Yard, Building 33



The Pentagon

46 Blackstone South, Harvard University

Charleston Navy Yard, Building 7

Cambridge City Hall Annex

New Mexico Villagra Building

The Gerding Theater at the Armory (Annex)

The Presidio

**Figure 3: Eight case studies featured in this report**

### 6.1.1 Washington Navy Yard, Building 33, Washington D.C.

**Figure 4: Building 33 Courtyard View**

Source: Photo by Karen Van Citters

The Washington Navy Yard, established in 1799, was one of the United States' first naval yards and was Washington D.C.'s largest and most important manufacturing area in the 19th century. In 1803, it was also designated the home port for the United States Navy by President Thomas Jefferson.

The Yard, consisting of nine blocks of 19th and early 20th century industrial and residential buildings, was constructed on an area that consisted primarily of landfill. Building 33 was constructed during the 1850s and served as a 45-foot high open bay factory building. An adjacent structure, Building 36, was constructed in 1857, and with Building 33 formed a quadrangle consisting of the two L-shaped structures and the central space between the two buildings. These two industrial buildings are emblematic of the Navy Yard's preeminence as an equipment and ordnance manufacturing area for the U.S. Navy, and the quadrangle buildings formed the heart of this manufacturing area.

The Navy adopted the principles of the Whole Building Design Guide. The earliest version of LEED was used for general guidance, but LEED certification was not sought. The rehabilitation was completed in the year that the first version of LEED appeared; it was a "pilot project" for the entire service branch, which previously had not attempted a comprehensive green rehabilitation on a major facility.

- **Constructed 1850**
- **US Navy Pilot Project for Sustainability, 1988**
- **National Historic Landmark**
- **Original Use: Factory**
- **Current Use: Offices for NAVFACENGCOM**
- **Size: 150,000 square feet**

#### *Sustainability Measures Applied*

- Brownfield Mitigation (site cleanup)
- Public Transportation
- Energy Efficiency Measures
- Lighting
- Water Efficiency
- Envelope Insulation
- Recycled Materials
- Construction Waste Management
- Operations
- Indoor Environmental Quality

## 6.1.2 The Pentagon, Washington, D.C.

**Figure 5: The Pentagon**

Source: Department of Defense

The Pentagon was originally conceived in 1941 as a facility to consolidate the scattered offices of the War Department, the predecessor to today's DoD. In 1941, Washington, D.C., War Department personnel numbered 21,000 workers housed in 17 different buildings. By 1942, it was anticipated that some 30,000 workers would be working for the War Department, and the Pentagon was therefore conceived as a facility that could house up to 40,000 defense workers in a single facility. Built of reinforced concrete, it consists of five concentric five-story pentagons connected by radiating corridors, all centered on a six-acre interior courtyard. As originally conceived, it contained a large shopping concourse on the first floor, taxi stands and bus lanes, and parking for 8,000 cars.

The building was constructed under conditions of wartime building supply shortages, and the builders substituted concrete ramps for passenger elevators and concrete drainpipes in place of metal drainpipes. Builders also eliminated other "frills" in order to speed construction and spare materials needed for the war effort. It was completed in January of 1943, an astounding 16-month construction schedule for a massive building that normally would have required 4 years to complete. At the time of completion it was the largest office building in the world, covering 29 acres and consisting of 17.5 miles of corridors. At one time it housed as many as 33,000 workers.

The building became the center of DoD activities during the Cold War era. It also became a symbol of the United States' global military supremacy, to the extent that the phrase "The Pentagon" is often used in the news media to personify the entire U.S. military establishment, and in particular the highest orders of the military hierarchy who shape its policies and direction. The building took on additional significance as the site of one of the terrorist attacks of September 11, 2001, ironically sixty years to the day after initial construction on the building began in 1941. Since the attack, Wedge One of the Pentagon has been substantially rebuilt, and the site now includes memorials to the victims of the attack.

- **Constructed 1943**
- **Major Renovation with Sustainability, 1998**
- **National Historic Landmark**
- **Original Use: Offices**
- **Current Use: Offices for all branches of the DoD**
- **Size: 6.5 million square feet**

### *Sustainability Measures Applied*

- Public Transportation
- Energy Efficiency Measures
- Lighting
- Water Efficiency
- Envelope Insulation
- Recycled Materials
- Construction Waste Management
- Operations
- Indoor Environmental Quality

The Pentagon is currently attempting to achieve LEED certification with its Wedge renovations. None of the Wedge renovations had achieved a certification level as of January 2010.

## 6.1.3 The Presidio/Thoreau Center San Francisco, California

**Figure 6: The Presidio**

Source: www.NPS.gov, photo by Will Elder

The Presidio is a unique historic resource consisting of nearly 500 historic buildings and several hundred acres of designed, vernacular, and natural landscapes. It existed first as a military outpost of the Spanish Empire from 1776 to 1821, during which time it served as the northernmost imperial outpost guarding San Francisco Bay and California against incursions by British and Russian interests. From 1821, when the Mexican revolution resulted in that nation's break from Spain, until 1846, the Presidio served as a military outpost of Mexico. With the coming of the Mexican-American War in 1846, the Presidio was occupied by the United States Army and remained a U.S. Army post until 1994, when the installation was decommissioned. It is now governed by a federal trust under the auspices of the National Park Service as part of the Golden Gate National Recreation Area. Many of its buildings and its landscapes have been restored employing both sustainability and historic preservation principles.

The Presidio is a veritable treasure trove of different architectural style periods, including buildings constructed in Queen Anne, Italianate, Greek, Colonial, Mission, Mediterranean and Italian Renaissance Revival styles, in addition to various military vernacular and utilitarian styles. Its designed and natural landscapes are some of the most important green spaces in the entire Bay area, and include rare native species that no longer exist elsewhere in the area.

- **Constructed 1885 - 1930**
- **LEED-based, Presidio-specific standards, 1998 to present**
- **National Historic Landmark**
- **Original Use: U.S. Army Post (decommissioned 1994)**
- **Current Use: Multiple Uses**
- **Size: 1,480 acres**

### *Sustainability Measures Applied*

- Public Transportation
- Energy Efficiency Measures
- Lighting
- Water Efficiency
- Envelope Insulation
- Recycled Materials
- Construction Waste Management
- Operations
- Indoor Environmental Quality

Many of the earliest building renovations at the Presidio took place before there was a LEED certification program in place. The Letterman complex, which includes the Thoreau Center for Sustainability, was the earliest major renovation, and its seven buildings were completed to "green" guidelines of the Presidio Trust's own devising.

When LEED became available in 1998, the Presidio adapted its own "Green Building Guidelines" as a Presidio-specific modification of LEED.

### 6.1.4 Charleston Navy Yard, Building 7, Charleston, South Carolina

**Figure 7: Charleston Navy Yard, Building 7**

Source: Cherry/See/Reames Architects, LLP

- **Constructed 1908**
- **LEED 1.0 Pilot Program, 2006**
- **Contributing Resource to the Charleston Navy Yard Historic District, Charleston County, South Carolina**
- **Original Use: Warehouse; Administration Building**
- **Current Use: Offices**
- **Size: 35,000 square feet**

#### *Sustainability Measures Applied*

- Public Transportation
- Energy Efficiency Measures
- Lighting
- Water Efficiency
- Envelope Insulation
- Recycled Materials
- Construction Waste Management
- Operations
- Indoor Environmental Quality

The Charleston Navy Yard served the United States Navy as a concentration of administrative, industrial, and storage buildings supporting a shipbuilding and supply mission between 1903 and 1996, when the yard was leased to a private shipbuilding concern. During its active years as a Navy shipbuilding yard, it produced nearly 40 destroyers, including many that played an important role in the United States victory in World War II. During the late nineteenth and early twentieth centuries, the United States Navy grew from a fleet of largely wooden ships with mainly regional influence, to one of the most powerful navies in the world by the beginning of the World War I. By that time, its fleets consisted of modern steel battleships that steamed to trouble-spots all over the globe. The Charleston Navy Yard exemplified the massive growth of shore-based operations that burgeoned in the early twentieth century to support the growing Navy.

The historic district at the Navy Yard consists of 57 buildings that contribute to the historic and architectural character of the district, as well as 29 that are non-contributing properties. Building styles at the historic section of the Yard include Neoclassical, industrial Moderne, and utilitarian military styles, dating to the period between 1903 and the end of World War II.

The Noisette Company, a sustainable development company, has been converting the Navy Yard and surrounding communities of North Charleston into a green development model since the late 1990s. The company has been refitting the former Charleston Navy Yard for residential and office occupancy using LEED 1.0 pilot principles. Two of the principal projects within this redevelopment are the building at 7 and 10 Storehouse Row. This study focuses on building 7.

