APPROVED
APR 21 2022
BOARD OF RECREATION
AND PARK COMMISSIONERS

BOARD REPORT **NO.** 22-094

DATE April 21, 2022 C.D. 12

BOARD OF RECREATION AND PARK COMMISSIONERS

SUBJECT: OAKRIDGE ESTATE – INDOOR AND OUTDOOR IMPROVEMENTS (PRJ21617) PROJECT – COMMITMENT OF PARK FEES – CATEGORICAL EXEMPTION FROM THE PROVISIONS OF THE CALIFORNIA ENVIRONMENTAL QUALITY ACT (CEQA) PURSUANT TO ARTICLE III, SECTION 1, CLASS1(1) [INTERIOR AND EXTERIOR ALTERATIONS INVOLVING REMODELING OR MINOR CONSTRUCTION WHERE THERE BE NEGLIGIBLE OR NO EXPANSION OF USE], CLASS 1(3) [MINOR ALTERATION OF EXISTING PEDESTRIAN TRAILS AND PARKING LOTS]; CLASS 4(3) [NEW LANDSCAPING] AND CLASS 4(12) [MINOR TRENCHING AND BACKFILLING WHERE THE SURFACE IS RESTORED] OF CITY CEQA GUIDELINES AND ARTICLE 19, SECTIONS 15301(c), 15304(b), 15304(f) AND 15331 OF CALIFORNIA CEQA GUIDELINES

AP Diaz		M. Rudnick	
H. Fujita		*C. Santo Domingo	DF
J. Kim		N. Williams	

for

M. Rudnick
General Manager

Approved X Disapproved _____ Withdrawn _____

RECOMMENDATIONS

1. Approve the scope of work for the Oakridge Estate – Indoor and Outdoor Improvements (PRJ21617) Project (Project), as described in the Summary of this Report;

2. Authorize RAP staff to commit from the following fund and work order numbers, a maximum of Eight Hundred Thousand Dollars ($800,000.00) in Park Fees, for the proposed Project:

FUNDING SOURCE	FUND/DEPT./ACCT. NO.	WORK ORDER NO.
Park Fees	302/89/89716H	QT074504
Park Fees	302/89/89716H	QM061023
Park Fees	302/89/89716H	QT073996
Park Fees	302/89/89716H	QT050791
Park Fees	302/89/89716H	QT072622
Park Fees	302/89/89718H	QP000447
Park Fees	302/89/89718H	QP002197
Park Fees	302/89/89718H	QP002036

3. Approve the proposed Project to be bid and constructed through the RAP's list of pre-qualified on-call contractors;

4. Approve the authorization of change orders as authorized under Report No. 06-136, for the construction contracts for this proposed Project in the budget contingency amounts for such contracts as stated in this Report;

5. Determine that the Project is categorically exempt from the provisions of the California Environmental Quality Act (CEQA) pursuant to Article III, Section 1, Class 1(1) [Interior and exterior alterations involving remodeling or minor construction where there be negligible or no expansion of use], Class 1(3) [Minor alteration of existing pedestrian trails and parking lots]; Class 4(3) [New landscaping] and Class 4(12) [Minor trenching and backfilling where the surface is restored] of City CEQA Guidelines and Article 19, Sections 15301(c), 15304(b), 15304(f) and 15331 of California CEQA Guidelines and direct RAP staff to file a Notice of Exemption (NOE) with the Los Angeles County Clerk;

6. Authorize RAP's Chief Accounting Employee to prepare a check to the Los Angeles County Clerk in the amount of $75.00 for the purpose of filing an NOE; and,

7. Authorize RAP staff to make technical corrections as necessary to carry out the intent of this Report.

SUMMARY

Oakridge Estate is located at 18700 West Devonshire Street in the Northridge community of the City. This 9.33-acre property is housed within Oakridge Estate Park, which provides tennis courts and open space for the surrounding community. Approximately 792 City residents live within a one half-mile walking distance of Oakridge Estate. Due to the facilities, features, programs, and services it provides, Oakridge Estate meets the standard for a Neighborhood Park, as defined in the City's Public Recreation Plan.

PROJECT SCOPE

RAP has recently completed a Historic Treatment Plan for the Oakridge Estate (Attachment 1). The Historic Treatment Plan outlines the critical next steps to further the public use and benefit of the residence and its open space. The Historic Treatment Plan also identified and recommended various immediate, near-term, and long-term priorities for the repair and restoration of the facility.

The scope of work of the Project would focus on the improvements that were identified in the Historic Treatment Plan as immediate priorities:

- Restoration of the residence's exterior and entry gates
- Restoration of the flagstone paths

- ADA Improvements, such as accessible parking, the installation of an ADA restroom in garage, path of travel improvements, and ADA entry to the Great Room
- Trees, landscaping and irrigation improvements
- Upgrades to the existing building electrical, plumbing and security systems
- Installation of a new fire detection and notification system
- Improvements to the Great Room, including mural conservation, insulation, and climate control
- Improvements to the tennis court fencing and walls.

PROJECT FUNDING

Upon approval of this Report, Eight Hundred Thousand Dollars ($800,000.00) in Park Fees can be committed to the proposed Project.

The anticipated pre-qualified on-call contracts for this Project will be for Park Facility Construction. The budget contingency amount for the Park Facility Construction Contract will be Forty Thousand Dollars ($40,000.00).

These Park Fees were collected within two (2) miles of Oakridge Estate, which is the standard distance for the commitment of the Park Fees for neighborhood recreational facilities pursuant to Los Angeles Municipal Code Section 12.33 E.3.

FUNDING SOURCE MATRIX

Source	Fund/Dept/Acct	Amount	Percentage
Park Fees	302/89/89716H	$799,895.82	99%
Park Fees	302/89/89718H	$104.18	1%
Total		$800,000.00	100%

PROJECT CONSTRUCTION

RAP staff has determined that sufficient funding has been identified and construction for the proposed Project is anticipated to begin in Spring 2023.

TREES AND SHADE

This proposed Project will have no impact on the existing trees and shade at Oakridge Estate.

ENVIRONMENTAL IMPACT

The proposed Project consists of interior and exterior alterations involving remodeling or minor construction where there be negligible or no expansion of use, maintenance, repair, restoration and preservation of historic resources in a manner consistent with the Secretary of the Interior's Standards for the Treatment of Historic Properties with Guidelines for Preserving, Rehabilitating,

Restoring and Reconstructing Historic Buildings (Weeks & Grimmer, 1995); minor alteration of existing pedestrian trails and parking lots; new landscaping and minor trenching and backfilling where the surface is restored.

This site is not within a coastal, methane zone, so there is no reasonable possibility that the project may impact on an environmental resource of hazardous or critical concern or have a significant effect due to unusual circumstances. No other known projects would involve cumulatively significant impacts, and no future projects would result from the proposed project. As of March 14, the State Department of Toxic Substances Control (DTSC) (Envirostor at www.envirostor.dtsc.ca.gov) has not listed the Project site or any contaminated sites near the Project area (within 500 feet). According to the Caltrans Scenic Highway Map there is no scenic highway located within the vicinity of the project or within the project site. Furthermore, the proposed project consists of the rehabilitation of a City of Los Angeles Historic Cultural Monument (HCM #484) in a manner consistent with the Secretary of the Interior's Standards for the Treatment of Historic Properties with Guidelines for Preserving, Rehabilitating, Restoring and Reconstructing Historic Buildings (Weeks & Grimmer, 1995), therefore it will not cause substantial adverse effect on an historic resource.

Based on this information, staff recommends that the Board of Recreation and Parks Commissioners' (Board) determines that it is categorically exempt from the provisions of the California Environmental Quality Act (CEQA) pursuant to Article III, Section 1, Class 1(3), Class 4(3) and Class 4(12) of City CEQA Guidelines and Article 19, Sections 15301(c), 15304(b), 15304(f) and 15331 of California CEQA Guidelines. RAP Staff will file a Notice of Exemption with the Los Angeles County Clerk upon Board's approval

FISCAL IMPACT

There is no immediate fiscal impact to RAP's General Fund as a result of this Project. Maintenance funds for the park will be requested as part of the annual City budget process. This budget will include part time staff, materials and supplies and will provide year round maintenance.

STRATEGIC PLAN INITIATIVES AND GOALS

Approval of this Board Report advances RAP's Strategic Plan by supporting:

Goal No. 1: Provide Safe and Accessible Parks
Outcome No. 2: All parks are safe and welcoming

Result: The improvements at Oakridge Estate will enhance the park users' experience and safety.

This Report was prepared by Ligaya Khennavong, Management Assistant, Planning, Maintenance and Construction Branch.

ATTACHMENTS

1) Attachment 1 – Historic Treatment Plan of Oakridge Estate

ATTACHMENT

THE OAKRIDGE ESTATE -
HISTORIC TREATMENT PLAN

PAGE&TURNBULL

THE OAKRIDGE ESTATE
HISTORIC TREATMENT PLAN

NORTHRIDGE, CALIFORNIA
[21103]

MARCH 16, 2022
FINAL REPORT

PREPARED FOR THE CITY OF LOS ANGELES
DEPARTMENT OF RECREATION AND PARKS

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I. INTRODUCTION

PROJECT INFORMATION

This historic treatment plan for The Oakridge Estate has been prepared by Page & Turnbull for the City of Los Angeles, Department of Recreation and Parks (RAP). Page & Turnbull was subcontracted to Tetra Tech, Inc. (Tetra Tech) who holds Prime Contract No. 3674 with the City of Los Angeles.

The Oakridge Estate, located at 18650 Devonshire Street in the Northridge area of Los Angeles, California, was acquired by the City of Los Angeles in 2009 and is Historic-Cultural Monument (HCM) Number 484. The estate is significant for its association with original owner, actress Barbara Stanwyck, and the second owner, actor Jack Oakie. The 6,500 square-foot, two-story residence is attributed to master architects Paul Revere Williams and Robert Finkelhor and is an excellent example of an English manor completed in the French Normandy and Tudor Revival styles.

A historic treatment plan is an essential step forward for The Oakridge Estate. In 2012, a Historic Structure Report (HSR) was completed to guide initial stabilization and repairs to the residence and estate. In the ensuing years, critical repairs to the exterior of the residence, including installation of a new roof, have been completed. Over the past decade, The Friends of Oakridge (Friends), in partnership with RAP, have raised the public's awareness and appreciation of the site through docent-led tours, lectures, film screenings and other special events.[1] Additionally, The Friends have provided critical financial support for repairs and landscape improvements. Building on the successes of the previous decade, this historic treatment plan outlines the critical next steps to further the public use and benefit of the residence and its open space.

STUDY BOUNDARIES

The Oakridge Estate is located in the Northridge community of the San Fernando Valley, approximately 30-miles northwest of downtown Los Angeles. Entry to the estate is from Devonshire Street between Wilbur Avenue and Reseda Boulevard. Oakridge Estate Park, a City Park consisting of walking trails and a children's play area, occupies the western portion of the 9.47-acre parcel acquired by the City in 2009. A car dealership adjoins the property to the east with residential use to the south.

The area is served by Council District 12. According to the Countywide Parks and Recreation Needs Assessment published in 2016, which quantifies the need for parks and recreation resources throughout Los Angeles County, the Northridge community is considered to have a high need for

[1] More information on The Friends of Oakridge is available at: https://www.theoakridgeestate.org/

additional parks and open space based on an analysis of demographic, health, and environmental information.[2] This designation unlocks opportunities for improvement projects in the region to receive competitive, needs-based funding for parks and recreation including Measure A funds.[3]

This historic treatment plan focuses on the historic residence and portions of the site that occupy "the knoll", including the entry gates, driveway, front and rear yards, and the swimming pool (**Figure 1**). The tennis court and landscape areas south of the pool are discussed in general terms and are not the focus of this plan.

Figure 1: Overview of The Oakridge Estate showing project limits and near-term focus area. Source: Google Earth with modifications by Page & Turnbull, 2021.

[2] https://lacountyparkneeds.org/final-report/
[3] https://www.laparks.org/measure-aprojects

PROJECT PURPOSE

A historic treatment plan defines the scope and preservation treatments for a historic property. A historic treatment plan is tailored to the unique preservation, resource management, and functional concerns of a given property. The historic treatment plan for The Oakridge Estate:

- Conceives of a concept plan that balances preservation of the residence and site with changes required for future public use;
- Outlines approaches for the preservation, rehabilitation, and restoration of significant spaces, features, and materials;
- Establishes immediate, near-term, and long-term priorities; and
- Provides preliminary cost data for budgeting and fund-raising.

METHODOLOGY

Page & Turnbull prepared this historic treatment plan using previous reports and existing historic documentation, including historic photographs provided by RAP and Friends. Additional historic research was not completed as part of this project. Original architectural plans of the residence have not been located. African American architect Paul Revere Williams is credited with the design. The Getty Research Institute is currently digitizing the Williams' archives and it is possible historic plans will be available at the completion of the archiving process[4]. All current photographs within this report were taken by Page & Turnbull unless otherwise noted.

The conceptual treatment plan was established through two collaborative workshops held at The Oakridge Estate. On June 29th, Friends Board members and volunteers and RAP provided input on their wish list and aspirations for the restoration and future use of The Oakridge Estate. Additional input was gathered through written surveys distributed at the June 29th meeting. Preliminary concepts were presented and discussed at the rehabilitation concepts workshop held on July 29th. There was consensus that the "Revitalize the Knoll" concept directed at the restoration and rehabilitation of the historic residence and the yard and pool south of the residence should be the focus of the treatment plan. The final concept plan presented in this report was further refined based on additional input from Friends Board following their monthly meeting on August 9th.

[4] http://news.getty.edu/architect-paul-revere-williams-archive-jointly-acquired-by-usc-school-architecture-and-getty-research-institute.htm

Figure 2: Visioning Workshop on June 29, 2021.

Figure 3: Site tour with Friends on June 29, 2021.

In addition to the workshop, Page & Turnbull conducted additional site visits in June and July of 2021 to verify existing conditions and gather input from City representatives with first-hand knowledge of the property. Caretaker and arborist, Leon Boroditsky, clarified the existing condition of trees and plant materials. Park maintenance supervisor, Brain Yamasaki, along with Miguel Gonzalez reviewed maintenance conventions for the property. RAP project manager, Elena Maggioni, Ph.D., orchestrated the site visits and provided background information and follow-up on project requests. Alexis Bahou and Julia Mates with Tetra Tech reviewed project deliverables and provided coordination with the City.

The historic treatment plan is organized into two chapters. The Treatment Concept Plan chapter presents the preferred concept plan that guides future restoration and reuse of the site. A summary of the key program elements and vision for the site is provided. The Treatment chapter forms the core of the historic treatment plan. The Treatment chapter first summarizes applicable historic preservation standards and guidelines before outlining specific repairs and upgrades. The Treatment chapter includes both the interior and exterior of the residence and the site. Detailed room-by-room treatment overviews are provided in the Appendix. Additional details on the cost estimate are also included in the Appendix.

SUMMARY OF TREATMENT PRIORITIES AND COSTS

To assist with budgeting and fundraising, costs for repair, restoration, and upgrades are structured into distinct projects. The projects generally fall into three categories. The colors associated with the three categories are applied to the cost summaries that follow.

	Preservation and Deferred Maintenance / Resource Protection • **Address safety issues and items requiring immediate repair** • **Stabilization of historic features to prevent additional deterioration** • **Upgrades to critical infrastructure to protect the historic resources** • **Encourage health of trees and vegetation**

	Programming and Use • Upgrades to the residence and site required for public use • Disabled access including entrance, restrooms, parking • Infrastructure and amenities required to host events

	Restoration and Interpretation • Restoration to specific era (Stanwyck or Oakie) • Rehabilitation of features to maintain historic look and feel • New features and items for education purposes

Furthermore, the projects are assigned to **Immediate** (1-5 years); **Near-term** (5 to 10 years); and **Long-term** (beyond 10-years) categories. Generally, projects listed under the immediate time frame relate to preservation and deferred maintenance. Near-term and long-term projects are associated with future programming and the interpretive program for the estate. Priorities may be reassessed and reassigned as funding opportunities become available.

Estimates of probable costs were prepared by cost estimators at J.R. Conkey & Associates. The costs are organized according to immediate, near-term, and long-term treatment priorities, as outlined above. Costs include direct construction costs and indirect contractor costs, including insurance, bonds, overhead and profit. A contingency is included to cover work items not yet well-defined and to address unexpected items encountered during construction. Escalation to an estimated bid date is not included, but should be assumed at 5-percent per annum. More details on the costs are included in the Appendix.

Immediate Priorities

Category	Project	Estimated Cost[1,4,7]
	1) Restoration of Residence Exterior and Entry Gates	$165,000.00
	2) Restoration of Flagstone Paths[2]	$21,000.00
	3) Disabled Access Improvements (Accessible parking, ADA restroom in garage, path of travel, entry to Great Room)	$53,000.00
	4) Improve Health of Existing Trees and Plants	$70,000.00
	5) Inspect, Repair and Upgrade Existing Building Electrical, Plumbing and Security Systems	$57,000.00
	6) Provide Fire Detection and Notification System	$20,000.00
	7) Great Room Mural Conservation[5]	$40,000.00
	8) Complete DWP Electrical Service Upgrades[6]	$105,000.00
	9) Improve Insulation and Climate Control at Building Envelope / Provide HVAC at Great Room Only	$35,000.00
	10) Yard Zone Rehabilitation - new landscape and infrastructure (power, water, irrigation) for events	$110,000.00
	11) Stabilize Tennis Court Fencing / Walls & Court	$12,000.00

Notes:

[1]Estimated costs include direct construction costs (materials and labor); estimating and construction contingency (20-percent); contractor mark-ups (overhead & profit 20-percent; and general conditions, insurance, and bonds 15-percent). Costs are rounded. Soft costs, including design fees are not included.

[2]Repair of flagstone surround at swimming pool included with conversion of swimming pool to reflecting pool.

[3]The list of projects is in no particular order.

[4]Total cost for the immediate projects listed above in current dollars is approximately $688,000.00

[5]Cost is based on the art conservation proposal by FACL, Inc dated November 28, 2017.

[6]Scope of work based on information provided to Elena Maggioni by Brian Reagan in an email on July 30, 2021. Confirm scope with City and LA-DWP. Additional work may be required.

[7]The costs are current and do not included escalation, assumed to be 5-percent per annum.

Near-term Priorities

Category	Project	Estimated Cost[1,4,5]
	1) Restoration of Interior Spaces - First Floor[2]	$75,000.00 to $110,000.00
	2) Restoration of Interior Spaces - Second Floor	$50,000.00 to $75,000.00
	3) Convert Swimming Pool to Reflecting Pool, Restore Flagstone surround, provide new low water landscape at pool zone	$310,000.00
	4) Provide Sprinklers at Residence	$65,000.00
	5) Provide HVAC for the Entire Residence	$150,000.00
	Notes: [1]Estimated costs include direct construction costs (materials and labor); estimating and construction contingency (20-percent); contractor mark-ups (overhead & profit 20-percent; and general conditions, insurance, and bonds 15-percent). Costs are rounded. Soft costs, including design fees are not included. [2]Art conservation of the mural in the Great Room included as an immediate priority. [3]The list of projects is in no particular order. [4]Total cost for the near-term projects listed above in current dollars is approximately $650,000.00 to $710,000.00. [5]The costs are current and do not included escalation, assumed to be 5-percent per annum.	

Long-term Priorities

Category	Project	ROM Cost[1,3,4]
	1) Tennis Court Rehabilitation for Event Space	$100,000.00
	2) Event Pavilion near Tennis Courts, Assume 1,500 square feet	$375,000.00
	3) Landscape Improvements beyond the Knoll – 1.5 acres	$225,000.00
	4) New architectural fence and gate along Devonshire Street – 450 linear feet	$80,000.00
	5) Additional Parking	$30,000.00 to $50,000.00
	Notes: [1]Estimated costs include direct construction costs (materials and labor); estimating and construction contingency (20-percent); contractor mark-ups (overhead & profit 20-percent; and general conditions, insurance, and bonds 15-percent). Costs are rounded. Soft costs, including design fees are not included. [2]The list of projects is in no particular order. [3]Total cost for the long-term priorities listed above in current dollars is approximately $810,000.00 to $830,000.00. [4]The costs are current and do not included escalation, assumed to be 5-percent per annum.	

II. Treatment Concept Plan

The treatment concept plan was developed through a collaborative design process led by Page & Turnbull at the beginning of the project. The treatment concept plan defines the treatment approach for the residence and key site features, including the rear yard, swimming pool, tennis courts and open space . The treatment concept plan reflects the following vison and future programming for the residence and site provided by Friends and staff from RAP at the workshops and through written surveys and emails.

VISION

Visions for The Oakridge Estate property include:

- Source of refuge for local community and all Angelenos
- Engage all generations and socioeconomic levels
- Retain the charm of being in the country
- Residence should be living museum
- Retain historic imprint of home
- Residence is a rare nearly untouched 1937 structure
- Full scale improvements needed, top to bottom plus the yard

FUTURE PROGRAMMING

The Oakridge Estate property may be used in the future for the following activities:

- Community meeting space
- Cultural facility
- Exhibits (permanent and rotating)
- Docent-led Tours
- Lectures and screenings
- Event rentals such as weddings
- Film-shoot rentals
- Afternoon tea
- Outdoor events (lawn)
- Habitat (monarchs and owls) or demonstration gardens
- Concerts
- Craft fairs
- Exercise classes
- Children’s conservation area
- Senior gathering for board games including mah jong or chess

- Tennis courts as an event staging area
- Vintage fairs

CONCEPTS

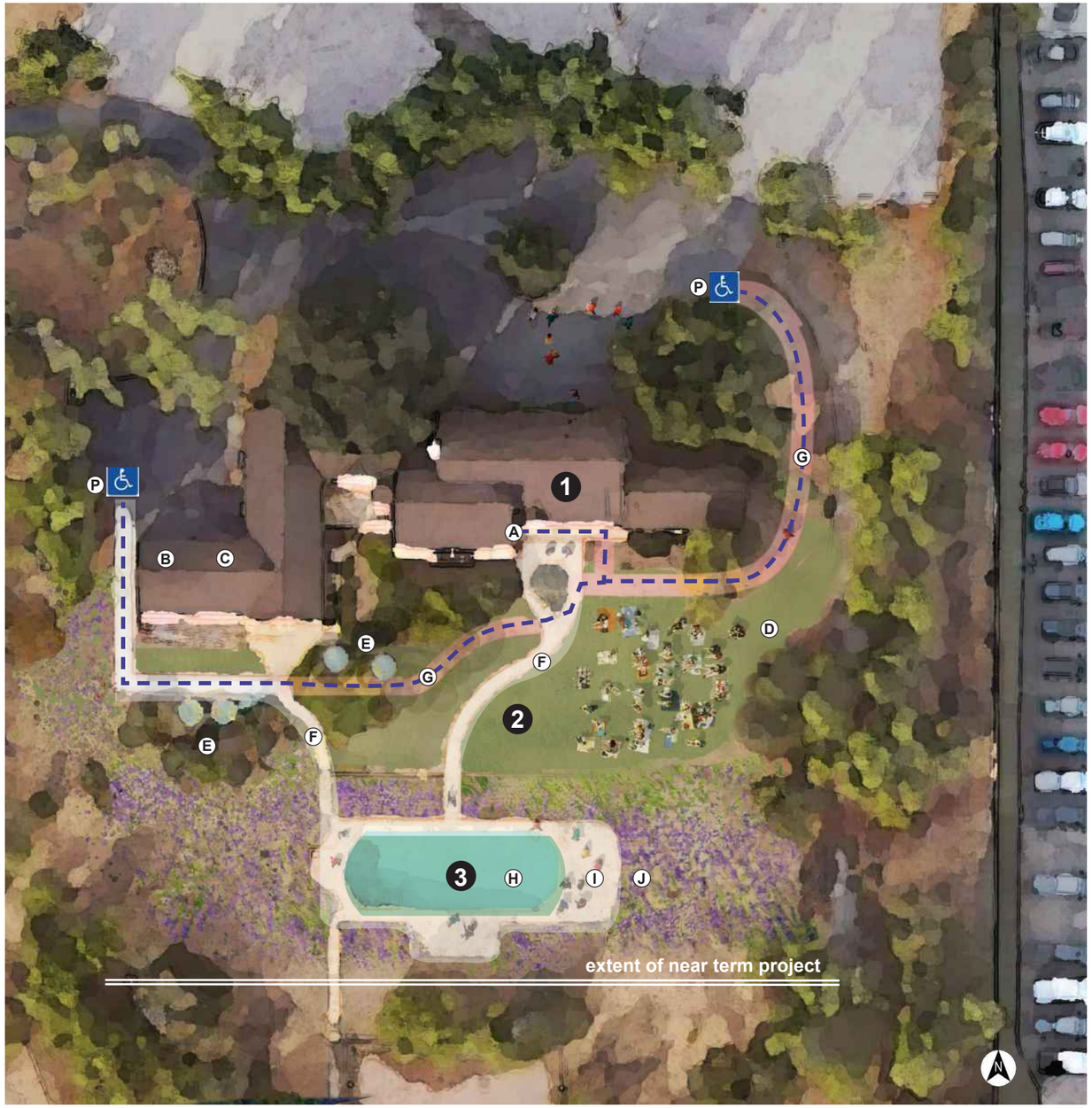
In order to expediently increase access to the site within current budget constraints while providing a vision for long term site use, two concepts were developed. The first concept focuses on areas immediately surrounding the historic residence and pool and is intended to be carried out in the near term. The second concept captures the rest of the site to the south including the tennis courts and imagines work undertaken within an expanded timeframe.

Revitalize the Knoll (Near Term)

- Accessible entrance to the historic residence through the Mural Room
- Accessible restroom and event storage at the Garage
- Accessibly pathways throughout the Knoll
- Restored flagstone paths
- Outdoor event space with lawn
- Shaded rest and picnic areas adjacent to the historic residence
- Reflecting pool with restored flagstone pool surround and drought tolerant landscaping

Make Room to Grow (Expanded)

- Habitat demonstration garden
- Restored tennis courts for event space with adjacent covered pavilion
- Orchard and landscape buffer
- Additional parking



Revitalize the Knoll

Near Term Concept

1 Historic Residence

- Ⓐ Accessible Entry to Mural Room, East Door
- Ⓑ Accessible Restroom at Garage
- Ⓒ Event Storage
- Ⓟ Accessible Parking Options

2 Yard Zone

- Ⓓ Outdoor Events Space with Lawn
- Ⓔ Shaded Rest and Picnic Area
- Ⓕ Restored Flagstone Paths
- Ⓖ Accessible Path

3 Pool Zone

- Ⓗ Reflecting Pool
- Ⓘ Restored Flagstone Pool Surround
- Ⓙ Drought Tolerant Habitat Garden

Site Preservation and Maintenance

- ① Stabilize and protect character-defining site features
- ② Prioritize maintenance and health of existing trees and shrubs

Make Room To Grow

Expanded Concept

1. Historic Residence
2. Yard Zone
3. Pool Zone
4. Habitat Demonstration Garden
5. Event Pavilion
6. Restored Tennis Courts Outdoor Event Space
7. Orchard or Productive Landscape
8. Landscape Buffer
9. Additional Parking

III. TREATMENTS

Treatments are included for key building and site elements. Each section includes a physical description and general condition of the element and recommendations for treatment and repair. Interior room-by-room surveys are included in the Appendix of the report and should be consulted for detailed condition and treatment recommendations. Overall photos of the exterior and existing floor plans are also included in the Appendix.

TREATMENT APPROACH

The Secretary of the Interior's Standards for the Treatment of Historic Properties are "a series of concepts about maintaining, repairing, and replacing historic materials, as well as designing new additions or making alterations," that promote best practices to help protect historic and cultural resources.[5] They provide a framework for making decisions about alterations or changes to a historic property. In addition, the *Standards* are the benchmark by which federal agencies and many local government bodies, including the City of Los Angeles Office of Historic Resources, evaluate rehabilitative work on historic properties. They are a useful analytic tool for understanding and describing the potential impacts of substantial changes to historic resources.

The Secretary of the Interior's Standards for the Treatment of Historic Properties, has four potential treatment options:

1. ***Preservation:*** Requires retention of the greatest amount of historic fabric, along with the building's historic form, features, and detailing as they have evolved over time.

2. ***Rehabilitation:*** Acknowledge the need to alter or add to a historic building to meet continuing or new uses while retaining the building's historic character.

3. ***Restoration:*** Allow for the depiction of a building at a particular time in its history by preserving materials from the period of significance and removing materials from other periods.

4. ***Reconstruction:*** Establish a limited framework for re-creating a vanished or non-surviving building with new materials, primarily for interpretive purposes.

[5] https://www.nps.gov/tps/standards.htm

Rehabilitation is the recommended treatment noted in the 2012 Historic Structure Report.[6] Rehabilitation is defined as the act or process of making possible a compatible use for a property through repair, alterations, and additions while preserving those portions or features which convey its historical, cultural, or architectural values. The treatment concept plan is

The *Secretary of the Interior's Standards for Rehabilitation*[7] are as follows:

1. *A property will be used as it was historically or be given a new use that requires minimal change to its distinctive materials, features, spaces and spatial relationships.*

2. *The historic character of a property will be retained and preserved. The removal of distinctive materials or alteration of features, spaces and spatial relationships that characterize a property will be avoided.*

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

4. *Changes to a property that have acquired historic significance in their own right will be retained and preserved.*

5. *Distinctive materials, features, finishes and construction techniques or examples of craftsmanship that characterize a property will be preserved.*

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

7. *Chemical or physical treatments, if appropriate, will be undertaken using the gentlest means possible. Treatments that cause damage to historic materials will not be used.*

8. *Archeological resources will be protected and preserved in place. If such resources must be disturbed, mitigation measures will be undertaken.*

9. *New additions, exterior alterations or related new construction will not destroy historic materials, features and spatial relationships that characterize the property. The new work will be*

[6] 2012 HSR, page 50.
[7] Kay D. Weeks and Anne E. Grimmer, *The Secretary of the Interior's Standards for the Treatment of Historic Properties with Guidelines for Preserving, Rehabilitating, Restoring, and Reconstructing Historic Buildings* (Washington, D.C.: U.S. Department of the Interior National Park Service, 1995), 2.

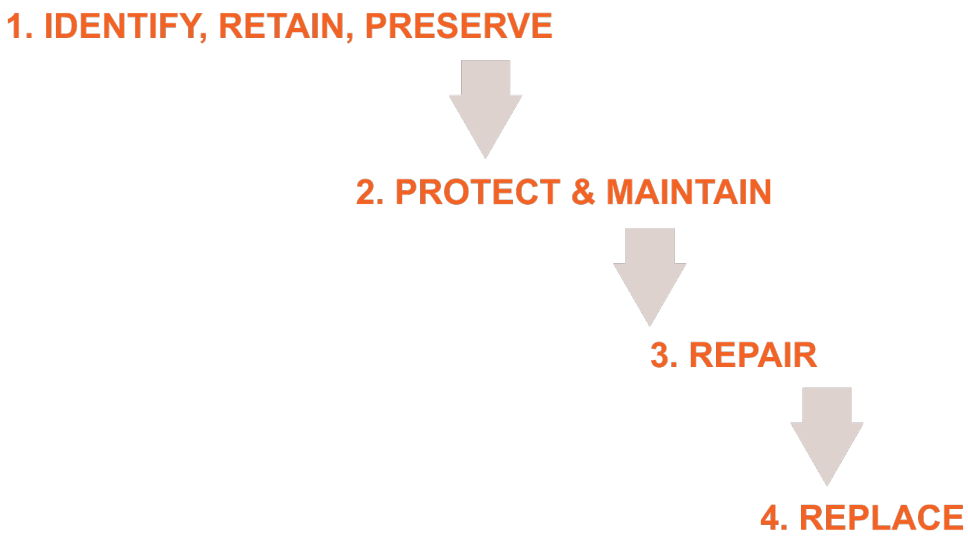
differentiated from the old and will be compatible with the historic materials, features, size, scale and proportion, and massing to protect the integrity of the property and its environment.

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

The *Standards* are supplemented by the *Guidelines for Preserving, Rehabilitating, Restoring and Reconstructing Historic Building* (the *Guidelines*) which offer general design and technical recommendations to assist in applying the *Standards* to a specific property.[8] The Guidelines also offer specific recommended (and not recommended) approaches to exterior and interior elements of a building, such as exterior cladding, porches, windows, structural systems, significant spaces, and finishes, as well as certain common materials. Guidelines are also offered for mechanical systems, site work, and energy efficiency. Separate guidelines are available for sustainability.

There are guidelines for each of the four Standard treatments that outline a general hierarchical process for the treatment of historic materials and features.

In general, the hierarchy for all the treatments and for preservation best practices is:



[8] *The Guidelines* are available on-line at: https://www.nps.gov/tps/standards/treatment-guidelines-2017.pdf.

For the Preservation Guidelines, the specific hierarchy of treatment is:

> Preservation Priority 1: Identify, retain, and preserve historic materials and features that are important in defining the buildings historic character.
> Preservation Priority 2: Stabilize deteriorated historic materials and features as a preliminary measure.
> Preservation Priority 3: Protect and maintain historic materials and features that are important and must be retained.
> Preservation Priority 4: Repair (stabilize, consolidate, and conserve) historic materials and features when warranted due to physical deterioration.
> Preservation Priority 5: Limited replacement in kind of extensively deteriorated portions of historic features.

Laws, Regulations & Functional Requirements

This section outlines applicable laws, regulations and functional requirements. Generally, building codes require that existing buildings need to be maintained in a safe and sanitary condition in conformance with the code edition under which they were originally built. New, or current, codes only apply in entirety to new work, including new additions to existing buildings and when there is a change of use. If the existing use is maintained, the current conditions can continue. Docent-led tours and meeting space proposed in the treatment plan are consistent with the existing residential use. A code analysis will be needed if more intense public use is proposed.

As a qualified historic site, the estate is eligible to take advantage of the *California Historical Building Code (CHBC)* with regard to code compliance. The CHBC is intended to be used by any agency with jurisdiction when reviewing code compliance for a qualified historic building in order to ensure its preservation. As stated in the CHBC Section 8-101.2:

> The CHBC is intended to provide solutions for the preservation of qualified historical buildings or properties, to promote sustainability, to provide access for persons with disabilities, to provide a cost-effective approach to preservation, and to provide for reasonable safety of the occupants or users. The CHBC requires enforcing agencies to accept solutions that are reasonably equivalent to the regular code (as defined in Chapter 8-2) when dealing with qualified historical buildings or properties. The CHBC includes the following code topics that are typically triggered during the repair and alteration of a historic building:

- Use and Occupancy (Chapter 8-3)
- Fire Protection (Chapter 8-4)
- Means of Egress (Chapter 8-5)

- Accessibility (Chapter 8-6)
- Structural Regulations (Chapter 8-7)
- Archaic Materials and Methods of Construction (Chapter 8-8)
- Mechanical, Plumbing and Electrical (Chapter 8-9)

CONDITIONS ASSESSMENT

An existing conditions assessment of The Oakridge Estate and site was completed on June 30 and July 22, 2021, by Drew Gorski and Johanna Hauser of Page & Turnbull, to document and assess the condition of the existing residence and site features; to identify areas of immediate concern; and to identify and develop treatments and repair strategy for these areas. Repair and restoration areas were quantified through on-site measurements. These quantities were used to generate the preliminary cost estimates included in this report. Existing conditions were recorded by digital photographs and hand-written field notes. No binocular surveys or investigative openings were undertaken.

CONDITIONS DEFINITIONS

Conditions of various building and site elements are described as **good**, **fair**, and **poor**, defined as:

Good

The building element / feature is intact, structurally sound, and performing its intended purpose. The component needs no repair or rehabilitation but may need routine or preventative maintenance.

Fair

The building element / feature shows signs of aging and one or more of the following conditions is present:

a) There are early signs of wear, failure, or deterioration, though the component and its features are generally structurally sound and performing their intended purpose; and/or
b) There is limited damage of a feature or component.

Poor

The building element / feature shows signs of deterioration and one or more the following conditions are present:

a) The features are no longer performing their intended purpose;
b) Features are missing;
c) Deterioration or damage affects more than 50% of the component; and/or
d) The component or features show signs of imminent failure or breakdown.

HAZARDOUS MATERIALS

An asbestos and lead paint survey of the Oakridge Estate was completed in 2012.[9] The report was updated in 2019 prior to replacement of the roof and wood siding at the roof gables.

Asbestos-containing building materials (ACBMs) documented in the 2019 report include:

- Black and brown penetration mastic at roof penetrations (mastic should have been removed when the roof was replaced in 2019)
- Rough stucco ceiling assemblies at the exterior south overhangs[10]
- Thermal System Insulation (TSI) and duct wrap at basement, attic, wall cavities, ceiling spaces, and crawl spaces

The 2019 report identifies a large number of lead-based painted materials (LBPMs), generally falling into the following categories:

- Exterior wood elements painted brown, including beams, columns, window and doors, frames, and assemblies
- Exterior white stucco
- Ceramic floor, countertop, and backsplash tiles
- Porcelain plumbing fixtures including toilets, sinks, and bathtubs
- Interior wood trim at base boards and window frames
- Interior wood doors at the pool bathroom
- Green metal light box at the tennis courts
- Green ceramic tile at the pool edge

The existing asbestos and lead paint survey did not include destructive testing. Additional asbestos-containing building materials and lead-based painted materials may be encountered in concealed wall and ceiling cavities and at other locations not included in the survey. Prior to treatment, review existing survey reports and complete additional testing, as required, to clarify the presence of ACBMs and LBPMs. Treatment methods included in this report may require modifications to deal with hazardous materials.

ACBMs and LBPMs that will be impacted by repair and restoration activities must be removed by a licensed abatement contractor according to current regulations.

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[9] Asbestos & Lead Inspection Report for the Oakridge Estate Property, ENCORP Environmental Network Corp. Prepared September 2012, revised October 2019. Report is included in the Appendix.

[10] Phase 1 Environmental Site Assessment Report, Limited Asbestos Survey & Limited Lead-Based Paint Survey, prepared for University of Southern California in 2002 notes all exterior stucco, including the exterior of the Garage and 2nd floor Master Bedroom as an ACBM. See page 20. Report is included in the Appendix.

Removal of paint from historic fabric shall use the gentlest means possible, removing paint to the next sound layer prior to repainting. See National Park Service, Preservation Brief 10: *Exterior Paint Problems on Historic Woodwork* and Preservation Brief 37: *Appropriate Methods for Reducing Lead-Paint Hazards in Historic Housing* for more info on mitigating lead-based paint issues and preparing historic surfaces for new paint coatings. The Preservation Briefs noted above are included in the Appendix.

RESIDENCE EXTERIOR FEATURES

EXTERIOR WOOD

Description

Exterior wood trim is present at roof rakes, eaves and at horizontal thresholds on every façade of the building.

Condition

The majority of the exterior wood trim is in fair condition with flaking paint and signs of rot, particularly at horizontal surfaces. Some wood boards are separating at corner joints.

Treatment Recommendations

Remove paint that is worn, chipped, peeling, blistered, or flaking using the gentlest means possible. Patch all holes and cracks up to 1/16 inch wide with wood filler and those 1/4 inch and greater with wood plugs or patches. Where portion of deteriorated wood is larger than 4 inches in length, provide new replacement boards spliced to surrounding sound wood using finger joints, dowels, or splines with water-resistant exterior adhesive and nailing. Use only concealed fasteners. Fill nail holes and patch surface, sanding to blend patch with surrounding existing surfaces. Prime and repaint all exterior wood trim to match existing.

Treatment methods above may require modifications to deal with hazardous materials. Review existing survey reports and complete additional testing, as required, to clarify the presence of LBPMs prior to treatment.

Figure 4: Wood sills typically require patching and paint.

Figure 5: Eave trim is separating at corner joints in some areas.

Figure 6: Portions of this wood window surround have detached from the building.

Figure 7: Rake boards typically require a new coat of paint.

FALSE HALF TIMBERING

Description

The west and south facades of the garage and the south façade at the second-floor master bedroom volume are finished with plaster articulated by Tudor style wood ornamentation mimicking 6-inch squared oak timbers joined by mortise and tenon with wooden pegs. A partial height site wall constructed with the same style encloses the south drying yard.

Condition

The majority of the ornamental woodwork is in fair to poor condition with flaking paint throughout and signs of water damage and rot, particularly at end grain edges. Wood boards are separating at corner joints and most pegs are lose or missing. The drying yard site wall appears to be structurally compromised and shifts under moderate hand pressure.

Treatment Recommendations

Remove paint that is worn, chipped, peeling, blistered, or flaking using the gentlest means possible. Patch all holes and cracks up to 1/16 inch wide with wood filler and those 1/4 inch and greater with wood plugs or patches. Where portion of deteriorated wood is larger than 4 inches in length, provide new replacement boards spliced to surrounding sound wood using finger joints, dowels, or splines with water-resistant exterior adhesive and nailing. Use only concealed fasteners. Fill nail holes and patch surface, sanding to blend patch with surrounding existing surfaces. Secure lose pegs with water-resistant exterior adhesive and provide new pegs where missing. Touch up plaster where it is cracked or missing around material transitions. Prime and repaint wood and plaster to match existing.

Rebuild the drying yard site wall to match the original. Use salvaged wood veneer where possible for false half-timber finishing.

Treatment methods above may require modifications to deal with hazardous materials. Review existing survey reports and complete additional testing, as required, to clarify the presence of LBPMs prior to treatment.

Figure 8: Flaking paint, wood deterioration and missing pegs at south second floor façade.

Figure 9: Flaking paint, wood deterioration and missing pegs at west garage facade.

Figure 10: Deteriorated boards separating at northwest corner of garage.

Figure 11: Lose peg at northwest corner of garage.

Figure 12: Wall at drying yard is not structurally sound and requires repairs using in-kind materials to match the existing wall.

WOOD PORCH PIERS

Description

The volume overhanging the south porch is supported by a wood beam and five wood piers with simple knee braces.

Condition

The majority of wood is in sound condition however there is extensive flaking paint, particularly at the southern, less protected exposure. One pier base appears to have been cut and is missing material.

Treatment Recommendations

Remove paint that is worn, chipped, peeling, blistered, or flaking using the gentlest means possible. Patch all holes and cracks up to 1/16 inch wide with wood filler and those 1/4 inch and greater with wood plugs or patches. At damaged pier base, fill void using a splice. Use only concealed fasteners. Fill nail holes and patch surface, sanding to blend patch with surrounding existing surfaces. Prime and repaint all patched and replacement wood to match existing.

Treatment methods above may require modifications to deal with hazardous materials. Review existing survey reports and complete additional testing, as required, to clarify the presence of LBPMs prior to treatment.

Figure 13: South facing porch looking north.

Figure 14: Detail of knee brace with extensive flaking paint.

Figure 15: Damaged pier base with missing material.

Figure 16: Pier base requiring paint repair.

LIMESTONE VENEER

Description

The majority of the façade is finished with an ashlar limestone veneer accented with darker limestone blocks intermittently.

Condition

At horizontal surfaces such as window sills where water collects and ponds, limestone is discolored and flaking, and in some places previous repair patches are eroding. The darker stone appears to be weakening at a faster rate, showing hairline fractures and in some places spalling significantly. The darker stone is also leaching, creating iron stains on the surrounding limestone.

Treatment Recommendations

Dirt and Debris Cleaning: Gently remove accumulated dirt and pollutants on horizontal surfaces using low to medium-pressure water (100 psi – 400 psi). Scrub with natural bristle or synthetic bristle brushes. Avoid metal brushes and high pressure washing. Use non-ionic detergents followed with a final water rinse.
Sandstone Stain Removal: For removal of streaking iron, apply a poultice cleaner, let stand, remove, and thoroughly clean following product instructions.
Stabilization: Stabilize spalling and cracks with a pin or crack fill.
Unit Repair: Reset loose, missing or cracked pieces of stone.
Unit Replacement: Carefully remove any stone which has spalled beyond repair by hand at perimeter joints using a hammer and chisel. Set salvaged stone or new stone to match existing in the cavity using new mortar to match the original mortar.

Figure 17: Dark sandstone is leaching iron onto surrounding limestone at north façade, creating dark orange streaks.

Figure 18: Limestone has discolored patches from environmental accumulation at horizontal surfaces such as window sills.

Figure 19: Limestone is flaking at horizontal surfaces.

Figure 20: Dark sandstone has spalled and is missing pieces.

STEEL CASEMENT WINDOWS

Description

The building façade is punctuated by steel casement windows in a wide range of sizes and configurations. Each window is equipped with a retractable window screen on the interior.

Condition

The windows are generally in good condition; however, they require some repair in order to secure their weather seal and maintain functionality in the long term. Many windows are missing hardware, and all windows have dried and cracking glazing putty. There are a few locations with broken glass, and many locations where the sashes have been caulked shut and are no longer operable. Retractable window screens remain; however, some do not operate with ease.

Treatment Recommendations

Remove caulking and glazing compound carefully by hand. Remove paint, rust and dirt from steel windows by scraping, sanding or wire brushing using the gentlest means possible. Air-blast any residual grit from the surface and wipe clean with a soft rag. Repair or replace deteriorated pieces of glazing or metal to match existing. Repair or replace damaged or missing hardware to match existing. Clean bare metal with a degreaser and fill small holes and other imperfections with a metal filler. After metal filler has cured, sand flush with the surface. Replace glazing compound and seal any open joints between metal features using backer rods and sealant. Apply primer and two coats of paint, covering surfaces completely to provide a uniform color and clean, sharp appearance, with no overlaps. New paint to match existing in color. Paint sheen to be semi-gloss. Window screens should be realigned where required to operate smoothly. See National Park Service, Preservation Brief 13: *The Repair and Thermal Upgrading of Historic Steel Windows*, included in the Appendix, for more information.

Treatment methods above may require modifications to deal with hazardous materials. Review existing survey reports and complete additional testing, as required, to clarify the presence of LBPMs prior to treatment.

Figure 21: Typical steel window.

Figure 22: Some sashes have been caulked shut from the exterior and are no longer operable.

Figure 23: Window paint at exterior is generally deteriorated.

Figure 24: Glazing compound is typically cracked and wood sills require repair (see exterior wood section).

Figure 25: Most windows retain original retractable screens.

EXTERIOR DOORS

Description

The house retains all original exterior wood panel doors. Four doors have an original screen door as well.

Condition

The majority of exterior doors are in fair condition, some with their original hardware intact, others with replacement hardware. Door paneling is separating in some locations and all doors require some level of patching and a new coat of paint. A few doors on the south façade have deteriorated significantly and may require full replacement if partial repairs are insufficient. Wood door trim is in fair condition, with the majority of wood sills exhibiting moderate rot and deterioration.

Treatment Recommendations

Remove flaking paint and reattach separated portions of door panels. Repaint and realign doors where required. New paint to match existing in color. Paint sheen to be semi-gloss. Patch small holes in trim and replace deteriorated portions with new to match existing. Restore existing hardware or replace with replica hardware if missing. Reconstruct the damaged screen door leading to the drying yard.

Treatment methods above may require modifications to deal with hazardous materials. Review existing survey reports and complete additional testing, as required, to clarify the presence of LBPMs prior to treatment.

Figure 26: The screen door leading into the drying yard requires reconstruction.

Figure 27: Lower portions of doors typically show more advanced deterioration.

Figure 28: The door leading into one pool restroom is boarded where a large portion of panel was removed.

Figure 29: Exterior wood sills are typically deteriorated, and many require replacement.

EXTERIOR LIGHT FIXTURES

Description

Building entrances were originally illuminated with decorative light fixtures matching the style of the house. Non-original security lighting was also added to the building exterior.

Condition

Some original decorative exterior light fixtures are present but require restoration. Some non-original fixtures have been installed, and some fixtures are missing entirely.

Treatment Recommendations

Where original light fixtures remain, repair, and refurbish housing, check operability, and rewire where required. Where no original light fixture remains, install a replica to match the original. Consider replacing non-original fixtures with replica to match the original based on photographic documentation. Re-lamp all fixtures with energy efficient bulbs.

Figure 30: Original light fixture at the garage to be refurbished.

Figure 31: Original light fixture at the south porch to be refurbished.

Figure 32: original light fixture at the south kitchen entry to be refurbished.

Figure 33: Non-original light fixture at the main entry door. Consider replacing with replica fixture to match original based on historic photographic documentation.

RESIDENCE INTERIOR FEATURES

FLOORING

Description

There are a variety of flooring types within the house, some rooms retaining original wood flooring, some finished with replacement materials, and some with an exposed subfloor where finishes were removed. Carpet has been removed from some rooms yet remains in the Mural Room and closets at the first and second floors. Newer, non-original wood flooring is installed in the entry hallway. Original linoleum flooring is present in the guest wing restroom and the trophy room, and original cork flooring remains in the kitchen and butler's pantry.

Condition

Original wood flooring is in good to fair condition, showing some discoloration in areas of water damage, uneven sun exposure, or other staining. Replacement wood flooring is in good condition. Original cork flooring is in good condition. Linoleum flooring shows signs of wear and delamination but is in working order. See individual rooms survey sheets located in the Appendix for additional information.

Treatment Recommendations

- Restore wood floors by gently sanding down discolored portions and refinishing to match the original. At the master bedroom, consider retaining discoloration left by room furnishings for interpretive purposes. Secure loose boards and patch holes where required.
- Where no finished floor exists, install new wood flooring to match the surrounding floor.
- Re-adhere delaminated linoleum and patch missing pieces with new to match the original. Use gentle soap and water for cleaning, and do not allow pooling water to stand for long.
- Clean cork flooring where required. If the material is found to have a polyurethane finish, mechanically buff using a low speed and 00-grade wool disks followed b' lamb's wool disks. If it has a wax finish, clean with liquid solvent wax. After cleaning, reapply the finish to match the original.

Figure 34: The master bedroom has original wood flooring with a significant difference in color at the center where a rug or carpet previously laid.

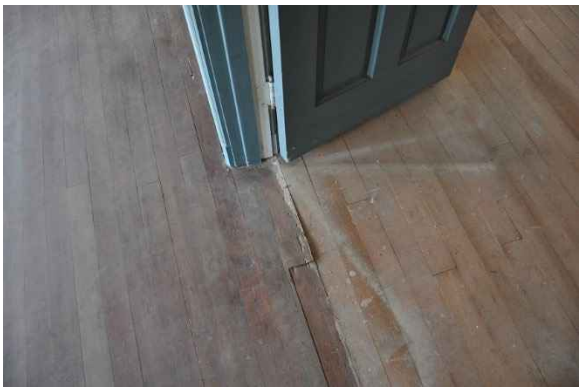

Figure 35: Loose boards at this room threshold should be reattached.

Figure 36: The first two stair treads at the entry hallway have exposed plywood subfloor with carpet tack holes and some discoloration.

Figure 37: Water damage is present at floor boards in the second-floor corridor.

Figure 38: Original linoleum flooring remains in the guest wing bathroom.

Figure 39: Detail of linoleum accent strips which have delaminated from the subfloor.

Figure 40: Original cork flooring remains in the kitchen and butler's pantry.

Figure 41: The plywood subfloor is exposed in the living room and guest wing bedroom where finishes have been removed.

WALL AND CEILING FINISHES

Description

The majority of interior walls are plastered and finished with either paint or wallpaper, in some cases printed with ornate patterning. The Master Closet ceiling was decorated by the Oakies with a striped fabric reminiscent of a circus tent, the Trophy Room walls have impeccable horizontal wood paneling, the second floor Guest Bath retains original white Vitrolite, and the Bar walls are upholstered with brown vinyl. As the name suggests, the "Mural Room" (Great Room) walls are adorned in wallpaper painted with scenic landscapes and figures on horseback.

Condition

Plaster walls and ceilings are in fair condition in most rooms, with cracking largely at corner joints, and some staining from water damage. Wallpaper in many areas is torn at plaster cracks, and delamination has caused tearing and sagging. The majority of unique wall finishes are in good condition. See individual rooms survey sheets located in the Appendix for additional information.

Treatment Recommendations

Scrape away loose or chipping paint where present and consolidate or remove friable plaster carefully using hand tools. Patch holes smaller than ¼-inch wide with joint compound and replaster to match surrounding areas. Where larger gaps and holes exist, cut the plaster back to the nearest studs to make a regular opening, re-secure the lath with drywall nails, patch with drywall and finish to match the surrounding areas.

Insert adhesive under free edges of wallpaper using an artist's palette knife. Gentle conservation with denatured alcohol is recommended in areas where there is limited mold on the surface of the paper. Where wallpaper is too damaged to clean or re-adhere, steam paper to soften adhesive and gently remove. Clean surface of plaster with a razor scraper as required to remove remnants of paste and install commercially available reproduction wallpapers without completely obscuring the distinction between historic and recreated surfaces.

Treatment methods above may require modifications to deal with hazardous materials. Review existing survey reports and complete additional testing, as required, to clarify the presence of ACBMs and LBPMs prior to treatment. See Fine Art Conservation Laboratories (FACL, Inc.) art conservation proposal dated November 28, 2017 for condition and treatments for the wallpaper murals located in the Great Room.[11]

[11] Fine Art Conservation Laboratories, Oakridge Estate Mural Exam for Art Conservation Proposal Mural #456, November 28, 2017. Proposal provided to Department of Cultural Affairs, City of Los Angeles. Report is included in the Appendix.

Figure 42: Thick layers of flaking paint have chipped and fallen away from plaster in some areas.

Figure 43: Wallpaper has ripped over cracking at plaster, often at corner joints.

Figure 44: Typical plaster cracking condition.

Figure 45: Large swaths of wallpaper have delaminated in some areas.

Figure 46: The Great Room wallpaper murals have cracked and discolored over time, likely due to heat and sun exposure.

Figure 47: Ornate wallpaper remains in the Powder Room.

INTERIOR LIGHT FIXTURES

Description

Minimal architectural lighting was incorporated into the original design of the house, with a single simple ceiling fixture centered in most rooms. In larger spaces, illumination was intended to be provided by floor and table lamps.

Condition

The majority of original interior light fixtures have been removed from the house. A few original fixtures remain, though some only partially.

Treatment Recommendations

Select and install replica fixtures for interpretive purposes, examining available period photography for clues. If no documentation exists, inspect the location of missing fixtures for “witness marks” indicating the size and shape of missing fixtures.

Figure 48: This photograph of Stanwyck in the Great Room shows the use of table lamps for mood lighting.

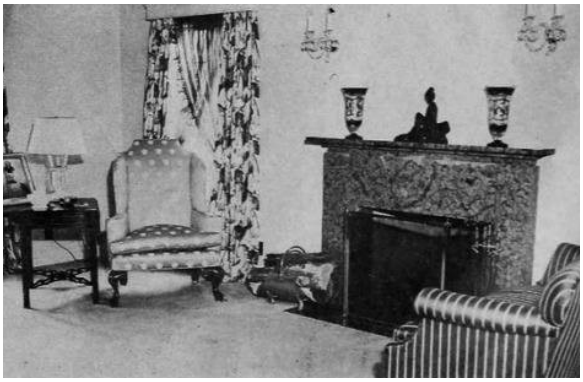

Figure 49: Decorative candelabra wall sconces shown in this historic photo of the Living Room could be replicated for interpretive purposes.

Figure 50: Original wall sconces remain in the upstairs Guest Bath.

Figure 51: The Trophy Room ceiling bares evidence of a missing light fixture.

INTERIOR DOORS

Description

The interior of the house is outfitted with single and double wood panel doors between most rooms.

Condition

The majority of original interior doors remain in good condition with their hardware intact. Surrounding wood trim is in good condition, with a few portions damaged from fasteners or water infiltration.

Treatment Recommendations

Repaint and realign doors where required. Patch small holes in trim and replace deteriorated portions with new to match existing. Restore existing hardware or replace with replica hardware if missing. New paint to match existing in color. Paint sheen to be semi-gloss.

Figure 52: Original double wood panel doors leading into the dining room remain.

Figure 53: Typical original interior door hardware.

BUILDING SYSTEMS

Building systems at the Oakridge Estate including mechanical, electrical, plumbing, security, and fire detection and suppression require attention, both to prevent safety hazards and to enhance functionality and user comfort. There is no mechanical heating or cooling in the house nor is there attic insulation or ventilation, leading to uncomfortably warm interior temperatures during much of the year. A balance of building envelope upgrades and strategic use of zoned air conditioning could resolve this issue. The electrical and plumbing systems throughout the house are outdated. Plumbing leaks have caused damage to historic features and some fixtures may be inefficient or inoperable. An estimated 10% of electrical outlets are non-functional, and a recent Los Angeles Department of Water and Power (LADWP) service upgrade was not completed. There is no fire suppression system installed and the fire detection system is inadequate. The security system appears robust but may require maintenance and repair.

Treatment Recommendations

IMMEDIATE

Electrical

- Test outlets and upgrade wiring where required.
- Complete LADWP electrical distribution project.

HVAC

- Install new R-38 batt insulation at attic spaces.
- Provide attic fans to exhaust hot air from attics.
- Provide heating, ventilation, and air conditioning (HVAC) for the Great Room to support public events.

Plumbing

- Inspect and repair existing fixtures and water supply and waste water piping. Upgrade as required.

Fire and Security Systems

- Provide a new fire detection and notification system for the entire residence.
- Inspect and test the existing security system.

NEAR TERM

- Provide HVAC for the entire residence.
- Provide fire sprinklers for the entire residence.

Figure 54: View of the updated transformer and switchgear along Devonshire.

Figure 55: A new electrical subpanel was installed in the garage but the connection to new service was not completed.

Figure 56: Many electrical outlets require repair.

Figure 57: Light fixtures throughout the house have been damaged and likely require rewiring in order to restore operability.

SITE FEATURES

The Oakridge Estate's historic character as a working equestrian property with leisure amenities is still felt and stands in stark contrast to the surrounding suburban neighborhood and adjacent commercial properties that have developed over the decades. In order to adapt the site into a self-sustaining public asset, it is critical to preserve and maintain character-defining features while strengthening points of connection and creating opportunities for new use.

ACCESSIBILITY

The main residence and many key site features require expanded access. Work includes creating an accessible entrance to the house, an accessible restroom, and accessible paths of travel throughout the site in order to create an inclusive community resource.

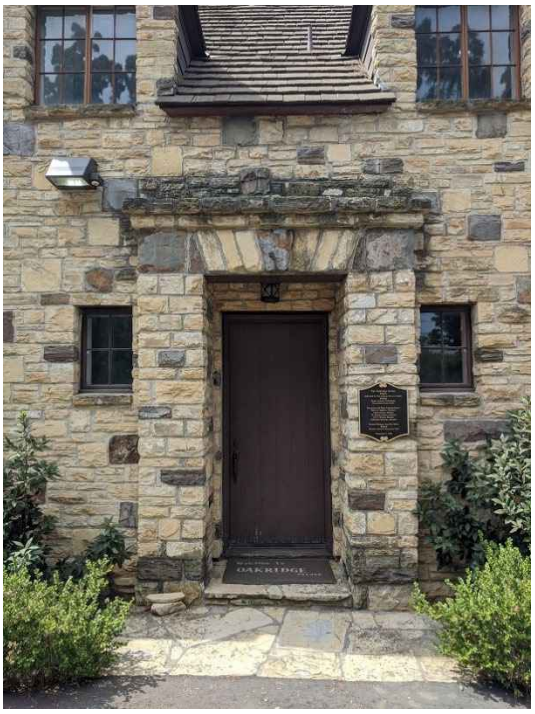

Figure 58: View of the front (north) entrance door, which does not have a level landing for accessible entry.

Treatment Recommendations

- Create an accessible entrance to the main residence at the Great Room by sensitively integrating a ramp to the rear porch. See Item G in the Near Term Treatment Concept Plan provided in Chapter II of this report for more information.
- Provide accessible parking and signage at the east and west of the residence.

- Modify the garage to accommodate a new accessible restroom.
- Create accessible pathways throughout the yard and pool zones.
- Provide a high-low pedestal drinking fountain along the path of travel.

Figure 59: View of the south porch looking north. A ramp could be integrated into the adjacent landscape to provide access to more visitors.

Figure 60: Door threshold leading from the south porch into the Great Room, which may require only minor modification to meet Historic Building Code accessibility standards.

Figure 61: View of the accessible path to the west of the garage.

Figure 62: View of the recommended west accessible parking location with existing accessible path in foreground.

YARD ZONE

The yard zone extends from the south façade of the historic residence to the retaining wall north of the pool area, and includes historic flagstone paths, trees and shrubs and the lawn area. The yard zone will be rehabilitated to improve public access by providing facilities for outdoor events. Work includes extending the existing accessible path from the west and providing a new accessible path from the east to a revitalized lawn event space. See Near Term Treatment Concept Plan provided in Chapter II of this report for more information.

Figure 63: Rear yard zone looking northeast.

Treatment Recommendations

HISTORIC FEATURES

- At flagstone paths, reset loose and damaged pieces and replace with new pieces to match existing where missing.

FUTURE USE

- Remove existing decomposed granite paths and edging.
- For new paths, install a 3-inch pedestrian traffic layer on a 4-inch base course over compacted subgrade.

- For the revitalized lawn event space, provide new sod on new subgrade and an irrigation system with excess valves so the system can be extended to pool zone and other areas in the future.
- Missing historic plants may be replaced based on historical, pictorial, and physical documentation. Select species that are visually similar in form, shape, and scale to historic plantings.
- Plant new trees and shrubs for shade, ambiance, and habitat. Species should be compatible with the historic setting and require low water.
- Provide a low voltage lighting system along paths and at exterior spaces. In addition to providing safe access to the public, low voltage lighting should enhance and accentuate the historic setting.

Figure 64: Existing decomposed granite paths and edging looking southwest.

Figure 65: The flagstone paths throughout the yard zone require repair.

Figure 66: View of the lawn and trees looking northeast. Some trees directly adjacent to the house may require pruning or removal in order to promote the long-term health of other trees and preserve views of the house.

POOL ZONE

The pool zone extends from the retaining wall south of the lawn area to the south edge of the pool deck, and includes the historic pool and flagstone pool surround, a subterranean equipment room, a chain link perimeter fence, and the surrounding vegetation. The pool zone will be rehabilitated to provide a safe and accessible site feature.

Figure 67: View of the pool looking west.

Treatment Recommendations

HISTORIC FEATURES

- At flagstone pool surround, reset loose and damaged pieces and replace with new pieces to match existing where missing.

FUTURE USE

- Remove the subterranean pool equipment.
- Remove the existing fence.
- Fill the existing pool basin with crushed rock and soil, pour a new 18-inch-deep concrete basin and finish the interior with pool tile. Tile color to be selected during design phase.

- At landscape areas surrounding the pool, provide low water use plantings with drip irrigation. Tie drip system into master irrigation controls and valves provided at yard zone
- Provide a low voltage lighting system along paths and at exterior spaces. In addition to providing safe access to the public, low voltage lighting should enhance and accentuate the historic setting.

Figure 68: View of the flagstone pool surround showing deterioration and unwanted plant growth.

Figure 69: The landscape north of the pool would benefit from drought-tolerant plant species and waterwise irrigation strategies.

GENERAL SITE

The site area included in this scope of work beyond the yard and pool zone extends from Devonshire St at the north to southern property edge, and from the east edge of the recently developed Oakridge Estate Park to the eastern property edge. Site features include the tennis courts and adjacent steps, the entry gate, the entrance driveway, site infrastructure, and perimeter fencing. Proposed site work will stabilize and protect site features and maintain the health of existing trees and shrubs.

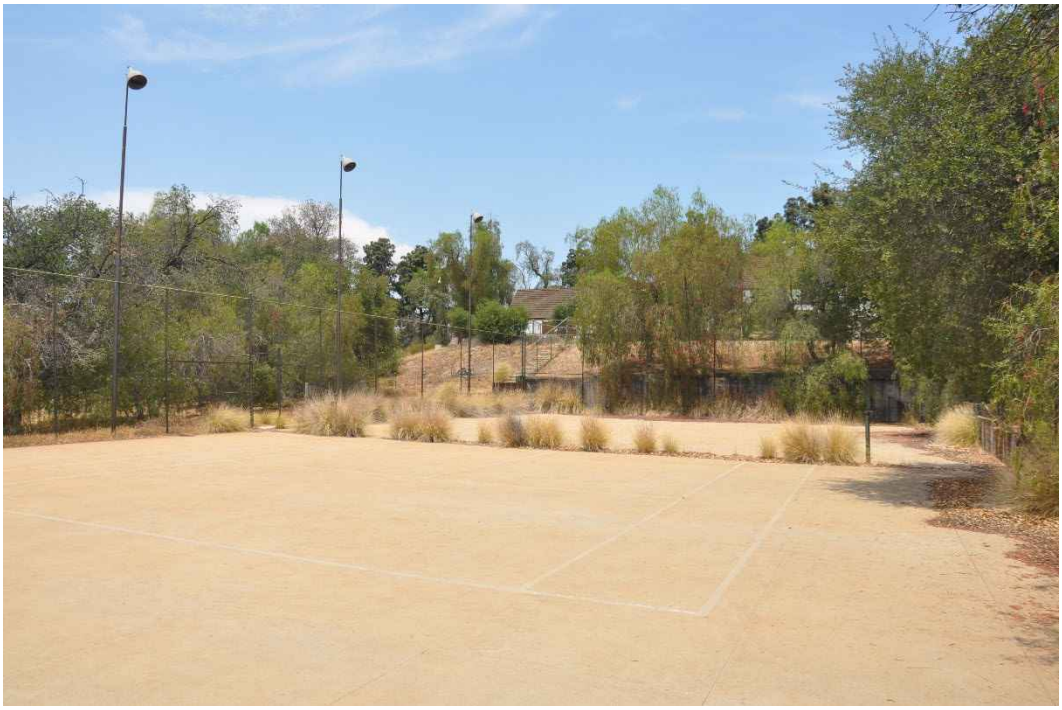

Figure 70: View of the tennis courts looking north towards the house.

