Open to the Public: Energy Efficiency and Alternative Use Guidelines for Historic Buildings in Region 6 of the United States Forest Service

Terminal Project
by Kate Kornder

June 2019

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Terminal Project Approval Page

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Title: Open to the Public: Energy Efficiency and Alternative Use Guidelines for Historic Buildings in Region 6 of the United States Forest Service

This Terminal Project has been accepted and approved in partial fulfillment of the requirements for the Master of Science degree in the Historic Preservation Program by:

Committee Chairperson: ____________________ **Date:** 6.6.2019

Committee Member: ____________________ **Date:** 6/10/19

Degree awarded: June, 2019

A special thank you to Allie Wenzl for the idea for this project, from which I have learned so much, and to both Suzana Radivojevic and Allie for hours of editing, meeting, and encouragement. Thank you to Matt Mawhirter and Rick McClure for their expertise on Trout Lake and its historic buildings, but most of all for their patience with me.

Cover Image: The Barn at the Trout Lake Administrative District in Washington, built in 1920. All images taken by author unless otherwise noted.

Abstract

There are innumerable historic buildings in the Pacific Northwest region of the United States Forest Service that are important elements of the nation's history. Unfortunately, many of these structures are underutilized by both the Forest Service and the public. Increasing the use of these structures will lead to their inevitable preservation as they are appreciated and maintained – a process this project calls Preservation Through Use. In order to increase the Preservation Through Use of these buildings, this project provides the top 3 most cost-efficient energy upgrades that maintain the character of historic administrative buildings, making them more attractive for use, as well as the most effective leasing strategies that provide new and alternative uses for them. Trout Lake Administrative District, a complex of 30 Forest Service buildings, is used as an example of the breadth of administrative buildings extant on Forest Service land and how to identify those that are eligible to be listed on the National Register of Historic Places. Then, case study buildings are used to illustrate appropriate energy efficiency treatments for historic buildings from different periods of significance in Forest Service history.

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Chapter 1: Introduction

Since 1905, the United States Forest Service (USFS) has been one of the largest land management agencies in the country. Today, the 114-year old agency is the steward of approximately 30% of all federally-owned land comprising 190 million acres, including 154 National Forests and 20 National Grasslands.[1] Although conceived in the late twentieth century as a land management agency to conserve timber stock, it was not long before the National Forests became a resource for the rest of the nation by providing venues for education, recreation, and wilderness conservation. The USFS has continually evolved to meet the needs of the nation and fulfill its mission - "Caring for the land and serving the people." Today the Forest Service provides recreation spaces, educational opportunities, natural resource management, wilderness conservation, and more as it continues to evolve and meet the needs of the American people. As environmental historian Alfred Runte put it in the United States Forest Service's centennial celebration film, "The National Forests could not have been sold to the American people without the guarantee of use."[2] Surely without this guarantee and emphasis on multiple uses, the land holdings of the USFS could not have grown to the size they are today, nearly double that of the National Park Service (190 million acres versus 79.8 million acres).

The history of the United States Forest Service mirrors the history of the nation and represents the country's complex relationship with nature. The National Forests are home to hydroelectric dams, fire lookouts, fish hatcheries, privately-owned homes,

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[1] Carol Hardy Vincent, Laura A. Hanson, and Carla N. Argueta, *Federal Land Ownership: Overview and Data,* (Washington D.C.: Congressional Research Service, 2017), 1.
[2] United States Forest Service, *The Greatest Good: A Forest Service Centennial Film* (United States Forest Service, 2005).

logging operations, research centers, summer camps, and more (Images 1 & 2). At every turn, the built environment of the agency provides a distillation of the larger culture, interests, and history of the nation. In a country where over 25% of all land is held in trust by the government for the benefit of the public, the buildings and structures on those lands represent an irreplaceable facet of history. The USFS owns countless historic buildings that are an important part of the nation's heritage, and as such, merit the highest level of preservation planning and conservation.


Image 1: Leadville Fish Hatchery, CO., built in 1890.

Historic buildings in the National Forests are not only valuable as cultural heritage, but as venues for the USFS to expand on its mission to care for its resources and serve the people. Historic structures are unique resources that enhance both the agency's and the public's use of their National Forests. They present opportunities for the public to enjoy the lands that they own and to be steeped in the country's history. Historic structures can increase visitation and appreciation of the National Forests and provide infrastructure that draws people who would otherwise be uninterested in exploring nature and history.

Image 2: Bull of the Woods Fire Lookout, OR., built in 1942.

The reuse of these buildings presents opportunities for the USFS to increase revenue through rentals as well as their own stock of buildings for administrative use. By giving historic buildings a new purpose, the United States Forest Service can also ensure their continued Preservation Through Use. A historic building that is actively used is more likely to be appreciated and maintained, thus ensuring its continued preservation. For the purposes of this project, Preservation Through Use denotes the practice of preserving historic buildings through the simple act of using them. This terminal project provides guidelines for how Forest Service personnel can increase the Preservation Through Use of their historic buildings.

Problem Statement

In 1966, Congress passed the National Historic Preservation Act (NHPA), which established that "the spirit and direction of the Nation are founded upon and reflected in its heritage, [and] the historical and cultural foundations of the Nation should be preserved as a living part of our community life and development."[3] The NHPA outlines laws and guidelines for inventorying, preserving, and interpreting the nation's built heritage. Most notably, the Act established the National Register of Historic Places, installed State Historic Preservation Offices in every state, and required the Secretary of the Interior to maintain Standards for the Treatment of Historic Properties (SOI Standards).

The NHPA also implemented controls for the way that federal agencies manage their historic buildings. Section 106 of the NHPA requires federal agencies to review and mitigate any adverse effect their undertakings may have on properties that are

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[3] "National Historic Preservation Act of 1966", National Park Service, accessed January 3, 2019, https://www.nps.gov/history/local-law/nhpa1966.htm.

eligible to be on the National Register and to follow the SOI Standards when working on historic properties. Section 110 requires federal agencies to maintain an inventory of their historic places. The NHPA also requires federal agencies to conduct reviews of federally owned sites at 50 years of age to determine if they are eligible to be on the National Register of Historic Places, and if so, to treat them as if they were on the Register. Unfortunately for most federal agencies, although Congress mandates these preservation efforts, they do not provide matching funds for the personnel, training, and administration needed to perform the work.

In addition to the lack of funds and guidance regarding historic preservation, the Forest Service has a lack of need for the wide variety of the historic buildings that it owns. As the scope of the Forest Service's duties to the country have ebbed and flowed over the last 100 years, so too has the agency's need for administrative buildings to house employees and manage forest operations. For example, the Upper Sandy Guard Station, built in 1940, has been without an active use since 1978, and is suffering from severe deterioration due to its lack of continued use (Image 3). At present, the United States Forest Service has a surplus of buildings that need to be put to new uses or find new owners before they face the fate of the Upper Sandy Guard Station. Unfortunately, this may result in the decommissioning, disposal (sale), or deterioration through neglect if measures are not taken to ensure their preservation and use.

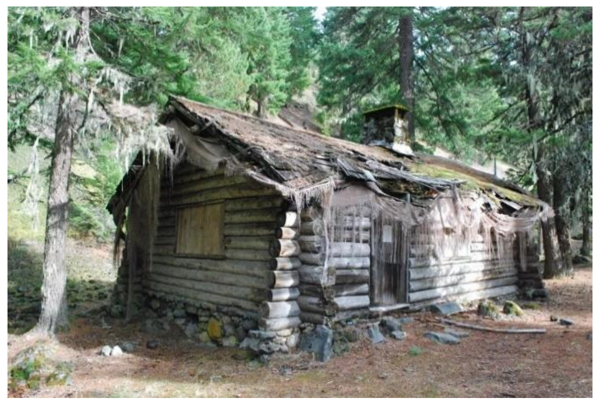

Image 3: The Upper Sandy Guard Station, Mt. Hood National Forest, built in 1935, vacant since 1978. Image: RestoreOregon.org

One challenging aspect of putting historic building to use is their poor energy efficiency compared to newer buildings. Often built before modern heating, air conditioning, and ventilation (HVAC) systems, historic buildings can be less comfortable to inhabit than modern structures and more costly to operate. Buildings constructed before 1950 are 30-40% less energy efficient than building constructed after 2000, because they were constructed before standards of modern comfort in buildings.[4] However, installing modern HVAC systems into historic buildings is not a quick fix to this issue. If installed without careful consideration, historic buildings can continually leak air and thus energy, perpetuating their high operating costs. In addition, installing energy efficiency treatments to reduce these costs can be problematic in historic buildings because of the Secretary of the Interior's Standards, which place the historic integrity of the structure above all other factors. Installing modern systems without consideration of historic building envelopes can also lead to the degradation of historic materials by changing a building envelope's functionality.

The effective and sensitive use of appropriate weatherization techniques can bring historic buildings back to life and promote their continued use. Energy efficiency treatments that increase the confortability of historic buildings while retaining their historic character can increase their use by both the Forest Service and the general public. In addition, by making historic buildings more efficient, the USFS will decrease the negative environmental impact of overuse of energy sources in the wilderness and decrease its need for new construction, fulfilling its directive under Executive Order

[4] Hensley, Jo Ellen, and Aguilar, Antonio, "Preservation Brief 3: Improving Energy Efficiency in Historic Buildings," National Park Service Technical Preservation Services, https://www.nps.gov/tps/how-to-preserve/briefs/3-improve-energy-efficiency.htm.

13693, “Planning for Federal Sustainability in the Next Decade,” which set a goal to reduce federal greenhouse gas emissions by 40% in ten years.[5]

Although making a historic building more comfortable to inhabit can increase its appeal, it can be challenging to find alternative uses and appropriate leasing strategies for historic buildings that are found to be in excess of Forest Service needs. However, the Forest Service has a variety of authorities granted to it by Congress to lease buildings to the public which retain the agency’s control over the structure and its historic fabric, each with strengths and weaknesses for historic places. Finding alternative uses and tenants for historic buildings can be one of the best ways to ensure their Preservation Through Use and provide public access to their own national heritage. Leasing historic structures can also provide funds to the Forest Service for historic building maintenance and administration, perpetuating historic preservation through the agency. For example, the Santiam Pass Lodge (Image 4), built in 1940 in the Willamette National Forest, has been vacant since 1986. Unused by the Forest Service for 30 years, a new owner is rehabilitating the structure to bring it back to life thanks to a Special User Permit issued by the Forest Service. A thorough knowledge of the breadth of leasing strategies could help the National Forests strategically utilize, profit from, and preserve their historic

Image 4: Santiam Pass Ski Lodge, OR., built in 1940, vacant since 1986, has recently been leased to a private owner for preservation and new use. Image: RestoreOregon.org

[5] Barack Obama, Executive Order 13693, “Planning for Federal Sustainability in the Next Decade,” obamawhitehouse.archives.gov, accessed April 3, 2019.

buildings. By utilizing all vested avenues that could aid in the preservation of its rich stock of historic buildings, including energy efficiency upgrades and proactive leasing strategies, the Forest Service could serve as a model for Preservation Through Use of historic buildings.

Audience

The intended audience of this project is Heritage Program Managers and Facilities Managers in Region 6 of the USFS, which includes 17 National Forests in Oregon and Washington. Each of the National Forests in Region 6 has at least one Facilities Manager and one Heritage Program Manager; however, oftentimes neither of these professionals are trained in historic preservation or architectural history. Facilities Managers are trained in building maintenance but are oftentimes not well-versed in cultural resource management or the Secretary of the Interior's Standards for the Treatment of Historic Properties. Conversely, Heritage Program Managers are often professional cultural resource managers trained as archaeologists but are less familiar with historic buildings, significant styles, and best management practices. Although the United States Forest Service has swayed towards the hiring of archaeologists in recent decades to comply with regulations surrounding logging sites, the 114-year-old agency has become the owner of a rich stock of buildings and structures associated with United States History, and is in need of more instruction and guidelines for the preservation of their historic properties. These guidelines are intended to help Forest Service personnel better maintain and preserve the historic buildings on National Forest land.

Objective

The goal of this project is to bolster the Preservation Through Use of historic buildings in the National Forests of Oregon and Washington. For the purposes of this project, Preservation Through Use means historic building preservation through the simple act of use. Weatherization techniques and leasing strategies are provided as methods for the Facilities Managers and Heritage Program Managers to increase the use and subsequent preservation of historic buildings in the 17 National Forests of Oregon and Washington. By introducing appropriate weatherization treatments into historic buildings, the USFS will increase their comfortability and decrease their operating costs, making them more attractive for use by both the agency and the public. Leasing historic buildings that are found to be in excess of the agency's needs will increase their likelihood for use and subsequent preservation while providing a great benefit to the public, who will be able to immerse themselves in history and increase their use of public lands. By upgrading the energy efficiency of historic buildings and giving them new uses, the USFS will give their historic buildings new life and perpetuate their Preservation Through Use.

Scope

This scope of this project encompasses historic administrative structures in the National Forests of Oregon and Washington, or Region 6 of the United States Forest Service (Image 5). There are seventeen National Forests and one Scenic Area in the region. Although the forests have difference climates, they share similar histories, building types, and preservation needs based on the communities of the Pacific Northwest.

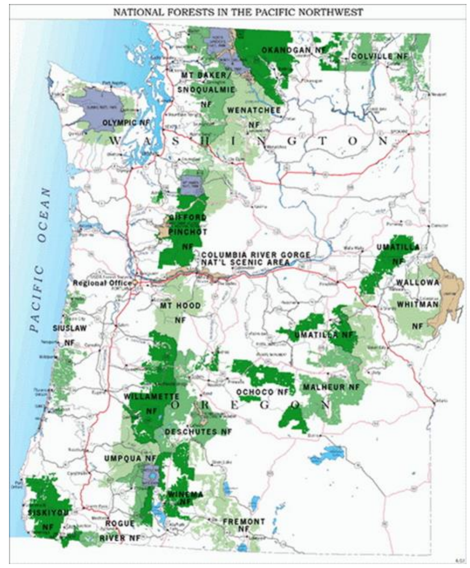

Image 5: Region 6 of the United States Forest Service.

There are over 10,000 buildings and structures in Region 6, ranging in construction dates from the 1890s to the modern day. The USFS has several categories for their structures - Recreational (campgrounds, ski resorts), Administrative (offices, ranger houses, guard stations), as well as Cooperative and Special Uses (fish hatcheries, research facilities). This terminal project focuses on administrative structures because of the nature of their convenient locations as well as potential for habitation and reuse. Administrative structures in the United States Forest Service comprise offices, ranger stations, residences, bunkhouses, bathhouses, warehouses, maintenance buildings, powerhouses, garages, barns, and other storage facilities. The variety of styles and forms of administrative structures represent the built environment that Forest Service employees created in order to carry out their responsibilities of management of the National Forests. Throughout the history of the agency, the funds and programs used to build these structures reflected the sentiment of the country towards the Forest Service, nature, and public lands.

There are approximately 4,000 administrative buildings in Region 6, 85% of which are potentially historic ranging in construction dates from 1890 to 2018. The building stock is separated into several Periods of Significance by the United States Forest Service: The Forest Reserve Period (1891 – 1904), The Early Forest Service Period (1905 – 1911), The Custodial Management Period (1912 – 1932), The Depression Era (1933 – 1945), and the WWII and Postwar Period (1945 – 1969). The Periods of Significance mark eras of building styles, trends, and materials. Buildings constructed before 1912 are particularly rare, while buildings from more recent Periods of Significance represent the larger stock of existing buildings in the National Forests today (Figure 1). In order to address the variety of ages, style, and materials present in the more common age group of historic buildings (c. 1912-1969), this terminal project uses Trout Lake Administrative District (TLAD), home to the Mount Adams Ranger Station in the Gifford Pinchot Forest in Washington, as a case study.

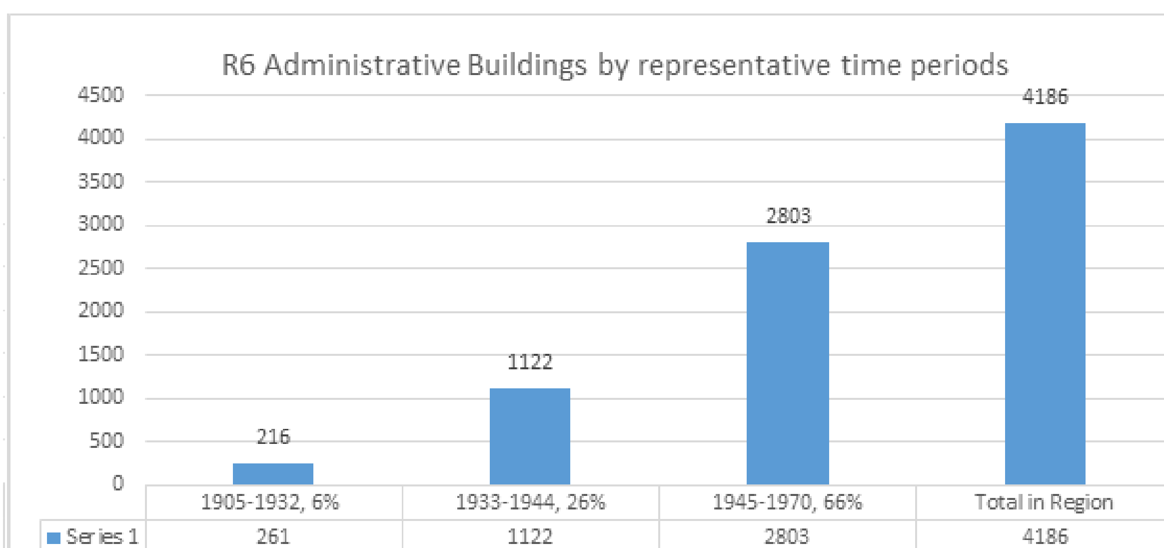

Figure 1: Administrative buildings in Region 6 by age. Source: USFS Engineering files, INFRA Administrative Buildings, 2005.

Trout Lake Administrative District sits just west of the town of Trout Lake, Washington, approximately 90 miles from Vancouver, Washington. There are 30 buildings on the site, 25 of which are potentially historic ranging in construction dates from 1920 to 1964. Trout Lake provides a representative example of the building stock in Region 6 - the majority of the buildings are from the 1945-1969 period, a substantial portion are from the 1933-1945 period, and a handful from the 1920-1933 period. Some of the buildings are used in the summertime for seasonal staff members, but go unused throughout the winter, while costly electric bills add up to keep the pipes from freezing. Some buildings are used year-round, while some are not used at all. The buildings have a variety of styles and materials, emblematic of their respective periods of construction. These buildings are representative of the larger building stock in Region 6 and provide examples for the types of structures and appropriate energy efficiency treatments that can increase their Preservation Through Use.

Underutilized historic buildings at Trout Lake are also good candidates for alternative uses through leasing to the public. Although many Forest Service structures are in remote areas, many of them, including TLAD, are also close to urban or semi-urban areas. This is because the USFS has historically provided resources in a natural environment that can be regularly accessed and utilized. TLAD is within the town of Trout Lake and 30 minutes from Hood River, a populous city with a lively tourist industry. Trout Lake has potential to benefit from innovative leasing strategies and to serve the people of the area by providing historic buildings to rent, as well as serve as an example for future creative leasing strategies on other National Forests.

Methodology

This terminal project uses Trout Lake Administrative District (TLAD) in Trout Lake, Washington, as a case study. TLAD has a variety of architectural styles which span the building program history in the Pacific Northwest Region of the Forest Service, from 1920s bungalow ranger residences to 1960s office buildings. This variety of building construction types, materials, and styles at Trout Lake provides a cohesive unit through which to view the greater scope of administrative buildings in Region 6. TLAD also represents an assembly of Forest Service buildings with great leasing potential because of their proximity to Hood River, Vancouver, and other metropolitan areas.

First, chapter two introduces the historic building stock of Region 6 through the lens of Trout Lake Administrative District and provides recommendations for how to identify a potentially historic building within the context of Region 6 history. One historic building from each period of significance will be used as a case study in chapter three, which introduces energy efficiency guidelines based on the most common energy efficiency issues found in buildings from their respective time periods. Finally, chapter four provides background and information on leasing strategies that can be used by Heritage Program Managers in the National Forests to foster alternative uses for historic buildings.

Chapter 2: Historic Buildings in the National Forests

The Pacific Northwest Region and Trout Lake Administrative District

From the seventeenth to the late nineteenth century, the United States' sole management plan for a seemingly endless expanse of federal land was to dispose of it through transfer to private ownership. Federal actions such as the Homestead Act of 1862 and the Timber-Culture Act of 1873 expedited this process by allowing pioneers 160 acres of land free of charge in exchange for proper land management. In fact, the primary responsibility of the first federal land management agency, the General Land Office, was simply to oversee this transfer of land. However, in 1881, after two centuries of unabated timber cutting, Congress passed the Forest Reserve Act, which gave the President the power to designate Forest Reserves and created the Division of Forestry within the Department of the Interior. In just three years after this act, President Harrison and President Cleveland designated 18 million acres of land as the nation's first Forest Reserves (Image 6). Between 1891 and 1904, eight different Forest Reserves were established in the Pacific Northwest Region – Bull Run Reserve, Pacific Reserve, Ashland Reserve, Cascade Reserve, Rainier Reserve, Washington Reserve,

NOTICE!