Building Number 7 (7 Storehouse Row) in the Historic District of the Navy Yard is a three-story, flat-roofed vertical warehouse building constructed of brick in the Neo-Classical style. Constructed in 1908, it is one of 28 buildings erected during the initial building campaign at the shipyard. As one of the core group of buildings at the Yard, it exemplifies the growth of the Charleston Navy Yard and the growth and changes that took place within the United States Navy during the first half of the twentieth century. It became an Administration Building after the Navy began using large single-story warehouse buildings for storage purposes.

The building was renovated using several sustainability principles, including access and proximity to public transportation, water and energy efficiency, lighting, envelope insulation, use of recycled materials, construction waste management, and indoor environmental quality. In August of 2004, the Noisette Company completed renovations to the 2nd floor of 7 Storehouse Row.The renovation was registered with the LEED-CI (commercial interiors) Pilot Program, and in 2006, the Noisette Company received LEED-CI Certification for the improvements, making it the first of its kind in South Carolina. In addition to housing the Noisette Company's offices, the 2nd floor is home to RL Bryan Company, an office of the City of North Charleston, and the Noisette Urban Alliance.

### 6.1.5 46 Blackstone South, Harvard University, Cambridge, Massachusetts

**Figure 8: 46 Blackstone South, Harvard University**

Source: Photo by Alyson Reece

The 46 Blackstone South project included three buildings consisting of a nineteenth century diary manufacturing building, and two buildings that were part of an early twentieth century electrical plant complex, built in various stages between 1889 and 1929. Today, the buildings and the site serve as the Central Steam Plant for some 200 buildings at Harvard University, and the building is also the headquarters for University Operations Services (UOS). The four-story brick Standard Diary Building, constructed in 1889, was financed by revenues gained on the popularity of journals and diaries, particularly during wartime; the biggest years for the Standard Diary company occurred during the Civil War and World War I. The Standard Diary Building's location on the Charles River in Cambridge was directly related to the proximity of other publishing concerns, notably the Little, Brown bindery and the Riverside Press. The building served as a headquarters, manufacturing plant, and warehouse for the company.

The other buildings on the 46 Blackstone South site, Building 7 (offices) and Building 10a (a warehouse), were developed by the Cambridge Electric Light Company to provide power for the growing city of Cambridge, Massachusetts. The location of the coal-burning plant on the banks of the Charles River allowed for easy delivery of coal via barge. The power plant was built in stages beginning in 1901, and it first functioned as an electrical generating plant, a steam plant, and then as part of the Cambridge Power Plant. The Blackstone Plant was purchased by Harvard University in 2000. Today, steam produced at the Blackstone plant is distributed over ten miles of pipeline under the campus. The renovation of the buildings comprising 46

- **Constructed 1889, 1926, 1929**
- **LEED-New Construction, Platinum, 2007**
- **National Register Eligible**
- **Original Use: Manufacturing, warehouse, office**
- **Current Use: Offices**
- **Size: 40,000 square feet**

#### *Sustainability Measures Applied*

- Employ integrated Design Principles
- Sustainable Sites
- Hazardous Materials
- Site Water Efficiency
- Heat Island Effects
- Transportation
- Green Power
- Maintenance
- Optimize Energy Performance
- Heating, Ventilation and Air Conditioning
- Electric Lighting
- Building Envelope
- Protect and Conserve Water
- Enhance Indoor Environmental Quality
- Ventilation and Thermal Comfort
- Reduce Environmental Impact of Materials
- Construction Waste Management
- Recycled and Biobased Content

Blackstone South achieved LEED Platinum certification for New Construction and Major Renovations in 2007. It incorporates many sustainability principles including site water efficiency, heat island effect reduction, energy performance optimization, energy efficient HVAC, an energy efficient building envelope, water conservation measures, ventilation and thermal comfort measures, construction waste management, and recycled and biobased content.

**Figure 9: Standard Diary building facade**

Source: Photo by Alyson Reece

## 6.1.6 The Gerding Theater at the Armory (Annex), Portland, Oregon

**Figure 10: The Gerding Theater at the Armory (Annex) facade**

Source: Courtesy Creative Commons Attribution-Share Alike 3.0 Unported

The Portland National Guard Armory Annex was constructed in 1891, enlarging the original 1887 Armory building of the Oregon National Guard. A 2002-2006 renovation converted the building into a space for the Gerding Theater, and as of 2000 it is listed on the National Register of Historic Places. The Armory and its Annex were built in response to outbreaks of violence and rioting along the West Coast of the United States that resulted from strong anti-Chinese sentiment. The presence of a suitable facility for National Guard troops was deemed by local authorities to be necessary to quell possible rioting in Multnomah County. The original armory building was torn down in 1968, but the Annex remained, and the Guard sold the building to a brewery in 1996. After the brewery's failure in the latter part of the 1990s, it was sold to the Gerding/Eden Development Company, which renovated and converted the building into a 600-seat theatre space.

Constructed in the Romanesque Revival style, the Annex's architecture has the heavy masonry cladding and the Romanesque window and doorway arches that characterize the style. It features a wood-truss roof system that provides a 100-foot north-south clear span that not only allows military drills but also concerts and even baseball games. It also features a mezzanine gallery with seating for 5,000 spectators, making it one of the few buildings in early twentieth century Portland that could accommodate large crowds. The truss system allows the roof to be supported with no pillars to obstruct views or to impede movement in the central space of the building.

- **Constructed 1891**
- **LEED-Existing Building, Platinum, 2007**
- **National Register Property**
- **Original Use: National Guard Armory Annex**
- **Current Use: Theater/Café/Meeting Place**
- **Size: 55,000 square feet**

### *Sustainability Measures Applied*

- Brownfield Redevelopment
- Alternative Transportation
- Stormwater Management\
- Landscape & Exterior Design to Reduce Heat Islands (both Non-Roof and Roof)
- Water Efficient Landscaping
- Interior Water Efficiency
- Water Use Reduction
- Optimize Energy Performance 40%
- Additional Commissioning
- Ozone Depletion
- Measurement & Verification
- Green Power (purchased)
- Building Reuse Maintain (75%)
- Construction Waste Management (Divert 75%)
- Recycled Content (10%)
- Carbon Dioxide ($CO_2$) Monitoring
- Increase Ventilation Effectiveness
- Construction IAQ Management Plan
- Low-Emitting Materials
- Controllability of Systems
- Thermal Comfort
- Daylight & Views 75%
- Green Housekeeping

Character-defining features of the building include parallel-chord wooden barrel trusses, turrets and arched doorways, a foundation constructed of Columbia River basalt, and the original windows, which retain their sandstone sills.

The Armory Annex is a notable sustainable design showcase, having received a Platinum LEED Certification (Existing Building) in 2007.

## 6.1.7 Cambridge City Hall Annex, Cambridge, Massachusetts

**Figure 11: Cambridge City Hall Annex facade**

Source: Photo by Alyson Reece

- **Constructed 1871**
- **LEED-New Construction, Gold, 2004**
- **Contributing Property: Mid Cambridge Neighborhood Conservation District**
- **Original Use: Public School**
- **Current Use: Municipal Offices**
- **Size: 33,216 square feet**

### *Sustainability Measures Applied*

- Sustainable Sites
- Hazardous Materials
- Site Water Efficiency
- Heat Island Effect (Roof)
- Transportation
- Operations
- Green Power
- Optimize Energy Performance
- Heating, Ventilation and Air Conditioning - Ground Source Heat Pump, demand control ventilation strategies
- Electric Lighting
- Building Envelope
- Heat Island Effect – Roof
- Protect and Conserve Water
- Interior Water Efficiency
- Enhance Indoor Environmental Quality
- Daylighting
- Ventilation and Thermal Comfort
- Reduce Environmental Impact of Materials
- Construction Waste Management
- Recycled and Biobased Content
- Eliminate Use of Ozone Depleting Compounds
- Moisture Control
- Low-emitting materials

The Annex building, part of the Cambridge City Hall, was originally constructed in 1871 as the Harvard Grammar School. At the time of original construction, it had a Mansard roof, which was destroyed during a fire in 1899, after which the building underwent the first of many renovations. During the first renovation, a new third floor was added, topped by a brick parapet, which was subsequently removed during a 1939 conversion of the building to municipal use. A 1932 refitting of the building converted it into an annex to the high school. The discovery in 1999 of mold in the building led to its immediate closure, and remediation and renovation between 2000 and 2004 resulted in the restoration of the 1899 parapet and the addition of a usable, accessible two-story lobby entry in what had been the basement of the building.

The building, which bears traces of both the Richardsonian Romanesque and the Italianate Revival styles, is a red brick building with keystone window arches and symmetrical massing. The historic exterior of the building was preserved during the renovation, while the main entry was relocated from Iman Street to the more public Broadway Street. It now houses the Animal Commission, the Cambridge Arts Council, the Community Development Department, the Conservation Commission, and the Traffic, Parking & Transportation Department.

The building was certified LEED Gold under New Construction in 2004. It incorporates many "green" features and is regarded as an exemplary blend of historic preservation and sustainability. It includes water efficiency measures, alternative commuting options, recycled building materials, sustainable forestry products, carbon sensors and low-emitting volatile organic compounds, solar power, and daylight and occupancy sensors to reduce electricity demand through lighting. The building also maximizes daylighting wherever possible.