Treatment Recommendations

IMMEDIATE

- At the entry gate pillars, reset loose and damaged pieces, and replace with new pieces to match existing where missing. Provide a new steel swinging entry gate.
- At the tennis courts, stabilize steel fence posts and fencing.
- At flagstone paths, reset loose and damaged pieces and replace with new pieces to match existing where missing.
- Provide low voltage lighting system along paths and at exterior spaces.
- Provide tree and shrub trimming where required.

LONG TERM

- At the site fence at Devonshire, replace the chain link fence with new architectural fencing.
- Replace entry gate.
- At the entrance driveway, fill cracks and reseal.
- Repair the concrete curb at the entrance driveway, where required.

Figure 71: View of the stairs leading down to the tennis courts looking southeast.

Figure 72: Overgrown vegetation adjacent to the tennis courts. Regular tree and brush trimming will mitigate fire risk and provide more hospitable surroundings.

Figure 73: View of the main entry gate and stone pillars looking north.

Figure 74: View of the entry gate wall looking northwest.

MAINTAINING HISTORIC BUILDINGS

It is important to maintain historic buildings to help preserve the integrity of the historic materials, features and finishes. When historic features are regularly maintained, the deterioration of these materials is reduced. Over time, regular maintenance of a building is more cost-effective than replacing deteriorated historic features.

Maintenance of a historic building includes regularly inspecting key building elements such as the roof, chimney, flashings, exterior walls, porches, windows and doors; attic and crawl spaces; and foundation. It is important to look for moisture infiltration, damage and deterioration, cracks, flaky paint, and loose materials. In addition to inspecting and maintaining the building, the site should be regularly maintained to keep debris and plant material off roofs and away from the facades. Deficiencies should be noted and repaired as required. See National Park Service, Preservation Brief 47: *Maintaining the Exterior of Small and Medium Size Historic Buildings*, included in the Appendix, for more information.

MATERIALS PRIMER

The following sections are based on guidance from the Guidelines and include a general overview of the issues encountered at many historic properties, including The Oakridge Estate.

Paint

The primary purpose of painting exterior features it to protect them from weathering due to moisture. When paint begins to crack and fail, water can penetrate the paint layer and get trapped, causing the wood to weather. Regular maintenance of exterior paint is highly recommended to prevent wood from deteriorating. Surfaces should be cleaned, lightly scraped, and sanded in preparation for new paint when required (recommended every 5-8 years). Where paint is deteriorated beyond repair using typical maintenance methods, paint removal is recommended. As a historic structure, flaking paint at the exterior of the residence should be removed to the next sound layer of paint, meaning that the layers of paint are effectively adhered to the substrate. Where paint is excessively flaking and peeling, to the point that the substrate is bare, full paint removal is recommended. When removing paint, appropriate personal protective equipment may be required if harmful substances are identified. For best future maintenance, use high quality primer and 2-3 coats of high-quality paint. See National Park Service, Preservation Brief 10: *Exterior Paint Problems on Historic Woodwork*, included in the Appendix, for more information.

Water Infiltration and Moisture

Uncontrolled moisture is the leading cause of deterioration in historic structures. It can cause corrosion and rot of materials, finishes and structural components. Regular inspection and maintenance of buildings can help identify moisture issues to repair the condition before it causes serious damage. See National Park Service, Preservation Brief 39: *Holding the Line: Controlling Unwanted Moisture in Historic Buildings*, included in the Appendix, for more information.

REFERENCES

Historic Cultural Monument (HCM) Application, 1989

Determination of the Cultural Heritage Commission, Case Number CHC-2005-5399-HCM

Oakridge Estate HABS Documentation, Historic Resources Group (HRG) with Positive Image Photographic Services, May 2005

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Preliminary Conceptual Plan, Mia Lehrer Associates, April 2011

Stanwyck Residence / Oakridge Estate Historic Structure Report (HSR) prepared by Chattel, Inc. 2012

Oakridge Estate, Conceptual Site Plan, Proposition K Prepared by RAP, 2021

The Oakridge Residence | The Oakie House, Condition Assessment prepared by RAP (undated)

City Planning Report to the Cultural Heritage Commission, Case Number CHC-2005-5399-HCMAssessment prepared by RAP (undated)

Tree Location Map as part of Vesting Tentative Tract No. 061332

As-built plans of the renovation for the caretaker and other improvements

Oakridge Estate Mural Exam for Art Conservation Proposal Mural #456, Fine Arts Conservation Laboratories, Santa Barbara, CA, dated November 28, 2017

Asbestos & Lead Inspection Report for the Oakridge Estate Property, ENCORP, prepared for the City of Los Angeles Department of Recreation and Parks, dated September 19, 2012 (Revised October 28, 2019).

Phase 1 Environmental Site Assessment Report, Limited Asbestos Survey & Limited Lead-Based Paint Surveys, prepared for University of Southern California, University Real Estate by Converse Consultants, March 19, 2002.

U.S. Department of the Interior, National Park Service, Technical Preservation Services Preservation Brief Number 10 *Exterior Paint Problems on Historic Woodwork.* Available at https://www.nps.gov/tps/how-to-preserve/briefs/10-paint-problems.htm Accessed 29 October 2021.

U.S. Department of the Interior, National Park Service, Technical Preservation Services Preservation Brief Number 13 *The Repair and Thermal Upgrading of Historic Steel Windows.* Available at https://www.nps.gov/tps/how-to-preserve/briefs/13-steel-windows.htm#maintenance Accessed 29 October 2021.

U.S. Department of the Interior, National Park Service, Technical Preservation Services Preservation Brief Number 37 *Appropriate Methods for Reducing Lead-Paint Hazards in Historic Housing.* Available at https://www.nps.gov/tps/how-to-preserve/briefs/37-lead-paint-hazards.htm Accessed 29 October 2021.

U.S. Department of the Interior, National Park Service, Technical Preservation Services Preservation Brief Number 39 *Holding the Line: Controlling Unwanted Moisture in Historic Buildings.* Available at https://www.nps.gov/tps/how-to-preserve/briefs/39-control-unwanted-moisture.htm Accessed 29 October 2021.

U.S. Department of the Interior, National Park Service, Technical Preservation Services Preservation Brief Number 47 *Maintaining the Exteriors of Small and Medium Sized Historic Buildings.* Available at https://www.nps.gov/tps/how-to-preserve/briefs/39-control-unwanted-moisture.htm Accessed 29 October 2021.

APPENDIX

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EXISTING BUILDING DOCUMENTATION

Figure 75: Main entry and north side of the house, looking southwest.

Figure 76: North side of the house, looking southwest.

Figure 77: North side of the house and garage, looking south.

Figure 78: Southwest side of the garage, looking northeast.

Figure 79: South side of the garage and pool restrooms, looking north.

Figure 80: South side of the house and drying yard, looking north.

Figure 81: South side of the house and porch, looking north.

EXISTING FLOOR PLANS

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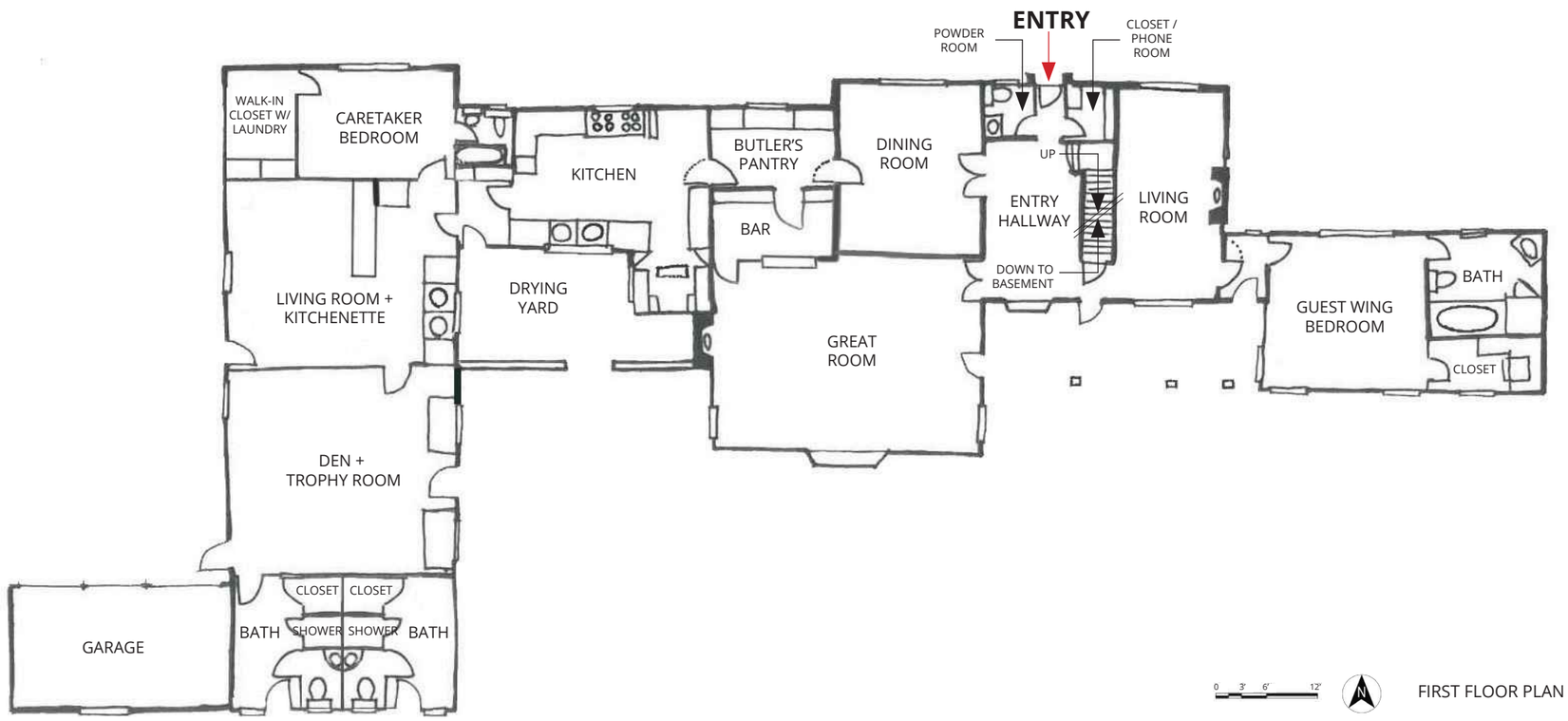
SECOND FLOOR PLAN



FIRST FLOOR PLAN

ROOM SURVEYS

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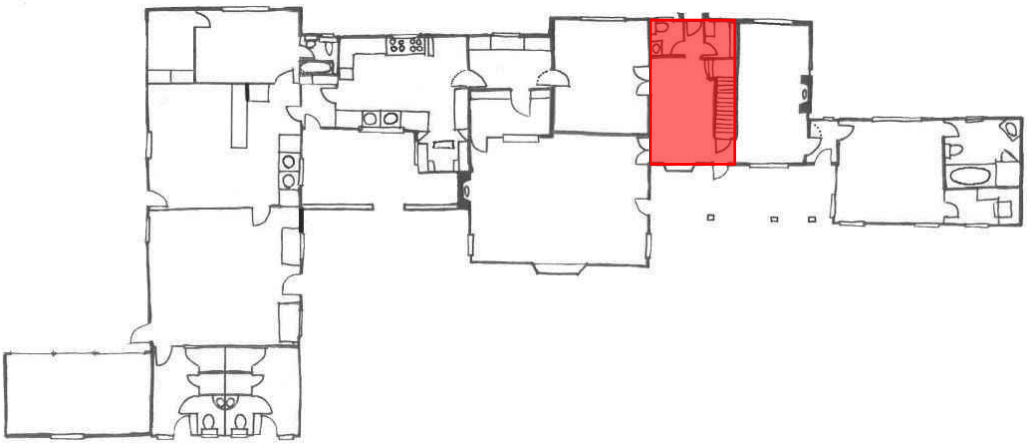
First Floor

ENTRY HALLWAY, POWDER ROOM AND PHONE ROOM



Overall Condition

The entry hallway is in good condition; however, most finishes are non-original, including green wall paint, a mirrored cladding on the west and wood floors replacing the original carpet. The first two wood stair treads leading to the landing have carpet tack holes and some discoloration, and the original south wall sconces are missing. The adjacent powder room and phone room are also in good condition with minor repairs required.

Interpretive Approach and Treatment Recommendations

Maintain existing finishes and install replica light fixtures in all three rooms. The first two stair treads should be patched and refinished. The phone room built-in shelf requires hardware and a new drawer. The powder room toilet valve needs replacement, and the wallpaper and plaster ceiling require touch-ups. Existing paint colors should be maintained in the Entry Hall.

Figure 82: Historic photo showing the west wall of the entry hallway during the Stanwyck era.

Figure 83: Entry hallway looking east towards stairs.

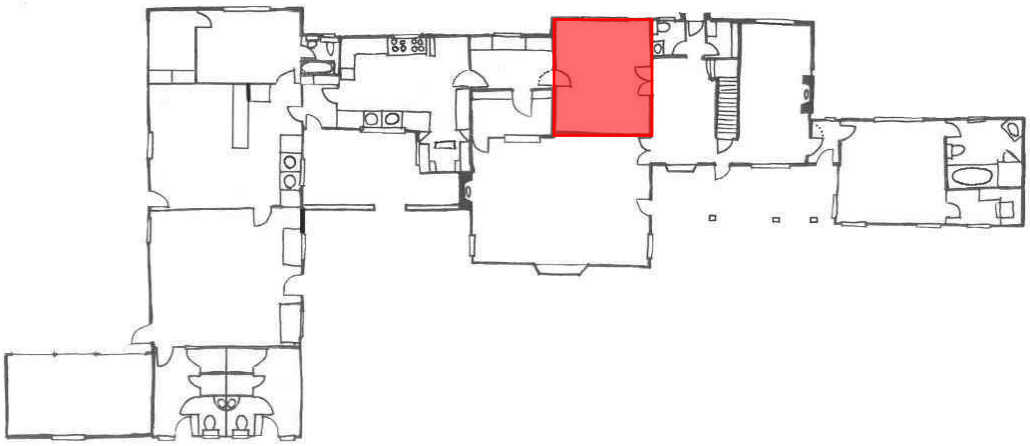
Figure 84: Entry hallway looking south. Note: existing mirror on west wall (at right) replacing original finishes shown in historic (above).

Figure 85: Entry hallway looking north.

Figure 86: First two stair treads require repair.

Figure 87: Phone room millwork requires repair.

DINING ROOM



Overall Condition

The Dining Room is in fair condition with some original finishes remaining from the Stanwyck period and others altered by the Oakies or afterwards. A plumbing leak in the upstairs restroom has caused water damage and staining at the east wall, ceiling and floor. Water damage is also present at the wall above the north windows. The Stanwyck-era peat green carpet was removed and replaced by with wood flooring, the original painted plaster walls were covered with decorative floral wallpaper, and the natural wood wainscot was painted. The wood tongue and groove ceiling with applied trim dividers appears to match the original Stanwyck-era finish, however the original chandelier is missing. The original door leading to the butler's pantry was replaced.

Interpretive Approach and Treatment Recommendations

Page & Turnbull recommends repairing water damage and returning finishes to the Stanwyck period, including removing paint from the wainscotting and floral wallpaper from the plaster walls, and replacing the existing door into the butler's pantry to match the original. Although the original floor finish was carpet, maintaining the existing wood floor is recommended due to the higher foot traffic associated with the room's proposed use as a public meeting space.

Figure 88: Historic photo showing Stanwyck arranging table settings in the dining room. Original finishes included painted plaster walls, natural wood wainscot and carpet.

Figure 89: View of the dining room today from a similar angle, looking west.

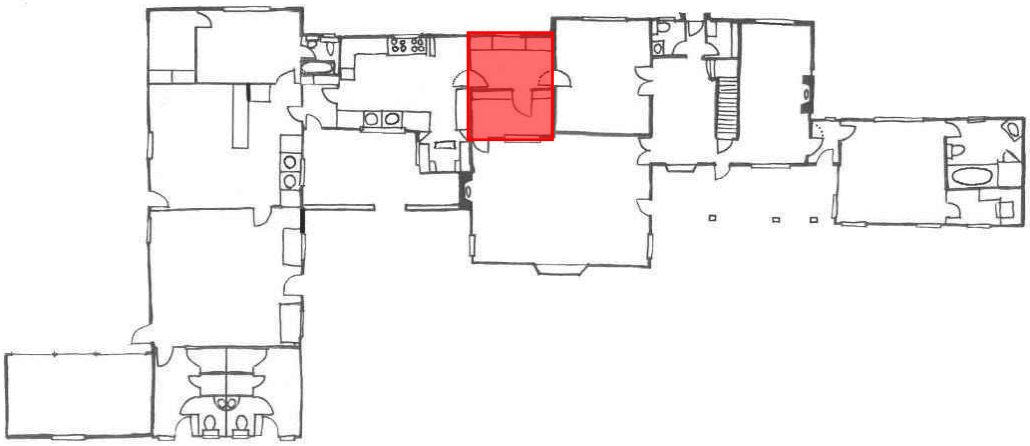
Figure 90: View looking east. Water damage is present at the east wall, floor and ceiling due to plumbing leak.

Figure 91: View looking north. Water damage is present above the windows.

Figure 92: Detail of water damage at the east door.

Figure 93: Detail of plaster crack at the west door.

BUTLER'S PANTRY AND BAR



Overall Condition

The Butler's Pantry and Bar are in good condition with most of the original finishes remaining, including the mahogany countertop and cork flooring in the Butler's Pantry and the vinyl upholstered wall covering in the Bar. Original light fixtures are missing.

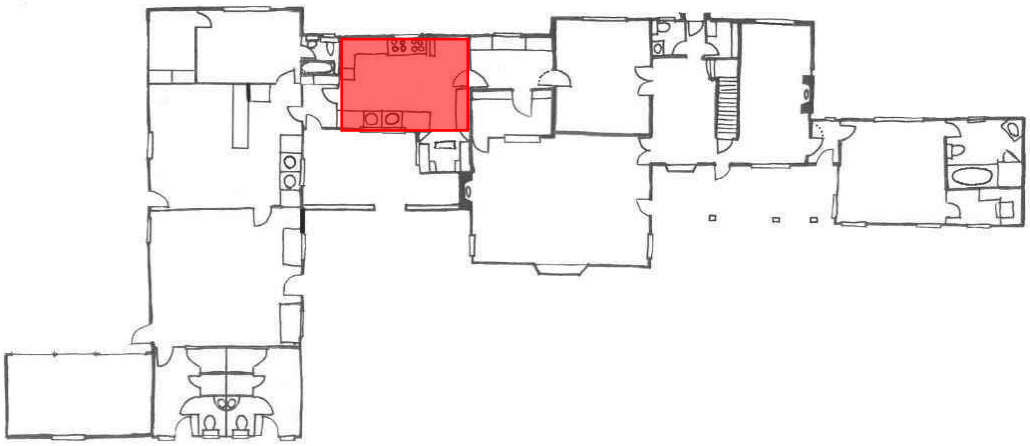
Interpretive Approach and Treatment Recommendations

Maintain the existing finishes and install replica light fixtures in both rooms. Patch and repaint walls and ceilings as required.

Figure 94: Butler's pantry looking west.

Figure 95: Bar interior with original millwork and wall and floor finishes.

KITCHEN AND DINING NOOK



Overall Condition

The Kitchen and Dining Nook are in good condition with most of the original finishes remaining, including cork flooring.

Interpretive Approach and Treatment Recommendations

Maintain the existing finishes and install replica light fixtures in both rooms. Patch and repaint walls and ceilings as required.

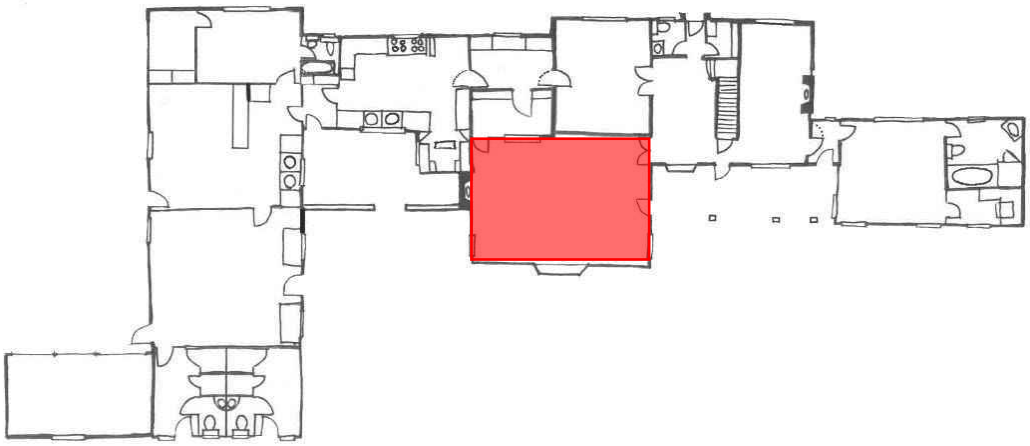
Figure 96: Kitchen looking west.

Figure 97: Kitchen and Dining Nook looking south.

Figure 98: Dining Nook looking south.

Figure 99: Kitchen looking north.

GREAT ROOM (MURAL ROOM)



Overall Condition

The Great Room is in good condition, however the mural installed by the Oakies requires stabilization in the near term. Large amounts of glazing on the south cause the room to heat up considerably, deteriorating the mural and making large gatherings uncomfortable.

Interpretive Approach and Treatment Recommendations

Maintain and restore the existing finishes and install replica light fixtures where missing. Patch and repaint the ceiling where required. Stabilize and restore the mural; although not an original finish, it is a poignant artifact of the Oakie period and brings strong character to the room. Consider adding a dedicated air conditioning unit and additional sun control, perhaps by utilizing window screen pockets for black out shades. Add AV infrastructure?

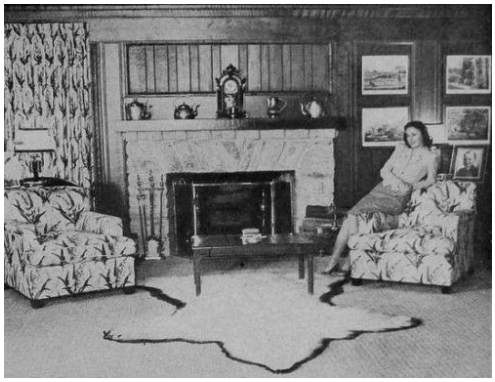


Figure 100: Stanwyck posing in the Great Room during her tenure at the house.

Figure 101: Current condition of the Great Room from a similar angle.

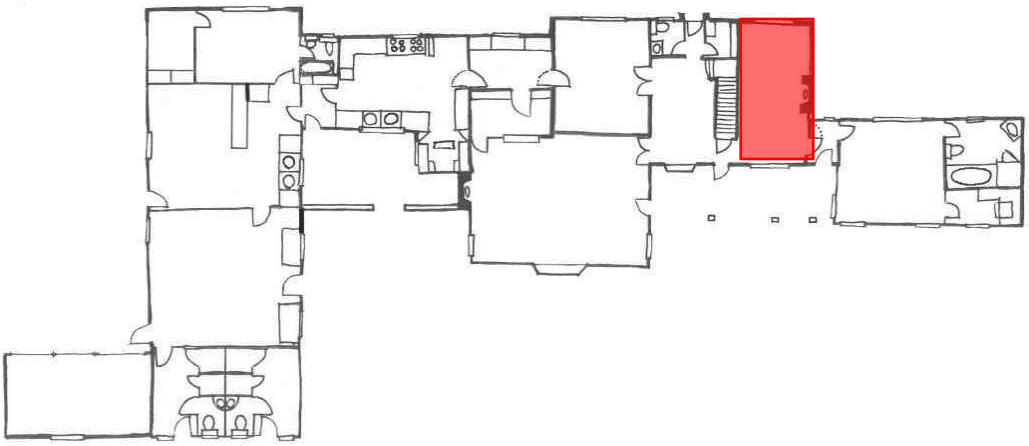
Figure 102: Stanwyck at the south bay window.

Figure 103: South bay window today.

Figure 104: Mural detail.

Figure 105: Great Room looking north into the Bar.

LIVING ROOM



Overall Condition

The Living Room is in good condition; however, the original carpet flooring has been removed.

Interpretive Approach and Treatment Recommendations

Install new wood flooring to match the Entry Hallway, and replica light fixtures where missing. Patch and repaint the ceiling where required. Repair toe molding damaged when carpet was removed.

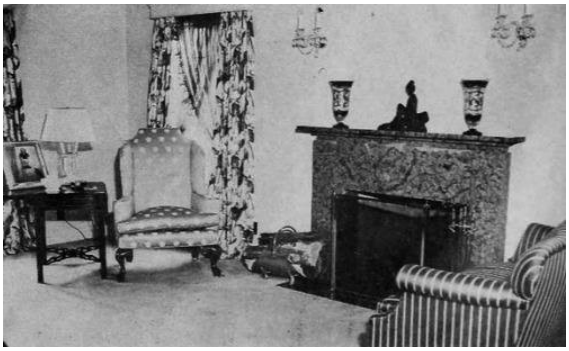
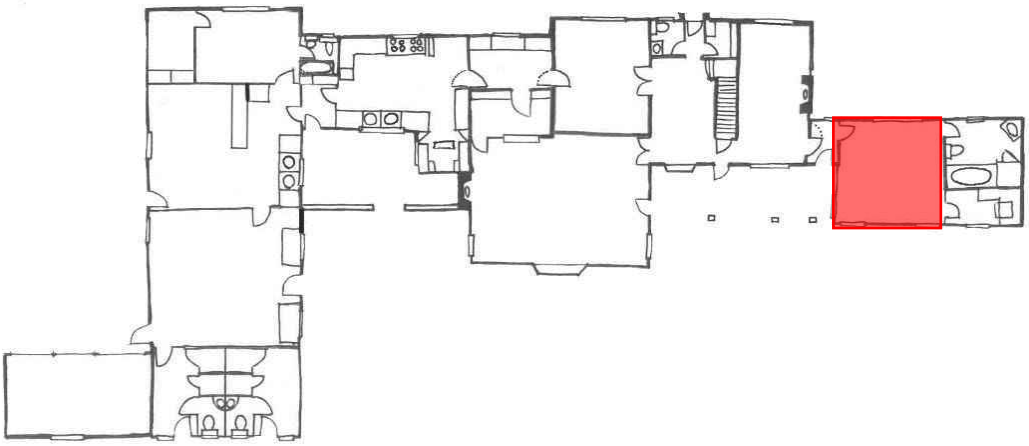


Figure 106: Stanwyck era photo showing original decorative sconces on the east wall.

Figure 107: Similar view today.

Figure 108: View looking north.

GUEST WING BEDROOM



Overall Condition

The Guest Wing Bedroom is in good condition; however, the original carpet (or linoleum) flooring and light fixtures have been removed. The adjacent vestibule requires wallpaper and flooring repair.

Interpretive Approach and Treatment Recommendations

Install new wood flooring to match the Entry Hallway, and replica light fixtures where missing. Re-adhere wallpaper in vestibule or install new to match existing. Consider restoring room interiors for interpretive purposes and relocating storage.

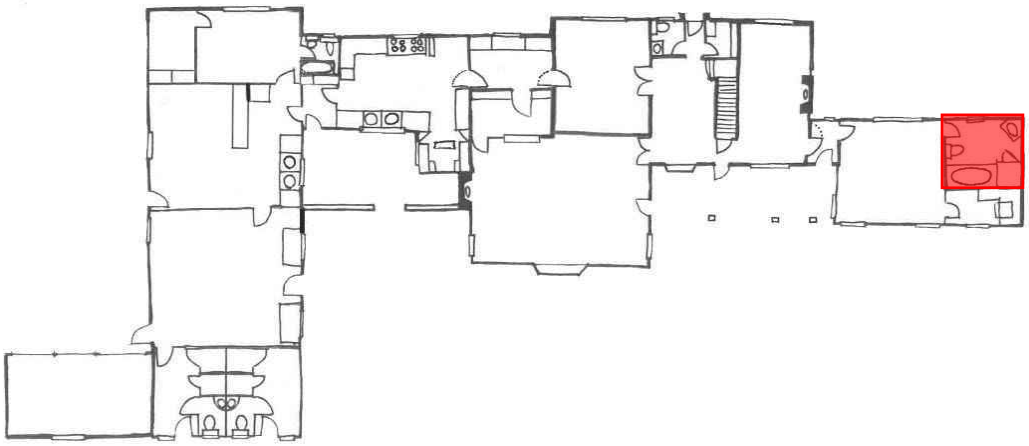
Figure 109: View looking east.

Figure 110: View looking west.

Figure 111: Linoleum with frayed fibers at the vestibule threshold.

Figure 112: Peeling wallpaper at the vestibule.

GUEST WING BATH



Overall Condition

The Guest Wing Bath is in good condition, with many original finishes remaining including a ceiling light fixture, Vitrolite wall paneling and linoleum flooring, which requires some repair. The shower door header has water damage, and the original wall sconces have been removed.

Interpretive Approach and Treatment Recommendations

Maintain existing finishes, repair cracking plaster at west door, repair linoleum flooring and install replica light fixtures where missing.

Figure 113: View looking east showing vanity wall sconces removed.

Figure 114: Original linoleum floors remain, and some repair is required.

Figure 115: The shower door header requires repair.

Figure 116: The original ceiling light fixture canopy remains but it may be missing its shade.

DEN / TROPHY ROOM

Overall Condition

The Den is in good condition, with many original finishes remaining including exquisite wood wall paneling, linoleum sheet flooring and built-in millwork. The original ceiling-mounted light fixture has been removed.

Interpretive Approach and Treatment Recommendations

Maintain existing finishes, repair cracking paint at trim, install replica light fixtures where missing.

Figure 117: View looking east.

Figure 118: View looking south.

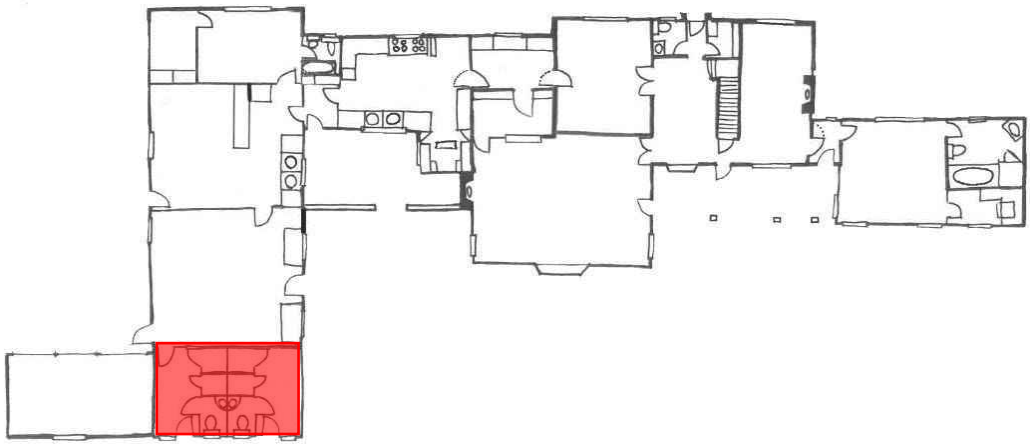
Figure 119: View looking west.

Figure 120: View looking north.

Figure 121: Door trim requires touch-ups.

Figure 122: Original flooring remains.

POOL AREA BATHROOMS



Overall Condition

There are two bathrooms in the pool area, one connecting to the Den, known colloquially as the "setters" bath and another to the east known as the "pointers" bath. The "setters" bath is in good condition, with many original finishes remaining including shower tile and sheet flooring. The "pointers" bath is in fair condition, with original shower tile remaining but flooring and light fixtures removed.

Interpretive Approach and Treatment Recommendations

In the "setters" bath, maintain existing finishes and install replica light fixtures where missing. If there is a need to provide a more functional, accessible restroom for site visitors, there may be an opportunity to rework the "pointers" bath given that less historic fabric remains. The pointers bathroom may also be reused for storage.

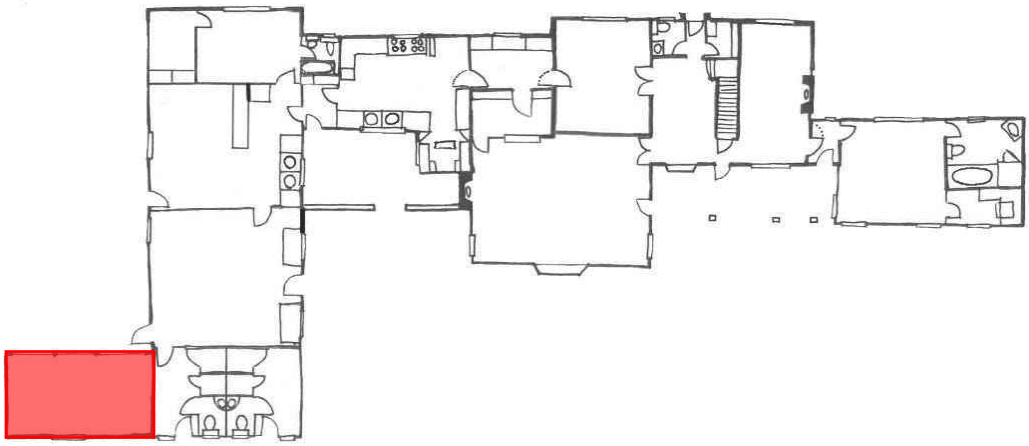
Figure 123: View of "pointers" bath looking south.

Figure 124: View of "pointers" bath looking north.

Figure 125: View of toilet room in “setters” bath.

Figure 126: View of shower in “setters” bath.

GARAGE



Overall Condition

The Garage is in good condition, with original finishes remaining including the wood garage doors and chauffer's storage cabinets. It is currently used for storage.

Interpretive Approach and Treatment Recommendations

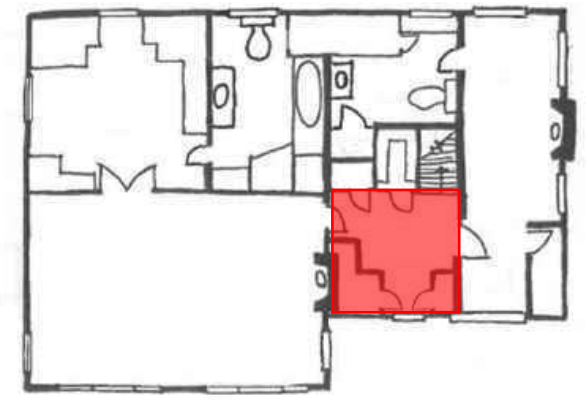
The Garage presents an opportunity for adaptive reuse to house an accessible restroom. The garage is conveniently located adjacent to a proposed accessible parking area and existing accessible pathway around the west and south of the building. Care should be taken to arrive at a historically sensitive design, particularly for elements that affect the exterior such as the restroom entrance. Additionally, storage space for special events and the caretaker can be provided.

Figure 127: View looking west.

Figure 128: View looking east showing the original chauffer's cabinets.

Second Floor

CORRIDOR



Overall Condition

The Corridor is in fair to good condition. The original carpet floor finish has been removed, revealing 2-3/8" wide floorboards in good condition. The original ceiling-mounted light fixture has been removed, and the wall paint matching the color in the entry hallway below is cracking in some places.

Interpretive Approach and Treatment Recommendations

Maintain and repair existing finishes and touch up peeling paint to match surrounding. Install replica light fixtures where missing. Provide sun control at windows to prevent heat gain and sun damage.

Figure 129: View looking east.

Figure 130: View looking west.

MASTER BEDROOM

Overall Condition

The Master Bedroom is in fair condition with some original finishes remaining including a marble fireplace surround. The original carpet floor finish has been removed, revealing 2-3/8" wide floorboards in good condition with a section of lighter coloring at the center where a rug or carpet previously laid. There is pronounced plaster cracking at the east wall around the fireplace, significant areas of wallpaper delamination, and cracking ceiling plaster, particularly at the west end of the room. The large windows at the south cause the room to stay quite hot, which contributes to material deterioration. Windows do not close properly, increasing heat gain.

Interpretive Approach and Treatment Recommendations

Maintain and repair existing finishes. Install replica light fixtures where missing. Provide sun control at windows to prevent heat gain and sun damage. Views to the rear yard from the south windows should be considered when introducing landscape improvements, as they are a significant part of the room's character and provide a sense of relief from urban life.

Figure 131: Historic image during the Stanwyck era looking west.

Figure 132: View of the room today from a similar angle looking west. Wallpaper is delaminating significantly.

Figure 133: View looking southwest.

Figure 134: View looking northeast.

Figure 135: Original marble fireplace surround and adjacent cracked plaster wall with delaminating wallpaper.

MASTER CLOSET

Overall Condition

The Master Closet is in fair to good condition with original built-in millwork. Striped wall paint and a matching fabric ceiling finish from the Oakie period create a unique circus tent character. The fabric ceiling is torn, discolored and sagging at the center. The original carpet floor finish has been removed, revealing 3-3/8" wide floorboards in good condition. The original ceiling-mounted light fixture and two wall sconces have been removed.

Interpretive Approach and Treatment Recommendations

Maintain and repair existing finishes. Carefully reattach the fabric ceiling where sagging occurs. Install replica light fixtures where missing. Consider sun control at windows to prevent further material deterioration.

Figure 136: View looking north.

Figure 137: View looking northwest with original dumbwaiter at west wall

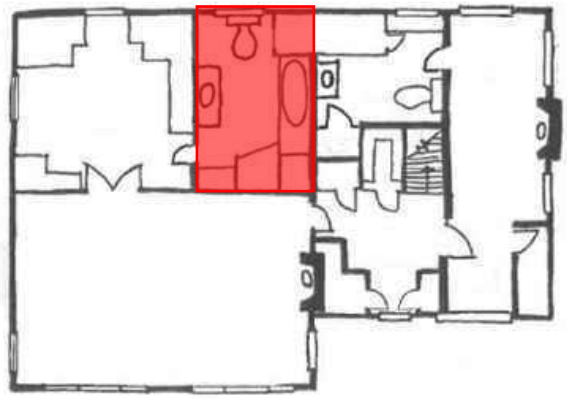
Figure 138: View looking south.

Figure 139: View looking east.

Figure 140: Detail of striped wall paint requiring touch-ups.

Figure 141: Detail of fabric ceiling finish.

MASTER BATH



Overall Condition

The Master Bath is in fair to good condition with original plumbing fixtures and some finishes remaining including a marble countertop and tub surround. The original ceiling-mounted light fixture has been removed. A wall-mounted vanity mirror was removed, revealing what could be the original wallpaper finish. A sizeable hole in the west wall at this area remains, possibly related to a plumbing leak repair. The original floor finish has been removed, revealing 3-3/8" wide floor boards in good condition.

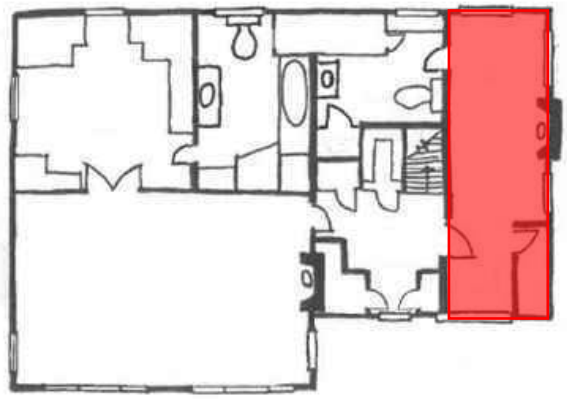
Interpretive Approach and Treatment Recommendations

Repair plaster wall and reinstall vanity mirror. Touch up wall paint. Install replica light fixtures where missing. Consider removing and salvaging wallpaper for display and installing period flooring for interpretive purposes, using photo documentation for historical accuracy if available.

Figure 142: View looking north.

Figure 143: View looking south.

GUEST BEDROOM



Overall Condition

The Guest Bedroom is in fair condition with a few original finishes remaining including the lower portion of the stone fireplace surround. The fireplace mantle was removed but remains stored in the adjacent closet, however the stone veneer above the fireplace was removed and is lost. An original ceiling-mounted light fixture remains. The original floor finish has been removed, revealing 3-3/8" wide fir floor boards in fair condition. Wallpaper is peeling or missing throughout, yet the wood wainscot is in excellent condition.

Interpretive Approach and Treatment Recommendations

Repair or reinstall wallpaper, reinstall the fireplace mantle and refinish wood flooring. Install replica light fixtures where missing. Consider installing stone veneer above the fireplace for interpretive purposes, using photo documentation for historical accuracy if available. Consider sun control at windows to prevent further material deterioration.

Figure 144: View looking north.

Figure 145: View of the fireplace looking east

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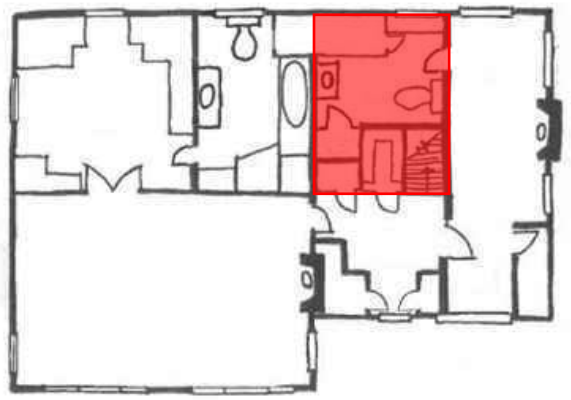
Figure 146: An original light fixture remains.

Figure 147: View looking south.

GUEST BATH



Overall Condition

The Guest Bath is in good condition with most original finishes remaining, including Vitrolite wall paneling and linoleum sheet flooring. Original wall sconces and plumbing fixtures also remain.

Interpretive Approach and Treatment Recommendations

Maintain and restore existing finishes.

Figure 148: View looking north.

Figure 149: Detail of Vitrolite wall and counter finish.

Figure 150: Original wall sconces remain.

Figure 151: Detail of original linoleum flooring.

COST TABLES

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Major Group	Element	Element General Condition	Component	Priority	Description	Quantity	Treatment Cycle	maintanence, capital, immediate	Cost
Exterior	Roof	Good	Valleys	Immediate	Clean leaf litter from valleys	Entire roof	Next 3 months, then annually	I, M	$1,200
Exterior	Roof	Good	N/A	Near-term	Inspect annually for leaks	Entire roof	Next 3 months, then annually	I, M	$800
Exterior	Walls	Good	Stone veneer	Near-term	Clean horizontal surfaces with soiling using gentlest means possible	1000 linear feet of sills and horizontal surfaces	Next 1-2 years	I, M	$15,500
Exterior	Walls	Fair	Sandstone blocks	Near-term	Clean iron staining from stone	2 locations, 4 square feet per location	Next 1-2 years	I, M	$800
Exterior	Walls	Fair	Sandstone blocks	Near-term	Stabilize spalls at face of stone (pinning or crack fill)	10 locations, 1 square foot per location	Next 1-2 years	I, M	$2,200
Exterior	Walls	Poor	Limestone sills	Near-term	Remove damaged sills and replace with in-kind material	12 locations, 1 square foot per location	Next 1-2 years	I, M	$2,700
Exterior	Walls	Fair	False half timbering	Near-term	Remove Paint	720 linear feet of 6-inch boards, 75 linear feet at porch columns and beams	Next 1-2 years	I, M	$6,200
Exterior	Walls	Poor	False half timbering	Near-term	Repair Open Joints and Reset Wood Pegs	30 locations	Next 1-2 years	I, M	$11,600
Exterior	Walls	Poor	False half timbering	Near-term	Repair Moderate Surface Deterioration and Cracks in 6-inch wood with Epoxy Consolidation	200 LF	Next 1-2 years	I, M	$6,500
Exterior	Walls	Poor	False half timbering	Near-term	Repair half-timbered site wall at Back Patio, including removal and replacement of wood sills	14 Linear Feet of Wall, approx. 4-foot high	Next 1-2 years	I, M	$1,600
Exterior	Walls	Poor	False half timbering	Near-term	Allowance for Misc repair of deteriorated wood, including sill plates at garage	15 locations 2-linear feet of sill and stud wall repairs	Next 1-2 years	I, M	$7,800
Exterior	Walls	Poor	Wood porch columns	Near-term	Dutchman repair at base of 6 x 6 porch columns	2-locations	Next 1-2 years	I, M	$800
Exterior	Walls	Poor	Wood porch columns and beam	Near-term	Repair Surface Deterioration and Cracks with Epoxy Consolidation	75 linear feet of 6-inch square columns.	Next 1-2 years	I, M	$2,400
Exterior	Walls	Poor	False half timbering, Wood porch columns	Near-term	Provide new paint finish	2 coats, exterior latex on primer. Approximately 800 linear feet of wood	Next 1-2 years	I, M	$3,200

Major Group	Element	Element General Condition	Component	Priority	Description	Quantity	Treatment Cycle	maintanence, capital, immediate	Cost
Exterior	Walls	Good	Wood siding	Long-term	Paint siding	500 square feet	Next 8 years, then every 10 years	M	$1,600
Exterior	Walls	Good	Plaster	Near-term	Minor repair of plaster, prep and paint	1000 square feet	Next 1-2 years	I, M	$4,000
Exterior	Windows	Fair	All	Near-term	Window restoration project - steel casement windows. Remove and replace glazing putty, light scaraping and wire brush to remove dirt, primer and two coats paint. New sealants around all openings. Assume new interior hardware for all windows. Restore retractable window screens. Replace broken glazing at 6 locations	(21) small (18x30); (18) medium (36x54); (15) large (60x60)	Next 1-2 years, then every 25 years	I, M	$32,400
Exterior	Windows	Fair	Wood sills	Near-term	Repair Surface Deterioration and Cracks at 2x4 wood sills with Epoxy Consolidation, prep and paint	All sills = 160 linear feet of wood sills	Next 1-2 years, then every 10 years	I, M	$1,300
Exterior	Pedestrian Doors	Fair	Wood Doors and Frames	Near-term	Heavy repair of exterior wood doors, including replacement of bottom panels and dutchman repair of stiles and rails.	Four (4) exterior doors	Next 1-2 years, then every 25 years	I, M	$9,300
Exterior	Pedestrian Doors	Fair	Wood Doors and Frames	Near-term	Door restoration project - light repair and touch up	Five (5) exterior doors	Next 1-2 years, then every 10 years	I, M	$5,800
Exterior	Pedestrian Doors	Poor	Wood Screen doors	Near-term	Provide new wood screens doors to replace damaged doors	Four (4) exterior doors	Next 1-2 years, then every 25 years	I, M	$5,900
Exterior	Garage Doors	Fair	Wood Doors and Frames	Near-term	Door restoration project - light repair and touch up, seal door bottoms and jambs to prevent vermin. Replace door springs for overhead operating system	Three (3) garage doors	Next 1-2 years, then every 10 years	I, M	$7,000
Exterior	Hardscape	Fair	Flagstone Paving at porch and south of garage	Near-term	Reset loose, missing and damaged flagstone pieces with surface erosion	10 locations / 2 square feet per location	Next 1-2 years	I, M	$2,300
Exterior	Lighting	Fair	Historic Exterior Fixtures	Near-term	Restore existing historic fixtures	Five (5) exterior fixtures require refurbishment	Next 1-2 years, then every 25 years	I, M	$11,600

Major Group	Element	Element General Condition	Component	Priority	Description	Quantity	Treatment Cycle	maintanence, capital, immediate	Cost
Exterior	Lighting	N/A	Historic Exterior Fixtures	Near-term	Replicate missing historic fixtures	Three (3) exterior light fixtures to be replicated based on historic documentation	Next 1-2 years	I, M	$14,000

Major Group	Element	Element General Condition	Component	Priority	Description	Quantity	Treatment Cycle	maintanence, capital, immediate	Cost
Site	Entry gate	Poor	Entry pillars	Near-term	Repair stone wall at west side of entry gate. Salvage stone veneer, repair structural damage and reinstall stone veneer.	8 linear feet of stone wall (6-foot high)	1-2 years	I, M	$5,600
Site	Entry gate	Fair	Gate	Near-term	Provide new steel swinging entry gate	10-foot long gate, 6-foot high, gate to be motorized	1-2 years	C	$10,100
Site	Entrance driveway	Good	Asphaltic Concrete Paving	Near-term	Fill cracks and Reseal	11,000 square feet of Asphaltic Concrete Paving	Next 10 years, every 15 years	M	$5,600
Site	Entrance driveway	Good	Concrete curbing	Near-term	Remove damaged concrete curb and replace in-kind	6 locations, 1 linear foot each	1-2 years	I, M	$1,200
Site	Motor court	Good	Circular planter	Near-term	Repair cracks in planter walls and reset loose stone.	10 locations, 1 linear foot	1-2 years	I, M	$3,100
Site	Vegetation	Fair	Trees	Immediate	Allowance for general pruning of all trees	180 total trees, Assume 1 hour per tree	Next 1 year and every 3-5 years	I, M	$40,500
Site	Vegetation	Fair	Trees	Immediate	Premium for pruning of historic and significant trees	30 trees, assume 4 additional hours for specialty pruning and maintenance by certified arborist	Next 1 year and every 3-5 years	I, M	$27,000
Site	Vegetation	Fair	Shrubs	Immediate	Maintenance of existing shrubs, including replanting 20-percent	250 linear feet of shrubs	Next 1 year and every 2 years	I, M	$1,600
Site	Paths	Fair	Flagstone paths and stairs	Near-term	Reset loose, missing and damaged flagstone and repair flagstone steps to the tennis courts	40 locations / 2 square feet per location	Next 1-2 years	I, M	$9,300
Site	Tennis Court	Fair	Tennis Court Fencing	Immediate	Stabilize steel fence posts and fencing	12 locations	Next 1-2 years	I, M	$5,600
Site	Tennis Court	Fair	Tennis Court Surfacing	Immediate	Remove grasses from tennis court edges and net	Lump sum - entire court	Next 1-2 years, then annually	I, M	$6,200

Major Group	Element	Element General Condition	Component	Priority	Description	Quantity	Treatment Cycle	maintanence, capital, immediate	Cost
Site	Infrastructure	Poor	Irrigation	Near-term	Provide new drip irrigation system for north side of residence	Tie into system provided at yard zone	Next 1-2 years	I, C	$7,000
Site	Infrastructure	Unknown	Water Distribution	Near-term	Assume new water service will be required to service irrigation and expaned use	Replace existing system from Devonshire to residence with new 2-inch service, including backflow for irrigation. Assume 200 linear feet	Next 1-2 years	I, C	$29,500
Site	Infrastructure	Unknown, believed to have been replaced in 2014	Sanitary Sewer	Near-term	Inspect system for issues	Lump sum	Next 1 year and every 3-5 years	M	$35,700
Site	Infrastructure	Uncompleted LA-DWP Project	Electrical Distribution	Near-term	LA-DWP work	a: Label the new stand-up with the property address of the permit. b:DWP needs to install service conduit, transformer, and all cables feeding the stand-up section. c: DWP will need to remove the present service drop and also the meter in the house.	Next 1-2 years	C	$23,300
Site	Infrastructure	Uncompleted LA-DWP Project	Electrical Distribution	Near-term	RAP - Complete service upgrade	a:. Remove the temporary connections that were put in place in order to keep power to the resident. b:. Land feeds from the stand-up section to the home. This can be done once the stand-up section has been connected to the DWP Transformer. Assume 350 Linear feet from "stand-up" to garage panels, Underground conduit and pullboxes have been previously installed. Assume two new wires @350 LF each	Next 1-2 years	C	$81,400

Major Group	Element	Element General Condition	Component	Priority	Description	Quantity	Treatment Cycle	maintanence, capital, immediate	Cost
Site	Fencing	Fair	Site Fence at Devonshire	Long-term	Replace chainlink fence with new architectural fencing	remove existing chain link fence and replacement with 450 linear feet of architectural metal fence	Next 10 years	C	$69,800
Site	Furnishings	N/A	Benches	Near-term	Provide new wood benches	10 benches	Next 1-2 years	C	$31,000

Major Group	Element	Element General Condition	Component	Priority	Description	Quantity	Treatment Cycle	maintanence, capital, immediate	Cost
Yard	Paths	Fair	Flagstone paths and stairs	Near-term	Reset loose, missing and damaged flagstone pieces with surface erosion	50 locations / 2 square feet per location	Next 1-2 years	I, M	$11,600
Yard	Walls	Good	Retaining wall	Near-term	Minor repair of wall	65 linear feet, 2-foot high	Next 1-2 years	I, M	$15,100
Yard	Paths	Poor	Decomposed granite	Near-term	Remove existing paths and edging	170 LF of path, 5 foot wide	Next 1-2 years	I, C	$6,600
Yard	Paths	N/A	New decomposed granite paths	Near-term	Install 3-inch pedestrian traffic layer on 4-inch base course over compacted subgrade.	1,200 SF decomposed granite, 400 LF of edging	Next 1-2 years	I, C	$9,300
Yard	Paths	N/A	Earthworks	Near-term	Fine grading to integrate paths with landscape and rear porch	Lump sum	Next 1-2 years	I, C	$11,400
Yard	Lawn	Poor	Plantings	Near-term	Provide new sod on new subgrade	5,000 square feet	Next 1-2 years	I, C	$19,400
Yard	Infrastructure	Fair	Irrigation	Near-term	New irrigation system, provide excess valves so system can be extended to pool zone and other areas in the future.	1 system, 8 valves for expansion. Locate irrigation controller in garage	Next 1-2 years	I, C	$15,500
Yard	Lawn	N/A	New Power	Near-term	Provide new exterior receptacles in waterproof box.	6 locations around yard zone, pull power from garage	Next 1-2 years	I, C	$2,300
Yard	Lawn	N/A	New Low Voltage Lighting for events	Near-term	Low voltage lighting system along paths and at exterior spaces	30 locations, 500 LF low voltage wire	Next 1-2 years	I, C	$14,000
Yard	Lawn	N/A	Potable Water	Near-term	Provide new hose bibbs at landscape	4 hosebibbs along 200 LF of new pipe	Next 1-2 years	I, C	$2,800
Yard	Vegetation	Fair	Trees	Near-term	New trees around yard zone for shade, ambiance and habitat	Assume eight (8) new 24-inch box trees	Next 1-2 years	I, C	$8,100
Yard	Vegetation	Fair	Shrubs	Near-term	New shrubs around yard zone for shade, ambiance and habitat	Assume (24) new 1-gallon plants	Next 1-2 years	I, C	$2,800
Yard	Disabled Access	N/A	Parking	Immediate	Provide stripping for accessible parking at the east and west of the residence	Per location		I, C	$1,200
Yard	Disabled Access	N/A	Signage	Immediate	Provide signage for accessible parking at the east and west of the residence	Per location		I, C	$2,300

Major Group	Element	Element General Condition	Component	Priority	Description	Quantity	Treatment Cycle	maintanence, capital, immediate	Cost
Yard	Disabled Access	N/A	Drinking Fountain	Immediate	Provide drinking fountain on path of travel	Per location		I, C	$10,000

Major Group	Element	Element General Condition	Component	Priority	Description	Quantity	Treatment Cycle	maintanence, capital, immediate	Cost
Pool	Deck	Fair	Flagstone	Near-term	Reset loose, missing and flagstone pieces with surface erosion	Flagastone deck around pool totals 1,225 square feet. Assume 25% repair / replacement	Next 5 years	I,M,C	$35,600
Pool	Equipment Room	Poor	Equipment	Near-term	Remove subterranean pool equipment	Lump Sum - estiamte 50 square feet of space, 7-foot high	Next 5 years	I,M,C	$2,900
Pool	Fence	Poor	Fence	Near-term	Remove Existing Fence	230 linear feet of 5-foot chain link fence. Remove post footings	Next 5 years	I,M,C	$5,700
Pool	Basin	Fair	Concrete	Near-term	Allowance to prepare existing pool basin for infill.	1,050 square feet	Next 5 years	I,M,C	$4,100
Pool	Reflecting Pool	N/A	Earthworks	Near-term	Infill pool with compacted soil and crushed rock with perforated pipe	5,400 cubic feet = 200 cubic yards of infill - 80% soil and 20% crushed rock with perforated pipe	Next 5 years	I,M,C	$38,800
Pool	Reflecting Pool	N/A	Concrete basin and pool edge	Near-term	Reinforced cast-in-place reflecting pool basin	Assume 950 square feet of pool with 6-inch thick walls, 6-inch bottom, 3-feet deep.	Next 5 years	I,M,C	$132,500
Pool	Reflecting Pool	Fair	Tile	Near-term	6" x 6' pool tile, 24-inches high at reflecting pool basin walls	260 square feet of 6-inch tile	Next 5 years	I,M,C	$8,100
Pool	Reflecting Pool	N/A	Reflecting Pool Equipment	Near-term	Filter pump, surface skimmer, and misc equipment. Locate south of reflecting basin	Lump sum	Next 5 years	I,M,C	$11,600
Pool	Reflecting Pool	N/A	Drain line	Near-term	Drain line for perforated pipe and to drain reflecting pool	150 linear feet	Next 5 years	I,M,C	$14,000
Pool	Vegetation	N/A	Drought Tolerant Habitat	Near-term	Low water use plantings with drip irrigation. Tie drip system into master irrigation cotrols and valves provided at yard zone	7,000 square feet	Next 5 years	I,M,C	$54,300

Major Group	Element	Element General Condition	Component	Priority	Description	Quantity	Treatment Cycle	maintanence, capital, immediate	Cost
Infrastructure	Residence	Fair	Electrical system	Near-term	Allowance to test and upgrade existing electrical system. 10% of outlets don't work. 200 AMP service is adequate for proposed future uses	6,000 GSF of Interior Space	1-2 Years and every 30 years	I, M, C	$23,300
Infrastructure	Residence	Fair	Plumbing system	Near-term	Inspect and repair existing supply and waste piping	8 existing bathrooms	1-2 Years and every 15 years	I, M, C	$32,600
Infrastructure	Residence	N/A	HVAC system	Near-term	Provide HVAC for Great Room only	720 square feet assembly space for 49 people	1-2 Years and every 15 years	I, M, C	$11,200
Infrastructure	Residence	N/A	HVAC system	Long-term	Provide HVAC for entire residence. Exclude caretaker and Great Room	4800 SF of additional conditioned space (excludes great room and caretaker)	5-10 Years and every 15 years	I, M, C	$148,800
Infrastructure	Residence	N/A	Fire protection system	Near-term	Provide new fire detection and notification system for the entire residence	6,300 GSF, first and second floor and garage	1-2 Years and every 30 years	I, C	$19,500
Infrastructure	Residence	N/A	Fire protection system	Long-term	Provide fire sprinklers at residence	6,300 GSF, first and second floor and garage	5-10 Years and every 30 years	I, C	$63,500
Infrastructure	Residence	Fair	Security system	Near-term	Inspect and test existing security system	Lump sum	Annually	I, M	$1,400
Building Envelope	Residence	N/A	Insulation	Near-term	Install new R-38 batt insulation at attic spaces. Premium for limited access	4,400 GSF of attics	1-2 Years	I, C	$17,100
Building Envelope	Residence	N/A	Attic Fans	Near-term	Provide attic fans to exhaust hot air from attics. Include conduits and junction boxes from nearest receptacle	Assume 6 locations	1-2 Years	I, C	$7,000
Interiors	Disabled Access	N/A	Disabled Access Toilet	Near-term	Frame out new restroom within existing grage space. Provide new walls, ceilings, toilet and sink, door, exhaust fan and mini split HVAC.	Provide lump sum cost per restroom	1-2 Years	I, C	$27,100
Site	Disabled Access	N/A	Drinking Fountain	Near-term	Provide high-low pedestal drinking fountain along path of travel. Include allowance to connect water and power. Assume location adjacent to garage	1	1-2 Years	I, C	$7,000

Major Group	Element	Element General Condition	Component	Priority	Description	Quantity	Treatment Cycle	maintanence, capital, immediate	Cost
Exterior	Disabled Access	N/A	Openings	Near-term	Allowance to modify garage door bay to accommodate new disabled access door	Per location	1-2 Years	I, C	$5,400

INTERIOR UNIT COSTS

Element	Element General Condition	Component	Description	Quantity	Cost
Walls	Good	Plaster	Patch cracks with joint compound	Per linear foot	$23.25
Walls	Good	Plaster	Patch large holes with drywall	Per square foot	$38.75
Walls	Fair	Plaster	Remove flaking and loose paint and provide new painted finish (non-decorative)	Per square foot	$3.88
Walls	Fair	Plaster	Remove flaking and loose paint and provide new painted finish (decorative paint)	Per square foot	$4.65
Walls	Fair	Wallpaper	Spot clean stains on wallpaper	Per square foot	$0.78
Walls	Fair	Wallpaper	Readhere loose edges of wallpaper	Per linear foot	$3.23
Walls	Fair	Wallpaper	Remove wallpaper and residue to provide clean and smooth surface for new finishes	Per square foot	$1.94
Walls	N/A	Wallpaper	Provide new wallpaper. Assume premium for custom matching wallpaper	Per square foot	$11.63
Walls	Fair	Wood Wainscot	Remove Paint, provide new two coat stain finish	Per square foot	$6.20
Walls	Fair	Wood trim	Remove flaking and loose paint and provide new painted finish	Per linear foot	$6.98
Walls	Fair	Mural	Stabilize / repair mural per report	Lump sum	Per previous report
Walls	Fair	Stone Veneer at fireplace	Install decorative stone at fireplace	Per square foot	$69.75
Ceilings	Good	Plaster	Patch cracks with joint compound	Per linear foot	$29.06
Ceilings	Good	Plaster	Patch large holes with drywall	Per square foot	$48.44
Ceilings	Fair	Fabric	Reattach faded and damaged fabric	Per square foot	$15.50

INTERIOR UNIT COSTS

Element	Element General Condition	Component	Description	Quantity	Cost
Ceilings	Fair	Wallpaper	Readhere loose edges of wallpaper	Per linear foot	$4.04
Ceilings	Fair	Wallpaper	Remove wallpaper and residue to provide clean and smooth surface for new finishes	Per square foot	$0.97
Ceilings	N/A	Wallpaper	Provide new wallpaper. Assume premium for custom matching wallpaper	Per square foot	$14.53
Ceilings	Fair	Wood Coffer with wood infill	Remove loose and flaking paint, repair water damage and provide new painted finish	Per square foot	$4.84
Floors	Good	Wood floors	Repair wood floors - secure loose boards	Per linear foot	$3.23
Floors	Good	Wood floors	Remove and replace damaged boards	Per linear foot	$9.69
Floors	Good	Wood floors	Light sand on wood floors and refinish with 3 coats	Per square foot	$9.69
Floors	N/A	New wood floors	Provide new solid wood floors at locations where carpet has been removed	Per square foot	$15.50
Floors	Good	Cork Floors	Light cleaning, light sanding, new sealer	Per square foot	$3.88
Floors	Good	Linoleum	Light cleaning with soap and water	Per square foot	$1.16
Floors	Good	Linoleum	Re-adhere delaminated portions	Per square foot	$1.24
Floors	Good	Linoleum	Patch missing pieces with new to match existing	Per square foot	$18.60
Doors	Good	Doors	Remove paint from doors, prep and provide new stain finish (both sides)	Per location	$339.06
Doors	Good	Doors	Provide new prep and paint at wood doors (both sides)	Per location	$242.19
Systems	Fair	Light Fixtures	Restore existing fixtures, remove, clean, rewire, and reinstall	Per location	$387.50

INTERIOR UNIT COSTS

Element	Element General Condition	Component	Description	Quantity	Cost
Systems	Poor	Light Fixtures	Provide new replica decorative chandelier based on historic documentation	Per location	$15,500.00
Systems	Poor	Light Fixtures	Provide new replica decorative light fixture based on historic documentation	Per location	$4,650.00

PREVIOUS REPORTS

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Oakridge Estate Mural Exam for Art Conservation Proposal
Mural # 456
November 28, 2017

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Dept. of Cultural Affairs, City of Los Angeles
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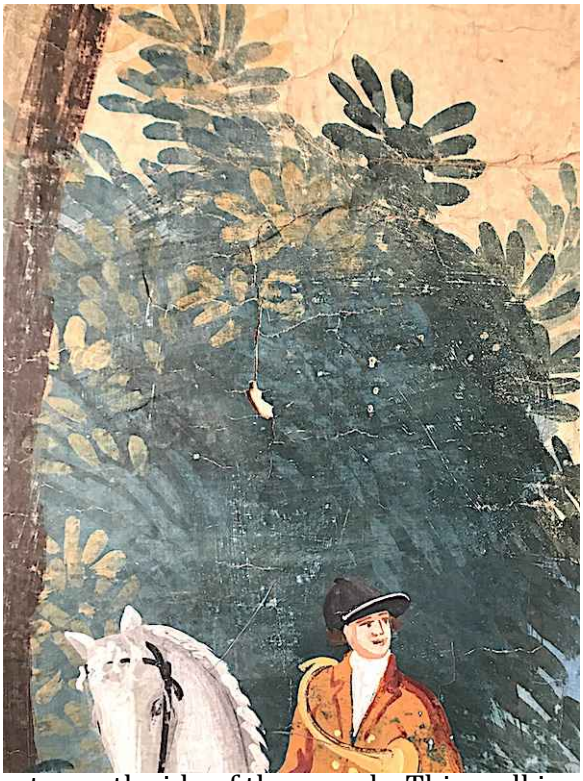
The wallpaper murals (on all four walls) in the living room of the Oakridge Estate were examined on Oct. 25, 2017 in order to provide 4 proposals and budgets:

1. Minimal art conservation treatments to stabilize the most unstable areas, minimal inpainting or blending of aesthetic problems to improve the appearance, make the murals more safe against damage during future use of the room. Extent of future use is unknown.
2. Extensive art conservation treatments to stabilize as much as possible the condition of the murals, inpaint and blend to return the murals as much as possible to an original appearance and make the murals as resistant as possible to damage during room use. Extent of future use is unknown.
3. Proposal for minimum protection of the murals during light renovation of the building. Extent of future renovations is unknown.
4. Proposal for extensive protection measures of the murals during more aggravated renovation of the building. Extent of future renovations is unknown.

