1 OIL STORAGE

2 Chronology of Alterations and Use

3 Original Construction

The Outer Island Oil Storage was built in 1895 to provide a safe storage area for the kerosene needed to
 fuel the lamps. ⁴²

On file is an undated historic photo that depicts the building in a similar condition to its current appearance.
 (Historic Image OI-11)

10

13

11 There are no available historic drawings of this building.12

14 Significant Alterations / Current condition15

There have been no significant alterations to the Oil Storage. It currently contains an empty steel kerosene
 storage tank and shelves for general storage.

19 There have never been electrical or mechanical systems in this building, except for the gravity vent located20 in the roof.

21

22 The Outer Island Oil Storage is in good condition.

23 24

⁴² "1895 Annual Report of the Lighthouse Board," Outer Island Light in annual reports 1850-1920

1 Summary of Documented Work on the Building

| Date | Work Described | Source of Information |
|-----------------------------------|------------------------------------|-------------------------------------|
| 1894, August 7 | Steamer "Amaranth" brings brick | John Leonard, OI Log, Sept 17, 1874 |
| | "for an Oil House." | – Dec 10, 1947, Vol I |
| Annual Report of 1895 Fiscal Year | "Outer Island, Apostle Group, Lake | "1895 Annual Report of the |
| | Superior, Wisconsin. – A brick oil | Lighthouse Board," Outer Island |
| | house was erected, with iron roof, | Light in annual reports 1850-1920 |
| | door, and shelving, located 60' | |
| | southwest of the dwelling. | |
| | 1324. Outer Island, Wisconsin This | |
| | 10-inch steam whistle was in | |
| | operation some 478 hours, and | |
| | consumed about 26 tons of coal." | |

4 General Physical Description

This building is a small, one-story, one room, rectangular utilitarian structure with brick bearing walls and foundation, and a sheet metal hipped roof. It has a circular metal vent in the center of the roof and a metal door on the north elevation. **Physical Description --** Architecture Architecture – Roof The roofing is sheet metal painted red, with eave molding, and a central vent. Architecture – Exterior Walls The exterior walls are three-wythe brick painted. There is stepped brick coursing at the foundation and a brownstone sill at the door. A mortar sample taken indicates that the mortar was composed mostly of sand with minimum lime, the sand was originally dirty, and is extremely fine. The mortar is tan and very soft. *Architecture – Exterior Door* The exterior door is made of steel, has an original lockset, and has two strap hinges. It is $2'7'' \times 6'10 \frac{1}{2}''$ and is original to the building. (OI-OS-05) There is a painted stone sill at the door. Architecture – Wall Finish The wall finish for this building is the original common bond brick painted gray and yellow. Architecture – Ceiling Finish There is no ceiling finish as the ceiling is the underside of the original metal roof. It is sheet metal painted yellow. Architecture – Floor The floor is concrete slab-on-grade that is painted blue-gray.

| 1 2 3 4 5 | Architecture – Casework There is a metal shelving unit along the entirety of the west wall, painted blue-gray. There is also a wood platform supporting the kerosene tank. It is 4'6'' wide, 1'1'' tall, and 2'1 $\frac{1}{2}$ '' deep. Neither shelving unit is historic. (OI-OS-06) |
|----------------------------------|--|
| 6 7 8 9 10 11 | Architecture – Accessibility This building is currently not accessible. The entry door opening is 2'7" clear with a grade to finished floor elevation change of 7 $\frac{1}{2}$ " due to a sill/threshold. The door hardware is not ADA compliant. |
| 12 | Physical Description Structural |
| 13 14 15 16 | <i>Structural – Foundation</i> The perimeter foundation system consists of brick masonry walls with stepped coursing. |
| 17 18 19 | Structural – Floor Framing The floor is a concrete slab-on-grade. |
| 20 21 22 23 24 25 | <i>Structural – Roof Framing</i> The roof framing is made up of metal angles that were not accessible and could not be measured. The angles are covered by metal roof sheathing. |
| 26 27 28 29 | <i>Structural – Wall Framing</i> The exterior walls are constructed of brick masonry. |
| 30 31 32 33 | Structural – Lateral System Lateral stability for the building is provided by the brick masonry walls. |
| 34 35 36 37 | Structural – Load Requirements The required floor load capacity is 125 psf and the required roof snow load capacity is 40 psf. |
| 38 | Physical Description Mechanical |
| 39 40 41 42 | <i>Mechanical – Plumbing Systems</i> There are no plumbing systems in the Oil Storage. |
| 42 43 44 45 46 47 | <i>Mechanical – HVAC</i> The original circular metal gravity vent remains on the roof. A roof cap has been put in place above the storage area rendering the vent inoperable. |
| 48 49 50 51 | Mechanical – Fire Suppression None in the building. |

| 1 | Physical Description Electrical |
|--|--|
| 2 3 4 5 | Electrical – System Configuration None in the building. |
| 6 7 8 9 | Electrical – Conductor Insulation None in the building. |
| 10 11 12 13 | Electrical – Overcurrent Protection None in the building. |
| 14 15 16 17 | Electrical – Lighting Systems None in building. |
| 18 19 20 21 | <i>Electrical – Telecommunications</i> None in the building. |
| 22 23 24 25 | Electrical – Fire Alarm System None in the building. |
| 26 27 28 29 | <i>Electrical – Lightning Protection</i> None on the building. |
| 30 | Physical Description Hazardous Materials |
| 31 32 33 34 35 36 | Landmark Environmental collected ten bulk samples from a total of ten different types of suspected asbestos containing materials (ACMs) at Outer Island. Of the ten suspect ACMs that were sampled and analyzed, a total of one suspect ACM resulted in a concentration of greater than one percent (positive for asbestos). |
| 37 38 39 40 41 42 43 44 45 46 47 48 | Hazardous Materials – Asbestos The following suspect ACMs were not sampled due to inaccessibility or park limitation regarding potential for damage to structures. Asbestos is assumed to be present in: Wall and Ceiling Interiors, Adhesives, Brick and Block Filler (The exterior of the structure is brick and has the potential to have a block filler or grout that is potentially asbestos containing), and, Asbestos-cement (Piping, wall-board, wall interior panels, roof flashing and roofing applications can be constructed of asbestos-cement. This type of application was not observed at the structure but may be present). The assumed ACMs were observed to be in good condition. |
| 49 50 51 | Hazardous Materials – Lead Containing Paint Detectable lead is assumed to be present at the following locations: |

- 1 1. Interior Painted Surfaces, and, 2 2. Exterior Painted Surfaces. 3 Based on the estimated dates of construction of the various structures, LCP is assumed to be present 4 throughout the structure. The confirmed LCP was observed to be in poor condition and the assumed LCP 5 was observed to be in poor condition. 6 7 Loose/flaking LCP is identified on the exterior walls of the structure. Paint chip debris is noted on 8 localized areas of surface soils surrounding the Oil Storage Building. 9 10 11 Hazardous Materials – Lead Dust 12 Surface wipe-sampling for lead dust was not conducted in the Oil Storage Building because it in a 13 noninhabited structure 14 15 16 Hazardous Materials – Lead in Soils 17 Historical paint maintenance activities such as manual scraping, power-washing, sanding, abrasive blasting 18 or the general poor and peeling condition of exterior LCP may have created the potential to impact the 19 surrounding soil. Areas of the surface soils adjacent to the structure were observed to have LCP debris and 20 additional areas may exhibit LCP debris or lead-contaminated soils, but are not observable due to 21 vegetative cover surrounding the structure. 22 23 Preliminary lead-in-soil sampling was not performed to assess whether these near-structure soils contain 24 lead concentrations above applicable soil standards. 25 26 Soil Sampling was not conducted around the Oil Storage Building. 27 28 29 Hazardous Materials – Mold 30 Inspections of the structure were performed to identify the readily ascertainable visual extent of the mold 31 growth. Moisture testing in building materials was not performed nor was sampling of building materials 32 performed for microbial analysis. Mold was not visually identified in the Oil Storage Building. 33 34 35 Hazardous Materials – Petroleum Hydrocarbons 36 Localized areas of staining were observed on concrete floors in the Oil Storage Building. Stained areas are 37 likely associated with fuel oil, diesel or other petroleum hydrocarbons. Tank and piping systems may also 38 contain petroleum hydrocarbons. 39 40
- 41

| 1 | Character Defining Features |
|----------------------------|---|
| 2 3 | Mass/Form. A simple utilitarian masonry hipped roof structure. |
| 4 5 | Exterior Materials. Painted white wood clapboard siding; metal roof shingles painted red. |
| 6 7 | Openings. One painted metal door painted red to match the painted brick. |
| 8 9 10 | Interior Materials. Exposed masonry, concrete floor and galvanized panels at the ceiling. |
| 11 | General Condition Assessment |
| 12 13 14 | In general, the Outer Island Oil Storage is in good condition. The original brick walls, concrete floor, and steel door are in good condition. |
| 15 16 | Structurally, the Oil Storage is in good condition. |
| 17 18 19 20 | The following section is a discipline-by-discipline, component-by-component condition assessment of the building. Refer to Volume I, Chapter 2: Methodology for definitions of the condition ratings. |
| 21 | Condition Assessment Architecture |
| 22 23 24 25 26 | Architecture – Roof <u>Condition:</u> GoodThis roof is in good condition. |
| 20 27 28 | Architecture – Exterior Walls <u>Condition:</u> Fair |
| 29 30 31 32 | The exterior walls are in fair condition, as the walls need repointing and the brick foundation is exposed and weathering at the southwest corner. The paint is peeling severely. |
| 33 | Architecture – Exterior Door |
| 34 35 36 37 | <u>Condition:</u> Good This steel door is in good condition as there is only minor paint peeling. The sill is cracked. |
| 38 | Architecture – Wall Finish |
| 39 40 41 42 43 | <u>Condition:</u> Poor The wall finish for this building is in poor condition. The paint is peeling badly and an older layer of white paint is visible. |
| 44 | Architecture – Ceiling Finish |
| 45 46 47 48 49 | <u>Condition:</u> Good The underside of the roof is in good condition. |

| 1 2 3 4 5 | Architecture – Floor <u>Condition:</u> Good to Fair The concrete floor is in good condition but the blue-gray paint is deteriorated. The concrete is intact. The front stoop, however, is in fair condition as it is cracked. |
|--|---|
| 6 7 8 9 10 11 | Architecture – Casework <u>Condition:</u> Fair The metal shelving unit is in good condition with some peeling paint and deflected shelves. The wood platform shelf is in fair condition as it is also deflected and there stains on the wood. |
| 12 13 14 15 16 17 | Architecture – Accessibility <u>Condition:</u> PoorThis building is currently not accessible. |
| 18 | Condition Assessment Structural |
| 19 20 21 22 23 | Structural – Foundation <u>Condition:</u> Good The visible portion of the foundation system appears to be in good condition. No obvious signs of distress or damage were observed. |
| 24 25 26 27 28 | Structural – Floor Framing <u>Condition:</u> GoodThe concrete slab-on-grade is in good condition. |
| 29 30 31 32 33 34 35 | Structural – Roof Framing <u>Condition:</u> Unknown The roof framing could not be observed, thus its condition is unknown. No obvious signs of distress or damage were observed. |
| 36 37 38 39 40 | Structural – Wall Framing <u>Condition:</u> GoodThe walls are in good condition. |
| 41 42 43 44 45 | Structural – Lateral SystemCondition:GoodLateral stability of the building is good. |
| 46 47 48 49 50 51 | Structural – Load Requirements <u>Condition:</u> Good The slab-on-grade has adequate capacity. The roof framing could not be observed, thus its capacity is unknown. |