## 6.1.8 New Mexico Villagra Building, Santa Fe, New Mexico

**Figure 12: Villagra Building Portal**

Source: Photo by Cynthia Figueroa-McInteer

**Figure 13: Territorial Windows and addition at left**

Source: Photo by Cynthia Figueroa-McInteer

The New Mexico Villagra Building was designed by prominent Santa Fe architect John Gaw Meem, the leading proponent in the early twentieth century of the Spanish-Pueblo Revival and Territorial Revival styles in the American Southwest. Built in 1934 to house the state's public welfare department, it was the first in the state to use New Deal money and was designed with the stucco exterior, brick coping, Classically-inspired pedimented window and door surrounds, and milled wood columns that characterize the Territorial Revival style.

The building faced demolition in the early 2000s, and in 2002 was named one of New Mexico's most endangered properties by the New Mexico Historic Preservation Division (NMHPD). The NMHPD negotiated with the state's General Services Department and Property Control Division to save the building, and then worked with general contractors to preserve important character-defining features and to add sustainable features in keeping with historic preservation goals. For example, in preserving the original windows and their pedimented wood surrounds, the NMHPD and contractors agreed to add a low-emissivity film to the glass panes in order to increase the R-value of the windows and save energy.

The New Mexico Villagra Building, which is now occupied by the Office of the New Mexico Attorney General, achieved LEED Commercial Interiors Gold status in 2006. It employs many sustainability principles directly related to LEED, including designated preferred parking for low-emitting and fuel efficient vehicles, bicycle racks and showers to encourage alternative transportation, and access to public transportation. It also uses state-of-the-art lighting sensors that dim and brighten electric lights based on the amount of sunlight coming through windows, which provide light and views to 90 percent of the office space. It uses a high performance ventilation system to keep indoor air healthy. According to the NMHPD, the building has an overall energy savings of 31 percent, and renovators recycled 82 percent of construction waste. In addition, the state saves 71% of the typical cost of watering landscaping.

- **Constructed 1934**
- **LEED-Commercial Interiors, Gold, 2006**
- **State Register of Cultural Properties**
- **Original Use: Office Building**
- **Current Use: Office Building**
- **Size: 18,180 square feet (not including new addition)**

### *Sustainability Measures Applied*

- Site Water Efficiency
- Transportation
- Green Power
- Maintenance
- Tenancy Management
- Integrated Pest Management
- Heating, Ventilation and Air Conditioning
- Electric Lighting
- Building Envelope
- Interior Water Efficiency
- Daylighting
- Ventilation and Thermal Comfort
- Construction Waste Management
- Recycling Waste

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# 7. Employ Integrated Design Principles

Under the guiding principles of the Federal Leadership in High Performance and Sustainable Building memorandum of understanding, Integrated Design is a collaborative, integrated planning and design process that:

- Initiates and maintains an integrated project team in all stages of a project's planning and delivery;
- Establishes performance goals for siting, energy, water, materials and indoor environmental quality along with other comprehensive design goals; and, ensures incorporation of these goals throughout the design and lifecycle of the building; and,
- Considers all stages of the building's lifecycle, including demolition.

This chapter focuses on Integrated Design Principles, one of the five guiding principles for sustainable buildings. This chapter addresses 11 design aspects and how they can be incorporated into historic building renovations, using the case studies to exemplify successful integration of historic preservation into sustainable development.

While most of the integrated design principles discussed in this chapter will not generally have an effect on the historic qualities of a building, there are some recommended measures that may have an adverse effect, but which can be minimized or mitigated through careful project planning. As the examples below demonstrate, it is important that the cleanup or replacement of hazardous materials, solutions for site water efficiency, the effects of heat islands, or the installation of alternative energy sources do not create visual adverse effects on the façade of an historic building. In addition, some historic properties may be significant for their cultural landscapes, which require special consideration so as not to adversely affect their character-defining features. It is important to work closely with the installation CRM to ensure the project's design and incorporation of integrated design principles will not result in adverse effects or at the very least that design alternatives will be instituted to minimize or mitigate any such effects.

## 7.1 Sustainable Sites

According to the United States Green Building Council (USGBC), the organization that developed the LEED certification system, "a sustainable site links natural and built systems to achieve balanced environmental, social and economic outcomes and improves quality of life and the long-term health of communities and the environment. Sustainable landscapes balance the needs of people and the environment and benefit both…." (USGBC website).

The LEED certification system has a Sustainable Sites category to develop benchmarks for site sustainability and encourage innovation in working with such building sites. The category describes how landscapes can improve environmental and community health, and minimize the project's impact on surrounding ecosystems and waterways.

Among the sustainable sites factors to consider is the effect of outdoor lighting at building sites. While outdoor lighting can contribute to the safety of a building and its surrounding grounds, it is important to mitigate the impacts that this lighting can have on the night sky. When too much light is directed toward the night sky, not only is the energy expended on producing this lighting wasted, it can contribute to the degradation of the nocturnal environment and ecosystem, produce unnecessary glare in the night sky in the building's vicinity, and interfere with astronomical research.

In addition to the above, when working with historic properties, it is important to understand whether there are cultural landscapes that are a part of the historic property or that are associated with the property, and how sustainability initiatives might impact those landscapes (see Chapter 3).

Cultural landscapes can be affected by sustainability issues. The quality of sustainability measures for landscapes and for associated buildings – erosion and sediment control, alternative transportation measures, reducing site disturbances, protecting open spaces, stormwater management, light pollution control and heat island reduction – can all enhance the quality of existing cultural and natural landscapes.

Developing sustainable sites can dovetail effectively with historic preservation principles as they apply to cultural and natural landscapes. Maintaining healthy grounds and landscaping in an historic district and its associated cultural landscape can enhance the appearance and the longevity of the cultural landscape and the district. For example, if a cultural landscape contains native plants and trees, these plantings can contribute to the site water efficiency because they are suited to the climate and average rainfall for the area, and therefore require little supplemental watering. If these plantings are also deemed character-defining features of the landscape, a synthesis of preservation and sustainability principles is already built into the cultural landscape.

In developing a sustainable site it is important to take into account the overall effect of a building and the associated surrounding property on local ecology. Hazardous materials should be removed from the building and from the site soil, and environmentally safe materials used in renovation. Plants can support sustainable sites through cleaning contaminated soils and reducing stormwater runoff issues through filtration or phytoremediation. Phytoremediation encompasses innovative technologies that use plants and natural processes to remediate or stabilize hazardous wastes in soil, sediments, surface water, or groundwater. It can be used to clean runoff before it enters waterways and can also be used to clean soils at former manufacturing facility sites that have left behind a legacy of contaminants, otherwise known as *brownfield sites*. Brownfield sites, which are sites on which hazardous substances, pollutants or contaminants have complicated the expansion, redevelopment of reuse of the site, are fairly common at DoD installations, especially where there has been a long history of site occupation and industrial use (e.g., the Washington Navy Yard, where armaments and munitions were manufactured for well over a century).

Sustainable site considerations include:

- Cultural Landscapes/Managing Landscaping
- Hazardous Waste
- Site Water Efficiency
    - Stormwater Runoff
    - Irrigation
- Heat Island Effects
- Transportation
- Light Pollution

## 7.1.1 The Presidio

### *Sustainability Measures*

The Presidio in San Francisco offers a large, varied cultural landscape. It also fits within the definition of two subcategories of cultural landscape as defined by the National Park Service: it is both a historic site and a historic designed landscape. The former DoD installation is both a National Historic Landmark and a historic site property for its association with important historic events, including its more than 200 year history as a garrison under three different national flags (Spain, Mexico, and the United States). Not only does it contain some 500 historic buildings, it also encompasses 1,491 acres, 991 acres of which are open space, including both designed landscapes and natural areas.

As a historic designed landscape, having been crafted over the years from the preexisting natural landscape of sand dunes and wetlands areas into the current mosaic of parks, gardens, and forests, the Presidio is admired as one of the Army's most impressive works of landscape design. In addition, the Presidio encompasses many natural landscapes. Over 200 bird species, as well as mammals, reptiles, and aquatic species live in the Presidio, and several ecosystem restorations have taken place at the Presidio within the last 15 years, including the restoration of Crissy Field from a derelict concrete airfield to a tidal salt marsh, and the rehabilitation of the Tennessee Hollow Watershed (which is entirely contained within the Presidio).

The Presidio has undertaken a massive combined historic preservation and sustainability initiative, and a large portion of the Presidio initiative involves the rehabilitation of historic landscapes. These include an urban park and lake on the grounds (Mountain Lake Park), a wetlands restoration at Crissy Field (a former airfield that has been converted into a recreational area, just north of the Thoreau Center), and a watershed restoration at Tennessee Hollow.