DEPARTMENT OF THE INTERIOR,
GENERAL LAND OFFICE,
WASHINGTON, D. C., APRIL 14, 1894.

Public notice is hereby given that these lands are set apart and reserved as a

FOREST RESERVATION,

BY PROCLAMATION OF THE PRESIDENT OF THE UNITED STATES, under authority of the act of Congress of March 3, 1891.

This reservation is made for the benefit of the adjoining communities, being created to maintain a permanent supply of water for irrigation and of wood for local use by a rational protection of the timber thereon.

ALL PERSONS ARE HEREBY WARNED

not to settle upon, occupy, or use any of these lands for agricultural, prospecting, mining, or other business purposes; nor to cut, remove, or use any of the timber, grass, or other natural product thereof, except under such regulations as may be hereafter prescribed.

No person shall start or kindle or allow to be started or kindled, ANY FIRE IN THE TIMBER, GRASS, OR UNDERGROWTH ON THESE LANDS, or commit any other waste thereon; and the DRIVING, FEEDING, GRAZING, PASTURING, OR HERDING OF CATTLE, SHEEP, OR OTHER LIVE STOCK WITHIN THIS RESERVATION, IS STRICTLY PROHIBITED.

Bona fide settlers having properly initiated their claims prior to the withdrawal of the lands for said reservation, and actual owners of lands within the reserve, may pass to and from their claims or property, but will not be allowed to occupy or use lands within the reservation outside of their claims, nor to use, damage, or destroy any timber or other natural product of such lands.

ANY PERSON VIOLATING THESE REGULATIONS WILL BE PROSECUTED FOR TRESPASS, and will be held responsible pecuniarily for any waste or damage, whether done intentionally or caused by neglect.

All law-abiding citizens are requested to report any cases of trespass upon said forest reserve that may come to their knowledge, and to assist in the prosecution of such trespasses.

S. W. LAMOREUX,
COMMISSIONER.

APPROVED:
HOKE SMITH,
SECRETARY.

Image 6: Forest Reserve Notice. Source: McClure and Mack, "For the Greatest Good: Early History of the Gifford Pinchot National Forest

Olympic Reserve, and Baker City Reserve.[6] From 1905 to 1907, President Theodore Roosevelt designated an additional seventeen Forest Reserves which gave the Pacific Northwest more national forest land than any other region.[7]

The architectural history of the Pacific Northwest region of the Forest Service is divided into five distinct periods of significance, established in *Utility and Service Combined with Beauty: A Contextual and Architectural History of USDA Forest Service Region 6: 1905-1960,* a historic context statement prepared by historians Kay Atwood, Sally Donovan, Dennis Gray, and Ward Tonsfeldt in 2005. These periods of significance are the Forest Reserve Period (1891-1904), Early Forest Service (1905-1911), Custodial Management Period (1912-1932), Depression-Era (1933-1941) and finally WWII and the Post-War Period (1942-1965). The WWII and Postwar Period is extended to 1970 and elaborated upon in *Beyond Rustic: Wartime and Mid-Century Administrative Facilities of the USDA Forest Service Pacific Northwest: 1941-1970*, written by Forest Service Architectural Historian Rachel Klein in 2018.

In the early years of the Forest Service, scant funds were available for the construction of administrative buildings. In 1898, when Congress first provided funding for forest supervisors, the General Land Office hired rangers who lived near their assigned Reserves so they could manage the forests from their homes. Congress provided no funding for the construction of stations or shelters to aid in the proper management of sometimes thousands of acres of lands. If rangers did take the initiative to construct buildings and structures for the management of the land, they were often

[6] Atwood, Donovan, Gray, and Tonsfeldt, *Utility and Service,* 8.
[7] Atwood, Donovan, Gray, and Tonsfeldt, *Utility and Service,* 12.

built of impermanent materials. Only a handful of homesteads and cabins from this period still exist in the Pacific Northwest Region.

It was not until after the National Forests were transferred to the Department of Agriculture in 1905 that funds were allocated to construct permanent structures for administrative use. Around this time, the Forest Service had established eight regions with headquarters in each. Headquarters for Region 6 were in Portland, Oregon, but management of the forests remained in local Forests and subsequent districts. Construction funds and instructions came slowly from the Region 6 headquarters in Portland to the 25 National Forests in the Region. In 1908, the Forest Service provided its first booklet of standard plans for the construction of cabins, bunkhouses, storehouses, and barns, titled *Bills for Material Accompanying Standard Plans for Buildings on Ranger Stations*. The book provided 29 standard plans with accompanying material lists, leading to the first permanent structures on Forest Service land intended for Forest Service Administration and Management.

Before the Oregon territory was settled by Europeans, the area around Trout Lake Administrative District was the traditional home of Lower Chinookan and Sahaptin tribes of Native Americans, including Klickitat, Wasco-Wishram, and Tenino tribes.[8] The tribes' primarily subsistence methods included the salmon populations of rivers like the Columbia and the White Salmon river, which runs south approximately one quarter-mile from TLAD, as well as variants of wild roots, hazelnuts, huckleberries, blackberries, and other gathering foods, which could be found throughout the area in the foothills of the

[8] French, David and Kathrine French, "Wasco, Wishram, and Cascades," in *Handbook of North American Indians, volume 12: The Plateau*, ed. Deward Walker, (Washington, D.C.: Smithsonian Institution, 1998), 360.

Cascade mountain range. The tribes were migratory with the peak seasons for fish, berries, and roots, as well as the weather. Trees such as red cedar provided material for canoes, houses, and other items. Through treaties between the United States Government and the native tribes in 1855, many people from the Lower Chinookan and Sahaptin tribes were enrolled in both the Warm Springs and Yakama Reservations, although many continued to live in their traditional locations.

In 1899, Swiss immigrant John Bernnegger filed a homestead claim to the land where Trout Lake Administrative District now sits, earning a title to the property in 1906. In 1910, he sold the land to John M. Filloon, a hardware store owner in The Dalles. By 1917, a 16-acre portion of the site was being used for administrative purposes by the Forest Service, and in 1928, the then owner, F.L. Houghton, donated the land to the federal government. In 1938, the Forest Service leased and eventually purchased an additional 11 acres from former District Ranger Harvey Welty.[9]

By 1917, when TLAD was first occupied by the Forest Service, agency employees were still commonly living and working in temporary bunkhouses and tent sheds.[10] The oldest extant structure at TLAD is the barn, a vernacular style building constructed by Forest

Image 7: The Barn (#2400), the oldest building at Trout Lake, built in 1920.

[9] McClure, Rick, and Cheryl Mack, *For the Greatest Good: Early History of the Gifford Pinchot National Forest,* (Seattle, WA: Northwest Interpretive Association, 1999), 27.

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Rangers in 1920 (Building #2400) (Image 7). In 1921, the first permanent Ranger Station was built at the site, which still stands today (Residence #1004). A second permanent residence was built in 1932 (Residence #1002). Ranger residences from this time period were often inspired by the Bungalow style, a popular residential design style in the Pacific Northwest during the 1910s and 1920s.

The Great Depression dramatically changed the built environment of the National Forests. In 1933, the Forest Service released the Copeland Report to Congress, which found that the significant increase in use of the forests by the general public warranted significant increases in infrastructure, housing, and administrative structures. Serendipitously, also in 1933, President Franklin Roosevelt's enacted his New Deal programs, federally sponsored programs that would give job to Americans affected by the Great Depression. One of these New Deal programs, the Civilian Conservation Corps (CCC) employed young men for infrastructure improvement projects within several federal agencies. In the Forest Service, CCC workers fulfilled the agency's dire need for increased infrastructure as established in the Copeland Report.

In the National Forests of Oregon and Washington, 40,000 men in several dozen CCC camps built roads, hiking trails, cabins, warming huts, administrative buildings, storage sheds and more. Most notably, the CCC constructed Timberline Lodge in 1937 in the Mt. Hood National Forest, a grand rustic lodge full of Arts and Crafts detailing, including hand-carved wooden furniture, one of a kind wrought iron detailing, and hand-woven fabrics. Many of the structures built by the CCC survive and are cherished today, a testament to the quality of design and craftsmanship that the Corps brought to the region. In 1934, the Civilian Conservation Corps began work at Trout Lake

Administrative District. There are 14 structures at Trout Lake that were built by the CCC, including four residences, four garages, three woodsheds, a fire warehouse, a truck shed, and a machine shop. Collectively, these buildings represent one of the largest, most cohesive collections of CCC buildings on any one Forest service site, and clearly demonstrate the rustic style often employed by the CCC (Image 8). Rustic style buildings, borrowing from the architecture developed in the National Park Service in 1916, harmonized with their surroundings by using local materials, compatible colors, textures, and proportions, as well as a high level of craftsmanship.[11]

Image 8: The Fire Warehouse (#2200), built in 1936 by the Civilian Conservation Corps.

The most recent era of history in the Pacific Northwest National Forests is WWII and the Post-War Period. During the WWII, the lumber industry in the region was devoted almost exclusively to war efforts. Many mines shut down during the war, after being required to mine only strategic minerals for the war effort.[12] The Forest Service lost some of its employees to the war draft, although it received conscientious objectors as well, who were assigned to work at former CCC camps in the Siuslaw and Mt. Hood National Forests.[13] Trout Lake Administrative District also has a breadth of buildings

[11] Elizabeth Gail Throop, *Utterly Visionary and Chemerical: A Federal Response to the Depression,* (Portland: Portland State University, 1979), 41.
[12] Atwood, Donovan, Gray, and Tonsfeldt, *Utility and Service,* 34.
[13] Atwood, Donovan, Gray, and Tonsfeldt, *Utility and Service,* 33.

from the WWII and Postwar Era of development (1942-1969). Although not readily considered historic, these buildings represent an important era in construction history, architectural design, and national identity during a critical era of United States History. Advances in technology and manufacturing during WWII translated directly to new architectural styles in both residential and commercial developments in the Post War period. These stylistic trends translated to the public sector as well, as Forest Service Rangers and their families embraced new housing and lifestyle trends.

After the war, lumber production in the National Forests skyrocketed to provide building materials for the new demand in housing such as timber, plywood, and other wood products. Increased staff and operations created a boom in building stock in the forests, often built with quantity and not quality in mind. In 1944, Congress passed the Sustained-Yield Forest Management Act, which promoted more partnerships between the National Forests and private companies to provide a continuous supply of lumber to the market. In 1960, Congress passed the Multiple-Use Sustained Yield Act, which sought to balance the focus of the Forest Service away from natural resource extraction to equal parts timber, wildlife, rangelands, water, and recreation management. The National Environmental Protection Act of 1969 also brought in specialists from every discipline to manage the panoply of resources in the National Forests: hydrology, geology, archaeology, biology, botany, and more. The specialization and work efforts of the Forest Service continued to grow steadily throughout the twentieth century as the agency expanded its vision of what it means to care for the land and serve the people.

Trout Lake Administrative District boast multiple buildings that represent many historical trends from the WWII and Postwar Era on and off Forest Service land, including the Ranch-style home, engineered wood product siding, aluminum window frames, homes built from standard plans by Forest Service architects, as well as buildings repurposed and moved from other areas of the region to accommodate the intense increase in Forest Service operations at the time. Trout Lake Administrative District is somewhat unique for its high concentration of buildings from the WWII and Postwar Period on a single administrative site. However, TLAD accurately represents the relative amount of buildings from this time period throughout Region 6. Of the 4,000 administrative buildings in Region 6, nearly 3,000 of them are from this time period.

Trout Lake Administrative District is unique for its overall assemblage of historic buildings from the Custodial Management, Depression Era, as well as WWII and Postwar periods of construction in Forest Service History. However, Trout Lake is also typical of ranger districts in Region 6 for its accurate representation of the relative amounts of buildings from each time period, their respective intended uses, materials, styles, and construction types. For these reasons, the buildings are also an excellent case study through which to view best practices for energy efficiency and administrative management issues in historic Forest Service administrative buildings.

A Case Study of Region 6: Trout Lake Administrative District

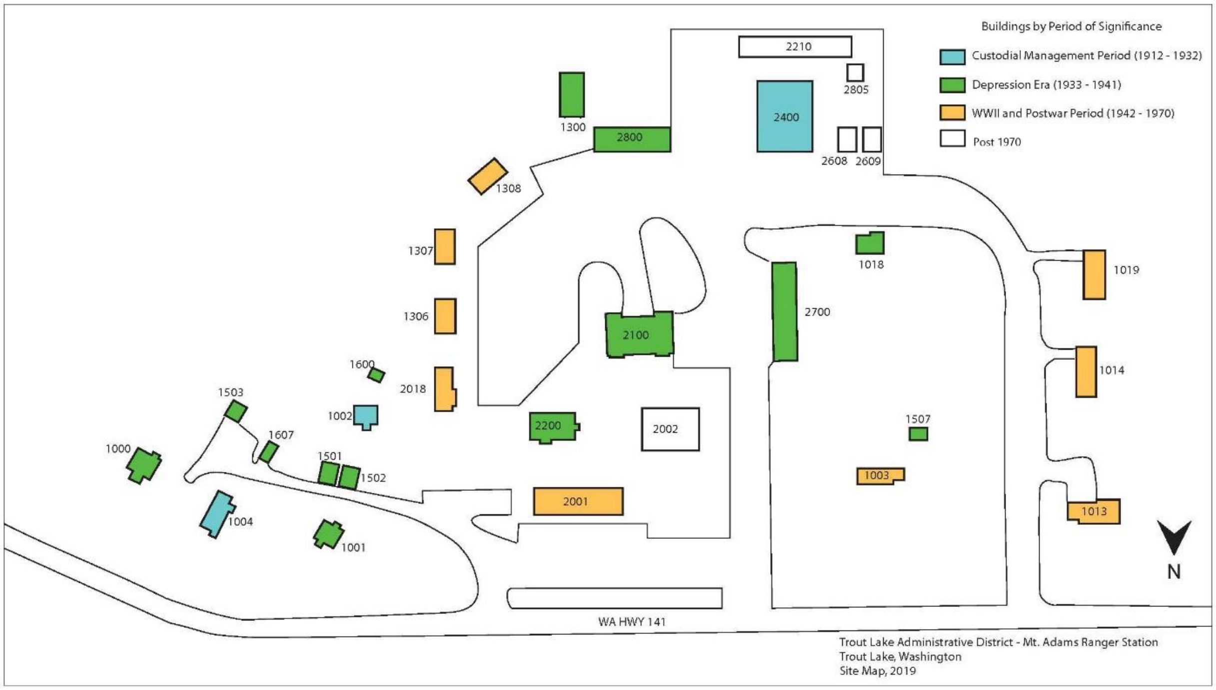

Figure 2: Site Map of Trout Lake Administrative District, 2019

Trout Lake Administrative District (TLAD), home to the Mount Adams Ranger District in the Gifford Pinchot National Forest, is an apt case study through which to view the history of administrative development in Region 6 of the National Forests (Figure 2). Region 6 interprets the agency's history through 5 distinct periods of growth and construction, or periods of significance. They are the Forest Reserve Period (1891-1904), Early Forest Service (1905-1911), Custodial Management Period (1912-1932), Depression-Era (1933-1941) and finally WWII and the Post-War Period (1942-1969). Of the 30 buildings at Trout Lake, 25 are over 50 years of age and as such, are potentially historic. The existing built resources at Trout Lake and their respective construction years are listed in Figure 3. The buildings at Trout Lake span in construction dates from

1920 up to the 2000s and represent the relative amounts of buildings constructed within each time period throughout the Region (Figure 1).

Image 9: Gotchen Creek Guard Station. Image: Wikimedia.org

Buildings constructed before 1912, during the Forest Reserve and Early Forest Service periods are a rare sight in the National Forests in Region 6. Examples of such buildings are Cloud Cap Inn, one of the oldest building in the Mount Hood National Forest, constructed in 1889, and the Independence Prairie Homestead, a log cabin built in 1890. Buildings from this time period tend to be log-wall structures that are unique representations of public interests on Forest Service land, such as homesteading and recreation. Other structures from this period are early Forest Ranger Guard Stations, used for ranger offices and forest fire management. One example is the Gotchen Creek Ranger Station on the Gifford Pinchot National Forest, built in 1909 (Image 9). It is a light timber wood-frame structure with horizontal drop siding, a wood shingle roof, a shed-style front porch, and exposed rafter tails. The Gotchen Creek Ranger Station is similar to Plan No. 7 in the 1908 standard plan book *Bills for Material Accompanying Standard Plans for Buildings on Ranger Stations*.[14] Ranger stations from this period were often adapted from the 1908 book to accommodate available materials and needs for the area. There are no buildings at Trout Lake from the Forest Reserve or Early Forest Service periods.

[14] Atwood, Donovan, Gray, and Tonsfeldt, *Utility and Service,* 43.

However, buildings from this early era of construction are particularly rare, and merit specialized preservation plans for any interventions to the building envelope or for alternative uses. As such, they are outside the scope of this project, which intends to provide general guidelines that are applicable to a wide variety of historic buildings.

Buildings constructed from 1912 to 1932, the Custodial Management Period, are often significant historic buildings that can be found sporadically throughout Region. Examples from Region 6 include early lookout towers and ranger residences such as the Black Butte Cupola in the Deschutes National Forest, constructed in 1924, or early recreation structures such as the Tilly Jane A-frame Ski Hut in the Mount Hood National Forest, construction in 1931 (Images 10 & 11). Some structures such as Tilly Jane or the Suiattle Guard Station were framed with heavy timbers or full logs, but light timber frame construction became more popular during this time period. The uses for buildings constructed during this time period represent the expanded interest in recreation on Forest Service lands, the expanded infrastructure of roads and automobile garages, and of fire lookouts and forest fire management.

Image 10: Tilly Jane A-Frame. Image: loomisadventures.org

Image 11: Black Butte Cupola. Image: Statesmanjournal.com

At Trout Lake, there are three buildings from the Custodial Management Period, two residences (#1004 and #1001) and a barn (#2400). The barn, built in 1920, is framed with heavy timbers. Residence #1004, originally a ranger station, and #1002, are both light-timber framed bungalow-style residences (Images 12 & 13). The barn at TLAD is representative of historic barns of this time period both in and out of the National Forests - rectangular plan, lumber-truss construction, wood shake gambrel roof with flared eaves, hay hoods, and multi-pane windows.[15]

Image 12: Residence #1004,built in 1920. Historical view (top) and 2019 (bottom).

Image 13: Residence #1002, built in 1932.

Ranger residences from this time period from around the region were often inspired by the Bungalow style, a popular residential design style in the Pacific Northwest during the 1910s and 1920s. These buildings were typically one or two stories high with rectangular floor plans, gable roofs, eave overhangs, decorative brackets, exposed rafter tails, shingle or horizontal siding, one-over-one or multi-light double-hung windows, and partial or full front porches with square posts.[16] The two residences from this time period at TLAD are emblematic of these characteristics, with rectangular floor plans, exposed rafter tails with eave

[15] Atwood, Donovan, Gray, and Tonsfeldt, *Utility and Service,* 47.
[16] Atwood, Donovan, Gray, and Tonsfeldt, *Utility and Service,* 46.

overhangs, fascia boards with decorative brackets, drop siding, and square porch posts. Trout Lake is a good example of the progress in the building program during this era.

Buildings from the Depression-Era period of construction are more common in Region 6 than their earlier counterparts and have a significant place in the history of the Forest Service. The Depression-Era buildings represent an increased investment in infrastructure in the Forest Service, expanded accessory structure construction, and a legacy of rustic style architecture on Forest Service land. Significant examples from the region include Timberline Lodge, built in 1938, the carpenter shop at Zig Zag Ranger Station, built in 1933. At Trout Lake, there are 14 buildings from this period. The WWII and Post-War Period is the largest group and most common building found in Region 6. At Trout Lake, there are 10 buildings from this time period. By concentration of buildings from each time period, Trout Lake accurately represents the larger historic building stock of Region 6.