1 **Condition Assessment -- Mechanical**

| 2 3 4 | Mechanical – Plumbing Systems and Fire Suppression <u>Condition:</u> N/A |
|----------------------------|---|
| 5 6 | Mechanical – HVAC |
| 7 | <u>Condition:</u> Good |
| 8 9 | The original circular metal gravity vent is in good condition, but a roof cap has been put in place above the storage area rendering the vent inoperable. |
| 10 11 | |
| 12 | Condition Assessment Electrical |
| 13 14 15 | N/A |
| 16 | Condition Assessment Hazardous Materials |
| 17 18 19 20 21 | Refer to 'Physical Description Hazardous Materials' for detailed descriptions of locations and conditions of hazardous materials. |

| 1 | Ultimate Treatment and Use |
|--|---|
| 2 3 4 5 | This building was constructed in 1895 and served as an oil storage building. Currently, the building is used for secure NPS storage. The proposed use for the Oil Storage is to maintain its existing function as storage with no visitor access. |
| 6 7 | Preservation, focusing on the exterior, is the recommended treatment for the building. |
| 8 9 | Requirements for Treatment |
| 10 11 12 | Compliance requirements for treatment currently include laws, regulations, and standards as outlined by the NPS and listed in Volume I, Administrative Data section of this report. |
| 13 14 15 16 17 18 19 | The recommended treatments are tailored to the Preferred Alternative as the outcome of the Value Analysis/CBA for the project. As individual buildings are rehabilitated, specific alternatives will present themselves during design and construction. The following section is a discipline-by-discipline, component-by-component description of the treatments proposed for the preservation of the building. Refer to Volume I, Chapter 2: Methodology for the priority rating definitions. |
| 20 | Treatment Recommendations Architecture |
| 21 22 23 24 25 | Architecture - Roof <u>Priority:</u> LowNo recommendations at this time. |
| 26 27 28 29 30 31 | Architecture – Exterior Walls <u>Priority:</u> Low Strip the existing paint. Repair masonry, repoint as needed and recoat with a proper vapor permeable coating. |
| 32 33 34 35 | Architecture – Exterior Door <u>Priority:</u> LowRepaint steel door. Epoxy repair the crack at the sill. |
| 36 37 38 39 40 | Architecture – Wall Finish <u>Priority:</u> LowScrape, sand and repaint using the paint analysis to guide the color selection. |
| 41 42 43 44 45 46 | Architecture – Ceiling Finish <u>Priority:</u> LowNo recommendations at this time. |
| 46 47 48 49 50 | Architecture – Floor <u>Priority:</u> LowRepaint the concrete floor to match existing color. |

| 1 2 3 4 5 6 | Architecture – Casework <u>Priority:</u> LowNo recommendations at this time. |
|----------------------------------|--|
| 7 8 9 | Architecture – Accessibility <u>Priority:</u> Low Provide program access through interpretive exhibits and waysides at the Visitor Center. |
| 10 11 | Treatment Recommendations Structural |
| 12 13 14 15 16 | Structural – Foundation <u>Priority:</u> LowNo recommendations at this time. |
| 17 18 19 20 21 | Structural – Floor Framing <u>Priority:</u> LowNo recommendations at this time. |
| 22 23 24 25 26 | Structural – Roof FramingPriority:LowNo recommendations at this time. |
| 27 28 29 30 | Structural – Wall FramingPriority:LowNo recommendations at this time. |
| 31 32 33 34 35 | Structural – Lateral System <u>Priority:</u> LowNo recommendations at this time. |
| 36 37 | Treatment Recommendations Mechanical |
| 38 39 40 41 | Mechanical – Plumbing Systems and Fire Suppression <u>Priority:</u> N/A |
| 42 43 44 45 46 47 | Mechanical – HVAC <u>Priority:</u> Low No recommendations at this time. Treatment Recommendations Electrical |
| 48 49 50 | N/A |

| 1 | Treatment Recommendations Hazardous Materials |
|----|---|
| 2 | Hazardous Materials – Asbestos |
| 3 | <u>Priority:</u> Low |
| 4 | Recommend sampling of suspect asbestos containing materials, including brick and block filler, adhesives, |
| 5 | wall and ceiling interiors, and asbestos cement should be sampled. |
| 6 | |
| 7 | |
| 8 | Hazardous Materials – Lead-Containing Paint and Lead Dust |
| 9 | <u>Priority:</u> Low |
| 10 | Recommend stabilization or abatement of Lead Containing Paint. Lead dust wipe sampling not |
| 11 | recommended. |
| 12 | |
| 13 | |
| 14 | Hazardous Materials – Lead In Soils |
| 15 | <u>Priority:</u> Low |
| 16 | No recommendations at this time. |
| 17 | |
| 18 | |
| 19 | Hazardous Materials – Mold/Biological |
| 20 | <u>Priority:</u> Low |
| 21 | No recommendations at this time. |
| 22 | |
| 23 | |
| 24 | Hazardous Materials – Petroleum Hydrocarbons |
| 25 | <u>Priority:</u> Low |
| 26 | No recommendations at this time. |
| 27 | |
| 28 | |
| 29 | |

1 Alternatives for Treatment

2 One alternative treatment for consideration could be for the use by the park to include this building for 3 interpretive use on the interior as opposed to continued use as park storage. However, due to the limited

3 interpretive use on the interior as opposed to continued use as park storage. However, due to the limited 4 options for the necessary maintenance functions' storage at this remote site, retaining the storage use on the 5 interior is deemed appropriate.

6 7

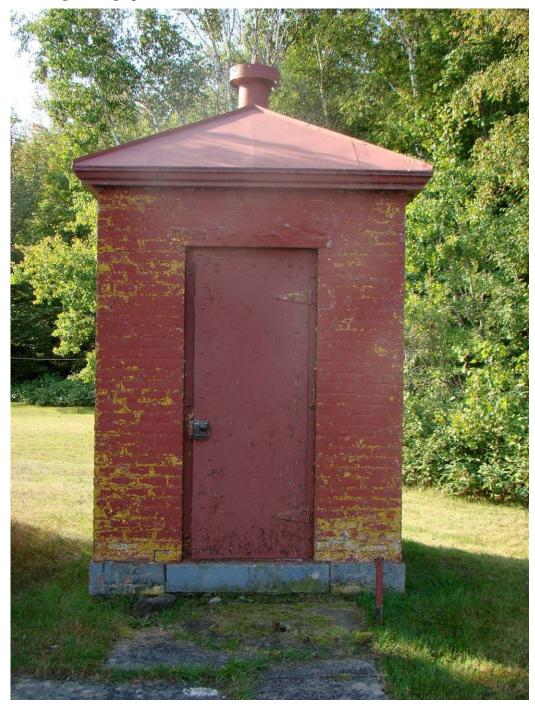
The following table includes an analysis of the major treatment recommendations which affect Section 106 Compliance:

8 Comp

10 Assessment of Effects for Recommended Treatments

| Recommended Treatment | Potential Effects | Mitigating Measures | Beneficial Effects |
|------------------------------|--------------------------|-----------------------------|---------------------------|
| 1. Additional Hazardous | Mitigation of hazardous | Any mitigation will need | - Improves safety for |
| Testing and Mitigation | material may require | to be evaluated for benefit | visitors and staff |
| | removal of historic | and implemented | - Removes hazards from |
| | materials. | sensitively to minimize | the cultural resource |
| | | damage to the resource. | |

1 Oil Storage Photographs, 2009



OI-OS-01: North elevation, 2009 (Source: A&A DSC01362)

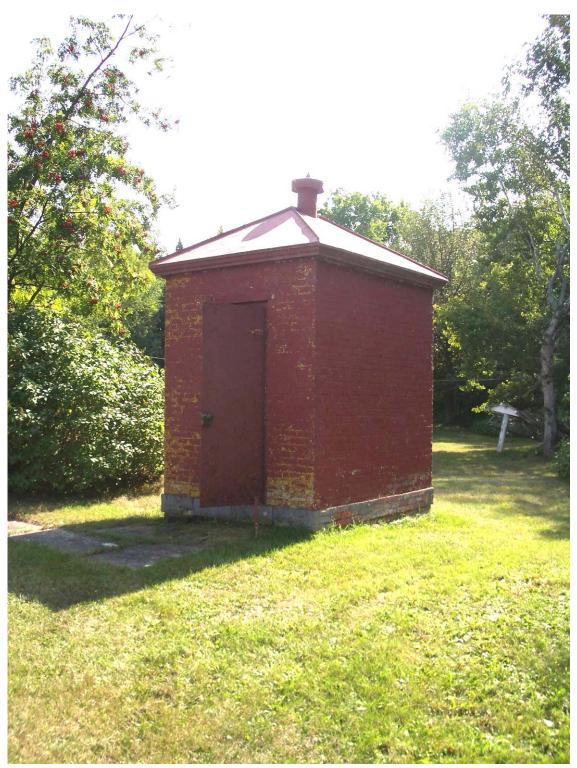


OI-OS-02: East elevation, 2009 (Source: A&A DSC01364)



1 2

OI-OS-03: South elevation, 2009 (Source: A&A DSC01363)



OI-OS-04: North and west elevations, 2009 (Source: A&A IMGP3167)



OI-OS-05: North entry door hardware (Source: A&A IMGP3169)



4 5

OI-OS-06: Interior, looking south (Source: A&A DSC01355-A)

Volume III – Outer Island 100% DRAFT March 2011

1 PRIVY

| 2 | Chronology of Alterations and Use |
|----------------------|--|
| 3 | Original Construction |
| 4 5 6 | The Outer Island Privy was built in 1874, the same year as the Tower. ⁴³ |
| 6 7 8 9 | A photo of the Privy around 1900 roughly illustrates painted brick on the lower half, and unpainted brick on the upper half of the building. (Historic Image OI-04) Today, the Privy is painted. |
| 9 10 11 12 | There are no available historic drawings of this building. |
| 12 13 14 | Significant Alterations / Current condition |
| 15 16 | There have been no significant alterations to the Privy. |
| 17 18 19 | There have never been electrical or mechanical systems in this building, except for the gravity vent located in the roof. |
| 20 21 22 23 | The Outer Island Privy is in fair to good condition. |

⁴³ List of Classified Structures, National Park Service, 2009.

1 General Physical Description

This building is a small, one-story, one room, rectangular utilitarian structure with brick bearing walls and
foundation. It has a simple gable roof with boxed rafter tails and a square wood vent. The casement
window has an arched opening and the door is located on the west elevation.

At the time of this survey, this building was inaccessible. Interior notes were garnered from looking in the
window and therefore the overall condition of interior finishes could not be determined from the partial
view.

9 10

11 *Physical Description -- Architecture*

12 Architecture – Roof

13 The roofing is metal shingle, painted red, and is original to the building. (OI-P-06) There is a wood fascia, 14 frieze board, and a vent. The eave consists of a closed raked soffit extending approximately 9". All of the 15 wood is painted and is original to the building. (OI-P-07)

- 16 17
- 18 Architecture Exterior Walls

19 The exterior walls are made of two-wythe red brick with rowlocks every seventh course (same as the 20 Keepers Quarters – the buildings were built the same year). The foundation is brownstone. A mortar 21 sample from the brick mortar indicates that it was composed of sand and lime, with course sand, tan 22 colored, and very soft.

- $\frac{22}{23}$
- 24

25 Architecture – Window

The window is a two-lite (one-over-one) casement or awning with a painted wood frame. There is a painted wood surround and sill. The window is 1'1" x 2'8" and is original to the building. A paint sample taken of the exterior window trim indicated that the original layer was whitewash and the subsequent white layer was impervious to acid, meaning it was a later white paint, not a whitewash. Currently, the trim is painted green.

- 31 32
- 33 Architecture Exterior Door
- The door is a five panel wood door, similar to the doors in the house, with original exterior knob (interior inaccessible). The door is 2'4" x 6'7".
- 36 37
- 38 Architecture Exterior Trim
- 39 There is no exterior trim other than the roof elements.
- 40
- 41
- 42 Architecture Wall Finish
- 43 The interior of this building was inaccessible (observations were made through the window). The wall
- 44 finish for this building appears to be horizontal beadboard, painted, most likely 3 ¹/₂" wide.
- 45 46
- 47 Architecture Ceiling Finish
- 48 The interior of this building was inaccessible (observations were made through the window). The ceiling
- 49 finish was not visible from this location.
- 50
- 51

| 1 2 3 4 5 | <i>Architecture – Floor</i> The interior of this building was inaccessible (observations were made through the window). The floor is concrete. |
|--|---|
| 6 7 8 9 | <i>Architecture – Casework</i> The interior of this building was inaccessible (observations were made through the window). The Privy contains two adult and one child privy seats, made of wood, painted blue. |
| 10 11 12 13 14 15 16 | Architecture – Accessibility This building is currently not accessible. The main entry door opening is 2'3" clear with a grade to finished floor elevation change of 5 $\frac{1}{2}$ " due to the masonry sill/threshold. There is not an adequate 5' diameter space within. No accessibility upgrades have been made. |
| 17 | Physical Description Structural |
| 18 19 20 21 | <i>Structural – Foundation</i> The foundation of the Privy appears to be concrete but was not accessible. |
| 22 23 24 | Structural – Floor Framing The floor is concrete slab-on-grade. |
| 25 26 27 28 29 30 | <i>Structural – Roof Framing</i> The roof framing could not be observed but is believed to be wood framing. The rafters span approximately 3'. The rafters are supported on the exterior wood-framed walls. The rafters are sheathed with solid wood underlayment. |
| 31 32 33 34 | <i>Structural – Wall Framing</i> The exterior walls are constructed of brick masonry. |
| 35 36 37 38 39 | Structural – Lateral System Lateral stability for the building is provided by the exterior masonry walls. |
| 40 41 42 43 | Structural – Load Requirements The required floor and roof snow load capacities are 40 psf. |
| 44 | Physical Description Mechanical |
| 45 46 47 48 | Mechanical – Plumbing Systems There are no plumbing systems in the Privy. |
| 49 50 51 | <i>Mechanical – HVAC</i> The original decorative gravity vent for the Privy remains through the roof. |

| Mechanical – Fire Suppression None in the building. |
|---|
| Physical Description Electrical |
| Electrical – System Configuration None in the building. |
| Electrical – Conductor Insulation None in the building. |
| <i>Electrical – Overcurrent Protection</i> None in the building. |
| Electrical – Lighting Systems None in the building. |
| <i>Electrical – Telecommunications</i> None in the building. |
| Electrical – Fire Alarm System None in the building. |
| Electrical – Lightning Protection None in the building. |
| Physical Description Hazardous Materials |
| Landmark Environmental collected ten bulk samples from a total of ten different types of suspected asbestos containing materials (ACMs) at Outer Island. Of the ten suspect ACMs that were sampled and analyzed, a total of one suspect ACM resulted in a concentration of greater than one percent (positive for asbestos). |
| Hazardous Materials – Asbestos The following suspect ACMs were not sampled due to inaccessibility or park limitation regarding potential for damage to structures. Asbestos is assumed to be present in: Adhesives, Wall Interiors, Brick and Block Filler (Wall interiors may be composed of brick or block and have the potential to have a block filler or grout that is potentially asbestos containing), and, Asbestos-cement (Piping, wall-board, wall interior panels, roof flashing and roofing applications can be constructed of asbestos-cement. This type of application was not observed at the structure but may be present). The assumed ACMs were observed to be in fair condition. |
| |