The preservation of the historic landscapes at the Presidio is significant because it represents a large scale effort to retain character-defining features of the Presidio complex as a whole. These features consist not only of the historic buildings belonging to the old Post, but also the 200 year history of human interaction with the local ecosystem, including extensive landscaping efforts by the U.S. Army that altered the wilderness areas of the northwestern corner of the San Francisco peninsula. The decline of Presidio ecosystems in recent decades led to community concerns about the overall ecological health of the installation, which in turn led to efforts to clean up several important features of the historic landscape.

**Mountain Lake rehabilitation:**
Mountain Lake, a natural, unlined lake, stands at the center of Mountain Lake Park, which was designed by William Hammond Hall, the engineer who designed Golden Gate Park. Hall was deeply influenced by landscape architect Frederick Law Olmsted. The Mountain Lake rehabilitation involved dredging of the lake bottom and aeration; tree removal and revegetation with native species; buffer planting along the Park Presidio Boulevard; installation of overlooks at a shore trail; removal of a culvert; construction of a bridge; and replanting along the lake's east rim.

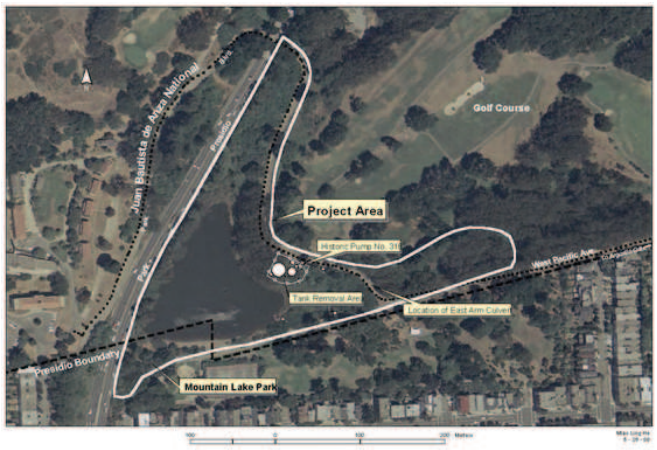


**Figure 19: Mountain Lake Park**

Source: Mountain Lake Enhancement Plan and Environmental Assessment

**Tennessee Hollow Watershed restoration:**
Tennessee Hollow is a complete watershed comprising a fifth of the area of the Presidio. It originates at El Polín Springs, the only named spring within the Presidio. At one time the springs, which feed the watershed that empties into San Francisco Bay, provided all of the fresh water for the early inhabitants of the Presidio, including the Spanish settlers who established the original garrison in 1776, as well as the indigenous peoples who predated the Spanish occupation of the area.

**Figure 20: Birds at Restored Mountain lake Park**

Source: www.NPS.gov, photo by Will Elder

Non-native trees and shrubs that cause blockage through leaf-fall and other organic debris in the springs are being removed and replaced with some 15,000 native trees and plantings. A stone well and stone channels built in the 1930s by the Works Progress Administration for the springs are also being restored. Part of the watershed restoration will also include the daylighting of parts of the creek downstream from the springs. In all, some 28 acres of the watershed near its upper reaches will be restored.

**Crissy Field restoration**:
The NPS and the Golden Gate National Park Association recently completed a wetlands restoration project along

Crissy Field, a former air field occupying part of the northern portion of the Presidio. Almost 90,000 tons of hazardous waste was removed from the 100 acre site, an 18 acre tidal salt marsh was recreated, and 16 acres of dune habitat were reconstructed. These sites constituted the partial restoration of a 130-acre salt marsh that had existed in the location for thousands of years before the arrival of Europeans. The salt marsh had been filled in and covered with concrete to form the airfield. The rehabilitation of the Crissy Field habitat has restored an important link in San Francisco Bay's overall ecosystem, where less than 10% of the original coastline remains.

**Figure 21: Crissy Field Marsh**

Source: www.NPS.gov, photo by Will Elder

## *Historic Preservation Impacts*

The project generally had positive impacts on the Presidio's cultural landscape. The Mountain Lake Park Restoration revived the lake, which had accumulated silt over the years, and restored the biological viability of the lake. Non-native trees and plants were removed and were replaced with native trees and plants, which will require less watering as they are adapted to the local climate. The improvement of accessibility to the park – through the emplacement of overlooks and the addition of a path – will allow visitors

to appreciate the designed landscape as envisioned by the landscape architect William Hammond Hall, while also making the park more ecologically sound.

The wetlands restoration at Tennessee Hollow biologically rehabilitates a fifth of the acreage of the Presidio, while restoring historic Works Progress Administration stone channels and rendering the watershed more ecologically viable. Replacement of invasive nonnative tree and plant species with native trees and plants makes the landscape more closely resemble the historic landscape that provided most of the water to the early Spanish settlers of the Presidio area.

The Crissy Field wetlands restoration removed the deteriorated concrete airfield and replaced it with a landscape more closely resembling its historic and prehistoric character as a large coastal wetlands area. While the concrete airfield constituted an historic resource, the restoration of a coastal wetland in the densely settled San Francisco Bay area took precedence over the negative impact to the historic airfield.

### 7.1.2 Gerding Theater at the Armory (Annex)

Stormwater runoff is harvested from the roof and used to water landscaping and flush toilets, reducing the amount of water that enters the stormwater sewer system by 26%. The captured stormwater is filtered and stored in tanks for reuse. The stormwater management process followed the Environmental Protection Agency (EPA) standard for stormwater treatment, which is more stringent than local standards. The treatment process resulted in approximately 80% reduction in total suspended solids and a 40% reduction in total phosphorus.

#### *Historic Preservation Impacts*

While the new stormwater drain pipes are labeled "GREEN" for educational purposes and thus impose a slight visual intrusion on the building's interior, this is not considered a significant negative impact since the original wall material remains visible.

## 7.2 Managing Landscaping

Managing the landscape comprises maintenance of the outdoor environment, including such items as vegetation, stormwater management, irrigation, erosion control, upkeep of hardscapes, and reducing potential hazardous waste. The case studies presented here have dealt with some aspect of landscaping and grounds keeping in areas around and under building sites and in natural and cultural landscapes.

### 7.2.1 The Pentagon

#### *Sustainability Measures*

In 2008 a Pentagon renovation (PENREN) update noted that care was being taken in selecting new trees and foliage that would be native to the region in order to reduce reliance upon irrigation. Native trees and foliage typically do not require additional irrigation since they are adapted to the region in which they grow. In addition, lawn irrigation water was drawn from non-potable water in the Potomac River lagoon. The watering system used an automated drip irrigation and evapotranspiration-based controls, which included rain sensors and weather-logic software to provide water management (SECDEF Environmental Award nomination, 2008). The system irrigates the Remote Delivery Facility, the heliport, the parade grounds, and other areas. The project was estimated to replace an estimated 16,828,560 gallons of potable water that was formerly used for irrigation purposes.

**Figure 22: Landscaping at the Pentagon on automated irrigation system**

Source: Washington Headquarters Services, PowerPoint presentation, 2008

#### *Historic Preservation Impacts*

The replacement of non-native plantings with native trees and plants will bring about a return to the historic natural foliage patterns in the landscape. As some exotic species can become invasive, replacing them can help restore the local ecosystem, particularly since native foliage may be better adapted to available rainfall in the area, thus reducing the need for excessive irrigation. The new irrigation system that was installed using non-potable Potomac Lagoon water is thus able to provide minimal watering to native foliage that

requires very little irrigation to remain green, while avoiding excessive irrigation and potential run-off. Neither the new irrigation system nor the replacement native foliage had a negative impact upon the Pentagon's historic character.

## 7.2.2 The Presidio

### *Sustainability Measures*

Five oil/water separators clean stormwater before the water is discharged into San Francisco Bay. The water is treated by allowing the solids to settle out and capturing any floating materials before the water moves off-site.

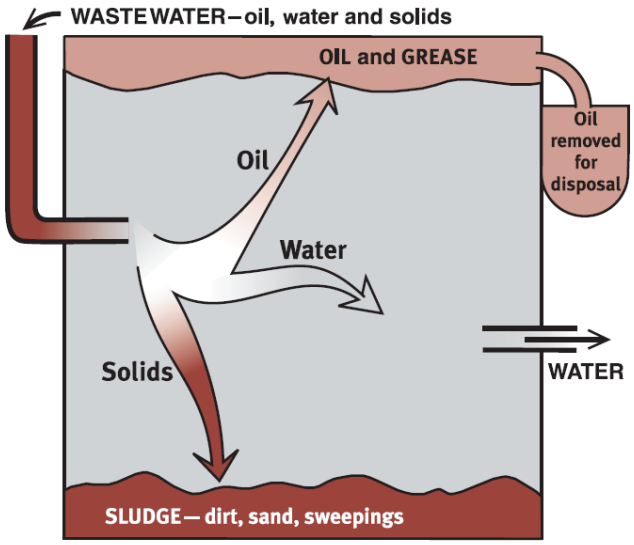


**Figure 23: Typical oil and water separator**

Source: Department of Toxic Substance Control

In addition, part of the challenge at the Presidio has been remediating of old DoD landfills that were scattered across the Presidio landscape. Whereas the approach has often been to place a protective "cap" on a landfill, at some places within the Presidio the approach has been to excavate the landfill down to the native soil layer and restore the site to its natural condition. A pilot landfill excavation project at the Presidio resulted in the restoration of serpentine grassland, sand dunes, and riparian systems. Plant survival at these sites has been good.