Title: Old European countryside scenes
Artist: English?
Period: c. 1935 (when house was built?) Style is 1850ish
Technique: Gouache, tempera and watercolor on paper. Composition may have been printed then reworked and modified by hand. The paper support was adhered to fabric with starch paste (probably on location) and adhered to the plaster walls with starch paste.
Dimensions: 3 ft wainscot, mural is 6.5 ft tall by about 60 ft long (80' with doors and windows) or about 390 sq. ft.

The murals were examined by Scott M. Haskins, Head of Conservation at FACL, Inc., with regular ambient lighting, added lights (including raking light), magnification and with an UV exam light. Solubility tests were conducted with mixtures of water, acetone, ethanol, naphtha, xylene.

Conditions due to original installation techniques and aging:



General deterioration of paper support is characteristic with low quality highly manufactured paper – it has browned and embrittled. Joins in sections of the murals are evident but stable. Cracks/splits in paper are abundant. Stains in paper (mostly visible in the areas of sky and light background) due to mounting techniques are prevalent. Extensive wrinkling of the paper occurred over almost all areas of the murals with original installation. Areas of most extensive wrinkling are evidence of poor adhesion of paper to fabric. Adhesion of fabric to wall appears good. Several slits by original installers were made to evacuate bubbles during installation. Small losses of paper and paint exist here and there and along some edges. Since the paper is so brittle, wherever it is lifting, there is risk of loss. It was told us that a leak occurred in the roof and trickled down through the upper floors onto south side of the murals. This wall is the most damaged followed by the corner section of the south-west wall.

Conditions due to previous restorations:

There are extensive areas of repainting and generous retouching which changes the color of the murals. Some compositional elements were also changed. Cleaning tests revealed that with the removal of the overpaint, extensive damage is underneath. It is possible/probable that airbrushing-retouching of vast areas of sky was undertaken. Presumably, futile attempts were made to clean the murals which resulted in damage to the paint layers, being extremely soluble in water and water based solvents.

The blue colors in the center section are original.
The yellowish/brownish right and left sides are discolored due to previous poor quality retouching/restoration

Proposal for Option 1, Budgets, Timelines

1. Minimal art conservation treatments to stabilize the most unstable areas, minimal inpainting or blending of aesthetic problems to improve the appearance, make the murals more safe against damage during future use of the room.

"Minimal art conservation treatments" refers to re-adhering only the most badly detached areas of murals to save them from loss. "Make the murals more safe against damage during future use of the room" refers to the re-adhering of these major spots of lifting mural so that visitors who touch will not knock off sections of the mural when the room is in use... although prying fingers will still do damage. All wrinkles and small areas of instability that are not at risk of imminent loss will not be treated. "Minimal inpainting or blending of aesthetic problems to improve the appearance" refers to inpainting or toning small losses without fills which will camouflage the losses so they will not be readily noticeable.

Timeline, Logistic, Budget: Option 1 will require 2.5 days working onsite for 2 people – Budget $7,880.00 The breakdown for this budget is $7,030.00 Labor, $750.00 Admin, $100.00 Equipment, $0 Supplies

Preservation and Aesthetic Results of Treatments Proposed In Option 1: The murals will be made safer against light abrasion damage during future use of the room by stabilizing the most fragile spots of the mural. Pieces of mural are not likely to fall off or flake. However, wrinkles in the mural which are not cracked/split open and lifting (which still may be detached from the wall) will still remain untreated. Any losses of paper with paint will be toned with similar color to be less noticeable and blend in. But the colors and texture will not match perfectly. Any previous restorations, retouchings, stains etc will also remain untreated, and therefore, just as visible as before. No general mural treatments are proposed.

Wall with the most unstable paper adhesion (area of past water leakage?)

Proposal for Option 2, Budgets, Timelines

1. Extensive art conservation treatments to stabilize as much as possible the condition of the murals, inpaint and blend to return the murals as much as possible to an original appearance and make the murals as resistant as possible to damage during room use. Extent of future use is unknown.

With this Option 2, more extensive re-adhesion of lifting paper, overall, would be undertaken. Any and all wrinkles that look unstable would be addressed (not just those lifting) but there are many wrinkles that are stable/well-adhered. Therefore maximum amount of re-stability of the paper layer would be the objective. Once the unstable wrinkles are treated we expect them to be stable long term, but the wrinkle in the paper will still be visible. Also, all stabilized wrinkles will remain visible.

Cleaning/removal of yellowed varnishes on repainted areas will help to return the areas to better match the tonality of the original colors and make it easier to blend the old retouching colors to blend in with the original colors.

Extensive retouching/blending/toning will be undertaken of several different types of inflicted damage, stains and previous repairs that have changed color. The goal will be to obtain an overall much more harmonious flow of color, composition, contrast in the composition and better depth of field.

Surface treatment to consolidate susceptible tempera paint layers without darkening in order to make the mural more resistant to touching/staining and accidental exposure to liquids. This treatment will not make the paint layers more resistant to impact, abrasions, abuse/careless use of the room.

Timeline, Logistic, Budget: Option 2 will require 3 weeks working time onsite for 3 art conservators – Budget $57,884.00 The breakdown for this budget is:
$38,400.00 /3 people for 16 days at $100 per hour)
$1,628.00 for documentation and reports;
$200.00 insurance.
$12,000.00 Travel expenses could range from $2,000.00 - $12,000.00 depending on where the art conservators come from (based on IRS allowances.
$2,028.00 Admin,
$2,250.00 Equipment,
$1,378.00 Supplies.

However, the client could, in the face of expanding difficulty and scope, designate that the work be limited to fit within a certain budget thereby restricting the work to completing sections of work according to priorities. The minimum I think this scope of work should be budgeted is $39,905.00 reflecting less labor hours and less travel expenses.

Preservation and Aesthetic Results of Treatments of Option 2

1. The murals will be made safer against abrasion damage during future use of the room by making more resistant the tempera/gouache paint layers of the mural.
2. In addition to the benefits included in Option1, much greater stability of the paint layers and wrinkles will result.
3. Option 2 provides for the best possible appearance of the murals, including hiding/camouflaging of past poor restoration problems.
4. The mural's aged appearance will remain. The objective is not to make the murals look new. But to the untrained eye, the murals will be in optimum condition.

Right side (yellowed) is due to previous retouchings discolored.
House etc also damaged (abraded) in a previous cleaning.

3. Proposal for minimum protection of the murals during light renovation of the building. Extent of future renovations is unknown. But, for most light renovations not located in the immediate proximity of the murals, a single or double layer of thick visqueen construction grade plastic attached to the crown molding or the ceiling plaster to drape in front of the murals will be sufficient. The joins in the vertical edges of the plastic sheeting could be tapped but it may not be necessary. The bottom should not be sealed. Air flow under the plastic is advisable so sealing the plastic coverings closed is not recommended if at all possible. The process could be done by facilities or a GC. If FACL, Inc. is awarded the mural conservation contract, we will include onsite consultation with the installer at no extra charge. If consultation with the installer is a stand-alone task then the charge will be $880.00. If you want FACL, Inc. to install the plastic barrier, then the charge will be $2,880.00

4. Proposal for extensive protection measures of the murals during more aggravated renovation of the building. Extent of future renovations is unknown. This option considers protection in the event that *sustained major vibrations* will be an issue. If they are an issue:

- Plaster layers of the walls may crack and this proposed option will not be effective protection for this problem.
- Weak, aged starch based paste which hold the mural's canvas to the plaster layers could be compromised and separation of the canvas from the plaster will result (air pockets). This proposed option will not be effective protection for this problem.
- Weak, aged starch based paste which hold the mural's paper to the canvas backing could be compromised and separation of the mural's paper from the canvas will result (air pockets). This proposed option will not be effective protection for this problem.

The proposed structure for the mural's protection includes:

1. Cover the murals with 3 layers of polypropylene plastic, thick construction grade visqueen, as suggested in "3. Proposal for minimum protection of the murals during light renovation of the building."
2. Cover ¾" – 1" thick plywood panels with extra soft cell foam to be placed on all areas of the murals
3. Brace/hold the plywood panels tightly against the wall with bracing anchored to the ceiling and floor

4. Bracing should be removed as soon as possible from murals as soon as work that causes vibrations is completed or heavy equipment usage in area of the murals is complete.
5. Once this protection is removed, "3. Proposal for minimum protection of the murals during light renovation of the building" could be left in place for the remainder of the renovation.

The process should be done by the GC. If FACL, Inc. is awarded the mural conservation contract, we will include onsite consultation with the installer at no extra charge. If consultation with the installer is a stand-alone task then the charge will be $880.00. FACL, Inc. will not construct nor install this protective barrier (we are not licensed to do construction).

Follow up exam and inspection of the murals, once the protective barriers are removed, should be conducted by FACL, Inc. to assess any damage during renovation. An inspection and report will cost $1,780.00.

Recommendations for maintenance: *In the mural's present state, or even after Option 1 were performed*, given the porous nature of the paint layers, they are easily stained by any application of commercial cleaner. If an attempt were made by maintenance to clean something off the murals, the damage would be extreme and irreversible. Even a dry microfiber cloth lightly wiped over the surface would knock off lifting cracks and break off very small pieces of the paint and paper mural. A feather duster is about all I can recommend.

Maintenance Recommendations if Option 2 were performed (more extensive laying down of lifting cracks would be performed and a consolidant to the entire surface would be applied making the paint layers more resistant). Still, the abundant application of commercial cleaners and other liquids would be detrimental and would probably stain the murals, though not so readily. However, in the advanced state of protection, a dry microfiber cloth could be wiped over the surface to remove dust etc without risk.

Recommended Protocol for Mural Safety: awkward equipment and a crowded room don't mix well. The paper wall coverings crush and crumble upon impact. Receptions/parties etc with drinks and food need to be tame and under control perhaps making sure people, carts, equipment etc stay away from the muraled walls. Anything spilled on the murals will be permanent damage.

Research on the production company/artist of the murals was researched with some time performing Internet searches. No matching compositional design, style of similar age could be found. Professional art conservation literature was reviewed but no similar murals were found.

If a more in-depth illustrated live presentation is required, I am available. If this work also requires fundraising, I am experienced in assisting successfully those efforts.

Scott M. Haskins, Head of Conservation, FACL, Inc. (aka Fine Art Conservation Laboratories)
805 564 3438 office, 805 570 4140 mobile

ASBESTOS & LEAD INSPECTION REPORT

For The

OAKRIDGE ESTATE PROPERTY

18650 Devonshire Street,
Northridge, California 91324

Prepared For

CITY OF LOS ANGELES DEPARTMENT OF RECREATION AND PARKS

221 N. Figueroa Street, Suite 100
Los Angeles, California 90012

Prepared By

ENCORP
Engineering our Environment

ENVIRONMENTAL NETWORK CORP.

16700 Valley View Avenue, Suite 100, La Mirada, California 90638
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www.encorp.net

September 19, 2012 (Revised October 28, 2019)
ENCORP PROJECT P12281.L25

TABLE OF CONTENTS

I. ASBESTOS & LEAD INSPECTION REPORT

ASBESTOS AND LEAD MATERIALS INSPECTION REPORT

SITE LOCATION:.....OAKRIDGE ESTATE PROPERTY
18650 Devonshire Street
Northridge, California 91324

INSPECTION DATES: .... September 19, 2012

INTRODUCTION

The **CITY OF LOS ANGELES DEPARTMENT OF RECREATION AND PARKS PLANNING, CONSTRUCTION & MAINTENANCE DIVISION** (hereinafter will be referred to as the client) retained **ENCORP** to conduct an asbestos and lead-based paint inspection of the park property located at 18650 Devonshire Street, Northridge, California. The purpose of this inspection was to identify suspect asbestos-containing building materials (ACBMs) and lead-based painted materials (LBPMs), which may be impacted by renovation activities. The subject property is a public park property consisting of a two story English Manor Style house with attached garage, basement and associated swimming pool and tennis court. The general construction of the structure consists of a concrete slab/foundation, plaster/drywall walls and ceiling assemblies, hardwood flooring, rough exterior stucco, brick/stone exterior finish, and wood shingled roofing material.

The property contains over nine acres of moderate vegetation, trees and open space. It is bordered by single and multi-family residential dwellings to the south and west as well as mixed retail and commercial facilities to the north and east.

ENCORP's Certified Asbestos Consultant/Site Surveillance Technician/DHS Certified Lead Inspector/Assessor Mr. Francisco Barraza completed the site inspection. Prior to sample collection, **ENCORP's** representative conducted a visual investigation of the property to identify and quantify all suspect asbestos-containing building materials, and lead-based painted materials. Upon completion of the visual investigation, building materials were grouped into homogeneous categories and samples were collected from the suspect asbestos-containing materials previously identified. XRF testing of suspect LBPMs' was also conducted. Crawl spaces were also inspected for damaged suspect asbestos-containing materials. All identified damaged materials were quantified, locations noted and included in this inspection report.

SAMPLING METHODOLOGY -- ASBESTOS

ENCORP used a modified random sampling protocol to collect the samples of the suspect asbestos-containing materials. Each of the suspect samples collected for this report were given a unique sample identification number and sealed inside leak-proof containers for shipment to the laboratory for analysis.

All of the bulk samples collected by **ENCORP** during this inspection were analyzed by **ENCORP's** Environmental Laboratory, La Mirada, California. **ENCORP** Environmental Laboratory is accredited by NIST/NVLAP for analysis of asbestos fibers in bulk. A copy of the certification is included in the certification section of this report. These samples were analyzed by Polarized Light Microscopy/Dispersion Staining (EPA Method 600/M4-82-020). This method is designed as an inexpensive screening method to examine bulk samples; it is not an absolute method. Any visible light method (including PLM) is limited by the resolution possible with visible light.

Because fibers with a diameter less than one micron will not be seen using PLM, a possibility exists that the asbestos content of materials with low asbestos percentages (such as floor tiles and soils) could actually be higher when analyzed by Trans Electron Microscopy (TEM), or X-ray diffraction.

INSPECTION RESULTS

The following page contains the summary of the suspect asbestos-containing materials sampled during this inspection, including the location and laboratory analysis. Samples collected and found not to contain asbestos are classified as being "None Detected" (ND). The complete sampling results can be found in the attachment section IIA of this report.

SUMMARY OF SUSPECT ASBESTOS-CONTAINING MATERIALS TESTED 18650 Devonshire Street				
Building Component	**Location Of Material Per Attached Floor Plan**	**Condition**	**Estimated Quantity**	**% and Type of Asbestos**
Wood Roof Shingles	Throughout Roof	D	-	Not sampled Not a suspect material
Black Vapor Barrier Paper	Under Woods Roof Shingles	G	-	ND
Black/Brown Penetration Mastic	**Throughout Roof @ Penetrations**	**G**	**30 sq ft**	**5% Chrysotile**
Window Putty (Grey)	Throughout Window Assemblies	D	-	ND
Stone Grout (Grey)	Throughout Exterior Stone Wall Finish	G	-	ND
Rough Stucco Wall Assemblies (White/Grey)	Exterior South Walls	D	-	ND
Rough Stucco Ceiling Assemblies (White/Grey)	**Exterior South Overhangs**	**D**	**1,000 sq ft**	**Trace Chrysotile <1% Chrysotile**
Black Vapor Barrier Paper	Under Stucco Walls & Ceiling Assemblies	G	-	ND
Smooth Plaster Wall Assemblies w/ Button Board	Throughout Interior Walls on the 1st & 2nd Floors	D	-	Skim Coat=ND Plaster=ND
Smooth Plaster Ceiling Assemblies w/ Button Board	Throughout Interior Ceilings on 1st & 2nd Floors	D	-	ND
Electrical Wire Cloth Covering	Throughout Interior Walls & Ceilings (wire covers)	D	-	ND
Green Linoleum Flooring	Restrooms, Room # 22, 24 & 25 of Floor Plan	D	-	ND
9" Brown Cork Flooring w/ Associated Mastic	1st Floor Laundry Room, Kitchen, & Butler's Pantry	D	-	ND
Green Linoleum Sheet Flooring (Marble Pattern)	Don Trophy Room, Restroom #7, & Restroom #26	D	-	ND
Green Linoleum & Black Backing Pad	Counter Tops Laundry Room	D	-	ND
Multi-Colored Linoleum Flooring	Laundry Room Interior Cabinets	D	-	ND

SUMMARY OF SUSPECT ASBESTOS-CONTAINING MATERIALS TESTED 18650 Devonshire Street				
Building Component	**Location Of Material Per Attached Floor Plan**	**Condition**	**Estimated Quantity**	**% and Type of Asbestos**
Rough Plaster Wall Assemblies w/ Button Board	Laundry Room, Servant Room # 1 & 2	D	-	Plaster=ND Button Board=ND
Rough Plaster Ceiling Assemblies w/Button Board	Laundry Room, Servant Rooms # 1 & 2	D	-	Plaster=ND Button Board=ND
Sink Undercoat Mastic (Black)	Kitchen Sink	G	-	ND
Yellow Sheet Flooring	Pool House Restroom	D	-	ND
Thermal System Insulation (TSI)	**Basement, Attic, Wall Cavities, Ceiling Spaces, & Crawl Spaces**	**D**	**300 ln ft**	**55% Chrysotile**
Damaged HVAC Duct Wrap & Thermal System Insulation	**Attic Space, Crawl Space Below Restrooms 23, 24 & 25, Throughout 1st & 2nd Floors HVAC Registers**	**SD**	**600 sf ft**	**55% Chrysotile**

Note 1: Conditions of materials are identified as follows: Good (G), Damaged (D), or Significantly Damaged (SD). The quantities listed are for budgetary purposes only. Contractors completing proposals for the removal of asbestos-containing materials are responsible for verifying the location, quantity, degree of difficulty and necessity for removing the identified materials.

Note 2: Damaged asbestos-containing thermal system insulation and duct wrap was identified in the crawl spaces throughout the basement and attic spaces above ceilings.

Note 3: The initial quantity of roof mastic was revised from 300 SF to 30 SF following the abatement contractor's observations of the material. This was likely a typographical error. If additional mastic is in fact discovered, this report must be revised. If applicable, any notifications to SCAQMD must be revised as well. (Quantity revised 10/28/2019).

DISCUSSIONS AND RECOMMENDATIONS (ASBESTOS)

Asbestos-containing materials (ACM) should be removed by a California trained and licensed abatement contractor in accordance with all governing regulations. **ENCORP** also recommends that a California Certified Asbestos Consultant/Site Surveillance Technician oversee the project to ensure that proper methods are being utilized.

In cases where the floor tile was found positive for asbestos content and the underlying mastic was found negative for asbestos, the materials (floor tile and mastic) shall be removed as asbestos containing. There is currently no feasible means of separating the floor tile from the underlying mastic without causing its disturbance.

Materials that are found to contain less than one (1) percent asbestos are considered asbestos-containing construction materials (ACCM) by CAL/OSHA and are not regulated by the South Coast Air Quality Management District (SCAQMD). These materials are regulated through CAL/OSHA and should be removed by a California trained and licensed abatement contractor in accordance with all governing regulations. Waste generated from these materials is considered construction debris and is not regulated as hazardous or asbestos-containing waste.

If asbestos-containing materials are damaged or will be impacted during this project **ENCORP** recommends that minor disturbance to ACM such as coring or drilling to be performed by a certified trained contractor with a minimum of 16-hour AHERA Operations and Maintenance Training – Class III asbestos work classification. This work classification is used as an adequate alternative for trade work involving electrical, lighting, plumbing, and miscellaneous disturbances where work is not to exceed three (3) square feet (sq ft) per area and a one hundred (100) square feet (sq ft) total combined square footage.

ENCORP also recommends that a California Certified Asbestos Consultant/Site Surveillance Technician oversee the project to ensure that proper methods are being utilized.

All clean-up of damaged asbestos-containing material should be performed by a California trained and licensed abatement contractor in accordance with all governing regulations. No unauthorized personnel should be allowed into these areas until proper abatement and clean-up activities have been performed and all areas cleared for re-occupancy by a certified asbestos consultant/Industrial hygienist.

INSPECTION RESULTS – LEAD

The SCITEC MAP4 XRF Spectrum Analyzer was utilized for the analysis of suspect lead-based painted materials. In this method of analysis, the material is exposed to X-Rays or other high-energy radiation (such as gamma rays), which causes lead to emit X-Rays with a characteristic frequency. The intensity of this radiation is measured by the instrument's detector and is then converted into a number that represents the amount of lead in the material per unit area, usually milligrams per square centimeter (mg/cm^2).

The HUD and OSHA have set a lead level of 1.0 mg/cm^2 as being a regulated lead-containing material.

All components with results of >0.7 mg/cm^2 are considered lead-based painted according to the County of Los Angeles. **ENCORP** recommends that a trained, licensed Lead Abatement Contractor perform any renovation/demolition or preparation for demolition activities, which will disturb the lead-containing building materials

Listed below is a summary of the materials sampled and found positive for lead within the residential structure, along with the location and estimated quantity. A complete listing of all components tested can be found in Section IIb of this report. Estimated quantities are listed for lead-based painted materials.

SUMMARY OF LEAD-CONTAINING COMPONENTS
18650 Devonshire Street

COMPONENT	LOCATION	Quantity
Wood White Base Board	2nd Floor Restroom	20 sq ft
White Wood Window Frames	Throughout 2nd Floor	100 sq ft
White Ceramic Floor Tile & Base Tile	Restroom # 24	25 sq ft
Grey Wood Door Frames	Room #22	5 each
Orange Metal Support Beams	Throughout Basement & House	1,000 sq ft
White Metal Beams	Basement @ Stairs	20 ln ft
White Porcelain Sink	Butler's Pantry	1 each
White Wood Window Assemblies	Butler's Pantry	1 each
White Ceramic Counter Top Tile & Back Splash	Kitchen	60 sq ft
White Porcelain Sink	Kitchen, Room # 26, 1st Floor Main Entrance Restroom, Pool House	1 each
Green Ceramic Floor Tile	Restroom #15	40 sq ft
White Porcelain Bath Tub	Restroom #15, Restroom #7	1 each

SUMMARY OF LEAD-CONTAINING COMPONENTS
18650 Devonshire Street

COMPONENT	LOCATION	Quantity
Grey Linoleum Counter Top	Laundry Room #13	40 sq ft
Yellow Ceramic Base Tile	Restroom #7	25 sq ft
Blue Ceramic Base Tile	Room #26 Shower	20 sq ft
White Porcelain Toilet	Room #26, Main 1st Floor Restroom, Pool House	1 each
Brown Wood Door & Assembly	Main Entrance Door	1 each
Brown Wood Beams	Main Entrance	1 each
Brown Wood Window Assemblies	Throughout Upper and Lower Exterior	70 each
Brown Wood Siding	Exterior Walls	1,200 sq ft
Brown Wood Eaves/Trim	Exterior Upper Roof Area	400 ln ft
Brown Wood Vent	Exterior	8 each
Brown Wood Columns	Exterior Patio	50 ln ft
Brown Wood Beams	Exterior Patio & Garage	35 ln ft
Brown Wood Door Assemblies	Exterior Patio	5 each
White Stucco Wall Assemblies	Exterior Patio Throughout	4,000 sq ft
White Stucco Ceiling Assemblies	Exterior Patio Throughout	1,000 sq ft
Brown Wood Window Trim	Exterior Adjacent to Windows	800 ln ft
Brown Wood Door Frames	Exterior	1 each
Brown Wood Post	Exterior (South)	8 each
Brown Wood Garage Door & Frame	Attached Garage	3 each
Brown Wood Wainscot	Interior Attached Garage	90 sq ft
White Wood Wall Hangers	Interior Attached Garage	10 sq ft
Yellow Wood Door & Assembly	Pool House Restroom	3 each
Light Ceramic Base	Pool House Shower	20 sq ft
Green Metal Light Box	Tennis Courts	1 each
Green Metal Light Poles	Tennis Courts	8 poles
Green Ceramic Pool Edge Tile	Throughout Pool Edge	200 ln ft

Note: The quantities listed are for budgetary purposes only. Contractors completing proposals for the removal of lead-based painted materials are responsible for verifying the location, quantity, degree of difficulty and necessity for removing the identified materials.

DISCUSSIONS AND RECOMMENDATIONS (LEAD)

All suspect lead-based painted components were tested utilizing SCITEC Corporation's MAP4 XRF Spectrum Analyzer. The XRF data stored in the MAP4 unit was downloaded to **ENCORP's** database.

Minor disturbance to lead-based painted components such as coring or drilling can be performed by a certified trained contractor with a minimum of 8-hour Lead Awareness Operations and Maintenance Training. This work classification is used as an adequate alternative for trade work involving electrical, lighting, plumbing, and miscellaneous disturbances where work is likely to disturb lead-containing material.

CONCLUSION

ENCORP recommends that the above listed asbestos-containing and lead-containing materials which will be impacted by demolition activities, be removed by a California trained and licensed abatement contractor in accordance with all governing regulations. **ENCORP** also recommends that a California Certified Asbestos Consultant/Site Surveillance Technician oversee the project to ensure that proper methods are being utilized.

Additional asbestos-containing and lead-based painted materials may be present at this site. Due to the historic preservation of the property destructive sampling was not performed during this inspection, care should still be taken when demolishing materials that will open wall cavities or sealed ceiling areas. If any additional known, assumed, or suspected asbestos-containing materials or lead-based painted components are discovered that are not listed in this report, during renovation, remodeling or demolition activities, contact an environmental consultant to determine the proper course of action.

Should you have any questions concerning this report, please contact me at (714) 523-9811. Thank you.

Respectfully submitted,

Shane Woods
Certified Site Surveillance Technician #01-3003
California DPH Lead Sampling Technician #12104

Reviewed,

Alexander Blankevoort
Certified Asbestos Consultant CAC #04-3555
California DPH Inspector/Assessor #11092

II. SAMPLE ANALYSIS

ENCORP FIELD DATA SUMMARY INSPECTION & PHYSICAL ASSESSMENT

CLIENT: Los Angeles County Parks and Recreation DATE: 9-19-12 PAGE: 1 OF 7

JOB NO: P12281.125 INSPECTORS: Francisco Barraza cert 07-4192

LOCATION: 18650 Devonshire st Northridge, CA 91324

SAMPLE NO.	LAB ID #	SAMPLE LOCATION	MATERIAL DESCRIPTION	CONDITION	QUANTITY	% ASBESTOS
1.		Room #1 and floor closet	Black vapor barrier	G black	6,500 SF	80% chrysotile
2.		↓	↓	↓	↓	↓
3.		RR # 7 2nd floor	↓	↓	↓	↓
4.		Penetration mastic Exterior Roof	Penetration mastic	G brown/black	300 SF	5% Chrysotile
5.		↓	↓	↓	↓	↓
6.		↓	↓	↓	↓	↓
7.		Bldg Exterior North	window putty	D grey	600 SF	ND
8.		↓	↓	↓	↓	↓
9.		↓	↓	↓	↓	↓
10.		Bldg Exterior North	Stone Grout	G beige	3,000 SF	ND

ABBREVIATIONS:

TYPES OF MATERIALS:	CONDITION:	OTHER:
S = Surface Material TSI = Thermal Systems Insulation M = Miscellaneous Material	G = Good D = Damaged SD = Significantly Damaged	S.F. = Square Feet L.F. = Linear Feet

CHAIN OF CUSTODY

Sampled by: Francisco Barraza Date/Time: 9-20-12

Relinquished/Received By: Date/Time: 9/21/12 08:00 AM

Relinquished/Received By: Date/Time: 9/30/12

Comments/special Instructions:

ENCORP FIELD DATA SUMMARY INSPECTION & PHYSICAL ASSESSMENT

CLIENT: Los Angeles County Parks and Recreation DATE: 9-19-12 PAGE: 2 OF 7

JOB NO: P12281.525 INSPECTORS: Francisco Barraza cert 07-4192

LOCATION: 18650 Dawnshire st Northridge CA 91324

			MATERIAL DESCRIPTION	CONDITION	QUANTITY	% ASBESTOS
1.					base	ND
2.						
3.		BLDG Exterior south	Stucco walls	D	white/grey 4,000 sf	ND
4.						
5.						
6.			Stucco ceiling	D	white/grey 1,000 sf	trace chry
7.						
8.						
9.		BLDG Exterior NW	Black Vapor Barrier	G	black 4000 sf	90% cell
20.						

ABBREVIATIONS:

TYPES OF MATERIALS:	CONDITION:	OTHER:
S = Surface Material TSI = Thermal Systems Insulation M = Miscellaneous Material	G = Good D = Damaged SD = Significantly Damaged	S.F. = Square Feet L.F. = Linear Feet

CHAIN OF CUSTODY

Sampled by: Francisco Barraza 9-20-12 Date/Time:

Relinquished/Received By: Date/Time: 9-21-12 @ 08:00AM

Relinquished/Received By: Date/Time: 9/30/12

Comments/special Instructions:

ENCORP FIELD DATA SUMMARY INSPECTION & PHYSICAL ASSESSMENT

CLIENT: Los Angeles County Parks and Recreation DATE: 9-19-12 PAGE: 4 OF 7

JOB NO: P12281.025 INSPECTORS: Francisco Barraza cell 07-4192

LOCATION: 18650 Devonshire st Northridge, CA 91324

SAMPLE NO.	LAB ID #	SAMPLE LOCATION	MATERIAL DESCRIPTION	CONDITION	QUANTITY	% ASBESTOS
31.		Room #24	Green Linoleum FLOORING	D g-24	200 sf	10% cell
2.		#25				
3.		#22				
4.		Butler pantry	Brown 9x9 Floortile + Mastic, paper	D green/brown	100 sf	20% cell
5.		Kitchen				
6.						
7.		Trophy Room	Green Linoleum sheet FLOORING Marble / Mastic paper	D	500 green sf	10% cell
8.						
9.						
40.		Laundry Room Room #3	Green Top counter top Linoleum Material Black Paper	D	green 30 sf	ND

ABBREVIATIONS:

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CHAIN OF CUSTODY

Sampled by: Francisco Barraza Date/Time: 9-20-12

Relinquished/Received By: Mary PL Date/Time: 9-21-12 @ 08:00

Relinquished/Received By: Date/Time: 9/30/12

Comments/special Instructions:

ENCORP FIELD DATA SUMMARY INSPECTION & PHYSICAL ASSESSMENT

CLIENT: Los Angeles County Parks and Recreation DATE: 9-19-12 PAGE: 5 OF 7

JOB NO: P12281.L25 INSPECTORS: Francisco Barraza cert 07-4192

LOCATION: 18650 Devonshire st Northridge, CA 91324

SAMPLE NO.	LAB ID #	SAMPLE LOCATION	MATERIAL DESCRIPTION	CONDITION	QUANTITY	% ASBESTOS
41.				green		ND
2.						
3.		Laundry Room inside cabinet	Flooring Multi color Linoleum	D yellow/green	20 sf	10% cell
4.						
5.						
6.		Servant Room #1	Rough plaster walls + Button Board	D beige brown/white	2,000 sf	a) ND (Plaster) b) 15% cell (BW)
7.		Laundry Room #13				
8.		~~Laundry Room~~ Servant Room #14				
9.		Laundry Room # 13	Rough Plaster ceiling + Button Board	~~beige~~ ND		
50.		Servant Room # 2				

ABBREVIATIONS:

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CHAIN OF CUSTODY

Sampled by: Francisco Barraza Date/Time: 9-20-12

Relinquished/Received By: Date/Time: 9-21-12 @ 08:00

Relinquished/Received By: Date/Time: 9/30/12

Comments/special Instructions:

ENCORP FIELD DATA SUMMARY INSPECTION & PHYSICAL ASSESSMENT

CLIENT: Los Angeles County Parks and Recreation DATE: 9-19-12 PAGE: 6 OF 7

JOB NO: P12281.E25 INSPECTORS: Francisco Barraza cert 07-4192

LOCATION: 18650 Devonshire st Northridge, CA 91324

SAMPLE NO.	LAB ID #	SAMPLE LOCATION	MATERIAL DESCRIPTION	CONDITION	QUANTITY	% ASBESTOS
51.		Laundry Room	⊥ (no pw)	beige		ND
2.		Kitchen	Sink undercoat Mastic	9 black	5 sf	ND
3.		↓	↓	↓	↓	↓
4.		↓	↓	↓	↓	↓
5.		Pool House	Yellow Sheet Flooring	D yellow/brown	2 1000 sf	10% cell
6.		↓	↓	↓	↓	↓
7.		↓	↓	↓	↓	↓
8.		Attic	TSI pipe wrap	D Grey	300 LF	55% Chry 25% Cell
9.		↓	↓	↓	↓	↓
10.		↓	↓	↓	↓	↓

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CHAIN OF CUSTODY

Sampled by: Francisco Barraza Date/Time: 9-20-12

Relinquished/Received By: Date/Time: 9-21-12 @ 08:00

Relinquished/Received By: Date/Time: 9/30/12

Comments/special Instructions:

ENCORP FIELD DATA SUMMARY INSPECTION & PHYSICAL ASSESSMENT

CLIENT: Los Angeles County Parks and Recreation DATE: 9-19-12 PAGE: 7 OF 7

JOB NO: P12281.L25 INSPECTORS: Francisco Barraza cert 07-4192

LOCATION: 18650 Devonshire St Northridge, CA 91324

SAMPLE NO.	LAB ID #	SAMPLE LOCATION	MATERIAL DESCRIPTION	CONDITION	QUANTITY	% ASBESTOS
6 1.		Attic	HVAC Duct wrap	D grey	500 sf	55% chry 20% cell
2.		↓	↓	↓	↓	↓
3.		↓	↓	↓	↓	↓
4.		2nd floor room #1 (6)	HVAC Boots Registers	9 beige	60 each	
5.		↓	↓	↓	↓	↓
6.		↓	↓	↓	↓	↓
7.						
8.						
9.						
10.						

ABBREVIATIONS:

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CHAIN OF CUSTODY

Sampled by: Francisco Barraza Date/Time: 9-20-12

Relinquished/Received By: [signature] Date/Time: 9-21-12 @ 08:00

Relinquished/Received By: [signature] Date/Time: 9/30/12

Comments/special Instructions:

ENCORP LEAD BASED PAINT INSPECTION WORKSHEET

CLIENT: Los Angeles county Parks-R | ADDRESS: 265 clearleaf Drive.

SCOPE OF PROJECT: Oakridge Estate 18650 Devonshire st Northridge CA | DATE: 9-19-12

INSPECTOR: Francisco Barraza | XRF SERIAL #: M41383 | PROJECT NUMBER: P12281.25

SAMPLE NUMBER	K-SHELL READING	PAINT COLOR	SUBSTRATE	COMPONENT	CONDITION	LOCATION	QUANTITY	COMMENTS
1.	1.17	Red	Block	wood	g	confirmation		
2.	1.23	"	"	"	"	"		
3.	Aborted	"	"	"	"	"		
4.	↓	"	"	"	"	"		
5.	1.26	"	"	"	"	"		
6.	R.test							
7.	0.49					wall int S E W N		
8.	0.19							
9.	0.17							
10.	-0.06							
11.	0.06	tan	plaster	ceiling		Mural Room	D	
12.	0.12		wood	Mantel			g	
13.	0.19		stone	on mantel				
14.	0.21		wood	column				
15.	-0.02			wainscoting				
16.	0.00	brown		hardwood floor				
17.	0.19	tan		wine rack.				
18.	0.18	clear		bar				
19.	0.46	tan	metal	vent.		and floor		
20.	0.43	tan	wood	wainscoting.				
21.	0.24		Metal	wall vent.				
22.	0.50		wood	door frame.		2nd RR East	g	
23.	0.12		d	door.				
24.	0.13	white		cabinet g				
25.	0.31		ceramic	wall tiles				
26.	0.80		"4x4"	ceramic wall tile		shaver	g	
27.	3.48			floor tile.		1 floor, basecove	20 sf.	good con.
28.	0.20		wood	sink		vynil top Floor tile basecove	g	20sf
29.	0.20			closet door.				
30.	3.31		porcelin	toilet		2nd flor RR		

By: Francisco Barraza Title: Lead sampling tech

ENCORP LEAD BASED PAINT INSPECTION WORKSHEET

CLIENT: Los Angeles county Park-Recreation ADDRESS: 265 clearleaf Drive

SCOPE OF PROJECT: 18650 Devonshire st Northridge CA DATE: 9-19-12

INSPECTOR: Francisco Barraza XRF SERIAL #: PROJECT NUMBER: P12281.LAS

	SAMPLE NUMBER	K-SHELL READING	PAINT COLOR	SUBSTRATE	COMPONENT	CONDITION	LOCATION	QUANTITY	COMMENTS
*	3 1.	0.63	white	wood	door frame		toilet RR 2nd floor main house (F)		
0.31	2.	0.68	Turquoise	wood	door		↓		
0.63	3.	0.54	|	|	door frame.		E	D	
0.68	4.	0.44	|	plaster	wall		S	|	
0.54	5.	0.28	|	|	|		W	|	
0.44	6.	0.06	|	|	|		N	|	
0.28	7.	0.26	|	|	|		|	|	
0.06	8.	0.16	white	|	ceiling		|	|	
0.26	9.	0.03	Turquoise	wood	basecase g		|	|	
0.10	4 0.	0.83	|	|	Trim g		|	|	
0.03	1.	Rtest							
0.92	2.	1.05	|	metal	window frames	D	↓	& window 2nd flr 3x	
1.05	*3.	0.12	|	wood	frames	D		↓	
0.12	4.	0.54	|	metal	vent HVAC	good con.	2nd floor		
*	5.	3.98	white	|	window	D	|	walk in closet	
3.98	*6.	0.53	|	wood	window frame	D	|	4 each	
0.25	7.	0.23	white grey strips	plaster	wall	D			
KW 0.23	8.	0.09	grey	wood	cubbys				
0.09	9.	0.21	|	|	closet doors	D			
0.21	5 0.	0.68	Marble	bath	bath		RR 2nd floor Bath west		
0.08	1.	0.22	white	ceramic	wall tile shaver	g	|		
0.22	2.	1.26	|	|	floor tile		|		
1.20	3.	0.47	|	|	|		|		
0.47	4.	0.27	black	metal	staircase	g	Handrail. 2nd floor		
0.27	5.	0.12	clear	wood	hard wood flooring	D	|		
0.12	6.	0.10	light orange	plaster	wall	D	Bedroom #2 2nd floor		
0.10	7.	0.22	Clear	Wood	post	wood	staircase.		
0.22	8.	0.36	|	Wood	Baluster		|		
	9.	0.36	turquoise	wood	wall string		|		
	10.	0.56	White	|	Riser		|		

By: Francisco Barraza Title: Lead sampling tech

ENCORP LEAD BASED PAINT INSPECTION WORKSHEET

CLIENT: Los Angeles county Park-Recreation ADDRESS: 265 Chaparleaf Drive
SCOPE OF PROJECT: 18650 Devonshire St Northridge CA DATE: 9-19-12
INSPECTOR: Francisco Barraza XRF SERIAL #: PROJECT NUMBER: ~~R-7~~ P12281 L45

SAMPLE NUMBER	K-SHELL READING	PAINT COLOR	SUBSTRATE	COMPONENT	CONDITION	LOCATION	QUANTITY	COMMENTS
6 1.	-0.66	clear	wood	landing	g	staircase		
2.	0.24	Grey	plaster	ceiling	D	1st floor RR#24		
3.	0.29	|	|	walls	|	↑ N		
4.	0.02	|	|	|	|	S		
5.	-1.17	|	|	|	|	E		
6.	0.17	|	|	|	|	W		
7.	0.39	white	ceramic	drawer	|	Ap#24		
* 8.	1.53	|	|	floor tile + Basecove	|	↓ (g)	25 sf	
9.	0.58	Grey	Linoleum	flooring	|	|		
7 0.	0.22	|	wood	door.	(g)	Bedroom #23 1st floor		
1.	0.43	|	|	Basecove.	|	|		
2.	0.29	|	|	trim	|	|		
3.	0.22	|	Metal	vent	|	|		
4.	-0.01	|	wood	window frame	|	|		
5.	0.65	Green	Linoleum	Flooring	D	closet.		
* 6.	0.89	Grey	wood	Door frame.	D	Room #22	5	
7.	0.25	Turquoise	wood	|	D	Main entrance		
8.	0.25	Brown	|	staircase.	g	Basement.		
9.	0.19	Blue	metal	Gas furnace	|	|		
* 8 0.	1.91	orange	|	Beam	D	support beams.	?	1000 LF
* 1.	2.60	white	|	Beam	D	entrance bottom of stairs	20 LF.	
2.	0.51	turquoise	wood	wall trim	D	Main entrance		
3.	0.45	Grey and turquoise	Plaster	wall paper	D	Room #5		
4.	0.24	Grey	wood	wainscoating	|	|		
5.	-0.25	|	wood	window trim	|	|		
6.	0.02	clear	|	carriter top	|	Butlers ~~kitchen~~ Pantry		
7.	0.55	white	|	cabinets	|	|		
* 8.	30.15	|	porceling	sink	|	|	1	
9.	0.53	|	wood	Doorframe	|	|		
9 0.	0.57	|	|	crown molding	|	|		

By: Francisco Barraza Title: sampling tech

ENCORP LEAD BASED PAINT INSPECTION WORKSHEET

CLIENT: Los Angeles county Parks-Recreation | ADDRESS: 265 cloverleaf Drive
SCOPE OF PROJECT: 18650 Devonshire St Northridge CA | DATE: 9-19-12
INSPECTOR: Francisco Barraza | XRF SERIAL #: | PROJECT NUMBER: P12281.445

SAMPLE NUMBER	K-SHELL READING	PAINT COLOR	SUBSTRATE	COMPONENT	CONDITION	LOCATION	QUANTITY	COMMENTS
9 1.	0.03	clear	wood	back plash	g	Butlers pantry.		
* 2.	1.50	white	1	window frame	g	1	1	
* 3.	1.06	1	1	window trim	1	1		
* 4.	13.76	1	Ceramic	4x4 counter top tile	g	kitchen	60sf	And Back plash
* 5.	23.67	1	porceling	sink	1	1	1	
6.	0.22	1	wood	Bench	1	1		
7.	0.25	1	1	table	1	1		
8.	0.44	1	1	Basecave	1	1		
9.	0.06	1	ceramic	"4x4" tile /Blue trim	g	Behind stove.		
* 10 0.	0.73	Green	1	4x4 floor tile	g	RR #15	40 sf	
* 1.	6.29	white	porceling	Bath	g	1	1	
2.	Rtest							
3.	-0.91	Green	ceramic basecave	—	g			
4.	-0.50	white	porceling	sink.				
* 5.	1.73	Grey	linoleum	counter top	D	* Room 13 Laundry Room	40sf	posible ceramic under.
6.	1.81	white	wood	cabinet	D	1	1	
7.	0.22	multi color	wood	wall paper	D	Room #7 RR2		
8.	-0.12	tan	ceramic	floor tile 4x4	D			
* 9.	6.73	yellow	1	basecave	D		25	
* 11 0.	3.49	white	porceling	bath tub.	g			
1.	0.26	1	wood	door	g			
2.	0.13	1	porceling	toilet	g			
3.	0.21	clear	wood	wall panel	g	Room #20 Den E		
4.	-0.24					W		
5.	-0.10					S		
6.	-0.18					N		
7.	0.04	1	1	ceiling				
8.	-0.24	Red	1	Cabinet.				
9.	-0.04	Burgandy	1	trim		Room #26 RR		
12 0.	0.20	1	1	door frame		1		

By: Francisco Barraza Title: Lead sampling tech.

ENCORP LEAD BASED PAINT INSPECTION WORKSHEET

CLIENT: Los Angeles county Parks-Recreation ADDRESS: 18650 Devonshire St Northridge CA

SCOPE OF PROJECT: DATE: 9-19-12

INSPECTOR: Francisco Barraza XRF SERIAL #: PROJECT NUMBER: P12281.L45

SAMPLE NUMBER	K-SHELL READING	PAINT COLOR	SUBSTRATE	COMPONENT	CONDITION	LOCATION	QUANTITY	COMMENTS
12 1.	-0.36	pink	wood	door	g	Room # 25		
2.	-0.63	"	paper	wall paper	D	"		
3.	0.25	"	ceramic	wall tile	g	shower		
4.	0.44	blue	"	"	"	"		
5.	-0.78	dark	"	"	"	"		
6.	0.60	white	"	soap dish	"	"		
* 7.	13.47	blue	"	basecap	g	"	20 SF	
8.	-0.11	"	"	floor tile pentagon	g	"		
9.	0.22	"	plaster	wall	g.	"		
* 13 0.	24.47	white	sink	porcelain			1	
* 1.	7.36	"	porcelain	toilet			1	
2.	0.28	pink	wood	window frame			1	
3.	0.50	Burgundy	wood	Basecap			1	
4.	0.67	"	"	Door trim			1	
5.	0.42	multi color	paper	wall paper		Main Entrance RR		
* 6.	3.30	white	porcelain	sink		"	1	
* 7.	7.25	"	"	toilet		"	1	
* 8.	1.66	brown	wood	Main Door	D	at entrance	1	
* 9.	3.96	"	"	1 door frame	D	"	1	
* 14 0.	1.26	"	"	beam		out MAIN ENTRANCE	1	
1.	R test							
* 2.	1.13	"	wood	window frame	D	ext Main BDG - E	70 each ext	
3.	2.41	"	Metal	window assembly		"		
4.	0.41	tan brown	stone	ext wall	g	N		
5.	0.21	"	"	"	"	S		
6.	0.57	"	"	"	"	E		
7.	-0.03	"	"	"	"	W		
* 8.	4.69	brown	wood	siding	D	ext E	1200 SF	
* 9.	1.82	"	"	eave trim	D	ext	400 LF	
15 0.	2.07	"	wood	Gas Meter	box	-D E	1	

By: Francisco Barraza Title: Sampling tech

ENCORP LEAD BASED PAINT INSPECTION WORKSHEET

CLIENT: Los Angeles county Parks-Recreation ADDRESS:

SCOPE OF PROJECT: 18150 Devonshire st NorthRidge CA DATE: 9-19-12

INSPECTOR: Francisco Barraza XRF SERIAL #: PROJECT NUMBER: PN2881.44

	SAMPLE NUMBER	K-SHELL READING	PAINT COLOR	SUBSTRATE	COMPONENT	CONDITION	LOCATION	QUANTITY	COMMENTS
*	15 1.	4.92	Brown	wood	vent	D	ext E	8	each exterior
*	2.	2.05	"	"	Beam columns	D	ext - south patio.	5	10 feet columns.
*	3.	2.36	"	"	Beam.	D.	"	35 sf	
*	4.	5.62	"	"	door	D	"	5	
*	5.	3.74	"	"	door frame	D	"	1	
*	6.	1.27	white	stucco	wall		ext south patio	~~4000~~ 1000 sf	
*	7.	1.08	"	"	ceiling		ext south patio	1000 sf	
*	8.	3.54	Brown	wood	wood trime	D	ext, adjacent to winda.	ext - 8 lf	
*	9.	3.44	"	wood	~~fence~~ wall door frame	D.		1	
*	16 0.	2.70	"	"	"	"	post	E.	
	1.	0.46	"	"	screen doors	D	ext		
	2.	R test							
	3.	0.36	"	wood	treshold				
	4.	0.65	"	Metal	light fixture				
*	5.	4.36	"	wood	Garage door.			3.	
*	6.	4.48	"	"	Garage door frame			3.	
*	7.	2.45	"	"	" Beam.				
	8.	0.56	"	Metal	crawlspace entrance - D				
	9.	0.24	"	wood	cabinet		Garage interior		
	17 0.	-0.01	white	plaster	ceiling Rough	D	"		
*	1.	1.65	brown	wood	wainscoating	D -	South garage int.	90 sf.	
*	2.	1.46	white	wood	wood wall hangers	10 sf(lf)	" West East wall.	10 lf	
*	3.	3.40	brown	"	Garage doors	gD	interior of Garage. Pool house ER	3	
	4.	Aborted							
	5.	0.53	Yellow	Plaster	ceiling				
	6.	-0.67			walls	D	N		
	7.	0.04					S		
	8.	0.18					E		
	9.	0.30					W		
	18 0.	0.91		Wood	window frim	D			

By: Francisco Barraza Title: Sampling tech.

ENCORP LEAD BASED PAINT INSPECTION WORKSHEET

CLIENT: Los Angeles county Park-Rec | ADDRESS: 265 Cloverleaf Drive LA
SCOPE OF PROJECT: 16650 Devonshire St Northridge CS | DATE: 9-19-12
INSPECTOR: Francisco Barraza | XRF SERIAL #: | PROJECT NUMBER: 92281.125

SAMPLE NUMBER	K-SHELL READING	PAINT COLOR	SUBSTRATE	COMPONENT	CONDITION	LOCATION	QUANTITY	COMMENTS
18 1.	0.23	Yellow	wood	window frame.	D	Pool house RD int.		
2.	0.07	"	"	door frame	D	"		
* 3.	1.86	"	"	door	D	"	3	
* 4.	29.20	white	paneling	sink	D.	"	1	
* 5.	6.75	"	"	toilet	D.	"	1	
6.	0.29	light blue	ceramic	wall tile	D	shower		
* 7.	13.20	"	"	basecave	D	"	20sf	
8.	-0.22	"	"	Pentagon floor tile.				
9.	0.48	Green	Metal	fence around the pool.				
* 19 0.	1.55	"	"	Lighting box	D	tennis courts.	1	
1.	0.54	"	"	Net poles.		"		
2.	R test							
3.	1.19	White	concrete	paint on concrete		"		
4.	* 1.15	Green	metal	Lighting poles			8 poles.	
* 5.	15.00	"	ceramic	Pool edge tile	D		200sf	
6.	0.52	"	Metal	tanks		under pool - pump		
7.	0.44	"	"	"		"		
8.	1.47	Red	Wood	Back		confirmation		
9.	1.30	"	"	"		"		
20 0.	Retest	"	"	"		"		
1.	1.20	"	"	"		"		
2.	.							
3.	.							
4.	.							
5.	.							
6.	.							
7.	.							
8.	.							
9.	.							
21 0.	.							

By: Francisco Barraza Title: Lead sampling tech

III. CERTIFICATIONS

IV. FIELD INSPECTION DATA

HOMOGENEOUS MATERIALS INSPECTION FORM

Date: 9-19-12 Job Name: Oakridge Estate Project # P12281.L2

Project Address: 18650 Devonshire st Northridge, CA 91324

Inspector(s): Francisco Barraza CSST 07-4192 Page: 1 of 4

Material Description	Locations	Individual Sq Ft	Total Sq Ft	Condition	Qty of Samples	Sample #'s
wood Roof shingles	Not sample				3	1 2 3
Black paper below shingles	Below wood shingles		6500 sf	G	3	1 2 3
Penetration mastic	Penetrations on roof area		300 sf	G	3	4 5 6
window putty	BLDG exterior windows throughout 1st and 2nd floor.		600 sf	D	3	7 8 9
Stone grout	exterior walls.		3000 sf	G	3	10 11 12
Stucco walls + white	BLDG Exterior walls		4000 sf	D small cracks	3	13 14 15
stucco ceiling + white	BLDG exterior ceiling - south patio area.		1,000 sf	D	3	16 17 18

HOMOGENEOUS MATERIALS INSPECTION FORM

Date: 9-19-12 Job Name: Oakridge Estate Project # P12281.L25

Project Address: 18650 Devonshire St North

Inspector(s): Francisco Barraza CSST 07-4192 Page: 2 of 4

Material Description	Locations	Individual Sq Ft	Total Sq Ft	Condition	Qty of Samples	Sample #'s
Vapor Barrier black	Behind Stucco, possible behind stone, stucco ceilings		4,000 sf	9	3	19 20 21
Smooth walls Plaster ceiling & Button Board	Bldg Interior throughout 2nd and 1st floor.		8,000 ~~1,300~~ sf	D	3	22 23 24
Smooth plaster walls & ceilings Button Board	↓		13,000 sf	D	3	25 26 27
Electrical wire	throughout the house		Approx 1,000 LF	D	3	28 29 30
Green Linoleum Flooring.	~~RR #24, 25, 22~~ RR- Room # 25, 25, 22	60 sf 20 sf 100 sf.	200 SF	D	3	31 32 33
Brown 9x9 Floor Tile + Mastic Black paper	Laundry room # 13 Kitchen 1 #10 Butlers pantry. # 9	150. 400 100.	7,00 sf	D	3	34 35 36
Grey Green Linoleum Black Marking Marble Mastic paper	Don trophy Room - #20 RR-#7 2nd floor RR #26 1st floor.	400 100 sf	500 SF	D	3	37 38 39

HOMOGENEOUS MATERIALS INSPECTION FORM

Date: 9-19-12 Job Name: Oakridge Estate Project # P12281.L25

Project Address: 18650 Devonshire St Northridge, CA 91324

Inspector(s): Francisco Barraza CSST 07-492 Page: 3 of 4

Material Description	Locations	Individual Sq Ft	Total Sq Ft	Condition	Qty of Samples	Sample #'s
Green counter top Linoleum material	Laundry Room #13		30 SF	D	3	40 41 42
Flooring Linoleum Multicolor	Inside cabinet flooring		20 SF	D	3	43 44 45
Rough Plaster walls + Button Board	Laundry room 13 Servant Room #2 #1		2000 SF	D	3	46 47 48
Rough plaster Ceiling Plaster + Button Board	Laundry Room #3 Servant room #2		1,000 SF	D	3	49 50 51
Sink undercoat Mastic	Kitchen } sinks Butlers }		5 SF	D	3	52 53 54
Yellow sheet Flooring Pool House RR	pool house		100 SF	D	3	55 56 57
TSI Pipe wrap	Basement, attic wall cavities, voids - Floors of Bldg Basement. Crawlspace		800 LF Approx.	D	3	58 59 60

HOMOGENEOUS MATERIALS INSPECTION FORM

Date: 9-19-12 Job Name: Oakridge Estate Project # P12281.L25

Project Address: 18650 Devonshire St Northridge, CA 91324

Inspector(s): Francisco Barraza CSST 07-4192 Page: 4 of 4

Material Description	Locations	Individual Sq Ft	Total Sq Ft	Condition	Qty of Samples	Sample #'s
HVAC Duct wraps	Attic, ~~see~~ crawspace, basemen Damage in crawspace east Behu RM# 23,24,25		500 LF	D	3	61 62 63
~~Hva~~ HVAC VENT Boots/ ~~Ge~~ Registers	throughout 2nd, 1st floor, Registers, HVAC		60 each	9	3	64 65 66
Wall paper not sample,	no positive per previus inspections-	Did not want to damage any further				

ENCORP
Engineering our Environment

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Tel: (714) 523-9811
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www.encorp.net

CLIENT: LOS ANGELES COUNTY PARKS AND RECREATION

SITE: OAKRIDGE ESTATE

PROJECT # P12281.L25

DATE: 9/19/2012

PHASE/AREA: ASBESTO AND LEAD

TECHNICIAN: FRANCISCO BARRAZA

PROJECT MANAGER: SHANE WOODS

Enter times and activities regarding the routine progress of the above project on the above date. Detail major problems and action taken, injuries, equipment breakdown, unusual conditions or situations, inspections, hiring and/or firing of personnel and any other occurance which may affect the project. **NOTE**: This log may be utilized as a legal document.

700 Meet Tom Rice on site. City employee gave full access to residential property and adjacent facilities.

Begin Lead and Asbestos inspection inside the residential home.

I was instructed not to damage the wall paper. Material indicates non acm per previous inspection.

I collected a total of 66 plm samples. And a total of 201 lead xrf shots.

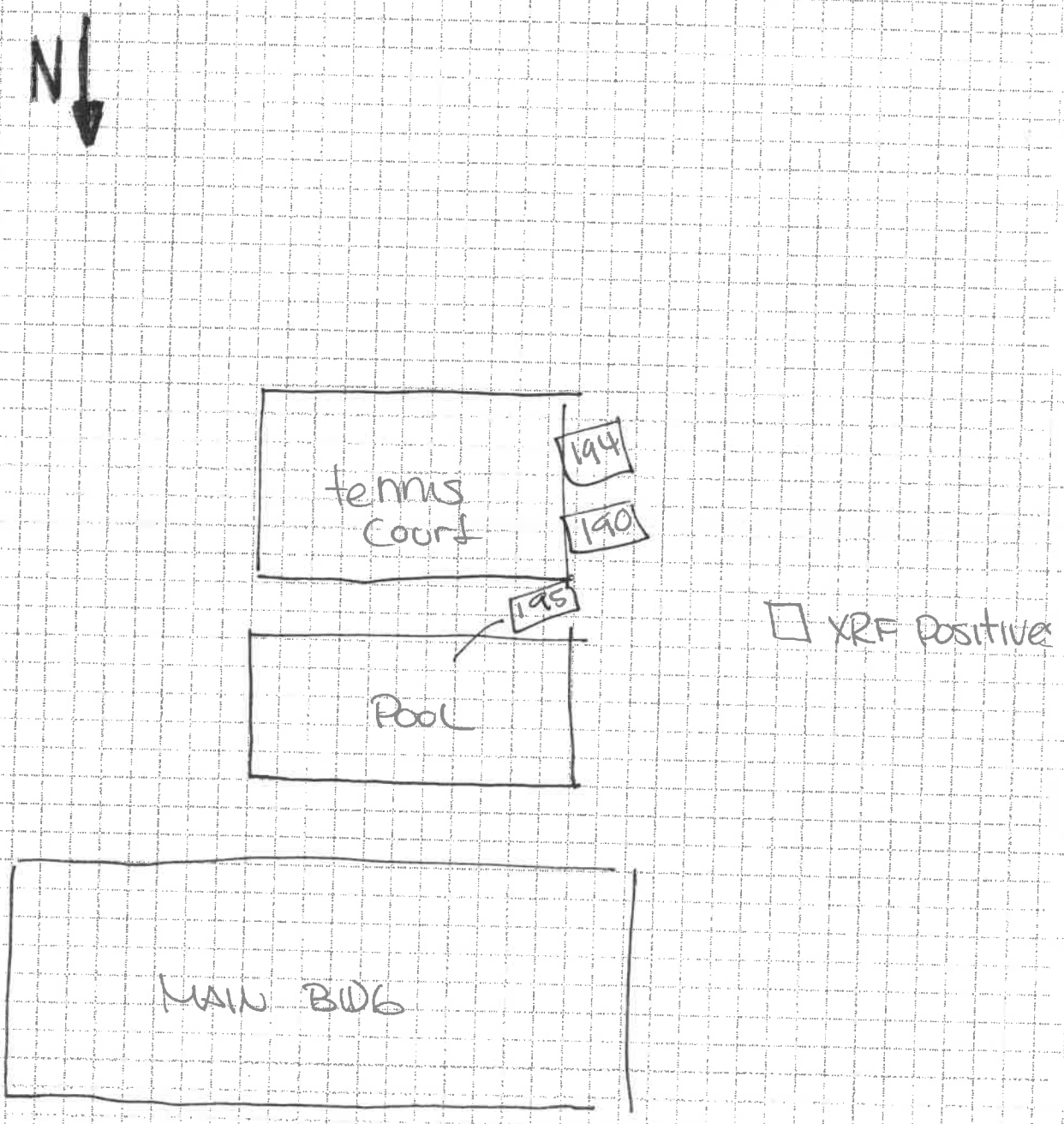
please note damage tsi observed in attic servant #2 room 20lf. Additional tsi damage was observed in crawlspace below bedroom #1. additional material may be damage in crawlspace but had no access to conduct any further inspecting. Approximately 100 lf.

would suggest crawlspace clean up or acm signs posted at entry to warn personal before entering area.

15:00 Acm and Lead inspection is completed. Call Tom Rice. Wait on site until city personal arrives.

work day ends.

BY: Francisco Barraza TITLE: Cast 07-4192



DESCRIPTION: Oakridge Estate Lead XRF
JOB NAME: Oakridge Estate
JOB NUMBER: P1228I.L25
DRAWN BY: Francisco Barraza
DATE: 9/19/20

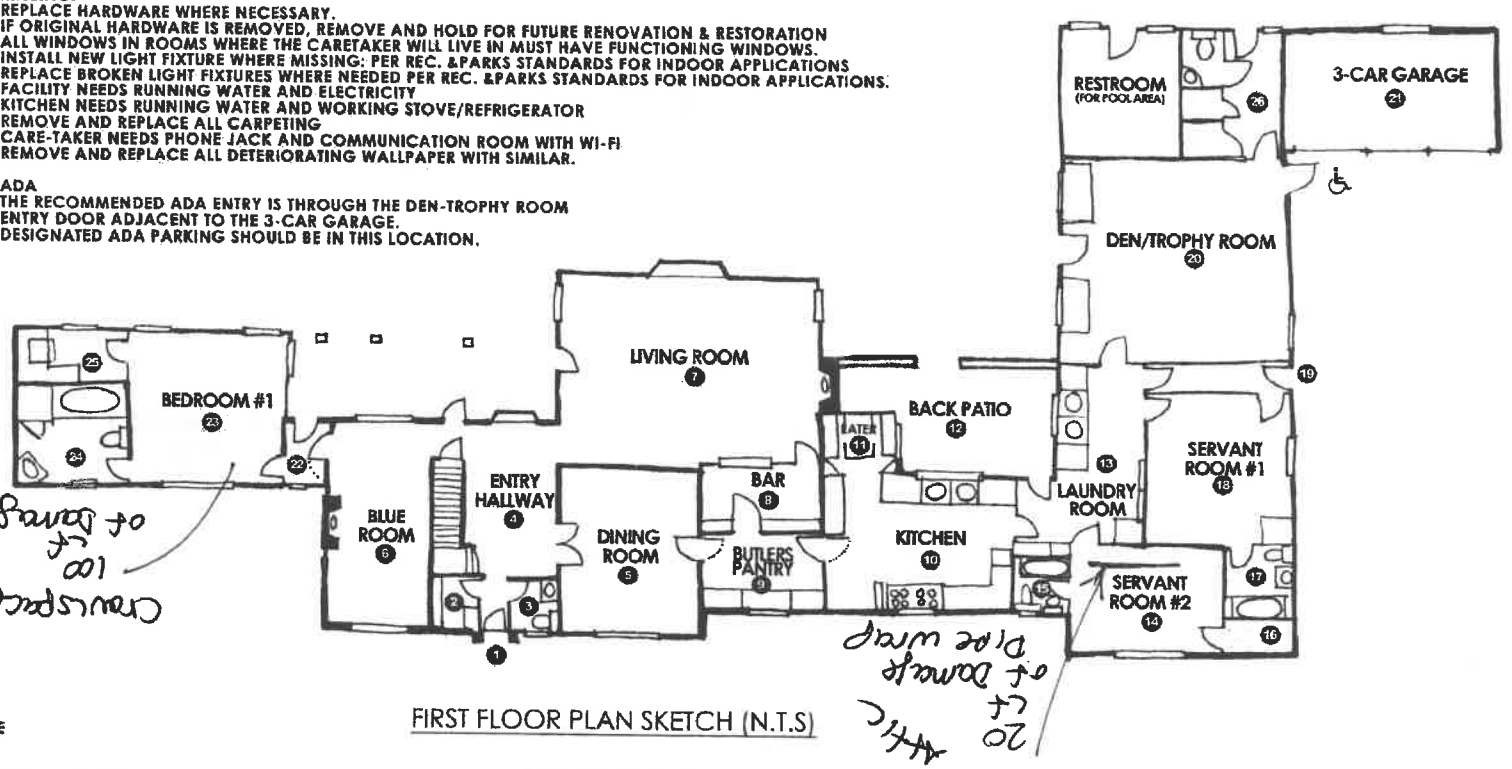
ENCORP
Engineering our Environment
16700 Valley View Ave., Suite
La Mirada, CA 90638
(714) 523-9811 FAX(714) 523-981

N↑

REC. &PARKS OVERALL GOAL FOR THE OAKIE HOUSE:
TO UPGRADE THE GROUNDS AND BUILDING SAFE ENOUGH FOR A CARETAKER TO LIVE IN.