During the Depression Era of the Forest Service, camps of the Civilian Conservation Corps were constructing buildings and infrastructure all around Region 6. At Trout Lake, the CCC built four residences (#1000, #1001, #1018, #1300), six garages (#1503, #1607, #1501, #1502, #1507, #1602), a machine shop (#2100), a fire warehouse (#2200), a woodshed (#2800), and a truck shed (#2700). These buildings collectively represent many variations of the rustic style and CCC traditions. All have poured concrete foundations, wood siding, multi-light windows, and partial front porches (Image 14). Residence #1001 and #1000, both built in 1934, have side-gabled roofs with horizontal-sided, gabled, partial front porches, cedar shake roofs, 3” horizontal drop siding, decorative multi-light windows, exposed rafter tails, decorative brackets, and brick chimneys. Residence #1018, built in 1936, features a cross gabled roof with vertical, angular cut boards in the gable ends, cedar shake roofs, and 8” drop siding, Residence #1300, built in 1938, features cedar shake siding, a front gabled roof with replacement standing-seam metal roofs, and a gabled front porch (Image 15). These buildings in the Forest Service were typically wood framed, with gabled or hipped roofs, horizontal clapboard or wood shingle siding, multi-light windows, and fieldstone or concrete foundations.[17] Oftentimes, these buildings bore pine-tree cut outs in their wood boards on their gable ends or window shutters. Accessory buildings typically bore similar characteristics as the residences for continuity.[18]

Image 14: Residence #1018, built in 1936.

Image 15: Residence #1300, built in 1938.

[17] Atwood, Donovan, Gray, and Tonsfeldt, *Utility and Service,* 53.
[18] Atwood, Donovan, Gray, and Tonsfeldt, *Utility and Service,* 53.

The Depression Era garages, woodsheds, machine shop, fire warehouse, and truck shed all bear similar characteristics to the residences from this period and emphasize new attention on the automobile and need for storage and accessory structures for fire management or machinery (Image 16). Most of these accessory buildings at TLAD have horizontal siding, although woodshed #2800 and truck shed #2300 both have cedar shake siding (Image 17). Garages have rectangular plans, front gables, with either hinged or sliding doors. Some feature eave overhangs with or without brackets, some have no overhang. The Machine Shop and Fire Warehouse both have high-pitched side-gabled roof with vertical, angular cut boards on gable ends.

Image 16: Garage #1502, built in 1934.

Image 17: Truck shed #2300, built in 1936.

There are ten buildings from the WWII and Postwar Period at Trout Lake - four residences (#1003, #1013, #1019, #1014), three barracks buildings (#1306, #1307, #1308), two offices (#1305, #2001) and one operations building (#2018). These buildings represent the gamut of architectural styles that emerged during WWII and the Postwar Era in the United States, particularly in the Pacific Northwest. During WWII, funds for infrastructure in the National Forests were low, and the Forest Service made use of standard plans designed by the Forest Products Laboratory in Wisconsin.[19] Known as Timber Sales Officer Homes or "TSO Homes," these building were fabricated in Portland by Carlton Lumber Company and shipped to forests throughout the region. Residence #1003 at Trout Lake is one such TSO home (Image 18). It exhibits elements of the emerging Ranch-style for homes on and of Forest Service lands.

Image 18: Building #1003, a prefabricated building built in 1947.

After the war, ranger residences began to reflect higher-style trends in residential architecture. Residence #1013, built in 1958, represents the changing taste in residential design during the early part of the Postwar period, with its low-pitch cross-gabled roof, plywood T1-11 siding, and attached garage (Image 19).

Image 19: Residence #1013, built in 1958.

Following an increase in budget in 1957 Regional Architect Americo Paul (A.P.) DiBenedetto created more than 40 different standard plans for the National Forests of Region 6.[20] Many of the buildings at Trout Lake were created according to

[19] Rachel Klein, *Beyond Rustic: Wartime and Mid-Century Administrative Facilities of the USDA Forest Service Pacific Northwest: 1941-1970,* (Washington D.C.: USDA Forest Service, 2018), 22.
[20] Klein, *Beyond Rustic,* 27.

DiBenedetto's and other Regional Architects guidelines, including #1019, #1014, #1306, #1307, #1308, #2018, all built in the 1960s.[21] These buildings represented the widespread priority of efficiency and economics in building construction during the Postwar period due to increased demand, using aluminum windows and T1-11 siding, an engineered wood board product (Image 20).

Image 20: Barracks #2, #1307, built in 1962

The Main Office at Trout Lake, #2001, built in 1963, was also created from standard plans produced in the late 1950s (Image 21). Designed by K.R. Reynolds, it is representative of common office buildings created during this time period heavily inspired by residential Ranch style homes, with wide, low-profiles, porch-style entries, asphalt roofing, and T1-11 siding.[22]

Image 21: The Main Office at Trout Lake (#2001), built in 1963.

Trout Lake Administrative District is unique for its assemblage of historic buildings from the Custodial Management, Depression Era, as well as WWII and

[21] Klein, *Beyond Rustic,* 62,
[22] Klein, *Beyond Rustic,* 60.

Postwar periods of construction in Forest Service History. However, Trout Lake is also typical of ranger districts in Region 6 for its accurate representation of the relative amounts of buildings from each time period, their respective intended uses, materials, styles, and construction types. For these reasons, the buildings are also an excellent case study through which to view best practices for energy efficiency and administrative management issues in historic Forest Service administrative buildings.

Building Number	Building Name	Construction Year
2400	Barn	1920
1004	Residence	1921
1002	Residence	1932
1503	Garage	1933
1000	Residence	1934
1001	Ranger's Residence	1934
1501	Garage	1934
1507	Garage	1934
1600	Woodshed	1934
1607	Woodshed	1934
2800	Lumber Shed	1935
1018	Residence	1936
2200	Fire Warehouse	1936
2300	Truck Shed	1936
2100	Machine Shop	1937-38
1300	Foreman's Quarters	1938
1500	Garage	1940
1003	Residence	1947
1013	Residence	1958
1305	Office (Former Mess Hall)	1961
1306	Barracks #2	1962
1307	Barracks #3	1962
1308	Barracks #4	1962
1019	Residence	1963
2001	Main Office	1963
1014	Residence	1964
2018	Ops Building	1964
2002	Planning Office	2000

Figure 3: Building Stock at Trout Lake Administrative District.

Building Eligible for Listing in the National Register of Historic Places at Trout Lake Administrative District

Section 106 of the National Historic Preservation Act requires several efforts by federal agencies to manage their historic buildings, including the requirement to assess all buildings at 50 years of age to determine if they are eligible to be listed in the National Register of Historic Places. If the agency determines that the structure is eligible to be listed on the National Register, it is obligated to treat the property according to the Secretary of the Interior's Standards for the Treatment of Historic Properties and to maintain its character defining features. These standards were established as a part of the National Historic Preservation Act and provide guidelines for the preservation, rehabilitation, restoration, and reconstruction of historic structures and buildings. Generally, the Standards establish that whenever possible and during any project, the historic integrity of the site must not be disturbed. There are seven aspects of historic integrity, at least five of which must be preserved to determine integrity is retained in an existing historic structure: location, setting, materials, design, workmanship, association, and feeling.

To determine if a building is eligible to be on the National Register of Historic Places, it must meet at least one of four criteria in addition to possessing at least five aspects of integrity. To meet Criterion A, the building must be "associated with events that have made a significant contribution to the broad patterns of our history." Criterion B requires that properties be "associated with the lives of significant persons in our past." To meet Criterion C, properties must "embody the distinctive characteristic of a type, period, or method of construction, or that represent the work of a master, or that possess high artistic values, or that represent a significant and distinguishable entity whose components may lack individual distinction." Properties that meet Criterion D must "have yielded or may be likely to yield, information important in history or prehistory."[23]

Additionally, properties that maintain integrity and meet one of the Criterion for eligibility must also be distinctive examples within their contexts. For example - a ranger station can have integrity and be a distinctive example of a standard plan in the Forest Service, but what if there are 15 others just like it? This can be challenging when working in scopes that are particularly large with homogenous building types, such as in the Forest Service. Luckily, agencies like the Region 6 of the Forest Service have developed Historic Context Statements to help identify what characteristics not only make historic buildings integrous and eligible according to the Criteria, but also distinctive amongst their type within a context. In Region 6, two historic contexts have been developed to aid in determining if buildings are eligible for listing in the National Register of Historic Places. They are *Utility and Service Combined with Beauty: A contextual and Architectural History of USDA Forest Service Region 6: 1905 - 1960* by Kay Atwood, Sally Donovan, Dennis Gray and Ward Tonsfeldt and *Beyond Rustic: Wartime and Mid-Century Administrative Facilities of the USDA Forest Service Pacific Northwest: 1941-1970* by Rachel Klein.

Nearly all buildings on National Forest land are significant under Criterion A for their association with the development of the United States Forest Service. However, to be considered eligible to be listed on the National Register of Historic Places, buildings must be significant when compared to similar buildings from their time period. That is,

[23] National Park Service, "National Register Bulletin 15: How to Apply the National Register Criteria for Evaluation," 1990, https://www.nps.gov/nr/publications/bulletins/nrb15/.

within the scope of historic buildings that are all eligible for Criterion A, a building must meet an additional Criterion to be considered eligible. Many buildings at Trout Lake and throughout the Forest Service not only meet Criterion A, but also Criterion C as distinct examples of types, periods, and methods of construction. By using the historic context statements for Region 6, *Utility and Service Combined with Beauty* and *Beyond Rustic,* the buildings at Trout Lake can be compared to similar buildings from their time periods throughout Region 6. Since they all meet Criteria A, then if they also meet Criteria C, maintain integrity, and are distinctive/representative examples of their type within the scope of Region 6, they are eligible for listing on the National Register of Historic Places.

Is this Building Eligible for listing in the National Register of Historic Places? Does the building meet Criteria A and C? Does is maintain integrity of design, materials, location, setting, workmanship, association, and feeling (Has it been altered or moved)? Is it a representative example of its type as outlined in *Utility and Service Combined with Beauty* and *Beyond Rustic?*

Determining if a Building is Eligible for Listing in the National Register of Historic Places

One case study building from each period at TLAD is identified below for its eligibility for listing in the National Register for Criteria C. Because the buildings are significant for C, or their distinct architectural qualities, it is important that any interventions into the building envelope maintain their physical character defining features. The following identifies these case studies and their character defining features, which embody not only their historic significance but the historic significance of other buildings of the same ilk throughout Region 6 of the Forest Service.

Eligible Buildings from the Custodial Management Period (1912 - 1932)

There are three buildings at Trout Lake Administrative District from the Custodial Management Period of the Forest Service. The Barn #2400 (Image 7), built in 1920, is a particularly unique structure. Its character defining features include its gambrel roof, flared eaves, cedar shingle roof, and four-light fixed windows along each of its sides. It is a vernacular style building and likely one of the only barns of its kind left on Forest Service land in Region 6. Very few modifications have been made to the barn over its 100-year lifespan. It is listed individually as a Representative Example of Administrative Buildings from the Custodial Management Period in *Utility and Service.* As such, it is eligible for listing in the National Register of Historic Places.

The two residences, #1004 and #1002, are both potentially significant because they are at least 50 year of age and possess high levels of integrity. Both are uses seasonally by summer staff for the Gifford Pinchot National Forest. Because of its potential for energy upgrades and expanded year-round use, Residence #1004 will serve as the case study from the Custodial Management Period. Residence #1004 may be exceptionally significant, having been built out of a Forest Service standard plan book from 1908, representative of the architectural character of the small stock of existing

Image 22: Character Defining Features of #1004 include decorative brackets, horizontal siding, and original wood windows.

buildings from this time period, only 216 in Region 6 (see Figure 2). The character defining features of #1004 include single-pane, double hung and fixed wood-framed windows, exposed rafter tails, eave overhangs, horizontal clapboard siding, and a partial front porch (Image 22).

Eligible Buildings from the Depression Era (1933 - 1941)

Image 23: Replacement vinyl windows on Residence #1001

There are 14 buildings from the Depression Era at Trout Lake Administrative District. All the buildings are emblematic of construction project completed by the Civilian Conservation Corps during the Great Depression, with horizontal clapboard or cedar shingle siding, multi-light windows, exposed rafter tails and decorative brackets. A few buildings have had alterations that negate their eligibility for listing in the Nation Register of Historic Places. For example, Residence #1001 has several replacement vinyl windows that negatively impact the historic fabric of the building (Image 23).

Residence #1300, originally housing for CCC crew leaders, has had its original roof replaced with a standing seam metal roof (Image 24). However, because Residence #1300 is entirely underutilized by the Forest Service and lacks any energy efficiency treatments, and because of its high level of significance, it will serve as the case study from the Depression Era. Character defining features of Residence #1300 include six-light awning windows along its sides and four-light awning windows on its front elevation, cedar shake siding, exposed rafter tails, and its front gabled roof with linear building massing.

Image 24: Building #1300 at Trout Lake, built in 1936 now has a replacement standing-seam metal roof.

Eligible Buildings from the WWII and Postwar Period (1942 - 1969)

There are ten buildings from the WWII and Postwar Period at Trout Lake. According to *Beyond Rustic,* buildings from this time period are potentially significant for "their direct association with rising environmental legislation and the Forest Service's expanding emphasis on multiple uses, which diversified the agency's programs and considerably grew its professional workforce." Several of them were created from standard plans developed by regional architects A.P. DiBenedetto, P.W. Carter, K.R. Reynolds, and others in the 1960s, including #1306, #1307, #1308, #1019, #2018, and

#1014. These standard plans reflect several developments in the Forest Service's building program, including compliance with federal guidelines for building style and cost, expanded scope of land use within the agency, and sensitivity to popular regional home styles such as the Ranch, with wide profiles, attached garages, and low-pitched roofs.

The buildings at Trout Lake from the Mid-Century and Postwar Period vary in their level of historic integrity. Ironically, newer building materials such as aluminum window frames have oftentimes been more swiftly replaced by vinyl than their older, wooden counterparts. Unfortunately, nearly all these building have had their windows replaced or have has their massing enlarged, including #2018, #1306, #1307, #1308, and #2001 (Image 25). For these reasons, they are ineligible for listing in the National Register.

Image 25: Barracks Building #1307 in 1966, top (Image source: Beyond Rustic) and 2019, bottom. Note replacement standing seam metal roof and vinyl windows

However, some of the building from the Mid-century and Postwar Period do possess historic integrity. *Beyond Rustic* makes accommodations for the cyclical nature of more modern building types in the Forest Service, stating that "new paint, new roofing material, moderate changes to materials; or additions that do not alter the original building form" may not necessarily affect integrity.[24] Buildings #1019, built in 1963 and 1964, has had its original asphalt roof replaced with a standing seam metal roof, but retains its original aluminum windows (Image 26). It is in in their original location, with attached garages along a curvilinear road in the compound, which reflect the suburban influence from the 1960s. Because of its underutilization and potential for energy efficiency upgrades, Residence #1019 will serve as a case study from the WWII and Postwar Period. Its character defining features include its aluminum-framed sliding windows, original wood garage door and front door, T1-11 siding, and rectangular massing.

Image #26: Residence #1019, built in 1963.

[24] Klein, *Beyond Rustic,* 107.

Chapter 3: Energy Efficiency

History of Energy Efficiency in Buildings

Historic buildings from before the time of mechanical heating and cooling systems are the original energy efficient buildings. With climate control and lighting systems built into design, historic buildings set an example for how new construction can reduce its reliance on mechanical systems for climate control.[25] For example, houses in the hot and humid Southeastern United States featured deep porches that shaded the nearly the entire building enclosure from direct sunlight and excessive heat. In the Southwestern United States, Adobe homes have thick walls of natural clay which acts as insulation to keep houses cool in the summer and warm in the winter.[26] In early architecture in the Pacific Northwest, full log walls provided a thermal mass that acted as insulation. Cupolas allow hot air to rise to the top of a building and be expelled.

Historic building materials and construction methods accounted for the effects of weather, the only option to control the climate before engineered heating and cooling systems. However, in the early part of the twentieth century, modern mechanical systems fueled by electricity or natural gases were introduced intro the control of building temperature and comfortability. Until the 1970s, Americans freely consumed a bountiful and affordable energy supply to heat and cool houses.[27] During the 1930s to 50s, new homes with expansive windows were created with no consideration for their excessive energy requirements. For example, the infamous glass-walled Farnworth

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[25] Banham, Reyner., *The Architecture of the Well-Tempered Environment,* (Chicago: University of Chicago Press, 1984) 23.
[26] Hensley, Jo Ellen, and Aguilar, Antonio, "Preservation Brief 3: Improving Energy Efficiency in Historic Buildings."
[27] Johnston, David and Kim Master, *Green Remodeling: Changing the World One Room at a Time, (*Gabriola Island, BC, Canada: New Society Publishers, 2004), 77.

House, designed by Mies Van der Rohe in 1951 and considered foundational to Modernist home design was uncomfortable to inhabit in both the summer and winter due to unrestricted heat flow.[28] Mid-century building designs reveal the naivete of unlimited energy consumption – large, single-pane plate glass walls allowed for the free transfer of thermal energy, for better or worse. While energy was cheap and seemingly endless in the first half of the twentieth century, it wasn't long before the consequences of the high energy output to heat and cool these designs became apparent.

Nationwide notions to conserve energy did not become widespread until 1973, when the Organization of Arab Petroleum Exporting Countries put an embargo on oil exports to countries around the world, including the United States. The nation's vulnerability to natural gas supplies became apparent when the price of an oil barrel jumped from $3 to $12.[29] This energy crisis prompted regulations that curbed the unabated use of natural gas for energy in the country, and the concept of energy efficiency was born. In the following decades, Americans began investing in renewable energy sources and energy efficient appliances, cars, and homes. In response to the energy crisis, the American Society of Heating, Refrigerating, and Air-Conditioning Engineers (ASHRAE) first published their Standard 90.1, Energy Conservation in New Building Design in 1975. For many architects and engineers, this was a herald of the coming age of balance between building design and energy efficiency.

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[28] Williams, James J., *Living with Nature: the Farnsworth House and the Environmental Successes and Failures of Modernist Architecture,* Master's Thesis, University of Cincinnati, 2015, 91.
[29] Alliance to Save Energy, *The History of Energy Efficiency,* Alliance Commission on Natural Energy Efficiency Policy, https://www.ase.org/sites/ase.org/files/resources/Media%20browser/ee_commission_history_report_2-1-13.pdf, January 2013, 4.

The concept of energy efficiency in buildings predated the energy crisis of 1973. In the 1950s, the Housing and Home Finance Agency, predecessor to the U.S. Department of Housing and Urban Development, created residential energy conservation standards to decrease the number of mortgage defaults due to high utility bills.[30] As early as 1976, the federal government began offering financial assistance and programs to decrease, audit, and understand their homes' energy consumption. In 1976, the Energy Conservation and Production Act began a funding program for low-income households to weatherize their homes with weather stripping and caulking and to subsidize their energy bills. The U.S. Department of Energy still has a Weatherization Assistance Program for low-income households, which utilizes digital energy output analysis tools, upgrades thermostats, retrofits ducts, heating, and water papers, installs energy efficient appliances, and more.[31] The federal government also manages the Energy Star program, which gives recognition to appliances and buildings that are energy efficient. Soon after the energy crisis of 1973, the federal government has also offered tax credits for energy conservation in households and for the use of energy-efficient appliances.[32]

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[30] Alliance to Save Energy, *The History of Energy Efficiency,* 9.
[31] U.S. Department of Energy Office of Energy Efficiency and Renewable Energy, "Weatherization Works!", https://www.energy.gov/sites/prod/files/2018/06/f52/EERE_WAP_Fact%20Sheet-v2.pdf.
[32] Alliance to Save Energy, *The History of Energy Efficiency,* 12.

Following the energy crisis of 1973, controlling energy efficiency in buildings revolved around maintaining the airtightness of a building, from insulation to triple-paned windows. Innovators also began to explore the notion of "Zero-Energy" houses in residential design. In 1973, Professor Vagn Korsgaard designed the first "zero-energy" house, using passive solar design and solar panels. In 1974, the Philips Experimental House in Germany explored the possibility of energy reduction through renewable energy sources such as ground heat exchangers and solar technologies. In 1994, architect Rolf Dish designed the Heliotrope, the first building in the world to produce more energy that it used through solar panels, geothermal heat exchangers, and more (Image 27).[33]

Image 27: Heliotrope, the first positive-energy building, designed by Rolf Disch in 1994. Freiburg im Breisgau, Germany.

Today, building energy codes are the primary driver behind energy savings. Most recently, the American Recovery and Reinvestment Act of 2009 required states to adopt a high standard of building energy efficiency before receiving funding through a State Energy Program.[34] The private sector also developed programs to encourage and quantify the energy efficiency of buildings, such as Leadership in Energy and

[33] Ionescu, Baracu, Vlad, Necula, and Badea, "The Historical Evolution of the Energy Efficient Buildings," *Renewable and Sustainable Energy Reviews* 49 (2015): 243-53, 249.
[34] Alliance to Save Energy, *The History of Energy Efficiency,* 9.

Environmental Design (LEED) and the Home Energy Rating System (HERS). Both programs promote and facilitate reducing energy consumption in residential and commercial buildings. According to the Alliance for Energy Saving, the United States has decreased energy consumption since the 1970s, despite the overwhelming increase of energy-hungry items, from airplanes to hair dryers.