Several other landfill projects have taken place, resulting in the removal of toxic waste and contaminated soils to a Kings County, California, landfill equipped to deal with hazardous materials. These landfills contained construction debris, trash, and various chemicals deposited by the U.S. Army over decades of use of the site. In the process of this clean-up effort, which removed a total of four landfills, some 164,500 tons of soil in about 8,000 truck loads were removed from the Presidio. Eight more landfills are to be cleaned, and are slated to be completed by 2010. Landscape restoration has been a major goal of these landfill remediation projects, including the restoration of the coastal bluffs area surrounding the Presidio, where the Army dumped many tons of waste over the years.

Plans are being prepared to remove waste from four toxic fill sites on the Presidio grounds near the Public Health Service Hospital. Ground and tree cover will be removed and recontouring will take place, creating new sand dunes with native plants. Areas around the hospital will be revegetated in keeping with the Presidio Trust's Vegetation Management Plan. Stormwater management and treatment will be instituted to protect Lobos Creek from pollution and runoff. During the summer of 2009, as a result of federal stimulus funding, work was also begun on rebuilding a thoroughfare, Doyle Drive, through the Presidio, which will include the careful selection of native plants while requiring the removal of 700 trees. According to the Sierra Club's San Francisco Bay area newsletter, location and species types for the project will be combined with other considerations including "cultural and historic considerations," under the direction of the Presidio Trust's Vegetation Management Plan. In addition, stormwater runoff from the rebuilt roadway will be treated on site and discharged into San Francisco Bay to mitigate concerns about the potential pollution of Crissy Marsh and its connectors to the Tennessee Hollow watershed.

### *Historic Preservation Impacts*

The removal of 700 trees from the intersection of Highway 1 with Doyle Drive, while a significant impact upon the cultural landscape of the Presidio, is being carefully monitored and mitigated by measures to find native plant species for the area and place them in appropriate locations.

**Figure 24: Aerial view of Doyle Drive**

Source: www.Presidioparkway.org

The additional mitigation of stormwater runoff via on site treatment and discharge directly into the Bay will also help conserve and improve the newly restored Crissy Marsh at the site of the former Crissy air field, as well as the riparian system represented by Tennessee Hollow. The restoration of both Crissy Field and the Tennessee Hollow watershed represent a return to earlier historic and prehistoric conditions at both areas. The landfill projects do not have an negative impact on the historic character of the Presidio.

## 7.3 Hazardous Materials

Hazardous materials can be prevalent in historic building rehabilitation projects. If the property was formerly a manufacturing facility, in many cases the ground beneath the site will have been contaminated and would be considered a brownfield site.

Other building types in the DoD inventory that might be brownfields include agricultural facilities, hangars, mechanic shops, or storage facilities because of contaminants and petroleum products used and stored on those sites. The EPA regulates the redevelopment, expansion, and reuse of such sites. Projects on a brownfield should consult with the EPA, local and state agencies for applicable regulations and technical assistance on remediation. The EPA established The Brownfield and Land Revitalization Technology Support Center (www.brownfieldstsc.org) as a resource to assist all parties involved in brownfield development.

More typically, architects, contractors and engineers will be working with asbestos, lead paint, polychlorinated biphenyls (PCBs), and areas contaminated with oils and solvents. Management of these hazardous materials has implications for site landscapes, indoor air quality, and building occupant health and productivity. It also has implications for the larger environment surrounding the building and site, in some cases extending for miles around the site, particularly in cases where groundwater or riparian systems have been contaminated with hazardous materials from the building and the site. Day-to-day handling of hazardous materials by building tenants must also be carefully managed in order to prevent the contamination of the site soil or the building. Careful ongoing management of hazardous materials is essential.

### 7.3.1 Washington Navy Yard, Building 33

#### *Sustainability Measures*

This site presented brownfield issues for the project team. Building 33 is on a site that had long been in use as a factory and the soil under and surrounding the building required remediation for petroleum contamination. The Washington Navy Yard as a whole is an area that for 150 years was used in the manufacture and storage of arms and munitions. As a result, the soils and groundwater were contaminated with oils, solvents, heavy metals, PCBs, and other hazardous waste. Effluents from the hazardous waste had been detected in the Anacostia River. The entire yard was declared an EPA Superfund site in the late 1990s. The soil under Building 33 was cleaned as part of the building's renovation and conversion from a munitions factory building to an office building.

### *Historic Preservation Impacts*

Since this building was converted from a 40-foot open-bay munitions factory to a four-story office building, access to the soil beneath the building was likely facilitated partly by the renovation process. It is assumed that the interior was not considered a character-defining feature. The exterior historic shell retains its overall historic character. Overall, the brownfield mitigation did not have a negative impact.

## 7.3.2 The Pentagon

### *Sustainability Measures*

Cleaning of the soil at the site began in 1998 and is ongoing in other areas of the Navy Yard. In addition, lead paint, mercury, PCBs, and 25 million pounds of asbestos have been removed from the building. An attempt to recycle the steel windows that had been replaced was impeded because the windows were coated with lead paint. It is likely that the cost to remediate the paint exceeded the value of recycling the steel.

### *Historic Preservation Impacts*

The original windows were replaced with units that were more energy efficient and blast resistant. The replacement windows matched the historic character of the originals to minimize the negative impacts.

## 7.3.3 The Presidio

### *Sustainability Measures*

In addition to the landfill clean-up detailed above under "Managing Landscapes", which has and will continue to result in removal of toxic soils from the Presidio grounds, other measures to reduce hazardous materials at the former DoD installation include covenants regarding handling and disposal of any hazardous materials. Types of flammable liquid and their storage and handling must be approved by the Presidio Trust. Tenants must also submit and keep updated a Hazardous Materials Management Plan, Hazardous Materials Inventory Statement, and Material Safety Data Sheets for hazardous chemicals, liquids, oils, lubricants, and gases. Tenants must also provide their own hazardous materials holding areas and establish Standard Operating Procedures for dealing with hazardous materials.

In addition to tenant hazardous materials management practices, the NPS and the Presidio Trust also worked to restore the Presidio Bluffs, which are coastal bluffs that are considered to be among the wildest places left in San Francisco. A large-scale Remediation Program began in 2003 with the removal of hazardous materials and toxic waste from landfills, which were taken from the Presidio to a landfill equipped to handle toxic waste in Kings County, California.

**Figure 25: North Bluffs area of the Presidio undergoing environmental remediation.**

Source: www.NPS.gov

### *Historic Preservation Impacts*

Since the Presidio encompasses not only hundreds of historic buildings but also significant cultural and natural landscapes, the restoration of the Presidio's landscapes is a positive step toward restoring the ecosystems and designed and natural landscapes of the entire park area, leading to long-term viability and sustainability for building occupants and Presidio visitors. Creating a system of covenants that tenants in Presidio buildings must abide by will also help sustain the long-term use and safety of the existing historic buildings and grounds at the former DoD installation.

## 7.3.4 46 Blackstone South, Harvard University

### *Sustainability Measures*

The 46 Blackstone site is a designated brownfield site because of its long history as an electric and steam generating plant. Contaminants were found in specific areas that were consistent with the use of transformer and electric equipment storage. The clean-up process required the excavation and removal of 307 tons of contaminated soil. UOS, the owner, followed Massachusetts Department of Environmental Protection guidelines for removal and disposal.

**Figure 26: Soil remediation for 46 Blackstone South at different stages**

Source: www.UOS.harvard.edu/blackstone

### *Historic Preservation Impact*

The contaminants were under non-historic pavement around the building. The removal of the pavement did not have a negative impact on the historic character of the building.

## 7.3.5 Gerding Theater at the Armory (Annex)

### *Sustainability Measures*

The Armory project is a brownfield redevelopment project. As part of the redevelopment as a performing arts center, asbestos abatement and remediation measures were performed to meet the requirements of EPA, Oregon Department of Environmental Quality, and Oregon Occupational Safety and Health Administration (OSHA) regulations. The historic wood windows contained asbestos putty materials that needed to be removed as part of the abatement process.

### *Historic Preservation Impact*

The building shell reused the wood windows, so the asbestos abatement did not have a negative impact on the historic structure.

**Figure 27: Exterior view of historic double hung, wood window**

Source: Photo by Tina Reames

### 7.3.6 Cambridge City Hall Annex

#### *Sustainability Measures*

Restoration / renovation efforts began with the discovery of mold inside the building. The original boiler had failed, so small individual units were brought in to supplement the boiler. Pipes for several of these units leaked and the combination of moisture and heat encouraged the growth or mold. Because of the mold, as well as lead paint and asbestos, all interior finishes were removed leaving only the stud framing and brick structure.