- Hazardous Materials Lead Containing Paint Detectable lead is assumed to be present at the following locations: 1. Interior Painted Surfaces, and, 2. Exterior Painted Surfaces. Based on the estimated dates of construction of the various structures, LCP assumed to be present throughout the structure. The assumed LCP was observed to be in poor condition. Loose/Flaking LCP is identified on the exterior painted surfaces of the structure. Paint chip debris was not seen on the ground surface. Hazardous Materials – Lead Dust Surface wipe-sampling for lead dust was not conducted in the Privy because it is an uninhabited structure. 14 16 Hazardous Materials – Lead in Soils Historical paint maintenance activities such as manual scraping, power-washing, sanding, abrasive blasting 18 or the general poor and peeling condition of exterior LCP may have created the potential to impact the 19 surrounding soil. Areas of the surface soils adjacent to the structure were not observed to have LCP debris 20 and additional areas may exhibit LCP debris or lead-contaminated soils, but are not observable due to vegetative cover surrounding the structure. Preliminary lead-in-soil sampling was not performed to assess whether these near-structure soils contain lead concentrations above applicable soil standards. Soil Sampling was not conducted around the Privy. Hazardous Materials – Mold Inspections of the structure were performed to identify the readily ascertainable visual extent of the mold growth. Moisture testing in building materials was not performed nor was sampling of building materials performed for microbial analysis. Mold was not visually identified in the Privy.
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| 1 | Character Defining Features | | | | |
|--|--|--|--|--|--|
| 2 3 4 | Mass/Form. A simple small utilitarian masonry gable roof structure with a decorative wood vent painted red. | | | | |
| 5 6 7 | Exterior Materials. White painted brick with dark grey accents, a metal shingle roof painted red and wood trim painted grey. | | | | |
| 8 9 | Openings. One wood two-lite casement and one five panel door both painted dark green. | | | | |
| 10 11 12 | Interior Materials. Unknown – no access. | | | | |
| 13 | General Condition Assessment | | | | |
| 14 15 16 | In general, the Outer Island Privy is in good condition on the exterior and the interior condition could not be determined as it was inaccessible. It is a three-seater privy for two adults and one child. | | | | |
| 17 18 19 20 | The following section is a discipline-by-discipline, component-by-component condition assessment of the building. Refer to Volume I, Chapter 2: Methodology for definitions of the condition ratings. | | | | |
| 21 | Condition Assessment Architecture | | | | |
| 22 23 24 25 26 27 28 | Architecture – Roof <u>Condition:</u> Fair and Poor The roof is in fair condition as there is missing trim at the ridge cap and the peeling paint has revealed rust on the metal shingles. The wood elements are in fair condition as they have badly peeling paint. The wood vent with peeling paint shows deteriorated wood. | | | | |
| 28 29 30 31 32 33 | Architecture – Exterior Walls <u>Condition:</u> Fair The exterior walls are in fair condition as they have peeling paint and spalling brick, especially on the east and north elevations. | | | | |
| 34 35 36 37 38 39 | Architecture – WindowCondition:Fair and UnknownThis window is in fair condition as the wood frame, surround, and sill have badly peeling paint. The interior condition of the window is unknown. | | | | |
| 40 41 42 43 44 45 | Architecture – Exterior DoorCondition:Fair and UnknownThe door is in fair condition with splitting wood at the panels and separation of stiles and rails. The condition of the interior face of the door is unknown. | | | | |
| 46 47 48 49 50 | Architecture – Exterior Trim <u>Condition:</u> N/A Refer to roof. | | | | |

| 1 2 3 4 5 6 | Architecture – Wall Finish <u>Condition:</u> Unknown The wall finish for this building appears to be horizontal bead board siding, most likely 3 ¹ / ₂ " wide. Surveyor was unable to determine the overall condition. | | | | |
|----------------------------------|---|--|--|--|--|
| 6 7 8 9 10 11 | Architecture – Ceiling Finish <u>Condition:</u> UnknownThe ceiling finish could not be identified. | | | | |
| 12 13 14 15 16 | <i>Architecture – Floor</i> <u>Condition:</u> Unknown The floor is concrete. Surveyor was unable to determine the overall condition. | | | | |
| 17 18 19 20 21 | Architecture – Casework <u>Condition:</u> Unknown This privy contains two adult and one child privy seats, made of wood, painted blue. Surveyor was unable to determine the overall condition. | | | | |
| 22 23 24 25 26 27 | Architecture – Accessibility <u>Condition:</u> PoorThis building is not accessible. | | | | |
| 28 | Condition Assessment Structural | | | | |
| 29 30 31 32 33 34 | Structural – Foundation <u>Condition:</u> Good The visible portion of the foundation appeared to be in good condition. No obvious signs of distress or damage were observed. | | | | |
| 35 36 37 38 39 | Structural – Floor Framing <u>Condition:</u> GoodThe concrete slab-on-grade is in good condition. | | | | |
| 40 41 42 43 44 45 | <i>Structural – Roof Framing</i> <u><i>Condition:</i></u> Unknown The roof framing could not be observed, thus its condition is unknown. No obvious signs of distress or damage were observed. | | | | |
| 46 47 48 49 50 51 | Structural – Wall Framing Condition:GoodThe walls are in good condition. | | | | |

| 1 2 3 4 | Structural – Lateral System <u>Condition:</u> GoodLateral stability of the building is good. |
|--|---|
| 5 6 7 8 9 10 | Structural – Load Requirements <u>Condition:</u> Good The slab-on-grade has adequate capacity. The roof framing could not be observed, thus its capacity is unknown. |
| 11 12 | Condition Assessment Mechanical |
| 13 14 15 | Mechanical – Plumbing Systems and Fire Suppression <u>Condition:</u> N/A |
| 16 17 18 19 20 21 22 | Mechanical – HVAC <u>Condition:</u> Poor The original decorative gravity vent on the roof is in poor condition as it needs conservation work. Condition Assessment Electrical |
| 23 24 25 | N/A |
| 26 | Condition Assessment Hazardous Materials |
| 27 28 29 30 31 | Refer to 'Physical Description Hazardous Materials' for detailed descriptions of locations and conditions of hazardous materials. |

1 Ultimate Treatment and Use

The Privy was constructed in 1874 and most likely was the primary sanitary facility until 1930 when indoor plumbing was installed in the Keepers Quarters. The building is currently vacant and not accessible to the public. The proposed use for the Privy is to retain the structure as an integral component of the site's cultural landscape while precluding public access to its interior.

Preservation, focusing on the exterior, is the recommended treatment for the building.

7 8

9

10 Requirements for Treatment

Compliance requirements for treatment currently include laws, regulations, and standards as outlined by the
 NPS and listed in Volume I, Administrative Data section of this report.

13

14 The recommended treatments are tailored to the Preferred Alternative as the outcome of the Value

15 Analysis/CBA for the project. As individual buildings are rehabilitated, specific alternatives will present

16 themselves during design and construction. The following section is a discipline-by-discipline, component-

- 17 by-component description of the treatments proposed for the preservation of the building. Refer to Volume
- 18 I, Chapter 2: Methodology for the priority rating definitions.
- 19 20

21 Treatment Recommendations -- Architecture

Low

Low

22 Architecture – Roof

23 <u>Priority:</u> Moderate

Replace the missing trim at the ridge cap and any rusted metal shingles in-kind. Scrape, sand and repaint
 metal shingles and wood elements at eave and rake. Scrape and sand the vent. Epoxy stabilize the wood
 members and prep and repaint.

27 28

29 Architecture – Exterior Walls

- 30 *Priority*:
- Strip existing paint at brick. Repair spalling brick by flipping the bricks or by replacing in kind. Repaint
 the exterior walls with a proper coating allowing vapor permeability.
- 33
- 3435 Architecture Window
- 36 Priority: Low
- 37 Scrape, sand and repaint the exterior window frame, sash and trim. The interior condition of the window is
 38 unknown.
- 36 unkn
- 40
- 41 Architecture Exterior Door
- 42 Priority:
- 43 Scrape and sand the door and frame. Epoxy stabilize the split wood in the door panels and repair the stiles 44 and rails that are separating from the door face. Paint the door and frame. The condition of the interior face
- 45 of the door is unknown.
- 46
- 47
- 48 Architecture Exterior Trim
- 49 <u>Priority:</u> N/A
- 50 Refer to roof.

| 1 | Architecture – Wall Finish |
|----------------------------------|--|
| 2 | <u>Priority:</u> Unknown |
| 3 | The interior condition of the building is unknown. |
| 4 | |
| 5 | |
| 6 | Architecture – Ceiling Finish |
| 7 | <u>Priority:</u> Unknown |
| 8 | |
| | The interior condition of the ceiling finish is unknown. |
| 9 | |
| 10 | |
| 11 | Architecture – Floor |
| 12 | <u>Priority:</u> Unknown |
| 13 | The interior condition of the concrete floor is unknown. |
| 14 | |
| 15 | |
| 16 | Architecture – Casework |
| 17 | |
| | <u>Priority:</u> Unknown |
| 18 | The interior condition of the wood privy seats is unknown. |
| 19 | |
| 20 | |
| 21 | Architecture – Accessibility |
| 22 | Priority: Low |
| 23 | Provide program access through interpretive exhibits and waysides at the Visitor Center. |
| 24 | |
| 25 | |
| 25 | Treatment Recommendations Structural |
| | |
| 27 | Structural – Foundation |
| 28 | <u>Priority:</u> Low |
| 29 | No recommendations at this time. |
| 30 | |
| 31 | |
| 32 | Structural – Floor Framing |
| | |
| 33 | <u>Priority:</u> Low |
| 34 | No recommendations at this time. |
| 35 | |
| 36 | |
| 37 | Structural – Roof Framing |
| 38 | <u>Priority:</u> Low |
| 39 | No recommendations at this time. |
| 40 | No recommendations at tins time. |
| 40 | |
| | |
| 42 | |
| 43 | Structural – Wall Framing |
| | <u>Priority:</u> Low |
| 44 | |
| 44 | <u>Priority:</u> Low |
| 44 45 | <u>Priority:</u> Low |
| 44 45 46 | <u>Priority:</u> Low No recommendations at this time. |
| 44 45 46 47 | <u>Priority:</u> Low No recommendations at this time. Structural – Lateral System |
| 44 45 46 47 48 | Priority: Low No recommendations at this time. Structural – Lateral System Priority: Low |
| 44 45 46 47 48 49 | <u>Priority:</u> Low No recommendations at this time. Structural – Lateral System |
| 44 45 46 47 48 | Priority: Low No recommendations at this time. Structural – Lateral System Priority: Low |

1 **Treatment Recommendations -- Mechanical** 2 Mechanical – Plumbing Systems and Fire Suppression 3 Priority: N/A 4 5 6 Mechanical – HVAC 7 Priority: Low 8 No recommendations at this time. 9 10 11 **Treatment Recommendations -- Electrical** 12 N/A 13 14 15 **Treatment Recommendations -- Hazardous Materials** 16 Hazardous Materials – Asbestos 17 Priority: Low 18 Recommend sampling of suspect asbestos containing materials, including brick and block filler, adhesives, 19 wall and interiors, and asbestos cement should be sampled. 20 21 22 Hazardous Materials - Lead-Containing Paint and Lead Dust 23 Low Priority: 24 Recommend stabilization or abatement of Lead Containing Paint. Lead dust wipe sampling not 25 recommended. 26 27 28 Hazardous Materials – Lead In Soils 29 Low Priority: 30 No recommendations at this time. 31 32 33 Hazardous Materials – Mold/Biological 34 Priority: Low 35 No recommendations at this time. 36 37 38 Hazardous Materials – Petroleum Hydrocarbons 39 Priority: Low 40 No recommendations at this time. 41 42

1 **Alternatives for Treatment**

- 2 3 The following are several considerations of alternatives for the proposed treatments:
- 1. An alternative at the exterior walls could be to leave the masonry exposed (if the quality 4 5 6 7 of the brick allowed) or alter the paint pattern vs. what is in situ. The finish of the Privy appeared to have several iterations including that seen in historic photo OI - 04.
 - Another alternative could be, similar to other islands utilitarian structures, allowing a view 2. panel for visitors to experience the interior of the Privy. Given the low visitorship of this island, this is not the currently the recommended treatment.