The art of designing a sustainable new building has come full circle. Basic concepts found in historic buildings, such as cupolas, awnings, thermal mass walls, and natural daylight have resurged in modern energy efficient design. While not completely rejecting modern HVAC systems and insulation, sustainably minded architects have sought to decrease dependency on modern systems that require high energy consumption by capitalizing on the sun's energy and daylighting. These fundamentals have created a positive outlook for the future of building construction, although it still leaves us with a dearth of building with less than optimal comfort and energy efficiency levels in need of revisiting, maintenance, and retrofits.

Benefits of Energy Efficiency in Historic Buildings

Despite nearly 70 years passing since the Housing and Home Finance agency introduced energy conservation in buildings to reduce utility costs, building demolition, construction, and operation continue to constitute a high proportion of the energy used in the United States today. Architecture 2030, an initiative of the American Institute of Architects seeking to empower the building sector to reach net zero carbon emissions by 2030, estimates that 30% of all carbon emissions globally come from the building sector -10% from building construction and 20% from building operations.[35] The United States Department of Energy has estimated that 37% of all energy consumption in building operations can be attributed to space heating and cooling.[36] These numbers are inflated in historic buildings, where single-pane windows, lack of insulation, poor weather stripping, and other issues cannot keep up with the output of modern HVAC systems, leading to the persistent use of those systems. The U.S. Energy Information Administration estimates that buildings constructed before 1950 are 30-40% less energy efficient than building constructed after 2000.[37] Fortunately, sensitive upgrades to historic building envelopes can nearly double the energy efficiency of historic buildings, making them more comfortable to inhabit, more useful, and more likely to be preserved.

The Fire Warehouse at Trout Lake Administrative District demonstrates how energy efficiency treatments can give historic buildings new life (Image 28). Originally constructed to house fire engines and equipment, the light timber framed walls were designed without insulation. It has undergone a complete energy efficiency retrofit, including double paned in-kind replacement wood windows, and installation of interior walls with insulation. The building is now used for fire management office space. The insulation

Image 28: Building #2200, Insulated and Weatherized Fire Warehouse now an Office

[35] "Embodied Carbon," Why the Building Sector?, Architecture 2030, http://dev-architecture-2030.pantheonsite.io/existing-buildings-operation/.

[36] D & R International, *2011 Energy Databook,* (U.S. Department of Energy: Pacific Northwest National Laboratory: 2012), 22.

[37] Hensley, Jo Ellen, and Aguilar, Antonio, "Preservation Brief 3: Improving Energy Efficiency in Historic Buildings."

has changed the interior character of the building, and the historic glazing has been replaced, both negatively affecting the historic character of the building. However, because of these energy efficiency upgrades, this building has gone from unused to completely renewed, ensuring its continued Preservation Through Use (Image 29). This building serves as an excellent example of energy efficiency projects that have transformed lifeless historic buildings into priceless heritage structures that will continued to be used and appreciated for generations.

Image 29: New interior walls and insulation in Building #2200 have rendered the defunct warehouse useful again.

Making historic buildings more comfortable to inhabit and giving them modern uses reduces the chances that they will be demolished and replaced with a new building. Reusing existing buildings is akin to recycling on a gigantic scale. Nearly 10% of global carbon emissions come from the demolition of an existing building and replacement with new construction. Not only is new construction intensive in terms of carbon emissions and new materials, but because of the physical waste and embodied energy that disappears with the existing building. Embodied energy represents the amount of labor, transport, extraction, processing, and construction that was used to create a building. Demolition of a 50,000 square foot building creates nearly 4,000 tons of waste and 80 million BTUs (British Thermal Units), equivalent to 640,000 gallons of gasoline. Demolishing 50,000 square feet of an existing building negates the positive environmental impacts of recycling nearly 15 million aluminum cans.[38]

[38] Green Preservation Charleston, "Recycling Buildings: Preservation & Energy Conservation," accessed May 7, 2019, https://www.preservationsociety.org/green/RecyclingBuildings.php.

Historic buildings provide powerful solutions to this environmental issue. Adaptive reuse of existing buildings can save anywhere from two to six times the amount of carbon emissions produced from demolition and new construction.[39] The reuse of historic buildings can dramatically decrease, if not eliminate, the 10% of carbon emissions, worldwide that come from building construction. In *The Greenest Building: Quantifying the Environmental Value of Building Reuse*, the National Trust for Historic Preservation's Preservation Green Lab put forth that "… Opportunities to gain carbon and other environmental savings through building reuse and retrofit remain poorly understood." By reusing historic buildings in the National Forests, the USFS can reduce its carbon footprint from new construction. By introducing energy efficient upgrades to historic buildings thereby lowering their operational and environmental costs, the USFS will create a larger stock of historic buildings that are able to be used by both the agency and the public. By pioneering energy efficiency treatments in historic buildings, the USFS can position itself as a leader in historic building maintenance, adaptive reuse, and resilience.

[39] Preservation Green Lab, "Executive Summary," *The Greenest Building: Quantifying the Environmental Value of Building Reuse*, Seattle: Preservation Green Lab, 2012.

Energy Efficiency Guidelines

There are many methods to increase the energy efficiency of existing buildings that range in price, intervention level, and reversibility. There are two primary routes to take when upgrading the efficiency and comfortability of historic buildings. The first is to weatherize the building envelope, controlling air movement into, out of, and inside of the thermal envelope of the building. The second is to replace and improve the mechanical systems that heat and cool the building. In order to address energy efficiency upgrades that typically affect the historic character of buildings, this project will focus on weatherization.

Weatherizing a building relies on limiting the amount of hot and cool air that travels between the interior and exterior of the building envelope. Hot air can infiltrate and leak out of buildings in three ways. The first way is through convection, or the simple process of air infiltration or leakage. The second way that energy can be wasted is by battling radiation, in which sunlight can radiate in through windows. The third way that heat enters or exits the house is through convection, or the transfer of heat from molecule to molecule.[40] Air infiltration and leakage, solar radiation,

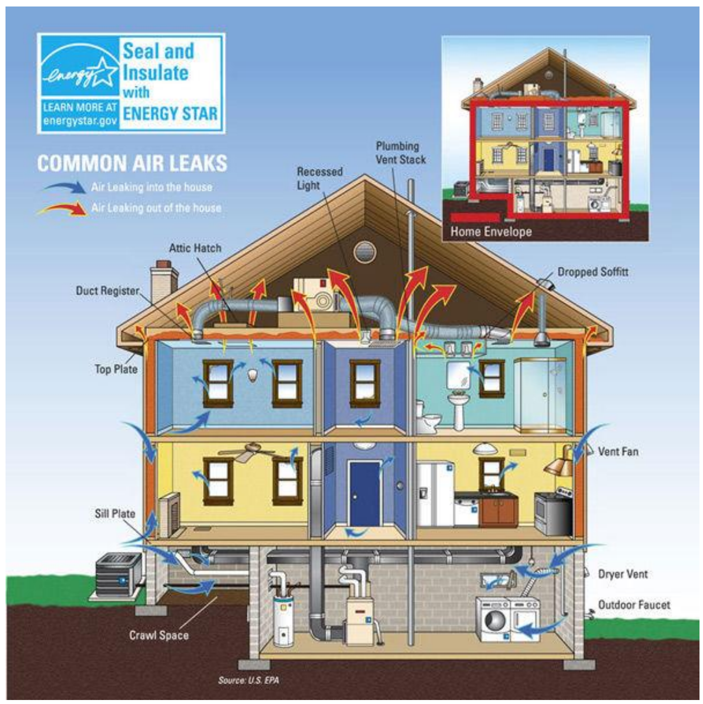

Image 30: Air leakage and the Stack Effect inside a home. Source: Energystar.gov

[40] Johnston and Master, *Green Remodeling,* 233.

and convection bring air into the house through all aspects of the building envelope, including basements, windows, air ducts, walls, vents, and more. Image 30 provides a diagram of how cool air can move into a house, forcing warm air up and out of openings and uninsulated attics. This creates a cycle of air transfer through the house, in which the warm air moving upwards creates a vacuum that draws more cool air into the house, known as the stack effect.

There are many ways to limit the stack effect and weatherize a home. These include sealing air leaks, adding insulation, sealing ductwork, replacing windows, new roofs, and more. However, not all methods and manners of weatherizing a building can be appropriate for a historic building. For example, while adding insulation to interior walls can decrease the air leakage from a building, it can cause a variety of issues by trapping moisture inside of walls, especially when moisture barriers trap water near historic materials. This can lead to deterioration of materials like paint or mortar and require more maintenance, or more seriously, to the deterioration of historic and structural wood and masonry (Image 31).[41]

Image 31: Damage to Masonry from over insulating. Image: NPS Preservation Brief 3.

[41] Hensley, Jo Ellen, and Aguilar, Antonio, “Preservation Brief 3: Improving Energy Efficiency in Historic Buildings.”

Adding insulation to interior walls can also dramatically affect the historic character of a building. Not only can it cause damage to historic woodwork and plaster, but widening walls affects the profile of interior trims (Image 32). For these reasons, the decision to insulate a historic building should be taken with great care. Interior walls in historic buildings should be insulated only after unfinished basements and attics, both of which will contribute significantly to limiting the stack effect.

Image 32: New interior walls negatively impacted the historic character of this building. Image: NPS Preservation Brief 3.

Certain methods of insulating building walls are also not recommended because they affect the exterior historic fabric of the building. Replacing historic siding to introduce new insulation or drilling holes to blow in new insulation both negatively affect the historic fabric of a building (Image 33). Instead, siding can be removed to blow in insulation and then put back in place. This can insulate a historic building while causing the least amount of damage to historic walls.[42]

Image 33: "Drill and Fill" Insulation can damage historic exteriors. Image: NPS Preservation Brief 3.

[42] Hensley, Jo Ellen, and Aguilar, Antonio, "Preservation Brief 3: Improving Energy Efficiency in Historic Buildings."

Energy-savvy building owners are also quick to replace historic wood windows with new, double-paned, vinyl-framed windows that boast high energy efficiency ratings and resistance to radiation and convection. However, vinyl is not an appropriate material for historic buildings and can negatively affect a building's historic character (Image 34). In addition, vinyl windows will only last 20-30 years and cannot be repaired or recycled, creating a cycle of constant replacement. Vinyl windows can also warp dramatically, creating openings and leading to rapid failure and degradation of adjoining materials (Image 35).

Image 34: Historic wood windows (bottom left) and replacement vinyl window (bottom right) shows negative impact of vinyl windows to historic character

Introducing energy efficiency treatments into historic buildings can have many consequences. Introducing modern HVAC systems can be futile without proper complimentary upgrades to the building envelope in order to retain the thermal temperature and control – heat or cool air that is generated will simply leak out of cracks in older windows or uninsulated attics. Natural materials such as stone, brick, mortar, and wood can perform in service for centuries, however, when moisture infiltrates the building enclosure because of over-insulation or improper use of vapor barriers, natural materials quickly degrade. Moisture breaks down the structural integrity of stone, brick, mortar, and wood. Moisture also

Image 35: Replacement vinyl frame around wood window on Building #2200 at Trout Lake – warping after just 10 years in service.

allows for insects, molds, and fungi to infiltrate the material and expedite decay. This decay can lead to structural failure and destruction of historic building fabric. Additionally, when modern materials replace historic ones, a buildings' historic character can also be compromised. New modern materials can also create a cycle of replacement rather than rehabilitation, as modern building materials such as vinyl are often not repairable.

Top 3 Most Cost-Efficient Energy Efficiency Upgrades for Historic Buildings in Region 6

There are many tests and monitoring systems that can be put in place to assess how a building is losing energy, such as blower-door tests which monitor where air is leaking out of the building.[43] However, in lieu of costly and time-intensive tests that illustrate how building is losing heat, the Forest Service could benefit from using funds instead to install energy efficiency upgrades by making assumptions about the most commonly recognized areas of energy loss. According to the U.S. Department of Energy, air leakage is one of the greatest sources of energy loss in a home.[44] The

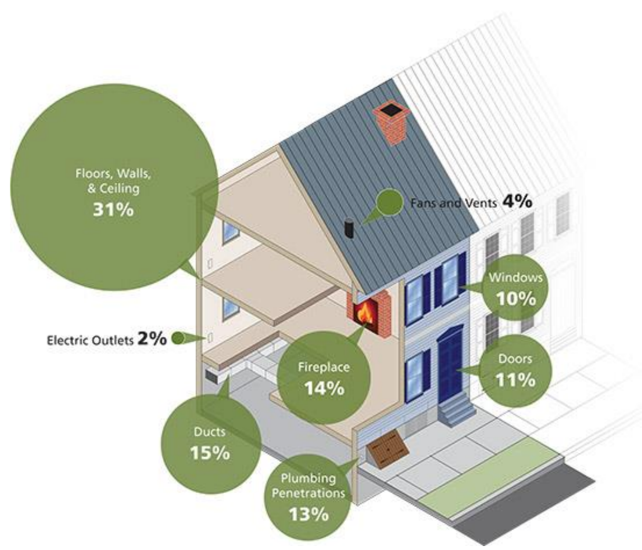

Image 36: Common sources of air leakage in a home. Source: NPS Preservation Brief 3.

[43] Cluver, John H., and Randall, Brad, "Saving Energy in Historic Buildings: Balancing Efficiency and Value", in *Planning for Higher Education* 40, no. 2 (2012): 6.
[44] US Department of Energy, Energy Savers Booklet, http://www1.eere.energy.gov/consumer/tips/pdfs/energy_savers.pdf, 6.

National Park Service Technical Preservation Services' *Preservation Brief 3: Improving Energy Efficiency in Historic Buildings,* states that 31% of air escapes from buildings through floors, walls, and ceilings, 21% through windows and doors, 14% through fireplaces, and 24% through mechanical penetrations in the building envelope such as ducts, plumbing, and vents (Image 36).

The following guidelines provide treatment recommendations for commonly known sources of the greatest energy loss in buildings: windows and doors, openings, and floors, walls, and ceilings. Through all these opportunity areas, air leaks in and out of buildings in three ways. The first way is through convection, or the simple process of air infiltration or leakage. This can be controlled through weather stripping and sealing. The second way that energy can be wasted is by battling radiation, in which sunlight can radiate in through windows. Radiation can be controlled through sunshades, awnings, blinds, or low-emissivity coatings on window glazing. The third way that heat enters or exits the house is through convection, or the transfer of heat from molecule to molecule. This can be controlled through insulation of walls and air space barriers in windows.[45] Insulation is vital to limit the flow of air through a building envelope and to resist the influence of outside temperature on the interior of a building. The following guidelines provide information on cost, benefits and drawbacks, appropriate uses, and approximate energy savings for weather stripping, window options, and insulation.

[45] Johnston, David and Kim Master, *Green Remodeling: Changing the World One Room at a Time, (*Gabriola Island, BC, Canada: New Society Publishers, 2004), 233.

Climate Considerations: Western vs. Eastern Oregon and Washington

Oregon and Washington are divided along a north-south axis by the Cascade Mountain Range. The climate is dramatically different on both sides. The western side of the Cascade Range is characterized by wet winters and dry summers, with generally low to sea-level elevation and moderate year-round temperatures. The average annual temperature is between 37 and 58°F, with an annual precipitation of 79 inches. On the eastern side of the Cascade Range the average elevation is between 2,000 – 4,000 ft. The climate is arid, with dry summers and cold winters. The average annual temperature ranges from 36 to 65°F, with an average annual precipitation is 14 inches.[46] However, many of the National Forests are along the Cascade Mountain Range, where the average weather is much harsher in the winter than on the western or eastern sides. Trout Lake is at an elevation of 1,800 ft., with an annual average temperature between 35 and 59°F, and an annual precipitation of 45 inches. For the purposes of insulation, the area west of the Cascade Range is in the Department of Energy's Zone 4, and the area east of the Cascade Range is in Zone 5.[47]

To compare the relative return on investment for energy efficiency window treatments, the National Trust for Historic Preservation's publication *Saving Windows, Saving Money* provides a comparison for the return on investment (ROI) for different window treatments in Portland, Boston, and Phoenix. Portland is a representative city of most areas in Oregon and Washington west of the Cascades, with average annual temperatures between 45 and 63°F, and average precipitation at 35 inches. Boston has

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[46] Radivojevic, Suzana, and Alex McMurry, "Protective Treatments for Western Red Cedar Shingle and Shake Roofs," Washington State Parks and Recreation Commission, April 16, 2019.
[47] EnergyStar.gov, "Recommended Home Insulation R-Values", accessed May 9, 2019, https://www.energystar.gov/index.cfm?c=home_sealing.hm_improvement_insulation_table.

an annual average precipitation of 53 inches a year, an average high temperature of 60.4°F and a low of 45°F, making it an apt comparison to Trout Lake and the climate within or on the western and eastern slopes of the Cascade Mountain Range.[48] Phoenix has an annual average temperature of 63 to 87°F, and an average precipitation of 8 inches.[49] While Phoenix is warmer and drier than the average weather for the eastern side of the Cascade mountains, it does share a similar number of sunny days and can serve as a comparison to the eastern Cascades, with consideration for these variations.

The National Trust for Historic Preservation's Research and Policy Lab, formerly known as Preservation Green Lab, conducted a study of different energy efficiency treatments in various cities throughout the U.S. and found that despite highly varied climates, reducing air leakage and thermal energy transfer through windows can provide high energy savings comparable to replacement windows in historic homes. The study concluded that insulating cellular shades combined with exterior storm windows, interior storm windows, and exterior storm windows were the most cost-saving energy efficiency treatments for historic windows, often meeting or exceeding the energy performance of replacement windows (Figure 4).

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[48] NOAA Climate Data, "Annual Climate Report: Boston, MA," accessed May 6, 2019, https://w2.weather.gov/climate/index.php?wfo=BOX.
[49] NOAA Climate Data, "Annual Climate Report: Phoenix, AZ," accessed May 6, 2019, https://w2.weather.gov/climate/index.php?wfo=BOX

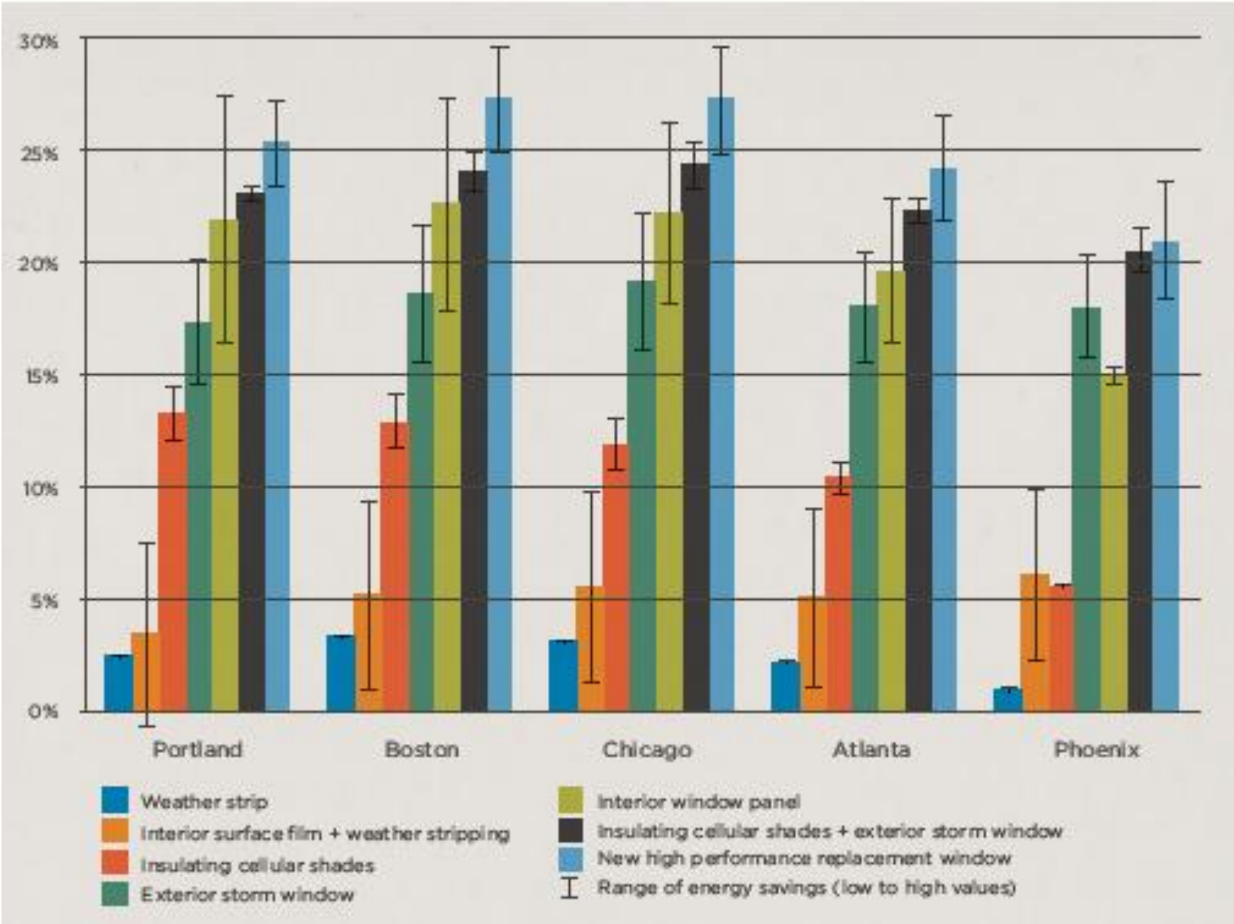

Figure 4: Energy Savings for Window Energy Efficiency Options. Source: National Trust for Historic Preservation Green Lab, "Saving Windows, Saving Money"

However, when the cost of energy efficiency treatment is considered, weather stripping, interior and exterior storm panels, and interior cellular shades provide a greater return on investment (ROI) than replacement storm windows. Figures 5, 6, and 7 illustrate these points. It is important to note that in these figures the ROI for weather stripping includes the cost of professional installation. Figure 8 shows that with DIY installation, weather stripping provides the highest return on investment of any of the treatments.