#### *Historic Preservation Impact*

The heavy accumulation of mold on the building's interior precluded the restoration of any historic interior features; however, great care was taken to avoid negative impacts to the building's historic exterior.

## 7.4 Site Water Efficiency

Site water efficiency includes not only regulating water use for irrigation, but controlling stormwater runoff, the quality of the water runoff, erosion and sediment control. Site water efficiency strategies can reduce the amount of water used on-site, can control erosion both on and off-site, and can contribute to the greater health of the site soil, nearby streams and riparian systems. Improving quality and controlling the quantity of stormwater runoff can prevent biodegradation of nearby riparian systems, ponds, and lakes. Some methods to accomplish cleaner runoff include seeding, mulching, silt fencing, filter fabric on storm drains, sediment traps, sediment basins and phytoremediation, as well as recharge the local aquifer. Seeding and mulching are effective means of providing erosion control, particularly on inclines.

Silt fencing is a temporary fabric barrier designed to retain sediment on a construction site. Filter fabric on storm drains, sediment traps, and sediment basins are all ways to manage stormwater on a more permanent basis at sites, to prevent sediment from passing directly into water courses. Phytoremediation, the use of plants and trees to filter toxins from the soil, is a particularly effective way to manage chemical agents from stormwater before it passes into the soil and into the water table.

### 7.4.1 Washington Navy Yard, Building 33

#### *Sustainability Measures*

At the Navy Yard as a whole, where a sustainability pilot project for the Navy was undertaken, innovative stormwater structures were installed using the following approaches:

- Permeable paving in parking areas;
- Street tree filters;
- Removal of contaminants and sediments on the street level by street sweeping to prevent their being absorbed into waste water;
- Disconnection of roof leaders to prevent direct runoff from roofs into the storm sewer system, and diversion of this runoff into soil and rain barrels, from which roof runoff is slowly released to planted areas;
- Use of inlet floatable removal devices; and
- Bioretention, whereby contaminants in the water are removed by passing through media or through biological filters (plants) in rain gardens.

These measures all helped with reducing the peak flow of stormwater which contributed to soil erosion in the area of the Navy Yard, and also helped remove pollutants and other effluents from the water being returned to the soil and to the Anacostia River watershed. Phytoremediation was also employed using native plants to help extract and neutralize contaminants in the soil. Biofiltration strips and islands were retrofitted into some parking areas at the Yard using native plants to filter contaminants out of parking lot runoff.

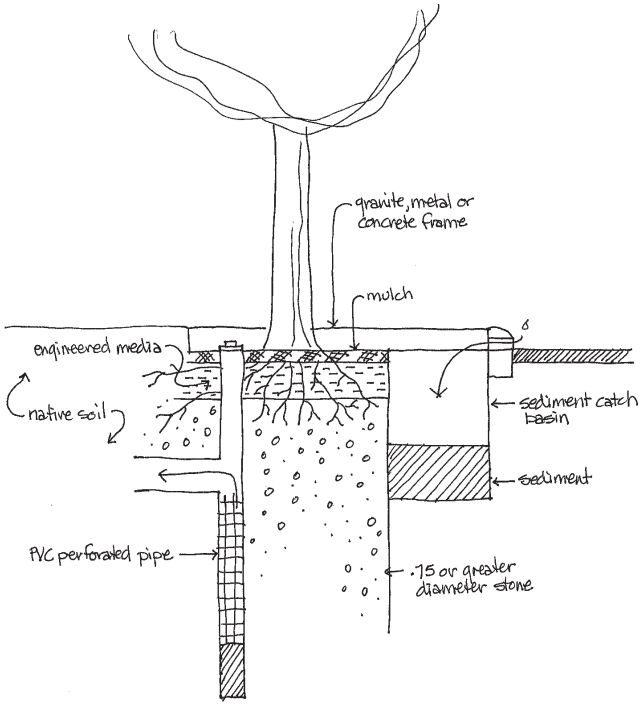


**Figure 28: Typical tree box filter**

Source: Sketch by Karen Van Citters

### *Historic Preservation Impact*

Since there is no designated historic landscape component to this National Historic Landmark, the alterations necessary to create pervious paving areas and to plant bioremediation areas did not have a negative impact on historic character-defining features of the Washington Navy Yard grounds.

Gutter systems (including the roof leaders) were not considered historically character-defining features in the Washington Navy Yard's historic buildings, so these could also be altered with only minimal effect upon the buildings.

The use of such devices as rain barrels necessarily changed the appearance of the exterior areas of buildings, but since they are easily removable and hence constitute a "reversible" effect they constitute only a minimal impact upon historic buildings at the Yard.

**Figure 29: Bioswale at Navy Yard**

Source: Courtesy of Shaw Group presentation prepared for the US Navy

**Figure 30: Rainbarrels at Navy Yard**

Source: Courtesy of Shaw Group presentation prepared for the US Navy

## 7.4.2 The Pentagon

### *Sustainability Measures*

New Pentagon parking lots include pervious paving systems. Pervious paving systems allow rainwater to pass through the pavement and be absorbed naturally by the ground, reducing the need for storm water collection systems, catch basins, storm water piping, and storm water detention ponds. This approach is superior to impervious paving systems in that an important step in the natural re-absorption of stormwater is bypassed when rain lands on impervious paving surfaces. Stormwater is typically carried back to watercourses through storm drains without being reabsorbed back into the soil and naturally filtered there. The disadvantage to this is that storm water that flows across paved surfaces such as sidewalks, streets, and parking surfaces carries along with it air pollution particles as well as petroleum, oil, solvents, salts, and fertilizers and pesticides. Allowing stormwater to be reabsorbed allows filtration to take place naturally. The type of pervious paving system used at the Pentagon is a bituminous pervious paving system.

### *Historic Preservation Impact*

The incorporation of pervious paving and reabsorbtion of stormwater had no negative impact on the historic character of the building.

## 7.4.3 The Presidio

The Presidio Center carried out extensive repairs to their leaking water distribution system resulting in saving 1.2 million gallons of water each week.

**Figure 31: Letterman Digital Arts Center, landscape and buildings enhanced by redesigning surface parking**

Source: www.NPS.gov, photo by Will Elder

Studies are currently under way to develop a water reclamation plant. This will provide up to 85% of the Presidio's irrigation needs and reduce the amount of water drawn from Lobos Creek, the park's primary potable water source. In addition, five oil/water separators are planned which will allow stormwater to be treated before the water is discharged into San Francisco Bay.

The Presidio's Letterman Complex (one of the more heavily built-up portions of the Presidio) at the northeast corner of the park has also incorporated sustainable design initiatives into its parking plans. Large surface parking lots were removed and reconfigured so that commuters and visitors to the area can use small satellite parking areas and short-term street parking instead of larger surface parking areas. Smaller surface parking areas have been designed with visual "buffers" via landscaping; drainage and management of stormwater runoff through appropriate design and use of permeable surface materials has also been incorporated.

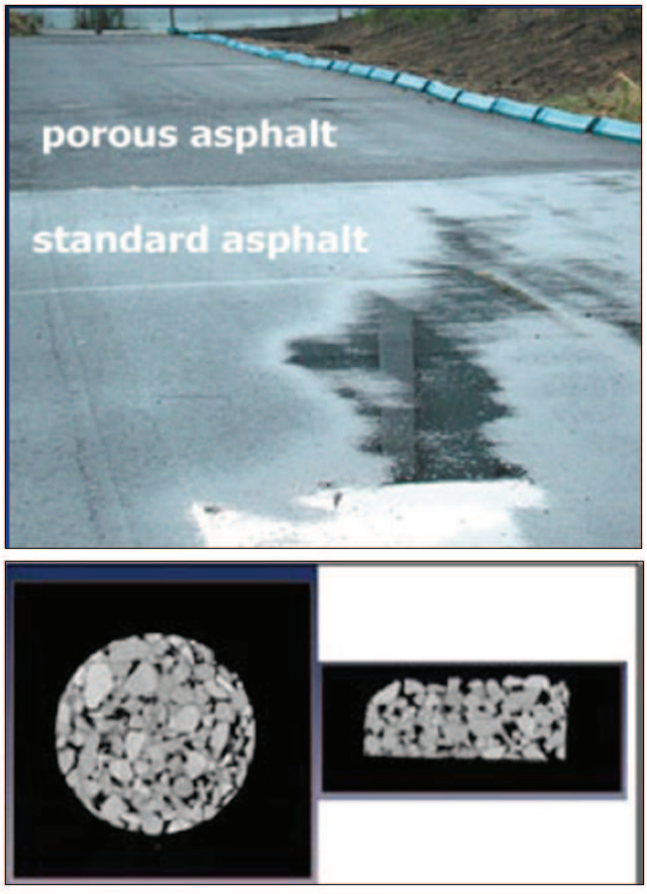


**Figure 32: Typical pervious paving**

Source: Matthew Lebens, PE, Minnesota Department of Transportation

### *Historic Preservation Impact*

Visual impacts to the historic built environment of the Presidio's Letterman Complex area by surface parking has been minimized and replaced with street parking and small parking islands.