GENERAL NOTES:
ALL DOORS MUST BE SECURED; USE STANDARD RECREATION & PARKS HARDWARE FOR DOORS, INSTALL NEW WHERE MISSING.
REPLACE HARDWARE WHERE NECESSARY.
IF ORIGINAL HARDWARE IS REMOVED, REMOVE AND HOLD FOR FUTURE RENOVATION & RESTORATION
ALL WINDOWS IN ROOMS WHERE THE CARETAKER WILL LIVE IN MUST HAVE FUNCTIONING WINDOWS.
INSTALL NEW LIGHT FIXTURE WHERE MISSING: PER REC. &PARKS STANDARDS FOR INDOOR APPLICATIONS
REPLACE BROKEN LIGHT FIXTURES WHERE NEEDED PER REC. &PARKS STANDARDS FOR INDOOR APPLICATIONS.
FACILITY NEEDS RUNNING WATER AND ELECTRICITY
KITCHEN NEEDS RUNNING WATER AND WORKING STOVE/REFRIGERATOR
REMOVE AND REPLACE ALL CARPETING
CARE-TAKER NEEDS PHONE JACK AND COMMUNICATION ROOM WITH WI-FI
REMOVE AND REPLACE ALL DETERIORATING WALLPAPER WITH SIMILAR.

ADA
THE RECOMMENDED ADA ENTRY IS THROUGH THE DEN-TROPHY ROOM
ENTRY DOOR ADJACENT TO THE 3-CAR GARAGE.
DESIGNATED ADA PARKING SHOULD BE IN THIS LOCATION.



FIRST FLOOR PLAN SKETCH (N.T.S)

1 **MAIN ENTRANCE**
-DOOR NEEDS TO HAVE FUNCTIONING HARDWARE.

2 **CLOSET**
-DOOR FIXTURES ARE MISSING;
-MISSING LIGHT FIXTURE;

3 **RESTROOM**
-MISSING LIGHT FIXTURE
-MIRROR MEDICINE CABINET BROKEN

4 **ENTRY HALLWAY**
-MISSING LIGHT FIXTURES (REPLACE)
-BROKEN WALL MIRROR (REPAIR)
-MISSING MIRROR DECORATIVE PIECES
-REMOVE AND HOLD EXISTING DECORATIVE PIECES ON MIRROR FOR FUTURE RESTORATION

5 **DINING ROOM**
-ORIGINAL WALLPAPER IN FAIR CONDITION (SOME WATER DAMAGE)
-MISSING LIGHT FIXTURE (INSTALL NEW)

6 **BLUE ROOM**
-HALLWAY TO BLUE ROOM HAS ACCESS DOOR TO BACKYARD + BASEMENT (HARDWARE ATTACHED)
-BEDROOM CARPETING TO BE REMOVED/REPLACED
-LIGHT FIXTURES ADJACENT TO MIRRORS ARE MISSING

7 **LIVING ROOM**
-THE CARPETING SHOULD BE REMOVED/REPLACED WITH SIMILAR
-LIGHT FIXTURES ARE MISSING, REPLACE
-DOOR EXITS TO BACK PATIO NEEDS STANDARD HARDWARE

8 **BAR**
-LIGHT FIXTURES SHOULD BE REPLACED
-DOOR SHOULD HAVE STANDARD HARDWARE

9 **BUTLERS PANTRY:**
-NEED RUNNING WATER
-LIGHT FIXTURE MISSING; REPLACE AND INSTALL NEW

10 **KITCHEN + EATING AREA:**
11 -KITCHEN TO BE USED BY CARETAKER
-NEED RUNNING WATER
-NEED WORKING STOVE
(THERE IS AN EXISTING 8 BURNER STOVE)
-REFRIGERATOR AREA IS CLEAR
-MISSING LIGHT FIXTURES; REPLACE
-MINOR CRACKS TO CEILING AND WALLS
-ALL WINDOWS IN THE KITCHEN NEED TO BE OPERABLE

12 **BACK PATIO**
-ALL OVERGROWN LANDSCAPING TO BE CLEARED
-DOOR; INSTALL NEW STANDARD WORKING HARDWARE

13 **LAUNDRY ROOM**
-LIGHT FIXTURES ARE MISSING; REPLACE
-MAIN ELECTRICAL PANEL
-ALL CABINETS/COUNTER TOPS ARE IN FAIR CONDITION

14 **SERVANT ROOM #2 + RESTROOM + WALK-IN CLOSET**
15 -THIS SPACE IS RECOMMENDED FOR CARE-TAKER OFFICE
-BEDROOM HAS A WALK IN CLOSET (IN FAIR CONDITION)
16 -RESTROOM (TILES)
-THE ROOM HAS A FLOURESENT LIGHT FIXTURE; REPLACE WITH STANDARD.
-LIGHT FIXTURES MISSING, REPLACE + INSTALL
-THE WALK-IN CLOSET HAS THE ACCESS PANEL FOR THE TUB,
-THE PANEL IS BROKEN NEEDS TO BE FIXED, REPLACED.
-THE WALK-IN CLOSET ALSO HAS ATTIC ACCESS

17 **SERVANT ROOM #1 + RESTROOM**
18 -THIS ROOM IS ALSO RECOMMENDED FOR OFFICE SPACE
-BEDROOM HAS TWO DOORS (ONE OPENS TO THE HALLWAY WHICH ALSO EXITS TO THE SIDE YARD NEAR THE GARAGE)
-BEDROOM CARPET NEEDS TO BE REMOVED+REPLACED
-LIGHT FIXTURES MISSING; REPLACE+INSTALL NEW
-SINK, TOILET NEED TO BE WORKING
-PORTION OF WALL BEHIND THE TOILET IS DAMAGED, MIGHT NEED REPAIR.

19 **EXIT DOOR**
-CARPET IN HALLWAY AREA REMOVE + REPLACE

20 **DEN/TROPHY ROOM**
-LIGHT FIXTURE IS MISSING, NEED TO INSTALL
-TWO DOORS THAT ACCESS OUTSIDE NEED TO BE SECURED WITH PROPER STANDARD HARDWARE.

22 **HALLWAY TO BEDROOM**
(DOOR EXITS OUT TO BACKYARD)
-WALLPAPER IS DETERIORATING (REMOVE AND REPLACE)

23 **BEDROOM #1 + RESTROOM + WALK-IN CLOSET**
24 -THIS ROOM IS RECOMMENDED FOR CARETAKER LIVE-IN;
-RESTROOM NEEDS TO BE FUNCTIONING
25 -CLOSET SPACE NEEDS PROPER HARDWARE;
-WINDOWS NEED TO BE OPERABLE
-REMOVE AND REPLACE FLOOR CARPETING
-DOORS NEED PROPER HARDWARE

26 **RESTROOM + SHOWER+ VANTIY AREA**
-ALL DOORS NEED TO BE SECURED AND HARDWARE NEEDS TO BE OPERABLE

Oakie House 18650 Devonshire Street
A 2 STORY, 6500 SQ.FT. ENGLISH MANOR STYLE HOUSE DESIGNED BY ARCHITECT PAUL WILLIAMS IN 1937

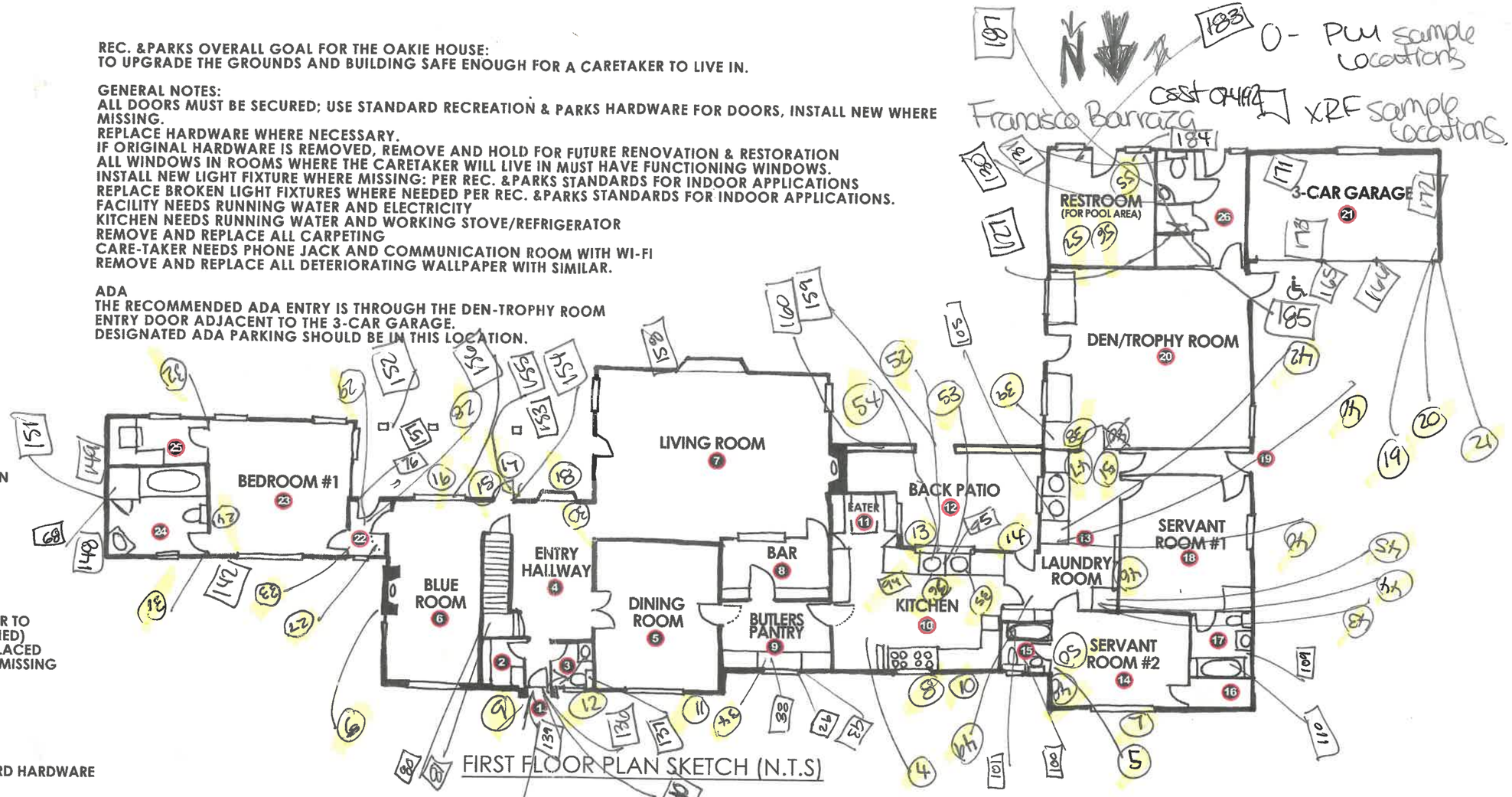
DEPARTMENT OF RECREATION + PARKS

Francisco Barraza 9/19/26

REC. &PARKS OVERALL GOAL FOR THE OAKIE HOUSE:
TO UPGRADE THE GROUNDS AND BUILDING SAFE ENOUGH FOR A CARETAKER TO LIVE IN.

GENERAL NOTES:
ALL DOORS MUST BE SECURED; USE STANDARD RECREATION & PARKS HARDWARE FOR DOORS, INSTALL NEW WHERE MISSING.
REPLACE HARDWARE WHERE NECESSARY.
IF ORIGINAL HARDWARE IS REMOVED, REMOVE AND HOLD FOR FUTURE RENOVATION & RESTORATION
ALL WINDOWS IN ROOMS WHERE THE CARETAKER WILL LIVE IN MUST HAVE FUNCTIONING WINDOWS.
INSTALL NEW LIGHT FIXTURE WHERE MISSING: PER REC. &PARKS STANDARDS FOR INDOOR APPLICATIONS
REPLACE BROKEN LIGHT FIXTURES WHERE NEEDED PER REC. &PARKS STANDARDS FOR INDOOR APPLICATIONS.
FACILITY NEEDS RUNNING WATER AND ELECTRICITY
KITCHEN NEEDS RUNNING WATER AND WORKING STOVE/REFRIGERATOR
REMOVE AND REPLACE ALL CARPETING
CARE-TAKER NEEDS PHONE JACK AND COMMUNICATION ROOM WITH WI-FI
REMOVE AND REPLACE ALL DETERIORATING WALLPAPER WITH SIMILAR.

ADA
THE RECOMMENDED ADA ENTRY IS THROUGH THE DEN-TROPHY ROOM
ENTRY DOOR ADJACENT TO THE 3-CAR GARAGE.
DESIGNATED ADA PARKING SHOULD BE IN THIS LOCATION.



FIRST FLOOR PLAN SKETCH (N.T.S)

1 MAIN ENTRANCE
-DOOR NEEDS TO HAVE FUNCTIONING HARDWARE.

2 CLOSET
-DOOR FIXTURES ARE MISSING;
-MISSING LIGHT FIXTURE;

3 RESTROOM
-MISSING LIGHT FIXTURE
-MIRROR MEDICINE CABINET BROKEN

4 ENTRY HALLWAY
-MISSING LIGHT FIXTURES (REPLACE)
-BROKEN WALL MIRROR (REPAIR)
-MISSING MIRROR DECORATIVE PIECES
-REMOVE AND HOLD EXISTING DECORATIVE PIECES ON MIRROR FOR FUTURE RESTORATION

5 DINING ROOM
-ORIGINAL WALLPAPER IN FAIR CONDITION (SOME WATER DAMAGE)
-MISSING LIGHT FIXTURE (INSTALL NEW)

6 BLUE ROOM
-HALLWAY TO BLUE ROOM HAS ACCESS DOOR TO BACKYARD + BASEMENT (HARDWARE ATTACHED)
-BEDROOM CARPETING TO BE REMOVED/REPLACED
-LIGHT FIXTURES ADJACENT TO MIRRORS ARE MISSING

7 LIVING ROOM
-THE CARPETING SHOULD BE REMOVED/REPLACED WITH SIMILAR
-LIGHT FIXTURES ARE MISSING, REPLACE
-DOOR EXITS TO BACK PATIO NEEDS STANDARD HARDWARE

8 BAR
-LIGHT FIXTURES SHOULD BE REPLACED
-DOOR SHOULD HAVE STANDARD HARDWARE

9 BUTLERS PANTRY:
-NEED RUNNING WATER
-LIGHT FIXTURE MISSING; REPLACE AND INSTALL NEW

10 KITCHEN + EATING AREA:
11
-KITCHEN TO BE USED BY CARETAKER
-NEED RUNNING WATER
-NEED WORKING STOVE (THERE IS AN EXISTING 8 BURNER STOVE)
-REFRIGERATOR AREA IS CLEAR
-MISSING LIGHT FIXTURES; REPLACE
-MINOR CRACKS TO CEILING AND WALLS
-ALL WINDOWS IN THE KITCHEN NEED TO BE OPERABLE

12 BACK PATIO
-ALL OVERGROWN LANDSCAPING TO BE CLEARED
-DOOR; INSTALL NEW STANDARD WORKING HARDWARE

13 LAUNDRY ROOM
-LIGHT FIXTURES ARE MISSING; REPLACE
-MAIN ELECTRICAL PANEL
-ALL CABINETS/COUNTER TOPS ARE IN FAIR CONDITION

14 SERVANT ROOM #2 + RESTROOM + WALK-IN CLOSET
15
-THIS SPACE IS RECOMMENDED FOR CARE-TAKER OFFICE
-BEDROOM HAS A WALK IN CLOSET (IN FAIR CONDITION)
-RESTROOM (TILES)
16
-THE ROOM HAS A FLOURESENT LIGHT FIXTURE; REPLACE WITH STANDARD.
-LIGHT FIXTURES MISSING, REPLACE + INSTALL
-THE WALK-IN CLOSET HAS THE ACCESS PANEL FOR THE TUB,
-THE PANEL IS BROKEN NEEDS TO BE FIXED, REPLACED.
-THE WALK-IN CLOSET ALSO HAS ATTIC ACCESS

17 SERVANT ROOM #1 + RESTROOM
18
-THIS ROOM IS ALSO RECOMMENDED FOR OFFICE SPACE
-BEDROOM HAS TWO DOORS (ONE OPENS TO THE HALLWAY WHICH ALSO EXITS TO THE SIDE YARD NEAR THE GARAGE)
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Oakie House 18650 Devonshire Street

A 2 STORY, 6500 SQ.FT. ENGLISH MANOR STYLE HOUSE DESIGNED BY ARCHITECT PAUL WILILAMS IN 1937

AA-02-09-10

CITY OF LOS ANGELES DEPARTMENT OF RECREATION + PARKS

Francisco Barraza
CSST 07-4192
O- PLM
□- XRF

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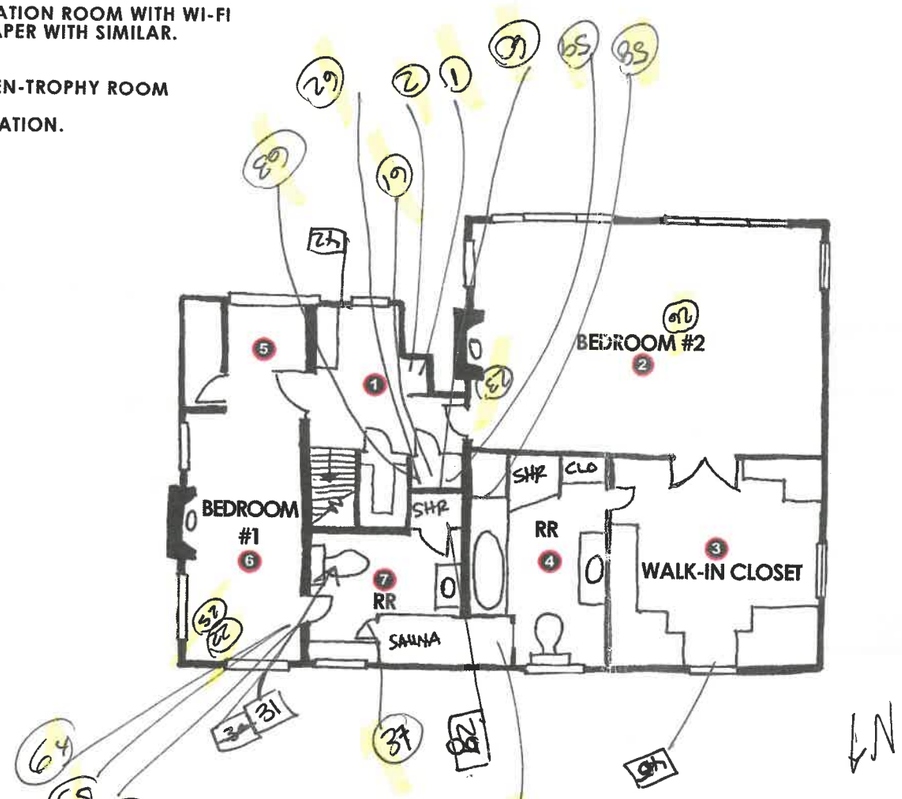

1 **HALLWAY SPACE**
MISSING DOOR HANDLES FOR CLOSEST - INSTALL NEW
REMOVE/REPLACE CARPETING

2 **BEDROOM # 2**
-FIREPLACE HAS MINOR CRACKS
-REMOVE AND REPLACE DETERIORATING WALLPAPER
-REMOVE AND REPLACE CARPETING

3 **WALK-IN CLOSET**
-REMOVE AND REPLACE CARPETING WITH SIMILAR
-INSTALL ALL CLOSET DOOR HANDLES
-TWO DOUBLE DOORS BROKEN, NEED TO BE REPAIRED

4 **RESTROOM**
-DOOR HANDLES MISSING, INSTALL NEW
-REMOVE AND REPLACE CARPET FLOORING
-LIGHT FIXTURE MISSING, REPLACE

5 **WALK-IN CLOSET**
-DOOR BROKEN, REPAIR
-BEDROOM ENTRY DOOR MISSING HARDWARE, INSTALL NEW
-MISSING LIGHT FIXTURE, INSTALL N EW

6 **BEDROOM #1**
-ALL WALLPAPER TO BE REMOVED + REPLACED WITH SIMILAR
-CARPETING TO BE REMOVED AND REPLACED

7 **RESTROOM:**
-VANITY COUNTER TOP IS BROKEN (REPAIR/REPLACE)
-LIGHT FIXTURES BROKEN (REPLACE)
-DOOR HARDWARE MISSING (INSTALL)
-REMOVE AND REPLACE CARPETED FLOORS

N

Oakie House 18650 Devonshire Street

A 2 STORY, 6500 SQ.FT. ENGLISH MANOR STYLE HOUSE DESIGNED BY ARCHITECT PAUL WILILAMS IN 1937

AA-02.09-10

CITY OF LOS ANGELES DEPARTMENT OF RECREATION + PARKS

V. LIMITATIONS

LIMITATIONS

Conditions described in this report are as found at the time of investigation, unless otherwise stated. Materials were homogenized were applicable. All additional materials not listed in this report that are discovered during demolition should be assumed to be asbestos-containing until the materials can be properly identified and analyzed for the presence of asbestos.

ENCORP analyzed only the substances, conditions, and locations described in this report at the time indicated. No inferences regarding other substances, conditions, location or time can be made unless specifically stated in this report. This report does not constitute a complete asbestos inspection of the property. Samples were taken at the direction of the client and limited to materials that will be impacted by the demolition procedures.

This report is intended for the use listed in the section of this report titled "INTRODUCTION". The use of this report in any manner other than that listed in the Introduction requires the written consent of **ENCORP**. This report must be presented in its entirety.

The conclusions and recommendations presented are based on the agreed upon scope of work outlined in this report. **ENCORP** makes no warranties or guarantees as to the accuracy or completeness of information obtained from information provided or compiled by others. Note that information exists beyond the scope of this investigation. Additional information, which was outside this scope of work, not found, or available to **ENCORP** at the time of writing this report, may result in a modification of the conclusions and recommendations presented. This report is not a legal opinion. The services performed by **ENCORP** have been conducted in a manner consistent with a level of care ordinarily exercised by members of our profession currently practicing under similar conditions. No other warranty, expressed or implied, is made.

Phase I Environmental Site Assessment Report, Limited Asbestos Survey & Limited Lead-Based Paint Surveys

18650 Devonshire Street
Northridge, California

PREPARED FOR

University of Southern California
University Real Estate
Hazel and Stanley Hall, Room 315
Los Angeles, California, 90089-1057

Converse Project No. 01-41-141-01
March 19, 2002

March 19, 2002

Ms. Gwen Louchouarn
University of Southern California
University Real Estate
Hazel and Stanley Hall, Room 315
Los Angeles, California 90089-1057

Subject: **PHASE I ENVIRONMENTAL SITE ASSESSMENT REPORT, LIMITED ASBESTOS & LIMITED LEAD-BASED PAINT SURVEYS**
18650 Devonshire Street
Northridge, California
Converse Project No. 02-41-141-01

Ms. Louchouarn:

Attached is a copy of the Phase I Environmental Site Assessment Report, Limited Asbestos & Limited Lead-Based Paint Surveys conducted for the referenced property.

We appreciate the opportunity to be of service to you. If you should have any questions or comments regarding the contents of this report please contact Laura Tanaka at (626) 930-1261 or Norman Eke at (626) 930-1260.

Sincerely,

CONVERSE CONSULTANTS

Kishore Butani
Sr. Staff Environmental Engineer

Steven T. Weatherton, SST #90-2812
Sr. Staff Environmental Scientist

Laura Tanaka, REA, DHS #I-3086
Senior Environmental Scientist

Norman S. Eke, REA, CAC#96-2093
Managing Officer

Dist.: 2/Addressee

Table of Contents

1.0 Introduction

1.1 Purpose and Scope of Work

This report presents the results of the Converse Consultants (Converse) Phase I Environmental Site Assessment (ESA) and Limited Asbestos and Lead-Based Paint Surveys performed at 18650 Devonshire Street in the Northridge area of the city of Los Angeles, Los Angeles County, California. Our study has been conducted in order to identify, to the extent feasible, recognized environmental conditions in connection with the subject property. The work was completed by environmental professionals and has been performed in accordance with our proposal dated February 22, 2002. Our work consisted of the following and was completed in general conformance with the scope and limitations of the American Society of Testing and Materials (ASTM) Practice E 1527-00:

- Interviews with the property owner representatives
- Site and vicinity reconnaissance
- Review of regulatory agency records
- Description of physical setting
- Historical review
- Interviews with public agency personnel
- Limited Asbestos Survey
- Limited Lead-Based Paint Survey
- Preparation of this report

1.2 Non-Scope Considerations

The following were non-scope considerations for this assessment:

- Wetlands
- Cultural & Historic Resources
- Industrial Hygiene
- Health & Safety
- High Voltage Powerlines
- Radon
- Lead in Drinking Water
- Regulatory Compliance
- Ecological Resources
- Endangered Species
- Indoor Air Quality

1.3 Significant Assumptions

Converse made no significant assumptions for this assessment.

1.4 Limitations and Exceptions

This report is for the sole benefit and exclusive use of University of Southern California as it applies to 18650 Devonshire Street in the Northridge area of the city of Los Angeles, Los Angeles County, California. Its preparation has been in accordance with generally accepted practices in environmental sciences. No other warranty, either express or implied, is made. This report should not be regarded as a guarantee that no further contamination beyond that which could be detected within the scope of this assessment is present at the Property.

The conclusions and recommendations presented in this report are based on the agreed upon scope of work outlined above. Converse makes no warranties or guarantees as to the accuracy or completeness of information provided or compiled by others. It is possible that information exists beyond the scope of this assessment. It is not possible to absolutely confirm that no hazardous materials, asbestos-containing materials, lead-based paints and/or substances exist at the Property. If none are identified as part of a limited scope of work, such a conclusion should not be construed as a guaranteed absence of such materials, but merely the results of the evaluation. Also, events may occur after the Property visit, which may result in contamination. Additional information, which was not found or available to Converse at the time of report preparation, may result in a modification of the conclusions and recommendations presented. Reliance on this report by Third Parties shall be at the Third Party's sole risk.

2.0 Property Description

2.1 Current Uses of the Property

The subject Property (herein referred to as Property) consists of one (1) irregular-shaped parcel consisting of approximately 9.47-acres. The east- northeast portion of the Property is currently improved with a two-story residential dwelling with basement, an attached garage and an associated swimming pool and tennis court. The southwest and northwest portions of the Property are currently vacant land with scattered vegetation.

A Property location map and a Property plan are provided in Appendix A. Pertinent site photographs are provided in Appendix B.

2.2 Location and Legal Description

The Property is located south of Devonshire Street and approximately 1,200-feet east of Wilbur Avenue and 1,000-feet west of Reseda Boulevard in the Northridge area of the City of Los Angeles, Los Angeles County, California. The Property is located approximately 1.1-miles south of State Highway 118 (Ronald Reagan Freeway).

The Los Angeles County Assessor's Office lists the Assessors Parcel Number (APN) as 2729-011-002 and the Property type as "Single Residence." The size of the lot was reported to be approximately 9.47-acres.

2.3 Description of Property Structure(s)

The Property is currently improved with a two-story, 5,958 square foot residential dwelling with a basement and attached garage. The dwelling, which consists of five bedrooms, eight restrooms and a kitchen, is currently vacant.

A swimming pool and tennis court are located south of the dwelling. A concrete pad of an approximate area of 11-feet by 30-feet is located on the southeastern corner of the Property.

2.4 Current Uses of Adjoining Properties

Based on our research and observations during our Property visit, the Property is bordered by the following:

North: Devonshire Street, beyond which is a retail strip with an associated asphalt paved parking lot.

South: Residential dwellings

East: Auto dealership facility

West: Wilbur Wash, beyond which are residential developments.

2.5 General Vicinity Description

The general vicinity is comprised primarily of single and multi-family residential dwellings to the south and west. Mixed retail and commercial facilities are located to the north and east.

3.0 User-Provided Information

The following documents and information were requested from Ms. Gwen Louchouarn (Property manager): However, Ms. Louchouarm had no information

- Title Records
- Environmental site assessment or audit reports
- Environmental permits or hazardous waste generator notices/reports
- Aboveground and underground storage tanks
- Septic systems, oil wells, or water wells
- Material Safety Data Sheets; Community Right to Know Plans; or Safety, Preparedness and prevention Plans; Spill Protection Countermeasures and Control Plans
- Knowledge of pending, threatened or past proceedings or notices from governmental entities regarding violation, liens, and hazardous substances, or petroleum products.
- Specialized Knowledge of Property
- Valuation Reduction for Environmental Issues
- Owner, Property Manager and Occupant Information
- Environmental problems with adjacent or vicinity locations.

4.0 Records Review

4.1 Physical Setting

4.1.1 Geology

The Property is located approximately 965-feet above mean sea level with surface topography sloping towards the south-southeast (United States Geological Survey [USGS] Topographic Map, Oat Mountain, California, 1965 photorevised 1981). The Property is underlain by quaternary age recent alluvial deposits (Division of Mines and Geology, Geologic Map of California, Los Angeles Sheet, 1969).

4.1.2 Groundwater

According to the Los Angeles County, Department of Public Works (DPW), Hydrologic Records Division, the nearest groundwater well to the Property is located approximately 700-feet north of the Property (near Wilbur Wash and Haiwatha Street). DPW well number 4754 was last measured on November 21, 2001. At that time, the depth to groundwater was recorded at 25.2-feet below ground surface. The surface elevation was recorded at 963-feet. The direction of regional groundwater flow is towards the southeast (1998-1999 Water Year ULARA Watermaster Report-Plate 12, Estimated Direction of Groundwater).

4.1.3 Potable Water Supplier

Water service to the San Fernando Valley is provided by the Metropolitan Water District (MWD) and the City of Los Angeles Department of Water and Power (DWP).

4.2 Historical Review

4.2.1. Aerial Photograph and Map Review

Available historical aerial photographs from the Fairchild Aerial Photography Collection were reviewed at Whittier College. The dates of the photographs reviewed are as follows: 1928-1929, 1930, 7-4-1948, 3-15-1947, 6-1949, 11-27-1950, 10-1954, 1956 and 1-14-1958.

Historical Sanborn Fire Insurance (Sanborn) maps covering the Property were requested from Environmental Data Resources Inc. (EDR). However, no maps were available for the Property. Topographic maps from 1952, 1952 photorevised 1969 and 1965 photorevised 1981 were also reviewed. A chronological summary of the topographic maps and aerial photographs reviewed is provided below. A portion of the 1965 photorevised 1981 USGS topographic map is provided in Appendix A as Figure 1.

1928-1929 and 1930 Photograph
The Property appeared to be an undeveloped parcel.

The adjacent properties appeared to be undeveloped land. Devonshire Street to the north appeared to be developed.

The general vicinity appeared to be undeveloped land.

7-4-1948, 3-15-1947, 6-1949, 11-27-1950, 10-1954, 1956 and 1-14-1958 Photographs and 1952 Map
The Property appeared to be in its present day configuration. The two-story house and attached garage were visible on the north-northeast portions of the Property. The pool and tennis court were visible on the central portion of the Property. A structure/shed (possible stable for horses) within a fenced enclosure was visible on the southeast corner of the Property (present day concrete pad area). A concrete sub-structure associated with the shed was visible on the southern portion of the Property. The eastern portion of the Property appeared to be agricultural (orchards). The northwest, west and southwest portions of the Property appeared to be undeveloped land.

The adjacent properties to the north (across Devonshire Street), and south appeared to be undeveloped land. The adjacent property to the east appeared to be residential. The adjacent property to the west beyond Wilbur Wash, appeared to be agricultural land.

The general vicinity appeared to be undeveloped or agricultural land.

1952 photorevised 1969 and 1965 photorevised 1981 Map
No apparent changes observed at the Property.

No apparent changes observed to the adjacent property to the north. The adjacent properties to the south and west appeared to be residential. The adjacent property to the east appeared to be developed with the present day auto-dealership.

The general vicinity appeared to be mixed residential and commercial land.

4.2.2 Building Permit Review

Available building permits were reviewed at the City of Los Angeles, Building Department. A chronological summary is provided in the table below.

Date of Permit	Permit Summary
January 26, 1937	A new building construction permit was issued to the owner Miss Barbara Stanwycr (sic) for the construction of a two-story residential dwelling and a private garage. The size of the dwelling was reported to be 4,500 square feet. The 10-acre lot was reported to be vacant.
January 18, 1967	A building permit was issued to owner Jack Oakie for the construction of a 780-feet concrete block retaining wall. A residential dwelling and garage was reported on the Property.

No other information was on file with the Building Department.

4.2.3 Historical Use Summary on Adjacent Properties

According to the historical information gathered by Converse, the adjacent properties appeared to have been undeveloped land between 1928 and 1930. Devonshire Street was developed prior to 1928.

Between the late 1930s and early 1960s, the adjacent property to the east was primarily residential and the adjacent properties to the west, beyond Wilbur Wash, appeared to be used for agricultural purposes. The adjacent properties to the south and north (beyond Devonshire Street) remained undeveloped during the same time frame.

By the late 1960s, the adjacent properties to the south and west were being developed for residential purposes. By 1965, the adjacent property to the east was occupied by the present day car-dealership.

4.3 Regulatory Database Search

A regulatory database search was completed on the Property by EDR. The complete EDR report is provided in Appendix C – EDR-Radius Map Report. Only properties within a ½mile radius of the Property are listed in the table on the following page:

Site Name	Address (EDR Map ID No.)	Database Listing	Comments
Property			
The Property was not listed in the EDR report.			
Adjacent Properties and Off-site Properties Within a -Mile Radius			
Builders Emporium.	18679 Devonshire Street (Map ID # 1)	HAZNET	The site generates off-specification, aged or surplus organic wastes. The disposal method was reported as transfer station.
REI	18605 Devonshire Boulevard (Map ID # A2)	HAZNET	The site generates aqueous solution with less than 10% total organic residues. The disposal method was reported as recycler and transfer station.
Baher Chevrolet Competition Chevrolet H. E. Baher Inc.	18600 Devonshire Street (Map ID # A3, A4 and A5)	HIST UST HAZNET RCRIS-SQG CA FID UST FINDS	One 2,000-gallon, one 500-gallon and two 500-gallon underground storage tanks (USTs) are reported on this auto dealership lot. The site generates aqueous solution with less than 10% total organic residues and oxygenated solvent containing wastes. The disposal method was reported as recycler and transfer station. No violations have been reported for this facility.
Lucky Store # 121667	18555 Devonshire Street (Map ID # 6)	HAZNET	The site generates waste oil and mixed oil. The disposal method was reported as recycler.
Off-site Properties Located Between a -Mile and ¼Mile Radius			
Uhlmann Offices Inc. Casa Blanca Cleaners	18530 Devonshire Street (Map ID # B7 and B8)	HAZNET CA SLIC	The site generates asbestos-containing waste, halogenated solvents and contaminated soil. The disposal method was reported as transfer station, recycler and landfill. This site is listed as a contaminated site that impacts groundwater or has the

Site Name	Address (EDR Map ID No.)	Database Listing	Comments
			potential to impact groundwater. The facility is currently being assessed for the release of PCE.
Off-site Properties Located Between a -Mile and ¼Mile Radius (continued)			
Hillcrest Cleaners	18527 Devonshire Street (Map ID # B10 and B11)	RCRIS-SQG FINDS, HAZNET CA SLIC	This site generates halogenated solvent waste. The disposal method was reported as recycler. No violations have been reported for this site. This site is listed as a contaminated site that impacts groundwater or has the potential to impact groundwater. The facility is currently being assessed for the release of VOCs.
1X Rreef Funds	18519 Devonshire Street (Map ID # 12)	HAZNET	The site generates asbestos-containing waste. The disposal method was reported as landfill.
Exxon #7-3623 Devonshire Car Care Center Inc.	18501 Devonshire Street (Map ID # C13 C14, C15 and C16)	HAZNET, CORTESE, RCRIS-SQG, FINDS, UST, LUST, HIST UST, CA FID UST	The site generates aqueous solution with less than 10% total organic residues, unspecified aqueous solution waste, off-specification, aged or surplus organics, unspecified oil-containing waste. The disposal method was reported as recycler. One 1,000-gallon waste oil, one 10,000-gallon diesel and three 10,000-gallon gasoline USTs are reported on this site. The tanks were reported to have been installed in 1969. A hydrocarbon release was reported in 1993. The case type was reported as “soil only”. The status is reported as “signed off, remedial action completed or deemed unnecessary.”
Shirley Cleaners	10220 Reseda Boulevard (Map ID #	RCRIS-SQG, FINDS,	

Site Name	Address (EDR Map ID No.)	Database Listing	Comments
	19)	HAZNET CLEANERS	The site generates halogenated solvent type waste. The disposal method was reported as recycler. No violations have been reported for this site.
Off-site Properties Located Between a -Mile and ¼Mile Radius (continued)			
Equilon Enterprises LLC Porter Ranch Shell Gas S/S Porter Ranch Auto Care	18473 Devonshire Street (Map ID # D20, D21, D22, D23 and D24)	HAZNET, CORTESE, RCRIS-SQG, FINDS, UST, LUST, HIST UST, CA FID UST	The site generates unspecified aqueous solution wastes, organic liquids with metals, alkaline solution with metals, aqueous solution with less than 10% total organic residue, waste oil and mixed oil waste. The disposal method was reported as recycler and transfer station. No violations have been reported for this facility. One 550-gallon waste oil, two 5,000-gallon and two 8,000-gallon gasoline USTs are reported on this site. A hydrocarbon release was reported in 1991. The case type was reported as “soil only”. The status is reported as “leak being confirmed”.
Classic Car Wash Quality Car Wash	18470 Devonshire Street (Map ID # D25, D26, D27, D28 and D29)	HAZNET, LUST, CA FID UST	The site generates aqueous solution with less than 10% total organic residue waste. The disposal method was reported as recycler and treatment tank. One active UST is reported on this site. A gasoline release was reported from the UST in 2000 during tank repair work. The case type was reported as “soil

Site Name	Address (EDR Map ID No.)	Database Listing	Comments
			only." The abatement method was reported as "Excavate and Dispose-remove contaminated soil and dispose in approved site."
Off-site Properties Located Within a ¼ Mile Radius			
Granada Hills Street MDY	10210 Etiwanda Avenue (Map ID # 30)	SWF/LF	The 3-acre site is listed as an active and permitted landfill facility. The type of waste was reported as "Construction/demolition, mixed municipal and tires."

Other off-site locations of environmental concern greater than a ½ mile from the Property identified by EDR included hazardous waste generators, solid waste landfills, permitted hazardous material and discharge sites and Leaking Underground Storage Tank (LUST) sites.

The potential for environmental impact to the Property from the identified off-site locations of concern within the vicinity of the Property, and other off-site locations of concern appears to be low due to one or more of the following: type of regulatory listing; distance from the subject Property; location with respect to the direction of regional groundwater flow; status of the case; type of resource affected, remedial efforts being directed by a regulatory agency; and/or potential responsible parties have been identified.

4.4 Additional Regulatory Agency Record Sources

4.4.1 Division of Oil and Gas (DOG)

According to the California Department of Conservation, DOG, Wildcat Map W-1-2, Los Angeles, dated September 15, 2001, no oil or gas wells are located on the Property or adjacent properties.

4.4.2 California State Fire Marshall (CSFM), Pipeline Safety Division

According to the CSFM, there are no pipelines within their jurisdiction in the vicinity of the Property.

4.4.3 California Regional Water Quality Control Board (RWQCB)

There is no information regarding the Property on file with the RWQCB.

4.4.4 South Coast Air Quality Management Districts (SCAQMD)

Information has been requested from the above agency. Upon receipt and review of the information, an addendum will be issued if items of concern are noted. In addition, our conclusions and recommendations will be modified accordingly.

4.4.5 City of Los Angeles, Fire Department (LAFD), UST Plan Check Division and Tank Enforcement Unit.

There is no information regarding the Property on file with LAFD.

4.4.6 City of Los Angeles, Fire Department, Hazardous Materials Division (HAZMAT)

There is no information regarding the Property on file with HAZMAT

5.0 Property Reconnaissance

5.1 Methodology

On Friday, March 8, 2002, Converse visited the Property to determine present use and to identify environmental conditions at the Property. Our methodology involved walking the perimeter and accessible interior areas of the building while noting observed evidence of present and potential environmental concerns. A Property map is provided in Appendix A. Pertinent Property photographs are provided in Appendix B.

5.2 Limiting Conditions

Converse's findings are based on the Property conditions observed on Friday, March 18, 2002

5.3 Interior Observations

During our Property visit, Converse made the following observations of the interior of the Property's building(s):

Item or Condition	Observed Evidence	No Evidence Observed	Comments
Hazardous Substances & Petroleum Products:	☐	☒	
Storage Tanks & Related Equipment:	☒	☐	A single gravity pump/dispenser was observed inside the garage. A 1-inch diameter vent pipe was observed along the side of the garage wall and on the roof of the garage.
Odors:	☐	☒	
Standing Surface Water or Other Pools of Liquid:	☐	☒	
Drums & Other Containers of Hazardous Substances, Petroleum Products, or Other Unidentified Contents:	☐	☒	
Transformers or Equipment containing	☐	☒	

Item or Condition	Observed Evidence	No Evidence Observed	Comments
Polychlorinated Biphenyls (PCBs):			
Heating/Cooling System:	☒	☐	Two gas furnaces and a heating unit was observed in the basement. No leaks or stains were observed around or emanating from the units.
Stains or Corrosion on Floors, Walls, or Ceilings:	☐	☒	
Drains and Sumps:	☐	☒	

5.4 Exterior Observations

During our Property visit, Converse made the following observations of the exterior of the Property:

Item or Condition	Observed Evidence	No Evidence Observed	Comments
Hazardous Substances & Petroleum Products:	☐	☒	
Storage Tanks & Related Equipment:	☒	☐	A 4-feet by 12-feet concrete pad with an associated fill cap was observed adjacent to the garage. 1-inch diameter vent pipe was observed on the roof. Cracks were visible on the concrete pad. The fill cap was tightly shut and could not be opened. The size and contents of the suspect UST could not be determined during the reconnaissance. No leaks or odors were detected in the vicinity of the suspect UST location.
Odors:	☐	☒	
Standing Surface Water or Other Pools of Liquid:	☐	☒	
Drums & Other Containers of Hazardous Substances, Petroleum Products, or Other Unidentified Contents:	☐	☒	

Item or Condition	Observed Evidence	No Evidence Observed	Comments
Transformers or Equipment containing Polychlorinated Biphenyls (PCBs):	☐	☒	
Pits, Ponds, or Lagoons:	☐	☒	
Stained Soil or Pavement:	☐	☒	
Stressed Vegetation (other than from insufficient water):	☐	☒	
Evidence of Mounds, Depressions or Filled or Graded Areas Suggesting Trash or Other Solid Waste Disposal:	☐	☒	
Waste Water or any discharge (including storm water) into a Drain, Ditch, or Stream on or Adjacent to the Property:	☐	☒	
Wells (active, inactive, or abandonded):	☐	☒	
Septic Systems or Cesspools:	☐	☒	
Prior Structures:	☒	☐	A 30-feet by 11-feet concrete pad (indicative of a prior shed/structure) was observed on the southeast corner of the Property.
Roads, Tracks, Railroad Tracks or Spurs:	☐	☒	

In addition to the above, Converse made the following observation on the exterior of the Property:

- A 9-feet by 5-feet subsurface concrete structure was observed on the southern portion of the Property. This structure appeared to be associated with the concrete pad located on the southeast corner of the Property.
- Remnants of an orchard were observed along the eastern portion of the Property.
- A pool equipment room associated with the swimming pool was not located during the Property reconnaissance.

6.0 Limited Asbestos Survey

6.1. ACM Sampling and Survey Methodology

On March 8, 2002, a visual inspection was performed prior to the actual sampling to determine suspect materials, homogenous areas, and to identify suspect materials that could be visually identified as non-asbestos containing materials.

Materials were divided into friable and non-friable materials. Friable ACMs are those that can be readily disturbed or destroyed by hand pressure. These materials are most likely to yield a fiber release should they become disturbed. Non-friable materials are those items that cannot be readily disturbed or destroyed by hand pressure but can still release asbestos fibers when disturbed by mechanical means. Vinyl floor tiles and stucco-like coatings are examples of non-friable materials. In addition, non-friable materials that are damaged, significantly damaged, or have a potential to become damaged, may be considered friable.

The survey was completed by Steven Weatherton (Cal-OSHA Certified Asbestos Site Surveillance Technician, #90-2812) under the supervision of Norman Eke, CalOSHA certified asbestos consultant # 96-2093.

Homogenous areas were defined by those that have uniform color, texture, and appearance within a building or dwelling unit. The homogenous materials were placed in one of the following Environmental Protection Agency (EPA) categories:

- Surfacing Materials (sprayed or troweled on materials)
- Thermal System Insulations (material generally applied to various mechanical systems)
- Miscellaneous Materials (any materials which do not fit in either of the other categories)

The strategy for the collection of asbestos samples was in general accordance with EPA guidance document *"Asbestos in Buildings: Simplified Sampling Scheme for Friable Surfacing Materials",* EPA 560/5-85-030a, October 1985; 40 CFR 763 (AHERA) and SCAQMD Rule 1403.

Accessible areas were sampled for the presence of asbestos. Destructive sampling was not performed. Therefore, void spaces between floors and walls and areas not visually observable were not surveyed.

Samples of general building components (i.e., visually identical flooring materials, and building materials) are assumed to be representative of materials used throughout the dwelling.

During the assessment of the Property, roofing material with the exception of roof barrier paper was not sampled as part of the limited asbestos survey.

6.2 Procedures

The bulk asbestos samples were submitted to the Converse asbestos laboratory located in Reno, Nevada for analysis. Bulk samples were analyzed according to EPA analytical method 600/M-82-020 for Polarized Light Microscopy (PLM) *Analysis of Bulk Materials for Asbestos*.

Analysis was performed by using the bulk sample for visual observation and slide preparation(s) for microscopic examination and identification. The samples were mounted on slides and analyzed for asbestos, fibrous non-asbestos constituents, and non-fibrous constituents. Asbestos was identified by refractive indices, morphology, color, pleochroism, birefringence, extinction characteristics, and signs of elongation. The same characteristics were used to identify the non-asbestos constituents.

Reported results are a visual estimate, by area, of the asbestos content. The lower limit of reliable detection for this method is 1% by area. Samples which contain less than one percent (1%) asbestos by area are reported as <1%. Samples in which no asbestos was observed are reported as None Detected (ND). Please note that there may be asbestos in samples reported as ND, but the concentration and/or size of the asbestos fibers are too small for accurate optical microscopic resolution.

6.3 Summary of Findings

Converse collected 38 bulk samples of suspect materials at the Property. Suspect materials sampled included interior plaster walls and ceilings, wallpaper, flooring materials, exterior stucco and texture coatings, thermal system insulation wrap, and roof barrier paper. Roofing material was not sampled during the survey except for the roof barrier paper, which was collected through an attic access panel on the first floor of the dwelling. A sample location map and the analytical report and chain of custody documentation are provided in Appendix D.

The Property is occupied by an approximate 5,958 square foot, two-story residential dwelling with basement and attached garage. The following table is a list of the materials sampled on March 8, 2002:

Material Sampled	Material Location	ACM	Comments/Condition
Wall/Ceiling Plaster (sand)	North and South Servants Quarters, and the Laundry Room	ND	Good condition.

Material Sampled	Material Location	ACM	Comments/Condition
Wall Plaster (Smooth)	Located throughout dwelling except in the Guest Bedroom (Wood Wall Paneling Floor and Walls).	ND	Good condition throughout except within the master bedroom closet, which was damaged.
Roof Barrier Paper	Beneath the roof substrate of the building (building attic)	ND	Good condition
Wallpaper	East Bedroom, above fireplace – 2nd Floor	ND	Good condition
Floor Sheeting and Mastic – Brown 9x9 tile pattern	Kitchen, Food Service Room, and Laundry Room	ND	Good condition
Floor Sheeting and Backing – Marble Pattern	Bar Area	ND	Good condition
Floor Sheeting and Mastic – Green Marble Pattern	Guest Bedroom	ND	Good condition
Floor Sheeting and Mastic – Green Streaked Pattern	Guest Bathroom	ND	Good condition
Floor Sheeting and Mastic – Blue and White Streaked Pattern	Laundry Room Countertops, and Kitchen Table Top	ND	Good condition
Floor Sheeting and Mastic – Green/Gray Pattern	Rear Entry-Way	ND	Good condition.
TSI Pipe Wrap	Basement and Throughout Wall and Floor Voids of Building	60 to 70% Chrysotile	Good condition. Approximately 150 linear feet of material is estimated to be present within the building.
Exterior Stucco	Exterior of Garage, Laundry Room, South Porch, and 2nd Floor Master Bedroom	>1 to 3% Chrysotile	Good condition. Approximately 4,000 square feet of material is estimated to be present.

ND – None Detected
TSI – Thermal System Insulation

Destructive sampling methods were not employed; therefore, no samples were collected of the following materials: wall and floor voids, roofing materials, second floor ceiling, and roof substrate.

7.0 Limited Lead-Base Paint (LBP) Survey

7.1 LBP Sampling and Survey Methodology

On March 8, 2002, a visual inspection was performed prior to the actual sampling to determine damaged interior and exterior paints. Paints which appeared to be of the same color were considered homogeneous and assumed to be representative of paint used throughout the structure. Only accessible areas were sampled. The survey is intended to identify representative painted surfaces. The survey is not intended to identify all painted surfaces or comply with Housing and Urban Development (HUD) Guidelines.

The survey was completed by Laura Tanaka (Department of Health Services Certified Inspector/Assessor #I-3086). The survey was completed using the RMD LPA 1 x-ray fluorescence (XRF) device.

The XRF field logs are provided in Appendix E.

7.2 Definition of LBP

Los Angeles County has defined a LBP at 600 milligrams/kilogram (mg/kg); 600 parts per million (ppm); or 0.7 milligrams per centimeter squared (mg/cm^2).

7.3 Summary of Results

7.3.1 Interior Surfaces

Interior surfaces surveyed included:

- Walls
- Hardwood floors
- Baseboards
- Wood counter tops
- Doors & associated components
- Wall trim/crown molding
- Staircase components
- Ceilings
- Ceramic tile floors
- Cabinets
- Ceramic counter tops
- Windows & associated components
- Ceramic bath and shower tiles

Interior components which were found to be a LBP included:

- Laundry area cabinet (white) – The cabinet had a lead concentration of 0.9 mg/cm^2. The paint was intact.

- Ceramic tile (white) kitchen counter top – The counter top has a lead concentration of greater than 9.9 mg/cm^2. The tile was in good condition.

- Metal window mullions in the formal dining room – The mullions had a lead concentration of 1.9 mg/cm^2. Five (5) windows were located in the room. The paint was intact.
- Metal window mullions in the 2nd floor east and west bedrooms – The mullions had a lead concentration of 3.4 mg/cm^2 and 1.5 mg/cm^2. The paint in the east bedroom was in damaged condition, and the west bedroom was intact.

7.3.2 Exterior Surfaces

Exterior surfaces surveyed included:

- Garage doors
- Roof eaves
- Doors & associated components
- Porch supports posts
- Walls
- Wall trim
- Windows & associated components

Exterior components which were found to be a LBP included components which were painted dark brown. These components included the garage doors, windows and associated components, doors and associated components, wall trim, and porch posts. The condition of the paint varied from intact to damaged.

The screen doors, which were also painted dark brown, were not a LBP.

8.0 Interviews

Ms. Gwen Louchouarn, Property Manager, was questioned on her knowledge of the Property. Ms. Louchouarn had no information or knowledge regarding the following items:

- Environmental site assessment or audit reports
- Environmental permits or hazardous waste generator notices/reports
- Above- and underground storage tanks
- Septic systems, oil wells, or water wells
- Material Safety Data Sheets; Community Right to Know Plans; or Safety, Preparedness and prevention Plans; Spill Protection Countermeasures and Control Plans
- Knowledge of pending, threatened or past proceedings or notices from governmental entities regarding violation, liens, and hazardous substances, or petroleum products.
- Environmental problems with adjacent or vicinity locations.

According to Ms. Louchouarn, the Property had been residential since 1920.

9.0 Findings, Opinions and Conclusions

Converse has performed a Phase I Environmental Site Assessment, Limited Asbestos and Lead-Based Paint Survey's in general conformance with the scope and limitations of ASTM Practice E 1527-00 for 18650 Devonshire Street in the city of Northridge, Los Angeles County, California. Any exceptions to or deletions from this practice are described in the Limitations and Exceptions of Assessment section of this report. This assessment has revealed no evidence of recognized environmental conditions in connection with the Property except for the following:

- An UST is located adjacent to the garage. A 4-foot by 12-foot concrete pad with an associated fill cap and 1-inch diameter vent pipe were observed adjacent to the garage. A gravity pump/dispenser and associated piping were observed inside the garage. The size and contents of the suspect UST could not be determined during the reconnaissance. None of the regulatory agencies contacted had any information relating to the UST at the Property. Converse recommends the UST be abandoned or removed according to the guidelines established by the LAFD. As part of the abandonment procedure, soil sampling will need to occur as part of the formal closure procedures.

- During the Property reconnaissance remnants of an orchard were observed along the eastern portion of the Property. Based on historical data, the eastern portion appears to have been used as an orchard as early as 1948. Converse recommends soil sampling be performed on the eastern portion of the Property to address historical pesticide and herbicide usage.

- During the Property reconnaissance a 30-foot by 11-foot concrete pad (indicative of a prior shed/structure) was observed on the southeast corner of the Property. A 9-foot by 5-foot subsurface concrete structure was also observed on the southern portion of the Property. This structure appeared to be associated with the larger concrete pad. Based on historical data gathered, it is Converses opinion that these structures were associated with a former animal ranch and stable located on the southern portion of the Property between 1948 and the late 1960s. No further assessment appears warranted at this time.

- According to the analysis of bulk samples collected during the limited asbestos survey, the following materials were indicated as being ACMs:

    - TSI wrap around the piping in the basement and the floor and ceiling voids throughout the building.
    - Exterior stucco on the walls of the building.

  Converse recommends that the TSI wrap and exterior stucco be maintained in place through an Operations and Maintenance (O & M) Plan. Roofing materials should be sampled prior to any renovation or demolition. If renovation activities

occur, the impacted ACMs will need to be abated in the affected areas. The abatement work should be performed by a licensed abatement company. Converse recommends abatement oversight be performed by an independent asbestos consultant during the abatement.

- The following interior and exterior surfaces were found to be LBPs: Laundry cabinets, ceramic counter topsin, the kitchen, metal window mullions and all dark brown exterior wood components (excluding screen doors). If renovation activities occur, the damaged paint should be stabilized or abated (remove of the component) prior to beginning renovation activities. The abatement should be completed by a licensed abatement company.

Based on the above information, there appears to be a potential for environmental impact to the Property from current or historical site usage. Further assessment appears warranted at this time.

Information has been requested from the SCAQMD. Upon receipt and review, an addendum will be issued if items of concern are noted. In addition, any conclusions and recommendations will be modified accordingly.

10.0 References

California Department of Conservation, Division of Oil and Gas, Regional Wildcat Map W1-2, Los Angeles Basin, September 15, 2001.

California State Fire Marshall, Request for Information, March 2002.

Division of Mines and Geology, Geologic Map, Geologic Map of the Los Angeles, 1969.

Environmental Data Resources (EDR), Inc., EDR-Radius Map Report, March 2002.

Environmental Data Resources (EDR), Inc., Request for Sanborn Map, March 2002.

Fairchild Aerial Photograph Collection, Whittier College, Aerial Photograph Review, March 2002.

Louchouarn, Gwen, Property Manager, Personal Communication, March 2002.

Los Angeles, City of, Department of Building and Safety, Building Permit Review, March 2002.

Los Angeles City of, Fire Department, Division of UST Plan Check, Personal Communication, March 2002.

Los Angeles City of, Fire Department, Division of Hazardous Materials, Personal Communication, March 2002.

Los Angeles County, Department of Public Works, Hydrologic Records, Personal Communication, March 2002.

South Coast Air Quality Management District, Request for Information, March 2002.

United States Geological Survey, 7.5-Minute Topographic Quadrangle, Oat Mountain, 1952, 1965, photorevised 1981.

ULARA Watermaster Report, Plate 12, Estimated Direction of Groundwater, 1998-1999 Water Year.

11.0 List of Preparers

Norman S. Eke

Managing Officer

B.A., Liberal Studies, Environmental Studies Emphasis, University of California, Santa Barbara, 1988.
Cal-EPA Registered Environmental Assessor, #05654
Cal-OSHA Certified Asbestos Consultant, #96-2093
NIOSH 582 Equivalent trained

Managing Officer of the southern California environmental offices of Converse Consultants. Mr. Eke has eleven years of experience of conducting Phase I & II Environmental Site Assessments, asbestos surveys, emergency response, hazardous waste transportation, and hazardous materials management. Current duties include managing Converse's three environmental offices, and review and approval of proposals and reports.

Principal area of responsibility for this ESA report: Quality Control and Technical Review.

Laura Tanaka

Senior Environmental Scientist

B.S., Biology, California State Polytechnic University, Pomona, 1987
Cal-EPA Registered Environmental Assessor, #06283
Cal-OSHA Site Surveillance Technician, #94-1388
DHS Certified Lead Inspector/Assessor, #I-3086
DHS Certified Project Designer, #D-3086
DHS Certified Project Monitor, #M-3086

Senior Manager of the Phase I Environmental Site Assessment department. Ms. Tanaka has ten years experience in the conducting Phase I ESAs, asbestos surveys, lead-based paint surveys, as well as hazardous material audits, completing business plans, and AQMD permitting. Current duties at Converse include project management, business development, and conducting/managing ESAs.

Principal area of responsibility for this ESA report: Project Management, Client Point of Contact, Report Review, LBP Survey.

Steven T. Weatherton

Senior Staff Environmental Scientist

B.S., Environmental Science, Water Quality and Waste Management Emphasis, University of California, Riverside, 1995
Cal-OSHA Certified Asbestos Site Surveillance Technician, #90-2812
DHS Certified Project Monitor (Pending)

Mr. Weatherton has performed numerous Phase I ESAs on undeveloped land to industrial facilities. He has also performed sampling and monitoring of UST removals, and compaction soil testing of UST excavation backfilling activities.

Principal area of responsibility for this ESA report: Asbestos Survey.

Kishore H. Butani

Senior Staff Environmental Engineer

M.S., Environmental Engineering, University of Southern California, Los Angeles, 2000.
B. S., Civil Engineering, University of Bombay, 1998.

Mr. Butani has performed numerous Phase I ESAs and Transaction Screens on undeveloped land to industrial facilities throughout California. He has also performed soil sampling and sub surface exploration at numerous sites.

Principal area of responsibility for this ESA report: Research, Site Reconnaissance and Report Generation.

PRESERVATION BRIEFS

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10 PRESERVATION BRIEFS

Exterior Paint Problems on Historic Woodwork

Kay D. Weeks and David W. Look, AIA

U.S. Department of the Interior
National Park Service
Cultural Resources

Heritage Preservation Services

A cautionary approach to paint removal is included in the guidelines to "The Secretary of the Interior Standards for Historic Preservation Projects." Removing paints down to bare wood surfaces using harsh methods can permanently damage those surfaces; therefore such methods are not recommended. Also, total removal obliterates evidence of the historical paints and their sequence and architectural context.

This Brief expands on that advice for the architect, building manager, contractor, or homeowner by identifying and describing common types of paint surface conditions and failures, then recommending appropriate treatments for preparing exterior wood surfaces for repainting[1] to assure the best adhesion and greatest durability of the new paint. Although the Brief focuses on responsible methods of "paint removal," several paint surface conditions will be described which do not require any paint removal, and still others which can be successfully handled by limited paint removal. In all cases, the information is intended to address the concerns related to *exterior wood*. It will also be generally assumed that, because houses built before 1950 involve one or more layers of lead-base paint,[2] the majority of conditions warranting paint removal will mean dealing with this toxic substance along with the dangers of the paint removal tools and chemical strippers themselves.

Purposes of Exterior Paint

Paint[3] applied to exterior wood must withstand yearly extremes of both temperature and humidity. While never expected to be more than a temporary physical shield—requiring re-application every 5-8 years—its importance should not be minimized. Because one of the main causes of wood deterioration is moisture penetration, a primary purpose for painting wood is to exclude such moisture, thereby slowing deterioration not only of a building's exterior siding and decorative features but, ultimately, its underlying structural members. Another important purpose for painting wood is, of course, to define and accent architectural features and to improve appearance.

Treating Paint Problems in Historic Buildings

Exterior paint is constantly deteriorating through the processes of weathering, but in a program of regular maintenance—assuming all other building systems are functioning properly—surfaces can be cleaned, lightly scraped, and hand sanded in preparation for a new finish coat. Unfortunately, these are ideal conditions. More often, complex maintenance problems are inherited by owners of historic buildings, including areas of paint that have failed[4] beyond the point of mere cleaning, scraping, and hand sanding (although much so-called "paint failure" is attributable to interior or exterior moisture problems or surface preparation and application mistakes with previous coats).

Although paint problems are by no means unique to historic buildings, treating multiple layers of hardened, brittle paint on complex, ornamental—and possibly fragile—exterior wood surfaces necessarily requires an extremely cautious approach (see figure 1). In the case of recent construction, this level of concern is not needed because the wood is generally less detailed and, in addition, retention of the sequence of paint layers as a partial record of the building's history is not an issue.

When historic buildings are involved, however, a special set of problems arises—varying in complexity depending upon their age, architectural style, historical importance, and physical soundness of the wood—which must be carefully evaluated so that decisions can be made that are sensitive to the longevity of the resource.

Justification for Paint Removal

At the outset of this Brief, it must be emphasized that removing paint from historic buildings—with the exception of cleaning, light scraping, and hand sanding as part of routine maintenance—should be avoided unless absolutely essential. *Once conditions warranting removal have*

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[1] General paint type recommendations will be made, but paint color recommendations are beyond the scope of this Brief.

[2] Douglas R. Shier and William Hall, *Analysis of Housing Data Collected in a Lead-Based Paint Survey in Pittsburgh, Pennsylvania, Part 1*, National Bureau of Standards, Inter-Report 77-1250, May 1977.

[3] Any pigmented liquid, liquefiable, or mastic composition designed for application to a substrate in a thin layer which is converted to an opaque solid film after application. *Paint and Coatings Dictionary*, 1978. Federation of Societies for Coatings and Technology.

[4] For purposes of the Brief, this includes any area of painted exterior woodwork displaying signs of peeling, cracking, or alligatoring to bare wood. See descriptions of these and other paint surface conditions as well as recommended treatments on pp. 5-10.

Fig. 1 *Excessive paint build-up on architectural details such as this ornamental bracket does not in itself justify total paint removal. If paint is cracked and peeling down to bare wood, however, it should be removed using the gentlest means possible. Photo: David W. Look, AIA.*

Fig. 2 *A traditionally painted bay window has been stripped to bare wood, then varnished. In addition to being historically inaccurate, the varnish will break down faster as a result of the sun's ultraviolet rays than would primer and finish coats of paint. Photo: David W. Look, AIA.*

been identified, the general approach should be to remove paint to the next sound layer using the gentlest means possible, then to repaint (see figure 2). Practically speaking as well, paint can adhere just as effectively to existing paint as to bare wood, providing the previous coats of paint are also adhering uniformly and tightly to the wood and the surface is properly prepared for repainting—cleaned of dirt and chalk and dulled by sanding. But, if painted exterior wood surfaces display continuous patterns of deep cracks or if they are extensively blistering and peeling so that bare wood is visible, then the old paint should be completely removed before repainting. The only other justification for removing all previous layers of paint is if doors, shutters, or windows have literally been "painted shut," or if new wood is being pieced-in adjacent to old painted wood and a smooth transition is desired (see figure 3).

Paint Removal Precautions

Because paint removal is a difficult and painstaking process, a number of costly, regrettable experiences have occurred—and continue to occur—for both the historic building and the building owner. Historic buildings have been set on fire with blow torches; wood irreversibly scarred by sandblasting or by harsh mechanical devices such as rotary sanders and rotary wire strippers; and layers of historic paint inadvertently and unnecessarily removed. In addition, property owners, using techniques that substitute speed for safety, have been injured by toxic lead vapors or dust from the paint they were trying to remove or by misuse of the paint removers themselves.