10 The following table includes an analysis of the major treatment recommendations which affect Section 106

- 11 Compliance:
- 12

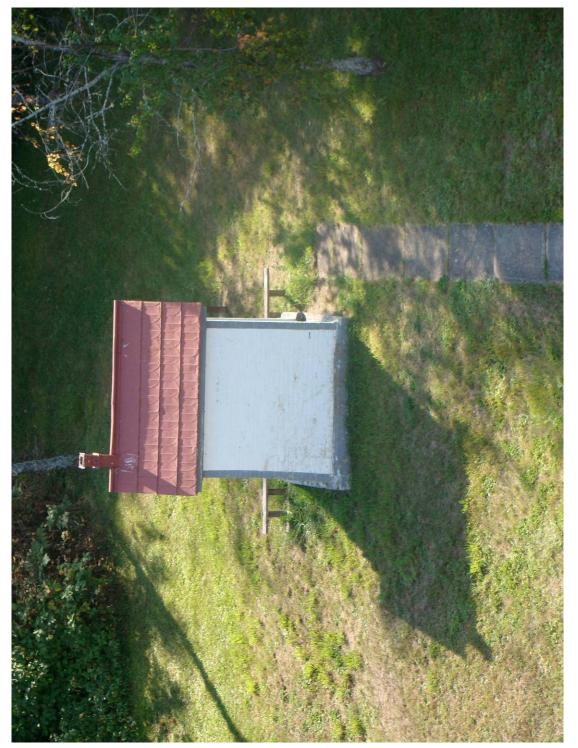
8

9

13 Assessment of Effects for Recommended Treatments

| Recommended Treatment | Potential Effects | Mitigating Measures | Beneficial Effects |
|------------------------------|--------------------------|-----------------------------|---------------------------|
| 1. Additional Hazardous | Mitigation of hazardous | Any mitigation will need | - Improves safety for |
| Testing and Mitigation | material may require | to be evaluated for benefit | visitors and staff |
| | removal of historic | and implemented | - Removes hazards from |
| | materials. | sensitively to minimize | the cultural resource |
| | | damage to the resource. | |

1 Privy Photographs, 2009

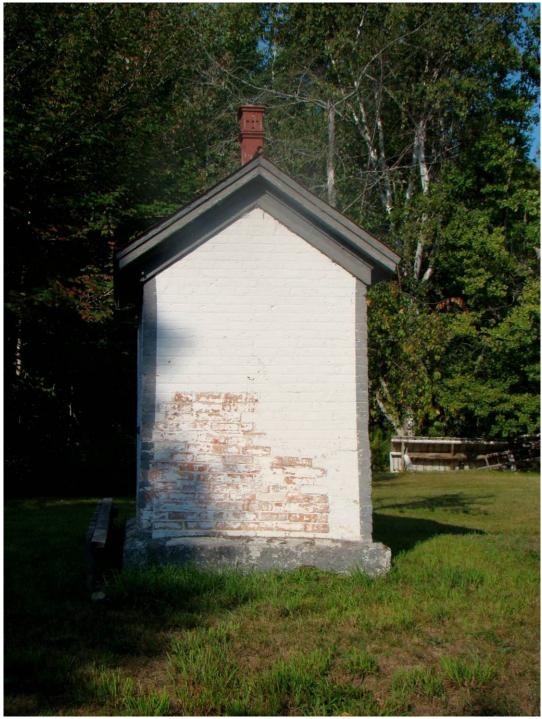




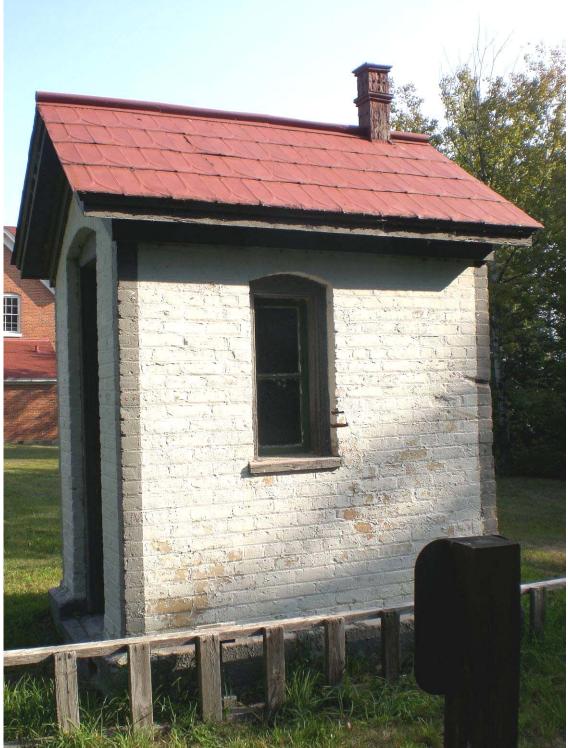
OI-P-02: West elevation, 2009 (Source: A&A IMGP3159)



Privy



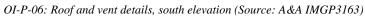
OI-P-04: East elevation, 2009 (Source: A&A DSC01377)



OI-P-05: South elevation, 2009 (Source: A&A DSC01376)

Privy









OI-P-07: Trim detail, west elevation (Source: A&A IMGP3164)

| 1 | |
|---|-------------------|
| 2 | GLOSSARY OF TERMS |

| 3 | PRIMARY TREATMENT APPROACH – PRESERVATION |
|----------|--|
| 4 5 | Preservation standards include measures necessary to sustain the existing form, integrity, and materials of a historic property. Work, including preliminary measures to protect and stabilize the property, generally |
| 6 | focuses upon the ongoing maintenance and repair of historic materials and features rather than extensive |
| 7 | replacement and new construction. Preservation requires the retention of the greatest amount of historic |
| 8 | fabric, including the landscape's historic form, features, and details as they have evolved over time. |
| 9 | Limited and sensitive upgrading of mechanical, electrical and plumbing systems and other code-required |
| 10 | work is permitted. |
| 11 | |
| 12 | |
| 13 | HOW TERMINOLOGY IS USED IN THE PRESERVATION APPROACH |
| 14 | HOW TERMINOLOGIT IS USED IN THE TRESERVATION ATTROACH |
| 15 | Maintain – are those standard maintenance practices that are necessary to retain the features of a property |
| 16 | as a contributing resource. Maintenance activities are usually not classified as repair, however minor repair |
| 17 | such as replacement of posts or railings or segments of paving are included. Limited and sensitive |
| 18 | upgrading of building systems (mechanical, electrical, plumbing) and other code related work is |
| 19 | appropriate. |
| 20 | |
| 21 | Plant – the removal and replanting of landscape plantings and vegetation as part of maintenance activities |
| 22 | |
| 23 | Protect – short term and minimal measures used to stabilize and protect features, such as fencing around |
| 24 | landscape features |
| 25 | |
| 26 | Relocate – the removal and resetting of noncontributing features |
| 27 28 | Demons the non-evel of nonhistoric factures |
| 28 29 | Remove – the removal of nonhistoric features |
| 30 | Repair – features, components of features and materials that require additional work. These may include |
| 31 | declining building features (e.g., roofing, foundation, mechanical systems) structures, small-scale features |
| 32 | (e.g., repair of a railing) or landscape plantings (e.g., repair mass planting by adding infill plantings). |
| 33 | Features that are repaired will match the old in design, color, texture, and if possible, material. Distinctive |
| 34 | features that are repaired will match the old in design, color, texture, and if possible, material. |
| 35 | |
| 36 | Retain – are those actions that are necessary to allow for a feature (contributing or noncontributing) to |
| 37 | remain in place in its contributing current configuration and condition. |
| 38 | |
| 39 | Stabilize – immediate measures (more than standard maintenance practices) are needed to prevent |
| 40 | deterioration, failure, or loss of features. |
| 41 | |
| 42 | |
| 43 | PRIMARY TREATMENT APPROACH – REHABILITATION |
| 44 | Rehabilitation in intended to return a property to a state of utility, through repair or alteration, which makes |
| 45 | possible an efficient contemporary use while preserving those portions and features of the property which |
| 46 | are significant to its historic, architectural, and cultural values. Rehabilitation allows for repairs, alterations, |
| 47 | restoration of missing features, and additions necessary to enable a compatible use for a property as long as |
| 48 | the portions or features which convey the historical, cultural, or architectural values are preserved. Limited |
| 49 50 | and sensitive upgrading of mechanical, electrical and plumbing systems and other code-required work is |
| 50 | permitted. |
| | |

| 1 2 | HOW TERMINOLOGY IS USED IN THE REHABILITATION APPROACH |
|--|---|
| 2 3 4 5 6 7 8 | Maintain – are those standard maintenance practices that are necessary to retain the features of a property as a contributing resource. Maintenance activities are usually not classified as repair, however minor repair such as replacement of posts or railings or segments of paving are included. Limited and sensitive upgrading of building systems (mechanical, electrical, plumbing) and other code related work is appropriate. |
| 9 10 11 | Plant – the removal and replanting of landscape plantings and vegetation as part of maintenance activities or the restoration of missing features. |
| 12 13 14 15 | Reestablish – are those measures necessary to depict a landscape feature as it occurred historically. Reestablishment may include the replacement of missing landscape features such as views, planting patterns, spatial relationships, or small scale features. |
| 16 17 | Relocate – remove and reset noncontributing features |
| 18 19 | Remove – removal of nonhistoric features |
| 20 21 22 23 24 25 | Repair – features, components of features and materials that require additional work. These may include declining building features (e.g., roofing, foundation, mechanical systems) structures, small-scale features (e.g., repair of a railing) or landscape plantings (e.g., repair mass planting by adding infill plantings). Features that are repaired will match the old in design, color, texture, and if possible, material. Distinctive features that are repaired will match the old in design, color, texture, and if possible, material. |
| 26 27 28 29 | Restore – are those measures necessary to depict a feature or area as it occurred historically. Restoration may include repair of a feature so that it appears as it did historically or it may include replacement of missing features or qualities. |
| 30 31 32 | Retain –are those actions that are necessary to allow for a feature (contributing or noncontributing) to remain in place in its contributing current configuration and condition. |
| 33 34 35 36 | Stabilize – immediate, more extensive measures (more than standard maintenance practices) are needed to prevent deterioration, failure, or loss of features. |
| 37 38 39 40 41 42 43 | PRIMARY TREATMENT APPROACH – RESTORATION Restoration standards allow for the accurate depiction of a property as it appeared at a particular time in its history by means of the removal of features from other periods in its history and reconstruction of missing features from the period of significance. The limited and sensitive upgrading of systems (mechanical, electrical, plumbing) and other code related work is appropriate. |
| 43 44 45 | HOW TERMINOLOGY IS USED IN THE RESTORATION APPROACH |
| 46 47 48 49 50 51 | Maintain – are those standard maintenance practices that are necessary to retain the features of a property as a contributing resource. Maintenance activities are usually not classified as repair, however minor repair such as replacement of posts or railings or segments of paving are included. Limited and sensitive upgrading of building systems (mechanical, electrical, plumbing) and other code related work is appropriate. Plant – the removal and replanting of landscape plantings and vegetation as part of maintenance activities |
| 52 | or the restoration of missing features |

| 1 2 | Relocate – re | move and reset noncontributing features | | | | | | | |
|---|---|--|--|--|--|--|--|--|--|
| 3 | Remove – removal of nonhistoric features | | | | | | | | |
| 4 5 6 7 8 | - are those measures necessary to depict a landscape feature as it occurred historically. ent may include the replacement of missing landscape features such as views, planting ial relationships, or small scale features. | | | | | | | | |
| 9 10 11 12 13 14 15 | Repair – features, components of features and materials that require additional work. These may include declining building features (e.g., roofing, foundation, mechanical systems) structures, small-scale features (e.g., repair of a railing) or landscape plantings (e.g., repair mass planting by adding infill plantings). Features that are repaired will match the old in design, color, texture, and if possible, material. Distinctive features that are repaired will match the old in design, color, texture, and if possible, material. | | | | | | | | |
| 16 17 18 19 | may include r | those measures necessary to depict a feature or area as it occurred historically. Restoration repair of a feature so that it appears as it did historically or it may include replacement of res or qualities. | | | | | | | |
| 20 21 | | hose actions that are necessary to allow for a feature (contributing or noncontributing) to ce in its contributing current configuration and condition. | | | | | | | |
| Stabilize – immediate, more extensive measures (more than standard maintenance practices) are prevent deterioration, failure, or loss of features. | | | | | | | | | |
| 27 | | N ASSESSMENT DESCRIPTION LEVELS | | | | | | | |
| 28 29 | | ature Condition Definitions ote: These terms are also applied to the overall structure/building.) | | | | | | | |
| 30 31 32 | GOOD | The feature is intact, structurally sound and performing its intended purpose. The feature needs no repair or rehabilitation, but only routine or preventive maintenance. | | | | | | | |
| 33 34 35 36 37 38 | FAIR | The feature is in fair condition if either of the following conditions is present: There are early signs of wear, failure or deterioration though the feature is generally structurally sound and performing its intended purpose – or – There is failure of a portion of the feature. | | | | | | | |
| 39 40 41 42 43 | POOR | The feature is in poor condition if any of the following conditions is present: The feature is no longer performing its intended purpose - or - Significant elements of the feature are missing - or - Deterioration or damage affects more than 25% of the feature - or - The feature shows signs of imminent failure or breakdown. | | | | | | | |
| 44 45 46 47 48 | UNKNOWN | Not enough information is available to make an evaluation. | | | | | | | |