Design in this area must take into account not only optimum viewsheds, topography, historic buildings and landscapes, it also must account for new buildings, in terms of both their appearance and their alignment.

## 7.4.4 New Mexico Villagra Building

### *Sustainability Measures*

The original landscape irrigation system had a clock driven controller that watered regardless of the need. This system was replaced with a six-zone high efficiency irrigation system with moisture sensors and satellite weather tracking. Plants were replaced with drought tolerant species. Landscaping water savings of 70% or 55,000 gallons per year are projected.

### *Historic Preservation Impact*

There are no cultural landscapes associated with the property. The replacement of the irrigation had no negative impact on the historic building.

## 7.4.5 Charleston Navy Yard, Building 7

### *Sustainability Measures*

Water savings resulted in the process of transitioning from a traditional landscape in to one that uses native plants of the Southeast. The amount of irrigation water to be saved is not estimated; however, since native plants are genetically disposed to thrive on the available rainfall, the irrigation need will be limited to periodic drought condition.

### *Historic Preservation Impact*

The original site was industrial in nature. The earlier transition to landscaping was a departure from the historical industrial setting. This transition to native plants in the Southeast is not a radical change in appearance from earlier landscaping.

## 7.4.6 46 Blackstone South, Harvard University

### *Sustainability Measures*

The 46 Blackstone project implemented several techniques to reduce potable water use on the site, filter stormwater contaminants, and reduce the impact on existing infrastructure. Native, drought-tolerant species of grasses, groundcover and trees were planted in previously asphalt paved parking lots. These species require no irrigation, thus eliminating all potable water consumption for irrigation purposes. Permeable paving creates walkways through the vegetation and allows precipitation that falls to gradually permeate the ground providing water to the plants and reduce stormwater runoff.

100% of the stormwater is treated and infiltrated on site which reduces pollutants into the Charles River watershed and reduces drainage to the municipal sewer system. A bioswale, or bioretention system, filters stormwater runoff from the adjacent 25,000 square foot parking lot through the site to prevent contamination of the Charles River. This system filters stormwater and allows it to naturally infiltrate into the soil layer. Microorganisms in the soil digest oils and greases in runoff, preventing these contaminants' entry into water bodies. Plants take up phosphorous to prevent eutrophication, the over-enrichment of water bodies that results in excessive algal growth, reduced oxygen levels, and animal death. A sand bed at the bottom of the pond filters solids out of the stormwater so that they are not carried into the soil. The bioretention pond also creates habitat for urban animal species.

### *Historic Preservation Impact*

The site around the buildings at 46 Blackstone had historically been paved parking lots, however, the historical commission did not deem the parking lots to be historically significant. The addition of green open space has created an inviting, park-like atmosphere in an urban setting. Altering the setting did not negatively impact the historic character of the site.

Source for next 3 photos: Alyson Reece

**Figure 33: Native grasses in a former parking lot**

**Figure 34: Native groundcover in a former parking lot**

**Figure 35: Bioswale surrounded by native trees and bushes including pin oak, river birch and honey locust. Waterline aligns gravel edge**

## 7.4.7 Cambridge City Hall Annex

### *Sustainability Measures*

New native and adaptive species landscaping resulted in an urban park and reduced landscaping water use by 50% over conventional lawns. Additionally, employees have a container garden by the side entrance on Iman Street which is watered by a rain barrel. They grow herbs, tomatoes and peppers in this small garden.

### *Historic Preservation Impact*

The new landscaping and sustainability measures did not negatively impact any significant historic features of the building.

**Figure 36: Box Planters**

Source: Photo by Alyson Reece

**Figure 37: Raised Planters**

Source: Photo by Alyson Reece

**Figure 38: Cistern at Cambridge City Hall Annex**

Source: Photo by Alyson Reece

### 7.4.8 The Gerding Theater at the Armory (Annex)

#### *Sustainability Measures*

The Armory site landscape design uses native plantings which do not require a permanent irrigation system. The irrigation system was temporary and was capped after the plants became established. By incorporating a water efficient landscape, the site water efficiency was reduced by 50%. In some cases paving was replaced with landscaping supported by stormwater collected from roof tops.

#### *Historic Preservation Impact*

The landscape is at the perimeter of the building. The plant selections are low growing and compliment rather than compete with the façade of the building. There were no negative impacts to the historic character of the building.

**Figure 39: Silver Park, formerly the location of a sidewalk and parking spaces, incorporates native vegetation, a small water feature with recirculating stormwater treatment**

Source: Photo by Tina Reames

## 7.5 Heat Island Effects

The term "Heat Island Effect" refers to thermal differences between rural (undeveloped) and urban (developed) as a result of greater solar retention in urban environments. Several factors cause the solar retention in urban environments, including use of dark non-reflective roof materials, less vegetation, waste heat from vehicles, buildings and machinery and the large areas of impervious paving (concrete, asphalt, etc.). The heat island effect has also been implicated in increasing ozone output from human—made surfaces. Heat island effects can be mitigated in a number of ways, including: use of vegetative shading to lower a site's surrounding temperatures; use of highly reflective surfaces for non-parking impervious surfaces (such as sidewalks); use of underground parking to eliminate the amount of surface area that is consumed by parking areas; and use of open-grid paving systems, which eliminates the use of impermeable surfaces that reduce the air flow between underlying soils and the atmosphere.

### 7.5.1 The Presidio

#### *Sustainability Measures*

Reduction of heat island effects in the existing landscaping and in new construction areas of the Presidio is part of the Presidio's long-term sustainability plan. In the existing areas of the Letterman Complex, areas of surface parking lots have been reduced dramatically by creating small satellite parking areas with pervious, high-albedo surfaces, and by reverting to street parking for short-term parking needs within the complex. In new construction areas, such as George Lucas's Letterman Digital Arts Center, parking for 1,500 cars was placed entirely underground in order to reduce the potential heat island effect within the Presidio landscape that would have resulted from the presence of large surface parking lots.

#### *Historic Preservation Impact*

Overall, the quality of the visitor experience at the National Historic Landmark was improved by reducing the number of large parking lots in favor of smaller satellite parking areas and on-street parking. Historic integrity of the existing buildings and grounds was not threatened by the changes in parking configuration.

Efforts to reduce heat island effects at the Presidio have included a reduction in the number of surface lots and an increase in the number of on-street parking and underground parking areas. The map of the Main Parade vicinity shows a mix of on-street parking, surface lot parking, and potential underground parking.

**Figure 40: Letterman Digital Arts Complex, note pedestrian and landscaped areas. Parking below allows for reduced heat island effects**

Source: www.NPS.gov, photo by Will Elder

### 7.5.2 46 Blackstone South, Harvard University

#### *Sustainability Measures*

The project included an Energy Star approved, cool roof. The installed roof has a high-albedo that reduces heat island effect and the cooling load. Solar reflectance of the roof is 65%, emittance is .92, and U-values are .024 to .032.

#### *Historic Preservation Impact*

The roof color was changed to meet cool roof standards. Since the roof was not visible from the street level and was surrounded by parapets, the roof was not a historically significant feature and there was no negative impact to the building.

### 7.5.3 The Gerding Theater at the Armory (Annex)

#### *Sustainability Measures*

In order to reduce the heat island effect, the site surfaces include pervious, impervious and landscaped surface areas. The impervious pavement is a combination of high-albedo materials and open grid pavement that will be shaded by trees within five years. The roof surface installed was new. It provided the LEED reflectance requirements.

#### *Historic Preservation Impact*

The surrounding site was not part of an historic landscape. Therefore the design was able to incorporate new landscape and sidewalks. There was no negative impact to an historic site.

**Figure 41: Armory during construction without roof**

Source: Photo courtesy of Gerding Theater

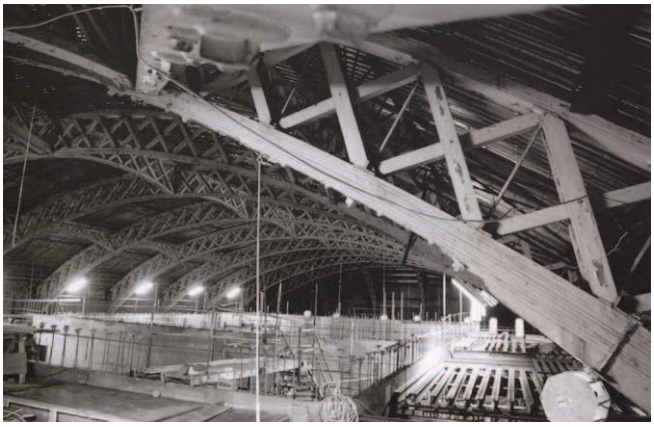

**Figure 42: Historically significant parallel-chord wooden barrel truss close-up**

Source: Photo courtesy of Gerding Theater

### 7.5.4 Cambridge City Hall Annex

#### *Sustainability Measures*

A white, thermo plastic olefin roof was installed on the building. A large solar array and black walk pads minimize the effect of the white roof.