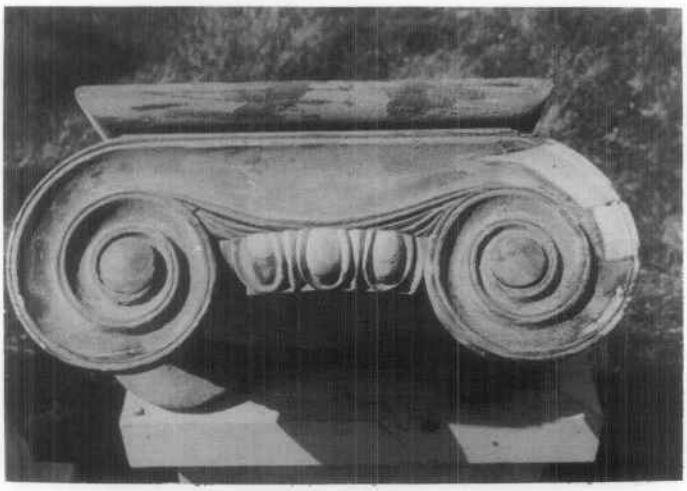

Fig. 3 *If damage to parts of a wooden element is severe, new sections of wood will need to be pieced-in. When such piecing is required, paint on the adjacent woodwork should be removed so that the old and new woods will make a smooth profile when joined. After repainting, the repair should be virtually impossible to detect. Photo: Morgan W. Phillips.*

Owners of historic properties considering paint removal should also be aware of the amount of time and labor involved. While removing damaged layers of paint from a door or porch railing might be readily accomplished within a reasonable period of time by one or two people, removing paint from larger areas of a building can, with-

out professional assistance, easily become unmanageable and produce less than satisfactory results. The amount of work involved in any paint removal project must therefore be analyzed on a case-by-case basis. Hiring qualified professionals will often be a cost-effective decision due to the expense of materials, the special equipment required, and the amount of time involved. Further, paint removal companies experienced in dealing with the inherent health and safety dangers of paint removal should have purchased such protective devices as are needed to mitigate any dangers and should also be aware of State or local environmental and/or health regulations for hazardous waste disposal.

All in all, paint removal is a messy, expensive, and potentially dangerous aspect of rehabilitating or restoring historic buildings and should not be undertaken without careful thought concerning first, its necessity, and second, which of the available recommended methods is the safest and most appropriate for the job at hand.

Repainting Historic Buildings for Cosmetic Reasons

If existing exterior paint on wood siding, eaves, window sills, sash, and shutters, doors, and decorative features shows no evidence of paint deterioration such as chalking, blistering, peeling, or cracking, then there is no *physical reason* to repaint, much less remove paint! Nor is color fading, of itself, sufficient justification to repaint a historic building.

The decision to repaint may not be based altogether on paint failure. Where there is a new owner, or even where ownership has remained constant through the years, taste in colors often changes. Therefore, if repainting is primarily to alter a building's primary and accent colors, a technical factor of paint accumulation should be taken into consideration. When paint builds up to a thickness of approximately 1/16" (approximately 16-30 layers), one or more extra coats of paint may be enough to trigger cracking and peeling in limited or even widespread areas of the building's surface. This results because excessively thick paint is less able to withstand the shrinkage or pull of an additional coat as it dries and is also less able to tolerate thermal stresses. Thick paint invariably fails at the weakest point of adhesion—the oldest layers next to the wood. Cracking and peeling follow. Therefore, if there are no signs of paint failure, it may be somewhat risky to add still another layer of unneeded paint simply for color's sake (extreme changes in color may also require more than one coat to provide proper hiding power and full color). When paint appears to be nearing the critical thickness, a change of accent colors (that is, just to limited portions of the trim) might be an acceptable compromise without chancing cracking and peeling of paint on wooden siding.

If the decision to repaint is nonetheless made, the "new" color or colors should, at a minimum, be appropriate to the style and setting of the building. On the other hand, where the intent is to restore or accurately reproduce the colors originally used or those from a significant period in the building's evolution, they should be based on the results of a paint analysis.[5]

Identification of Exterior Paint Surface Conditions/Recommended Treatments

It is assumed that a preliminary check will already have been made to determine, first, that the painted exterior surfaces are indeed wood—and not stucco, metal, or other wood substitutes—and second, that the wood has not decayed so that repainting would be superfluous. For example, if any area of bare wood such as window sills has been exposed for a long period of time to standing water, wood rot is a strong possibility (see figure 4). Repair or replacement of deteriorated wood should take place before repainting. After these two basic issues have been resolved, the surface condition identification process may commence.

The historic building will undoubtedly exhibit a variety of exterior paint surface conditions. For example, paint on the wooden siding and doors may be adhering firmly; paint on the eaves peeling; and paint on the porch balusters and window sills cracking and alligatoring. The accurate identification of each paint problem is therefore the first step in planning an appropriate overall solution.

Paint surface conditions can be grouped according to their relative severity: CLASS I conditions include minor blemishes or dirt collection and generally require *no* paint removal; CLASS II conditions include failure of the top layer or layers of paint and generally require *limited* paint removal; and CLASS III conditions include substantial or multiple-layer failure and generally require *total* paint removal. It is precisely because conditions will vary at different points on the building that a careful inspection is critical. Each item of painted exterior woodwork (i.e., siding, doors, windows, eaves, shutters, and decorative elements) should be examined early in the planning phase and surface conditions noted.

CLASS I Exterior Surface Conditions Generally Requiring No Paint Removal

- **Dirt, Soot, Pollution, Cobwebs, Insect Cocoons, etc.**

Cause of Condition

Environmental "grime" or organic matter that tends to cling to painted exterior surfaces and, in particular, protected surfaces such as eaves, do not constitute a paint problem unless painted over rather than removed prior to repainting. If not removed, the surface deposits can be a barrier to proper adhesion and cause peeling.

Recommended Treatment

Most surface matter can be loosened by a strong, direct stream of water from the nozzle of a garden hose. Stubborn dirt and soot will need to be scrubbed off using ½ cup of household detergent in a gallon of water with a medium soft bristle brush. The cleaned surface should then be rinsed thoroughly, and permitted to dry before further inspection to determine if repainting is necessary. Quite often, cleaning provides a satisfactory enough result to postpone repainting.

[5] See the Reading List for paint research and documentation information. See also *The Secretary of the Interior's Standards for Historic Preservation Projects with Guidelines for Applying the Standards* for recommended approaches on paints and finishes within various types of project work treatments.

- **Mildew**

Cause of Condition

Mildew is caused by fungi feeding on nutrients contained in the paint film or on dirt adhering to any surface. Because moisture is the single most important factor in its growth, mildew tends to thrive in areas where dampness and lack of sunshine are problems such as window sills, under eaves, around gutters and downspouts, on the north side of buildings, or in shaded areas near shrubbery. It may sometimes be difficult to distinguish mildew from dirt, but there is a simple test to differentiate: if a drop of household bleach is placed on the suspected surface, mildew will immediately turn white whereas dirt will continue to look like dirt.

Recommended Treatment

Because mildew can only exist in shady, warm, moist areas, attention should be given to altering the environment that is conducive to fungal growth. The area in question may be shaded by trees which need to be pruned back to allow sunlight to strike the building; or may lack rain gutters or proper drainage at the base of the building. If the shady or moist conditions can be altered, the mildew is less likely to reappear. A recommend solution for removing mildew consists of one cup non-ammoniated detergent, one quart household bleach, and one gallon water. When the surface is scrubbed with this solution using a medium soft brush, the mildew should disappear; however, for particularly stubborn spots, an additional quart of bleach may be added. After the area is mildew-free, it should then be rinsed with a direct stream of water from the nozzle of a garden hose, and permitted to dry thoroughly. When repainting, specially formulated "mildew-resistant" primer and finish coats should be used.

- **Excessive Chalking**

Cause of Condition

Chalking—or powdering of the paint surface—is caused by the gradual disintegration of the resin in the paint film. (The amount of chalking is determined both by the formulation of the paint and the amount of ultraviolet light to which the paint is exposed.) In moderation, chalking is the ideal way for a paint to "age," because the chalk, when rinsed by rainwater, carries discoloration and dirt away with it and thus provides an ideal surface for repainting. In excess, however, it is not desirable because the chalk can wash down onto a surface of a different color beneath the painted area and cause streaking as well as rapid disintegration of the paint film itself. Also, if a paint contains too much pigment for the amount of binder (as the old white lead carbonate/oil paints often did), excessive chalking can result.

Recommended Treatment

The chalk should be cleaned off with a solution of ½ cup household detergent to one gallon water, using a medium soft bristle brush. After scrubbing to remove the chalk, the surface should be rinsed with a direct stream of water from the nozzle of a garden hose, allowed to dry thoroughly, (but not long enough for the chalking process to recur) and repainted, using a non-chalking paint.

- **Staining**

Cause of Condition

Staining of paint coatings usually results from excess moisture reacting with materials within the wood substrate. There are two common types of staining, neither of which requires paint removal. The most prevalent type of stain is due to the oxidation or rusting of iron nails or metal (iron, steel, or copper) anchorage devices. A second type of stain is caused by a chemical reaction between moisture and natural extractives in certain woods (red cedar or redwood) which results in a surface deposit of colored matter. This is most apt to occur in new replacement wood within the first 10-15 years.

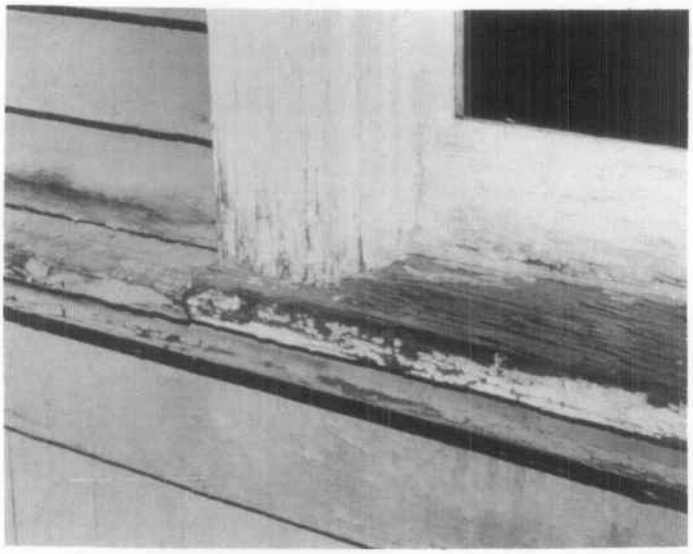

Fig. 4 *Paint films wear unevenly depending on exposure and location. Exterior locations which are susceptible to accelerated deterioration are horizontal surfaces such as window sills. These and similar areas will require repainting more often than less vulnerable surfaces. In the case of this window sill where paint has peeled off and adjacent areas have cracked and alligatored, the paint should be totally removed. Prior to repainting, any weathered wood should be rejuvenated using a solution of 3 cups exterior varnish, 1 oz. paraffin wax, and mineral spirits/paint thinner/or turpentine to make 1 gallon. Liberal brush application should be made. This formula was tested over a 20-year period by the U.S. Department of Agriculture's Forest Products Laboratory and proved to be just as effective as water-repellent preservatives containing pentachlorophenol. After the surface has thoroughly dried (2-3 days of warm weather), the treated surface can be painted. A high quality oil-base primer followed by two top coats of a semi-gloss oil-enamel or latex-enamel paint is recommended. Photo: Baird M. Smith, AIA.*

Recommended Treatment

In both cases, the source of the stain should first be located and the moisture problem corrected.

When stains are caused by rusting of the heads of nails used to attach shingles or siding to an exterior wall or by rusting or oxidizing iron, steel, or copper anchorage devices adjacent to a painted surface, the metal objects themselves should be hand sanded and coated with a rust-inhibitive primer followed by two finish coats. (Exposed nail heads should ideally be countersunk, spot primed, and the holes filled with a high quality wood filler except where exposure of the nail head was part of the original construction system or the wood is too fragile to withstand the countersinking procedure.)

Discoloration due to color extractives in replacement wood can usually be cleaned with a solution of equal parts denatured alcohol and water. After the affected area

has been rinsed and permitted to dry, a "stain-blocking primer" especially developed for preventing this type of stain should be applied (two primer coats are recommended for severe cases of bleeding prior to the finish coat). Each primer coat should be allowed to dry at least 48 hours.

CLASS II Exterior Surface Conditions Generally Requiring Limited Paint Removal

- **Crazing**

Cause of Condition

Crazing—fine, jagged interconnected breaks in the top layer of paint—results when paint that is several layers thick becomes excessively hard and brittle with age and is consequently no longer able to expand and contract with the wood in response to changes in temperature and humidity (see figure 5). As the wood swells, the bond between paint layers is broken and hairline cracks appear. Although somewhat more difficult to detect as opposed to other more obvious paint problems, it is well worth the time to scrutinize all surfaces for crazing. If not corrected, exterior moisture will enter the crazed surface, resulting in further swelling of the wood and, eventually, deep cracking and alligatoring, a Class III condition which requires total paint removal.

Recommended Treatment

Crazing can be treated by hand or mechanically sanding the surface, then repainting. Although the hairline cracks may tend to show through the new paint, the surface will be protected against exterior moisture penetration.

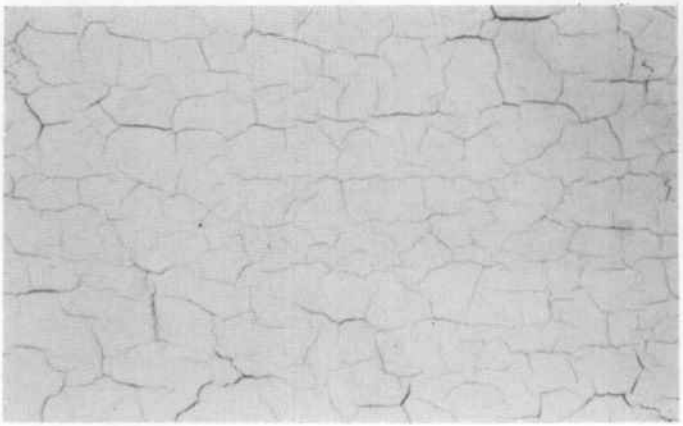

Fig. 5 *Crazing—or surface cracking—is an exterior surface condition which can be successfully treated by sanding and painting. Photo: Courtesy, National Decorating Products Association.*

- **Intercoat Peeling**

Cause of Condition

Intercoat peeling can be the result of improper surface preparation prior to the last repainting. This most often occurs in protected areas such as eaves and covered porches because these surfaces do not receive a regular rinsing from rainfall, and salts from air-borne pollutants thus accumulate on the surface. If not cleaned off, the new paint coat will not adhere properly and that layer will peel.

Another common cause of intercoat peeling is incompatibility between paint types (see figure 6). For example, if oil paint is applied over latex paint, peeling of the top coat can sometimes result since, upon aging, the oil paint becomes harder and less elastic than the latex paint. If latex paint is applied over old, chalking oil paint, peeling can also occur because the latex paint is unable to penetrate the chalky surface and adhere.

Recommended Treatment

First, where salts or impurities have caused the peeling, the affected area should be washed down thoroughly after scraping, then wiped dry. Finally, the surface should be hand or mechanically sanded, then repainted.

Where peeling was the result of using incompatible paints, the peeling top coat should be scraped and hand or mechanically sanded. Application of a high quality oil type exterior primer will provide a surface over which either an oil or a latex topcoat can be successfully used.

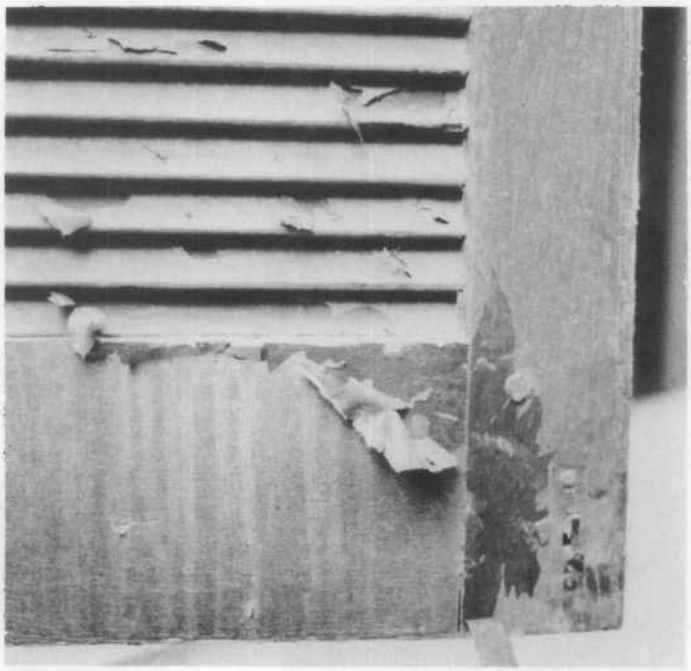

Fig. 6 *This is an example of intercoat peeling. A latex top coat was applied directly over old oil paint and, as a result, the latex paint was unable to adhere. If latex is being used over oil, an oil-base primer should be applied first. Although much of the peeling latex paint can be scraped off, in this case, the best solution may be to chemically dip strip the entire shutter to remove all of the paint down to bare wood, rinse thoroughly, then repaint. Photo: Mary L. Oehrlein, AIA.*

- **Solvent Blistering**

Cause of Condition

Solvent blistering, the result of a less common application error, is not caused by moisture, but by the action of ambient heat on paint solvent or thinners in the paint film. If solvent-rich paint is applied in direct sunlight, the top surface can dry too quickly and, as a result, solvents become trapped beneath the dried paint film. When the solvent vaporizes, it forces its way through the paint film, resulting in surface blisters. This problem occurs more often with dark colored paints because darker colors absorb more heat than lighter ones. To distinguish between solvent blistering and blistering caused by moisture, a blister should be cut open. If another layer of paint is visible, then solvent blistering is likely the problem whereas if bare wood is revealed, moisture is probably to blame. Solvent blisters are generally small.

Recommended Treatment

Solvent-blistered areas can be scraped, hand or mechanically sanded to the next sound layer, then repainted. In order to prevent blistering of painted surfaces, paint should not be applied in direct sunlight.

- **Wrinkling**

Cause of Condition

Another error in application that can easily be avoided is wrinkling (see figure 7). This occurs when the top layer of paint dries before the layer underneath. The top layer of paint actually moves as the paint underneath (a primer, for example) is drying. Specific causes of wrinkling include: (1) applying paint too thick; (2) applying a second coat before the first one dries; (3) inadequate brushing out; and (4) painting in temperatures higher than recommended by the manufacturer.

Recommended Treatment

The wrinkled layer can be removed by scraping followed by hand or mechanical sanding to provide as even a surface as possible, then repainted following manufacturer's application instructions.

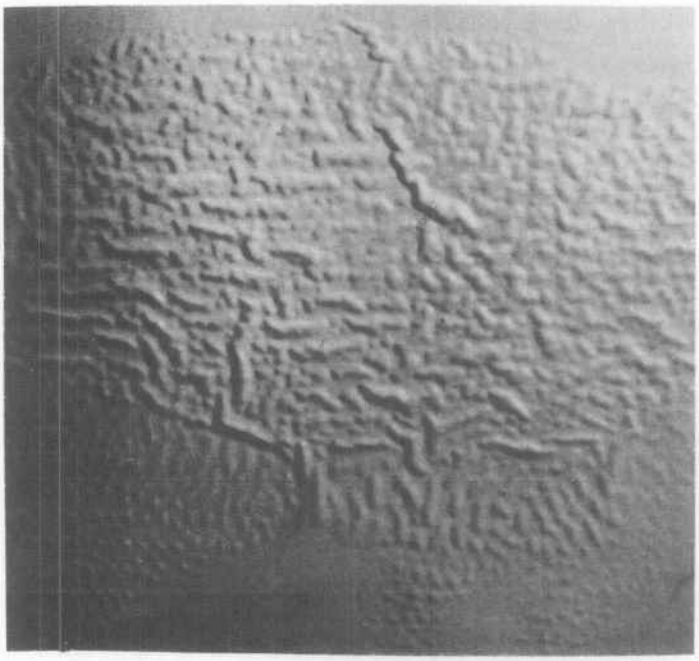

Fig. 7 *Wrinkled layers can generally be removed by scraping and sanding as opposed to total paint removal. Following manufacturers' application instructions is the best way to avoid this surface condition. Photo: Courtesy, National Decorating Products Association.*

CLASS III Exterior Surface Conditions Generally Requiring Total Paint Removal

If surface conditions are such that the majority of paint will have to be removed prior to repainting, it is suggested that a small sample of intact paint be left in an inconspicuous area either by covering the area with a metal plate, or by marking the area and identifying it in some way. (When repainting does take place, the sample should not be painted over). This will enable future investigators to have a record of the building's paint history.

- **Peeling**

Cause of Condition

Peeling to bare wood is most often caused by excess interior or exterior moisture that collects behind the paint film, thus impairing adhesion (see figure 8). Generally beginning as blisters, cracking and peeling occur as moisture causes the wood to swell, breaking the adhesion of the bottom layer.

Recommended Treatment

There is no sense in repainting before dealing with the moisture problems because new paint will simply fail. Therefore, the first step in treating peeling is to locate and remove the source or sources of the moisture, not only because moisture will jeopardize the protective coating of paint but because, if left unattended, it can ultimately cause permanent damage to the wood. Excess interior moisture should be removed from the building through installation of exhaust fans and vents. Exterior moisture should be eliminated by correcting the following conditions prior to repainting: faulty flashing; leaking gutters; defective roof shingles; cracks and holes in siding and trim; deteriorated caulking in joints and seams; and shrubbery growing too close to painted wood. After the moisture problems have been solved, the wood must be permitted to dry out thoroughly. The damaged paint can then be scraped off with a putty knife, hand or mechanically sanded, primed, and repainted.

Fig. 8 *Peeling to bare wood—one of the most common types of paint failure—is usually caused by an interior or exterior moisture problem. Photo: Anne E. Grimmer.*

- **Cracking/Alligatoring**

Cause of Condition

Cracking and alligatoring are advanced stages of crazing (see figure 9). Once the bond between layers has been broken due to intercoat paint failure, exterior moisture is able to penetrate the surface cracks, causing the wood to swell and deeper cracking to take place. This process continues until cracking, which forms parallel to grain, extends to bare wood. Ultimately, the cracking becomes an overall pattern of horizontal and vertical breaks in the paint layers that looks like reptile skin; hence, "alligatoring." In advanced stages of cracking and alligatoring, the surfaces will also flake badly.

Recommended Treatment

If cracking and alligatoring are present only in the top layers they can probably be scraped, hand or mechanically sanded to the next sound layer, then repainted. However, if cracking and/or alligatoring have progressed to

bare wood and the paint has begun to flake, it will need to be totally removed. Methods include scraping or paint removal with the electric heat plate, electric heat gun, or chemical strippers, depending on the particular area involved. Bare wood should be primed within 48 hours, then repainted.

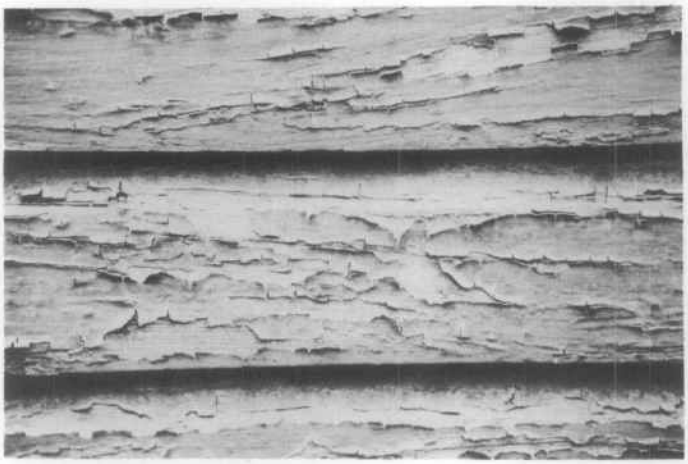

Fig. 9 *Cracking, alligatoring, and flaking are evidence of long-term neglect of painted surfaces. The remaining paint on the clapboard shown here can be removed with an electric heat plate and wide-bladed scraper. In addition, unsound wood should be replaced and moisture problems corrected before primer and top coats of paint are applied. Photo: David W. Look, AIA.*

Selecting the Appropriate/Safest Method to Remove Paint

After having presented the "hierarchy" of exterior paint surface conditions—from a mild condition such as mildewing which simply requires cleaning prior to repainting to serious conditions such as peeling and alligatoring which require total paint removal—one important thought bears repeating: if a paint problem has been identified that warrants either limited or total paint removal, the gentlest method possible for the particular wooden element of the historic building should be selected from the many available methods.

The treatments recommended—based upon field testing as well as onsite monitoring of Department of Interior grant-in-aid and certification of rehabilitation projects—are therefore those which take three over-riding issues into consideration (1) the continued protection and preservation of the historic exterior woodwork; (2) the retention of the sequence of historic paint layers; and (3) the health and safety of those individuals performing the paint removal. By applying these criteria, it will be seen that no paint removal method is without its drawbacks and all recommendations are qualified in varying degrees.

Methods for Removing Paint

After a particular exterior paint surface condition has been identified, the next step in planning for repainting—if paint removal is required—is selecting an appropriate method for such removal.

The method or methods selected should be suitable for the specific paint problem as well as the particular wooden element of the building. Methods for paint removal can be divided into three categories (frequently, however, a combination of the three methods is used). Each method is defined below, then discussed further and specific recommendations made:

Abrasive—"Abrading" the painted surface by manual and/or mechanical means such as scraping and sanding. Generally used for surface preparation and limited paint removal.

Thermal—Softening and raising the paint layers by applying heat followed by scraping and sanding. Generally used for total paint removal.

Chemical—Softening of the paint layers with chemical strippers followed by scraping and sanding. Generally used for total paint removal.

- **Abrasive Methods (Manual)**

If conditions have been identified that require limited paint removal such as crazing, intercoat peeling, solvent blistering, and wrinkling, scraping and hand sanding should be the first methods employed before using mechanical means. Even in the case of more serious conditions such as peeling—where the damaged paint is weak and already sufficiently loosened from the wood surface—scraping and hand sanding may be all that is needed prior to repainting.

Recommended Abrasive Methods (Manual)

Putty Knife/Paint Scraper: Scraping is usually accomplished with either a putty knife or a paint scraper, or both. Putty knives range in width from one to six inches and have a beveled edge. A putty knife is used in a pushing motion going under the paint and working from an area of loose paint toward the edge where the paint is still firmly adhered and, in effect, "beveling" the remaining layers so that as smooth a transition as possible is made between damaged and undamaged areas (see figure 10).

Paint scrapers are commonly available in 1 5/16, 2½, and 3½ inch widths and have replaceable blades. In addition, profiled scrapers can be made specifically for use on moldings. As opposed to the putty knife, the paint scraper is used in a pulling motion and works by raking the damaged areas of paint away.

The obvious goal in using the putty knife or the paint scraper is to selectively remove the affected layer or layers of paint; however, both of these tools, particularly the paint scraper with its hooked edge, must be used with care to properly prepare the surface and to avoid gouging the wood.

Sandpaper/Sanding Block/Sanding sponge: After manually removing the damaged layer or layers by scraping, the uneven surface (due to the almost inevitable removal of varying numbers of paint layers in a given area) will need to be smoothed or "feathered out" prior to repainting. As stated before, hand sanding, as opposed to harsher mechanical sanding, is recommended if the area is relatively limited. A coarse grit, open-coat flint sandpaper—the least expensive kind—is useful for this purpose because, as the sandpaper clogs with paint it must be discarded and this process repeated until all layers adhere uniformly.

Blocks made of wood or hard rubber and covered with sandpaper are useful for handsanding flat surfaces. Sanding sponges—rectangular sponges with an abrasive aggregate on their surfaces—are also available for detail work that requires reaching into grooves because the sponge easily conforms to curves and irregular surfaces. All sanding should be done with the grain.

Summary of Abrasive Methods (Manual)

Recommended: Putty knife, paint scraper, sandpaper, sanding block, sanding sponge.
Applicable areas of building: All areas.
For use on: Class I, Class II, and Class III conditions.
Health/Safety factors: Take precautions against lead dust, eye damage; dispose of lead paint residue properly.

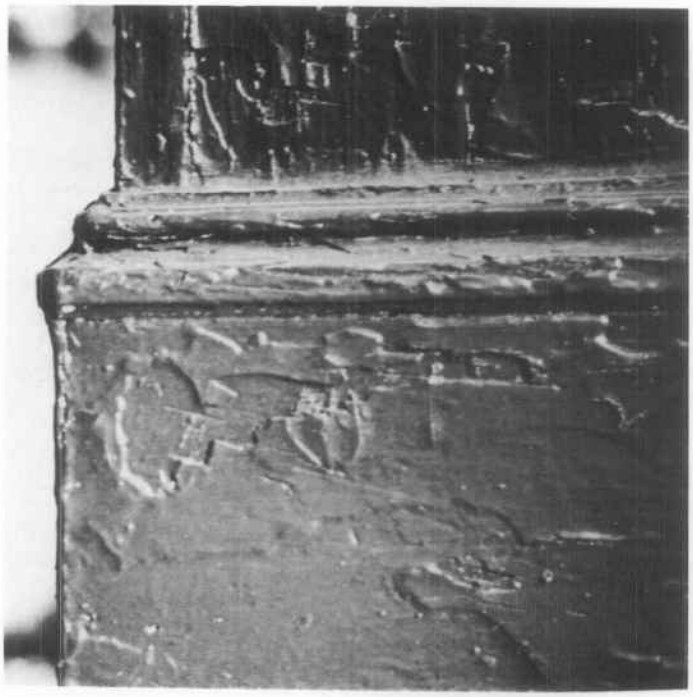

Fig. 10 *An excellent example of inadequate scraping before repainting, the problems here are far more than cosmetic. This improperly prepared surface will permit moisture to get behind the paint film which, in turn, will result in chipping and peeling. Photo: Baird M. Smith, AIA.*

- **Abrasive Methods (Mechanical)**

If hand sanding for purposes of surface preparation has not been productive or if the affected area is too large to consider hand sanding by itself, mechanical abrasive methods, i.e., power-operated tools may need to be employed; however, it should be noted that the majority of tools available for paint removal can cause damage to fragile wood and must be used with great care.

Recommended Abrasive Methods (Mechanical)

Orbital sander: Designed as a finishing or smoothing tool—not for the removal of multiple layers of paint—the oribital sander is thus recommended when limited paint removal is required prior to repainting. Because it sands in a small diameter circular motion (some models can also be switched to a back-and-forth vibrating action), this tool is particularly effective for "feathering" areas where paint has first been scraped (see figure 11). The abrasive surface varies from about 3×7 inches to 4×9 inches and sandpaper is attached either by clamps or sliding clips. A medium grit, open-coat aluminum oxide sandpaper should be used; fine sandpaper clogs up so quickly that it is ineffective for smoothing paint.

Belt sander: A second type of power tool—the belt sander—can also be used for removing limited layers of paint but, in this case, the abrasive surface is a continuous belt of sandpaper that travels at high speeds and consequently offers much less control than the orbital sander. Because of the potential for more damage to the paint or the wood, use of the belt sander (also with a medium grit sandpaper) should be limited to flat surfaces and only skilled operators should be permitted to operate it within a historic preservation project.

Fig. 11 *The orbital sander can be used for limited paint removal, i.e., for smoothing flat surfaces after the majority of deteriorated paint has already been scraped off. Photo: Charles E. Fisher, III.*

Not Recommended

Rotary Drill Attachments: Rotary drill attachments such as the rotary sanding disc and the rotary wire stripper should be avoided. The disc sander—usually a disc of sandpaper about 5 inches in diameter secured to a rubber based attachment which is in turn connected to an electric drill or other motorized housing—can easily leave visible circular depressions in the wood which are difficult to hide, even with repainting. The rotary wire stripper—clusters of metals wires similarly attached to an electric drill-type unit—can actually shred a wooden surface and is thus to be used exclusively for removing corrosion and paint from metals.

Waterblasting: Waterblasting above 600 p.s.i. to remove paint is not recommended because it can force water into the woodwork rather than cleaning loose paint and grime from the surface; at worst, high pressure waterblasting causes the water to penetrate exterior sheathing and damages interior finishes. A detergent solution, a medium soft bristle brush, and a garden hose for purposes of rinsing, is the gentlest method involving water and is recommended when cleaning exterior surfaces prior to repainting.

Sandblasting: Finally—and undoubtedly most vehemently "not recommended"—sandblasting painted exterior woodwork will indeed remove paint, but at the same time can scar wooden elements beyond recognition. As with rotary wire strippers, sandblasting erodes the soft porous fibers (spring wood) faster than the hard, dense fibers (summer wood), leaving a pitted surface with ridges and valleys. Sandblasting will also erode projecting areas of carvings and moldings before it removes paint from concave areas (see figure 12). Hence, this abrasive method is potentially the most damaging of all possibilities, even if a contractor promises that blast pressure can be controlled so that the paint is removed without harming the historic exterior woodwork. (For Additional Information, See Presevation Briefs 6, "Dangers of Abrasive Cleaning to Historic Buildings".)

Fig. 12 *Sandblasting has permanently damaged this ornamental bracket. Even paint will not be able to hide the deep erosion of the wood. Photo: David W. Look, AIA.*

Summary of Abrasive Methods (Mechanical)

Recommended: Orbital sander, belt sander (skilled operator only).
Applicable areas of building: Flat surfaces, i.e., siding, eaves, doors, window sills.
For use on: Class II and Class III conditions.
Health/Safety factors: Take precautions against lead dust and eye damage; dispose of lead paint residue properly.
Not Recommended: Rotary drill attachments, high pressure waterblasting, sandblasting.

- **Thermal Methods**

Where exterior surface conditions have been identified that warrant total paint removal such as peeling, cracking, or alligatoring, two thermal devices—the electric heat plate and the electric heat gun—have proven to be quite successful for use on different wooden elements of the historic building. One thermal method—the blow torch—is not recommended because it can scorch the wood or even burn the building down!

Recommended Thermal Methods

Electric heat plate: The electric heat plate (see figure 13) operates between 500 and 800 degrees Fahrenheit (not hot enough to vaporize lead paint), using about 15 amps of power. The plate is held close to the painted exterior surface until the layers of paint begin to soften and blister, then moved to an adjacent location on the wood while the softened paint is scraped off with a putty knife (it should be noted that the heat plate is most successful when the paint is very thick!). With practice, the operator can successfully move the heat plate evenly across a flat surface such as wooden siding or a window sill or door in a continuous motion, thus lessening the risk of scorching the wood in an attempt to reheat the edge of the paint sufficiently for effective removal. Since the electric heat plate's coil is "red hot," extreme caution should be taken to avoid igniting clothing or burning the skin. If an extension cord is used, it should be a heavy-duty cord (with 3-prong grounded plugs). A heat plate could overload a circuit or, even worse, cause an electrical fire; therefore, it is recommended that this implement be used with a single circuit and that a fire extinguisher always be kept close at hand.

Fig. 13 *The electric heat plate (with paint scraper) is particularly useful for removing paint down to bare wood on flat surfaces such as doors, window frames, and siding. After scraping, some light sanding will probably be necessary to smooth the surface prior to application of primer and top coats. Photo: David W. Look, AIA.*

Electric heat gun: The electric heat gun (electric hot-air gun) looks like a hand-held hairdryer with a heavy-duty metal case (see figure 14). It has an electrical resistance coil that typically heats between 500 and 750 degrees Fahrenheit and, again, uses about 15 amps of power which requires a heavy-duty extension cord. There are some heat guns that operate at higher temperatures but they should not be purchased for removing old paint

because of the danger of lead paint vapors. The temperature is controlled by a vent on the side of the heat gun. When the vent is closed, the heat increases. A fan forces a stream of hot air against the painted woodwork, causing a blister to form. At that point, the softened paint can be peeled back with a putty knife. It can be used to best advantage when a paneled door was originally varnished, then painted a number of times. In this case, the paint will come off quite easily, often leaving an almost pristine varnished surface behind. Like the heat plate, the heat gun works best on a heavy paint build-up. (It is, however, not very successful on only one or two layers of paint or on surfaces that have only been varnished. The varnish simply becomes sticky and the wood scorches.)

Although the heat gun is heavier and more tiring to use than the heat plate, it is particularly effective for removing paint from detail work because the nozzle can be directed at curved and intricate surfaces. Its use is thus more limited than the heat plate, and most successfully used in conjunction *with* the heat plate. For example, it takes about two to three hours to strip a paneled door with a heat gun, but if used in combination with a heat plate for the large, flat area, the time can usually be cut in half. Although a heat gun seldom scorches wood, it can cause fires (like the blow torch) if aimed at the dusty cavity between the exterior sheathing and siding and interior lath and plaster. A fire may smolder for hours before flames break through to the surface. Therefore, this thermal device is best suited for use on solid decorative elements, such as molding, balusters, fretwork, or "gingerbread."

Fig. 14 *The nozzle on the electric heat gun permits hot air to be aimed into cavities on solid decorative elements such as this applied column. After the paint has been sufficiently softened, it can be removed with a profiled scraper. Photo: Charles E. Fisher, III.*

Not Recommended

Blow Torch: Blow torches, such as hand-held propane or butane torches, were widely used in the past for paint removal because other thermal devices were not available. With this technique, the flame is directed toward the paint until it begins to bubble and loosen from the surface. Then the paint is scraped off with a putty knife. Although this is a relatively fast process, at temperatures between 3200 and 3800 degrees Fahrenheit the open flame is not only capable of burning a careless operator and causing severe damage to eyes or skin, it can easily scorch or ignite the wood. The other fire hazard is more insidious. Most frame buildings have an air space between the exterior sheathing and siding and interior lath and plaster. This cavity usually has an accumulation of dust which is also easily ignited by the open flame of a blow torch. Finally, lead-base paints will vaporize at high temperatures, releasing toxic fumes that can be unknowingly inhaled. Therefore, because both the heat plate and the heat gun are generally safer to use—that is, the risks are much more controllable—the blow torch should definitely be avoided!

Summary of Thermal Methods

Recommended: Electric heat plate, electric heat gun.
Applicable areas of building: Electric heat plate—flat surfaces such as siding, eaves, sash, sills, doors. Electric heat gun—solid decorative molding, balusters, fretwork, or "gingerbread."
For use on: Class III conditions.
Health/Safety factors: Take precautions against eye damage and fire. Dispose of lead paint residue properly.
Not Recommended: Blow torch.

- **Chemical Methods**

With the availability of effective thermal methods for total paint removal, the need for chemical methods—in the context of preparing historic exterior woodwork for repainting—becomes quite limited. Solvent-base or caustic strippers may, however, play a supplemental role in a number of situations, including:

- Removing paint residue from intricate decorative features, or in cracks or hard to reach areas if a heat gun has not been completely effective;
- Removing paint on window muntins because heat devices can easily break the glass;
- Removing varnish on exterior doors after all layers of paint have been removed by a heat plate/heat gun if the original varnish finish is being restored;
- Removing paint from detachable wooden elements such as exterior shutters, balusters, columns, and doors by dip-stripping when other methods are too laborious.

Recommended Chemical Methods
(Use With Extreme Caution)

Because all chemical paint removers can involve potential health and safety hazards, no wholehearted recommendations can be made from that standpoint. Commonly known as "paint removers" or "strippers," both solvent-base or caustic products are commercially available that, when poured, brushed, or sprayed on painted exterior woodwork are capable of softening several layers of paint at a time so that the resulting "sludge"—which should be remembered is nothing less than the sequence of historic

paint layers—can be removed with a putty knife. Detachable wood elements such as exterior shutters can also be "dip-stripped."

Solvent-base Strippers: The formulas tend to vary, but generally consist of combinations of organic solvents such as methylene chloride, isopropanol, toluol, xylol, and methanol; thickeners such as methyl cellulose; and various additives such as paraffin wax used to prevent the volatile solvents from evaporating before they have time to soak through multiple layers of paint. Thus, while some solvent-base strippers are quite thin and therefore unsuitable for use on vertical surfaces, others, called "semi-paste" strippers, are formulated for use on vertical surfaces or the underside of horizontal surfaces.

However, whether liquid or semi-paste, there are two important points to stress when using any solvent-base stripper: First, the vapors from the organic chemicals can be highly toxic if inhaled; skin contact is equally dangerous because the solvents can be absorbed; second, many solvent-base strippers are flammable. Even though application out-of-doors may somewhat mitigate health and safety hazards, a respirator with special filters for organic solvents is recommended and, of course, solvent-base strippers should never be used around open flames, lighted cigarettes, or with steel wool around electrical outlets.

Although appearing to be the simplest for exterior use, a particular type of solvent-base stripper needs to be mentioned here because it can actually cause the most problems. Known as "water-rinsable," such products have a high proportion of methylene chloride together with emulsifiers. Although the dissolved paint can be rinsed off with water with a minimum of scraping, this ultimately creates more of a problem in cleaning up and properly disposing of the sludge. In addition, these strippers can leave a gummy residue on the wood that requires removal with solvents. Finally, water-rinsable strippers tend to raise the grain of the wood more than regular strippers.

On balance, then, the regular strippers would seem to work just as well for exterior purposes and are perhaps even better from the standpoint of proper lead sludge disposal because they must be hand scraped as opposed to rinsed off (a coffee-can with a wire stretched across the top is one effective way to collect the sludge; when the putty knife is run across the wire, the sludge simply falls into the can. Then, when the can is filled, the wire is removed, the can capped, and the lead paint sludge disposed of according to local health regulations).

Caustic Strippers: Until the advent of solvent-base strippers, caustic strippers were used exclusively when a chemical method was deemed appropriate for total paint removal prior to repainting or refinishing. Now, it is more difficult to find commercially prepared caustic solutions in hardware and paint stores for home-owner use with the exception of lye (caustic soda) because solvent-base strippers packaged in small quantities tend to dominate the market.

Most commercial dip stripping companies, however, continue to use variations of the caustic bath process because it is still the cheapest method available for removing paint. Generally, dip stripping should be left to professional companies because caustic solutions can dissolve skin and permanently damage eyes as well as present serious disposal problems in large quantities.

If exterior shutters or other detachable elements are being sent out[6] for stripping in a caustic solution, it is wise to see samples of the company's finished work. While some companies do a first-rate job, others can leave a residue of paint in carvings and grooves. Wooden elements may also be soaked too long so that the wood grain is raised and roughened, requiring extensive hand sanding later. In addition, assurances should be given by these companies that caustic paint removers will be neutralized with a mild acid solution or at least thoroughly rinsed with water after dipping (a caustic residue makes the wood feel slippery). If this is not done, the lye residue will cause new paint to fail.

Summary of Chemical Methods

Recommended, with extreme caution: Solvent-base strippers, caustic strippers.
Applicable areas of buildings: decorative features, window muntins, doors, exterior shutters, columns, balusters, and railings.
For use on: Class III Conditions.
Health/Safety factors: Take precautions against inhaling toxic vapors; fire; eye damage; and chemical poisoning from skin contact. Dispose of lead residue properly

General Paint Type Recommendations

Based on the assumption that the exterior wood has been painted with oil paint many times in the past and the existing top coat is therefore also an oil paint,* it is recommended that for CLASS I and CLASS II paint surface conditions, a top coat of high quality oil paint be applied when repainting. The reason for recommending oil rather than latex paints is that a coat of latex paint applied directly over old oil paint is more apt to fail. The considerations are twofold. First, because oil paints continue to harden with age, the old surface is sensitive to the added stress of shrinkage which occurs as a new coat of paint dries. Oil paints shrink less upon drying than latex paints and thus do not have as great a tendency to pull the old paint loose. Second, when exterior oil paints age, the binder releases pigment particles, causing a chalky surface. Although for best results, the chalk (or dirt, etc.) should *always* be cleaned off prior to repainting, a coat of new oil paint is more able to penetrate a chalky residue and adhere than is latex paint. Therefore, unless it is possible to thoroughly clean a heavy chalked surface, oil paints—on balance—give better adhesion.

If however, a latex top coat is going to be applied over several layers of old oil paint, an oil primer should be applied first (the oil primer creates a flat, porous surface to which the latex can adhere). After the primer has thoroughly dried, a latex top coat may be applied. In the long run, changing paint types is more time consuming and expensive. An application of a new oil-type top coat on the old oil paint is, thus, the preferred course of action.

[6] Marking the original location of the shutter by number (either by stamping numbers into the end grain with metal numeral dies or cutting numbers into the end with a pen knife) will minimize difficulties when rehanging them.

* If the top coat is latex paint (when viewed by the naked eye or, preferably, with a magnifying glass, it looks like a series of tiny craters) it may either be repainted with new latex paint or with oil paint. Normal surface preparation should precede any repainting.

If **CLASS III** conditions have necessitated total paint removal, there are two options, both of which assure protection of the exterior wood: (1) an oil primer may be applied followed by an oil-type top coat, preferably by the same manufacturer; or (2) an oil primer may be applied followed by a latex top coat, again using the same brand of paint. It should also be noted that primers were never intended to withstand the effects of weathering; therefore, the top coat should be applied as soon as possible after the primer has dried.

Conclusion

The recommendations outlined in this Brief are cautious because at present there is no completely safe and effective method of removing old paint from exterior woodwork. This has necessarily eliminated descriptions of several methods still in a developmental or experimental stage, which can therefore neither be recommended nor precluded from future recommendation. With the ever-increasing number of buildings being rehabilitated, however, paint removal technology should be stimulated and, in consequence, existing methods refined and new methods developed which will respect both the historic wood and the health and safety of the operator.

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This publication has been prepared pursuant to The Economic Recovery Tax Act of 1981, which directs the Secretary of the Interior to certify rehabilitations of historic buildings that are consistent with their historic character; the advice and guidance in this brief will assist property owners in complying with the requirements of this law.

Preservation Briefs 10 has been developed under the technical editorship of Lee H. Nelson, AIA, Chief, Preservation Assistance Division, National Park Service, U.S. Department of the Interior, Washington, D.C. 20240. Comments on the usefulness of this information are welcomed and can be sent to Mr. Nelson at the above address.

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13 PRESERVATION BRIEFS

The Repair and Thermal Upgrading of Historic Steel Windows

Sharon C. Park, AIA

U.S. Department of the Interior
National Park Service
Cultural Resources
Heritage Preservation Services

The Secretary of the Interior's "Standards for Rehabilitation" require that where historic windows are individually significant features, or where they contribute to the character of significant facades, their distinguishing visual qualities must not be destroyed. Further, the rehabilitation guidelines recommend against changing the historic appearance of windows through the use of inappropriate designs, materials, finishes, or colors which radically change the sash, depth of reveal, and muntin configuration; the reflectivity and color of the glazing; or the appearance of the frame.

Windows are among the most vulnerable features of historic buildings undergoing rehabilitation. This is especially the case with rolled steel windows, which are often mistakenly not deemed worthy of preservation in the conversion of old buildings to new uses. The ease with which they can be replaced and the mistaken assumption that they cannot be made energy efficient except at great expense are factors that typically lead to the decision to remove them. In many cases, however, repair and retrofit of the historic windows are more economical than wholesale replacement, and all too often, replacement units are unlike the originals in design and appearance. If the windows are important in establishing the historic character of the building (see fig. 1), insensitively designed replacement windows may diminish—or destroy—the building's historic character.

This *Brief* identifies various types of historic steel windows that dominated the metal window market from 1890-1950. It then gives criteria for evaluating deterioration and for determining appropriate treatment, ranging from routine maintenance and weatherization to extensive repairs, so that replacement may be avoided where possible.[1] This information applies to do-it-yourself jobs and to large rehabilitations where the volume of work warrants the removal of all window units for complete overhaul by professional contractors.

This *Brief* is not intended to promote the repair of ferrous metal windows in every case, but rather to insure that preservation is always the first consideration in a rehabilitation project. Some windows are not important elements in defining a building's historic character; others are highly significant, but so deteriorated that repair is infeasible. In such cases, the *Brief* offers guidance in evaluating appropriate replacement windows.

Fig. 1 Often highly distinctive in design and craftsmanship, rolled steel windows play an important role in defining the architectural character of many later nineteenth and early twentieth century buildings. Art Deco, Art Moderne, the International Style, and Post World War II Modernism depended on the slim profiles and streamlined appearance of metal windows for much of their impact. Photo: William G. Johnson.

[1]The technical information given in this brief is intended for most ferrous (or magnetic) metals, particularly rolled steel. While stainless steel is a ferrous metal, the cleaning and repair techniques outlined here must not be used on it as the finish will be damaged. For information on cleaning stainless steel and non-ferrous metals, such as bronze, Monel, or aluminum, refer to *Metals in America's Historic Buildings* (see bibliography).

HISTORICAL DEVELOPMENT

Although metal windows were available as early as 1860 from catalogues published by architectural supply firms, they did not become popular until after 1890. Two factors combined to account for the shift from wooden to metal windows about that time. Technology borrowed from the rolling industry permitted the mass production of rolled steel windows. This technology made metal windows cost competitive with conventional wooden windows. In addition, a series of devastating urban fires in Boston, Baltimore, Philadelphia, and San Francisco led to the enactment of strict fire codes for industrial and multi-story commercial and office buildings.

As in the process of making rails for railroads, rolled steel windows were made by passing hot bars of steel through progressively smaller, shaped rollers until the appropriate angled configuration was achieved (see fig. 2). The rolled steel sections, generally 1/8'' thick and 1'' - 1 1/2'' wide, were used for all the components of the windows: sash, frame,and subframe (see fig. 3). With the addition of wire glass, a fire-resistant window resulted. These rolled steel windows are almost exclusively found in masonry or concrete buildings.

A byproduct of the fire-resistant window was the strong metal frame that permitted the installation of larger windows and windows in series. The ability to have expansive amounts of glass and increased ventilation dramatically changed the designs of late 19th and early 20th century industrial and commercial buildings.

The newly available, reasonably priced steel windows soon became popular for more than just their fire-resistant qualities. They were standardized, extremely durable, and easily transported. These qualities led to the use of steel windows in every type of construction, from simple industrial and institutional buildings to luxury commercial and apartment buildings. Casement, double-hung, pivot, projecting, austral, and continuous windows differed in operating and ventilating capacities. Figure 4 outlines the kinds and properties of metal windows available then and now. In addition, the thin profiles of metal windows contributed to the streamlined appearance of the Art Deco, Art Moderne, and International Styles, among others.

The extensive use of rolled steel metal windows continued until after World War II when cheaper, non-corroding aluminum windows became increasingly popular. While aluminum windows dominate the market today, steel windows are still fabricated. Should replacement of original windows become necessary, replacement windows may be available from the manufacturers of some of the earliest steel windows. Before an informed decision can be made whether to repair or replace metal windows, however, the significance of the windows must be determined and their physical condition assessed.

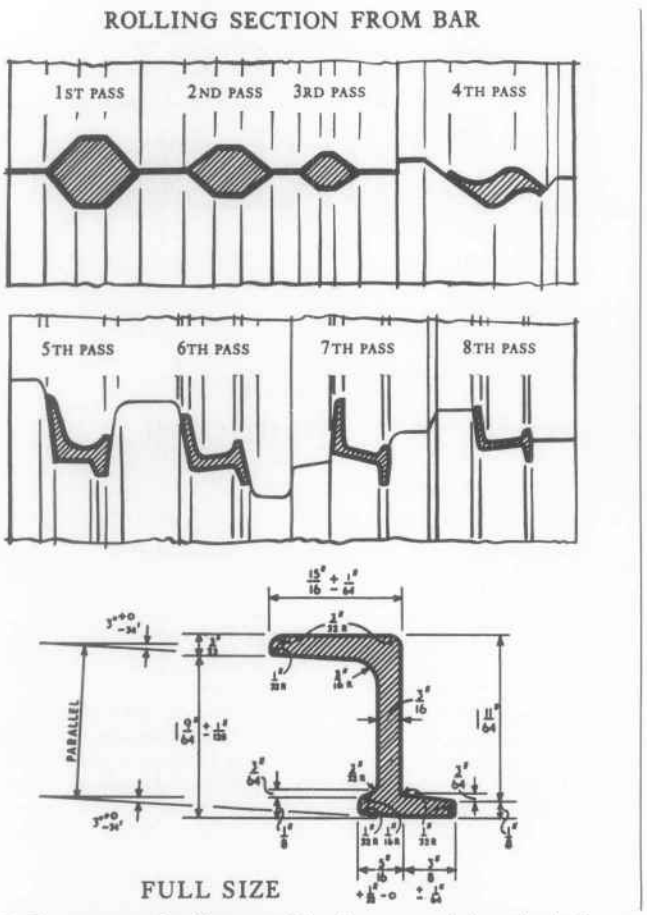


Fig. 2. The process of rolling a steel bar into an angled section is illustrated above. The shape and size of the rolled section will vary slightly depending on the overall strength needed for the window opening and the location of the section in the assembly: subframe, frame, or sash. The 1/8 '' thickness of the metal section is generally standard. Drawing: A Metal Window Dictionary. Used with permission.

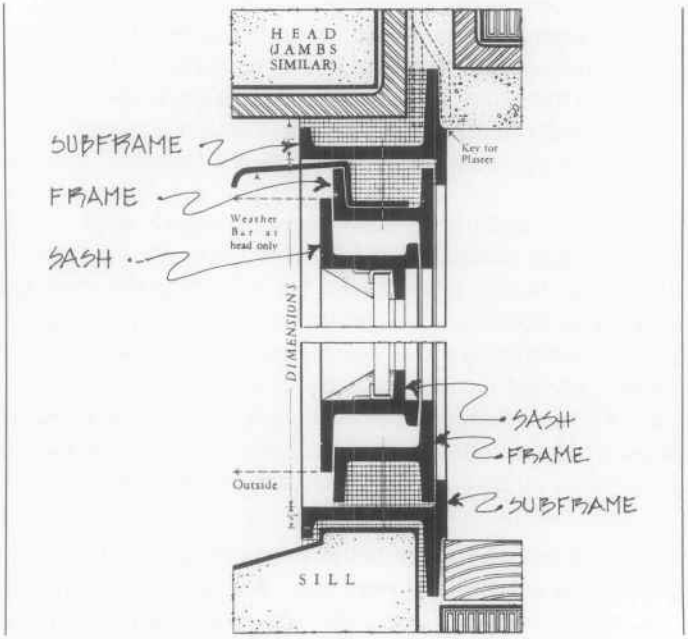


Fig. 3 A typical section through the top and bottom of a metal window shows the three component parts of the window assembly: subframe, frame, and sash. Drawings: Catalogue No. 15, January 1931; International Casement Co, Inc., presently Hope's Architectural Products, Inc., Jamestown, NY. Used with permission.

Cover illustration: from *Hope's Metal Windows and Casements: 1818-1926,* currently Hope's Architectural Products, Inc. Used with permission.

EVALUATION

Historic and Architectural Considerations

An assessment of the significance of the windows should begin with a consideration of their function in relation to the building's historic use and its historic character. Windows that help define the building's historic character should be preserved even if the building is being converted to a new use. For example, projecting steel windows used to introduce light and an effect of spaciousness to a warehouse or industrial plant can be retained in the conversion of such a building to offices or residences.

Other elements in assessing the relative importance of the historic windows include the design of the windows and their relationship to the scale, proportion, detailing and architectural style of the building. While it may be easy to determine the aesthetic value of highly ornamented windows, or to recognize the importance of streamlined windows as an element of a style, less elaborate windows can also provide strong visual interest by their small panes or projecting planes when open, particularly in simple, unadorned industrial buildings (see fig. 5).

One test of the importance of windows to a building is to ask if the overall appearance of the building would be changed noticeably if the windows were to be removed or radically altered. If so, the windows are important in defining the building's historic character, and should be repaired if their physical condition permits.

Physical Evaluation

Steel window repair should begin with a careful evaluation of the physical condition of each unit. Either drawings or photographs, liberally annotated, may be used to record the location of each window, the type of operability, the condition of all three parts—sash, frame and subframe—and the repairs essential to its continued use.

Specifically, the evaluation should include: presence and degree of corrosion; condition of paint; deterioration of the metal sections, including bowing, misalignment of the sash, or bent sections; condition of the glass and glazing compound; presence and condition of all hardware, screws, bolts, and hinges; and condition of the masonry or concrete surrounds, including need for caulking or resetting of improperly sloped sills.

Corrosion, principally rusting in the case of steel windows, is the controlling factor in window repair; therefore, the evaluator should first test for its presence. Corrosion can be light, medium, or heavy, depending on how much the rust has penetrated the metal sections. If the rusting is merely a surface accumulation or flaking, then the corrosion is light. If the rusting has penetrated the metal (indicated by a bubbling texture), but has not caused any structural damage, then the corrosion is medium. If the rust has penetrated deep into the metal, the corrosion is heavy. Heavy corrosion generally results in some form of structural damage,through delamination, to the metal section, which must then be patched or spliced. A sharp probe or tool, such as an ice pick, can be used to determine the extent of corrosion in the metal. If the probe can penetrate the surface of the metal and brittle strands can be dug out, then a high degree of corrosive deterioration is present.

In addition to corrosion, the condition of the paint, the presence of bowing or misalignment of metal sections, the amount of glass needing replacement, and the condition of the masonry or concrete surrounds must be assessed in the evaluation process. These are key factors in determining whether or not the windows can be repaired in place. The more complete the inventory of existing conditions, the easier it will be to determine whether repair is feasible or whether replacement is warranted.

Rehabilitation Work Plan

Following inspection and analysis, a plan for the rehabilitation can be formulated. The actions necessary to return windows to an efficient and effective working condition will fall into one or more of the following categories: routine maintenance, repair, and weatherization. The routine maintenance and weatherization measures described here are generally within the range of do-it-yourselfers. Other repairs, both moderate and major, require a professional contractor. Major repairs normally require the removal of the window units to a workshop, but even in the case of moderate repairs, the number of windows involved might warrant the removal of all the deteriorated units to a workshop in order to realize a more economical repair price. Replacement of windows should be considered only as a last resort.

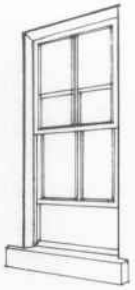
Since moisture is the primary cause of corrosion in steel windows, it is essential that excess moisture be eliminated and that the building be made as weathertight as possible before any other work is undertaken. Moisture can accumulate from cracks in the masonry, from spalling mortar, from leaking gutters, from air conditioning condensation runoff, and from poorly ventilated interior spaces.

Finally, before beginning any work, it is important to be aware of health and safety risks involved. Steel windows have historically been coated with lead paint. The removal of such paint by abrasive methods will produce toxic dust. Therefore, safety goggles, a toxic dust respirator, and protective clothing should be worn. Similar protective measures should be taken when acid compounds are used. Local codes may govern the methods of removing lead paints and proper disposal of toxic residue.

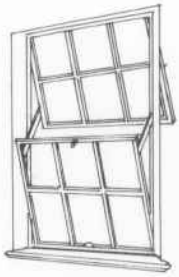
ROUTINE MAINTENANCE

A preliminary step in the routine maintenance of steel windows is to remove surface dirt and grease in order to ascertain the degree of deterioration, if any. Such minor cleaning can be accomplished using a brush or vacuum followed by wiping with a cloth dampened with mineral spirits or denatured alcohol.

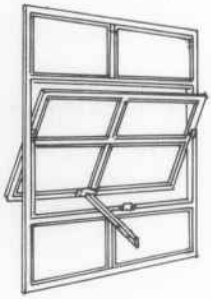
Double-hung industrial windows duplicated the look of traditional wooden windows. Metal double-hung windows were early examples of a building product adapted to meet stringent new fire code requirements for manufacturing and high-rise buildings in urban areas. Soon supplanted in industrial buildings by less expensive pivot windows, double-hung metal windows regained popularity in the 1940s for use in speculative suburban housing.



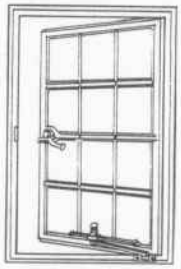
Austral windows were also a product of the 1920s. They combined the appearance of the double-hung window with the increased ventilation and ease of operation of the projected window. (When fully opened, they provided 70% ventilation as compared to 50% ventilation for double-hung windows.) Austral windows were often used in schools, libraries and other public buildings.



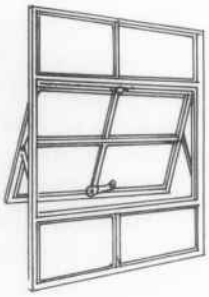
Pivot windows were an early type of industrial window that combined inexpensive first cost and low maintenance. Pivot windows became standard for warehouses and power plants where the lack of screens was not a problem. The window shown here is a horizontal pivot. Windows that turned about a vertical axis were also manufactured (often of iron). Such vertical pivots are rare today.



Casement windows adapted the English tradition of using wrought iron casements with leaded cames for residential use. Rolled steel casements (either single, as shown, or paired) were popular in the 1920s for cottage style residences and Gothic style campus architecture. More streamlined casements were popular in the 1930s for institutional and small industrial buildings.



Projecting windows, sometimes called awning or hopper windows, were perfected in the 1920s for industrial and institutional buildings. They were often used in "combination" windows, in which upper panels opened out and lower panels opened in. Since each movable panel projected to one side of the frame only, unlike pivot windows, for example, screens could be introduced.



Continuous windows were almost exclusively used for industrial buildings requiring high overhead lighting. Long runs of clerestory windows operated by mechanical tension rod gears were typical. Long banks of continuous windows were possible because the frames for such windows were often structural elements of the building.

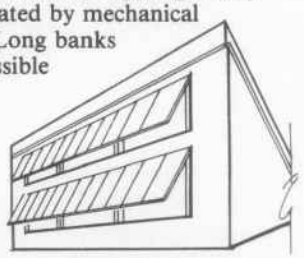


Fig. 4 Typical rolled steel windows available from 1890 to the present. The various operating and ventilating capacities in combination with the aesthetics of the window style were important considerations in the selection of one window type over another. Drawings: Sharon C. Park, AIA.

If it is determined that the windows are in basically sound condition, the following steps can be taken: 1) removal of light rust, flaking and excessive paint; 2) priming of exposed metal with a rust-inhibiting primer; 3) replacement of cracked or broken glass and glazing compound; 4) replacement of missing screws or fasteners; 5) cleaning and lubrication of hinges; 6) repainting of all steel sections with two coats of finish paint compatible with the primer; and 7) caulking the masonry surrounds with a high quality elastomeric caulk.

Recommended methods for removing light rust include manual and mechanical abrasion or the application of chemicals. Burning off rust with an oxy-acetylene or propane torch, or an inert gas welding gun, should never be attempted because the heat can distort the metal. In addition, such intense heat (often as high as 3800° F) vaporizes the lead in old paint, resulting in highly toxic fumes. Furthermore, such heat will likely result in broken glass. Rust can best be removed using a wire brush, an aluminum oxide sandpaper, or a variety of power tools

Fig. 5 Windows often provide a strong visual element to relatively simple or unadorned industrial or commercial buildings. This design element should be taken into consideration when evaluating the significance of the windows. Photo: Michael Auer.

adapted for abrasive cleaning such as an electric drill with a wire brush or a rotary whip attachment. Adjacent sills and window jambs may need protective shielding.

Rust can also be removed from ferrous metals by using a number of commercially prepared anti-corrosive acid compounds. Effective on light and medium corrosion, these compounds can be purchased either as liquids or gels. Several bases are available, including phosphoric acid, ammonium citrate, oxalic acid and hydrochloric acid. Hydrochloric acid is generally not recommended; it can leave chloride deposits, which cause future corrosion. Phosphoric acid-based compounds do not leave such deposits, and are therefore safer for steel windows. However, any chemical residue should be wiped off with damp cloths, then dried immediately. Industrial blow-dryers work well for thorough drying. The use of running water to remove chemical residue is never recommended because the water may spread the chemicals to adjacent surfaces, and drying of these surfaces may be more difficult. Acid cleaning compounds will stain masonry; therefore plastic sheets should be taped to the edge of the metal sections to protect the masonry surrounds. The same measure should be followed to protect the glazing from etching because of acid contact.

Measures that remove rust will ordinarily remove flaking paint as well. Remaining loose or flaking paint can be removed with a chemical paint remover or with a pneumatic needle scaler or gun, which comes with a series of chisel blades and has proven effective in removing flaking paint from metal windows. Well-bonded paint may serve to protect the metal further from corrosion, and need not be removed unless paint build-up prevents the window from closing tightly. The edges should be feathered by sanding to give a good surface for repainting.

Next, any *bare* metal should be wiped with a cleaning solvent such as denatured alcohol, and dried immediately in preparation for the application of an anti-corrosive primer. Since corrosion can recur very soon after metal has been exposed to the air, the metal should be primed immediately after cleaning. Spot priming may be required periodically as other repairs are undertaken. Anti-corrosive primers generally consist of oil-alkyd based paints rich in zinc or zinc chromate.[2] Red lead is no longer available because of its toxicity. All metal primers, however, are toxic to some degree and should be handled carefully. Two coats of primer are recommended. Manufacturer's recommendations should be followed concerning application of primers.