1 **RATINGS OF TREATMENT SEVERITY** 2 An impact is a detectable result of an agent or series of agents having a negative effect on the significant 3 characteristics or integrity of a structure and for which some form of mitigation or preventative action is 4 possible. The assessment should include only those impacts likely to affect the structure within the next 5 five years. 6 The Level of Impact Severity and their definitions are given below. For all levels, except UNKNOWN, two 7 criteria are given. At least one of the criteria must be met for the declared Level of Impact Severity. 8 9 **SEVERE** 1. The structure/feature will be significantly damaged or irretrievably lost if 10 action is not taken within two (2) years. 11 2. There is an immediate and severe threat to visitor or staff safety. 12 13 **MODERATE** 1. The structure/feature will be significantly damaged or irretrievably lost if 14 action is not taken within five (5) years. 15 2. The situation caused y the impact is potentially threatening to visitor or staff 16 safety. 17 18 LOW 1. The continuing effect of the impact is known and will not result in significant 19 damage to the structure/feature. 20 2. The impact and its effects are not a direct threat to visitor or staff safety. 21 22 Not enough information is available to make an evaluation. **UNKNOWN** 23 24 25 **DEFINITIONS OF TERMS** 26 27 A 28 29 **AAS:** Atomic Absorption Spectroscopy 30 31 AC: Alternating current; the movement of current through an electrical circuit that periodically reverses 32 direction. Alternating current is the form of electric power that is delivered to businesses and residences. 33 34 ACM: Asbestos Containing Material 35 36 Accessibility: a term used to describe facilities or amenities to assist people with disabilities and can extend 37 to Braille signage, wheelchair ramps, elevators/lifts, walkway contours, reading accessibility, etc. 38 According to its website, the Park Service is "committed to making all practicable efforts to make NPS 39 facilities, programs, services, employment, and meaningful work opportunities accessible and usable by all 40 people, including those with disabilities. This policy reflects the commitment to provide access to the widest cross section of the public and to ensure compliance with the Architectural Barriers Act of 1968, the 41 42 Rehabilitation Act of 1973, the Equal Employment Opportunity Act of 1972, and the Americans with 43 Disabilities Act of 1990. The Park Service will also comply with section 507 of the Americans with 44 Disabilities Act (42 USC 12207), which relates specifically to the operation and management of federal 45 wilderness areas. The accessibility of commercial services within national parks are also covered under all 46 applicable federal, state and local laws" (source: http://www.nps.gov/aboutus/eeo.htm). 47 48 AES-ICP: Atomic Emission Spectroscopy – Inductively Coupled Plasma 49 50 AIHA: American Industrial Hygiene Association 51 52 *Air Terminal:* A rod that extends above a surface to attract lightning strikes.

| 1 2 3 | AL: Action Level |
|----------------------------|--|
| 3 4 5 | <u>B</u> |
| 6 7 | <i>Beam:</i> a structural member, usually horizontal, with a main function to carry loads cross-ways to its longitudinal axis. |
| 8 9 10 | Branch Circuit: Insulated conductors used to carry electricity to an associated device or devices that originate from a single circuit breaker. |
| 11 12 | BTUH: British Thermal Unit per Hour; A traditional unit of energy. |
| 13 14 15 16 17 | <i>BX Cable:</i> Cable with flexible steel armored outer tube with individual copper conductors insulated with rubber and covered with a cotton braided sheath. |
| 17 18 19 | <u>C</u> |
| 20 21 22 | <i>Cantilever</i> : refers to the part of a member that extends freely over a beam or wall, which is not supported at its end. |
| 23 24 25 | <i>Cast Iron</i> : a large group of ferrous alloys that are easily cast. Cast iron tends to be brittle and is resistant to destruction and weakening by oxidation. The amount of carbon in cast irons is 2.1 to 4 wt%. |
| 23 26 27 | CFR: Code of Federal Regulation |
| 27 28 29 | Cistern: An underground receptacle for storage of liquids, usually water. |
| 30 | Clay Sewer: Sewer pipe made from vitrified clay that is highly resistant to corrosion. |
| 31 32 33 34 | Column : a main vertical member that carries axial loads from beams or girders to the foundation parallel to its longitudinal axis. |
| 35 36 37 | D |
| 38 39 40 | DC: Direct current; the unidirectional flow of current through an electrical circuit. Direct current is produced through such sources as batteries, thermocouples, or photovoltaic solar cells. |
| 41 | Dead Load: describes the loads from the weight of the permanent components of the structure. |
| 42 43 | Deflection: the displacement of a structural member or system under a load. |
| 44 45 46 | DRO: Diesel-Range Organics |
| 47 48 40 | <u>E</u> |
| 49 50 51 | ELPAT: Environmental Lead Proficiency Analytical Testing |

| 1 2 3 | <i>EMT:</i> Electro-metallic tubing; A metallic tube raceway that is used to carry and protect current carrying conductors or cables. |
|----------------------------------|--|
| 4 5 | EPA: Environmental Protection Agency |
| 6 7 8 | <u>F</u> |
| 9 10 | Flue Vent: A duct or pipe conveying combustion by-products from a heater or furnace. |
| 10 11 12 | <i>Fluorescent:</i> A source of light that emits light radiation at longer wavelengths and lower energy. |
| 13 14 15 | <i>Footing</i> : a slab of concrete or an assortment of stones under a column, wall, or other structural member to transfer the loads of the member into the surrounding soil. |
| 16 17 | Foundation: supports a building or structure. |
| 18 19 | FRP: Fiberglass reinforced plastic |
| 20 21 | Full Sawn (FS): Lumber cut, in the rough, to its full nominal size. |
| 22 23 24 25 26 27 | <u>G</u> |
| 25 26 | <i>Gable</i> : located above the elevation of the eave line of a double-sloped roof. |
| 27 28 | Galvanized Steel: Steel coated with zinc carbonate to resist corrosion. |
| 29 30 | GPM: Gallon per minute; a standard unit of volumetric liquid flow rate. |
| 31 32 | Grade: the ground elevation of the soil. |
| 33 34 | Gravity Vent: Openings in a roof intended to vent hot air by the action of convection. |
| 35 36 | Gray Water: Wastewater generated from domestic washing activities and not containing human waste. |
| 37 38 39 | GRO: Gasoline Range Organics |
| 40 41 | Η |
| 42 43 | <i>Header</i> : a member that carries joists, rafters or beams and is placed between other joists, rafters or beams. |
| 44 45 | <i>Hip Roof:</i> a roof sloping from all four sides of a building. |
| 46 47 | HUD: Housing and Urban Development |
| 48 49 50 51 | <i>HVAC:</i> Heating, Ventilation, and Air Conditioning. |

| 1 2 | Ī |
|----------------------|---|
| 2 3 4 | IAQ: Indoor Air Quality |
| 5 6 | IEUBK: Integrated Exposure Uptake Biokinetic |
| 7 8 9 | <i>Incandescent:</i> A source of light that works by incandescence, or works by a heat-driven light emission through black-body radiation. |
| 10 11 12 | <i>Inverter:</i> A device that converts electrical direct current (DC) to electrical alternating current (AC). |
| 12 13 14 | J |
| 15 16 17 | Joist: a horizontal structural load-carrying member which supports floors and ceilings. |
| 18 19 | <u>K</u> |
| 20 21 22 | kVA: Kilovolt-ampere equal to 1,000 volt-amperes. kVA is a unit to express the apparent power consumed in an electrical circuit or electrical device. |
| 23 24 25 26 | <i>kW</i> : Kilowatt equal to 1,000 watts. A kilowatt is typically used to express the output power consumption of large devices or electrical systems. |
| 20 27 28 | L |
| 29 30 | LBP: Lead-Based Paint |
| 31 32 | LCP: Lead-Containing Paint |
| 33 34 | LCS: Lead-Contaminated Soils |
| 35 36 37 | <i>Leach Field:</i> A drain field used to remove contaminants and impurities from liquid that emerges from a septic tank. |
| 38 39 40 | <i>LED:</i> Light emitting diode; a semiconductor light source that can emit light in various colors and brightness. |
| 41 42 | <i>Live Load</i> : nonpermanent loads on a structure created by the use of the structure. |
| 43 44 | <i>Load</i> : an outside force that affects the structure or its members. |
| 45 46 47 | <i>Louver:</i> An opening with horizontal slats angled to allow passage of air while keeping out rain and snow. |
| 48 49 | $\underline{\mathbf{M}}$ |
| 50 51 52 | <i>Mg/kg:</i> Milligrams per Kilogram |

| 1 | <u>N</u> |
|--------------------------------------|---|
| $\frac{2}{3}$ | NEC: National Electric Code. |
| 1 2 3 4 5 6 7 8 | NESHAP: National Emission Standards for Hazardous Air Pollutants |
| 67 | <i>Nonpotable Water:</i> Water that has not been approved for safe human consumption. |
| 8 | Nonpolable water: water that has not been approved for safe numan consumption. |
| 9 10 | NVLAP: National Voluntary Laboratory Accreditation Program |
| 10 | |
| 12 13 | $\underline{\mathbf{O}}$ |
| 14 | OSHA: Occupational Safety and Health Administration |
| 15 | |
| 16 17 18 | Overcurrent Protection: A fuse, circuit breaker or relay that will open the electrical circuit when the downstream electrical current exceeds the stated current rating. |
| 19 | |
| 20 21 | <u>P</u> |
| 22 | Passive Ventilation: Ventilation of a building without the use of a fan or other mechanical system. |
| 23 24 | <i>Pitch</i> : the slope of a member defined as the ratio of the total rise to the total run. |
| 25 | <i>Tucu</i> . the slope of a member defined as the fatto of the total first to the total full. |
| 26 27 | PLM: Polarized Light Microscopy |
| 27 | PV: Photovoltaic; An array of solar modules or cells that collect solar energy and convert the energy into |
| 29 | direct current electricity. |
| 30 31 | <i>PVC:</i> Polyvinyl Chloride; A biologically and chemically resistant plastic widely used for household |
| 32 | sewage pipe. |
| 33 34 | |
| 35 | <u>R</u> |
| 36 37 | <i>Rafter</i> : a sloped structural load-carrying member which supports the roof. |
| 38 | Rajter. a stoped structural toad-carrying memoer which supports the tool. |
| 39 40 | <i>RBM:</i> Regulated/Hazardous Material |
| 41 | <i>Reaction</i> : the force or moment developed at the points of a support. |
| 42 43 | RLM: Industrial stem mounted reflector. |
| 43 44 | KLM : Industrial stem mounted reflector. |
| 45 | Romex: Wiring with rubber insulated conductors in an overall sheath of braided cotton fiber. |
| 46 47 | |
| 48 | <u>S</u> |
| 49 50 | Seismic Load: loads produced during the seismic movements of an earthquake. |
| 51 | |
| 52 | Septic Tank: A sewage tank containing anaerobic bacteria which decomposed waste discharged into tank. |

| 1 2 3 | <i>Shear</i> : forces resulting in two touching parts of a material to slide in opposite directions parallel to their plane of contact. |
|----------------------|---|
| 4 5 | Snow Load: loads produced from the accumulation of snow. |
| 6 7 | <i>Span</i> : the distance between supports. |
| 8 9 | <i>Step-down Transformer:</i> A device that converts a high voltage down to a lower voltage through a series of winding coils. |
| 10 11 12 13 | <i>Structural Steel</i> : an iron alloy with a carbon content of 0.16% to 0.29%. Steel is malleable, and easily welded. |
| 13 14 15 | <i>Strut</i> : a structural brace that resists axial forces. |
| 16 17 | <i>Stud</i> : a vertical wall member used to construct partitions and walls. |
| 18 19 20 | <u>T</u> |
| 21 22 23 | <i>Thermal Expansion Tank:</i> A tank used in a closed water heating system to absorb excess water pressure caused by thermal expansion. |
| 24 25 | TSI: Thermal System Insulation |
| 26 27 28 | Turbine Vent: Vents utilizing rotating wind vanes to create air flow. |
| 28 29 30 | <u>V</u> |
| 31 32 | <i>Vent Stack:</i> A vertical pipe proving ventilation. |
| 33 34 35 | W |
| 36 37 | <i>WAC:</i> Wisconsin Administrative Code |
| 38 39 | WDNR: Wisconsin Department of Natural Resources |
| 40 41 42 43 | <i>Wrought Iron</i> : an iron alloy with very low carbon content, in comparison to steel. Wrought iron is tough, malleable, ductile, and easily welded. |
| 44 45 | X |
| | <i>XRF:</i> X-ray fluorescence analyzer |

1 Other 2 30 μg/4 5 μg/SF: 6 7 Ix: Pie

30 µg/m3: 30 micrograms per cubic meter

µg/SF: Micrograms of Lead Dust per Square Foot of Floor Space

1x: Piece of dimensional lumber 1" (nominal) / 3/4" (actual) thick

8 1**9** 11

11 **OTHER RESOURCES** 12

13 Source: Letter from Regional Director of the Midwest Region to Superintendent of Apostle Islands

14 National Lakeshore, June 16, 1977, located at APIS/NPS Business Office File # D3423-Outer

15

| Paint (cheap, fences, etc.) Whitewash | 1/2 | 1/4 | 1/8 | 1/16 |
|--|------------------------|------------------------|-------------|---------------------------------|
| 1 bushel* unslaked lime or Hydrated lime | $\frac{1}{2}$ (2 peck) | $\frac{1}{4}$ (1 peck) | 1/8 (1 gal) | 1/16 (1/2 gal) |
| 20 lbs Spanish Whiting | 10 lbs | 5 lbs | 2 ½ lbs | 1 ¼ lbs |
| 17 lbs Rock Salt | 8 ½ lbs | 4 ¼ lbs | 2 1/8 lbs | 1 1/16 lbs |
| 12 lbs Brown Sugar | 6 lbs | 3 lbs | 1 ½ lbs | ³ / ₄ lbs |
| Slake lime w/ 40 gallons water | 20 gals | 10 gals | 5 gals | 2 ½ gals |

16

17 Apply two coats to wood

18

19 Apply three coats to stone or brick

20 21

22

23

 $\overline{24}$ Boxes = 8" x 8" x 8 5/12" deep = 1 peck – 2 gallons (8 qts.)