The National Trust study also found differences between the ROI of certain window energy efficiency treatments in the highly varied climates of Portland, Boston, and Phoenix. Interior window panels provided a greater return in Boston, while exterior storm windows provided a greater return in Phoenix. Surface films on windows were remarkably more effective in Phoenix, whereas interior cellular shades were more effective in Boston. While weather stripping proved to have the lowest return on investment in all three cities in this study with professional installation, installing weather stripping without a professional's help increased the ROI in Phoenix to 30% - despite these differences, all methods of energy efficiency upgrades tested in the study were more cost effective and provided a greater ROI than new, high performance replacement windows. Repairing and treating historic wood windows not only preserves the historic character of a building but provides similar energy efficiency with significantly higher return on investment than replacement windows.

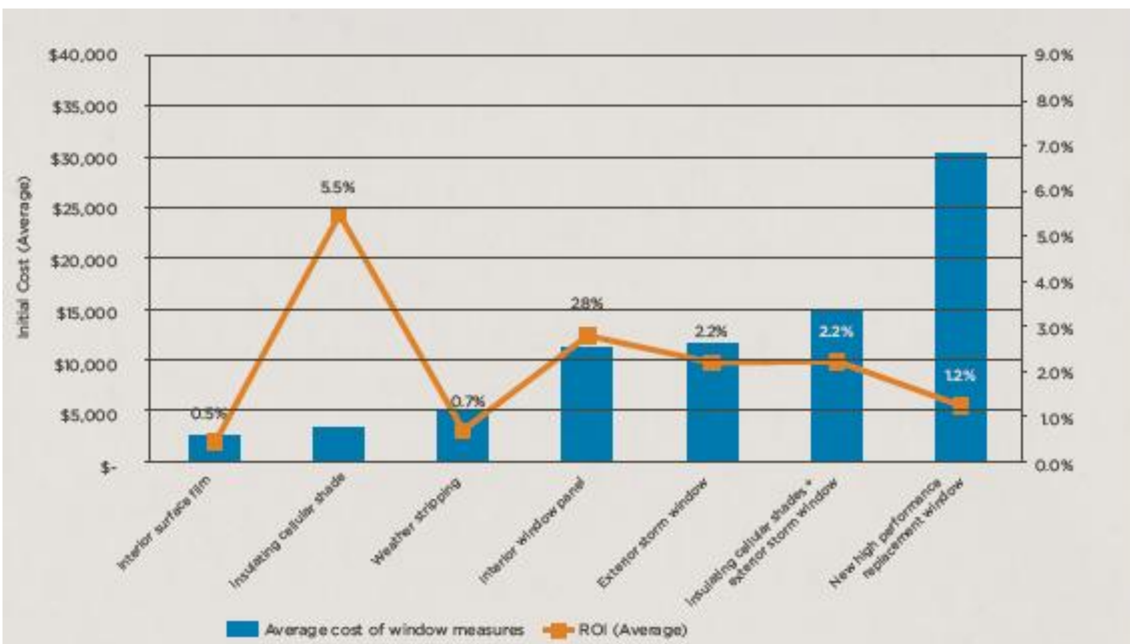

Figure 5: Cost vs. Return on Investment for Window Energy Efficiency Treatments in Portland. Source: Saving Windows, Saving Money

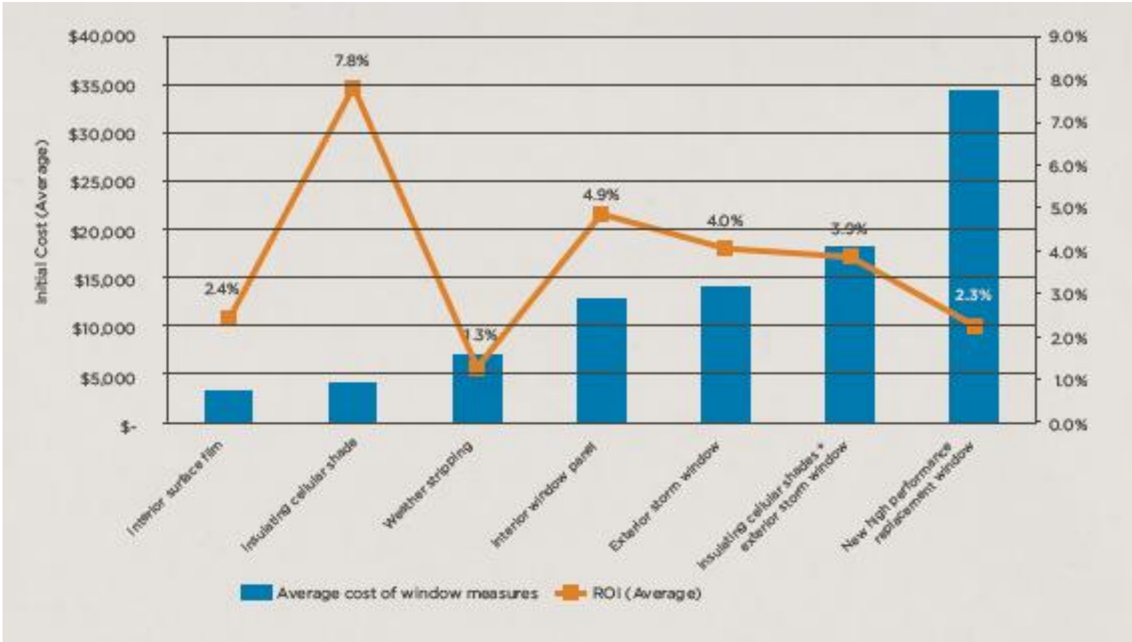

Figure 6: Cost vs. Return on Investment for Window Energy Efficiency Treatments in Boston. Source: Saving Windows, Saving Money

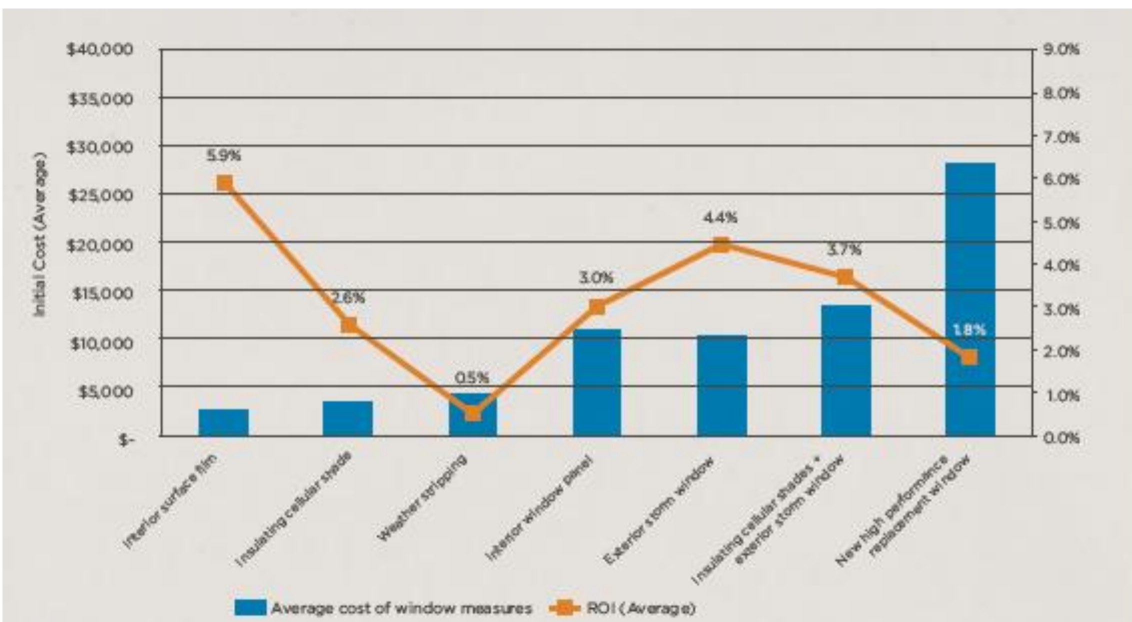

Figure 7: Cost vs. Return on Investment for Window Energy Efficiency Treatments in Phoenix. Source: Saving Windows, Saving Money

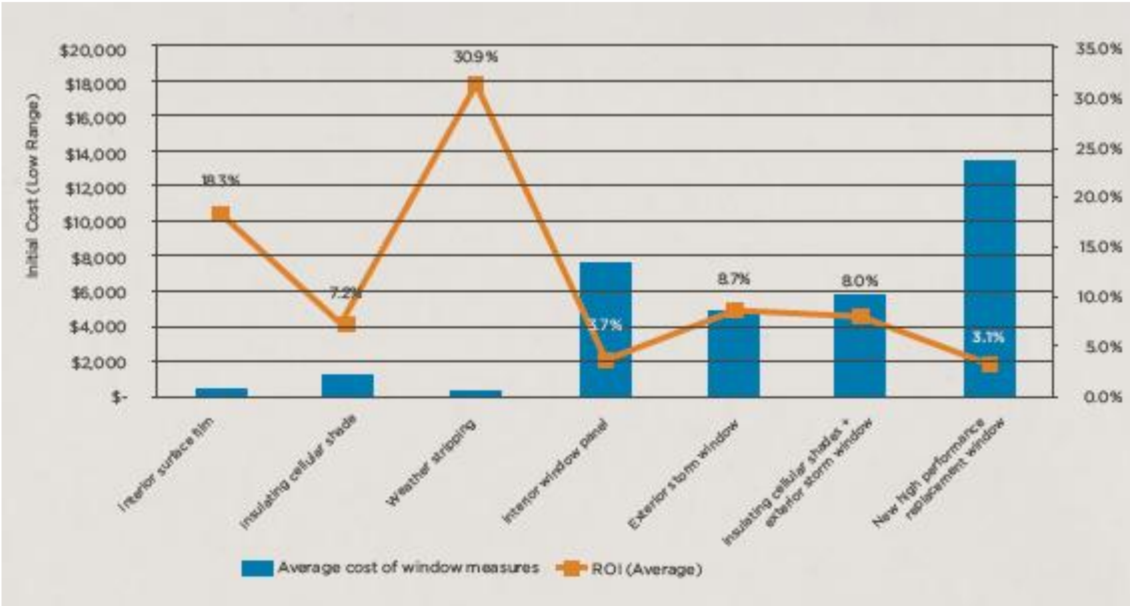

Figure 8: Cost vs. Return on Investment for DIY Installation in Phoenix

Energy Efficiency Treatments

The following are energy efficiency treatment recommendations for historic Structures in the National Forests of Oregon and Washington. Each treatment provides material recommendations, cost estimates, best uses, benefits and drawbacks, efficacy level for climate, effect on character defining features, as well as level of treatment according to the Secretary of the Interior's Standards for the Treatment of Historic Properties. Material recommendations are those which are the most compatible with historic fabric and/or the least intrusive. Cost estimates are given on a case-by-case basis, acquired through online research or directly from companies who perform the type of work. Benefits and drawbacks address reversibility, installation costs, and maintenance requirements of each treatment.

Weather Stripping

As outlined above, when installed without installation fees, weather stripping will provide a greater return on investment than all other interventions to the building envelope.[50] Weather stripping addresses the issue of air infiltration/leakage in a building, which can make a building draftier, less comfortable, as well as account for 5 to 40 percent of all heating and cooling costs in a building.[51] A ¼" crack between two 6'8" doors adds up to 20-square inch opening in the building envelope.[52] Air transfer between the interior and the exterior of the building can also trap unwanted moisture

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[50] National Trust for Historic Preservation Research and Policy Lab, *Saving Windows, Saving Money: Evaluating the Energy Performance of Window Retrofit and Replacement,* Seattle: National Trust for Historic Preservation, 2012, 11.
[51] National Park Service Technical Preservation Service, Preservation Brief 3.
[52] North Carolina Energy Office, "Caulking and Weather Stripping," March 2010, accessed May 6, 2019, https://files.nc.gov/ncdeq/Environmental%20Assistance%20and%20Customer%20Service/IAS%20Energy%20Efficiency/Opportunities/Caulk_and_Weather_Strip.pdf.

inside of roofs and insulation, leading to decay of materials.[53] When insulation has been introduced into a historic building, it is important to minimize moisture infiltration, as insulation and moisture barriers can trap water in unwanted places. Weather stripping can reduce the air leakage by 75%.[54]

Weather stripping, caulking, and sealing can save 10% on an energy bill with minimal cost and little effect on historic materials or character defining features. Weather stripping is appropriate for use in historic buildings because it is mostly not noticeable from the exterior of a building and it is completely reversible. Weather stripping is the least intrusive way to significantly increase a building's energy efficiency. The concept of weather stripping existed in the United States as early as 1838, first developed from strips of metal or rubber. Later, in the early 1900s, weather stripping was made from tubing, in which a natural material such as cloth or leather would be filled with an insulating material such as straw or yarn.[55] Modern weather stripping comes in several types and materials. Common types include spring-metal, plastic strips, compressible foam tapes, and sealant beads. Materials include felt, foams, vinyl, and metal. Different weather-stripping types may be more appropriate for houses from different time periods.

For buildings from the Custodial Management of Depression Era, weather stripping with a darker color to mimic leather or the wood of door or window frames is most appropriate. Because of the insignificant visual impact of weather stripping to the

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[53] Johnston and Master, *Green Remodeling,* 239.
[54] National Trust for Historic Preservation, *Saving Windows, Saving Money,* 25.
[55] Stuckey, Steven, "Alternative Weather Stripping for Historic Window Sash at Mount Vernon, Virginia," *APT Bulletin: The Journal of Preservation Technology* 49, no. 1 (2018): 51-58, 52. https://www-jstor-org.libproxy.uoregon.edu/stable/26452205,

historic character of the buildings and the availability of modern weather-stripping materials like rubber, vinyl, or foam are appropriate. For the bottom of doors, weather strips that slip on the door frame and match the color of the door are most appropriate because they require no drilling or permanent change to the historic door material.

Image 37: Residence #1004

Residence #1004 is slightly larger than other buildings from its time period (Image 37). It has a total of 23 windows and 3 doors. Assuming weather stripping will only be applied to either the tops and bottoms (in the case of double hung) or the sides (in the case of sliding) of each widow, there are approximately 157 linear feet that would need weather stripping. For this house, the price for 157 linear feet of foam-filled vinyl weather stripping could be as low as $50, just over $2 per window, with an additional $15 for a bottom door strip for each door, for a total of $95.[56]

[56] Home Depot, "Weather Stripping," www.homedepot.com, accessed April 7, 2019.

Residence #1300 is slightly smaller than other buildings from its time period, many of which are one-and-a-half to two stories (Image 38). #1300 has 16 windows, all roughly 2.5' x 2', and two doors. They are all awning windows and could be weather stripped on all four sides for a total of 162 linear feet of weather stripping. The price to weather strip the windows with foam-filled vinyl and put door bottoms on both doors could be as low as $100.

Image 38: Residence #1300

Image 37: Residence #1019

Residence #1019, from the WWII and Postwar Era, is of average size for buildings from its time period (Image 37). It has 10 sliding, aluminum-framed windows and two wood doors with aluminum storm doors. To weather strip the sides of all the sliding windows and doors would require approximately 90 linear feet of weather stripping. To apply weather stripping and provide two door bottoms could cost less than $75.

Weather Stripping Guidelines

Recommended Materials: Foam tape or Vinyl

Benefits: Completely reversible with no effect on the historic fabric of a building

Drawbacks: Expensive to have professionally installed

Best Uses: Offices, Residences, and Storage Sheds to limit air, water, and pest infiltration.

Climate: Effective in all geographic areas

SOI Standard: Rehabilitation

Effect on Character Defining Features: None if installed as to not be visible.

Cost Estimates:

Building	Area of Windows and Doors	Cost for Weather stripping
#1004	59 sq. ft.	$95
#1300	100 sq. ft.	$100
#1019	141 sq. ft.	$75

Insulation

Introducing insulation can reduce the "stack effect" of air inside a building, in which warm air rises through every nook and cranny in a building, creating low pressure areas in the lower parts of the house, which draws cool air in that pushes warm air out of the home.[57] This process forces the mechanical systems in a building to work harder and perform less efficiently. When appropriately applied, insulation can retain warm air inside of a building and limit the stack effect, making the building more comfortable to inhabit and more economical to heat and cool.

Heat loss from the stack effect is the greatest at the top of the building.[58] Therefore, reducing air loss in attic spaces with insulation can significantly decrease energy losses in a historic building, all the while having little to no effect on the historic fabric of a building. Conversely, cold air primarily infiltrates from lower areas of the building such as the basement, therefore insulating basements and crawlspaces can have significant advantages when trying to reduce energy consumption in a building.

Buildings constructed before the energy crisis of 1973 are likely to have been built without insulation. Since energy was so affordable, it was cheaper to use more energy that to insulate a home. Adding insulation to attic and basement spaces of historic buildings can significantly decrease their energy consumption and air leakage. However, the decision to insulate the walls of a historic building that was originally constructed without insulation should be made after careful consideration. Insulation can accelerate the decay of historic materials by trapping moisture inside of walls,

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[57] Preservation Brief 3.
[58] Hensley, Jo Ellen, and Aguilar, Antonio, "Preservation Brief 3: Improving Energy Efficiency in Historic Buildings."

making the exterior wall cladding more prone to weather, as well as permanently altering the interior spaces of historic buildings.[59] By introducing insulation, humid air from the exterior of the structure can become trapped inside the wall cavity. By insulating the wall cavity, the exterior wall no longer benefits from the warm interior wall, particularly during the winter, and is left to weather the elements with less warm, dry air from the inside leaking out. Major insulation projects can permanently alter the interior historic fabric of a building.

However, insulating a historic building can transform an underutilized building to a revitalized one, making a comfortable interior space available to a variety of new uses. By giving historic buildings renewed life, they benefit from Preservation Through Use. As the Fire Warehouse building demonstrates (see page 48), introducing insulation to a previously uninsulated structure can save a building. Introducing new interior stud-wall framing in a single-wall structure can not only allow for increased insulation, but electrical, plumbing, and other utilities, which can make a building more useful than ever before.[60] Therefore, recommendations are given on how to insulate the walls of a historic building, but only after thorough consideration, and after other less-intrusive means of weatherization are implemented first.

Insulation comes in a variety of forms and strengths. For any insulation project in historic buildings, non-permanent and easily reversible insulation types are recommended for insulating attic and basement spaces. These include batts, loose fills,

[59] Rose, William B., "Should the Walls of Historic Buildings Be Insulated," *APT Bulletin: The Journal of Preservation Technology* 36, no. 4 (2005): 13-18, http://www.jstor.org.libproxy.uoregon.edu/stable/40003158, 1.
[60] The National Trust For Historic Preservation, "Single-Wall Construction: The West's Humble (But Fascinating) Architecture," Accessed April 8, 2019. https://savingplaces.org/stories/single-wall-construction-the-wests-humble-but-fascinating-architecture/#.XKuSOFVKhjE.

or foam board insulation but exclude spray insulation, which is difficult to remove and can permanently alter historic materials. However, if the decision is made to insulate historic walls, spray insulation will likely lead to the least damage to historic materials. Natural materials are the best option from a sustainability standpoint. These include mineral wood, cellulose, or bio-based insulation.[61]

The United States Department of Energy maintains recommendations for insulation R-value, the insulation's ability to resist heat transfer based on geographic regions numbered 1- 7. For Oregon and Washington, buildings on the west side of the Cascade mountains are in region 4, with a wetter climate and low altitude, are in need insulation with a lower R-value than buildings on the east side on the Cascades mountains, in region 5, where higher elevation leads to colder temperatures in the Winter (Image 40). Most areas on the Western or Eastern slopes of the Cascade Range should follow recommendations for Eastern Cascades, due cold winter temperatures. The associated R-values for these regions are included in the recommendations below.