REPAIR

Repair in Place

The maintenance procedures described above will be insufficient when corrosion is extensive, or when metal window sections are misaligned. Medium to heavy corrosion that has not done any structural damage to the metal sections can be removed either by using the chemical cleaning process described under "Routine Maintenance" or by sandblasting. Since sandblasting can damage the masonry surrounds and crack or cloud the glass, metal or plywood shields should be used to protect these materials. The sandblasting pressure should be low, 80-100 pounds per square inch, and the grit size should be in the range of #10-#45. Glass peening beads (glass pellets) have also been successfully used in cleaning steel sections. While sandblasting equipment comes with various nozzle sizes, pencil-point blasters are most useful because they give the operator more effective control over the direction of the spray. The small aperture of the pencil-point blaster is also useful in removing dried putty from the metal sections that hold the glass. As with any cleaning technique, once the bare metal is exposed to air, it should be primed as soon as possible. This includes the inside rabbeted section of sash where glazing putty has been removed. To reduce the dust, some local codes allow only wet blasting. In this case, the metal must be dried immediately, generally with a blow-drier (a step that the owner should consider when calculating the time and expense involved). Either form of sandblasting metal covered with lead paints produces toxic dust. Proper precautionary measures should be taken against toxic dust and silica particles.

Bent or bowed metal sections may be the result of damage to the window through an impact or corrosive expansion. If the distortion is not too great, it is possible to realign the metal sections without removing the window to a metal fabricator's shop. The glazing is generally removed and pressure is applied to the bent or bowed section. In the case of a muntin, a protective 2 x 4 wooden bracing can be placed behind the bent portion and a wire cable with a winch can apply progressively more pressure over several days until the section is realigned. The 2 x 4 bracing is necessary to distribute the pressure evenly over the damaged section. Sometimes a section, such as the bottom of the frame, will bow out as a result of pressure exerted by corrosion and it is often necessary to cut the metal section to relieve this pressure prior to pressing the section back into shape and making a welded repair.

Once the metal sections have been cleaned of all corrosion and straightened, small holes and uneven areas resulting from rusting should be filled with a patching material and sanded smooth to eliminate pockets where water can accumulate. A patching material of steel fibers and an epoxy binder may be the easiest to apply. This steel-based epoxy is available for industrial steel repair; it can also be found in auto body patching compounds or in plumber's epoxy. As with any product, it is important to follow the manufacturer's instructions for proper use and best results. The traditional patching technique—melting steel welding rods to fill holes in the metal sections—may be difficult to apply in some situations; moreover, the window glass must be removed during the repair process, or it will crack from the expansion of the heated metal sections. After these repairs, glass replacement, hinge lubrication, painting, and other cosmetic repairs can be undertaken as necessary.

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[2]Refer to Table IV. Types of Paint Used for Painting Metal in *Metals in America's Historic Buildings*, p. 139. (See bibliography).

To complete the checklist for routine maintenance, cracked glass, deteriorated glazing compound, missing screws, and broken fasteners will have to be replaced; hinges cleaned and lubricated; the metal windows painted, and the masonry surrounds caulked. If the glazing must be replaced, all clips, glazing beads, and other fasteners that hold the glass to the sash should be retained, if possible, although replacements for these parts are still being fabricated. When bedding glass, use only glazing compound formulated for metal windows. To clean the hinges (generally brass or bronze), a cleaning solvent and fine bronze wool should be used. The hinges should then be lubricated with a non-greasy lubricant specially formulated for metals and with an anti-corrosive agent. These lubricants are available in a spray form and should be used periodically on frequently opened windows.

Final painting of the windows with a paint compatible with the anti-corrosive primer should proceed on a dry day. (Paint and primer from the same manufacturer should be used.) Two coats of finish paint are recommended if the sections have been cleaned to bare metal. The paint should overlap the glass slightly to insure weathertightness at that connection. Once the paint dries thoroughly, a flexible exterior caulk can be applied to eliminate air and moisture infiltration where the window and the surrounding masonry meet.

Caulking is generally undertaken after the windows have received at least one coat of finish paint. The perimeter of the masonry surround should be caulked with a flexible elastomeric compound that will adhere well to both metal and masonry. The caulking used should be a type intended for exterior application, have a high tolerance for material movement, be resistant to ultraviolet light, and have a minimum durability of 10 years. Three effective compounds (taking price and other factors into consideration) are polyurethane, vinyl acrylic, and butyl rubber. In selecting a caulking material for a window retrofit, it is important to remember that the caulking compound may be covering other materials in a substrate. In this case, some compounds, such as silicone, may not adhere well. Almost all modern caulking compounds can be painted after curing completely. Many come in a range of colors, which eliminates the need to paint. If colored caulking is used, the windows should have been given two coats of finish paint prior to caulking.

Repair in Workshop

Damage to windows may be so severe that the window sash and sometimes the frame must be removed for cleaning and extensive rust removal, straightening of bent sections, welding or splicing in of new sections, and reglazing. These major and expensive repairs are reserved for highly significant windows that cannot be replaced; the procedures involved should be carried out only by skilled workmen. (see fig. 6a—6f.)

As part of the orderly removal of windows, each window should be numbered and the parts labelled. The operable metal sash should be dismantled by removing the hinges; the fixed sash and, if necessary, the frame can then be unbolted or unscrewed. (The subframe is usually left in place. Built into the masonry surrounds, it can only be cut out with a torch.) Hardware and hinges should be labelled and stored together.

The two major choices for removing flaking paint and corrosion from severely deteriorated windows are dipping in a chemical bath or sandblasting. Both treatments require removal of the glass. If the windows are to be dipped, a phosphoric acid solution is preferred, as mentioned earlier. While the dip tank method is good for fairly evenly distributed rust, deep set rust may remain after dipping. For that reason, sandblasting is more effective for heavy and uneven corrosion. Both methods leave the metal sections clean of residual paint. As already noted, after cleaning has exposed the metal to the air, it should be primed immediately after drying with an anti-corrosive primer to prevent rust from recurring.

Sections that are seriously bent or bowed must be straightened with heat and applied pressure in a workshop. Structurally weakened sections must be cut out, generally with an oxy-acetylene torch, and replaced with sections welded in place and the welds ground smooth. Finding replacement metal sections, however, may be difficult. While most rolling mills are producing modern sections suitable for total replacement, it may be difficult to find an exact profile match for a splicing repair. The best source of rolled metal sections is from salvaged windows, preferably from the same building. If no salvaged windows are available, two options remain. Either an ornamental metal fabricator can weld flat plates into a built-up section, or a steel plant can mill bar steel into the desired profile.

While the sash and frame are removed for repair, the subframe and masonry surrounds should be inspected. This is also the time to reset sills or to remove corrosion from the subframe, taking care to protect the masonry surrounds from damage.

Missing or broken hardware and hinges should be replaced on all windows that will be operable. Salvaged windows, again, are the best source of replacement parts. If matching parts cannot be found, it may be possible to adapt ready-made items. Such a substitution may require filling existing holes with steel epoxy or with plug welds and tapping in new screw holes. However, if the hardware is a highly significant element of the historic window, it may be worth having reproductions made.

Following are illustrations of the repair and thermal upgrading of the rolled steel windows in a National Historic Landmark (fig. 6). Many of the techniques described above were used during this extensive rehabilitation. The complete range of repair techniques is then summarized in the chart titled *Steps for Cleaning and Repairing Historic Steel Windows* (see fig. 7).

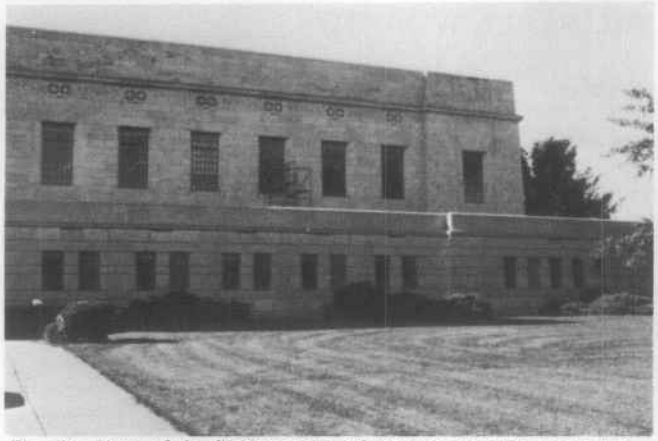

Fig. 6 a. View of the flanking wing of the State Capitol where the rolled steel casement windows are being removed for repair.

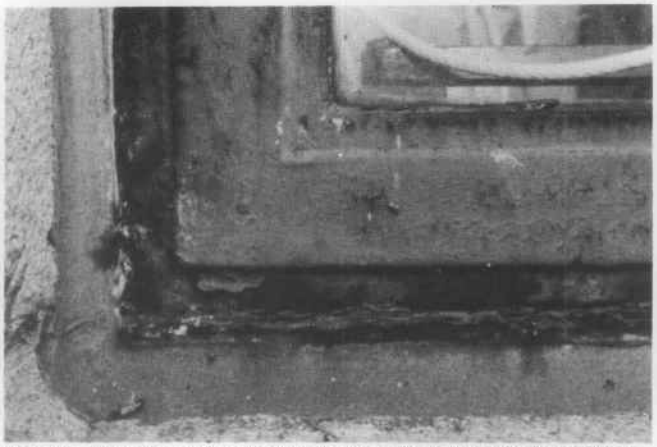

Fig. 6 b. View from the exterior showing the deteriorated condition of the lower corner of a window prior to repair. While the sash was in relatively good condition, the frame behind was rusted to the point of inhibiting operation.

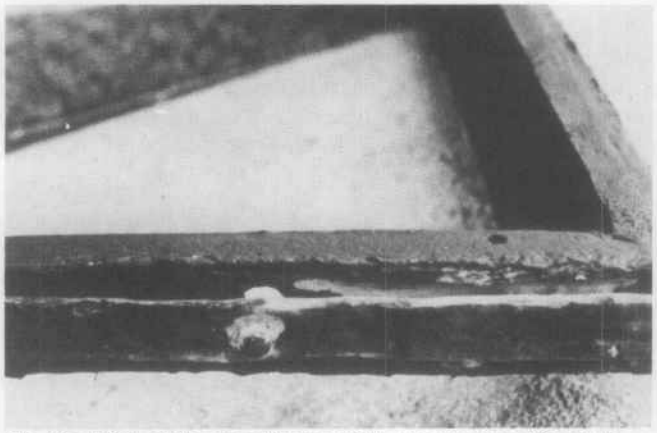

Fig. 6 c. View of the rusted frame which was unscrewed from the subframe and removed from the window opening and taken to a workshop for sandblasting. In some cases, severely deteriorated sections of the frame were replaced with new sections of milled bar steel.

Fig. 6 d. View looking down towards the sill. The subframes appeared very rusted, but were in good condition once debris was vacuumed and surface rust was removed, in place, with chemical compounds. Where necessary, epoxy and steel filler was used to patch depressions in order to make the subframe serviceable again.

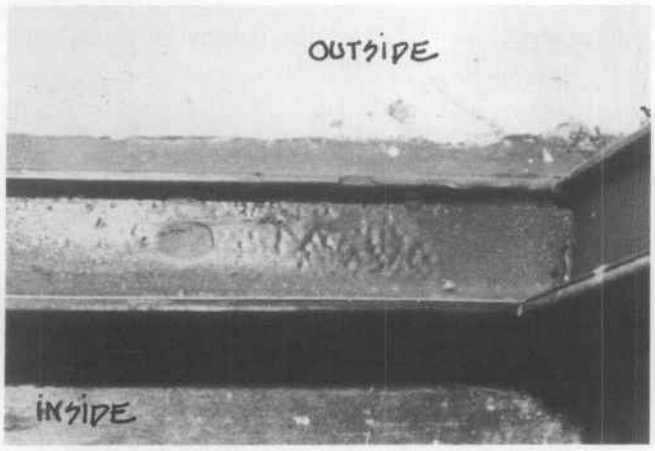

Fig. 6 e. View looking down towards the sill. The cleaned frame was reset in the window opening. The frame was screwed to the refurbished subframe at the jamb and the head only. The screw holes at the sill, which had been the cause of much of the earlier rusting, were infilled. Vinyl weatherstripping was added to the frame.

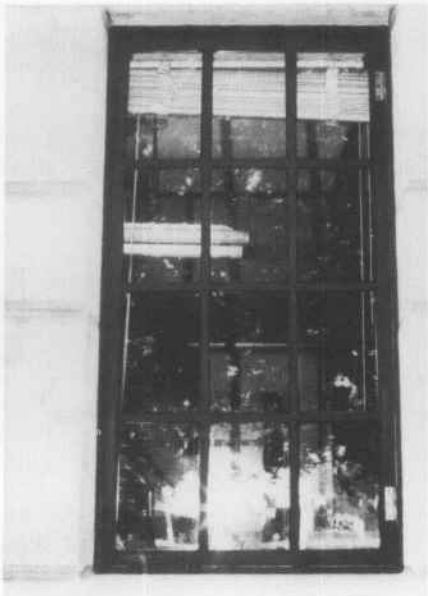

Fig. 6 f. View from the outside of the completely refurbished window. In addition to the steel repair and the installation of vinyl weatherstripping, the exterior was caulked with polyurethane and the single glass was replaced with individual lights of thermal glass. The repaired and upgraded windows have comparable energy efficiency ratings to new replacement units while retaining the historic steel sash, frames and subframes.

Fig. 6. The repair and thermal upgrading of the historic steel windows at the State Capitol, Lincoln, Nebraska. This early twentieth century building, designed by Bertram Goodhue, is a National Historic Landmark. Photos: All photos in this series were provided by the State Building Division.

STEPS FOR CLEANING AND REPAIRING HISTORIC STEEL WINDOWS

Work Item	Recommended Techniques	Tools, Products and Procedures	Notes
	*(Must be done in a workshop)		
1. Removing dirt and grease from metal	General maintenance and chemical cleaning	Vacuum and bristle brushes to remove dust and dirt; solvents (denatured alcohol, mineral spirits), and clean cloths to remove grease.	Solvents can cause eye and skin irritation. Operator should wear protective gear and work in ventilated area. Solvents should not contact masonry. Do not flush with water.
2. Removing Rust/ Corrosion			
Light	Manual and mechanical abrasion	Wire brushes, steel wool, rotary attachments to electric drill, sanding blocks and disks.	Handsanding will probably be necessary for corners. Safety goggles and masks should be worn.
	Chemical cleaning	Anti-corrosive jellies and liquids (phosphoric acid preferred); clean damp cloths.	Protect glass and metal with plastic sheets attached with tape. Do not flush with water. Work in ventilated area.
Medium	Sandblasting/abrasive cleaning	Low pressure (80-100 psi) and small grit (#10-#45); glass peening beads. Pencil blaster gives good control.	Removes both paint and rust. Codes should be checked for environmental compliance. Prime exposed metal promptly. Shield glass and masonry. Operator should wear safety gear.
Heavy	*Chemical dip tank	Metal sections dipped into chemical tank (phosphoric acid preferred) from several hours to 24 hours.	Glass and hardware should be removed. Protect operator. Deepset rust may remain, but paint will be removed.
	*Sandblasting/ abrasive cleaning	Low pressure (80-100 psi) and small grit (#10-#45).	Excellent for heavy rust. Remove or protect glass. Prime exposed metal promptly. Check codes for environmental compliance. Operator should wear safety gear.
3. Removing flaking paint.	Chemical method	Chemical paint strippers suitable for ferrous metals. Clean cloths.	Protect glass and masonry. Do not flush with water. Have good ventilation and protection for operator.
	Mechanical abrasion	Pneumatic needle gun chisels, sanding disks.	Protect operator; have good ventilation. Well-bonded paint need not be removed if window closes properly.
4. Aligning bent, bowed metal sections	Applied pressure	Wooden frame as a brace for cables and winch mechanism.	Remove glass in affected area. Realignment may take several days.
	*Heat and pressure	Remove to a workshop. Apply heat and pressure to bend back.	Care should be taken that heat does not deform slender sections.

Work Item	Recommended Techniques	Tools, Products and Procedures	Notes
	*(Must be done in a workshop)		
5. Patching depressions	Epoxy and steel filler	Epoxy fillers with high content of steel fibers; plumber's epoxy or autobody patching compound.	Epoxy patches generally are easy to apply, and can be sanded smooth. Patches should be primed.
	Welded patches	Weld in patches using steel rods and oxy-acetylene torch or arc welder.	Prime welded sections after grinding connections smooth.
6. Splicing in new metal sections	*Cut out decayed sections and weld in new or salvaged sections	Torch to cut out bad sections back to 45° joint. Weld in new pieces and grind smooth.	Prime welded sections after grinding connection smooth.
7. Priming metal sections	Brush or spray application	At least one coat of anti-corrosive primer on bare metal. Zinc-rich primers are generally recommended.	Metal should be primed as soon as it is exposed. If cleaned metal will be repaired another day, spot prime to protect exposed metal.
8. Replacing missing screws and bolts	Routine maintenance	Pliers to pull out or shear off rusted heads. Replace screws and bolts with similar ones, readily available.	If new holes have to be tapped into the metal sections, the rusted holes should be cleaned, filled and primed prior to redrilling.
9. Cleaning, lubricating or replacing hinges and other hardware	Routine maintenance, solvent cleaning	Most hinges and closure hardware are bronze. Use solvents (mineral spirits), bronze wool and clean cloths. Spray with non-greasy lubricant containing anti-corrosive agent.	Replacement hinges and fasteners may not match the original exactly. If new holes are necessary, old ones should be filled.
10. Replacing glass and glazing compound	Standard method for application	Pliers and chisels to remove old glass, scrape putty out of glazing rabbet, save all clips and beads for reuse. Use only glazing compound formulated for metal windows.	Heavy gloves and other protective gear needed for the operator. All parts saved should be cleaned prior to reinstallation.
11. Caulking masonry surrounds	Standard method for application	Good quality (10 year or better) elastomeric caulking compound suitable for metal.	The gap between the metal frame and the masonry opening should be caulked; keep weepholes in metal for condensation run-off clear of caulk.
12. Repainting metal windows	Spray or brush	At least 2 coats of paint compatible with the anti-corrosive primer. Paint should lap the glass about 1/8" to form a seal over the glazing compound.	The final coats of paint and the primer should be from the same manufacturer to ensure compatibility. If spraying is used, the glass and masonry should be protected.

Fig. 7. STEPS FOR CLEANING AND REPAIRING HISTORIC STEEL WINDOWS. Compiled by Sharon C. Park, AIA.

WEATHERIZATION

Historic metal windows are generally not energy efficient; this has often led to their wholesale replacement. Metal windows can, however, be made more energy efficient in several ways, varying in complexity and cost. Caulking around the masonry openings and adding weatherstripping, for example, can be do-it-yourself projects and are important first steps in reducing air infiltration around the windows. They usually have a rapid payback period. Other treatments include applying fixed layers of glazing over the historic windows, adding operable storm windows, or installing thermal glass in place of the existing glass. In combination with caulking and weatherstripping, these treatments can produce energy ratings rivaling those achieved by new units.[1]

Weatherstripping

The first step in any weatherization program, caulking, has been discussed above under "Routine Maintenance." The second step is the installation of weatherstripping where the operable portion of the sash, often called the ventilator, and the fixed frame come together to reduce perimeter air infiltration (see fig. 8). Four types of weatherstripping appropriate for metal windows are spring-metal, vinyl strips, compressible foam tapes, and sealant beads. The spring-metal, with an integral friction fit mounting clip, is recommended for steel windows in good condition. The clip eliminates the need for an applied glue; the thinness of the material insures a tight closure. The weatherstripping is clipped to the inside channel of the rolled metal section of the fixed frame. To insure against galvanic corrosion between the weatherstripping (often bronze or brass), and the steel window, the window must be painted prior to the installation of the weatherstripping. This weatherstripping is usually applied to the entire perimeter of the window opening, but in some cases, such as casement windows, it may be best to avoid weatherstripping the hinge side. The natural wedging action of the weatherstripping on the three sides of the window often creates an adequate seal.

Vinyl weatherstripping can also be applied to metal windows. Folded into a "V" configuration, the material forms a barrier against the wind. Vinyl weatherstripping is usually glued to the frame, although some brands have an adhesive backing. As the vinyl material and the applied glue are relatively thick, this form of weatherstripping may not be appropriate for all situations.

Compressible foam tape weatherstripping is often best for large windows where there is a slight bending or distortion of the sash. In some very tall windows having closure hardware at the sash mid-point, the thin sections of the metal window will bow away from the frame near the top. If the gap is not more than 1/4", foam weatherstripping can normally fill the space. If the gap exceeds this, the window may need to be realigned to close more tightly. The foam weatherstripping comes either with an adhesive or plain back; the latter variety requires application with glue. Compressible foam requires more frequent replacement than either spring-metal or vinyl weatherstripping.

A fourth type of successful weatherstripping involves the use of a caulking or sealant bead and a polyethylene bond breaker tape. After the window frame has been thoroughly cleaned with solvent, permitted to dry, and primed, a neat bead of low modulus (firm setting) caulk, such as silicone, is applied. A bond breaker tape is then applied to the operable sash covering the metal section where contact will occur. The window is then closed until the sealant has set (2-7 days, depending on temperature and humidity). When the window is opened, the bead will have taken the shape of the air infiltration gap and the bond breaker tape can be removed. This weatherstripping method appears to be successful for all types of metal windows with varying degrees of air infiltration.

Since the several types of weatherstripping are appropriate for different circumstances, it may be necessary to use more than one type on any given building. Successful weatherstripping depends upon using the thinnest material adequate to fill the space through which air enters. Weatherstripping that is too thick can spring the hinges, thereby resulting in more gaps.

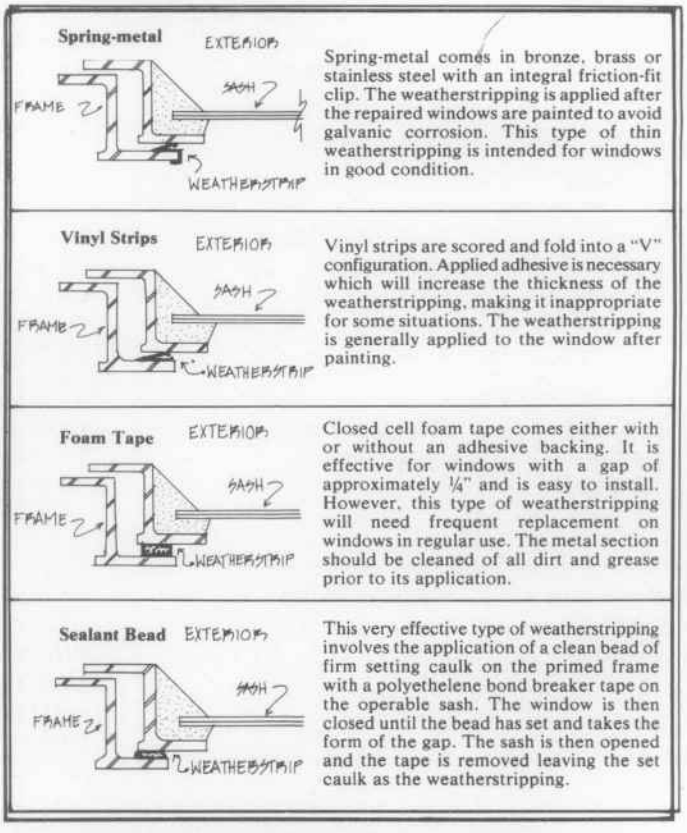

Fig. 8 APPROPRIATE TYPES OF WEATHERSTRIPPING FOR METAL WINDOWS. Weatherstripping is an important part of upgrading the thermal efficiency of historic steel windows. The chart above shows the jamb section of the window with the weatherstripping in place. Drawings: Sharon C. Park, AIA.

[1]One measure of energy efficiency is the U-value (the number of BTUs per hour transferred through a square foot of material). The lower the U-value, the better the performance. According to *ASHRAE HANDBOOK-1977 Fundamentals,* the U-value of historic rolled steel sash with single glazing is 1.3. Adding storm windows to the existing units or reglazing with 5/8" insulating glass produces a U-value of .69. These methods of weatherizing historic steel windows compare favorably with rolled steel replacement alternatives: with factory installed 1" insulating glass (.67 U-value); with added thermal-break construction and factory finish coatings (.62 U-value).

Thermal Glazing

The third weatherization treatment is to install an additional layer of glazing to improve the thermal efficiency of the existing window. The decision to pursue this treatment should proceed from careful analysis. Each of the most common techniques for adding a layer of glazing will effect approximately the same energy savings (approximately double the original insulating value of the windows); therefore, cost and aesthetic considerations usually determine the choice of method. Methods of adding a layer of glazing to improve thermal efficiency include adding a new layer of transparent material to the window; adding a separate storm window; and replacing the single layer of glass in the window with thermal glass.

The least expensive of these options is to install a clear material (usually rigid sheets of acrylic or glass) over the original window. The choice between acrylic and glass is generally based on cost, ability of the window to support the material, and long-term maintenance outlook. If the material is placed over the entire window and secured to the frame, the sash will be inoperable. If the continued use of the window is important (for ventilation or for fire exits), separate panels should be affixed to the sash without obstructing operability (see fig. 9). Glass or acrylic panels set in frames can be attached using magnetized gaskets, interlocking material strips, screws or adhesives. Acrylic panels can be screwed directly to the metal windows, but the holes in the acrylic panels should allow for the expansion and contraction of this material. A compressible gasket between the prime sash and the storm panel can be very effective in establishing a thermal cavity between glazing layers. To avoid condensation, 1/8" cuts in a top corner and diagonally opposite bottom corner of the gasket will provide a vapor bleed, through which moisture can evaporate. (Such cuts, however, reduce thermal performance slightly.) If condensation does occur, however, the panels should be easily removable in order to wipe away moisture before it causes corrosion.

The second method of adding a layer of glazing is to have independent storm windows fabricated. (Pivot and austral windows, however, which project on either side of the window frame when open, cannot easily be fitted with storm windows and remain operational.) The storm window should be compatible with the original sash configuration. For example, in paired casement windows, either specially fabricated storm casement windows or sliding units in which the vertical meeting rail of the slider reflects the configuration of the original window should be installed. The decision to place storm windows on the inside or outside of the window depends on whether the historic window opens in or out, and on the visual impact the addition of storm windows will have on the building. Exterior storm windows, however, can serve another purpose besides saving energy: they add a layer of protection against air pollutants and vandals, although they will partially obscure the prime window. For highly ornamental windows this protection can determine the choice of exterior rather then interior storm windows.

The third method of installing an added layer of glazing is to replace the original single glazing with thermal glass. Except in rare instances in which the original glass is of special interest (as with stained or figured glass), the glass can be replaced if the hinges can tolerate the weight of the additional glass. The rolled metal sections for steel windows are generally from 1" - 1 1/2" thick. Sash of this thickness can normally tolerate thermal glass, which ranges from 3/8" - 5/8". (Metal glazing beads, readily available, are used to reinforce the muntins, which hold the glass.) This treatment leaves the window fully operational while preserving the historic appearance. It is, however, the most expensive of the treatments discussed here. (See fig. 6f).

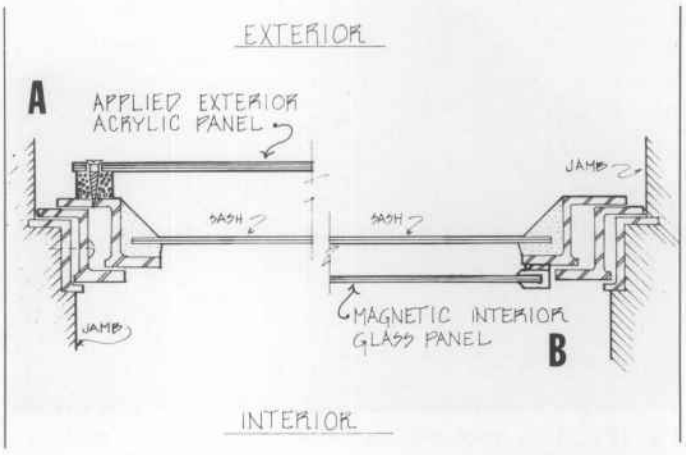

Fig. 9 Two examples of adding a second layer of glazing in order to improve the thermal performance of historic steel windows. Scheme A (showing jamb detail) is of a ¼" acrylic panel with a closed cell foam gasket attached with self-tapping stainless steel screws directly to the exterior of the outwardly opening sash. Scheme B (showing jamb detail) is of a glass panel in a magnetized frame affixed directly to the interior of the historic steel sash. The choice of using glass or acrylic mounted on the inside or outside will depend on the ability of the window to tolerate additional weight, the location and size of the window, the cost, and the long-term maintenance outlook. Drawing: Sharon C. Park, AIA.

WINDOW REPLACEMENT

Repair of historic windows is always preferred within a rehabilitation project. Replacement should be considered only as a last resort. However, when the extent of deterioration or the unavailability of replacement sections renders repair impossible, replacement of the entire window may be justified. In the case of significant windows, replacement in kind is essential in order to maintain the historic character of the building. However, for less significant windows, replacement with compatible new windows may be acceptable. In selecting compatible replacement windows, the material, configuration, color, operability, number and size of panes, profile and proportion of metal sections, and reflective quality of the original glass should be duplicated as closely as possible.

A number of metal window manufacturing companies produce rolled steel windows. While stock modern window designs do not share the multi-pane configuration of

historic windows, most of these manufacturers can reproduce the historic configuration if requested, and the cost is not excessive for large orders (see figs. 10a and 10b). Some manufacturers still carry the standard pre-World War II multi-light windows using the traditional 12" x 18" or 14" x 20" glass sizes in industrial, commercial, security, and residential configurations. In addition, many of the modern steel windows have integral weatherstripping, thermal break construction, durable vinyl coatings, insulating glass, and other desirable features.

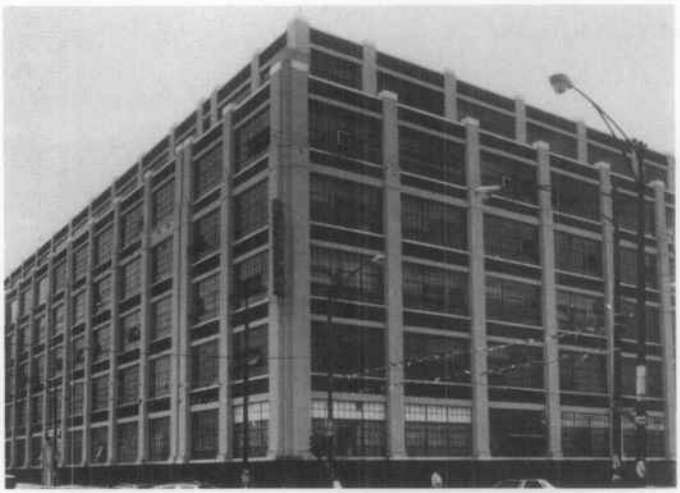

Fig. 10 a. A six-story concrete manufacturing building prior to the replacement of the steel pivot windows. Photo: Charles Parrott.

Fig. 10 b. Close-up view of the new replacement steel windows which matched the multi-lighted originals exactly. Photo: Charles Parrott.

Windows manufactured from other materials generally cannot match the thin profiles of the rolled steel sections. Aluminum, for example, is three times weaker than steel and must be extruded into a box-like configuration that does not reflect the thin historic profiles of most steel windows. Wooden and vinyl replacement windows generally are not fabricated in the industrial style, nor can they reproduce the thin profiles of the rolled steel sections, and consequently are generally not acceptable replacements.

For product information on replacement windows, the owner, architect, or contractor should consult manufacturers' catalogues, building trade journals, or the Steel Window Institute, 1230 Keith Building, Cleveland, Ohio 44115.

SUMMARY

The National Park Service recommends the retention of significant historic metal windows whenever possible. Such windows, which can be a character-defining feature of a historic building, are too often replaced with inappropriate units that impair rather than complement the overall historic appearance. The repair and thermal upgrading of historic steel windows is more practicable than most people realize. Repaired and properly maintained metal windows have greatly extended service lives. They can be made energy efficient while maintaining their contribution to the historic character of the building.

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This publication has been prepared pursuant to the Economic Recovery Tax Act of 1981, which directs the Secretary of the Interior to certify rehabilitations of historic buildings that are consistent with their historic character; the guidance provided in this brief will assist property owners in complying with the requirements of this law.

Preservation Briefs: 13 has been developed under the technical editorship of Lee H. Nelson, AIA, Chief, Preservation Assistance Division, National Park Service, U.S. Department of the Interior, Washington, D.C. 20240. Comments on the usefulness of this information are welcomed and can be sent to Mr. Nelson at the above address.

37 PRESERVATION BRIEFS

Appropriate Methods for Reducing Lead-Paint Hazards in Historic Housing

Sharon C. Park, FAIA, and Douglas C. Hicks

National Park Service
U.S. Department of the Interior
Heritage Preservation Services

Lead-based paint, a toxic material, was widely used in North America on both the exteriors and interiors of buildings until well into the second half of the twentieth century. If a "historic" place is broadly defined in terms of time as having attained an age of fifty years, this means that almost every historic house contains some lead-based paint. In its deteriorated form, it produces paint chips and lead-laden dust particles that are a known health hazard to both children and adults. Children are particularly at risk when they ingest lead paint dust through direct hand-to-mouth contact and from toys or pacifiers. They are also at risk when they chew lead-painted surfaces in accessible locations. In addition to its presence in houses, leaded paint chips, lead dust, or lead-contaminated soil in play areas can elevate a child's blood lead level to a degree that measures to reduce and control the hazard should be undertaken (see Action Level Chart, page 6)

The premise of this Preservation Brief is that historic housing can be made lead-safe for children without removing significant decorative features and finishes, or architectural trimwork that may contribute to the building's historic character (see fig. 1). *Historic housing* — encompassing private dwellings and all types of rental units—is necessarily the focus of this Brief because federal and state laws primarily address the hazards of lead and

Before

After

Figure 1. A large-scale historic rehabilitation project incorporated sensitive lead-hazard reduction measures. Interior walls and woodwork were cleaned, repaired, and repainted and compatible new floor coverings added. The total project was economically sound and undertaken in a careful manner that preserved the building's historic character. Photos: Landmarks Design Associates.

lead-based paint in housing and day-care centers to protect the health of children under six years of age. Rarely are there mandated requirements for the removal of lead-based paint from non-residential buildings.

Ideally, most owners and managers should understand the health hazards created by lead-based paint and voluntarily control these hazards to protect young children. A stricter approach has been taken by some state and federal funding programs which have compliance requirements for identifying the problem, notifying tenants, and, in some cases, remedying lead hazards in housing (see Legislation Sidebar, pg.15). With new rules being written, and new products and approaches being developed, it is often difficult to find systematic and balanced methodologies for dealing with lead-based paint in historic properties.

This Preservation Brief is intended to serve as an introduction to the complex issue of historic lead-based paint and its management. It explains how to plan and implement lead-hazard control measures to strike a balance between preserving a historic building's significant materials and features and protecting human health and safety, as well as the environment. It is not meant to be a "how-to guide" for undertaking the work. Such a short-cut approach could easily result in creating a greater health risk, if proper precautions were not taken. Home renovators and construction workers should be aware that serious health problems can be caused by coming into contact with lead. For this reason, there are also laws to protect workers on the job site (see Worker Safety Sidebar, pg. 4). Controlling the amount of waste containing lead-based paint residue will also reduce the impact on the environment. All of these considerations must be weighed against the goal of providing housing that is safe for children.

Lead in Historic Paints

Lead compounds were an important component of many historic paints. Lead, in the forms of lead carbonate and lead oxides, had excellent adhesion, drying, and covering abilities. White lead, linseed oil, and inorganic pigments were the basic components for paint in the 18th, 19th, and early 20th centuries. Lead-based paint was used extensively on wooden exteriors and interior trimwork, window sash, window frames, baseboards, wainscoting, doors, frames, and high gloss wall surfaces such as those found in kitchens and bathrooms. Almost all painted metals were primed with red lead or painted with lead-based paints. Even milk (casein) and water-based paints (distemper and calcimines) could contain some lead, usually in the form of hiding agents or pigments. Varnishes sometimes contained lead. Lead compounds were also used as driers in paint and window glazing putty.

In 1978, the use of lead-based paint in residential housing was banned by the federal government. Because the hazards have been known for some time, many lead components of paint were replaced by titanium and other less toxic elements earlier in the 20th century. Since houses are periodically repainted, the most recent layer of paint will most likely *not* contain lead, but the older layers underneath probably will. Therefore, the only way to accurately determine the amount of lead present in older paint is to have it analyzed.

It is important that owners of historic properties be aware that layers of older paint can reveal a great deal about the history of a building and that paint chronology is often used to date alterations or to document decorative period colors (see figs. 2, 3). Highly significant decorative finishes, such as graining, marbleizing, stenciling, polychrome decoration, and murals should be evaluated by a painting conservator to develop the appropriate preservation treatment that will stabilize the paint and eliminate the need to remove it. If such finishes must be removed in the process of controlling lead hazards, then research, paint analysis, and documentation are advisable as a record for future research and treatment.

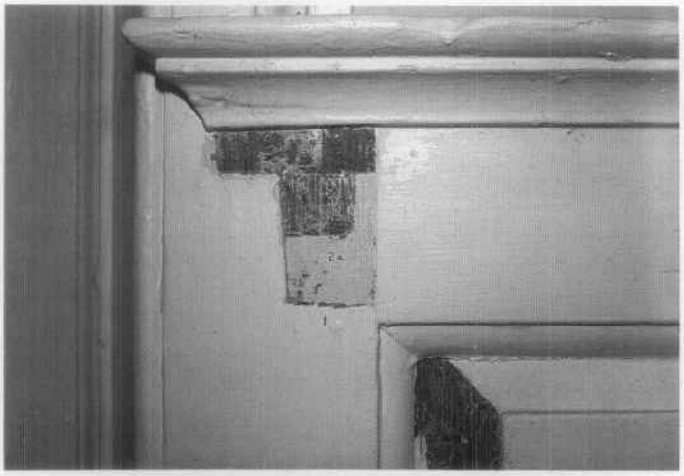

Figure 2. The paint chronology of this mantel, seen in the exposed paint layers in the left corner, proved it had been relocated from another room of the house. To remove a significant feature's paint history and the evidence of its original sequence of color by stripping off all the paint is inappropriate — and unnecessary — as part of a lead hazard reduction project. Careful surface preparation and repainting with lead-free top coats is recommended. Photo: NPS Files.

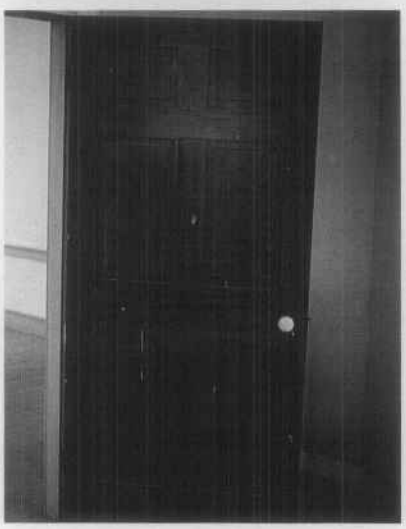

Figure 3. Significant architectural features and their finishes should not be removed during a project incorporating lead hazard controls. If the decorative stencilling above, or hand grained doors below, or painted murals need repair, then a paint conservator should be consulted. Once loose paint is consolidated or otherwise stabilized, a clear finish or other reversible clear protective surface or coating can be added to areas subject to impact or abrasion. Photos: NPS Files.

Planning for Lead Hazard Reduction in Historic Housing

Typical health department guidelines call for removing as much of the surfaces that contain lead-based paint as possible. *This results in extensive loss or modification of architectural features and finishes and is not appropriate for most historic properties* (see fig. 4). A great number of federally-assisted housing programs are moving away from this approach as too expensive and too dangerous to the immediate work environment. A preferred approach, consistent with *The Secretary of the Interior's Standards for the Treatment of Historic Properties*, calls for removing, controlling, or managing the hazards rather than wholesale—or even partial—removal of the historic features and finishes (fig. 5). This is generally achieved through careful cleaning and treatment of deteriorating paint, friction surfaces, surfaces accessible to young children, and lead in soil (see figs. 6, 7). Lead-based paint that it not causing a hazard is thus permitted to remain, and, in consequence, the amount of historic finishes, features and trimwork removed from a property is minimized.

Because the hazard of lead poisoning is tied to the risk of ingesting lead, careful planning can help to determine how much risk is present and how best to allocate available financial resources. An owner, with professional assistance, can protect a historic resource and make it lead-safe using this three-step planning process:

I. Identify the historical significance of the building and architectural character of its features and finishes;

II. Undertake a risk assessment of interior and exterior surfaces to determine the hazards from lead and lead-based paint; and,

III. Evaluate the options for lead hazard control in the context of historic preservation standards.

I. Identify the historical significance of the building and architectural character of its features and finishes

The historical significance, integrity, and architectural character of the building always need to be assessed before work is undertaken that might adversely affect them. An owner may need to enlist the help of a preservation architect, building conservator or historian. The State Historic Preservation Office (SHPO) may be able to provide a list of knowledgeable preservation professionals who could assist with this evaluation.

Before

After

Figure 4. The typical method for abating lead-based paint through substrate removal is not consistent with the Standards for Rehabilitation. In this project, all the historic trim, base panels, and the transom were removed. While the unit is lead-safe, its character has been severly altered. Figure 5 shows a similar, but successful, balance of historic preservation and lead hazard control work. Photo: NPS Files.

Before

After

Figure 5. When historic interiors are rehabilitated, it is possible to remove the offending substance, such as deteriorated paint, without removing the features. In this case, the walls were repaired, and the trim and base panels were stripped of paint to a sound substrate, then repainted. Photos: Landmarks Design Associates.

Worker Safety

Low-level heat guns can be used to remove lead-based paint from significant historic windows and trimwork, but a worker exposed to lead dust over an extended period of time must be protected from the hazards created during the process of paint removal. Photo: Williamsport Preservation Training Center.

Current worker safety standards were established by OSHA's 29 CFR Part 1926, Lead Exposure in Construction; Interim Final Rule, which became effective June 3, 1993. These standards base levels of worker protection on exposure to airborne lead dust. They are primarily targeted to persons working within the construction industry, but apply to any workers who are exposed to lead dust for longer than a specific amount of time and duration. The Interim Final Rule establishes an action level of 30 micrograms of lead dust per cubic meter of air (30 ug/m^3) based on an eight hour, time-weighted average, as the level at which employers must initiate compliance activities; and it also establishes 50 ug/m^3 of lead dust as the permitted exposure level (PEL) for workers.

The standard identifies responsibilities before, during, and after the actual abatement activity necessary to protect the worker. Before the project begins, it requires an exposure assessment, a written compliance plan, initial medical surveillance, and training. The exposure assessment determines whether a worker may be exposed to lead. OSHA has identified a number of work tasks expected to produce dust levels between 50 and 500 ug/m^3 of air, including manual demolition, manual scraping, manual sanding, heat gun applications, general cleanup, and power tool use when the power tool is equipped with a dust collection system. It is an OSHA requirement that, at a minimum, a HEPA filtered half-face respirator with a protection factor of 10 be used for these operations. Initial blood lead level (BLL) base lines are established for each worker. Actual dust levels are monitored by air sampling of representative work activities, generally by an industrial hygienist or an environmental monitoring firm. Protective equipment is determined by the dust level. For all workers exposed at, or above, the action level for over 30 days in a 12-month period, BLLs are tested on a regular basis of every 2 months for the first 6 months and every 6 months thereafter. After completing a project, maintenance, medical surveillance, and recordkeeping responsibilities continue.

HEPA vacuums, HEPA respirators, and HEPA filters, which substantially reduce exposure to lead dust, are available through laboratory safety and supply catalogs and vendors.

Copies of 29 CFR Part 1926, Lead Exposure in Construction: Interim Final Rule, are available from the Department of Labor, Occupational Safety and Health Administration, or may be found in any library with a current edtion of the Code of Federal Regulation (CFR).

Features and finishes of a historic building that exhibit distinctive characteristics of an architectural style; represent work by specialized craftsmen; or possess high artistic value should be identified so they can be protected and preserved during treatment. When it is absolutely necessary to remove a significant architectural feature or finish—as noted in the first two priorities listed below—it should be replaced with a new feature and finish that matches in design, detail, color, texture, and, in most cases, material.

Figure 6. Deteriorating operable windows often contribute to lead dust in a house. Peeling paint and small particles from abraded surfaces collect in window troughs or sills and are then carried inside by air currents, settling on floors. When the lead dust mixes with regular house dust, it can easily be ingested by a child through hand to mouth contact. In homes with small children, floors and other surfaces should be kept as clean as possible to avoid lead contamination.

Figure 7. Chalking exterior paint can cause dangerous lead levels in soil around a house. Lead levels are usually highest in the one foot wide area adjacent to the building foundation. In these cases, the existing soil should be replaced with new soil or sod. This is particularly important if children and small pets play in contaminated areas, then inadvertently track the dirt inside.

Finally, features and finishes that characterize simple, vernacular buildings should be retained and preserved; in the process of removing hazards, there are usually reasonable options for their protection. Wholesale removal of historic trim, and other seemingly less important historic material, undermines a building's overall character and integrity and, thus, is never recommended.

For each historic property, features will vary in significance. As part of a survey of each historic property (see figure 8), a list of priorities should be made, in this order:

- *Highly significant features and finishes that should always be protected and preserved;*
- *Significant features and finishes that should be carefully repaired or, if necessary, replaced in-kind or to match all visual qualities; and*
- *Non-significant or altered areas where removal, rigid enclosure, or replacement could occur.*

This hierarchy gives an owner a working guide for making decisions about appropriate methods of removing lead paint.

Before

After

Figure 8. A survey of the property will help establish priorities for treatment based on its historical significance and physical condition. In this 1878 plank house, the original interlocking planks, corner details, projecting rafter tails, and original windows were considered highly significant features and were carefully stripped of failing paint using chemical poultices and HEPA sanding, then repainted. The less significant, but character-defining, painted porch flooring was replaced in new, but matching material. The non-historic porch screening was removed entirely. Photo before: Bryan Blundell; Photo after: Deborah Birch.

II. Undertake a risk assessment of interior and exterior surfaces to determine hazards from lead and lead-based paint.

While it can be assumed that most historic housing contains lead-based paint, it cannot be assumed that it is causing a health risk and should be removed. The purpose of a risk assessment is to determine, through testing and evaluation, where hazards from lead warrant remedial action (see fig. 9). Testing by a specialist can be done on paint, soil, or lead dust either on-site or in a laboratory using methods such as x-ray fluorescence (XRF) analyzers, chemicals, dust wipe tests, and atomic absorption spectroscopy. Risk assessments can be fairly low cost investigations of the location, condition, and severity of lead hazards found in house dust, soil, water, and deteriorating paint. Risk assessments will also address other sources of lead from hobbies, crockery, water, and the parents' work environment. A public health office should be able to provide names of certified risk assessors, paint inspectors, and testing laboratories. These services are critical when owners are seeking to implement measures to reduce suspected lead hazards in housing, day-care centers, or when extensive rehabilitations are planned.

The risk assessment should record:

- *the paint's location*
- *the paint's condition*
- *lead content of paint and soil*
- *the type of surface (friction; accessible to children for chewing; impact)*
- *how much lead dust is actively present*
- *how the family uses and cares for the house*
- *the age of the occupants who might come into contact with lead paint.*

a

b

c

Figure 9. A variety of testing methods are used to establish how much lead is in paint and where this paint is located: a home test kit *(a) is a good screening device to determine if lead is present, but it should not be relied upon exclusively; an* X-ray Fluorescence *machine or scanner (b), used by a licensed professional, determines, without disturbing the surface, if lead is present in underlying layers of paint; and a* dust wipe test *(c), sent to a laboratory for processing, can be used as either a clearance test, once work is completed, or as a monitoring device to determine if lead dust is present on surfaces. Paint chips can also be sent to a laboratory for analysis to determine the exact amount of lead by weight in a sample.*

ACTION LEVELS

Check with a Regional Environmental Protection Agency (EPA) office or appropriate state authorities if you have questions about applicable action levels that may change over time.

Blood Lead Levels are generally established from drawn blood and not from a finger stick test that may be unreliable. Units are measured in micrograms per deciliter (μg/dL) and reflect the Centers for Disease Control (CDC) Standards in effect in 2006.

Children:
- <10 μg/dL normal; no action needed
- 10-14 μg/dL; slight concern; look for lead source
- 15-19 μg/dL; mild concern; counseling; medical monitoring
- 20-44 μg/dL; moderate-high concern; must find/reduce lead source
- >45 μg/dL; very serious; hospitalization and removal of lead source

Adults:
- 25 μg/dL; level of concern; find source of lead
- >50 μg/dL; Occupational Safety and Health Administration (OSHA) Standard for medical removal from the worksite.

Lead in paint: Paint with lead levels greater than or equal to 1.0 milligrams per square centimeter, or more that 0.5% by weight is considered lead-based paint.

Lead dust wipes should be below the following:
- Floors; 40 μg/ft2
- Window sills; 250 μg/ft2
- Window troughs; 400 μg/ft2

Lead in soil: measured in parts per million (ppm)
Hazardous conditions:
- Play area residential soil; 400 ppm
- Soil in remaining yard areas; 1200 ppm

It is important from a health standpoint that future tenants, painters, and construction workers know that lead-based paint is present, even under treated surfaces, in order to take precautions when work is undertaken in areas that will generate lead dust. Whenever mitigation work is completed, it is important to have a clearance test using the *dust wipe method* to ensure that lead-laden dust generated during the work does not remain at levels above those established by the Environmental Protection Agency (EPA) and the Department of Housing and Urban Development (HUD) (see Action Levels Chart, above). A building file should be maintained and updated whenever any additional lead hazard control work is completed.

Hazards should be removed, mitigated, or managed in the order of their health threat, as identified in a risk assessment (with 1. the greatest risk and 8. the least dangerous):

1. Peeling, chipping, flaking, and chewed interior lead-based paint and surfaces
2. Lead dust on interior surfaces
3. High lead in soil levels around the house and in play areas (check state requirements)
4. Deteriorated exterior painted surfaces and features
5. Friction surfaces subject to abrasion (windows, doors, painted floors)
6. Accessible, chewable surfaces (sills, rails) if small children are present
7. Impact surfaces (baseboards and door jambs)
8. Other interior surfaces showing age or deterioration (walls and ceilings)

III. Evaluate options for hazard control in the context of historic preservation standards.

The Secretary of the Interior's Standards for the Treatment of Historic Properties—established principles used to evaluate work that may impact the integrity and significance of National Register properties—can help guide suitable health control methods. The *preservation standards* call for the protection of historic materials and historic character of buildings through stabilization, conservation, maintenance, and repair. The *rehabilitation standards* call for the repair of historic materials with replacement of a character-defining feature appropriate only when its deterioration or damage is so extensive that repair is infeasible. From a preservation standpoint, selecting a hazard control method that removes *only* the deteriorating paint, or that involves some degree of repair, is always preferable to the total replacement of a historic feature.

By tying the remedial work to the areas of risk, it is possible to limit the amount of intrusive work on delicate or aging features of a building without jeopardizing the health and safety of the occupants. To make historic housing lead-safe, the gentlest method possible should be used to remove the offending substance—lead-laden dust, visible paint chips, lead in soil, or extensively deteriorated paint. Overly aggressive abatement may damage or destroy much more historic material than is necessary to remove lead paint, such as abrading historic surfaces. Another reason for targeting paint removal is to limit the amount of lead dust on the work site. This, in turn, helps avoid expensive worker protection, cleanup, and disposal of larger amounts of hazardous waste.

Whenever extensive amounts of lead must be removed from a property, or when methods of removing toxic substances will impact the environment, it is extremely important that the owner be aware of the issues surrounding worker safety, environmental controls, and proper disposal (see fig. 10, 11). Appropriate architectural, engineering and environmental professionals should be consulted when lead hazard projects are complex.

Following are brief explanations of the two approaches for controlling lead hazards, once they have been identified as a risk. These controls are recommended by the Department of Housing and Urban Development in *Guidelines for the Evaluation and Control of Lead-Paint Hazards in Housing*, and are summarized here to focus on the special considerations for historic housing:

Interim Controls: Short-term solutions include thorough dust removal; thorough washdown and clean-up of exposed surfaces; paint film stabilization and repainting; covering of lead-contaminated soil; and making tenants aware of lead hazards. Interim controls require ongoing maintenance and evaluation.

Figure 10. The choice of paint removal method will trigger various environmental controls and worker protection. The chemical poultice-type paint remover uses a paper backing that keeps the lead waste contained for proper disposal. The worker is adequately protected by a suit and gloves; for this work a respirator was not required. Local laws required containment and neutralization of any after-wash water run off. Photo: NPS Files.

Figure 11. New methods are being developed or adapted to safely remove lead-based paint from various substrates. On this cast iron building undergoing rehabilitation for apartment units, multiple layers of lead-based paint were removed with pneumatic needle guns with vacuum attachments. Paint chips and waste containing lead-based paint were placed in 55 gallon drums for transport to a special waste site, and the workers were fully protected. The cleaned metal was primed and repainted. Photo: Building Conservation Associates, Inc.

Hazard Abatement: Long-term solutions are defined as having an expected life of 20 years or more, and involve permanent removal of hazardous paint through chemicals, heat guns or controlled sanding/abrasive methods; permanent removal of deteriorated painted features through replacement; the removal or permanent covering of contaminated soil; and the use of enclosures (such as drywall) to isolate painted surfaces. The use of specialized elastomeric encapsulant paints and coatings can be considered as permanent containment of lead-based paint if they receive a 20-year manufacturer's warranty or are approved by a certified risk assessor. One should be aware of their advantages and drawbacks for use in historic housing.

Within the context of the historic preservation standards, the most appropriate method will always be the least invasive. More invasive approaches are considered only under the special circumstances outlined in the three-step process. An inverted triangle (see fig. 12) shows the greatest number of residential projects fall well within the "interim controls" section. Most housing can be made safe for children using these sensitive treatments, particularly if no renovation work is anticipated. Next, where owners may have less control over the care and upkeep of housing and rental units, more aggressive means of removing hazards may be needed. Finally, large-scale projects to rehabilitate housing or convert non-residential buildings to housing may successfully incorporate "hazard abatement" as a part of the overall work.

Appropriate Methods for Controlling Lead Hazards

In selecting appropriate methods for controlling lead hazards, it is important to refer to Step I. of the survey where architecturally significant features and finishes are identified and need to be preserved. Work activities will vary according to hazard abatement needs; for example, while an interim control would be used to stabilize paint on most trimwork, an accessible window sill might need to be stripped prior to repainting. Since paint on a window sill is usually not a significant finish, such work would be appropriate. Other appropriate methods for controlling lead hazards are summarized in the accompanying chart (see fig. 13).

The method selected for removing or controlling the hazards has a direct bearing on the type of worker protection as well as the type of disposal needed, if waste is determined to be hazardous (see fig. 14). Following are

Figure 12. An inverted triangle makes the point that most of the nation's housing can be made lead-safe using interim control methods, such as dust control, paint stabilization, and good housekeeping. Shaded from light to dark, the lighter interim controls will generally not harm the historic materials. The darker, more aggressive controls, can be implemented with rehabilitation projects where paint removal, selective replacement of deteriorated elements, and encapsulation or enclosure are incorporated into other work.

MANAGING OR REMOVING LEAD-BASED PAINT IN HISTORIC BUILDINGS

Interim solutions, the preferred approach, include a combination of the following:

General maintenance	Dust control	Paint stabilization	Soil treatment	Tenant education
Repair deteriorated materials; Control leaks; Maintain exterior roofs, siding, etc. to keep moisture out of building; Perform emergency repairs quickly if lead-based paint is exposed; Maintain building file with lead test data and reports, receipts or invoices on completed lead mitigation work.	Damp mop floor; wet broom sweep porches and steps; Damp dust window sills and window troughs; Washdown painted surfaces periodically (use tri-sodium phosphate or equivalent, if necessary); Clean or vacuum carpets regularly (use HEPA vacuum if lead dust returns); Undertake periodic inspection with annual dust wipe tests.	Wet-sand loose paint and repaint; Keep topcoats of paint in good condition; Selectively remove paint from friction & chewable surfaces (sills) and repaint; Use good quality latex, latex acrylic or oil/ alkyd paints compatible with existing paint; Consider more durable encapsulating paints and wall lining systems if necessary.	Add bark mulch, sod or topsoil to bare dirt areas with high lead levels; Discourage children from playing in these areas by providing sand box or other safe areas; Do not plant vegetable garden in areas with lead in soil; Be careful that pets do not track contaminated soil inside house.	Notify tenants and workers as to the location of lead-based paint; Instruct tenants to keep property clean; Instruct tenants to notify owner or manager when repairs are necessary; Provide tenants with health department pamphlets on the hazards of lead-based paint.

Hazard abatement removes the hazard - not necessarily all the paint or the feature, and may include:

Paint removal	Paint Encapsulation Enclosure	Replace deteriorated elements	Soil treatment	Compliance
Remove deteriorated paint or paint on friction, chewable, or impact surfaces to sound layer, repaint; Consider using the gentlest means possible to remove paint to avoid damage to substrate: wet sanding, low level heat guns, chemical strippers, or HEPA sanding; Send easily removable items (shutters, doors) off-site for paint stripping, then reinstall and paint.	Consider encapsulating paints with 20 years warranty to seal-in older paint; or use in combination with wall liners to stabilize plaster wall surfaces prior to repainting; Seal lead-based painted surfaces behind rigid enclosures, such as drywall, or use luan or plywood with new coverings over previously painted floors; Use rubber stair treads on painted steps.	Remove, only when necessary, seriously deteriorated painted elements such as windows, doors, and trimwork. Replace with new elements that match the historic in appearance, detailing, and materials, when possible; Replace component element of a friction surface (parting bead or stops of windows) or of impact surfaces (shoe moldings) with new elements.	Remove contaminated soil around foundation to a depth of 3" and replace with new soil and appropriate planting material or paving; If site is highly contaminated from other lead sources (smelter, sandblasted water tank) consult an environmental specialist as well as a landscape architect; Do not alter a significant historic landscape	Be aware of all federal, state and local laws regarding lead-based paint abatement, environmental controls and worker safety; Dispose of all hazardous waste according to applicable laws; Be aware that methods to remove lead-based paint can cause differing amounts of lead dust which can be dangerous to workers and residents.

Figure 13. This chart indicates the wide variety of treatments that can be used to control or eliminate lead-based paint hazards. For historic buildings, the least invasive method should be used to control the hazards identified during a risk assessment and are shown in the lighter shaded portion of the chart. The darker portions show the more invasive hazard control methods which must be carefully implemented to ensure that whenever possible, historic materials are protected. The total abatement of all surfaces is not recommended for historic buildings because it can damage historic materials and destroy the evidence of early paint colors and layering. Prepared by Sharon C. Park, AIA.

IMPACT OF VARIOUS PAINT REMOVAL/ABATEMENT TECHNIQUES

REMOVAL METHOD	IMPACT ON MATERIALS	LEAD DUST GENERATED	IMPACT ON WORKER	IMPACT ON ENVIRONMENT
Wet scraping; wet sanding; repainting	Low: Gentle to substrate; feather edges to obtain smooth paint surface	Low: Misting surfaces reduces lead dust	Low: No special protection for respiration, but wash before eating, drinking, etc.	Low-medium: Debris often general waste; check disposal requirements
Heat gun; paint removal w/ scrapers < 450°F	Low: Gentle to substrate	Medium: Flicking softened paint does create airborne lead dust	Medium: Respirator w/HEPA filters usually required	Medium: Lead-paint sludge is hazardous waste
Chemical stripping on-site; use liquid or poultice; avoid methylene chloride	Low to Medium: Avoid damage to wood texture/grain with long dwell time	Low: Chemicals are moist and reduce lead dust	Low: For lead dust; for volatile chemicals may require solvent filter mask	Medium: Lead residue hazardous; off/rinse must be filtered or contained
Controlled HEPA sanding; primarily for wooden surfaces; sander uses HEPA vacuum shroud	Low to Medium: Avoid gouging wooden surfaces; good for feathering edges	Medium to High: Worker must know how to use equipment	Medium to High: Requires respirator with HEPA filter and possibly containment of area	Medium to High: Paint debris is hazardous and must be contained in drums for disposal
Dry Abrasives on cast iron; CO_2, walnut shells, needle gun removal; can use vacuum shrouds	Low to Medium: Substrate must be durable and in good condition; not for soft or porous materials	Generally High: Large volume of paint chips fall freely unless there is a vacuum shroud	High; Generally requires full suiting, respirators and containment, even if vacuum shroud used	Medium to High: Increased volume of hazardous waste if abrasive is added to lead debris
Chemical stripping off-site; cold tank reduces ungluing caused by hot tank	Medium to High: Elements can be damaged during removal or in tank	Usually low: Take care when removing elements to minimize lead-laden dust	Low: Take care when washing up to remove dust; wash clothes separately	Low to Medium: Stripping contractor responsible for disposal
Feature or substrate removal and replacement	High: Loss of feature is irretrievable; Avoid wholesale removal of significant elements	Usually low: Worker exposure can be high if element hazardous due to high amounts of lead-based paint	Usually low: Varies with lead dust generated; use air monitors and wet mist area	Varies: Must do a TCLP leach test to determine if debris can go to landfill or is hazardous waste

Figure 14. This chart shows how the impact of lead hazard control work can impact a property. The paint or hazard removal methods, shaded from light to dark, are listed from low to medium to high impact on historic materials. Each method will generate varying amounts of lead dust and hazardous materials; the impact on workers and the environment will thus vary accordingly. This information gives a general overview and is not a substitute for careful air monitoring and compliance with worker protection as established by OSHA regulations, and the proper handling/disposal of hazardous waste. Prepared by Sharon C. Park, AIA.

examples of appropriate methods to use to control lead hazards within an historic preservation context.

Historic Interiors (deteriorating paint and chewed surfaces). Whenever lead-based paint (or lead-free paint covering older painted surfaces) begins to peel, chip, craze, or otherwise comes loose, it should be removed to a sound substrate and the surface repainted. If children are present and there is evidence of painted surfaces that have been chewed, such as a window sill, then these surfaces should be stripped to bare wood and repainted. The removal of peeling, flaking, chalking, and deteriorating paint may be of a small scale and undertaken by the owner, or may be extensive enough to require a paint contractor. In either case, care must be taken to avoid spreading lead dust throughout the dwelling unit. If the paint failure is extensive and the dwelling unit requires more permanent hazard removal, then an abatement contractor should be considered. Many states are now requiring that this work be undertaken by specially trained and certified workers.

If an owner undertakes interim controls, it would be advisable to receive specialized training in handling lead-based paint. Such training emphasizes isolating the area, putting plastic sheeting down to catch debris, turning off mechanical systems, taping registers closed, and taking precautions to clean up prior to handling food. Work clothes should be washed separately from regular family laundry. The preferred method for removing flaking paint is the wet sanding of surfaces because it is gentle to the substrate and controls lead dust. The key to reducing lead hazards while stabilizing flaking paint is to keep the surfaces slightly damp to avoid ingesting lead dust. Wet sanding uses special flexible sanding blocks or papers that can be rinsed in water or used along with a bottle mister. This method will generally not create enough debris to constitute hazardous waste (see fig. 15).

Other methods for selectively removing more deteriorated paint in historic housing include controlled sanding, using low-temperature heat guns, or chemical strippers. Standard safety precautions and appropriate worker protection should be used. Methods to *avoid* include uncontrolled dry abrasive methods, high heat removal (lead vaporizes at 1100° F), uncontrolled water blasting, and some chemicals considered carcinogenic (methylene chloride). When possible and practicable, painted elements, such as radiators, doors, shutters, or other easily removable items, can be taken to an off site location for paint removal.

In most cases, when interior surfaces are repainted, good quality interior latex or oil/alkyd paints may be used. The paint and primer system must be compatible with the substrate, as well as any remaining, well-bonded, paint.

Encapsulant paints and coatings, developed to contain lead-based paint, rely on an adhesive bonding of the new paint through the layers of the existing paint. The advantages of these special paint coatings is that they allow the historic substrate to remain in-place; reduce the amount of existing paint removed; can generally be applied without extensive worker protection; and are a durable finish. (They cannot, however, be used on friction surfaces.) The drawbacks include their ability to obscure carved details, unless thinly applied in several applications, and difficulty in future removal. If a specialized paint, such as an elastomeric encapsulant paint, is considered, the manufacturer should be contacted for specific instructions for its application. Unless these specialized paint systems are warranted for 20 years, they are considered as less permanent interim controls.

Lead-dust on interior finishes. Maintaining and washing painted surfaces is one of the most effective measures to prevent lead poisoning. Houses kept in a clean condition, with paint film intact and topcoated with lead-free paint or varnish, may not even pose a health risk. Dust wipe tests, which are sent to a laboratory for processing, can identify the level of lead dust present on floors, window sills, and window troughs. If lead dust is above acceptable levels, then specially modified maintenance procedures can be undertaken to reduce it. All paints deteriorate over time, so maintenance must be ongoing to control fine lead dust. The periodic washing of surfaces with a surfactant, such as tri-sodium phosphate (TSP) or its equivalent, loosens dirt and removes lead dust prior to a water rinse and touch-up painting, if necessary. This interim treatment can be extremely beneficial in controlling lead dust that is posing a hazard (see fig. 16).