 $14 \frac{1}{3}$ x 10" x 7 $\frac{1}{2}$ " = $\frac{1}{2}$ bushel – 2 pecks

*Bushel = $17\frac{3}{4}$ " x 15" x 8" deep = 1 bushel - 4 pecks or 2130 cubic inches

25 $7" \ge 8" \ge 4 \frac{1}{8}" = 1$ gallon

26

APPENDIX A: MATRIX OF TREATMENT ALTERNATIVE

1

APPENDIX A

Apostle Islands National Lakeshore CLR/HSR

| Landscape 5. 4. 4. 4. 4. 4. 4. 4. 4. 4. 4. 4. 4. 4. | St | Accessibility | HazMat | Electrical Print | Mechanical | Structural | Architecture | Proposed Use of Building Re | Existing Conditions Site Plan - for reference only | |
|---|---|---|---|--|--|---|--|---|--|--|
| Selectively clear trees along bank to open views to light station from lake Stabilize slope embankment with planting and erosion control measures where needed Maintain all slope stabilization improvements Clear trees and brush at light station to restore meadow Maintain drainage swale and system | Spatial Organization/ Views and Vistas/ Clearing/ Topography | Program access through interpretive wayside exhibits. | Soil characterization (lead); asbestos sampling of materials to be preserved/stabilized; remove/stabilize lead paint | Provide additional PV power to facilitate running of new ventilation equipment. Engage an LPI (Lightning Protection Institute) certified inspector to perform an inspection of the lightning protection system and provide findings and recommendations in accordance with LPI- 175. | ncrease ventilation for moisture control. | Monitor existing cracks to verify non-structural | Increase tower ventilation; investigate replacing a window sash with a secure louver; repair cracks at masony; repair rust patches; repaint exterior and interior complete; repaint metal door at base; replace missing access door at walk; replace broken glass and glazing at Lantern; seal all joints | rower Rehabilitate; guided visitor access. | - for reference only | DOA WINDOW W |
| Repair current boat dock location and configuration Repair tramway to working condition (minor track repair) Add new tramway landings for cart Repair tram tracks to working condition (paint; repair; new handrail) New tramway railing (east side) (paint; repair; new handrail) New tramway railing (west side) (paint; repair; new railing and handrail) Repair concrete walks (leveling; replace stones where needed) | Circulation/ Site Accessibility | Program access through interpretive wayside exhibits. | Water intrusion mitigation; soil characterization (lead); asbestos sampling of materials to be preserved/stabilized; remove/stabilize lead paint | Remove existing lightning protection system and after re- roofing, replace with new system. Rehabilitate and expand existing PV Array and storage battery system to permit charging of staff radio units, accommodate new ventilation, and provide power for new refrigerator and stove. | Increase ventilation for moisture control. Install chimney liner for heater flue vent. Clean, inspect, and test sewer/septic system. Perform repairs as needed for operational septic system. Remove propane piping to refrigerator and stove. | Repoint masonry cracks, repair east framed wall in connection to tower, strengthen roof to properly support dormets | Increase tower: basement ventilation; add gutter and downspout system; reroof the north shed and southwest entry vestbules with materials in kind; repair the rotted siding at the base of the SW entry and repair the rotted exterior trim; repair windows and all doors, repaint; repair masonry walls and chimney; remove non historic ceiling tiles; remove damaged areas of plaster at walls and ceilings, repair in kind and paint; paint all interior trim; repair existing flooring in situ; add handrail at basement stair | Rehabilitate as "rustic" for staff housing. | Kanners Dustfors | |
| Mark historic location of well New NPS accessible privy (location TBD by NPS) | Structures | Program access through interpretive wayside exhibits. | Asbestos sampling of materials to be preserved/stabilized; abatement of a few pieces of deteriorating asbestos cement siding; remove/stabilize lead paint | d Replace broken lighting fixtures and rehabilitate wiring systems. Replace existing tram hoist with new as required. | Replace tram hoist. Clean and repaint fog signal components, piping, and tanks. | Strengthen ceiling framing over work room | Paint fascia, soffit and frieze; repair windows and paint; repair all doors and paint; repair exterior walls and chipped siding; paint interior complete | Rehabilitate for limited visitor access to interior; possibly visual only. | Eog Signal Building | General Description: This treatment alternative proposes rehabilitation conveys specific characterizes the Apos others to convey that characteristics related architectural values are preserved. Period of Significance: 1874 - 1961 Please refer to the proposed treatments below. |
| Remove propane tanks Repair flagpole on buff - repair pole; paint Maintain concrete foundation west of Fog Signal building Repair cistern - new cover; minor conc repair Retain fuel tank Maintain flagpole (compass) - paint Repair ladder stand Relocate fire pit to west Relocate solar panel to west Remove misc. non-contributing features | Small Scale Features | Program access through interpretive wayside exhibits. | Remove/stabilize lead paint | No action at this time. | No action at this time. | No action at this time | t Repoint masonry at southwest corner; strip paint from brick walls; repaint with permeable coating; repaint door | Preserve and maintain current use as NPS storage. | Oil Storson | General Description: PREFERRED / This treatment alternative proposes rehabilitating each island's cultural landscape to best portray navigational history that characterizes the Apostle Islands as a system of light stations. Each isla archipelago. This treatment will reveal this continuum by restoring missing historic features, and others to convey the full historical significance of the system. Additions that are necessary to end use of the light stations or islands are allowed as long as portions or features that convey the hist architectural values are preserved. Period of Significance: 1874 - 1961 Please refer to the proposed treatments below. |
| 1. Remove non-contrib Signal Building and 2. Maintain landscape | Station Vegetation | . Program access throu | Remove/stabilize lead | No action at this time. | No action at this time. | No action at this time | Replace missing ridge of soffit/fascia; strip paint or window and door and p | Preserve and maintain | Drive | PREFERRED , ape to best portray stations. Each ista toric features, and re necessary to en- that convey the his |

1 APPENDIX B: SUMMARY OF HAZARDOUS MATERIAL FINDINGS

2

APPENDIX B

1 OUTER ISLAND TOWER

| Building Number | LCS ID 006376 |
|--|---|
| Building Name | Outer Island Tower |
| >1% Asbestos Confirmed | |
| Asbestos Assumed ⁴⁴ | Adhesives, Plaster, Brick/Block Filler, Caulk, Transite and Roofing |
| Detectable Lead in Paint Confirmed | Window Sashes and Window Trims |
| Detectable Lead in Paint Assumed | Interior and Exterior Painted Surfaces |
| Lead Dust on Floors >40 μ g/SF Confirmed ⁴⁵ | |
| Lead Dust on Floors >40 μ g/SF Assumed ² | Throughout |
| Lead Dust on Floors <40 μ g/SF Confirmed ² | |
| Visual Mold | Yes |
| Lead in Soils >50 mg/kg ⁴⁶ | Roof Drip line |
| Lead in Soils <50 mg/kg | |
| Lead in Soils Assumed | |

2 3

< = Less Than

 μ g/SF = Micrograms of Lead Dust per Square Foot of Floor Space

< = Greater Than

mg/kg = Milligrams of Lead per Kilogram of Soil

 ⁴⁴ Materials listed are those identified or assumed to be present during the September 15, 2009 site assessment
 ⁴⁵ In accordance with EPA 40 CFR part 457 the clearance level for lead dust on floors in child occupied housing is 40

micrograms of lead dust per square foot of floor space.

⁴⁶ In accordance with NR720, WIS. Adm Code; 50 milligrams per kilogram, is the conservative acceptable residual containment level for lead in soil based on human health risk from direct contact (ingestion or inhalation) related to nonindustrial land use and considering more than one contaminant may be present in the soil. However, site specific Risk Assessment is recommended to identify the site specific clean up levels for lead contaminated soil at each of these sites.

APPENDIX B

1 **KEEPERS QUARTERS**

| Building Number | LCS ID 101140 |
|--|--|
| Building Name | Outer Island Keepers Quarters |
| >1% Asbestos Confirmed | Floor Tile |
| Asbestos Assumed ⁴⁷ | Adhesives, Plaster, Brick/Block Filler, Caulk, Transite and Wall Interiors |
| Detectable Lead in Paint Confirmed | Window Sashes and Trims, Doors and Trims, Walls and Ceilings |
| Detectable Lead in Paint Assumed | Interior and Exterior Painted Surfaces |
| Lead Dust on Floors >40 μ g/SF Confirmed ⁴⁸ | |
| Lead Dust on Floors >40 μ g/SF Assumed ² | Throughout |
| Lead Dust on Floors <40 μ g/SF Confirmed ² | |
| Visual Mold | Yes |
| Lead in Soils >50 mg/kg ⁴⁹ | Roof Drip line |
| Lead in Soils <50 mg/kg | |
| Lead in Soils Assumed | |

2 3

< = Less Than

 $\mu g/SF =$ Micrograms of Lead Dust per Square Foot of Floor Space mg/kg = Milligrams of Lead per Kilogram of Soil

< = Greater Than

 ⁴⁷ Materials listed are those identified or assumed to be present during the September 15, 2009 site assessment
 ⁴⁸ In accordance with EPA 40 CFR part 457 the clearance level for lead dust on floors in child occupied housing is 40 micrograms of lead dust per square foot of floor space.

⁴⁹ In accordance with NR720, WIS. Adm Code; 50 milligrams per kilogram, is the conservative acceptable residual containment level for lead in soil based on human health risk from direct contact (ingestion or inhalation) related to nonindustrial land use and considering more than one contaminant may be present in the soil. However, site specific Risk Assessment is recommended to identify the site specific clean up levels for lead contaminated soil at each of these sites.

1 FOG SIGNAL BUILDING

| Building Number | LCS ID 006378 |
|--|---|
| Building Name | Outer Island Fog Signal Building |
| >1% Asbestos Confirmed | |
| Asbestos Assumed ⁵⁰ | Adhesives, Brick/Block Filler, Caulk, Transite and Wall Interiors |
| Detectable Lead in Paint Confirmed | Window Sashes and Trims, Doors and Trims, and Generators |
| Detectable Lead in Paint Assumed | Interior and Exterior Painted Surfaces |
| Lead Dust on Floors >40 μ g/SF Confirmed ⁵¹ | |
| Lead Dust on Floors >40 μ g/SF Assumed ² | |
| Lead Dust on Floors <40 µg/SF Confirmed ² | |
| Visual Mold | |
| Lead in Soils >50 mg/kg ⁵² | |
| Lead in Soils <50 mg/kg | |
| Lead in Soils Assumed | Yes |

2 3

< = Less Than

< = Greater Than

 $[\]mu$ g/SF = Micrograms of Lead Dust per Square Foot of Floor Space

mg/kg = Milligrams of Lead per Kilogram of Soil

⁵⁰ Materials listed are those identified or assumed to be present during the September 15, 2009 site assessment

⁵¹ In accordance with EPA 40 CFR part 457 the clearance level for lead dust on floors in child occupied housing is 40 micrograms of lead dust per square foot of floor space.

⁵² In accordance with NR720, WIS. Adm Code; 50 milligrams per kilogram, is the conservative acceptable residual containment level for lead in soil based on human health risk from direct contact (ingestion or inhalation) related to nonindustrial land use and considering more than one contaminant may be present in the soil. However, site specific Risk Assessment is recommended to identify the site specific clean up levels for lead contaminated soil at each of these sites.

APPENDIX B

1 **OIL STORAGE**

| Building Number | LCS ID 006379 |
|--|---|
| Building Name | Outer Island Oil Storage |
| >1% Asbestos Confirmed | |
| Asbestos Assumed ⁵³ | Adhesives, Brick/Block Filler, Caulk, Transite and Wall Interiors |
| Detectable Lead in Paint Confirmed | |
| Detectable Lead in Paint Assumed | Interior and Exterior Painted Surfaces |
| Lead Dust on Floors >40 μ g/SF Confirmed ⁵⁴ | |
| Lead Dust on Floors >40 μ g/SF Assumed ² | |
| Lead Dust on Floors <40 µg/SF Confirmed ² | |
| Visual Mold | |
| Lead in Soils >50 mg/kg ⁵⁵ | |
| Lead in Soils <50 mg/kg | |
| Lead in Soils Assumed | Yes |

2 3

< = Less Than

< = Greater Than

 $[\]mu$ g/SF = Micrograms of Lead Dust per Square Foot of Floor Space

mg/kg = Milligrams of Lead per Kilogram of Soil

 ⁵³ Materials listed are those identified or assumed to be present during the September 15, 2009 site assessment
 ⁵⁴ In accordance with EPA 40 CFR part 457 the clearance level for lead dust on floors in child occupied housing is 40

micrograms of lead dust per square foot of floor space.

⁵⁵ In accordance with NR720, WIS. Adm Code; 50 milligrams per kilogram, is the conservative acceptable residual containment level for lead in soil based on human health risk from direct contact (ingestion or inhalation) related to nonindustrial land use and considering more than one contaminant may be present in the soil. However, site specific Risk Assessment is recommended to identify the site specific clean up levels for lead contaminated soil at each of these sites.

1 **PRIVY**

| Building Number | LCS ID 006380 |
|--|---|
| Building Name | Outer Island Privy |
| >1% Asbestos Confirmed | |
| Asbestos Assumed ⁵⁶ | Adhesives, Brick/Block Filler, Caulk, Transite and Wall Interiors |
| Detectable Lead in Paint Confirmed | |
| Detectable Lead in Paint Assumed | Interior and Exterior Painted Surfaces |
| Lead Dust on Floors >40 μ g/SF Confirmed ⁵⁷ | |
| Lead Dust on Floors >40 μ g/SF Assumed ² | Throughout |
| Lead Dust on Floors <40 μ g/SF Confirmed ² | |
| Visual Mold | |
| Lead in Soils >50 mg/kg ⁵⁸ | |
| Lead in Soils <50 mg/kg | |
| Lead in Soils Assumed | Yes |

2 3

4

< = Less Than

 μ g/SF = Micrograms of Lead Dust per Square Foot of Floor Space

⁵⁷ In accordance with EPA 40 CFR part 457 the clearance level for lead dust on floors in child occupied housing is 40 micrograms of lead dust per square foot of floor space.