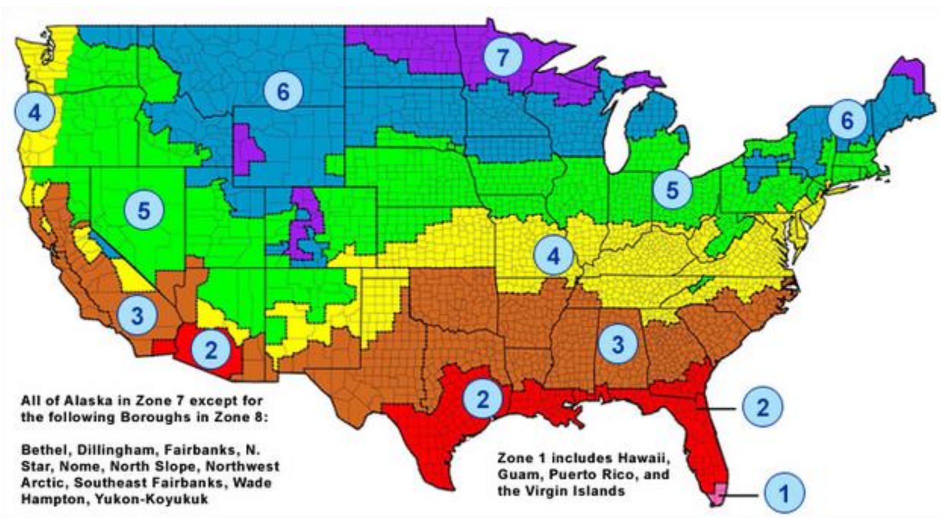

Image 40: R-value zones. Source: Energy.gov

[61] Johnston and Master, *Green Remodeling,* 238.

Option #1: Insulate Unfinished Attic Spaces

Image 41: Insulation in the attic of Building #2200

Insulate unfinished attic first (Image 41). Heat loss from the stack effect is most offensive at the top of a building, so introducing insulation that will retain rising air will be most effective in reducing the air leakage of a building. If no mechanical systems or storage is necessary in the attic spaces, insulating the attic floor, rather than the bottom of the roof, will decrease the thermal heating space of a building a reduce energy costs. However, if mechanical equipment or duct work is present in the attic space, it is important to insulate the area so moisture does not condense on the equipment. When attics roofs are insulated, all vents must be sealed to keep heat from escaping. However, when attic floors are insulated, vents will allow cold air to ventilate the area in the winter and keep it cool, preventing ice dams from building.

Buildings constructed before 1950 that have had no insulation upgrades and no mechanical equipment in the attic, such as building #1004 and #1300, would benefit from installation of fiberglass batt insulation on the attic floors. Buildings constructed after 1960, which may have had insulation upon construction, could still benefit from additional and upgraded insulation. However, due to the low pitch of the roof of #1019, it may be difficult to install batt insulation, and spray foam insulation is recommended to insulate the entire attic roof. Additionally, vapor barriers are not necessary in attic insulation projects, nor recommended for existing buildings where vapor barriers cannot act as a uniform moisture-inhibiting system.[62]

[62] Hensley, Jo Ellen, and Aguilar, Antonio, "Preservation Brief 3: Improving Energy Efficiency in Historic Buildings."

Attic Insulation Guidelines

Recommended Materials: Batt fiberglass or rigid foam insulation for high-pitch roofs, spray foam for low-pitch

Benefits: Easy to install, batt and rigid foam is easily reversible.

Drawbacks: Spray foam is not reversible as it penetrates wood.

Best Uses: Residences and Office Buildings

Climate:

Unfinished Attics West of Cascades**:** R38 to R60 insulation for attic roof, R25 to R30 on attic floor.

Existing 3-4 in. of Insulation on Roof: R38

Unfinished Attics East of Cascades: R49 to R60 insulation to roof, R25 to R30 to floor.

Existing 3-4 in. of Insulation on Roof: R38 to R49.

Effect on Character Defining Features: None

SOI Standard: Rehabilitation

Option #2: Insulate Unfinished Basement Areas

Basements also contribute substantially to the stack effect by drawing cool in air from the surrounding earth, which pushes warm air up and out of a building. Limiting air infiltration from basement spaces can significantly improve the energy efficiency performance of historic buildings. Like attic spaces, if the basement has mechanical equipment, insulating the entire basement envelope is recommended. However, in this case, all vents should be sealed and windows and doors in the basement weather stripped. If this route it taken, drainage issues on the outside of the building must be addressed first so that moisture does not infiltrate and become trapped in the basement.

More commonly, as in Residences #1004, basements will not hold mechanical equipment and it is advisable to install rigid foam insulation on the bottom or between the floor joists. Whichever insulation method is chosen for basement areas, covering any exposed dirt with a moisture barrier is recommended to limit moisture infiltration.[63]

Buildings constructed from standard plans in the 1960s, such as Residence #1019, do not have basements. Residences such as #1300, used as officer's quarters while more permanent residences were built, also do not have basements. The following applies to all historic wood-framed buildings with basements.

Basement Insulation Guidelines

Recommended Materials: Rigid Foam Insulation

Benefits: Easy to install, easily reversible.

Drawbacks: None.

Best Uses: Residences

Climate:

Unfinished Attics West of Cascades**:** R38 to R60 insulation for attic roof, R25 to R30 on attic floor.

Existing 3-4 in. of Insulation on Roof: R38

Unfinished Attics East of Cascades: R49 to R60 insulation to roof, R25 to R30 to floor.

Existing 3-4 in. of Insulation on Roof: R38 to R49.

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[63] Hensley, Jo Ellen, and Aguilar, Antonio, "Preservation Brief 3: Improving Energy Efficiency in Historic Buildings."

Effect on Character Defining Features: None

SOI Standard: Rehabilitation

Option #3: Insulate Wall Cavity

As discussed on page 53, the decision to insulate the walls of historic buildings should be done under careful consideration. Installing insulation into an existing wall cavity should only be pursued if sheathing exists between the siding and the studs, in order to limit the wetting of the insulation. To insulate the walls of uninsulated historic buildings, best practice is to carefully remove as little historic siding as necessary to apply insulation. In most cases, this means removing small strips of clapboard siding or individual shingles in shingle siding to blow spray insulation into the wall cavity. This can insulate a historic building while causing the least amount of damage to historic walls (Image 42).[64] Removing large areas of siding to install rigid foam or fiberglass batt insulation is not recommended, because it is likely that the historic materials will become damaged in the process.

Image 42: Historic Shingles are Removed and then put back after insulation is blown into wall cavity. Source: NPS Preservation Brief 3.

For buildings with clapboard siding such as #1004, removing single strips of clapboard to blow-in insulation is recommended. For building with shingle siding such as #1300, removing single shingles to blow-in insulation is recommended.

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[64] Hensley, Jo Ellen, and Aguilar, Antonio, "Preservation Brief 3: Improving Energy Efficiency in Historic Buildings."

Wall Cavity Insulation Guidelines

Recommended Materials: 3 ½" R-13 dense-packed cellulose or fiberglass[65], NOT spray foam or expanding insulation

Benefits: Upgrades thermal performance of building

Drawbacks: Not reversible nor appropriate for all historic buildings.

Best Uses: Residences and Offices

Climate: West and East of Cascades, R-13

Effect on Character Defining Features: Can damage exterior siding.

SOI Standard: Rehabilitation

Residence #1004

Insulation Area and Value	Amount of Insulation	Cost
Attic Floor, Fiberglass Batt R-30	931 sq. ft.	Approximately $400[66]
Basement, Rigid Foam	931 sq. ft.	Approximately $500[67]
Walls	--	Approximately $2,500[68]

Residence #1300

Insulation Area and Value	Amount of Insulation	Cost
Attic Floor, Fiberglass Batt R-30	1,250 sq. ft.	Approximately $500
Walls	--	Approximately $1,750

Residence #1019

Insulation Area and Value	Amount of Insulation	Cost
Attic, Spray Foam Insulation	2,640 sq. feet	Approximately $3,000

[65] Great Day Improvement, LLC. "Insulation R Value Chart," accessed May 9, 2019, https://www.greatdayimprovements.com/insulation-r-value-chart.aspx.
[66] Improvenet.com, "How Much Does it Cost to Install Batt Insulation?" https://www.improvenet.com/r/costs-and-prices/batt-insulation-installation-cost-estimator.
[67] Remodelingexpense.com, "Cost of Rigid Foam Insulation," https://www.remodelingexpense.com/costs/cost-rigid-foam-insulation/.
[68] Homeadvisor.com, "How Much Does Spray Foam Insulation Cost?" https://www.homeadvisor.com/cost/insulation/install-spray-foam-insulation/.

Windows

The United States Department of Energy has estimated that ten to twenty percent of all heating and cooling costs in residential buildings comes from energy loss through windows (Image 43).[69] Windows allow for energy loss in two ways: air leakage/infiltration and temperature-driven heat transfer. Air leakage and infiltration allows air to move freely from the exterior to the interior of the building and vice versa. This leakage/infiltration allows air to travel from high-pressure areas (warm areas) to low (cooler areas) whether those be inside or outside the home. Cracking or warping in window frames allow for air infiltration and leakage. Single-pane and untreated glass panels allow for most of the temperature-driven heat transfer.

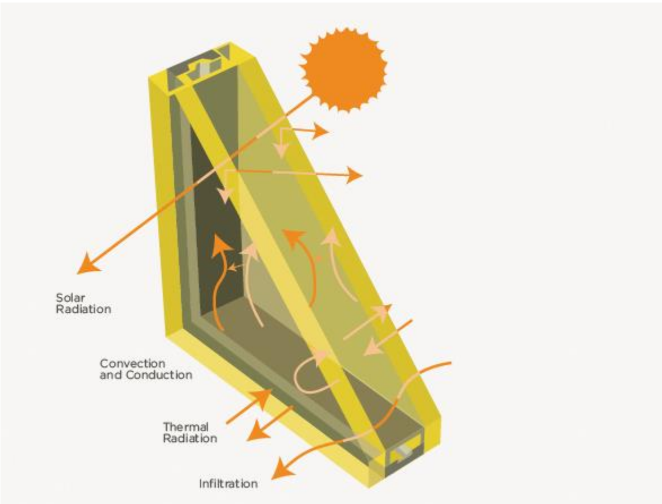

Image 43: Energy Gain and Loss through Windows. Source: U.S. Department of Energy

The amount of non-solar energy transfer through windows can be measured by U-value. The U-value represents a window's resistance to heat flow, or its insulating value. The lower the U-value, the better a window is insulated. The solar-heat gain of a window is measured by the Solar Heat Gain Coefficient (SHGC) expressed as a number between 0 and 1. The lower the SHGC, the less solar heat the window transmits. Regardless the of mechanisms of energy loss, ensuring warm or cool air that

[69] US Department of Energy, Energy Savers Booklet. http://www1.eere.energy.gov/consumer/tips/pdfs/energy_savers.pdf

is intentionally generated for the interior of the building stays inside the building will dramatically decrease energy loss through windows.

Inefficient Windows in the National Forests

In buildings in the National Forests from the Custodial Management and Depression Era, both hot and cold weather infiltrates older, single-pane wooden windows and renders interior climate control system less effective. For historic building, it is important to consider the original design of the building to avoid introducing energy efficiency treatments that are incompatible with the historic fabric or construction type for the buildings. In many of the wood-framed, historic buildings from the first half of the twentieth century at Trout Lake, window frames were designed to hold storm windows in the winter, replaced by screens in the summer. Unfortunately, over time, many of these storm windows have been lost or damaged, leaving the Forest Service to resort to other means for insulating the windows on many historic buildings (Image 44).

Image 44: Rigid Foam behind single-pane window in building #1018.

Single-pane wood windows with no exterior storm windows have U-values ranging from 0.77 to 1.11.[70] A new, high-performance replacement window can produce U-values as low as 0.24, for double-pane, low-e coated, inert-gas filled, and insulating frame, and 0.35, for a double-pane vinyl window with low-e film. However, introducing exterior storm windows can reduce the U-value of historic windows to 0.21, for a double-pane low-e exterior storm, and to 0.55 for a single-pane exterior storm. Interior

[70] National Trust for Historic Preservation, *Saving Windows, Saving Money,* 21.

storm windows can reduce the U-value to 0.36, for a low-e single pane interior storm, and to 0.48 for a normal single-pane interior storm.[71] Introducing double glazing, even without low-e coated exterior storm windows can actually produce lower U-values than replacement windows.[72] A storm window with optimized weather stripping produces a U-factor very similar to that of a double-pane replacement window with an air-space fill such as argon, with the added benefit of another insulating frame.[73]

In order to ameliorate the issue of energy loss through historic single-pane windows while maintaining the character of historic buildings in the National Forests, the following treatments are recommended:

- When exterior storm window frames exist as part of the original building construction, new storm windows with low-e glass are the most appropriate treatment.
- When exterior storm frames do not exist, interior storm windows provide the most return on investment for improved energy efficiency.
- When increased efficiency is desired, new double-pane panels inserted into historic wood window frames are the best solution.

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[71] National Trust for Historic Preservation, *Saving Windows, Saving Money,* 26-30.
[72] Baker, Paul, Roger Curtis, Craig Kennedy, and Chris Wood, "Thermal Performance of Traditional Windows and Low-Cost Energy-Saving Retrofits," *APT Bulletin* 41, no. 1 (2010): 29-34, 32.
[73] Joseph H. Klems, *Measured Winter Performance of Storm Windows,* (Berkeley, California: Lawrence Berkeley National Laboratory: 2002), 1.

Windows from Custodial Management and Depression Era Buildings, 1912 - 1944

Residence #1004, built in 1921, has all its original single-pane, double-hung wood windows, except for one replacement aluminum window in the kitchen. However, the building has none of its original exterior storm windows and sports screens in its exterior frames year-round. Building #1300, from the Depression Era Period of Construction has 2 four-light awning windows on its east façade, eight six-light awning windows on its north façade, and six six-light awning windows on its south façade (Image 45). Construction methods and materials are similar in buildings from both the Custodial Management and Depression Era Periods of Construction. Particularly in the case of windows, where wood framed windows prevailed in buildings well into the 1940s. In order to preserve the historic character and upgrade the energy efficiency of both of these buildings and similar buildings from the same time periods, the following window treatments are recommended.

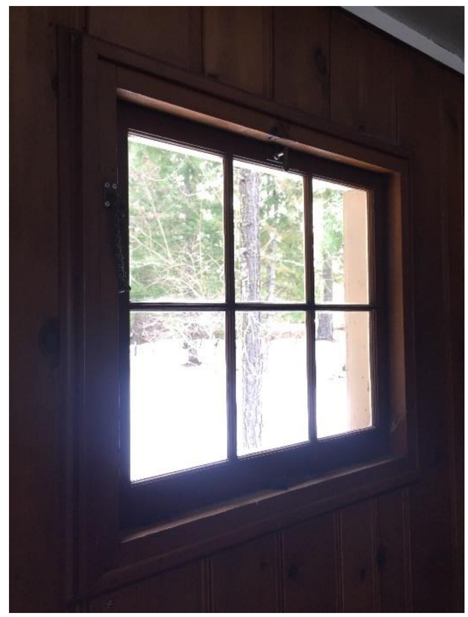

Image 45: Interior of Awning Windows in Residence #1300

Energy Efficiency Upgrade Options for Custodial Management Period and Depression Era Period Buildings (c.1920 - 1944):

Option #1: Replacement Storm Windows

Refabricate double-pane, fixed, wood-framed exterior storm windows with low-e glass to affix to the window frames during the winter (Image 46).

Image 46: A Wood Storm Window. Image Source: "Saving Windows, Saving Money"

Benefits: Historically compatible.

Drawbacks: Must be removed during winter and stored

Best Uses: All buildings with original storm window frames – Residences, Offices, and Storage.

Climate: Biggest Annual Return on Investment in Eastern Region and Cascade Range 4 – 4.4%, 2.2% ROI in Western Region.

Effect on Character Defining Features: None

SOI Standard: Reconstruction

Estimated Cost:
Residence #1004: $5,560
Residence #1300: $3,776

Thermal Performance Improvement:
Before: 0.77 to 1.11 u-value
With single-pane storm: 0.55 u-value
With double-pane exterior storm: 0.21 u-value

Compared to All New Replacement Vinyl Windows

Residence #1004 Cost: $8,055 - $14,633

Residence #1300 Cost: $4,680 - $8,502

Thermal Performance: .24 - .35[1]

Option #2: Interior Cellular Shades

Image 47: Cellular Shade. Image: Costco.com

Installing interior cellular window shades can greatly reduce energy loss through single-pane glass windows (Image 47). Although not historically appropriate, when used at night, energy loss can be reduced by half.

Benefits: Completely reversible with no damage to historic fabric.

Drawbacks: Affects historic appearance when used during the day.

Best Uses: Residences and Offices

Climate: Biggest ROI in Western and Cascade Range Region (5.5 – 7.8%), 2.8% return in the Eastern Region.

Effect on Character Defining Features: Minimal effects include installation penetrations on interior window frame.

SOI Standard: Rehabilitation

Estimated Cost:

$5 - $12 per square foot
Cost for Residence #1004: $671 – $1,611
Cost for Residence #1300: $390 – $936

Thermal Performance Improvement:
Before: 0.77 to 1.11 u-value
After: 0.58 to 1.05 u-value

Option #3: Interior Storm Panels

Fabricate interior storm panels to fit in original window frames (Images 48 & 49).

Benefits: Completely reversible

Drawbacks: Need to be custom-made

Best Uses: WWII and Postwar Residences and Office without exterior storm windows.

Climate: Biggest Annual Return on Investment in Cascade Range (4.9%), 2.8% in Western Region, 3% in Eastern Region.

Effect on Character Defining Features: None

SOI Standard: Rehabilitation

Estimated Cost:
Per Window: $36 per square foot.[74]
Residence #1004: $4,833
Residence #1300: $2,808

Thermal Performance Improvement:
Before: 0.77 to 1.11
After: 0.36 to 0.48

Image 48: Interior Storm Window. Image: IndowWindow.com

Image 49: Interior Storm Windows do not interrupt character-defining multi-lite windows. Image: oldhousejournal.com

[74] Indow Windows, "Get a Free Estimate," accessed April 8, 2019, https://indowwindows.com/indow-cost-c/?utm_expid=.jnNNY-h0RsC-qjLuYWc_Hg.2&utm_referrer=https%3A%2F%2Findowwindows.com%2F.

Option #4: New Double-Pane Glazing

Image 50: DIY Double-pane replacement in original wood door frame done by Forest Service personnel

Replace all original single-pane panels with double pane glazing. By routing out the original wood window frames to be deeper, the original frames can now hold double-paned glass. This can be done by professional companies or by maintenance personnel (Images 50 & 51).[75] This option is a compromise between preservation of historic character and energy upgrades that will preserve the building through use.

Benefits: Most energy-efficient option while retaining original window frames.

Drawbacks: Not reversible

Best Uses: Residences and Offices

Climate: All Climates

Effect on Character Defining Features: Removes original historic glazing and alters historic wood frame.

SOI Standard: Rehabilitation

Estimated cost:
$1,393 per window
Residence #1004: $36,218
Residence #1300: $25,074

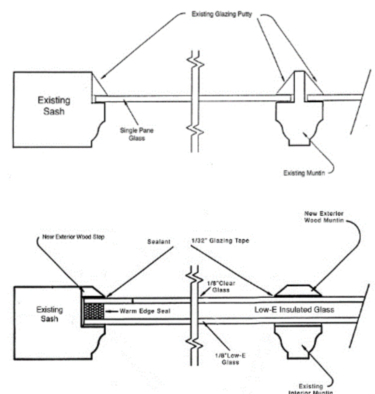

Image 51: Cross-section of historic single-pane window frame (top) and of historic frame with replacement Bi-glass system. Source: Veridian Window Restoration.

Thermal Performance Improvement:
Before: 0.77 to 1.11
After: 0.24 to 0.35[76]

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[75] Veridian Window Restoration, "How We Do It: Let's Get Technical," Accessed March 13, 2019, http://viridianwindows.com/lets-get-technical.

[76] Replacement glazing combined with the thermal performance of wood frames should result in approximate U-value for new, replacement windows. *Saving Windows, Saving Money*, 30.

Windows from WWII and Postwar Buildings (c.1944 - 1970):

Beginning in the late 1800s, buildings began to feature rolled steel-framed windows, which allowed for larger windows with a high resistance to fire.[77] Steel-framed windows lent themselves to the architectural styles of Streamline Moderne and Art Deco but were also widely used in commercial and industrial buildings. After WWII, architects and home builders began to use much-cheaper aluminum to frame windows. At Trout Lake Administrative District, many WWII and Postwar Era buildings have, or originally had, aluminum windows - an important part of the architectural character of certain Postwar Era buildings. Unfortunately, as metal is a naturally conductive rather than insulative material, metal-framed windows are not energy efficient, and many original aluminum windows at Trout Lake have been replaced with vinyl.[78] However, aluminum windows are not all bad. An Australian study found that aluminum windows have the lowest environmental impact when their entire life cycle is considered.[79]

Aluminum windows are an important part of the architectural character and historic integrity of WWII and Postwar buildings. Replacement windows can significantly decrease historic integrity and make the buildings ineligible for listing on the National Register. In order to retain the character and guarantee the continued use of these historic buildings, it is critical that the Forest Service improve the energy efficiency of these architecturally significant aluminum windows.