#### *Historic Preservation Impact*

The roof color was changed to meet cool roof standards. Since the roof was not visible from the street level and

was surrounded by parapets, the roof was not a historically significant feature and there was no negative impact from the change.

**Figure 43: White thermo plastic olefin roof**

Source: Photo by Alyson Reece

## 7.6 Transportation (General)

Transportation initiatives are those that incorporate planning for such green practices in commuting to and from work as car-pooling, bicycling, riding commuter trains and buses, walking, and use of fuel efficient and alternative fuel vehicles. The comparable LEED standard suggests several options to reduce the "pollution and land development impacts from automobile use," including encouraging the use of various rail options, buses, and shuttles that run to and from public transportation hubs (LEED 3.0).

### 7.6.1 The Presidio/Thoreau Center

#### *Sustainability Measures*

The Thoreau Center at the Presidio has included as part of its sustainable sites initiatives a transportation plan, which "encourages tenants with easy access to use public or other alternative transportation, reduces carbon emissions and promotes a healthy lifestyle…..[they] also provide showers and bike lockers to encourage tenants to bike to work." In addition, there are electric car charging/parking facilities, bike paths, storage areas and maps for the Presidio and Center. The Letterman Complex, of which the Thoreau Center is a part, includes in its planning documents a commitment to sustainable transportation practices, that encourage shorter commutes for residents.

The Presidio has a clean fuel shuttle bus that runs between downtown San Francisco and the Thoreau Center every fifteen minutes each weekday, with downtown stops at the Embarcadero BART station and the Transbay Terminal. Municipal buses also run to and from the Presidio to various destinations around the Bay area.

#### *Historic Preservation Impact*

Transportation planning need not have an adverse effect on historic preservation. Bicycle locks and electric car charging and parking facilities can be retrofitted to existing facilities with relatively little impact. Installation of shower facilities can possibly be integrated into existing plumbing, although such a project could have an effect on existing historic fabric. Utilizing mass transit options can actually reduce the need for on-site parking and remove impacts to landscapes from, large parking lots.

**Figure 44: Presidio shuttle**

Source: www.Presidio.gov


**Figure 45: PresidiGo around the park map**

Source: www.Presidio.gov

### 7.6.2 Washington Navy Yard, Building 33

#### *Sustainability Measures*

There are two means of mass transit to the Navy Yard. There is a bus stop at the main gate, and two D.C. Metro stations are within walking distance. In addition to nearby mass transit, there are shuttle buses that transport employees to other DoD sites. The decision to site the Naval Facilities offices at Building 33 was partly based on the proximity of multiple transit options and the option to fold sustainable transportation into planning for the facility.

#### *Historic Preservation Impact*

The use of mass transit does not impact the building's historic character.

### 7.6.3 The Pentagon

#### *Sustainability Measures*

In the early 2000s, the PENREN project team completed a dedicated Metro Entrance Facility. The primary object of this remodeling was, for security reasons, to eliminate direct entry into the interior spaces at the Pentagon via the Metro and bus system. The sustainability advantage of having a major office facility situated on a subway system remains.

#### *Historic Preservation Impact*

Because the Pentagon is a National Historic Landmark, the profile of this facility was kept low to reduce the impact on the historic limestone façade; the Metro Entrance Facility's profile was purposely set well below that of the main Pentagon structure. In addition, in order that the appearance of the Metro Entrance Facility would be consistent with that of the Pentagon office building, limestone from the same quarry out of which the Pentagon's limestone façade was cut was used in the construction of the Metro Entrance Facility.

### 7.6.4 New Mexico Villagra Building

#### *Sustainability Measures*

The city bus line has two routes that run within a 1/4 mile of the building, and serves as an alternate transportation option. The original parking lot containing 89 parking spaces remained unchanged despite the addition of the new 4 story, 42,305 square foot wing.

There are five parking spaces reserved for low-emitting and fuel-efficient vehicles to encourage the use of such vehicles.


**Figure 46: Pentagon Metro Station**

Source: metro.pentagon.mil

Bicycle racks have been added to encourage alternative transportation, along with showers and changing facilities located in the state owned building across the street.

#### *Historic Preservation Impact*

The retention of the existing parking lot and the placement of bicycle racks had no negative impact on the historic property. The assignment of five spaces for low-emitting and fuel efficient vehicles also had no negative impact on the historic building.

### 7.6.5 Blackstone South, Harvard University

#### *Sustainability Measures*

The project is near multiple forms of public transportation including bus and subway. Bicycle parking is also conveniently placed at the front entrance.

### *Historic Preservation Impact*

Taking advantage of the existing public transportation had no negative impact on the building. Most of the bicycle parking is in the basement, however covered parking was added to the exterior which has a negative impact on the building.

**Figure 47: Covered bicycle parking near the front entrance**

Source: Photo by Alyson Reece

## 7.6.6 The Gerding Theater at the Armory (Annex)

### *Sustainability Measures*

There are 2 bus lines within 1/4 mile of the project site. Thirty new bicycle stalls and 7 showers were provided within the building. The bike racks provided are adequate for the full time equivalent occupants including the visitors. The project provided a hybrid flex car service for employees located within a block of the project site.

The project has set up a carpool program and provided a carpool drop off area in front of the building since no parking was been provided on site.

### *Historic Preservation Impact*

Most of the transportation improvements occurred off site and therefore had no negative impact. The bicycle parking for staff is in the basement and has no negative impact.

## 7.6.7 Cambridge City Hall Annex

### *Sustainability Measures*

The site is located in the urban environment of Cambridge, Massachusetts, with public transit and local car-share known as (ZIP) system readily available. The City offers subsidized MBTA passes and an on-site transportation coordinator.

The Annex has gone beyond that and provides carpooling, as well as a hybrid car and bicycles for employees to share while at work. Additionally, an indoor bicycle storage room is available for employees with a shower/changing room. The entire site only has 14 (double parked) parking spaces for employees.

### *Historic Preservation Impact*

While these changes were made to promote sustainability, they also honor the historically small site of the building, by not enlarging the available parking. There was not a negative impact on the historic features of the building.

**Figure 48: Bicycle parking**

Source: Photo by Alyson Reece

**Figure 49: Double parked cars**

Source: Photo by Alyson Reece

**Figure 50: Interior bicycle storage room, located near the main entrance**

Source by: Alyson Reece

## 7.7 Operations

Operations include the day-to-day maintenance and upkeep of the building and site, and include such practices as providing energy from alternative sources (or "Green Power"), employing sound Tenancy Management practices, and using Integrated Pest Management to reduce harm to the site, the building, and its occupants and maintenance personnel. Ongoing operations are where instituting commissioning from the outset of a building or renovation project can make a difference, i.e. so that its systems (e.g. HVAC) and design can be tested using pre-established performance goals as a benchmark.

- Alternative Energy Sources
  Building operators can provide energy efficient and environmentally friendly means of powering their building. These can include (but are not limited to) electricity produced from solar, wind, geothermal, biogas, biomass, and low-impact small hydroelectric sources.
  Building operators can sometimes buy green power from power companies to avoid the negative impact on the environment produced by non-renewable fossil fuels (such as electricity produced at coal-burning plants).
  Green power also applies to the use of energy efficient devices (such as photovoltaic lighting fixtures) associated with buildings on site.

- Maintenance
  "Green" approaches to maintenance and operations help increase energy efficiency, conserve natural resources, and improve indoor air quality. These practices include regular metering and inspection of operating systems (such as HVAC), use of low-volitle organic compound (VOC) materials (such as paints, primers, and carpet adhesives), use of environmentally sound floor surfaces such as low-VOC carpets, non-vinyl flooring tiles, natural linoleum, environmentally friendly floor and carpet maintenance, use of walk-off mats to reduce contaminants being tracked indoors by building occupants and visitors, use of Energy Star-compliant appliances, continued use of water efficient products (low-flow fixtures, faucets, shower heads, urinals and toilets), and use of janitorial cleaning and supply products that meet environmentally preferable cleaning standards.

- Tenancy Management
  Sound Tenancy Management practices can lead to retention of tenants within a building or facility. This in turn reduces the harm done to the environment by the need to renovate a building for new tenants, which leads to demolition and construction debris, in addition to the transportation impact of moving tenants' equipment to the new building. Part of sound tenancy management also includes engaging tenants in sound operating practices at the facilities where they are housed so that they take "ownership" in the sustainability and long-term viability of the facility.

- Integrated Pest Management
  Integrated Pest Management (IPM) means using chemical pesticides as a last resort, and even then using only those that have a proven low impact upon the environment, in order to help protect a building and site's occupants, maintenance personnel and the surrounding ecosystem. IPM strives to control pests such as rodents and insects via physical means (such as traps) and biological means (such as naturally occurring pheromones to