⁵⁸ In accordance with NR720, WIS. Adm Code; 50 milligrams per kilogram, is the conservative acceptable residual containment level for lead in soil based on human health risk from direct contact (ingestion or inhalation) related to nonindustrial land use and considering more than one contaminant may be present in the soil. However, site specific Risk Assessment is recommended to identify the site specific clean up levels for lead contaminated soil at each of these sites.

< = Greater Than

mg/kg = Milligrams of Lead per Kilogram of Soil

⁵⁶ Materials listed are those identified or assumed to be present during the September 15, 2009 site assessment

APPENDIX B

1 APPENDIX C: MATERIAL ANALYSIS REPORTS, OUTER ISLAND

2

APPENDIX C

1 2

OUTER ISLAND ACM SAMPLE CHART

| Sample # | Sample Date | API ID | Sample Location | Material Description | Laboratory Result |
|-------------------|-------------|--------|---------------------------------------|--|---|
| B-OIKQ-FT1- 01 | 9/14/2009 | 26768 | Keepers Quarters - Second Floor | Brown with black and white steaks floor tile with brown mastic | Trace Chrysotile in Brown mastic, 10% Chrysotile in Brown tile |
| B-OIKQ-BF1- 01 | 9/14/2009 | 26768 | Keepers Quarters - First Floor | Orange/white plaster block filler | ND |
| B-OIKQ-BF2- 02 | 9/14/2009 | 26768 | Keepers Quarters - First Floor | White chalky plaster block filler | ND |
| B-OIKQ-SF1- 01 | 9/14/2009 | 26768 | Keepers Quarters - First Floor | Orange/brown pattern sheet flooring | ND |
| B-OIKQ-SF2- 01 | 9/14/2009 | 26768 | Keepers Quarters - First Floor | Blue sheet flooring w/ black/tan fibrous backing and White leveler | ND |
| B-OIKQ-SF3- 01 | 9/14/2009 | 26768 | Keepers Quarters - First Floor | Red sheet flooring w/ black fibrous backing and Tan leveler | ND |
| B-OIKQ-SF4- 01 | 9/14/2009 | 26768 | Keepers Quarters - First Floor | Green marble sheet flooring with black backing and white leveling compound | ND |
| B-OIKQ-WT1- 01 | 9/14/2009 | 26768 | Keepers Quarters - First Floor | Thick applied white granular wall texture | ND |
| B-OIKQ-DW1- 01 | 9/14/2009 | 26768 | Keepers Quarters - First Floor | Pink granular drywall | ND |
| B-OIKQ-WP-01 | 9/14/2009 | 26768 | Keepers Quarters - First Floor | Wall plaster patching material | ND |

ND=None Detected

TR=Trace, <1% Visual Estimate

APPENDIX C

1 2

OUTER ISLAND LEAD SAMPLE CHART

| Sample ID | Sample Type | API ID | Sample Location | Sample Date | Reporting Limit (ug/sq ft) | Lead Concentration (ug/sq ft) |
|-----------|-------------------|--------|-----------------------------------|----------------|----------------------------------|----------------------------------|
| S-OILH-01 | Soil Composite | 26768 | Outer Island Tower dripline | 9/14/2009 | 16.9 | 116.5 |
| S-OIKQ-01 | Soil Composite | 26768 | Keepers Quarters dripline | 9/14/2009 | 16.9 | 794.3 |

| 1 | APPENDIX D: FABRIC ANALYSIS |
|---|------------------------------------|
| 2 | |

APPENDIX D

| 1 | | | | | | |
|----------------------------|--|--|--|--|--|--|
| 2 | Fabric Analysis Outer Island | | | | | |
| 3 1 | Outer Is Apostle Island Nati | | | | | |
| 4 5 | | | | | | |
| 6 | October, 2009 | | | | | |
| 2 3 4 5 6 7 | On Tuesday, October 6, 2009, David Arbogast, architectural conservator, of Davenport, Iowa, received a | | | | | |
| 8 9 | large box containing paint and mortar samples from Eliz Andrews & Anderson Architects, PC of Golden, Colora | do. She is in the process of preparing Historic | | | | |
| 10 11 | Structures Reports for the historic lighthouse complexes headquartered in Bayfield, Wisconsin. As part of the HS | SRs paint and mortar/plaster analysis is required in | | | | |
| 12 13 | an attempt to ascertain historic finishes, mortars, and pla divided into sets contained within large manila mailing | 5 1 | | | | |
| 14 | the large envelopes have been arranged. The two sets wi | | | | | |
| 15 | Outer Island Lighthouse Complex. There were 30 samp | | | | | |
| 16 | and nine were of plaster and mortar (nos. 4, 8, 17, 22, and | | | | | |
| 17 18 | set of which one (no. 45) was a plaster sample. | | | | | |
| 19 | During the preceding twenty or more years Mr. Arbogas | t has performed paint analyses for various | | | | |
| 20 | structures at the Apostles Islands. Those samples and hi | | | | | |
| 21 | Bayfield and may be examined in relation to the finding | | | | | |
| 22 | | · | | | | |
| 23 | The paint samples were visually examined on Wednesda | ay, October 21, using the same procedures | | | | |
| 24 | employed for the samples from the previous seven sets t | from the other lighthouse complexes. Numbering of | | | | |
| 25 | the samples commenced with one and ended with 55. The | ne quality of the samples ranged from fair to quite | | | | |
| 26 | excellent. Because of the exposed nature of many of the | | | | | |
| 27 | appeared in several cases to be missing older layers seen | | | | | |
| 28 | top (most recent) to bottom (oldest). The following resu | Its were obtained from the analysis: | | | | |
| 29 | | | | | | |
| 30 | | | | | | |
| 31 | Oil Ho | | | | | |
| 32 | Sample 1 | Munsell | | | | |
| 33 | Dark maroon | 7.5R 3/6 | | | | |
| 34 | Dark maroon | 7.5R 3/6 | | | | |
| 35 | Yellow | 2.5Y 8/4 | | | | |
| 36 | Dark green | 5G 4/4 | | | | |
| 37 | Dark green | 5G 4/4 | | | | |
| 38 | Dark green | 5G 4/4 | | | | |
| 39 | Dark green | 5G 4/4 | | | | |
| 40 | Green | 5GY 6/2 | | | | |
| 41 | Dark maroon | 7.5R 3/6 | | | | |
| 42 | Dark maroon | 7.5R 3/6 | | | | |
| 43 | | | | | | |
| 44 | The first sample was collected from the brick of the oil | | | | | |
| 45 | large number of paint layers. Most of the pieces did not reveal the oldest pair of dark maroon layers, but | | | | | |
| 46 | they remained semi-detached on one of the pieces. Ther | e was no substrate attached to any of the pieces. | | | | |
| 47 | | | | | | |
| 48 | | | | | | |
| 49 | Oil Ho | | | | | |
| 50 | Sample 2 | Munsell | | | | |
| 51 | Brown | 10YR 6.5/8 | | | | |
| 52 | Brown | 10YR 6.5/8 | | | | |

APPENDIX D

| 1 | Brown | 10YR 6.5/8 | | | | | |
|------------------|---|---|--|--|--|--|--|
| 2 | Whitewash | N 9.5/ | | | | | |
| 3 | Whitewash | N 9.5/ | | | | | |
| 4 | Whitewash | N 9.5/ | | | | | |
| 2 3 4 5 | | | | | | | |
| 6 | The second sample came from the oil house interior. Its top layer was quite glossy. Beneath the brown | | | | | | |
| 7 | layers a minimum of three layers of whitewas | | | | | | |
| 8 | | | | | | | |
| 9 | | | | | | | |
| 10 | | Oil House | | | | | |
| 11 | Sample 3 | Munsell | | | | | |
| 12 | Green | 10G 5.5/1.5 | | | | | |
| 13 | Green | 10G 5/2 | | | | | |
| 13 | | | | | | | |
| | Light gray- | | | | | | |
| 15 | Dark green | | | | | | |
| 16 | Whitewash | N 9.5/ | | | | | |
| 17 | | | | | | | |
| 18 | • | house exterior. Beneath a set of four varying shades of dull | | | | | |
| 19 | green were multiple layers of whitewash as ev | videnced by its dissolution in hydrochloric acid. | | | | | |
| 20 | | | | | | | |
| 21 | | | | | | | |
| 22 | As noted in the introduction above there were | nine plaster and mortar samples in the first set of samples | | | | | |
| 23 | from the Outer Island Lighthouse complex. T | he fourth sample was the first of these samples. It was | | | | | |
| 24 | analyzed on Thursday, October 22 utilizing th | e standard testing procedure developed by E. Blaine Cliver, | | | | | |
| 25 | | antic Region of the National Park Service. The sample was | | | | | |
| 26 | | color and was very soft in consistency. The resultant reaction | | | | | |
| 27 | | act, coupled with the softness of the sample and its very rapid | | | | | |
| 28 | | vas probably composed of sand and a minimum amount of | | | | | |
| 29 | | on of fines in the sample indicating that the sand was | | | | | |
| 30 | | revealed bits of red brick which were trapped in the two | | | | | |
| | | | | | | | |
| 31 | | y brick bits and the second largest sieve also contain some | | | | | |
| 32 | e | d was extremely fine. At least 42% passed all of the sieves | | | | | |
| 33 | and at least 36% was trapped in the finest siev | e. | | | | | |
| 34 | | | | | | | |
| 35 | | | | | | | |
| 36 | | | | | | | |
| 37 | Mortar/Plast | er/Stucco Analysis Test Sheet | | | | | |
| 38 | | | | | | | |
| 39 | | | | | | | |
| 40 | Sample No. 4 | | | | | | |
| 41 | Building: Oil House, Outer A | postle Islands NL | | | | | |
| 42 | Location: Mortar | | | | | | |
| 43 | Sample Description: Tan, very soft, smal | l reaction, rapid filtering time | | | | | |
| 44 | Sample Description. <u>Tail, very sort, smar</u> | | | | | | |
| 45 | | | | | | | |
| 46 | | | | | | | |
| 40 | Test No. 1 Soluble Erection | | | | | | |
| | Test No. 1 – Soluble Fraction | | | | | | |
| 48 | Data | | | | | | |
| 49 | Data: | | | | | | |
| 50 | 1. <u>185.5</u> Container A weight | 8. <u>No</u> Hair or fibertype | | | | | |
| 51 | 2. <u>193.2</u> Container A and sample | 9. <u>3.8</u> Fines and paper weight | | | | | |
| 52 | 3. <u>760.22</u> Barometric pressure | 10. <u>3.0</u> Filter paper weight | | | | | |
| | | | | | | | |

| 1 2 3 4 5 | 4. <u>23</u> 5. <u>0.03</u> 6. <u>Champagne</u> 7. <u>Tan</u> | Temperature Liters of water displaced Filtrate color Fines color | 12. <u>3.8</u> 13. <u>33</u> | 0.5 Sand and Cor 8 cc. of sand 6.8 Weight of grad 6.8 Weight of grad | duated cylinder and sand |
|---|---|---|---|---|---|
| 5 6 7 8 9 10 11 12 13 14 15 16 17 | 18. <u>.76</u> 19. <u>1.9</u> | _Starting weight of sampl _Weight of fines: No. 9 – _Weight of sand: No. 11 Sand density: No. 12 divid _Weight of soluble conter _Mols. Of CO2: No. 5 x N _Gram weight of CaCO3: _Gram weight of Ca(OH) _Mols. of Ca(OH)2: No. 2 _Gram total weight of Ca _Gram weight CO2: No. 2 | No. 10 – No. 1 ded by (No. 13 – nt: No. 15 – (No. No. 3. x 0.016 div 100 x No. 20 2: No. 19 – No. 22 22 divided by 74 (OH)2: 74 x (No | 16 + No. 17) vided by (No. 4 + 21 | + 273.16 C.) |
| 18 19 20 | 26. <u>1.11</u> 27. <u>4.5</u> | Gram weight total possil %CO2 gain: No. 25 divi | ole CO2: 44 x (N | lo. 20 + No. 23) | |
| 21 22 23 24 25 26 | Conclusions: 28. 7.65 29. 10.46 30. 49.67 31. 26.89 | Gram weight of sample: Fine parts/volume: Sand parts/volume: Lime parts/volume: | | | |
| 27 28 29 30 31 | 33 | ent) _Portland cement parts/vol _Natural cement parts/vol _Lime with cement parts/ | ume: | (No. 16 divideo | d by No. 28) x 0.78 d by No. 28) x 0.86 divided by No. 28 x 1.1 |
| 32 33 34 | Test No. 2 – Sa | nd Sieve Analysis | | | |
| 35 36 37 38 39 40 41 42 43 | Sieve No. 10 No. 20 No. 30 No. 40 No. 50 Base | Sieve w/ sand weight <u>107.0</u> <u>106.6</u> <u>99.4</u> <u>101.2</u> <u>95.0</u> <u>73.3</u> | Sieve weight <u>106.7</u> <u>106.4</u> <u>99.3</u> <u>100.7</u> <u>93.2</u> <u>71.2</u> | Sand weight 0.3 0.2 0.1 0.5 1.8 2.1 | Sand ratio |
| 43 44 45 | | | Outhous | e | |
| 46 47 48 | | | ple 5 tewash | Munsell N 9.5/ | |
| 49 50 51 52 | • | e continued the paint serie coating of whitewash laye | | | |