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79 Australian Government Forest and Wood Products Research and Development Corporation, "Comparative Service Life Assessment of Window Systems," August 2007, https://www.fwpa.com.au/images/marketaccess/PR07.1047%20Final%20Report%20WEB.pdf.

It is important to note that not all buildings from the WWII and Postwar Era feature aluminum windows. At Trout Lake, Residence #1013, built in 1958, features wood windows. To increase the energy efficiency of single-pane (or original, now less-efficient, double-pane) wood windows in WWII and Postwar Era buildings, follow guidelines for Custodial Management and Depression Era buildings.

Building #1019 is eligible for listing on the National Register of Historic Places and contributes to Trout Lake's myriad of historic buildings from throughout the history of the Forest Service (Image 52). It retains all its original aluminum-framed sliding windows (Image 53).

Image 52: Residence #1019, built in 1963. Forest Service's Standard Plan #266, designed by Perry W. Carter.

In the interior, walls have been removed to transform the building into a fitness center for the ranger station. In the living room, the aluminum windows are single-paned. In what used to be the bedroom, the windows are double, single-pane, aluminum framed windows (Image 54). The most cost-efficient upgrades for both single and double single-pane aluminum windows are described below.

Option #1: Fabricate interior storm panels

Benefits: Completely reversible, doubles insulating value

Drawbacks: Need to be custom-made, render windows inoperable.

Best Use: Residences and Offices

Climate: Biggest Annual Return on Investment in Cascade Range (4.9%), 2.8% in Western Region, 3% in Eastern Region.

Effect on Character Defining Features: None

SOI Standard: Rehabilitation

Image 53: Single Single-pane Storm Windows in #1019

Estimated Cost: Residence #1019 all windows: $4,320 **/ o**nly current single windows in #1019: $3,456

Thermal Performance Improvement:
Before: 0.77 to 1.11 / After: 0.36 to 0.48

Option #2: Fabricate exterior aluminum storm windows.

Benefits: Completely reversible, doubles insulating value.

Drawbacks: Need to be custom-made, render windows inoperable.

Best Use: Residences and Offices

Climate: Biggest Annual Return on Investment in Eastern Region and Cascade Range (4 – 4.4%), 2.2% ROI in Western Region.

Effect on Character Defining Features: None

SOI Standards: Rehabilitation

Image 54: Operable Single-Pane Prime and Storm Windows in #1019

Estimated Cost: Residence #1019: $1,842
Thermal Performance Improvement:
Before: 1.3[80]
After: With single-pane storm: 0.55 u-value, double-pane exterior storm: 0.21 u-value

[80] Whole Building Design Guide Resource Pages, "Windows and Glazing," https://www.wbdg.org/resources/windows-and-glazing, accessed May 7, 2019.

Option #4: Replace original aluminum windows with new anodized aluminum windows.

Benefits: Most energy-efficient option.

Drawbacks: Not reversible

Best Uses: Residences and Offices

Climate: All Climates

Effect on Character Defining Features: Removes original historic fabric

SOI Standard: Rehabilitation

Estimated cost for Residence #1019: $4,800

Thermal Performance Improvement:
Before: 0.77 to 1.11
After: 0.24 to 0.35[81]

[81] Replacement glazing combined with the thermal performance of wood frames should result in approximate U-value for new, replacement windows. *Saving Windows, Saving Money*, 30.

Building #1004: Custodial Management: Current Window U-Value: .77 – 1.11
Cost of Vinyl Replacement Windows: $8,055 - $14,633

Treatment	Cost	U-Value
Cellular Shades	$671 - $1,611	.58
New Wood Storm Windows	$4,764	.21
Interior Storm Windows	$4,833	.36 - .48
New Double-Pane Glazing	$36,218	.24 - 35

Building #1300: Depression Era: Current Window U-value: .77 – 1.11
Cost of Vinyl Replacement Windows: $4,680 - $8,502

Treatment	Cost	U-Value
Cellular Shades	$390 - 936	.58
New Wood Storms	$2,996	.21
Interior Storms	$2,808	.36 - .48
New Double-Pane Glazing	$25,074	.24-.35

Building #1019: WWII and Postwar: Current Window U-value:
Cost of Vinyl Replacement Windows: $7,200 - $13,080

Treatment	Cost	U-Value
Cellular Shades	$600 - $1,400	.58
New Storm Windows	$1,842	.21
Interior Storm Windows	$4,320*	.36 - .48

*Price for interior storm windows for each window, including double windows. Price per window can be calculated by multiplying window square footage by $36.

Chapter 5: Alternative Uses for Historic Structures

The United States Forest Service has more historic buildings than they are able to use for agency purposes. Luckily for the public, many of the Forest Service's buildings are sites are rentable as recreation rentals through Special Use Permits. Leasing historic structures to the public is an alternative to disposal of buildings, which removes integral historic fabric from the National Forests. For some historic buildings, such as #1300 at Trout Lake, which is a significant historic structure with no insulation, energy efficiency treatments must be applied to make it more attractive for use by the public. A combination of energy efficiency treatments that elevate the comfortability of historic structure and leasing strategies can render countless historic structures in the National Forests of Oregon and Washington useful again.

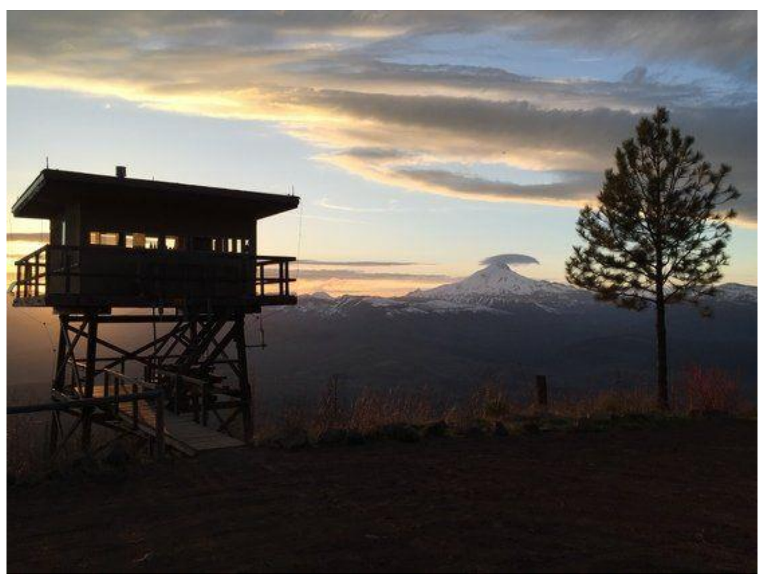

Image 55: Green Ridge Lookout Tower, Deschutes National Forest, available to rent to the public. Photo: Recreation.gov.

The United States Forest Service has several authorities granted to it by Congress to lease out buildings and structures to other agencies and the public. Leasing structures out maintains Forest Service control over their buildings, particularly historic ones with character to maintain, and returns funds for the maintenance of those structures. Leasing strategies that are appropriate for historic buildings include Section 111 of the National Historic Preservation Act and Special Use Permits. Leasing out historic structures to give them new alternative uses and subsequent funds for maintenance will increase the number of historic buildings that benefit from Preservation Through Use.

Special Use Permits

Special Use Permits have contributed to the preservation and appreciation of numerous historic structures throughout Region 6 of the Forest Service. For example, there are 22 historic fire lookouts and 52 historic cabins and guard stations that are available to rent throughout Region 6 (Image 55). These rentals are popular with the public and often are fully rented throughout the summer season, which generates funds for the Forest Service and allows the public to fully immerse themselves in historic places in their National Forests. The historic Santiam Pass Ski Lodge, listed on the National Register of Historic Places in 2018, has recently received a Special Use Permit from the Forest Service to be operated again as a lodge, open to the public (Image 56). Built in 1940, the rustic ski lodge has been vacant since 1986. The lodge is shuttered, difficult to access, and nearly invisible to passersby on the highway. A Special Use Permit has authorized the new owner to operate the lodge for travelers, skiers, sightseers, and more. If it weren't for the Special Use Permit, the USFS would have no use for the building and it would

Image 56: Santiam Pass Ski Lodge, built in 1940.

eventually have deteriorated to a point of no return. This new alternative use will bring the Santiam Ski Lodge back to life, an excellent example of Preservation Through Use.

Special Use Permits are authorized under a variety of acts of congress such as the Federal Lands Recreation Enhancement Act of 2005 and the Term Permit Act of 1915.[82,83] These enabling authorities require funds be remitted into the general fund of the Forest Service or the United States Treasury. Special User Permits allow the Forest Service to rent out structures for recreational purposes and is the enabling feature behind the many recreational residences in Region 6. Special Use Permits also allow for the leasing of historic structures for Recreation only. These uses include non-commercial group use, ski areas, resorts, outfitters/guides, recreation events, organizational camps, and concession operated campgrounds. These Special Use Permits increase awareness and appreciation for historic structures like Tilly Jane A-Frame (Image 10), where the Oregon Nordic Club maintains rentals and manages maintenance of the structure according to the Secretary of the Interior's Standards. While Special Use Permits do promote Preservation Through Use of historic structures, the funds generated from Special Use Permits do not allocate funds to manage and administer the Preservation Through Use of additional structures.

Section 111 Leases

Section 111 of the National Historic Preservation Act is an underutilized leasing tool within the Forest Service that can help Heritage Program Managers generate tenants and revenue for vacant historic buildings. The authorizing language of Section

[82] United States Forest Service, *FSH 2709.14 Recreation Special Uses Handbook Chapter 50: Outfitting and Guiding Concession Services,* Washington D.C.: United States Forest Service, 2013, 3.
[83] Congressional Research Service, "Federal Lands Recreation Enhancement Act: Overview and Issues," October 31, 2018, https://fas.org/sgp/crs/misc/IF10151.pdf.

111, which encourages federal agencies to lease historic structures to the public, specifies that the funds generated from rentals in historic buildings through Section 111 leases may be retained for the management, administration, and maintenance of historic structures. These funds can be distributed to other historic structures within the Forest Service, allowing for the leasing of one historic structure to benefit another.

Section 111 permits have other strengths that could potentially benefit the Forest Service. Section 111 allows for long-term leases, which allows lessees to potentially capitalize on the Federal Historic Tax Credit. The authorizing language also allows agencies to rent structures at less than fair market value, which creates incentive for private parties to choose to rent historic buildings while generating revenue to bring their physical condition up to market value standards. Section 111 can be a mitigation strategy to counter adverse effects that the Forest Service's actions have on historic places. Most of all, the great benefit of Section 111 comes from the language of the law which is focused on the preservation of historic structures, which creates leases tailored to the needs of historic structures and funds for federal agencies to hire personnel to continue to inventory, monitor, lease, and manage historic places.

The Forest Service has only utilized two Section 111 leases in the history of the agency nationwide. The USFS has otherwise used Special Use Permits for leasing property, historic or otherwise. However, the National Forests have

Image 57: Forest Lodge, Wisconsin. 14 historic structures on the site were built between 1838 - 1950.

recently begun to use Section 111 leases. The Chequamegon-Nicolet National Forest in Wisconsin entered the USFS into its first Section 111 lease ever in 2017 for a 50-acre property featuring twelve historic buildings to promote preservation (Image 57). This lease is effective towards the preservation of the property explicitly in its language: "This lease is issued for operation and maintenance of Forest Lodge… to ensure the adequate preservation of the historic properties … as required under Section 111(a) of the National Historic Preservation Act."[84] The Gifford Pinchot National Forest has entered into a Section 111 lease for a historic property at its Wind River Administrative District, an underutilized historic site with 26 historic buildings, an arboretum, and historic cultural landscape features.[85] The lease stipulates that the tenancy is contingent upon the maintenance, weatherization, and rehabilitation/restoration when appropriate, conducted to the Secretary of the Interior's Standards for the Treatment of Historic Properties. These types of leases could provide greatly beneficial for historic buildings throughout the National Forests of Oregon and Washington.

Some agencies, like the General Services Administration (GSA) have been successful at utilizing Section 111 leases because of the great advantage of focus and personnel the agency has for leasing properties in general. The GSA maintains Historic Preservation as one of its key initiatives and owns nearly 500 historic buildings across the country. The GSA employs at least one Historic Preservation Specialists to oversee its historic properties in each of its 10 districts. GSA recognizes and professes the benefits of historic buildings – in their 2017 annual report, the GSA reported visitation to

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[84] Chequamegon-Nicolet National Forest and Northland College, "Historic Property Lease for Forest Lodge," January 9, 2017, 1.
[85] Gifford Pinchot National Forest and Skamania County, "Wind River Work Center – NHPA Sec. 111 Historic Property Lease Draft," February 28, 2018, 3.

the National Archives and Records Administration quadrupled when relocated to a the Alexander Hamilton U.S. Custom House, a National Historic Landmark.[86] Their 2011 annual report states that Section 111 leasing authority is superior to authorities granted under the Cooperative Use Act because Section 111 allows federal agencies to lease smaller parts of federal buildings and gives a higher level of discretion of how funds from leases can be used. The GSA uses funds from Section 111 leases to fill vacancies, provide retail shops to buildings occupied by federal tenants, and even to place rooftop antennas, provide event rental space, and sets for Hollywood movies.[87] The GSA's development of Section 111 procedures and innovate use of the statute has led to creative new uses for historic buildings that produce funds for historic preservation.

As noted cultural resource management professional Tom King notes in his blog: "Do SHPOs or the ACHP ever ask agencies about Sections 110 and 111 when the agencies come screaming in with proposals to down old buildings so they can build new ones? … Not that I've seen."[88] Despite the language of Section 111, which states that "any Federal Agency… shall, to the extent practicable, establish and implement alternatives for historic properties," very few federal agencies are implementing Section 111 leasing structure for the preservation of historic properties.[89] This may be because a careful reading of language of the statute requires ("shall") the preservation of

[86] U.S. General Services Administration, "Extending the Legacy: GSA Historic Building Stewardship 2017," https://www.gsa.gov/cdnstatic/Historic_Preservation/2017%20GSA%20Extending%20the%20Legacy.pdf, 3.
[87] "Extending the Legacy: GSA Historic Buildings Stewardship 2017," 26.
[88] King, Tom, "Tuesday, February 15, 2011 - 106: The Loneliest Number," Tom King's CRM Plus Blog, accessed November 14, 2018.
[89] National Park Service, "National Historic Preservation Act of 1966," accessed November 14, 2018, https://www.nps.gov/history/local-law/nhpa1966.htm.

properties but then qualifies it ("to the extent practicable"). In 2003, President George W. Bush published Executive Order 13287 – Preserve America to promote compliance with the National Historic Preservation Act. In Section 3, the order states that federal agencies with real property to manage "shall review its regulations, management policies, and operating procedures for compliance with Sections 110 and 111 of the NHPA.[90] Despite this, it seems only the GSA has succeeded in inventory and leasing of historic structures.

Section 111 leases provide an alternative to disposal of historic buildings to ensure they remain in the control of the federal agency for potential future use. Section 111 also allows for extended leases, which promote significant investment in the property and a sense of ownership with the lessee. The National Trust for Historic Preservation found that the National Park Service often enters into leases for historic properties for the shortest amount of time possible, which limits the use of Federal Historic Tax Credit projects for these buildings.[91] The tenant of the 1899 Old Post Office Building in D.C., under a Section 111 lease from the GSA, completed a $200 million rehabilitation of the structure that would not have been possible or reasonable without a long term lease which allowed for a return on their investment (Image 10).[92] Section 111 has language which enables the active preservation of historic structures, and is a more appropriate tool for federal agency leasing authority than laws such as the Cooperative Use Act, the General Authorities Act, or natural resource management acts which enable Special-Use Permits on Forest Service lands.

[90] Bush, George W. "Executive Order 13287," March 3, 2003, https://www.gpo.gov/fdsys/pkg/WCPD-2003-03-10/pdf/WCPD-2003-03-10-Pg286.pdf, 287.
[91] "Executive Order 13287," 28.
[92] "Extending the Legacy: GSA Historic Buildings Stewardship 2017," 24.

Section 111 of the National Historic Preservation Act is woefully underused within the United States Forest Service, partially due to lack of knowledge of how to implement and manage the leases. Special Use Permits are limited as well, because granting a new Special Use Permit required the authorization of a Resource Advisory Committee. For these reasons, historic buildings on forest lands often could potentially be decommissioned, demolished, or sold before they are leased out in the spirit of their continued preservation. Heritage Program Managers have the option to use Section 111 of the National Historic Preservation Act and Special Use Permits to lease historic buildings and to generate revenue for the maintenance and management of all their historic structures.

Conclusion

For the Greatest Good: Historic Building Rehabilitation and Reuse

The United States Forest Service is the proud owner of countless historic buildings that are irreplaceable vestiges of the history of the nation. Not only to they represent the microcosmic history of the Forest Service, but they reflect the history of the country's relationship with natural resources and wilderness. These structures embody history and represent the best opportunity for the public to immerse themselves in the history of the largest owner of publicly-accessible federal lands – their own Forest Service. The USFS has an excess of historic structures that must be preserved if the agency wishes to fulfill its mission: "caring for the land and serving the people." In order to bring these structures to new uses by the public and the agency it is critical that the Forest Service invest in the energy efficiency performance of their historic structures in the most cost-effective manner possible and utilize every leasing authority vested in them to provide alternative uses to these historic places. Increasing the energy efficiency of these structures and leasing them to the public will increase the Preservation Through Use of historic structures on the National Forests, making the Forest Service a leader in environmentally friendly reuse of historic buildings and an even greater provider of recreational and educational opportunities to the public.

This project has shown that low-cost energy efficiency treatments can have profound effect on the comfortability and cost of operating historic buildings. When these treatments are applied sensitively, historic buildings can maintain their historic character while providing new uses for generations to come. In addition, a greater focus on intentionally leasing historic buildings using the authority granted in Section 111 of the National Historic Preservation Act can facilitate preservation not only of the structure in question but of additional structures through the National Forests. When used together, energy efficiency upgrades and progressive leasing strategies can greatly increase the Preservation Through Use of historic buildings in the National Forests. These advanced efforts of the Pacific Northwest Region of the United States Forest Service to preserve and reuse historic buildings while focusing on energy efficiency and sustainability could set an example for not only other regions of the Forest Service, but other land management agencies throughout the country.

Appendix A: Summary of Energy Efficiency Guidelines

Weather Stripping Guidelines

Recommended Materials: Foam tape or Vinyl

Benefits: Completely reversible with no effect on the historic fabric of a building

Drawbacks: Expensive to have professionally installed

Best Uses: Offices, Residences, and Storage Sheds to limit air, water, and pest infiltration.

Climate: Effective in all geographic areas

SOI Standard: Rehabilitation

Effect on Character Defining Features: None if installed as to not be visible.

Cost Estimates:

Building	Area of Windows and Doors	Cost for Weather stripping
#1004	59 sq. ft.	$95
#1300	100 sq. ft.	$100
#1019	141 sq. ft.	$75

Note: This project did not provide guidelines for caulking, which can complement weather stripping to reduce the amount of air leakage in a building where openings exist. For more information on caulking historic buildings, visit: http://www.oldhouseweb.com/how-to-advice/old-house-wall-sealants-caulk.shtml.

Attic Insulation Guidelines

Recommended Materials: Batt fiberglass or rigid foam insulation for high-pitch roofs, spray foam for low-pitch

Benefits: Easy to install, batt and rigid foam is easily reversible.

Drawbacks: Spray foam is not reversible as it penetrates wood.

Best Uses: Residences and Office Buildings

Climate: Unfinished Attics West of Cascades**:** R38 to R60 insulation for attic roof, R25 to R30 on attic floor. Existing 3-4 in. of Insulation on Roof: R38. Unfinished Attics East of Cascades: R49 to R60 insulation to roof, R25 to R30 to floor. Existing 3-4 in. of Insulation on Roof: R38 to R49.

Effect on Character Defining Features: None

SOI Standard: Rehabilitation

Basement Insulation Guidelines

Recommended Materials: Rigid Foam Insulation for basement ceiling.

Benefits: Easy to install, easily reversible.

Drawbacks: None.

Best Uses: Residences

Climate: Effective in all climates.

Effect on Character Defining Features: None

SOI Standard: Rehabilitation

Wall Cavity Insulation Guidelines

Recommended Materials: 3 ½" R-13 dense-packed cellulose or fiberglass, NOT spray foam or expanding insulation

Benefits: Upgrades thermal performance of building

Drawbacks: Not reversible nor appropriate for all historic buildings.