Soil/landscape. Soil around building foundations may contain a high level of lead from years of chalking and peeling exterior paint. This dirt can be brought indoors on shoes or by pets and small children if they play outside a house. Lead in the soil is generally found in a narrow band

Figure 15. Wet sanding of interior surfaces will keep dust levels down, reduce the need for workers' protection, and provide a sound surface for repainting. Priming and repainting with oil/ alkyd, latex or latex acrylic should be undertaken according to manufacturers' instructions.

Figure 16. Washing windows and cleaning debris from window wells on a periodic basis can substantially reduce lead dust. Using water and tri-sodium phosphate (TSI' or equivalent) will remove loose paint, and, after rinsing, the surface can be repainted with latex, oil/ alkyd, or latex acrylic paints.

directly adjacent to the foundation. If the bare soil tests high in lead (see Action Levels Chart, pg. 6), it should be replaced to a depth of several inches or covered with new sod or plantings. Care should be taken to protect historic plantings on the building site and, in particular, historic landscapes, while mitigation work is underway (see fig. 17). If an area has become contaminated due to a variety of environmental conditions (for example, a smelter nearby or water tanks that have been sandblasted in the past), then an environmental specialist as well as a landscape preservation architect should be consulted on appropriate site protection and remedial treatments. It is inappropriate to place hard surfaces, such as concrete or macadam, over historically designed landscaped areas, which is often the recommendation of typical abatement guidelines.

Figure 17. When historic sites are found to contain high levels of lead in bare soil — particularly around foundations — it is important to reduce the hazard without destroying significant landscapes. In many cases, contaminated soil can be removed from the foundation area and appropriate plantings or ground covers replanted in new soil. Photo: Charles A. Birnbaum, ASLA.

Deteriorating paint on exteriors. Deteriorating exterior paint will settle onto window ledges and be blown into the dwelling, and will also contaminate soil at the foundation, as previously discussed. Painted exteriors may include wall surfaces, porches, roof trim and brackets, cornices, dormers, and window surrounds. Most exteriors need repainting every 5-10 years due to the cumulative effect of sun, wind, and rain or lack of maintenance. Methods of paint removal that do not abrade or damage the exterior materials should be evaluated. Because there is often more than one material (for example, painted brick and galvanized roof ornaments), the types of paint removal or paint stabilization systems need to be compatible with each material (see fig. 18). If paint has failed down to the substrate, it should be removed using either controlled sanding/scraping, controlled light abrasives for cast iron and durable metals, chemicals, or low heat. If chemicals are used, it may be necessary to have the contractor contain, filter, or otherwise treat any residue or rinse water. Environmental regulations must be checked prior to work, particularly if a large amount of lead waste will be generated or public water systems affected.

A cost analysis may show that, in the long run, repair and maintenance of historic materials or in-kind replacement can be cost effective. Due to the physical condition and location of wood siding, together with the cost of paint removal, a decision may be made to remove and replace

Figure 18. As part of an urban housing grant program, the exterior of this row house was sucessfully made lead-safe and met the Secretary of the Interior's Standards for Rehabilitation. The exterior was washed, then repainted with exterior grade alkyd paint. The decorative roof brackets and cornice were repainted; not removed or covered as is often recommended in typical abatement guidelines. The previously altered, deteriorated window sash were replaced with new sash and jamb liners set within the historic frames. Photos: Deborah Birch.

these materials on some historic frame buildings. If the repair or replacement of historic cladding on a primary elevation is being undertaken, such replacement materials should match the historic cladding in material, size, configuration, and detail (see fig. 19). The use of an artificial siding or aluminum coil stock panning systems over wooden trimwork or sills and lintels (as recommended in some abatement guidelines) is not appropriate, particularly on principal facades of historic buildings because they change the profile appearance of the exterior trimwork and may damage historic materials and detailing during installation. Unless the siding is too deteriorated to warrant repair and the cost is too prohibitive to use matching replacement materials (i.e., wood for wood), substitute materials are not recommended.

The use of specialized encapsulant paint coatings on exteriors—in particular, moist or humid climates, and, to some extent, cold climates—is discouraged because such coatings may serve to impede the movement of moisture that naturally migrates through other paints or mask leaks that may be causing substrate decay. Thus, a carefully applied exterior paint system (either oil/alkyd or latex) with periodic repainting can be very effective.

Friction Surfaces. Interior features with surfaces that—functionally—rub together such as windows and doors, or are subject to human wear and tear, such as floor and steps, are known as friction surfaces. It is unclear how much lead dust is created when friction surfaces that contain lead-based paint, but are top-coated with lead-free paint, rub together because much of the earlier paint may have worn away. For example, if lead dust levels around windows or on painted floors are consistently above acceptable levels, treating nearby friction surfaces should be considered. If surfaces, such as operable windows, operable doors, painted porch decks, painted floors and painted steps appear to be generating lead dust, they should be controlled through isolating or removing the lead-based paint. Window and door edges can be stripped or planed, or the units stripped on or off site to remove paint prior to repainting. Simple wooden stops and parting beads for windows, which often split upon removal, can be replaced.

Before

After

Figure 19. In many cases, exterior wood siding can be repaired, selectively replaced, and repainted, as illustrated in this successful residential rehabilitation. Deteriorating wood siding was removed from the foundation to the top of the first floor windows and replaced with matching wood siding. The entire building was repainted. Photos: Crispus Attucks Community Development Corporation.

Figure 20. Operable windows have friction surfaces between the sash and the frames, which can be a source of fine lead dust. In this case, the deteriorated sash was replaced, but the historic frame remains in place, sucessfully isolated from the sash with a simple vinyl jamb liner that is part of the new sash operation.

Figure 21. Painted stairs and floors can cause a problem because lead dust settles between the wooden boards. In this case, the steps were sanded, repainted, and covered with rubber stair treads. The floors could not be effectively cleaned and sealed so they were isolated with a new subflooring, and a washable tile finish installed.

If window sash are severely deteriorated, it is possible to replace them; and vinyl jamb liners can effectively isolate remaining painted window jambs (see fig. 20). When windows are being treated within rehabilitation projects, their repair and upgrading are always recommended. In the event that part or all of a window needs to be replaced, the new work should match in size, configuration, detail, and, whenever possible, material.

Painted floors often present a difficult problem because walking on them abrades the surface, releasing small particles of lead-based paint. It is difficult to remove lead dust between the cracks in previously painted strip flooring even after sanding and vacuuming using special High Efficiency Particulate Air (HEPA) filters to control the lead dust. If painted floors are not highly significant in material, design, or craftsmanship, and they cannot be adequately cleaned and refinished, then replacing or covering them with new flooring may be considered. Stair treads can be easily fitted with rubber or vinyl covers (see fig. 21).

Accessible, projecting, mouthable surfaces. Accessible, chewable surfaces that can be mouthed by small children need not be removed entirely, as some health guidelines recommend. These accessible surfaces are listed as projecting surfaces within a child's reach, including window sills, banister railings, chair rails, and door edges. In many cases, the projecting edges can have all paint removed using wet sanding, a heat gun or chemical strippers, prior to repainting the feature (see fig. 22). If the homeowner feels that there is no evidence of unsupervised mouthing of surfaces, a regular paint may be adequate once painted surfaces have been stabilized. An encapsulant paint that adhesively bonds existing paint layers onto the substrate extends durability. While encapsulant paint systems are difficult to remove from a surface in the future, they permit retention of the historic feature itself. If encapsulant paint is used on molded or decorative woodwork, it should be applied in several thin coats to prevent the architectural detail from being obscured by the heavy paint (see fig 23).

Figure 22. Research has shown that some small children will chew on projecting window sills while teething. As part of a lead hazard control project, the edge of the sill can be stripped to bare wood or an encapsulating paint applied. In this case, a new window sill was installed as part of a window upgrade that retained the historic trim and frame.

Figure 23. Stair banisters and railings are considered mouthable surfaces. In this case, the old paint was wet sanded to a sound layer. Special encapsulant paints were then applied in three thin layers to avoid obscuring the woodwork's fine detailing. It should be noted that many encapsulant paints are now treated with a bitter agent to discourage mouth contact. Photo: Landmarks Design Associates.

Impact Surfaces. Painted surfaces near doorways and along corridors tend to become chipped and scraped simply because of their location. This is particularly true of baseboards, which were designed to protect wall surfaces, and also for doorjambs. Owners should avoid hitting painted impact surfaces with vacuums, brooms, baby carriages, or wheeled toys. Adding new shoe moldings can give greater protection to some baseboards. In most cases, stabilizing loose paint and repainting with a high quality interior paint will provide a durable surface. Clear panels or shields can be installed at narrow doorways, if abrasion continues, or these areas can be stripped of paint and repainted. Features in poor condition may need to be replaced with new, matching materials (see fig. 24).

Other surfaces showing age or deterioration/ walls and ceilings. Many flat wall surfaces and ceilings were not painted with lead-based paint, so will need to be tested for its presence prior to any treatment. Flat surfaces that contain deteriorating lead-based paint should be repaired following the responsible approach previously cited (i.e., removing loose paint to a sound substrate, then repairing damaged plaster using a skim coat or wet plaster repair (see fig. 25). Drywall is used *only* when deterioration is too great to warrant plaster repair. If walls and ceilings have a high lead content, and extensive paint removal is not feasible, there are systems available that use elastomeric paints with special fabric liners to stabilize older, though intact, wall surfaces.

Figure 24. Historic baseboards are often bumped by brooms and vacuum cleaners, causing lead-based paint chips to fall on the floor. Shoe moldings can be added or replaced to increase protection to the baseboard itself. In this case, because the condition of the interior warranted substantial repair, simple historic board trim was replaced with new matching trim. Note the HEPA filter vacuum in the foreground. Photo: NPS file.

Figure 25. In some cases, skim coating deteriorated plaster and repainting is adequate. If the plaster is seriously damaged or failing, drywall may be considered so long as the molding and window reveal relationships are retained. In this case, plaster between the windows was repaired and repainted and the side wall plaster was replaced with drywall. Photo: Landmarks Design Associates.

If a new drywall surface needs to be applied, care should be taken that the historic relationship of wall to trim is not lost. Also, if there are significant features, such as crown moldings or ceiling medallions, they should always be retained and repaired (see fig. 26).

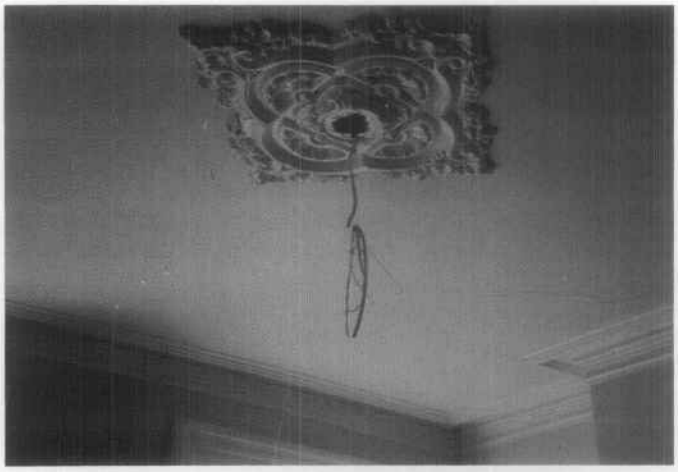

Figure 26. Deteriorated ceiling plaster was removed and a new drywall ceiling installed. The historic ceiling medallion was preserved, and the plaster cornices repaired in place. Photo: Landmarks Design Associates.

Maintenance after Hazard Control Treatment

Following treatment, particularly where interim controls have been used, ongoing maintenance and re-evaluation become critical. In urban areas, even fully lead-safe houses can be re-contaminated within a year from lead or dirt outside the immediate property. Thus, housing interiors must be kept clean, once lead hazard control measures have been implemented. Dust levels should be kept down by wet sweeping porch steps and entrances on a regular basis. Vacuum cleaning and dusting should be repeated inside on a weekly basis or even more often. Vinyl, tile, and wood floor surfaces should be similarly damp mopped. Damp washing of window troughs and sills to remove new dust should be encouraged several times a year, particularly in the spring and fall when windows will be open. Carpets and area rugs should be steam cleaned or washed periodically if they appear to hold outside dirt.

Housing should be inspected frequently for signs of deterioration by both owner and occupant. Tenants need to be made aware of the location of lead-based paint under lead-free top coats and instructed to contact the owners or property managers when the paint film becomes disturbed (see figure 27). Any leaks, peeling paint, or evidence of conditions that may generate lead-dust should be identified and corrected immediately. Occupants must be notified prior to any major dust-producing project. Dry sanding, burning, compressed air cleaning or blasting should be not be used. Repairs, repainting, or remodeling activities that have the potential of raising significant amounts of lead dust should be undertaken in ways that isolate the area, reduce lead-laden dust as much as possible, and protect the occupants.

Figure 27. Wall leaks can cause historic surfaces to deteriorate, thereby exposing underlayers of lead-based paint. If painted surfaces show signs of deterioration, they should be repaired as soon as possible.

Yearly dust wipe tests are recommended to ensure that dust levels remain below actionable levels. Houses or dwelling units that fail the dust-wipe test should be thoroughly re-cleaned with TSP, or its equivalent, washed down, wet vacuumed and followed by HEPA vacuuming, if necessary, until a clearance dust wipe test shows the area to be under actionable levels (see Action Levels chart). Spaces that are thoroughly cleaned and maintained in good condition are not a health risk (see fig. 28).

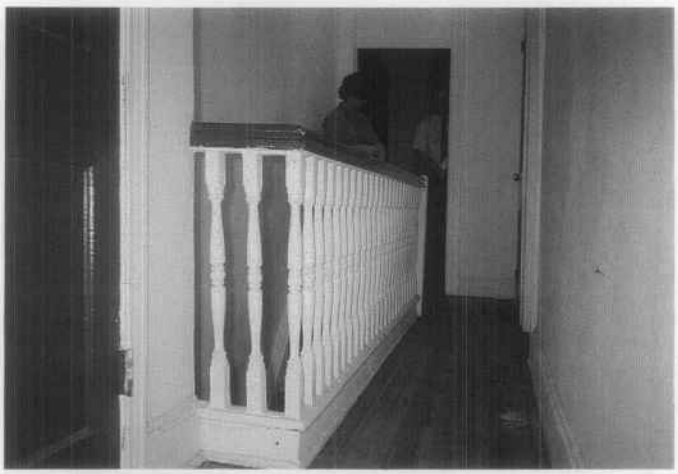

Figure 28. This recently completed housing, which is now lead-safe, could become re-contaminated from lead if safe conditions are not maintained. Damp mopping floor surfaces and regular dusting to keep the house clean will ensure its continuing safety.

Conclusion

The three-step planning process outlined in this Brief provides owners and managers of historic housing with responsible methods for protecting historic paint layers and architectural elements, such as windows, trimwork, and decorative finishes. Exposed decorative finishes, such as painted murals or grained doors can be stabilized by a paint conservator without destroying their significance.

Reducing and controlling lead hazards can be successfully accomplished without destroying the character-defining features and finishes of historic buildings. Federal and state laws generally support the reasonable control of lead-based paint hazards through a variety of treatments, ranging from modified maintenance to selective substrate removal. The key to protecting children, workers, and the environment is to be informed about the hazards of lead, to control exposure to lead dust and lead in soil, and to follow existing regulations. In all cases, methods that control lead hazards should be selected that minimize the impact to historic resources while ensuring that housing is lead-safe for children.

LEAD-BASED PAINT LEGISLATION

Federal Legislation: **Title X (Ten) Residential Lead-Based Paint Hazard Reductions Act of 1992.** Title X is part of Housing and Urban Development (HUD) Housing and Community Development Act of 1992 (Public Law 102-550). Title X calls for the reduction of lead in housing that is *federally supported* and outlines the federal responsibility towards its own residential units and the need for disclosure of lead in residences, even private residences, prior to sale.

Interim Final Regulations of Lead in Construction Standards (29 CFR 1926.62). Issued by the Department of Labor, Occupational Safety and Health Administration (OSHA), these regulations address worker safety, training, and protective measures. It is based in part on environmental air sampling to determine the amount of lead dust generated by various activities.

Lead: Identification of Dangerous Levels of Lead; Final Rule (Environmental Protection Agency (EPA) 40 CFR Part 745). This regulation supports the efforts of Title X to reduce and prevent lead poisoning in children under the age of six. This rule issues uniform national standards for lead paint hazards. EPA Regional Offices can provide guidance on the appropriate regulatory agency for states within their region. See www.epa.gov/lead.

State Laws: States generally have the authority to regulate the removal and transportation of lead-based paint and the generated waste for disposal through the appropriate state environmental and public health agencies. Most states have requirements for mitigation in the case of a lead-poisoned child, or for protection of children, or for oversight to ensure the safe handling and disposal of lead waste. When undertaking a lead-based paint reduction program, it is important to determine which laws are in place that may affect your project. Call the appropriate officials.

Local Ordinances: Check with local health departments, Poison Control Centers, and offices of housing and community development to determine if there are laws that require compliance with building owners. Some cities have their own rules, so check with your local authorities to see which laws apply to you or for assistance in finding firms licensed to handle lead-based paint projects.

Owner's Responsibility: Owners are ultimately responsible for ensuring that hazardous waste is properly disposed of when generated on site. Owners should check with the state or local authorities to determine requirements for proceeding with abatement or management of lead-based paint in either commercial or residential projects. Owners should establish that the contractor is responsible for the safety of the crew and that all applicable laws are followed, and that transporters and disposers of hazardous waste have liability insurance as a protection for the owner. If an interim treatment is being used to reduce lead hazards, the owner should notify the contractor that lead-based paint is present and that it is the contractor's responsibility to follow appropriate work practices to protect workers and complete a thorough clean-up to ensure that lead-laden dust is not present after the work is completed.

Glossary of Terms

Deteriorated Lead-Based Paint: Paint known to contain lead that shows signs of peeling, chipping, chalking, blistering, alligatoring or otherwise separating from its substrate.

Dust Removal: The process of removing dust to avoid creating a greater problem of spreading lead particles, usually through wet or damp collection or through the use of special HEPA vacuums.

Hazard Abatement: Long-term measures to remove the hazards of lead-based paint through selective paint stripping of deteriorated areas, or, in some cases, replacement of deteriorated features.

Hazard Control: Measures to reduce lead hazards to make housing safe for young children. Can be accomplished with interim (short-term) or hazard abatement (long-term) controls.

Interim Control: Short-term methods to remove lead dust, stabilize deteriorating surfaces, and repaint surfaces. Maintenance can ensure that housing remains lead-safe.

Lead-based Paint: Any existing paint, varnish, shellac, or other coating that is in excess of 1.0 mg/cm2 as measured by an XRF detector or greater than 0.5% by weight from laboratory analysis (5,000 ppm, 5,000 ug /g, or 5,000 mg/kg). For new products, the Consumer Safety Act notes 0.06% as the maximum amount of lead allowed in paint.

Lead-safe: The act of making a property safe from contamination by lead-based paint, lead-dust, and lead in soil generally through short and long-term methods to remove it, or to isolate it from small children.

Risk Assessment: An on-site investigation to determine the presence and condition of lead-based paint, including limited test samples, and an evaluation of the age, condition, housekeeping practivces, and uses of a residence.

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Photographs courtesy of the authors unless identified.

Front cover:
Most residences painted prior to 1978 will contain some lead-based paint. It was widely used on exterior woodwork, siding, and windows as well as interior finishes. This apartment stairhall retains its historic character after a successful rehabilitation project that included work to control lead-based paint hazards. Photo: Crispus Attucks Community Development Corporation.

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39 PRESERVATION BRIEFS

Holding the Line: Controlling Unwanted Moisture in Historic Buildings

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National Park Service
Cultural Resources
Heritage Preservation Services

Uncontrolled moisture is the most prevalent cause of deterioration in older and historic buildings. It leads to erosion, corrosion, rot, and ultimately the destruction of materials, finishes, and eventually structural components. Ever-present in our environment, moisture can be *controlled* to provide the differing *levels* of moisture necessary for human comfort as well as the longevity of historic building materials, furnishings, and museum collections. The challenge to building owners and preservation professionals alike is to understand the patterns of moisture movement in order to better manage it — not to eliminate it. There is never a single answer to a moisture problem. Diagnosis and treatment will always differ depending on where the building is located, climatic and soil conditions, ground water effects, and local traditions in building construction.

Remedial Actions within an Historic Preservation Context

In this Brief, advice about controlling the sources of unwanted moisture is provided within a preservation context based on philosophical principles contained in the *Secretary of the Interior's Standards for the Treatment of Historic Properties*. Following the Standards means significant materials and features that contribute to the historic character of the building should be preserved, not damaged during remedial treatment (see fig.1). It also means that physical treatments should be reversible, whenever possible. The majority of treatments for moisture management in this Brief stress preservation maintenance for materials, effective drainage of troublesome ground moisture, and improved interior ventilation.

The Brief encourages a systematic approach for evaluating moisture problems which, in some cases, can be undertaken by a building owner. Because the source of moisture can be elusive, it may be necessary to consult with historic preservation professionals prior to starting work that would affect historic materials. Architects, engineers, conservators, preservation contractors, and staff of State Historic Preservation Offices (SHPOs) can provide such advice.

Regardless of who does the work, however, these are the principles that should guide treatment decisions:

- Avoid remedial treatments without prior careful diagnosis.
- Undertake treatments that protect the historical significance of the resource.
- Address issues of ground-related moisture and rain run-off thoroughly.
- Manage existing moisture conditions before introducing humidified / dehumidified mechanical systems.
- Implement a program of ongoing monitoring and maintenance once moisture is controlled or managed.
- Be aware of significant landscape and archeological resources in areas to be excavated.

Finally, mitigating the effects of catastrophic moisture, such as floods, requires a different approach and will not be addressed fully in this Brief.

Fig. 1. Moisture problems, if not properly corrected, will increase damage to historic buildings. This waterproof coating trapped moisture from the leaking roof, causing portions of the masonry parapet to fail. Photo: NPS Files.

How and Where to Look for Damaging Moisture

Finding, treating, and managing the sources of damaging moisture requires a systematic approach that takes time, patience, and a thorough examination of all aspects of the problem—including a series of variable conditions (See this page). Moisture problems may be a direct result of one of these factors or may be attributable to a combination of interdependent variables.

Factors Contributing to Moisture Problems

A variety of simultaneously existing conditions contribute to moisture problems in old buildings. For recurring moisture problems, it may be necessary for the owner or preservation professional to address many, if not all, of the following variables:

- Types of building materials and construction systems
- Type and condition of roof and site drainage systems and their rates of discharge
- Type of soil, moisture content, and surface /subsurface water flow adjacent to building
- Building usage and moisture generated by occupancy
- Condition and absorption rates of materials
- Type, operation, and condition of heating, ventilating, cooling, humidification/ dehumidification, and plumbing systems
- Daily and seasonal changes in sun, prevailing winds, rain, temperature, and relative humidity (inside and outside), as well as seasonal or tidal variations in groundwater levels
- Unusual site conditions or irregularities of construction
- Conditions in affected wall cavities, temperature and relative humidity, and dewpoints
- Amount of air infiltration present in a building
- Adjacent landscape and planting materials

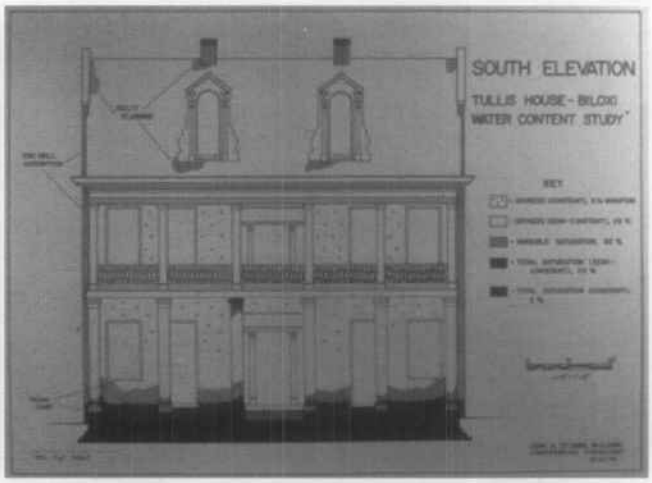


Fig. 2. Historic buildings plagued by dampness problems will benefit from systematic documentation to set a baseline against which moisture changes can be measured. Exterior areas with higher moisture levels may have algae growth or discoloration stains. Drawing: John H. Stubbs.

Diagnosing and treating the cause of moisture problems requires looking at both the localized decay, as well as understanding the performance of the entire building and site. Moisture is notorious for traveling far from the source, and moisture movement within concealed areas of the building construction make accurate diagnosis of the source and path difficult. Obvious deficiencies, such as broken pipes, clogged gutters, or cracked walls that contribute to moisture damage, should always be corrected promptly.

For more complicated problems, it may take several months or up to four seasons of monitoring and evaluation to complete a full diagnosis. Rushing to a solution without adequate documentation can often result in the unnecessary removal of historic materials—and worse—the creation of long-term problems associated with an increase, rather than a decrease, in the unwanted moisture.

Looking for Signs

Identifying the type of moisture damage and discovering its source or sources usually involves the human senses of sight, smell, hearing, touch, and taste combined with intuition. Some of the more common signs of visible as well as hidden moisture damage (see fig. 2, 3) include:

- Presence of standing water, mold, fungus, or mildew
- Wet stains, eroding surfaces, or efflorescence (salt deposits) on interior and exterior surfaces
- Flaking paint and plaster, peeling wallpaper, or moisture blisters on finished surfaces
- Dank, musty smells in areas of high humidity or poorly ventilated spaces
- Rust and corrosion stains on metal elements, such as anchorage systems and protruding roof nails in the attic
- Cupped, warped, cracked, or rotted wood
- Spalled, cracked masonry or eroded mortar joints
- Faulty roofs and gutters including missing roofing slates, tiles, or shingles and poor condition of flashing or gutters
- Condensation on window and wall surfaces
- Ice dams in gutters, on roofs, or moisture in attics

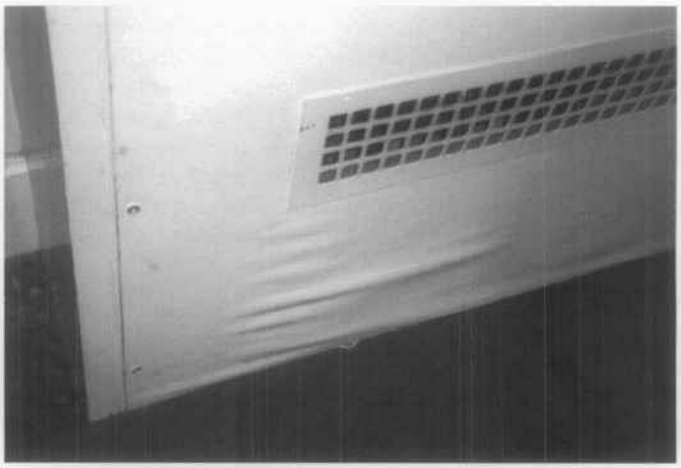


Fig. 3. The deterioration of this wooden cover was a sign that water was leaking from the fan coil unit behind. Photo: author.

Uncovering and Analyzing Moisture Problems

Moisture comes from a variety of external sources. Most problems begin as a result of the weather in the form of rain or snow, from high ambient relative humidity, or from high water tables. But some of the most troublesome moisture damage in older buildings may be from internal sources, such as leaking plumbing pipes, components of heating, cooling, and climate control systems, as well as sources related to use or occupancy of the building. In some cases, moisture damage may be the result of poorly designed original details, such as projecting outriggers in rustic structures that are vulnerable to rotting, and may require special treatment.

The five most common sources of unwanted moisture include:

- Above grade exterior moisture entering the building
- Below grade ground moisture entering the building
- Leaking plumbing pipes and mechanical equipment
- Interior moisture from household use and climate control systems
- Water used in maintenance and construction materials.

Above grade exterior moisture generally results from weather related moisture entering through deteriorating materials as a result of deferred maintenance, structural settlement cracks, or damage from high winds or storms (see fig. 4). Such sources as faulty roofs, cracks in walls, and open joints around window and door openings can be corrected through either repair or limited replacement. Due to their age, historic buildings are notoriously "drafty," allowing rain, wind, and damp air to enter through missing mortar joints; around cracks in windows, doors, and wood siding; and into uninsulated attics. In some cases, excessively absorbent materials, such as soft sandstone, become saturated from rain or gutter overflows, and can allow moisture to dampen interior surfaces. Vines or other vegetative materials allowed to grow directly on building materials without trellis or other framework can cause damage from roots eroding mortar joints and foundations as well as dampness being held against surfaces. In most cases, keeping vegetation off buildings, repairing damaged materials, replacing flashings, rehanging gutters, repairing downspouts, repointing mortar, caulking perimeter joints around windows and doors, and repainting surfaces can alleviate most sources of unwanted exterior moisture from entering a building above grade.

Below grade ground moisture is a major source of unwanted moisture for historic and older buildings. *Proper handling of surface rain run-off is one of the most important measures of controlling unwanted ground moisture.* Rain water is often referred to as "bulk moisture" in areas that receive significant annual rainfalls or infrequent, but heavy, precipitation. For example, a heavy rain of 2" per hour can produce 200 gallons of water from downspout discharge alone for a house during a one hour period. When soil is saturated at the base of the building, the moisture will wet footings and crawl spaces or find its way through cracks in foundation walls and enter into basements (see fig. 5). Moisture in saturated basement or foundation walls—also exacerbated by high water tables—will generally rise up within a wall and eventually cause deterioration of the masonry and adjacent wooden structural elements.

Builders traditionally left a working area, known as a builder's trench, around the exterior of a foundation wall. These trenches have been known to increase moisture problems if the infill soil is less than fully compacted or includes rubble backfill, which, in some cases, may act as a reservoir holding damp materials against masonry walls. Broken subsurface pipes or downspout drainage can leak into the builder's trench and dampen walls some distance from the source. Any subsurface penetration of the foundation wall for sewer, water, or other piping also can act as a direct conduit of ground moisture unless these holes are well sealed. A frequently unsuspected, but serious, modern source of ground moisture is a landscape irrigation system set too close to the building. Incorrect placement of sprinkler heads can add a tremendous amount of moisture at the foundation level and on wall surfaces.

Fig. 4. Deferred maintenance often leads to blocked gutters and downspouts. This cracked gutter system allowed moisture to penetrate the upper exterior wall, erode mortar joints, and rot fascia boards. Photo: NPS files.

Fig. 5. Excavating this foundation revealed that the downspout pipe had corroded at the " u-trap" and was leaking moisture into the soil. Openings around the horizontal water supply line and cracks in the wall allowed moisture to penetrate the basement in multiple locations. Photo: author.

The ground, and subsequently the building, will stay much drier by 1) re-directing rain water away from the foundation through sloping grades, 2) capturing and disposing downspout water well away from the building, 3) developing a controlled ground gutter or effective drainage for buildings historically without gutters and downspouts, and 4) reducing splash-back of moisture onto foundation walls. The excavation of foundations and the use of dampproof coatings and footing drains should only be used after the measures of reducing ground moisture listed above have been implemented.

Leaking plumbing pipes and mechanical equipment can cause immediate or long-term damage to historic building interiors. Routine maintenance, repair, or, if necessary, replacement of older plumbing and mechanical equipment are common solutions. Older water and sewer pipes are subject to corrosion over time. Slow leaks at plumbing joints hidden within walls and ceilings can ultimately rot floor boards, stain ceiling plaster, and lead to decay of structural members. Frozen pipes that crack can damage interior finishes (see fig. 6). In addition to leaking plumbing pipes, old radiators in some historic buildings have been replaced with water-supplied fan coil units which tend to leak. These heating and cooling units, as well as central air equipment, have overflow and condensation pans that require cyclical maintenance to avoid mold and mildew growth and corrosion blockage of drainage channels. Uninsulated forced-air sheet metal ductwork and cold water pipes in walls and ceilings often allow condensation to form on the cold metal, which then drips and causes bubbling plaster and peeling paint. Careful design and vigilant maintenance, as well as repair and insulating pipes or ductwork, will generally rid the building of these common sources of moisture.

Fig. 6. Uninsulated plumbing pipes close to the exterior wall froze and cracked, wetting this ornamental plaster ceiling before the water supply line could be shut off. As a result, limited portions of the ceiling needed reattaching. Photo: author.

Interior moisture from building use and modern humidified heating and cooling systems can create serious problems. In northern U.S. climates, heated buildings will have winter-time relative humidity levels ranging from 10%-35% Relative Humidity (RH). A house with four occupants generates between 10 and 16 pounds of water a day (approximately 1 – 2 gallons) from human residents. Moisture from food preparation, showering, or laundry use will produce condensation on windows in winter climates. When one area or floor of a building is air-conditioned and another area is not, there is the chance for condensation to occur between the two areas. Most periodic condensation does not create a long-term problem.

Humidified climate control systems are generally a major problem in museums housed within historic buildings. They produce between 35%-55% RH on average which, as a vapor, will seek to dissipate and equalize with adjacent spaces (see fig. 7). Moisture can form on single-glazed windows in winter with exterior temperatures below 30 F and interior temperatures at 70 F with as little as 35% RH. Frequent condensation on interior window surfaces is an indication that moisture is migrating into exterior walls, which can cause long-term damage to historic materials. Materials and wall systems around climate controlled areas may need to be made of moisture resistant finishes in order to handle the additional moisture in the air. Moist interior conditions in hot and humid climates will generate mold and fungal growth. Unvented mechanical equipment, such as gas stoves, driers, and kerosene heaters, generate large quantities of moisture. It is important to provide adequate ventilation and find a balance between interior temperature, relative humidity, and airflow to avoid interior moisture that can damage historic buildings.

Fig. 7. Condensation dripping from the large overhead courtyard skylight was damaging the masonry in this museum. A new skylight with thermal glazing was installed, replacing the deteriorated single-glazed unit. A new climate control system monitors interior temperature and humidity. Photo: © Isabella Stewart Gardner Museum, Boston.

Moisture from maintenance and construction materials can cause damage to adjacent historic materials. Careless use of liquids to wash floors can lead to water seepage through cracks and dislodge adhesives or cup and curl materials. High-pressure power washing of exterior walls and roofing materials can force water into construction joints where it can dislodge mortar, lift roofing tiles, and saturate frame walls and masonry. Replastered or newly

plastered interior walls or the construction of new additions attached to historic buildings may hold moisture for months; new plaster, mortar, or concrete should be fully cured before they are painted or finished. The use of materials in projects that have been damaged by moisture prior to installation or have too high a moisture content may cause concealed damage (see fig. 8).

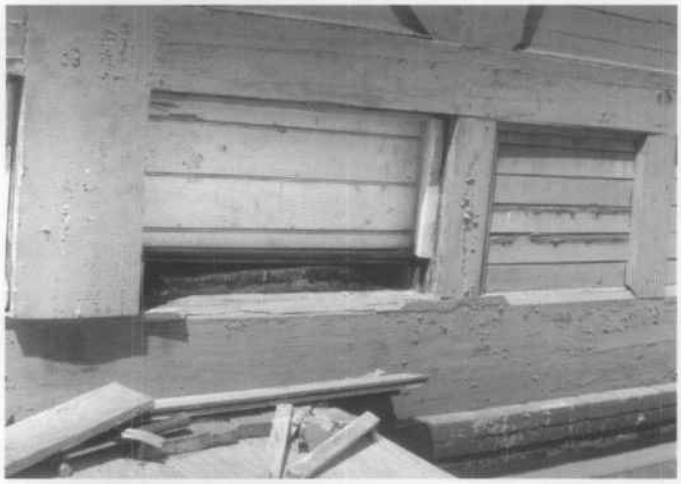


Fig. 8. Damaging moisture conditions can occur during construction. Peeling paint on this newly rehabilitated frame wall was attributed to wall insulation that had become wet during the project and was not discovered. Photo: NPS Files.

Transport or Movement of Moisture

Knowing the five most common sources of moisture that cause damage to building materials is the first step in diagnosing moisture problems. But it is also important to understand the basic mechanisms that affect moisture movement in buildings. Moisture transport, or movement, occurs in two states: liquid and vapor. It is directly related to pressure differentials. For example, water in a gaseous or vapor state, as warm moist air, will move from its high pressure area to a lower pressure area where the air is cooler and drier. Liquid water will move as a result of differences in hydrostatic pressure or wind pressure. *It is the pressure differentials that drive the rate of moisture migration in either state.* Because the building materials themselves resist this moisture movement, the rate of movement will depend on two factors: the permeability of the materials when affected by vapor and the absorption rates of materials in contact with liquid.

The mechanics, or physics, of moisture movement is complex, but if the driving force is difference in pressure, then an approach to reducing moisture movement and its damage is to reduce the difference in pressure, not to increase it. That is why the treatments discussed in this Brief will look at *managing moisture by draining bulk moisture and ventilating vapor moisture* before setting up new barriers with impermeable coatings or over-pressurized new climate control systems that threaten aging building materials and archaic construction systems.

Three forms of moisture transport are particularly important to understand in regards to historic buildings — *infiltration, capillary action, and vapor diffusion* —remembering, at the same time, that the subject is infinitely complex and, thus, one of continuing scientific study (see fig. 9). Buildings were traditionally designed to deal with the movement of air. For example, cupolas and roof lanterns allowed hot air to rise and provided a natural draft to pull air through buildings. Cavity walls in both frame and masonry buildings were constructed to allow moisture to dissipate in the air space between external and internal walls. Radiators were placed in front of windows to keep cold surfaces warm, thereby reducing condensation on these surfaces. Many of these features, however, have been altered over time in an effort to modernize appearances, improve energy efficiency, or accommodate changes in use. The change in use will also affect moisture movement, particularly in commercial and industrial buildings with modern mechanical systems. Therefore, the way a building handles air and moisture today may be different from that intended by the original builder or architect, and poorly conceived changes may be partially responsible for chronic moisture conditions.

Moisture moves into and through materials as both a visible liquid (capillary action) and as a gaseous vapor (infiltration and vapor diffusion). Moisture from leaks, saturation, rising damp, and condensation can lead to the deterioration of materials and cause an unhealthy environment. Moisture in its solid form, ice, can also cause damage from frozen, cracked water pipes, or split gutter seams or spalled masonry from freeze-thaw action. Moisture from melting ice dams, leaks, and condensation often can travel great distances down walls and along construction surfaces, pipes, or conduits. The amount of moisture and how it deteriorates materials is dependent upon complex forces and variables that must be considered for each situation.

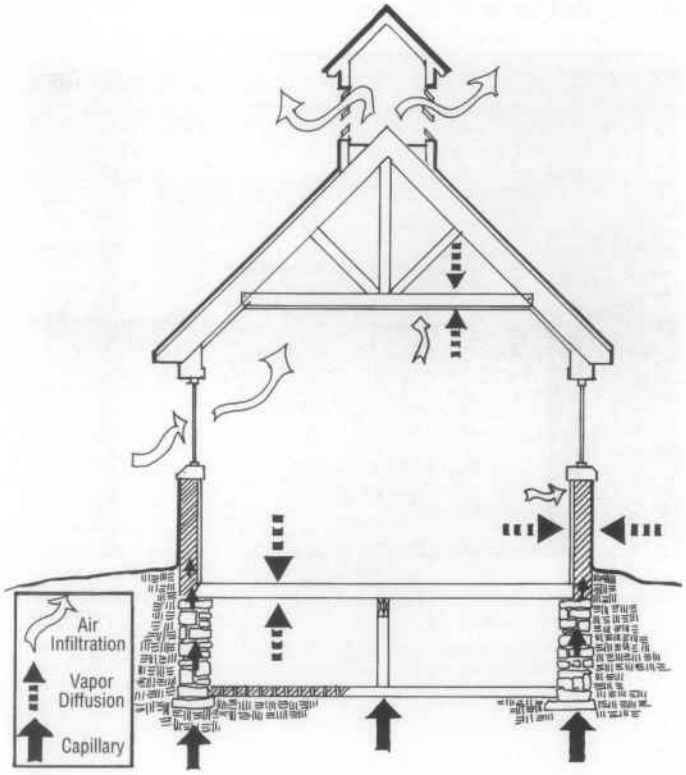


Fig. 9. The dynamic forces that move air and moisture through a building are important to understand particularlly when selecting a treatment to correct a moisture problem. Air infiltration, capillary action, and vapor diffusion all affect the wetting and drying of materials. Drawing; NPS Files.

Determining the way moisture is handled by the building is further complicated because each building and site is unique. Water damage from blocked gutters and downspouts can saturate materials on the outside, and high levels of interior moisture can saturate interior materials. Difficult cases may call for technical evaluation by consultants specializing in moisture monitoring and diagnostic evaluation. In other words, it may take a team to effectively evaluate a situation and determine a proper approach to controlling moisture damage in old buildings.

Infiltration is created by wind, temperature gradients (hot air rising), ventilation fan action, and the stack or chimney effect that draws air up into tall vertical spaces. Infiltration as a dynamic force does not actually move liquid water, but is the vehicle by which dampness, as a component of air, finds its way into building materials. Older buildings have a natural air exchange, generally from 1 to 4 changes per hour, which, in turn, may help control moisture by diluting moisture within a building. The tighter the building construction, however, the lower will be the infiltration rate and the natural circulation of air. In the process of infiltration, however, moisture that has entered the building and saturated materials can be drawn in and out of materials, thereby adding to the dampness in the air (see fig. 10). Inadequate air circulation where there is excessive moisture (i.e., in a damp basement), accelerates the deterioration of historic materials. To reduce the unwanted moisture that accompanies infiltration, it is best to incorporate maintenance and repair treatments to close joints and weatherstrip windows, while providing controlled air exchanges elsewhere. The worst approach is to seal the building so completely, while limiting fresh air intake, that the building cannot breathe.

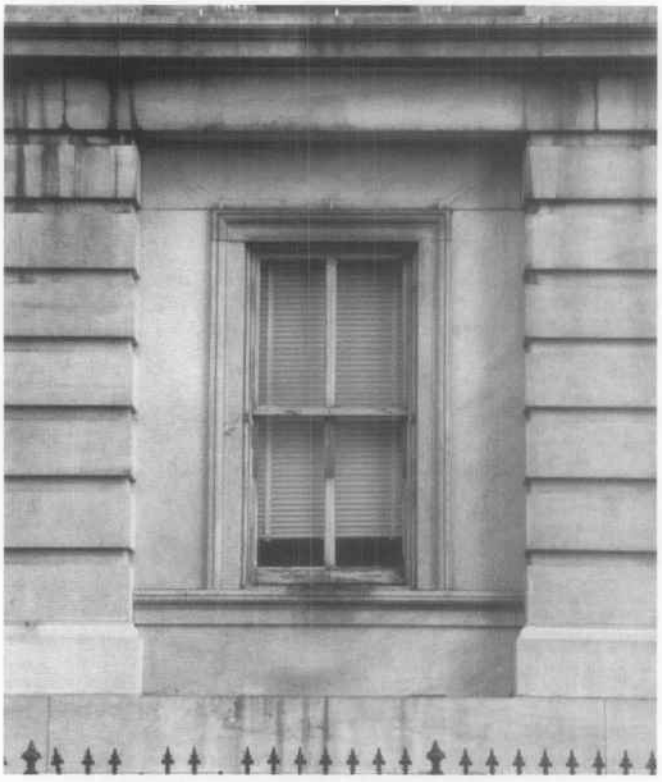


Fig. 10. Infiltration of damp air can occur around loose-fitting or deteriorated window sash and through cracks or open joints in building exteriors. Photo: Ann Brooks Prueher.

Capillary action occurs when moisture in saturated porous building materials, such as masonry, wicks up or travels vertically as it evaporates to the surface. In capillary attraction, liquid in the material is attracted to the solid surface of the pore structure causing it to rise vertically; thus, it is often called "rising damp," particularly when found in conjunction with ground moisture. It should not, however, be confused with moisture that laterally penetrates a foundation wall through cracks and settles in the basement. Not easily controlled, most rising damp comes from high water tables or a constant source under the footing. In cases of damp masonry walls with capillary action, there is usually a whitish stain or horizontal tide mark of efflorescence that seasonally fluctuates about 1- 3 feet above grade where the excess moisture evaporates from the wall (see fig. 11). This tide mark is full of salt crystals, that have been drawn from the ground and building materials along with the water, making the masonry even more sensitive to additional moisture absorption from the surrounding air. Capillary migration of moisture may occur in any material with a pore structure where there is a constant or recurring source of moisture.

Fig. 11. Capillary rise of moisture in masonry is often accompanied with a horizontal tide-mark line several feet above the grade, as seen here. Removing or redirecting as much ground moisture as possible usually helps reduce moisture within a wall. Photo: NPS Files.

The best approach for dealing with capillary rise in building materials is to reduce the amount of water in contact with historic materials. If that is not possible due to chronically high water tables, it may be necessary to introduce a horizontal damp-proof barrier, such as slate course or a lead or plastic sheet, to stop the vertical rise of moisture. Moisture should not be sealed into the wall with a waterproof coating, such as cement parging or vinyl wall coverings, applied to the inside of damp walls. This will only increase the pressure differential as a vertical barrier and force the capillary action, and its destruction of materials, higher up the wall.

Vapor diffusion is the natural movement of pressurized moisture vapor through porous materials. It is most readily apparent as humidified interior air moves out through walls to a cooler exterior. In a hot and humid climate, the reverse will happen as moist hot air moves into cooler, dryer, air-conditioned, interiors. The movement of the moisture vapor is not a serious problem until the dewpoint temperature is reached and the vapor changes into liquid moisture known as *condensation*. This can occur within a wall or on interior surfaces. Vapor diffusion will be more of

a problem for a frame structure with several layers of infill materials within the frame cavity than a dense masonry structure. Condensation as a result of vapor migration usually takes place on a surface or film, such as paint, where there is a change in permeability.

The installation of climate control systems in historic buildings (mostly museums) that have *not* been properly designed or regulated and that force pressurized damp air to diffuse into perimeter walls is an ongoing concern. These newer systems take constant monitoring and back-up warning systems to avoid moisture damage.

Long-term and undetected condensation or high moisture content can cause serious structural damage as well as an unhealthy environment, heavy with mold and mildew spores. Reducing the interior/exterior pressure differential and the difference between interior and exterior temperature and relative humidity helps control unwanted vapor diffusion. This can sometimes be achieved by reducing interior relative humidity. In some instances, using vapor barriers, such as heavy plastic sheeting laid over damp crawl spaces, can have remarkable success in stopping vapor diffusion from damp ground into buildings. Yet, knowledgeable experts in the field differ regarding the appropriateness of vapor barriers and when and where to use them, as well as the best way to handle natural diffusion in insulated walls.

Adding insulation to historic buildings, particularly in walls of wooden frame structures, has been a standard modern weatherization treatment, but it can have a disastrous effect on historic buildings. The process of installing the insulation destroys historic siding or plaster, and it is very difficult to establish a tight vapor barrier. While insulation has the benefit of increasing the efficiency of heating and cooling by containing temperature controlled air, it does not eliminate surfaces on which damaging moisture can condense. For insulated residential frame structures, the most obvious sign of a moisture

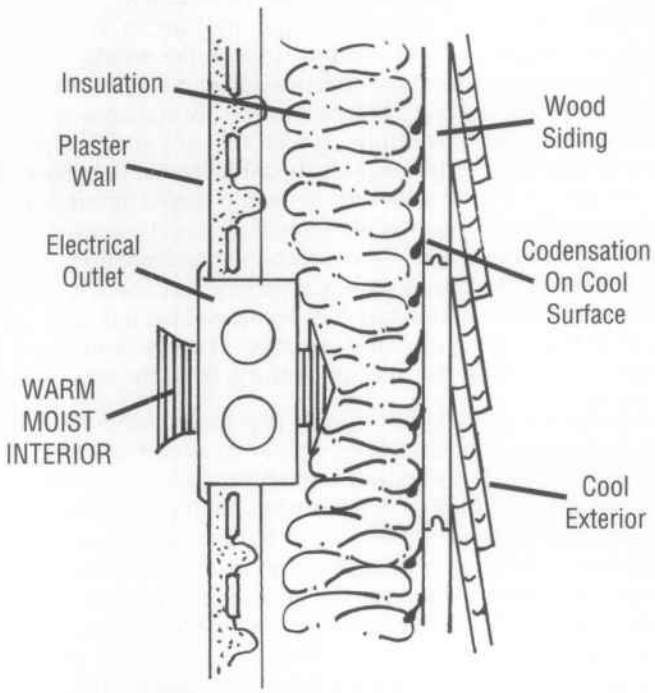


Fig. 12. Vapor diffusion can result in damp air migrating into absorbent materials and condensing on colder surfaces, thereby wetting insulation, damaging electrical conduits, and causing deterioration of the wooden framing. Drawing: NPS Files.

diffusion problem is peeling paint on wooden siding, even after careful surface preparation and repainting. Vapor impermeable barriers such as plastic sheeting, or more accurately, *vapor retarders,* in cold and moderate climates generally help slow vapor diffusion where it is not wanted.

In regions where *humidified* climate control systems are installed into insulated frame buildings, it is important to stop *interstitial*, or in-wall, dewpoint condensation. This is very difficult because humidified air can penetrate breaches in the vapor barrier, particularly around electrical outlets (see fig. 12). Improperly or incompletely installed retrofit vapor barriers will cause extensive damage to the building, just in the installation process, and will allow trapped condensation to wet the insulation and sheathing boards, corrode metal elements such as wiring cables and metal anchors, and blister paint finishes. Providing a tight wall vapor barrier, as well as a ventilated cavity behind wooden clapboards or siding appears to help insulated frame walls, if the interior relative humidity can be adjusted or monitored to avoid condensation. Correct placement of vapor retarders within building construction will vary by region, building construction, and type of climate control system.

Surveying and Diagnosing Moisture Damage: Key Questions to Ask

It is important for the building to be surveyed first and the evidence and location of suspected moisture damage systematically recorded before undertaking any major work to correct the problem. This will give a baseline from which relative changes in condition can be noted.

When materials become wet, there are specific physical changes that can be detected and noted in a record book or on survey sheets. Every time there is a heavy rain, snow storm, water in the basement, or mechanical systems failure, the owner or consultant should note and record the way moisture is moving, its appearance, and what variables might contribute to the cause. *Standing outside to observe a building in the rain may answer many questions and help trace the movement of water into the building.* Evidence of deteriorating materials that cover more serious moisture damage should also be noted, even if it is not immediately clear what is causing the damage. (For example, water stains on the ceiling may be from leaking pipes, blocked fan coil drainage pans above, or from moisture which has penetrated around a poorly sloped window sill above.) Don't jump to conclusions, but use a systematic approach to help establish an educated theory — or hypothesis — of what is causing the moisture problem or what areas need further investigation.

Surveying moisture damage must be systematic so that relative changes can be noted. Tools for investigating can be as simple as a notebook, sketch plans, binoculars, camera, aluminum foil, smoke pencil, and flashlight. The systematic approach involves looking at buildings from the top down and from the outside to the inside. Photographs, floor plans, site plan, and exterior elevations — even roughly sketched — should be used to indicate all evidence of damp or damaged materials, with notations for musty or poorly ventilated areas. Information might be needed on the absorption and permeability characteristics of the building materials and soils. Exterior drainage patterns should be noted and these base plans referred to on a regular basis in different seasons and in differing types of weather (see fig. 13).

Glossary:

Air flow/ infiltration: The movement that carries moist air into and through materials. Air flow depends on the difference between indoor and outdoor pressures, wind speed and direction as well as the permeability of materials.

Bulk water: The large quantity of moisture from roof and ground run-off that can enter into a building either above grade or below grade.

Capillary action: The force that moves moisture through the pore structure of materials. Generally referred to as rising damp, moisture at or below the foundation level will rise vertically in a wall to a height at which the rate of evaporation balances the rate at which it can be drawn up by capillary forces.

Condensation: The physical process by which water vapor is transformed into a liquid when the relative humidity of the air reaches 100% and the excess water vapor forms, generally as droplets, on the colder adjacent surface.

Convection: Heat transfer through the atmosphere by a difference in force or air pressure is one type of air transport. Sometimes referred to as the "stack effect," hotter less dense air will rise, colder dense air will fall creating movement of air within a building.

Dewpoint: The temperature at which water vapor condenses when the air is cooled at a constant pressure and constant moisture content.

Diffusion: The movement of water vapor through a material. Diffusion depends on vapor pressure, temperature, relative humidity, and the permeability of a material.

Evaporation: The transformation of liquid into a vapor, generally as a result of rise of temperature, is the opposite of condensation. Moisture in damp soil, such as in a crawl space, can evaporate into the air, raise the relative humidity in that space, and enter the building as a vapor.

Ground moisture: The saturated moisture in the ground as a result of surface run-off and naturally occuring water tables. Ground moisture can penetrate through cracks and holes in foundation walls or can migrate up from moisture under the foundation base.

Monitoring instrumentation: These devices are generally used for long term diagnostic analysis of a problem, or to measure the preformance of a treatment, or to measure changes of conditions or environment. In-wall probes or sensors are often attached to data-loggers which can be down-loaded into computers.

Permeability: A characteristic of porosity of a material generally listed as the rate of diffusion of a pressurized gas through a material. The pore structure of some materials allows them to absorb or adsorb more moisture than other materials. Limestones are generally more permeable than granites.

Relative humidity (RH): Dampness in the air is measured as the percent of water vapor in the air at a specific temperature relative to the amount of water vapor that can be held in a vapor form at that specific temperature.

Survey instrumentation: technical instrumentation that is used on-site to provide quick readings of specific physical conditions. Generally these are hand-held survey instruments, such as moisture, temperature and relative humidity readers, dewpoint sensors, and fiber optic boroscopes.

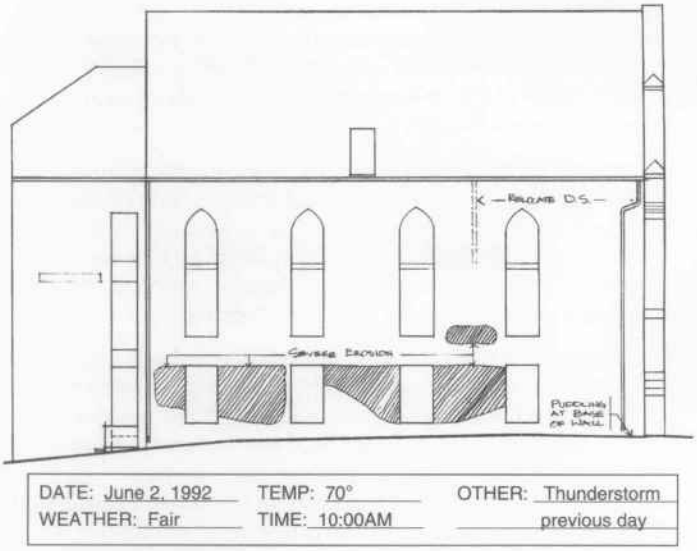


Fig. 13. Using sketch plans and elevation drawings to record the moisture damage along with the date, time, and weather conditions will show how moisture is affecting buildings over time. Drawing: Courtesy, Quinn Evans Architects.

It is best to start with one method of periodic documentation and to use this same method each time. Because moisture is affected by gravity, many surveys start with the roof and guttering systems and work down through the exterior walls. Any obvious areas of water penetration, damaged surfaces, or staining should be noted. Any recurring damp or stain patterns, both exterior and interior, should also be noted with a commentary on the temperature, weather, and any other facts that may be relevant (driving rains, saturated soil, high interior humidity, recent washing of the building, presence of a lawn watering system, etc.).

The interior should be recorded as well, beginning with the attic and working down to the basement and crawl space. It may be necessary to remove damaged materials selectively in order to trace the path of moisture or to pinpoint a source, such as a leaking pipe in the ceiling. The use of a basic resistance moisture meter, available in many hardware stores, can identify moisture contents of materials and show, over time, if wall surfaces are drying or becoming damper (see fig. 14). A smoke pencil can chart air infiltration around windows or draft patterns in interior spaces. For a quick test to determine if a damp basement is caused by saturated walls or is a result of condensation, tape a piece of foil onto a masonry surface and check it after a day or two; if moisture has developed behind the foil, then it is coming from the masonry. If condensation is on the surface of the foil, then moisture is from the air.

Comparing current conditions with previous conditions, historic drawings, photographs, or known alterations may also assist in the final diagnosis. A chronological record, showing improvement or deterioration, should be backed up with photographs or notations as to the changing size, condition, or features of the deterioration and how these changes have been affected by variables of temperature and rainfall. If a condition can be related in time to a particular event, such as efflorescence developing on a chimney after the building is no longer heated, it may be possible to isolate a cause, develop a hypothesis, and then test the hypothesis (by adding some temporary heat), before applying a remedial treatment.

Fig. 14. Using instruments in this damp-check kit can help determine the relative change in wet conditions over time. This involves readings of air temperature, computing dewpoint temperatures, and tracking the moisture content of materials to indicate if they are drying properly. Photo: Dell Corporation.

If the owner or consultant has access to moisture survey and monitoring equipment such as resistance moisture meters, dewpoint indicators, salt detectors, infrared thermography systems, psychrometer, fiber-optic boroscopes, and miniaturized video cameras, additional quantified data can be incorporated into the survey (see fig. 15). If it is necessary to track the wetting and drying of walls over a period of time, deep probes set into walls and in the soil with connector cables to computerized data loggers or the use of long-term recording of hygrothermographs may require a trained specialist. Miniaturized fiber-optic video cameras can record the condition of subsurface drain lines without excavation (see fig. 16). It should be noted, however, that *instrumentation, while extremely useful, cannot take the place of careful personal observation and analysis.* Relying on instrumentation alone rarely will give the owner the information needed to fully diagnose a moisture problem.

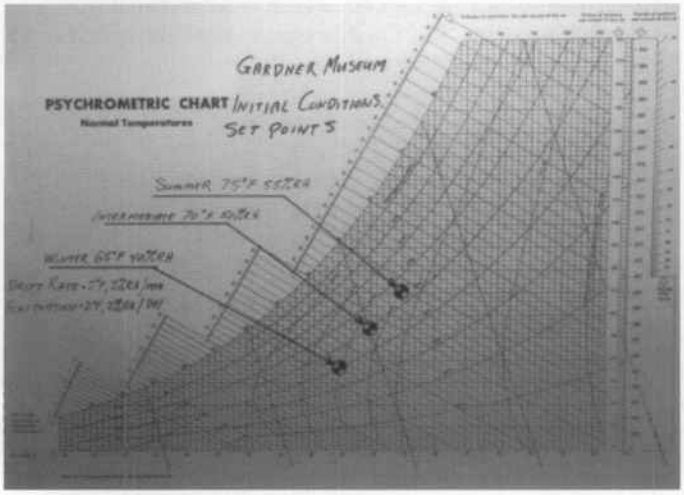


Fig. 15. Psychrometric charts quantify the amount of relative humidity a building can tolerate before dewpoint condensation occurs. This is important when the range of temperature and humidity are critical to both collections management and historic building preservation. Chart: Landmark Facilities Group.

Fig. 16. Contractors specializing in building diagnostics often have video cameras or fiber optic equipment that allow the viewing of inaccessible areas. This is particularly helpful in chimney flues or subsurface drains, as shown here. In the past, these areas would need to be excavated for visual inspection. Photo: author.

To avoid jumping to a quick—potentially erroneous—conclusion, a series of questions should be asked first. This will help establish a theory or hypothesis that can be tested to increase the chances that a remedial treatment will control or manage existing moisture.

How is water draining around building and site? What is the effectiveness of gutters and downspouts? Are the slopes or grading around foundations adequate? What are the locations of subsurface features such as wells, cisterns, or drainage fields? Are there subsurface drainage pipes (or drainage boots) attached to the downspouts and are they in good working condition? Does the soil retain moisture or allow it to drain freely? Where is the water table? Are there window wells holding rain water? What is the flow rate of area drains around the site (can be tested with a hose for several minutes)? Is the storm piping out to the street sufficient for heavy rains, or does water chronically back up on the site? Has adjacent new construction affected site drainage or water table levels?

How does water/moisture appear to be entering the building? Have all five primary sources of moisture been evaluated? What is the condition of construction materials and are there any obvious areas of deterioration? Did this building have a builder's trench around the foundation that could be holding water against the exterior walls? Are the interior bearing walls as well as the exterior walls showing evidence of rising damp? Is there evidence of hydrostatic pressure under the basement floor such as water percolating up through cracks? Has there been moisture damage from an ice dam in the last several months? Is damage localized, on one side of the building only, or over a large area?

What are the principal moisture dynamics? Is the moisture condition from liquid or vapor sources? Is the attic moisture a result of vapor diffusion as damp air comes up through the cavity walls from the crawl space or is it from a leaking roof? Is the exterior wall moisture from rising damp with a tide mark or are there uneven spots of dampness from foundation splash back, or other ground

moisture conditions? Is there adequate air exchange in the building, particularly in damp areas, such as the basement? Has the height of the water table been established by inserting a long pipe into the ground in order to record the water levels?

How is the interior climate handling moisture? Are there areas in the building that do not appear to be ventilating well and where mold is growing? Are there historic features that once helped the building control air and moisture that can be reactivated, such as operable skylights or windows? Could dewpoint condensation be occurring behind surfaces, since there is often condensation on the windows? Does the building feel unusually damp or smell in an unusual way that suggest the need for further study? Is there evidence of termites, carpenter ants, or other pests attracted to moist conditions? Is a dehumidifier keeping the air dry or is it, in fact, creating a cycle where it is actually drawing moisture through the foundation wall?

Does the moisture problem appear to be intermittent, chronic, or tied to specific events? Are damp conditions occuring within two hours of a heavy rain or is there a delayed reaction? Does rust on most nail heads in the attic indicate a condensation problem? What are the wet patterns that appear on a building wall during and after a rain storm? Is it localized or in large areas? Can these rain patterns be tied to gutter over-flows, faulty flashing, or saturation of absorbent materials? Is a repaired area holding up well over time or is there evidence that moisture is returning? Do moisture meter readings of wall cavities indicate they are wet, suggesting leaks or condensation in the wall?

Once a hypothesis of the source or sources of the moisture has been developed from observation and recording of data, it is often useful to prove or disprove this hypothesis with interim treatments, and, if necessary, the additional use of instrumentation to verify conditions. For damp basements, test solutions can help determine the cause. For example, surface moisture in low spots should be redirected away from the foundation wall with regrading to determine if basement dampness improves. If there is still a problem, determine if subsurface downspout collection pipes or cast iron boots are not functioning properly. The above grade downspouts can be disconnected and attached to long, flexible extender pipes and redirected away from the foundation (see fig. 17). If, after a heavy rain or a simulation using a hose, there is no improvement, look for additional ground moisture sources such as high water tables, hidden cisterns, or leaking water service lines as a cause of moisture in the basement. New data will lead to a new hypothesis that should be tested and verified. *The process of elimination can be frustrating, but is required if a systematic method of diagnosis is to be successful.*

Selecting an Appropriate Level of Treatment

The treatments in chart format at the back of this publication are divided into levels based on the degree of moisture problems. Level I covers preservation maintenance; Level II focuses on repair using historically compatible materials and essentially mitigating damaging moisture conditions; and Level III discusses replacement and alteration of materials that permit continued use in a chronically moist environment. It is important to begin

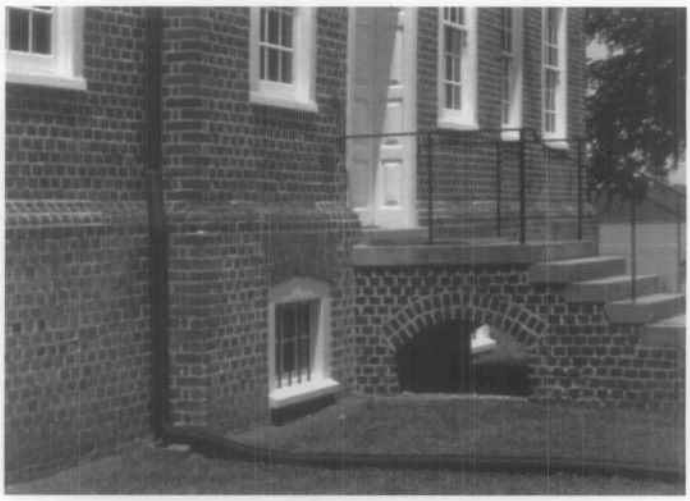


Fig. 17. In testing a theory for the cause of basement wetness, the owner used long black extender pipes to direct roof run-off away from the foundation. This test established that the owner did not need expensive waterproofing of the foundation, but a better drainage system. Photo: Baird M. Smith.

with Level I and work through to a manageable treatment as part of the control of moisture problems. Buildings in serious decay will require treatments in Level II, and difficult or unusual site conditions may require more aggressive treatments in Level III. Caution should always be exercised when selecting a treatment. The treatments listed are a guide and not intended to be recommendations for specific projects as the key is always proper diagnosis.