Best Uses: Residences and Offices

Climate: West and East of Cascades, R-13

Effect on Character Defining Features: Can damage exterior siding.

SOI Standard: Rehabilitation

Residence #1004

Insulation Area and Value	Amount of Insulation	Cost
Attic Floor, Fiberglass Batt R-30	931 sq. ft.	Approximately $400
Basement, Rigid Foam	931 sq. ft.	Approximately $500
Walls	--	Approximately $2,500

Residence #1300

Insulation Area and Value	Amount of Insulation	Cost
Attic Floor, Fiberglass Batt R-30	1,250 sq. ft.	Approximately $500
Walls	--	Approximately $1,750

Residence #1019

Insulation Area and Value	Amount of Insulation	Cost
Attic, Spray Foam Insulation	2,640 sq. feet	Approximately $3,000

Energy Efficiency Upgrade Options for Custodial Management Period and Depression Era Period Buildings (c.1920 - 1944):

Option #1: Replacement Storm Windows

Refabricate double-pane, fixed, wood-framed exterior storm windows with low-e glass to affix to the window frames during the winter.

Image 46: A Wood Storm Window. Image Source: "Saving Windows, Saving Money"

Benefits: Historically compatible.

Drawbacks: Must be removed during winter and stored

Best Uses: All buildings with original storm window frames – Residences, Offices, and Storage.

Climate: Biggest Annual Return on Investment in Eastern Region and Cascade Range 4 – 4.4%, 2.2% ROI in Western Region.

Effect on Character Defining Features: None

SOI Standard: Reconstruction

Estimated Cost:
Residence #1004: $5,560
Residence #1300: $3,776

Thermal Performance Improvement:
Before: 0.77 to 1.11 u-value
With single-pane storm: 0.55 u-value
With double-pane exterior storm: 0.21 u-value

Compared to All New Replacement Vinyl Windows
Residence #1004 Cost: $8,055 - $14,633
Residence #1300 Cost: $4,680 - $8,502
Thermal Performance: .24 - .35[1]

Option #2: Interior Cellular Shades

Installing interior cellular window shades can greatly reduce energy loss through single-pane glass windows. Although not historically appropriate, when used at night, energy loss can be reduced by half.

Image 47: Cellular Shade. Image: Costco.com

Benefits: Completely reversible with no damage to historic fabric

Drawbacks: Affects historic appearance when used during the day.

Best Uses: Residences and Offices

Climate: Biggest ROI in Western and Cascade Range Region (5.5 – 7.8%), 2.8% return in the Eastern Region.

Effect on Character Defining Features: Minimal effects include installation penetrations on interior window frame.

SOI Standard: Rehabilitation

Estimated Cost:

$5 - $12 per square foot
Cost for Residence #1004: $671 – $1,611
Cost for Residence #1300: $390 – $936

Thermal Performance Improvement:
Before: 0.77 to 1.11 u-value
After: 0.58 to 1.05 u-value

Option #3: Interior Storm Panels

Fabricate interior storm panels to fit in original window frames.

Benefits: Completely reversible

Drawbacks: Need to be custom-made

Best Uses: WWII and Postwar Residences and Office without exterior storm windows.

Climate: Biggest Annual Return on Investment in Cascade Range (4.9%), 2.8% in Western Region, 3% in Eastern Region.

Effect on Character Defining Features: None

SOI Standard: Rehabilitation

Estimated Cost:
Per Window: $36 per square foot.
Residence #1004: $4,833
Residence #1300: $2,808

Thermal Performance Improvement:
Before: .77 to 1.11
After: .36 to .48

Image 48: Interior Storm Window. Image:: IndowWindow.com

Image 49: Interior Storm Windows do not interrupt character-defining multi-lite windows. Image: oldhousejournal.com

Option #4: New Double-Pane Glazing

Replace all original single-pane panels with double pane glazing. By routing out the original wood window frames to be deeper, the original frames can now hold double-paned glass. This can be done by professional companies or by maintenance personnel (Image 51). This option is a compromise between preservation of historic character and energy upgrades that will preserve the building through use.

Image 50: DIY Double-pane replacement in original wood door frame done by Forest Service personnel

Benefits: Most energy-efficient option while retaining original window frames.

Drawbacks: Not reversible

Best Uses: Residences and Offices

Climate: All Climates

Effect on Character Defining Features: Removes original historic glazing and alters historic wood frame.

SOI Standard: Rehabilitation

Estimated cost:
$1,393 per window
Residence #1004: $36,218
Residence #1300: $25,074

Thermal Performance Improvement:
Before: 0.77 to 1.11
After: 0.24 to 0.35

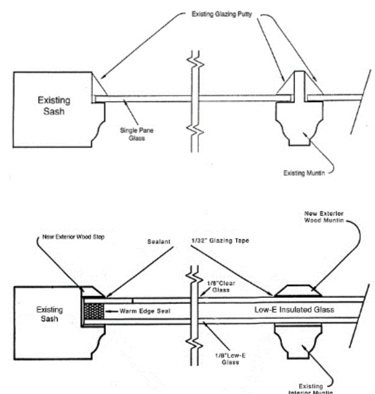

Image 51: Cross-section of historic single-pane window frame (top) and of historic frame with replacement Bi-glass system. Source: Veridian Window Restoration.

Energy Efficiency Upgrade Options for WWII and Postwar Period Buildings (c.1945 - 1969):

Option #1: Fabricate interior storm panels

Benefits: Completely reversible, doubles insulating value

Drawbacks: Need to be custom-made, render windows inoperable.

Best Use: Residences and Offices

Climate: Biggest Annual Return on Investment in Cascade Range (4.9%), 2.8% in Western Region, 3% in Eastern Region.

Effect on Character Defining Features: None

SOI Standard: Rehabilitation

Image 53: Single Single-pane Storm Windows in #1019

Estimated Cost: Residence #1019 all windows: $4,320 **/ o**nly current single windows in #1019: $3,456

Thermal Performance Improvement:
Before: 0.77 to 1.11 / After: .036 to 0.48

Option #2: Fabricate exterior aluminum storm windows.

Benefits: Completely reversible, doubles insulating value.

Drawbacks: Need to be custom-made, render windows inoperable.

Best Use: Residences and Offices

Climate: Biggest Annual Return on Investment in Eastern Region and Cascade Range (4 – 4.4%), 2.2% ROI in Western Region.

Effect on Character Defining Features: None

SOI Standards: Rehabilitation

Image 54: Operable Single-Pane Prime and Storm Windows in #1019

Estimated Cost: Residence #1019: $1,842
Thermal Performance Improvement:
Before: 1.3
After: With single-pane storm: 0.55 u-value, double-pane exterior storm: 0.21 u-value

Option #4: Replace original aluminum windows with new anodized aluminum windows.

Benefits: Most energy-efficient option.

Drawbacks: Not reversible

Best Uses: Residences and Offices

Climate: All Climates

Effect on Character Defining Features: Removes original historic fabric

SOI Standard: Rehabilitation

Estimated cost for Residence #1019: $4,800

Thermal Performance Improvement:
Before: 0.77 to 1.11
After: 0.24 to 0.35

Appendix B: Available Grants for Energy Efficiency Projects or other Historic Preservation Projects on USFS Land

Grant: Preserving Oregon Grant
Grantor: Oregon State Historic Preservation Office
Amount: Up to $20,000. Grant is reimbursable and must be matched 1:1 with cash, volunteer time, or in-kind donations.
Eligible Properties: Properties listed on the National Register of Historic Places. Priority for properties that are publicly owned.
Who May Apply: USFS or non-profit partner
More Information: https://www.oregon.gov/oprd/hcd/finasst/pages/grants.aspx

Grant: Diamonds in the Rough Grant
Grantor: Oregon State Historic Preservation Office
Amount: Up to $20,000. Grant is reimbursable and must be matched 1:1 with cash, volunteer time, or in-kind donations.
Eligible Properties: Buildings in Historic Districts with heavily altered façades that, if rehabilitated, may be eligible for listing in the National Register of Historic Places.
Who May Apply: USFS or non-profit partner
More Information: https://www.oregon.gov/oprd/hcd/finasst/pages/grants.aspx

Grant: Heritage Capital Projects Fund
Grantor: Washington Department of Archaeology and Historic Preservation
Amount: $4,000 - $1,000,000. Grant must be matched 2:1, half of which can be in-kind donations.
Eligible Properties: Historic properties that promote public access to history.
Who May Apply: Non-profit partners of USFS
More Information: https://dahp.wa.gov/grants

Grant: Save America's Treasures
Grantor: National Park Service
Amount: Up to $20,000. Grant is reimbursable and must be matched 1:1 with cash, volunteer time, or in-kind donations.
Eligible Properties: National Historic Landmarks and properties listed on the National Register of Historic Places at the National level of significance.
Who May Apply: USFS or non-profit partner
More Information: https://www.nps.gov/preservation-grants/sat/

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Grant: Kinsman Foundation Historic Preservation Grant
Grantor: Kinsman Foundation
Amount: The Kinsman Foundation dedicated 40% of its $1.2 million grant funding to Historic Preservation. In the past, grants have ranged from $2,000 - $35,000.
Eligible Properties: Primarily properties listed on the National Register of Historic Places.
Who May Apply: USFS or non-profit partner
More Information: https://kinsmanfoundation.org/historic-preservation/

Grant: Cultural Development Grant
Grantor: Oregon Cultural Trust
Amount: $5,000 - $50,000
Eligible Properties: Properties that embody Oregon's Cultural Heritage.
Who May Apply: USFS or non-profit partner
More Information: https://culturaltrust.org/grants/what-we-fund/

Grant: Kinsman Foundation Historic Preservation Grant
Grantor: Kinsman Foundation
Amount: The Kinsman Foundation dedicated 40% of its $1.2 million grant funding to Historic Preservation. In the past, grants have ranged from $2,000 - $35,000.
Eligible Properties: Primarily properties listed on the National Register of Historic Places.
Who May Apply: USFS or non-profit partner
More Information: https://kinsmanfoundation.org/historic-preservation/

Grant: Historic Preservation Grant
Grantor: American Express
Eligible Properties: All historic properties
Who May Apply: Non-profit partners of USFS
More Information: https://about.americanexpress.com/we-preserve-places

Grant: Preservation Technology and Training Grants
Grantor: National Center for Preservation Technology and Training
Amount: Up to $30,000
Eligible Properties: This grant will fund workshops that address national preservation needs, which could be applicable to energy solutions for historic buildings.
Who May Apply: USFS or non-profit partner
More Information: https://www.ncptt.nps.gov/grants/preservation-technology-and-training-grants/

Bibliography

Chapter 1

Barack Obama. Executive Order 13693. "Planning for Federal Sustainability in the Next Decade." Obamawhitehouse.archives.gov. Accessed April 3, 2019.

Carol Hardy Vincent, Laura A. Hanson, and Carla N. Argueta. *Federal Land Ownership: Overview and Data.* Washington D.C.: Congressional Research Service, 2017.

McClure, Rick and Cheryl Mack*. For the Greatest Good: Early History of the Gifford Pinchot National Forest.* Seattle, WA: Northwest Interpretive Association, 1999.

National Historic Preservation Act. "National Historic Preservation Act of 1966." Accessed January 3, 2019. https://www.nps.gov/history/local-law/nhpa1966.htm.

United States Forest Service. *The Greatest Good: A Forest Service Centennial Film.* Washington D.C., United States Forest Service, 2005.

Chapter 2

Gerald W. Williams. *The USDA Forest Service - The First Century.* Washington D.C.: USDA Forest Service, 2005.

Grosvenor, John R. *A History of the Architecture of the USDA Forest Service.* Washington D.C.: USDA Forest Service, 199.

Kay Atwood, Sally Donovan, Dennis Gray, and Ward Tonsfeldt. *Utility and Service Combined with Beauty: A Contextual and Architectural History of USDA Forest Service Region 6: 1905-1960*. Bend, Oregon: Ward Tonsfeldt Consulting, 2005.

W. Ellis Groben. *Acceptable Plans: Forest Service Administrative Buildings*. Washington D.C.: USDA Forest Service, 1938.

David French and Kathrine French. "Wasco, Wishram, and Cascades," in *Handbook of North American Indians, volume 12: The Plateau*, ed. Deward Walker. Washington, D.C.: Smithsonian Institution, 1998.

Elizabeth Gail Throop. *Utterly Visionary and Chemerical: A Federal Response to the Depression.* Portland: Portland State University, 1979.

Rachel Klein. *Beyond Rustic: Wartime and Mid-Century Administrative Facilities of the USDA Forest Service Pacific Northwest: 1941-1970.* USDA Forest Service, 2019.

Chapter 3

Architecture 2030. “Embodied Carbon,” Why the Building Sector? accessed March 20, 2019. http://dev-architecture-2030.pantheonsite.io/existing-buildings-operation/.

Alliance to Save Energy. *The History of Energy Efficiency,* Alliance Commission on Natural Energy Efficiency Policy. https://www.ase.org/sites/ase.org/files/resources/Media%20browser/ee_commission_history_report_2-1-13.pdf. January 2013.

Australian Government Forest and Wood Products Research and Development Corporation. “Comparative Service Life Assessment of Window Systems.” August 2007. https://www.fwpa.com.au/images/marketaccess/PR07.1047%20Final%20Report%20WEB.pdf.

Baker, Paul, Roger Curtis, Craig Kennedy, and Chris Wood. "Thermal Performance of Traditional Windows and Low-Cost Energy-Saving Retrofits." *APT Bulletin* 41, no. 1 (2010): 29-34.

Banham, Reyner. *The Architecture of the Well-Tempered Environment.* Chicago: University of Chicago Press, 1984.

Cluver, John H., and Randall, Brad. "Saving Energy in Historic Buildings: Balancing Efficiency and Value." Planning for Higher Education 40, no. 2 (2012): 13-24.

D & R International. *2011 Energy Databook,* U.S. Department of Energy: Pacific Northwest National Laboratory, 2011. Accessed March 25, 2019. https://ieer.org/wp/wp-content/uploads/2012/03/DOE-2011-Buildings-Energy-DataBook-BEDB.pdf.

EnergyStar.gov. “Recommended Home Insulation R-Values.” Accessed May 9, 2019, https://www.energystar.gov/index.cfm?c=home_sealing.hm_improvement_insulation_table.

Great Day Improvement, LLC. “Insulation R Value Chart.” Accessed May 9, 2019, https://www.greatdayimprovements.com/insulation-r-value-chart.aspx.

Hensley, Jo Ellen, and Aguilar, Antonio. “Preservation Brief 3: Improving Energy Efficiency in Historic Buildings.” National Park Service Technical Preservation Services. https://www.nps.gov/tps/how-to-preserve/briefs/3-improve-energy-efficiency.htm.

Homeadvisor.co., “How Much Does Spray Foam Insulation Cost?” https://www.homeadvisor.com/cost/insulation/install-spray-foam-insulation/.

Home Depot. "Weather Stripping." www.homedepot.com. Accessed April 7, 2019.

Indow Windows. "Get a Free Estimate." Accessed April 8, 2019. https://indowwindows.com/indow-cost-c/?utm_expid=.jnNNY-h0RsC-qjLuYWc_Hg.2&utm_referrer=https%3A%2F%2Findowwindows.com%2F.

Improvenet.com. "How Much Does it Cost to Install Batt Insulation?" https://www.improvenet.com/r/costs-and-prices/batt-insulation-installation-cost-estimator.

Ionescu, Baracu, Vlad, Necula, and Badea. "The Historical Evolution of the Energy Efficient Buildings." *Renewable and Sustainable Energy Reviews* 49 (2015): 243-53.

Johnston, David and Kim Master. *Green Remodeling: Changing the World One Room at a Time.* Gabriola Island, BC, Canada: New Society Publishers, 2004.

National Park Service Technical Preservation Services. "National Register Bulletin 15: How to Apply the National Register Criteria for Evaluation." Accessed April 2, 2019. https://www.nps.gov/nr/publications/bulletins/nrb15/.

National Park Service Technical Preservation Services. "Preservation Brief 13: The Repair and Thermal Upgrading of Historic Steel Windows." Accessed April 1, 2019. https://www.nps.gov/tps/how-to-preserve/briefs/13-steel-windows.htm.

National Park Service Technical Preservation Services. *The Secretary of the Interior's Standards for Rehabilitation & Illustrated Guidelines on Sustainability for Rehabilitating Historic Buildings.* Washington D.C.: U.S. Department of the Interior, 2011.

National Trust for Historic Preservation. *Saving Windows, Saving Money: Evaluating the Energy Performance of Window Retrofit and Replacement.* Seattle: Preservation Green Lab, 2012.

The National Trust for Historic Preservation. "Single-Wall Construction: The West's Humble (But Fascinating) Architecture." Accessed April 8, 2019. https://savingplaces.org/stories/single-wall-construction-the-wests-humble-but-fascinating-architecture/#.XKuSOFVKhjE.

National Trust for Historic Preservation. *The Greenest Building: Quantifying the Environmental Value of Building Reuse.* Seattle: Preservation Green Lab, 2012.

NOAA Climate Data. "Annual Climate Report: Boston, MA." Accessed May 6, 2019. https://w2.weather.gov/climate/index.php?wfo=BOX.

NOAA Climate Data. "Annual Climate Report: Phoenix, AZ." Accessed May 6, 2019. https://w2.weather.gov/climate/index.php?wfo=BOX

Radivojevic, Suzana, and Alex McMurry. “Protective Treatments for Western Red Cedar Shingle and Shake Roofs.” Washington State Parks and Recreation Commission. April 16, 2019.

Remodelingexpense.com. “Cost of Rigid Foam Insulation.” https://www.remodelingexpense.com/costs/cost-rigid-foam-insulation/.

Rose, William B. "Should the Walls of Historic Buildings Be Insulated." *APT Bulletin: The Journal of Preservation Technology* 36, no. 4 (2005): 13-18. http://www.jstor.org.libproxy.uoregon.edu/stable/40003158.

Score, Robert, and Bradford S. Carpenter. "An Analysis of the Thermal Performance of Repaired and Replacement Windows." APT Bulletin 40, no. 2 (2009): 11-19.

Stuckey, Steven. "Alternative Weather Stripping for Historic Window Sash at Mount Vernon, Virginia." APT Bulletin: The Journal of Preservation Technology 49, no. 1 (2018): 51-58. https://www-jstor-org.libproxy.uoregon.edu/stable/26452205.

US Department of Energy, Energy Savers Booklet. http://www1.eere.energy.gov/consumer/tips/pdfs/energy_savers.pdf

U.S. Department of Energy Office of Energy Efficiency and Renewable Energy. “Weatherization Works!” https://www.energy.gov/sites/prod/files/2018/06/f52/EERE_WAP_Fact%20Sheet-v2.pdf.

Viridian Window Restoration. “How We Do It: Let’s Get Technical.” http://viridianwindows.com/lets-get-technical. Accessed April 1, 2019.

Whole Building Design Guide Resource Pages. “Windows and Glazing.” https://www.wbdg.org/resources/windows-and-glazing. Accessed May 7, 2019.

Williams, James J. *Living with Nature: the Farnsworth House and the Environmental Successes and Failures of Modernist Architecture.* Master’s Thesis, University of Cincinnati, 2015.

Chapter 4

Bush, George W. “Executive Order 13287.” March 3, 2003. https://www.gpo.gov/fdsys/pkg/WCPD-2003-03-10/pdf/WCPD-2003-03-10-Pg286.pdf.

Chequamegon-Nicolet National Forest and Northland College. “Historic Property Lease for Forest Lodge.” January 9, 2017.

Congressional Research Service. "Federal Lands Recreation Enhancement Act: Overview and Issues." October 31, 2018. https://fas.org/sgp/crs/misc/IF10151.pdf.

General Services Administration. "Historic Building Stewardship." Historic Preservation. Last reviewed May 11, 2018. https://www.gsa.gov/real-estate/historic-preservation/historic-building-stewardship.

Gifford Pinchot National Forest and Skamania County. "Wind River Work Center – NHPA Sec. 111 Historic Property Lease Draft." February 28, 2018.

National Trust for Historic Preservation. *Historic Leasing in the National Park System.* Washington D.C.: National Trust for Historic Preservation, 2013.

National Park Service. "National Historic Preservation Act of 1966." Accessed November 14, 2018. https://www.nps.gov/history/local-law/nhpa1966.htm.

U.S. General Services Administration. "Extending the Legacy GSA Historic Building Stewardship 2017." https://www.gsa.gov/cdnstatic/Historic_Preservation/2017%20GSA%20Extending%20the%20Legacy.pdf.

United States Forest Service. *FSH 2709.14 Recreation Special Uses Handbook Chapter 50: Outfitting and Guiding Concession Services.* Washington D.C.: United States Forest Service, 2013.