Start with the repair of any obvious deficiencies using sound preservation maintenance. If moisture cannot be managed by maintenance alone, it is important to reduce it by mitigating problems *before* deteriorated historic materials are replaced (see fig. 18). Treatments should not remove materials that can be preserved; should not involve extensive excavation unless there is a documented need; and should not include coating buildings with waterproof sealers that can exacerbate an existing problem. Some alteration to historic materials, structural systems, mechanical systems, windows, or finishes may be needed when excessive site moisture cannot be controlled by drainage systems, or in areas prone to floods. These changes, however, should, be sensitive to preserving those materials, features, and finishes that convey the historic character of the building and site.

Ongoing Care

Once the building has been repaired and the larger moisture issues addressed, it is important to keep a record of additional evidence of moisture problems and *to protect the historic or old building through proper cyclical maintenance* (see fig. 19) In some cases, particularly in museum environments, it is critical to monitor areas vulnerable to moisture damage. In a number of historic buildings, in-wall moisture monitors are used to ensure that the moisture purposely generated to keep relative humidity at ranges appropriate to a museum collection does not migrate into walls and cause deterioration. The potential problem with all systems is the failure of controls, valves, and panels over time. Back-up systems, warning devices, properly trained staff and an emergency plan will help control damage if there is a system failure.

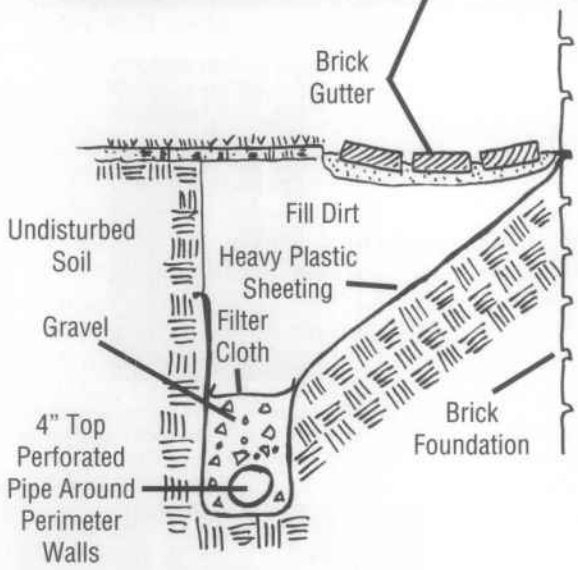


Fig. 18. This detail drawing shows a sub-surface perimeter drain in conjunction with a historic brick ground gutter system to help control roof run-off moisture from entering the historic foundation. Detail: Courtesy, Gunston Hall Plantation. Photo: Elizabeth Sasser.

Fig. 19. Maintaining gutters and downspouts in good operable condition, repairing exteriors to keep water out, redirecting damaging moisture away from foundations and controlling interior moisture and condensation are all important when holding the line on moisture deterioration. Photo: Nebraska State Historical Society.

Ongoing maintenance and vigilance to situations that could potentially cause moisture damage must become a routine part of the everyday life of a building. The owner or staff responsible for the upkeep of the building should inspect the property weekly and note any leaks, mustiness, or blocked drains. Again, observing the building during a rain will test whether ground and gutter drainage are working well.

For some buildings a back-up power system may be necessary to keep sump pumps working during storms when electrical power may be lost. For mechanical equipment rooms, condensation pans, basement floors, and laundry areas where early detection of water is important, there are alarms that sound when their sensors come into contact with moisture.

Conclusion

Moisture in old and historic buildings, though difficult to evaluate, can be systematically studied and the appropriate protective measures taken. Much of the documentation and evaluation is based on common sense combined with an understanding of historic building materials, construction technology, and the basics of moisture and air movement. Variables can be evaluated step by step and situations creating direct or secondary moisture damage can generally be corrected. The majority of moisture problems can be mitigated with maintenance, repair, control of ground and roof moisture, and improved ventilation. For more complex situations, however, a thorough diagnosis and an understanding of how the building handles moisture at present, can lead to a treatment that solves the problem without damaging the historic resource.

It is usually advantageous to eliminate one potential source of moisture at a time. Simultaneous treatments may set up a new dynamic in the building with its own set of moisture problems. Implementing changes sequentially will allow the owner or preservation professional to track the success of each treatment.

Moisture problems can be intimidating to a building owner who has diligently tried to control them. Keeping a record of evidence of moisture damage, results of diagnostic tests, and remedial treatments, is beneficial to a building's long-term care. The more complete a survey and evaluation, the greater the success in controlling unwanted moisture now and in the future.

Holding the line on unwanted moisture in buildings will be successful if 1) there is constant concern for signs of problems and 2) there is ongoing physical care provided by those who understand the building, site, mechanical systems, and the previous efforts to deal with moisture. For properties with major or difficult-to-diagnose problems, a team approach is often most effective. The owner working with properly trained staff, contractors and consultants can monitor, select, and implement treatments within a preservation context in order to manage moisture and to protect the historic resource.

MOISTURE: LEVEL I PRESERVATION MAINTENANCE

Exterior: Apply cyclical maintenance procedures to eliminate rain and moisture infiltration.

Roofing/ guttering: Make weather-tight and operational; inspect and clean gutters as necessary depending on number of nearby trees, but at least twice a year; inspect roofing at least once a year, preferably spring; replace missing or damaged roofing shingles, slates, or tiles; repair flashing; repair or replace cracked downspouts.

Walls: Repair damaged surface materials; repoint masonry with appropriately formulated mortar; prime and repaint wooden, metal, or masonry elements or surfaces; remove efflorescence from masonry with non-metallic bristle brushes.

Window and door openings: Eliminate cracks or open joints; caulk or repoint around openings or steps; repair or reset weatherstripping; check flashing; repaint, as necessary.

Ground: Apply regular maintenance procedures to eliminate standing water and vegetative threats to building/site.

Grade: Eliminate low spots around building foundations; clean out existing downspout boots twice a year or add extension to leaders to carry moisture away from foundation; do a hose test to verify that surface drains are functioning; reduce moisture used to clean steps and walks; eliminate the use of chlorides to melt ice which can increase freeze/thaw spalling of masonry; check operation of irrigation systems, hose bib leaks, and clearance of air conditioning condensate drain outlets.

Crawl space: Check crawl space for animal infestation, termites, ponding moisture, or high moisture content; check foundation grilles for adequate ventilation; seasonally close grilles when appropriate — in winter, if not needed, or in summer if hot humid air is diffusing into air conditioned space.

Foliage: Keep foliage and vines off buildings; trim overhanging trees to keep debris from gutters and limbs from rubbing against building; remove moisture retaining elements, such as firewood, from foundations.

Basements and foundations: Increase ventilation and maintain surfaces to avoid moisture.

Equipment: Check dehumidifiers, sump pump, vent fans, and water detection or alarm systems for proper maintenance as required; check battery back-up twice a year.

Piping/ductwork: Check for condensation on pipes and insulate/seal joints, if necessary.

Interior: Maintain equipment to reduce leaks and interior moisture.

Plumbing pipes: Add insulation to plumbing or radiator pipes located in areas subject to freezing, such as along outside walls, in attics, or in unheated basements.

Mechanical equipment: Check condensation pans and drain lines to keep clear; insulate and seal joints in exposed metal ductwork to avoid drawing in moist air.

Cleaning: Routinely dust and clean surfaces to reduce the amount of water or moist chemicals used to clean building; caulk around tile floor and wall connections; and maintain floor grouts in good condition.

Ventilation: Reduce household-produced moisture, if a problem, by increasing ventilation; vent clothes driers to the outside; install and always use exhaust fans in restrooms, bathrooms, showers, and kitchens, when in use.

A. Inspecting the overall building on at least an annual basis will identify areas needing maintenance. A bucket lift is helpful for large buildings. Photo: author.

B. Repair exterior surfaces, paint, and recaulk as needed. Photo: Williamsport Preservation Training Center (WPTC), NPS.

C. Cleaning out gutters and downspouts should be done at least twice a year. Photo: WPTC, NPS.

D. Protect the building from damage by maintaining equipment and using alarms, like this floor water sensor. Photo: Dell Corporation.

MOISTURE: LEVEL II REPAIR AND CORRECTIVE ACTION

Exterior: Repair features that have been damaged. Replace an extensively deteriorated feature with a new feature that matches in design, color, texture, and where possible, materials.

Roofing: Repair roofing, parapets and overhangs that have allowed moisture to enter; add ice and water shield membrane to lower 3-4 feet or roofing in cold climates to limit damage from ice dams; increase attic ventilation, if heat and humidity build-up is a problem. Make gutters slope @ 1/8" to the foot. Use professional handbooks to size gutters and reposition, if necessary and appropriate to historic architecture. Add ventilated chimney caps to unused chimneys that collect rain water.

Walls: Repair spalled masonry, terra cotta, etc. by selectively installing new masonry units to match; replace rotted clapboards too close to grade and adjust grade or clapboards to achieve adequate clearance; protect or cover open window wells.

A. Mitigate poor drainage with gravel, filter cloth, or the use of subsurface drainage mats under finished paving. Photo: Larry D. Dermody.

Ground: Correct serious ground water problems; capture and dispose of downspout water away from foundation; and control vapor diffusion of crawlspace moisture.

Grade: Re-establish positive sloping of grade; try to obtain 6" of fall in the first 10' surrounding building foundation; for buildings without gutter systems, regrade and install a positive subsurface collection system with gravel, or waterproof sheeting and perimeter drains; adjust pitch or slope of eave line grade drains or French drains to reduce splash back onto foundation walls; add subsurface drainage boots or extension pipes to take existing downspout water away from building foundation to the greatest extent feasible.

Crawl space: Add polyethylene vapor barrier (heavy construction grade or Mylar) to exposed dirt in crawlspace if monitoring indicates it is needed and there is no rising damp; add ventilation grilles for additional cross ventilation, if determined advisable.

B. Repair roofs and add ice and water shields at eaves and under valleys in cold climates. Photo: Larry D. Dermody.

Foundations and Basements: Correct existing high moisture levels, if other means of controlling ground moisture are inadequate.

Mechanical devices: Add interior perimeter drains and sump pump; add dehumidifiers for seasonal control of humidity in confined, unventilated space (but don't create a problem with pulling dampness out of walls); add ventilator fans to improve air flow, but don't use both the dehumidifier and ventilator fan at the same time.

Walls: Remove commentates coatings, if holding rising damp in walls; coat walls with vapor permeable lime based rendering plaster, if damp walls need a sacrificial coating to protect mortar from erosion; add termite shields, if evidence of termites and dampness cannot be controlled.

Framing: Reinforce existing floor framing weakened by moisture by adding lolly column support and reinforcing joist ends with sistered or parallel supports. Add a vapor impermeable shield, preferably non-ferrous metal, under wood joists coming into contact with moist masonry.

C. Develop new drainage systems for roof run-off that remove moisture from the base of the building. Photo: WPTC, NPS.

Interior: Eliminate areas where moisture is leaking or causing a problem.

Plumbing: Replace older pipes and fixtures subject to leaking or overflowing; insulate water pipes subject to condensation.

Ventilation: Add exhaust fans and whole house fans to increase air flow through buildings, if areas are damp or need more ventilation to control mold and mildew.

Climate: Adjust temperature and relative humidity to manage interior humidity; Correct areas of improperly balanced pressure for HVAC systems that may be causing a moisture problem.

D. Install ventilating fans when additional air circulation will improve damp conditions in buildings or reduce cooling loads. Photo: Ernest A. Conrad, P. E.

MOISTURE: LEVEL III REPLACEMENT / ALTERATIONS — —

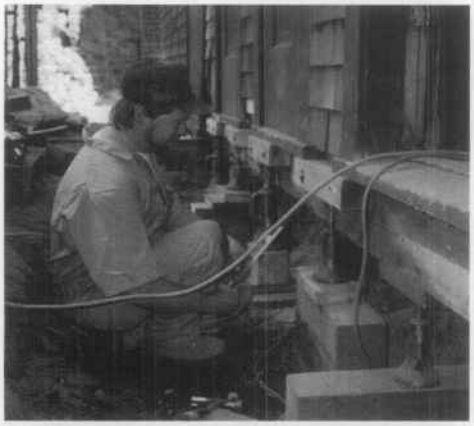
A. This lead sheet was installed at the base of the replacement column to stop rising damp. Photo: Bryan Blundell.

Exterior: Undertake exterior rehabilitation work that follows professional repair practices —i.e., replace a deteriorated feature with a new feature to match the existing in design, color, texture, and when possible, materials. In some limited situations, non-historic materials may be necessary in unusually wet areas.

Roofs: Add ventilator fans to exhaust roofs but avoid large projecting features whose designs might negatively affect the appearance of the historic roof. When replacing roofs, correct conditions that have caused moisture problems, but keep the overall appearance of the roof; for example, ventilate under wooden shingles, or detail standing seams to avoid buckling and cracking. Be attentive to provide extra protection for internal or built-in gutters by using the best quality materials, flashing, and vapor impermeable connection details.

Walls: If insulation and vapor barriers are added to frame walls, consider maintaining a ventilation channel behind the exterior cladding to avoid peeling and blistering paint occurrences.

Windows: Consider removable exterior storm windows, but allow operation of windows for periodic ventilation of cavity between exterior storm and historic sash. For stained glass windows using protective glazing, use only ventilated storms to avoid condensation as well as heat build-up.



B. Wood sills set on grade were replaced with concrete pier foundation and new wooden sill plates. Changes were not visible on the exterior (see C). Photo: WPTC, NPS.

Ground: Control excessive ground moisture. This may require extensive excavations, new drainage systems, and the use of substitute materials. These may include concrete or new sustainable recycled materials for wood in damp areas when they do not impact the historic appearance of the building.

Grade: Excavate and install water collection systems to assist with positive run-off of low lying or difficult areas of moisture drainage; use drainage mats under finished grade to improve run-off control; consider the use of column plinth blocks or bases that are ventilated or constructed of non-absorbent substitute materials in chronically damp areas. Replace improperly sloped walks; repair non-functioning catch basins and site drains; repair settled areas around steps and other features at grade.

C. The new ground gutter gravel base helps drainage around the concrete foundation (see B above) which is not visible behind the replaced wooden wall shingles. Photo: WPTC, NPS.

D. In a flood plain, rotted joists were replaced with a concrete slab and sleepers designed to drain water. Spaced flooring allowed drainage and room for damp wood to swell without buckling. Harper's Ferry Center, NPS.

E. Mechanical systems on the lower level were placed on platforms above the flood line. Harper's Ferry Center, NPS.

— — FOR CHRONICALLY DAMP CONDITIONS

Foundations: Improve performance of foundation walls with damp-proof treatments to stop infiltration or damp course layers to stop rising damp. Some substitute materials may need to be selectively integrated into new features.

Walls: excavate, repoint masonry walls, add footing drains, and waterproof exterior subsurface walls; replace wood sill plates and deteriorated structural foundations with new materials, such as pressure treated wood, to withstand chronic moisture conditions; materials may change, but overall appearance should remain similar. Add dampcourse layer to stop rising damp; avoid chemical injections as these are rarely totally effective, are not reversible, and are often visually intrusive.

Interior: Control the amount of moisture and condensation on the interiors of historic buildings. Most designs for new HVAC systems will be undertaken by mechanical engineers, but systems should be selected that are appropriate to the resource and intended use.

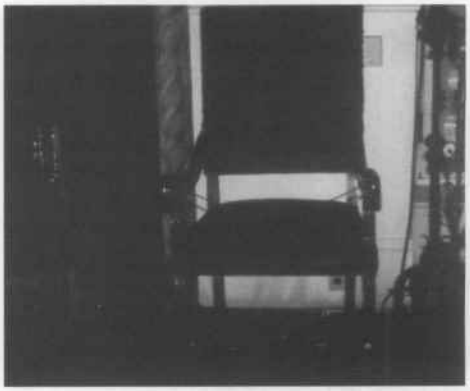
Windows, skylights: Add double and triple glazing, where necessary to control condensation. Avoid new metal sashes or use thermal breaks where prone to heavy condensation.

Mechanical systems: Design new systems to reduce stress on building exterior. This might require insulating and tightening up the building exterior, but provisions must be made for adequate air flow. A new zoned system, with appropriate transition insulation, may be effective in areas with differing climatic needs.

Control devices/Interior spaces: If new climate control systems are added design back-up controls and monitoring systems to protect from interior moisture damage.

Walls: If partition walls sit on floors that periodically flood, consider spacers or isolation membranes behind baseboards to stop moisture from wicking up through absorbent materials.

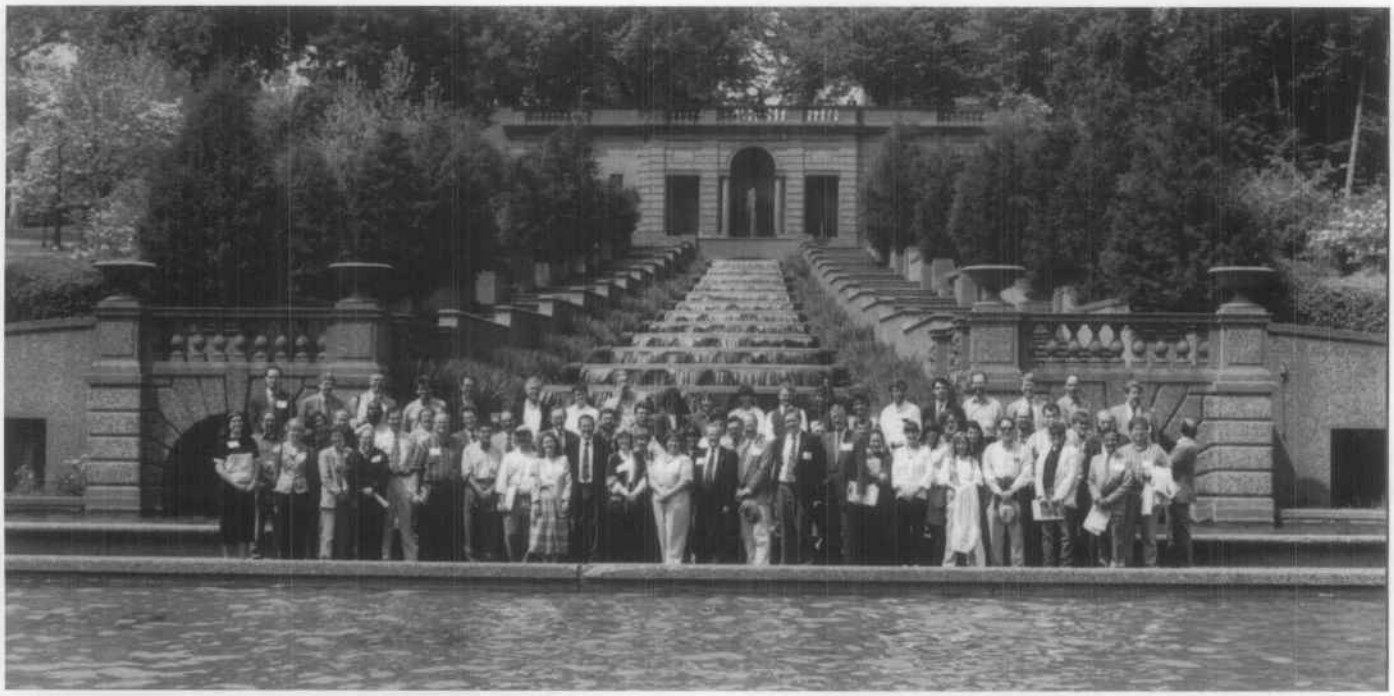
F. Triple glazed windows replaced the originals to control condensation. Photo: © Isabella Stewart Gardner Museum, Boston.



G. New sensors which monitor temperature and relative humidity are located throughout this museum and tied to a computer that controls the climate control system. Photo: © Isabella Stewart Gardner Museum, Boston.

I. Critically damp foundation walls were protected with a layer of bentonite clay to reduce moisture penetration. This work was in combination with new downspouts that were connected to drainage boots that deposited captures roof run-off away from the foundation. Photo: Courtesy, Larry D. Dermody and the National Trust for Historic Preservation.

H. New computers tie a variety of monitoring and security features into a comprehensive system which provides warning and backup alerts when any of the system components are not functioning properly. Photo: © Isabella Stewart Gardner Museum, Boston.



Back Cover: The Diagnosing Moisture in Historic Building Symposium held in Washington, DC, May, 1996, brought together practitioners in the field of historic preservation to discuss the issues contained in this Preservation Brief. Attendees are standing in front of the cascading fountains at Meridian Hill Park, a National Historic Landmark. Photo: Eric Avner.

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This publication has been prepared pursuant to the National Historic Preservation Act, as amended, which directs the Secretary of the Interior to develop and make available information concerning historic properties. Comments about this publication should be directed to de Teel Patterson Tiller, Acting Manager, Heritage Preservation Services Program, National Park Service, P.O. Box 37127, Washington, DC 20013-7127. This publication is not copyrighted and can be reproduced without penalty. Copyright photographs included in this publication may not be used to illustrate publications other than as a reference to this Preservation Brief, without permission of the owners. Normal procedures for credit to the authors and the National Park Service are appreciated.

Cover Photo: Masonry repointing in a wet environment. Photo: Williamsport Preservation Training Center, NPS.

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47 PRESERVATION BRIEFS

Maintaining the Exteriors of Small and Medium Size Historic Buildings

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Preservation is defined as "the act or process of applying measures necessary to sustain the existing form, integrity, and materials of an historic property. Work, including preliminary measures to protect and stabilize the property, generally focuses upon the *ongoing maintenance and repair* of historic materials and features rather than extensive replacement and new construction."[1]

Maintenance helps preserve the integrity of historic structures. If existing materials are regularly maintained and deterioration is significantly reduced or prevented, the integrity of materials and workmanship of the building is protected. Proper maintenance is the most cost effective method of extending the life of a building. As soon as a building is constructed, restored, or rehabilitated, physical care is needed to slow the natural process of deterioration. An older building has already experienced years of normal weathering and may have suffered from neglect or inappropriate work as well.

Decay is inevitable but deterioration can accelerate when the building envelope is not maintained on a regular basis. Surfaces and parts that were seamlessly joined when the building was constructed may gradually become loose or disconnected; materials that were once sound begin to show signs of weathering. If maintenance is deferred, a typical response is to rush in to fix what has been ignored, creating additional problems. Work done on a crisis level can favor inappropriate treatments that alter or damage historic material.

There are rewards for undertaking certain repetitive tasks consistently according to a set schedule. Routine and preventive care of building materials is the most effective way of slowing the natural process of deterioration. The survival of historic buildings in good condition is primarily due to regular upkeep and the preservation of historic materials.

Well-maintained properties tend to suffer less damage from storms, high winds, and even small earthquakes. Keeping the roof sound, armatures and attachments such as shutters tightened and secured, and having joints and connections functioning well, strengthens the ability of older buildings to withstand natural occurrences.

Over time, the cost of maintenance is substantially less than the replacement of deteriorated historic features and involves considerably less disruption. Stopping decay before it is widespread helps keep the scale and complexity of work manageable for the owner.

This *Preservation Brief* is designed for those responsible for the care of small and medium size historic buildings, including owners, property administrators, in-house maintenance staff, volunteers, architects, and maintenance contractors. The Brief discusses the benefits of regular inspections, monitoring, and seasonal maintenance work; provides general guidance on maintenance treatments for historic building exteriors; and emphasizes the importance of keeping a written record of completed work.

Getting Started

Understanding how building materials and construction details function will help avoid treatments that are made in an attempt to simplify maintenance but which may also result in long-term damage. It is enticing to read about "maintenance free" products and systems, particularly waterproof sealers, rubberized paints, and synthetic siding, but there is no such thing as maintenance free when it comes to caring for historic buildings. Some approaches that initially seem to reduce maintenance requirements may over time actually accelerate deterioration.

Exterior building components, such as roofs, walls, openings, projections, and foundations, were often constructed with a variety of functional features, such as overhangs, trim pieces, drip edges, ventilated cavities, and painted surfaces, to protect against water infiltration, ultraviolet deterioration, air infiltration, and

Figure 1. Maintenance involves selecting the proper treatment and protecting adjacent surfaces. Using painter's tape to mask around a brass doorknocker protects the painted door surface from damage when polishing with chemical compounds. On the other hand, hardware with a patinated finish was not intended to be polished and should simply be cleaned with a damp cloth.

Cautions During Maintenance Work

All maintenance work requires attention to safety of the workers and protection of the historic structure. Examples include the following:

• Care should be taken when working with historic materials containing lead-based paint. For example, damp methods may be used for sanding and removal to minimize air-borne particles. Special protection is required for workers and appropriate safety measures should be followed.

• Materials encountered during maintenance work, such as droppings from pigeons and mice, can cause serious illnesses. Appropriate safety precautions need to be followed. Services of a licensed contractor should be obtained to remove large deposits from attics and crawlspaces.

• Heat removal of paint involves several potential safety concerns. First, heating of lead-containing paint requires special safety precautions for workers. Second, even at low temperature levels, heat removal of paint runs the risk of igniting debris in walls. Heat should be used only with great caution with sufficient coverage by smoke detectors in work areas. Work periods need to be timed to allow monitoring after completion of paint removal each day, since debris will most often smolder for a length of time before breaking out into open flame. The use of torches, open flames, or high heat should be avoided.

• Many chemical products are hazardous and volatile organic compounds (VOC) are banned in many areas. If allowed, appropriate respirators and other safety precautions are essential for use.

• Personal protection is importan and may require the use of goggles, gloves, mask, closed-toed shoes, and a hard hat.

• Electrical service should be turned off before inspecting a basement after a flood or heavy rain, where there is high standing water.

pest infestation. Construction assemblies and joints between materials allow for expansion and contraction and the diffusion of moisture vapor, while keeping water from penetrating the building envelope. Older buildings use such features effectively and care must be taken to retain them, avoiding the temptation to reduce air infiltration or otherwise alter them.

Monitoring, inspections, and maintenance should all be undertaken with safety in mind. Besides normal safety procedures, it is important to be cognizant of health issues more commonly encountered with older buildings, such as lead-based paint, asbestos, and bird droppings, and to know when it is necessary to seek professional services (see sidebar).

Original building features and examples of special craftsmanship should be afforded extra care. The patina or aging of historic materials is often part of the charm and character of historic buildings. In such cases, maintenance should avoid attempts to make finishes look new by over-cleaning or cladding existing materials. As with any product that has the potential to harm historic materials, the selection of a cleaning procedure should always involve testing in a discreet location on the building to ensure that it will not abrade, fade, streak, or otherwise damage the substrate (Fig 1).

Maintenance Plan, Schedules and Inspection

Organizing related work into a written set of procedures, or a Maintenance Plan, helps eliminate duplication, makes it easier to coordinate work effort, and creates a system for prioritizing maintenance tasks that takes into account the most vulnerable and character-defining elements.

The first time a property owner or manager establishes a maintenance plan or program, it is advisable to have help from a preservation architect, preservation consultant, and/or experienced contractor. Written procedures should outline step-by-step approaches that are custom- tailored to a building. No matter how small the property, every historic site should have a written guide for maintenance that can be as simple as:

1) Schedules and checklists for inspections;
2) Forms for recording work, blank base plans and elevations to be filled in during inspections and upon completion of work;
3) A set of base-line photographs to be augmented over time;
4) Current lists of contractors for help with complex issues or in case of emergencies;
5) Written procedures for the appropriate care of specific materials, including housekeeping, routine care, and preventive measures;
6) Record-keeping sections for work completed, costs, warranty cards, sample paint colors, and other pertinent material.

This information can be kept in one or more formats, such as a three-ring binder, file folders, or a computer database. It is important to keep the files current with completed work forms to facilitate long-term evaluations and planning for future work (Fig 2).

Proper maintenance depends on an organized plan with work prescribed in manageable components. Regular maintenance needs to be considered a priority both in terms of time allotted for inspections and for allocation of funding.

Maintenance work scheduling is generally based on a variety of factors, including the seriousness of the problem, type of work involved, seasonal appropriateness, product manufacturer's recommendations, and staff availability. There are other variables as well. For example, building materials and finishes on southern and western exposures will often weather faster than those on northern or eastern exposures. Horizontal surfaces facing skyward usually require greater maintenance than vertical ones; in regions with moderate or heavy rainfall, wood and other materials in prolonged shadow are subject to more rapid decay.

Maintenance costs can be controlled, in part, through careful planning, identification of the amount of labor required, and thoughtful scheduling of work. Maintenance schedules should take into account daily and seasonal activities of the property in order to maximize the uninterrupted time necessary to complete the work. Institutions generally need to budget annually between 2 and 4 percent of the replacement value of the building to underwrite the expense of full building maintenance.[2] Use of trained volunteers to undertake maintenance can help reduce costs.

Exterior inspections usually proceed from the roof down to the foundation, working on one elevation at

Cyclic Building Inspection Checklist: Horse Stable			**Inspection date: 04/24/05**	
Building Feature	*Material(s)*	*Condition Description*	*Maintenance Action Required*	*Work Done*
ROOF:				
Covering	Clay tile Painted metal standing seam	Two slipped tiles Slight corrosion; blistering paint on metal roof section	Reattach tiles Sand and repaint area that is peeling	5/4/05 6/8/05
Flashing	Painted metal	Flashing in good condition	N/A	N/A
Gutters/ Downspouts	6" half round galvanized metal	Gutter sagging; downspouts OK	Realign gutter and put on new hanger strap Flush out downspouts	5/4/05 5/5/05
Chimneys	No masonry chimney	N/A	N/A	N/A
Attachments/ Penetrations	Metal vent stack and weathervane	Vent stack hood has some peeling paint; vane OK	Sand and repaint vent stack	6/8/05

Figure 2. All personnel associated with a historic structure need to become acquainted with how existing building features should appear and during their daily or weekly routines look for changes that may occur. This will help augment the regular maintenance inspection that will occur at specified intervals based on seasonal changes, use, and other factors. A segment of an inspection form showing the roof elements of a horse stable is shown. The inspection report should be kept along with the maintenance plan and other material in notebook, file or electronic form.

a time, moving around the building in a consistent direction. On the interior, the attic, inside surfaces of exterior walls, and crawlspaces or basements should be examined for signs of potential or existing problems with the building envelope.

The following chart lists suggested inspection frequencies for major features associated with the building's exterior, based on a temperate four-season climate and moderate levels of annual rainfall. For areas of different climate conditions and rainfall, such as in the more arid southwest, the nature of building decay and frequency of inspections will vary. For buildings with certain inherent conditions, heavy use patterns, or locations with more extreme weather conditions, the frequency of inspections should be altered accordingly.

Note: All building features should be inspected after any significant weather event such as a severe rainstorm or unusually high winds.

INSPECTION FREQUENCY CHART		
Feature	Minimum Inspection Frequency	Season
Roof	Annually	Spring or fall; every 5 years by roofer
Chimneys	Annually	Fall, prior to heating season; every 5 years by mason
Roof Drainage	6 months; more frequently as needed	Before and after wet season, during heavy rain
Exterior Walls and Porches	Annually	Spring, prior to summer/fall painting season
Windows	Annually	Spring, prior to summer/fall painting season
Foundation and Grade	Annually	Spring or during wet season
Building Perimeter	Annually	Winter, after leaves have dropped off trees
Entryways	Annually; heavily used entries may merit greater frequency	Spring, prior to summer/fall painting season
Doors	6 months; heavily used entry doors may merit greater frequency	Spring and fall; prior to heating/ cooling seasons
Attic	4 months, or after a major storm	Before, during and after wet season
Basement/ Crawlspace	4 months, or after a major storm	Before, during and after rain season

Survey observations can be recorded on a standardized report form and photographs taken as a visual record. All deficient conditions should be recorded and placed on a written schedule to be corrected or monitored.

BUILDING COMPONENTS

For purposes of this discussion, the principal exterior surface areas have been divided into five components and are presented in order from the roof down to grade. While guidance for inspection and maintenance is provided for each component, this information is very general in nature and is not indeed to be comprehensive in scope. Examples have been selected to address some typical maintenance needs and to help the reader avoid common mistakes.

Roofs/chimneys

The roof is designed to keep water out of a building. Thus one of the principal maintenance objectives is to ensure water flows off the roof and into functional gutters and downspouts directly to grade and away from the building—and to prevent water from penetrating the attic, exterior walls, and basement of a building. (Note: Some buildings were designed without gutters and thus assessments must be made as to whether rain water is being properly addressed at the foundation and perimeter grade.) Keeping gutters and downspouts cleared of debris is usually high on the list of regular maintenance activities (Fig 3). Flashing around chimneys, parapets, dormers, and other appendages to the roof also merit regular inspection and appropriate maintenance when needed. The material covering the roof—wood shingles, slate, tile, asphalt, sheet metal, rolled roofing—requires maintenance both to ensure a watertight seal and to lengthen its service life; the type and frequency of maintenance varies with the roofing material. Older chimneys and parapets also require inspection and maintenance. With the exception of cleaning and minor repairs to gutters and downspouts, most roof maintenance work will necessitate use of an outside contractor.

Inspection:

The functioning of gutters and downspouts can be safely observed from the ground during rainy weather and when winter ice has collected. Binoculars are a useful tool in helping to identify potential roofing problems from the same safe vantage point. Careful observation from grade helps to identify maintenance needs between close-up inspections by an experienced roofer. Observation from the building interior is also important to identify possible leak locations. When access can be safely gained to the roof, it is important to wear shoes with slip-resistant soles and to use safety ropes.

Figure 3. Keeping gutters clean of debris can be one of the most important cyclical maintenance activities. On this small one-story addition, a garden hose is being used to flush out the trough to ensure that the gutter and downspouts are unobstructed. Gutters on most small and medium size buildings can be reached with an extension ladder and a garden hose. Photo: Bryan Blundell.

Depending on the nature of the roof, some common conditions of concern to look for are:

- sagging gutters and split downspouts;
- debris accumulating in gutters and valleys;
- overhanging branches rubbing against the roof or gutters
- plant shoots growing out of chimneys;
- slipped, missing, cracked, bucking, delaminating, peeling, or broken roof coverings;
- deteriorated flashing and failing connections at any intersection of roof areas or of roof and adjacent wall;
- bubbled surfaces and moisture ponding on flat or low sloped roofs;
- evidence of water leaks in the attic;
- misaligned or damaged elements, such as decorative cresting, lightning rods, or antennas; and
- cracked masonry or dislodged chimney caps.

Maintenance:

• Remove leaves and other debris from gutters and downspouts. Utilize a ladder with a brace device, if necessary, to keep the ladder from crushing the gutter. Use a garden hose to flush out troughs and downspouts. Patch or repair holes in gutters using products such as fiberglass tape and epoxy adhesive in metal gutters. Avoid asphalt compounds since acidic material can cause further deterioration of metal gutters.

• Correct misaligned gutters and adjust, if necessary, so that water flows to drains and does not pond. If gutter edges sag, consider inserting wooden wedges between the fascia board and the back of the gutter to add support. Seal leaking seams or pinholes in gutters and elbows.

• Broom sweep branch or leaf debris away from shingles, valleys, and crickets, particularly around chimneys and dormers.

• Where mechanical equipment is mounted on flat or low-sloped roofs, ensure that access for maintenance can be provided without damaging the roof. Clean out trapped leaves and debris from around equipment base and consider adding a protective walkway for access.

• Remove biological growth where it is causing erosion or exfoliation of roofing. Use low-pressure garden hose water and a natural or nylon scrubbing brush to remove such growth, scraping with a plastic putty knife or similar wood or plastic tool as needed on heavier buildup. Most growth is acidic and while there are products designed to kill spores, such as diluted chlorine bleach, they should be avoided. Even fairly weak formulas can still cause unexpected color changes, efflorescence, or over-splash damage to plantings or surfaces below the roof. Where appropriate, trim adjacent tree branches to increase sunlight on the roof since sunlight will deter further biological growth.

• Re-secure loose flashing at the dormers, chimneys or parapets. Clean out old mortar, lead, lead wool, or fastening material and make sure that flashing is properly inserted into reglet (slot) joints, taking care not to damage the substrate. Avoid installing new step flashing as a single metal component where multiple pieces are required to provide proper waterproofing. Also avoid attaching step flashing with mastic or sealant. Properly re-bed all step flashing. Use appropriate non-ferrous flashing metal or painted metal if needed. Since cap, step, valley, cricket, and apron flashings each have specific overlap and extension requirements, replacement flashing should match the existing material unless there has been a proven deficiency.

Figure 4. Damage to roofs often requires immediate attention. As a temporary measure, this damaged roof tile could be replaced with a brown aluminum sheet wedged between the existing tiles. Photo: Chad Randl.

Figure 5. The use of a sealant to close an exposed joint is not always an effective long-term solution. Where this decorative wood element connects to the slate roof, the sealant has failed within a short time and a proper metal flashing collar is being fitted instead. Photo: Bryan Blundell.

• Repoint joints in chimneys, parapet, or balustrade capping stones using a hydraulic lime mortar or other suitable mortar where the existing mortar has eroded or cracked, allowing moisture penetration. In general, a mortar that is slightly weaker than the adjacent masonry should be used. This allows trapped moisture in the masonry to migrate out through the mortar and not the masonry. Spalled masonry is often evidence of the previous use of a mortar mix that was too hard.

• Use professional services to repair chimneys and caps. Avoid the use of mortar washes on masonry since they tend to crack, allowing moisture to penetrate and promoting masonry spalling. Repoint masonry with a durable mortar that is slightly weaker than the adjacent masonry. Slope the masonry mortar cap to insure drainage away from the flue. If a chimney rain cap is installed, ensure adequate venting and exhaust.

• As a temporary measure, slip pieces of non-corrosive metal flashing under or between damaged and missing roofing units until new slate, shingles, or tile can be attached. Repair broken, missing or damaged roofing units with ones that match. Follow roofing supplier and industry guidance on inserting and attaching replacement units (Fig 4). Avoid using temporary asphalt patches as it makes a proper repair difficult later on.

• For long-term preservation of wooden shingle roofs coated with a preservative, recoat every few years following the manufacturer's recommendations. Be aware of environmental considerations.

• Scrape and repaint selected areas of coated ferrous metal roofing as needed; repaint on a regularly scheduled basis. Ferrous metal roofs can last a long time if painted regularly. Alkyd coatings are generally used on metal roofs; be sure to wash and properly prepare the area beforehand. Environmental regulations may restrict the use of certain types of paints. Apply the coating system in accordance with manufacturer's recommendations. Prepare the surface prior to application to obtain good adhesion with the prime coat. Apply both a prime coat and a topcoat for good bonding and coverage; select primer and topcoat products from the same manufacturer.

• Re-secure loose decorative elements, such as finials and weathervanes. Seek professional advice if decorative elements exhibit considerable corrosion, wood rot, or structural instability. Small surface cracks may benefit from a flexible sealant to keep moisture out; sealants have a limited life and require careful inspection and periodic replacement (Fig 5).

Exterior Walls

Exterior walls are designed to help prevent water infiltration, control air infiltration, and serve as a barrier for unwanted animals, birds and insects. The primary maintenance objective is to keep walls in sound condition and to prevent water penetration, insect infestation, and needless decay (Fig 6). Depending on the materials and construction methods, walls should have an even appearance, free from unwanted cracks, and should be able to shed excess moisture. Where surfaces are significantly misaligned or where there are bulging wall sections

or cracks indicative of potential structural problems, seek professional guidance as to the cause of distress and appropriate corrective measures. Wood-frame construction generally will require more frequent maintenance than buildings constructed of brick, stone, or terra cotta (Fig 7).

Inspections:

It is best to inspect walls during dry as well as wet weather. Look for moisture patterns that may appear on the walls after a heavy or sustained rainfall or snow, recording any patterns on elevation drawings or standard recording forms. Monitoring the interior wall for moisture or other potential problems is important as well. Look for movement in cracks, joints, and around windows and doors and try to establish whether movement is seasonal in nature (such as related to shrinkage of wood during dry weather) or signs of an ongoing problem. For moderate size buildings, a ladder or mechanical lift may be necessary, though in some cases the use of binoculars and observations made from windows and other openings will be sufficient. When examining the walls, some common conditions of concern to look for are:

- Misaligned surfaces, bulging wall sections, cracks in masonry units, diagonal cracks in masonry joints, spalling masonry, open joints, and nail popping;
- Evidence of wood rot, insect infestation, and potentially damaging vegetative growth;
- Deficiencies in the attachment of wall mounted lamps, flag pole brackets, signs, and similar items;
- Potential problems with penetrating features such as water spigots, electrical outlets, and vents;
- Excessive damp spots, often accompanied by staining, peeling paint, moss, or mold; and
- General paint problems (Fig 8).

Maintenance:

• Trim tree branches away from walls. Remove ivy and tendrils of climbing plants by first cutting at the base of the vine to allow tendrils to die back, and later using a plastic scraper to dislodge debris and an appropriate digging tool to dislodge and remove root systems. Be cautious if using a commercial chemical to accelerate root decay; follow safety directions and avoid contact of chemicals with workers and wall materials.

• Wash exterior wall surfaces if dirt or other deposits are causing damage or hiding deterioration; extend

Figure 6. Stucco applied to an exterior wall or foundation was intended to function as a watertight surface. Unless maintained, rainwater will penetrate open joints and cracks that may occur over time. A spalled section of stucco indicates some damage has occurred and a wooden mallet is being used to tap the surface to determine whether the immediate stucco has lost adhesion. Photo: Bryan Blundell.

Figure 7. One of the advantages of wood shingles as a wall covering is that individual shingles that are damaged can easily be replaced. On this highly exposed corner, worn shingles have been selectively replaced to help safeguard against water damage. The new shingles will be stained to match the existing shingles.

Figure 8. The paint on the siding of this south-facing wall needs to be scraped, sanded, primed and repainted. Postponing such work will lead to further paint failure, require greater preparatory costs, and could even result in the need to replace some siding. Photo: Charles Fisher.

Figure 9. To help extend a repainting cycle, dirt and spider webs should be removed before permanent staining occurs. In this case, a natural bristle brush and a soft damp cloth are being used to remove insect debris and refresh the surface appearance.

scheduled times for cleaning for cosmetic purposes to reduce frequency (Fig 9). When cleaning, use the gentlest means possible; start with natural bristle brushes and water and only add a mild phosphate-free detergent if necessary. Use non-abrasive cleaning methods and low-pressure water from a garden hose. For most building materials, such as wood and brick, avoid abrasive methods such as mechanical scrapers and high-pressure water or air and such additives as sand, natural soda, ice crystals, or rubber products. All abrasives remove some portion of the surface and power-washing drives excessive moisture into wall materials and even into wall cavities and interior walls. If using a mild detergent, two people are recommended, one to brush and one to prewet and rinse. When graffiti or stains are present, consult a preservation specialist who may use poultices or mild chemicals to remove the stain. If the entire building needs cleaning other than described above, consult a specialist.

• Repoint masonry in areas where mortar is loose or where masonry units have settled. Resolve cause of cracks or failure before resetting units and repointing. Rake out joints by hand, generally avoiding rotary saws or drills, to a depth of 2 ½ times the width of the joint (or until sound mortar is encountered), to make sure that fresh mortar will not pop out. Repointing mortar should be lime-rich and formulated to be slightly weaker than the masonry units and to match the historic mortar in color, width, appearance, and tooling. Off-the-shelf pre-mixed cement mortars are not appropriate for most historic buildings. Avoid use of joint sealants in place of mortar on vertical masonry wall surfaces, as they are not breathable and can lead to moisture-related damage of the adjacent masonry (Fig 10).

• Correct areas that trap unwanted moisture. Damaged bricks or stone units can sometimes be removed, turned around, and reset, or replaced with salvaged units. When using traditional or contemporary materials for patching wood, masonry, metal, or other materials, ensure that the materials are compatible with the substrate; evaluate strength, vapor permeability, and thermal expansion, as well as appearance.

• When patching is required, select a compatible patch material. Prepare substrate and install patch material according to manufacturer's recommendations; respect existing joints. Small or shallow surface defects may not require patching; large or deep surface defects may be better addressed by installation of a dutchman unit than by patching.

• Where a damaged area is too large to patch, consider replacing the section with in-kind material. For stucco and adobe materials, traditional patching formulas are recommended.

• When temporarily removing wood siding to repair framing or to tighten corner boards and loose trim, reuse the existing siding where possible. Consider using stainless steel or high strength aluminum nails as appropriate. Putty or fill nail holes flush with siding prior to repainting. Back-prime any installed wood with

Figure 10. Repointing of masonry should usually be approached as repair rather than maintenance work in part because of the need for a skilled mason familiar with historic mortar. In this case, a moisture condition was not corrected and the use of a waterproof coating and off-the-shelf Portland cement mortar trapped water and resulted in further damage to these 19th century bricks. Photo: NPS files.

one coat of primer and coat end grain that might be exposed with two coats of primer.

• Prepare, prime, and spot paint areas needing repainting. Remember that preparation is the key to a successful long lasting paint job. Ensure beforehand the compatibility of new and existing paints to avoid premature paint failure. Remove loose paint to a sound substrate; sand or gently rough surface if needed for a good paint bond; wipe clean; and repaint with appropriate primer and topcoats. Follow manufacturer's recommendations for application of coatings, including temperature parameters for paint application. Use top quality coating materials. Generally paint when sun is not shining directly onto surfaces to be painted.

• Remove deteriorated caulks and sealants, clean, and reapply appropriate caulks and sealants using backer rods as necessary. Follow manufacturer's instructions regarding preparation and installation.

• Correct deficiencies in any wall attachments such as awning and flag pole anchors, improperly installed electrical outlets, or loose water spigots.

Openings

Exterior wall openings primarily consist of doors, windows, storefronts, and passageways. The major maintenance objectives are to retain the functioning nature of the opening and to keep in sound condition the connection between the opening and the wall in order to reduce air and water infiltration.

Inspection:

Wall openings are typically inspected from inside as well as out. Examinations should include the overall material condition; a check for unwanted water penetration, insect infiltration, or animal entry; and identification of where openings may not be properly functioning. Frames should be checked to make sure they are not loose and to ascertain whether the intersection between the wall and the frame is properly sealed. Secure connections of glazing to sash and between sash and frames are also important. Particular attention should be placed on exposed horizontal surfaces of storefronts and window frames as they tend to deteriorate much faster than vertical surfaces. Inspections should identify:

- loose frames, doors, sash, shutters, screens, storefront components, and signs that present safety hazards;
- slipped sills and tipped or cupped thresholds;
- poorly fitting units and storm assemblies, misaligned frames, drag marks on thresholds from sagging doors and storm doors;
- loose, open, or decayed joints in door and window frames, doors and sash, shutters, and storefronts;
- loose hardware, broken sash cords/chains, worn sash pulleys, cracked awning, shutter and window hardware, locking difficulties, and deteriorated weatherstripping and flashing;
- broken/cracked glass, loose or missing glazing and putty;
- peeling paint, corrosion or rust stains; and
- window well debris accumulation, heavy bird droppings, and termite and carpenter ant damage.

Maintenance:

• Replace broken or missing glass as soon as possible; in some cases cracked glass may be repaired using specialty glues. For historic crown glass and early cylinder glass, a conservation approach should be considered to repair limited cracks. Where panes with a distinct appearance are missing, specialty glass should be obtained to match, with sufficient inventory kept for future needs. Avoid using mechanical devices to remove old putty and match historic putty bevels or details when undertaking work.

• Reputty window glazing where putty is deteriorated or missing. Take care in removing putty so as not to crack or break old glass or damage muntins and sash frames. Re-glaze with either traditionally formulated

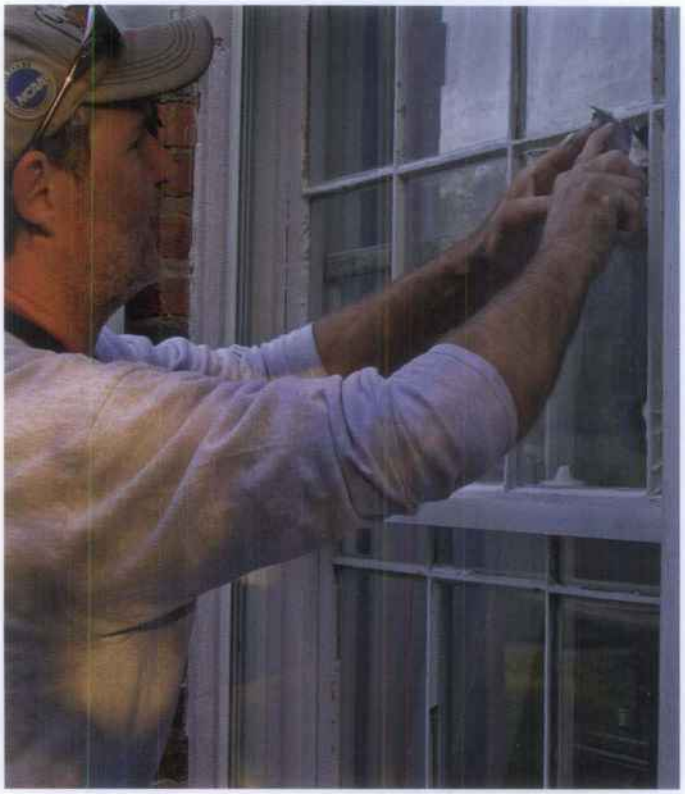

Figure 11. Glazing putty should be maintained in sound condition to prevent unwanted air infiltration and water damage. New glazing putty should be pulled tight to the glass and edge of the wood, creating a clean bevel that matches the historic glazing.

oil putties or modern synthetic ones, making sure to properly bed the glass and secure with glazing points (Fig 11).

• Clean window glass, door glazing, storefronts, transom prism lights, garage doors, and storm panels using a mild vinegar and water mixture or a non-alkaline commercial window cleaner. Be cautious with compounds that contain ammonia as they may stain brass or bronze hardware elements if not totally removed. When using a squeegee blade or sponge, wipe wet corners with a soft dry cloth. Avoid high-pressure washes.

• Clean handles, locks and similar hardware with a soft, damp cloth. Use mineral spirits or commercial cleaners very sparingly, as repeated use may remove original finishes. Most metal cleaners include ammonia that can streak and stain metal, so it is important to remove all cleaning residue. Polished hardware subject to tarnishing or oxidation, particularly doorknobs, often benefits from a thin coat of paste wax (carnauba), hand buffed to remove extra residue. Avoid lacquer finishes for high use areas, as they require more extensive maintenance. Patinated finishes should not be cleaned with any chemicals, since the subtle aged appearance contributes to the building's character.

• Remove and clean hardware before painting doors and windows; reinstall after the paint has dried.

• Tighten screws in doorframes and lubricate door hinges, awning hardware, garage door mechanisms, window sash chains, and pulleys using a graphite or silicone type lubricant.

Contracting Maintenance and Repair Work

Many contractors are very proficient in using modern construction methods and materials; however, they may not have the experience or skill required to carry out maintenance on historic buildings. The following are tips to use when selecting a contractor to work on your historic building:

1. Become familiar with work done on similar historic properties in your area so that you can obtain names of possible preservation contractors.

2. Be as specific as possible in defining the scope of work you expect to undertake.

3. Ask potential contractors for multiple references (three to five) and visit previous work sites. Contact the building owner or manager and ask how the job proceeded; if the same work crew was retained from start to finish; if the workers were of a consistent skill level; whether the project was completed in a reasonable time; and whether the person would use the contractor again.

4. Be familiar with the preservation context of the work to be undertaken. Use the written procedures in your maintenance plan to help define the scope of work in accordance with preservation standards and guidelines. Always request that the gentlest method possible be used. Use a preservation consultant if necessary to ensure that the work is performed in an appropriate manner.

5. Request in the contract proposal a detailed cost estimate that clearly defines the work to be executed, establishes the precautions that will be used to protect adjoining materials, and lists specific qualified subcontractors, if any, to be used.

6. Insure that the contractor has all necessary business licenses and carries worker compensation.

• Check weather stripping on doors and windows and adjust or replace as necessary. Use a durable type of weather stripping, such as spring metal or high quality synthetic material, avoiding common brush and bulb or pile weather stripping that require more frequent replacement.

• Adjust steel casement windows as needed for proper alignment and tight fit. Avoid additional weather stripping as this may lead to further misalignment, creating pathways for air and water infiltration.

• Check window sills for proper drainage. Fill cracks in wood sills with a wood filler or epoxy. Follow manufacturer's instructions for preparation and installation. Do not cover over a wood sill with metal panning, as it may trap moisture and promote decay.

• Repair, prime, and repaint windows, doors, frames, and sills when needed. Clean out putty debris and paint chips from windows using a wet paper towel and dispose of debris prior to repair or repainting. Take appropriate additional precautions when removing lead-based paint. Sand and prepare surfaces and use material-specific patching compounds to fill any holes or areas collecting moisture (Fig 12). Avoid leaving exposed wood unpainted for any length of time, as light will degrade the wood surface and lead to premature failure of subsequent paint applications. Immediately prime steel sash after paint is removed and the substrate prepared for repainting.

Figure 12. Good surface preparation is essential for long lasting paint. Scraping loose paint, filling nail holes and cracks, sanding, and wiping with a damp cloth prior to repainting are all important steps whether touching up small areas or repainting an entire feature. Always use a manufacturer's best quality paint. Windows and shutters may need repainting every five to seven years, depending on exposure and climate.

• Adjust wood sash that bind when operated. Apply beeswax, paraffin, or similar material to tracks or sash runs for ease of movement. If sash are loose, replace worn parting beads. Sash runs traditionally were unpainted between the stop and parting bead; removing subsequent paint applications will often help improve sash operation.

• Correct perimeter cracks around windows and doors to prevent water and air infiltration. Use traditional material or modern sealants as appropriate. If fillers such as lead wool have been used, new wool can be inserted with a thin blade tool, taking care to avoid damage to adjacent trim. Reduce excess air infiltration around windows by repairing and lubricating sash locks so that windows close tightly.

Figure 13. Window air conditioning units can cause damage to surfaces below when condensation drips in an uncontrolled manner. Drip extension tubes can sometimes be added to direct the discharge.

• Remove debris beneath window air conditioning units and ensure that water from units does not drain onto sills or wall surfaces below (Fig 13). Removal of air conditioning units when not in season is recommended.

• Adjust storm panels and clean weep holes; check that weep holes at the bottom of the panels are open so water will not be trapped on the sill. Exterior applied storm windows are best attached using screws and not tightly adhered with sealant. Use of sealant makes storm units difficult to remove for maintenance and can contribute to moisture entrapment if weep holes become clogged.

• Remove weakened or loose shutters and store for later repair. Consider adding a zinc or painted metal top to shutters as a protective cap to cover the wood's exposed end grain. This will extend the life of the shutters.

Figure 14. When inspecting connections between projections and the main building, look for areas where birds, bees and pests may enter or nest. Birds have been nesting in this porch roof and the area is being cleaned of their debris. Where an opening exists, it may be necessary to cover it with a trim piece, screening, or sealant. Photo: Bryan Blundell.

Projections

Numerous projections may exist on a historic building, such as porches, dormers, skylights, balconies, fire escapes, and breezeways. They are often composed of several different materials and may include an independent roof. Principal maintenance objectives include directing moisture off these features and keeping weathered surfaces in good condition. Secondary projections may include brackets, lamps, hanging signs, and similar items that tend to be exposed to the elements.

Inspection:

In some cases, projections are essentially independent units of a building and so must be evaluated carefully for possible settlement, separation from the main body of the building, and materials deterioration. Some electrical features may require inspection by a electrician or service technician. Common conditions of concern to look for are:

- damaged flashing or tie-in connections of projecting elements;
- misaligned posts and railings;
- deteriorated finishes and materials, including peeling paint, cupped and warped decking, wood deterioration, and hazardous steps;
- evidence of termites, carpenter ants, bees, or animal pests (Fig 14);
- damaged lamps, unsafe electrical outlets or deteriorated seals around connections;
- loose marker plaques, sign, or mail boxes; and
- rust and excessive wear of structural, anchorage, and safety features of balconies and fire escapes.

Maintenance:

• Selectively repair or replace damaged roofing units on porches and other projections. Ensure adequate drainage away from the building. Repair flashing connections as needed; clean and seal open joints as appropriate.

• Secure any loose connections, such as on porch rails or fire escapes.

• Maintain ferrous metal components by following manufacturer's recommendation for cleaning and repainting. Remove rust and corrosion from porch handrails, balconies, fire escapes, and other metal features; prepare, prime, and repaint using a corrosion-inhibitive coating system. Apply new primer before new corrosion sets in, followed by new topcoat. Take appropriate safety measures when dealing with existing lead-based paint and in using corrosion-removal products (Fig 15).

• Reattach loose brackets, lamps, or signs. With electrical boxes for outlets or lighting devices, ensure that cover plates are properly sealed. Prime and paint metal elements as needed.

• Keep porch decks and steps free from dust, dirt, leaf debris, and snow as soon at it accumulates using a broom or plastic blade shovel.

• Repair areas of wood decay or other damage to railings, posts, and decorative elements. Repair with wood dutchman, wood putty, or epoxy filler, as appropriate; replace individual elements as needed.

Figure 15. Metal projecting elements on a building, such as sign armatures and railings, are easily subject to rust and decay. Proper surface preparation to remove rust is essential. Special metal primers and topcoats should be used.

Prime and repaint features when necessary and repaint horizontal surfaces on a more frequent basis.

• Sand and repaint porch floorboards to keep weather surfaces protected. The exposed ends of porch floorboards are especially susceptible to decay and may need to be treated every year or two.

• Carefully cut out damaged or buckled porch flooring and replace with wood to match. Back-prime new wood that is being installed; treat end grain with wood preservative and paint primer. Ensure that new wood is adequately kiln or air-dried to avoid shrinkage and problems with paint adherence.

• Repair rotted stair stringers; adjust grade or add stone pavers at stair base to keep wooden elements from coming into direct contact with soil.

• Consider durable hardwoods for replacement material where beading, chamfering, or other decorative work is required in order to match existing features being replaced. Although appropriate for certain applications, pressure treated lumber is hard to tool and may inhibit paint adherence if not allowed to weather prior to coating application.

• Clean out any debris from carpenter bees, ants, termites, and rodents, particularly from under porches. Replace damaged wood and add screening or lattice to discourage rodents. Consider treating above ground features with a borate solution to deter termites and wood rot and repaint exposed surfaces.

Foundations and Perimeter Grades

The foundation walls that penetrate into the ground, the piers that support raised structures, and the ground immediately around a foundation (known as grade) serve important structural functions. To help sustain these functions, it is important that there is good drainage around and away from the building. The maintenance goal is to prevent moisture from entering foundations and crawl spaces and damaging materials close to the grade, and to provide ventilation in damp areas.

Inspection:

Inspections at the foundation should be done in conjunction with the inspection of the downspouts to ensure that water is being discharged a sufficient distance from the building perimeter to avoid excessive dampness in basements or crawl spaces. In addition, crawl spaces should be adequately vented to deter mold and decay and should be screened or otherwise secured against animals. Look for:

- depressions or grade sloping toward the foundation; standing water after a storm;

Figure 16. This chronically wet area has a mildew bloom brought on by heat generated from the air-conditioning condenser unit. The dampness could be caused be a clogged roof gutter, improper grading, or a leaking hose bibb.

Sealants and Caulks

Using sealants and caulks has become a familiar part of exterior maintenance today. As the use of precision joinery and certain traditional materials to render joints more weathertight has waned in recent years, caulks and more often elastomeric sealants are used to seal cracks and joints to keep out moisture and reduce air infiltration. Where cracks and failing joints are indicators of a serious problem, sealants and caulks may be used as a temporary measure. In some cases they may actually exacerbate the existing problem, such as by trapping moisture in adjacent masonry, and lead to more costly repairs.

Manufacturer's recommendations provide instructions on the proper application of caulks and sealants. Special attention should be placed on ensuring that the subsurface or joint is properly prepared and cleaned. Backer rods may be necessary for joints or cracks. Tooling of the caulk or sealant is usually necessary to ensure contact with all edge surfaces and for a clean and consistent appearance.

Caulks generally refer to older oil resin-based products, which have relatively limited life span and limited flexibility. Contemporary elastomeric sealants are composed of polymer synthetics. Elastomeric sealants are more durable than caulks and have greater flexibility and wider application. Caulks and sealants can become maintenance problems, as they tend to deteriorate faster than their substrates and must be replaced periodically as a part of cyclical maintenance of the structure.

The selection criteria for caulks and sealants include type of substrate, adhesion properties, size and configuration of joint, intended appearance/color and paintability, movement characteristics, and service life. Both one-part and two-part sealants are available; the latter require mixing as part of the application process. Sealants are commonly used for a variety of places on the exterior of a building such as around windows and doors, at interfaces between masonry and wood, between various wood features or elements, and at attachments to or through walls or roofs, such as with lamps, signs, or exterior plumbing fixtures. Their effectiveness depends on numerous factors including proper surface preparation and application. Applications of sealants and caulks should be examined as part of routine maintenance inspection, irrespective of their projected life expectancy.

Installation of caulks and sealants often can be undertaken by site personnel. For large and more complex projects, a contactor experienced in sealant installation may be needed. In either case, the sealant manufacturer should be consulted on proper sealant selection, preparation, and installation procedures.

- material deterioration at or near the foundation, including loss of mortar in masonry, rotting wood clapboards, or settlement cracks in the lower sections of wall;
- evidence of animal or pest infestation;
- vegetation growing close to the foundation, including trees, shrubs and planting beds;
- evidence of moisture damage from lawn and garden in-ground sprinkler systems;
- evidence of moss or mold from damp conditions or poorly situated downspout splash blocks (Fig 16); and
- blocked downspout drainage boots or clogged areaway grates.

Maintenance:

• Remove leaves and other debris from drains to prevent accumulation. Detach drain grates from paved areas and extract clogged debris. Flush with a hose to ensure that there is no blockage. Use a professional drain service to clear obstructions if necessary.

• Conduct annual termite inspections. Promptly address termite and other insect infestations. Use only licensed company for treatment where needed.

• Keep the grade around the foundation sloping away from the building. Add soil to fill depressions particularly around downspouts and splash blocks. Make sure that soil does not come too close to wooden or metal elements. A 6" separation between wooden siding and the grade is usually recommended.

• Avoid use of mulching material immediately around foundations as such material may promote termite infestation, retain moisture or change existing grade slope.

• Reset splash blocks at the end of downspouts or add extender tubes to the end of downspouts as necessary (Fig 17).

• Lubricate operable foundation vent grilles to facilitate seasonal use; paint as needed.

• Manage vegetation around foundations to allow sufficient air movement for wall surfaces to dry out during damp periods. Trim plantings and remove weeds and climbing vine roots. Be careful not to scar foundations or porch piers with grass or weed cutting equipment. If tree roots appear to be damaging a foundation wall, consult an engineer as well as a tree company.

• Wash off discoloration on foundations caused by splash-back, algae, or mildew. Use plain water and a soft natural or nylon bristle brush. Unless thoroughly researched and tested beforehand on a discreet area of the wall, avoid chemical products that may discolor certain types of stone. If cleaning products are used, test beforehand in a discreet area; and avoid over splash to plantings and adjacent building materials.

• Selectively repoint unit masonry as needed. Follow guidance under the wall section in regard to compatible mix, appearance, and texture for pointing mortar.

• Avoid using salts for de-icing and fertilizers with a high acid or petro-chemical content around foundations, as these materials can cause salt contamination of masonry. Use sand or organic materials without chloride additives that can damage masonry. Where salt is used on icy walks, distribute it sparingly and sweep up residual salt after walks have dried.

• Use snow shovels and brooms to clean snow from historic paths and walkways. Avoid blade-type snow removers as they may chip or abrade cobblestones, brick, or stone paving. Note that use of steel snow removal tools in areas where salt-containing snow melters are used may result in rust staining from steel fragments left on the paving.

Figure 17. Extending downspouts at their base is one of the basic steps to reduce dampness in basements, crawl spaces and around foundations. Extensions should be buried, if possible, for aesthetics, ease of lawn care, and to avoid creating a tripping hazard. Photo: NPS files.

Conclusion

Maintenance is the most important preservation treatment for extending the life of a historic property. It is also the most cost effective. Understanding the construction techniques of the original builders and the performance qualities of older building materials, using traditional maintenance and repair methods, and selecting in-kind materials where replacements are needed will help preserve the building and its historic character.

Maintenance can be managed in small distinct components, coordinated with other work, and scheduled over many years to ensure that materials are properly cared for and their life span maximized. A written maintenance plan is the most effective way to organize, schedule, and guide the work necessary to properly care for a historic building. The maintenance plan should include a description of the materials and methods required for each task, as well as a schedule for work required for maintenance of different building materials and components.

Historic house journals, maintenance guides for older buildings, preservation consultants, and preservation maintenance firms can assist with writing appropriate procedures for specific properties. Priorities should be established for intervening when unexpected damage occurs such as from broken water pipes or high winds.

Worker safety should always be paramount. When work is beyond the capabilities of in-house personnel and must be contracted, special efforts should be made to ensure that a contractor is both experienced in working with historic buildings and utilizes appropriate preservation treatments.

A well-maintained property is a more valuable property and one that will survive as a legacy for generations to come.

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Acknowledgements

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