| 1 | | Outhouse | |
|--|--|--|---|
| | Sample 6 | Outhouse | Munsell |
| $\frac{2}{3}$ | Green | | 10G 5.5/1.5 |
| 5 | | | |
| 4 | Dark gray-gr | een | 10G 4/1 |
| 2 | Gray-green | | 5G 5/1 |
| 6 | White | | N 9.5/ |
| 2 3 4 5 6 7 8 | Whitewash | | N 9.5/ |
| 8 | | | |
| 9 | The sixth sample was found on the trim of the o | outhouse exterior. In | terestingly, it retained a stark white |
| 10 | paint layer above a set of whitewash layers. Th | e paint was impervio | ous to the acid as opposed to the |
| 11 | whitewash which completely dissolved in the a | cid. | |
| 12 | 1 5 | | |
| 13 | | | |
| 14 | | Outhouse | |
| 15 | Sample 7 | | Munsell |
| 16 | Green | | 5G 4.5/4 |
| 17 | Dark gray | | 5Y 4/1 |
| 18 | Dark gray | | 5Y 4/1 |
| 19 | Dark gray | | 51 4/1 |
| 20 21 22 23 | The seventh sample was collected from the extension three paint layers with dark gray being the olde | | nouse door. Its analysis revealed only |
| 24 25 26 27 28 29 30 31 32 | The eighth sample continued the series of mort mortar. It was tan in color and was very soft wi reaction with a relatively small water displacen composition of sand and lime. There were a rel initially taken to clean the sand. As anticipated, failed to pass any of the sieves, which was a lan and all of the sieves, combined. Almost 2/3 was | th large, visible sand nent. That, along wit atively small propor , the sand sieve analy ge amount than that | d grains. It had a fast and bubbly th a rapid filtering time indicated a tion of fines, indicating a level of care ysis revealed coarse sand. Over 5% which passed all but the finest sieve |
| 33 34 35 36 | Mortar/Plaster | /Stucco Analysis T | 'est Sheet |
| 37 | Sample No 8 | | |
| 38 | Building: Outhouse, Outer Islan | nd, Apostle Islands N | NL |
| 39 | Location: Mortar | | |
| 40 | | sand grains fast a | nd bubbly reaction, rapid filtering time |
| 41 | | zana pranio, ruot u | soor, reaction, rapid monthing time |
| 42 | | | |
| 43 | | | |
| 44 | Test No. 1 – Soluble Fraction | | |
| 44 | | | |
| 46 | Data: | | |
| 40 | 1. <u>188.9</u> Container A weight | 8 No Usir | or fibertype |
| 47 48 | 0 | | |
| | 2. <u>203.8</u> Container A and sample | | and paper weight |
| 49 | 3. <u>760.22</u> Barometric pressure | 10. <u>3.0</u> Filter | |
| 50 | 4. <u>23</u> Temperature | | and Container A weight |
| 51 | 5. <u>0.18</u> Liters of water displaced | 12. <u>6.9</u> cc. of | |
| 52 | 6. <u>Clear</u> Filtrate color | 13. <u>39.7</u> Weigh | t of graduated cylinder and sand |

| 1 2 | 7. <u>Tan</u> | Fines color | 14. <u>28</u> . | <u>8</u> Weight of grad | luated cylinder | | |
|---------------|---------------------------------------|---|---------------------------------------|-------------------------|--|--|--|
| $\frac{2}{3}$ | Computations: | | | | | | |
| 4 | 15. 14.9 | Starting weight of sample: | No. 2 – No. 1 | | | | |
| 5 | 16. 0.3 | | | | | | |
| 6 | <u>17</u> 10.9 | Weight of sand: No. $11 - 1$ | | | | | |
| 7 | 18633 | Sand density: No. 12 divided | | | | | |
| 8 | 19. 3.7 | | | | | | |
| 9 | | <u>3925</u> Mols. Of CO2: No. 5 x No. 3. x 0.016 divided by (No. $4 + 273.16$ C.) | | | | | |
| 10 | 21. 074 | | | | | | |
| 11 12 | | | | | | | |
| 12 | 23. <u></u> | 3. <u>.04</u> Mols. of Ca(OH)2: No. 22 divided by 74 4. <u>3.51</u> Gram total weight of Ca(OH)2: 74 x (No. 20 + No. 23) | | | | | |
| 13 | 24. <u>3.31</u> 25. <u>0.33</u> | Gram weight CO2: No. 20 | | 20 + 100.23) | | | |
| 15 | 26. 2.09 | Gram weight total possible | | 20 + No 23 | | | |
| 16 | 27. 15.79 | %CO2 gain: No. 25 divide | | | | | |
| 17 | · · · · · · · · · · · · · · · · · · · | | , , , , , , , , , , , , , , , , , , , | | | | |
| 18 | Conclusions: | | | | | | |
| 19 | 28. 14.57 | Gram weight of sample: | | No. 15 – No. 25 | 5 | | |
| 20 | 29. 2.06 | Fine parts/volume: | | No. 16 divided | | | |
| 21 | | Sand parts/volume: | | | by No. 28) x No. 18 | | |
| 22 | 31. 26.50 | Lime parts/volume: | | (No. 24 divided | by No. 28) x 1.1 | | |
| 23 | | | | | | | |
| 24 25 | Cement (if pres | | | No. 16 divided | $h_{\rm M} = 28 + 0.78$ | | |
| 23 26 | 32 | Portland cement parts/volu Natural cement parts/volur | me. | | by No. 28) x 0.78 by No. 28) x 0.86 | | |
| 20 27 | | Lime with cement parts/volu | | | livided by No. 28 x 1.1 | | |
| 28 | 54 | | fume. | (110.10 x 0.2) 0 | ivided by 100. 20 x 1.1 | | |
| 29 | | | | | | | |
| 30 | Test No. 2 – Sa | and Sieve Analysis | | | | | |
| 31 | | , j | | | | | |
| 32 | Sieve | Sieve w/ sand weight S | Sieve weight | Sand weight | Sand ratio | | |
| 33 | No. 10 | | 106.8 | 0.6 | 5.55 | | |
| 34 | No. 20 | | 106.4 | 7.0 | 64.81 | | |
| 35 | No. 30 | 101.1 | 99.3 | 1.8 | <u>16.67</u> | | |
| 36 | No. 40 | 101.4 | 100.7 | 0.7 | 6.48 | | |
| 37 | No. 50 | 93.5 | 93.2 | 0.3 | 2.78 | | |
| 38 | Base | 71.6 | 71.2 | 0.4 | 3.70 | | |
| 39 | | | | | | | |
| 40 41 | | | Fog Signa | 1 | | | |
| 42 | | Sample 9 | | Munse | n | | |
| 43 | | Black | | N 0.5/ | | | |
| 44 | | Dark gray | J | N 2.0/ | | | |
| 45 | | Black | 1 | N 0.5/ | | | |
| 46 | | Gray-gree | en | 10 G 6 | /1 | | |
| 47 | | Dark gray | | N 4.0/ | | | |
| 48 | | Dark gray | | 10G 4/ | 1 | | |
| 49 | | White | - | N 9.5/ | | | |
| 50 | | | | | | | |
| 51 52 | | ble was collected from the fog | | | realed a set of gray and greenish | | |

52 gray layers. The oldest white layer appeared on only one end of one of the pieces.

| 1 | | | |
|-----------------------|---|---------------------------|--|
| 2 3 4 5 6 | | Fog Signal | |
| 4 | | Sample 10 | Munsell |
| 5 | | Light green | 7.5G 7/2 |
| 6 | | 0 0 | |
| 7 | | rkroom wall of the fog s | ignal. It consisted on a single layer of light |
| 8 9 | green paint without any substrate. | | |
| 9 10 | | | |
| 11 | | Fog Signal | |
| 12 | S | ample 11 | Munsell |
| 13 | | Thite | N 9.5/ |
| 14 | V | /hite | N 9.5/ |
| 15 | V | /hite | N 9.5/ |
| 16 | | an | 2.5Y 6/5 |
| 17 | | an | 2.5Y 7/4 |
| 18 | | an | 2.5Y 7/4 |
| 19 | | an | 2.5Y 7/4 |
| 20 21 | | an | 2.5Y 7/4 2.5Y 7/2 |
| $\frac{21}{22}$ | C | ray-tan | 2.51 //2 |
| $\frac{22}{23}$ | The eleventh sample was removed t | rom the workroom ceilir | ng of the fog signal. Beneath a set of three stark |
| 24 | | | the oldest being somewhat grayer than the |
| 25 | others. No substrate remained. | 5 | 6 6 9 |
| 26 | | | |
| 27 | | | |
| 28 | _ | Fog Signal | |
| 29 | | ample 12 | Munsell |
| 30 | | ray | N 6.0/ |
| 31 32 | v | /hite | 5Y 9/1 |
| 33 | The twelfth sample was from the wa | orkroom trim of the fog s | signal. The white layer on its wood surface was |
| 34 | extremely thin and probably served | | |
| 35 | 5 1 5 | | 5 |
| 36 | | | |
| 37 | | Fog Signal | |
| 38 | | ample 13 | Munsell |
| 39 | | ight green | 7.5G 7/2 |
| 40 | | ream | 2.5Y 8.5/2 |
| 41 42 | | ight brown | 10YR 6/4 |
| 42 | | ight brown ight brown | 10YR 6/4 10YR 6/4 |
| 44 | | ight brown | 10YR 6/4 |
| 45 | | lack | N 0.5/ |
| 46 | _ | | |
| 47 | The thirteenth sample was found on | the storage wall of the f | og signal. The substrate was a thick paper. On |
| 48 | its surface was a very glossy, flaky, | black substance which r | eadily delaminated from the light brown paint |
| 49 | on its surface. It is unlikely that the | black layer was an appli | ed finish. |
| 50 | | | |
| 51 | | | |
| 52 | | Fog Signal | |
| | | | |

| | Sample 14 | Munsell | |
|----------------------------|--|---|-------|
| | White | N 9.5/ | |
| | | n of the storage of the fog signal. Its top | layei |
| a stark white, high-glos | ss paint. All of the layers were extra | emely thin and evenly applied. | |
| | Fog Sign | al | |
| | Sample 15 | Munsell | |
| | Dark maroon | 2.5R 3/4 | |
| | Gray | 5Y 7/1 | |
| | Light green | 7.5G 7/2 | |
| | Light gray | 5Y 8/1 | |
| | Gray | 5Y 6/1 | |
| | Dark gray | 5Y 4/1 | |
| | White | 5Y 9/1 | |
| | | | |
| | | white being the oldest color. The sample | |
| clearly revealing a set of | of evenly applied, thin layers with v rate. | white being the oldest color. The sample | |
| clearly revealing a set of | of evenly applied, thin layers with v rate. Fog Sign | white being the oldest color. The sample | |
| clearly revealing a set of | of evenly applied, thin layers with v rate. Fog Sign Sample 16 | white being the oldest color. The sample al Munsell | |
| clearly revealing a set of | of evenly applied, thin layers with v rate. Fog Sign Sample 16 Dark maroon | white being the oldest color. The sample al Munsell 2.5R 3/4 | |
| clearly revealing a set of | of evenly applied, thin layers with v rate. Fog Sign Sample 16 Dark maroon Dark maroon | al Munsell 2.5R 3/4 2.5R 3/4 | |
| clearly revealing a set of | of evenly applied, thin layers with v rate. Fog Sign Sample 16 Dark maroon Dark maroon Gray | al Munsell 2.5R 3/4 2.5R 3/4 5Y 6/1 | |
| clearly revealing a set of | of evenly applied, thin layers with v rate. Fog Sign Sample 16 Dark maroon Dark maroon Gray Gray | al Munsell 2.5R 3/4 2.5R 3/4 5Y 6/1 5Y 6.5/1 | |
| clearly revealing a set of | of evenly applied, thin layers with v rate. Fog Sign Sample 16 Dark maroon Dark maroon Gray Gray Gray Gray | al Munsell 2.5R 3/4 2.5R 3/4 5Y 6/1 5Y 6.5/1 5Y 6/1 | |
| clearly revealing a set of | of evenly applied, thin layers with v rate. Fog Sign Sample 16 Dark maroon Gray Gray Gray Light gray | al Munsell 2.5R 3/4 2.5R 3/4 5Y 6/1 5Y 6/1 5Y 6/1 5Y 8/1 | |
| clearly revealing a set of | of evenly applied, thin layers with v rate. Fog Sign Sample 16 Dark maroon Dark maroon Gray Gray Gray Light gray Green | al Munsell 2.5R 3/4 2.5R 3/4 2.5R 3/4 5Y 6/1 5Y 6/1 5Y 6/1 5Y 6/1 5Y 8/1 5G 4/4 | |
| clearly revealing a set of | of evenly applied, thin layers with v rate. Fog Sign Sample 16 Dark maroon Dark maroon Gray Gray Light gray Green Charcoal | al Munsell 2.5R 3/4 2.5R 3/4 5Y 6/1 5Y 6/1 5Y 6/1 5Y 6/1 5Y 8/1 5G 4/4 5Y 3/1 | |
| clearly revealing a set of | of evenly applied, thin layers with v rate. Fog Sign Sample 16 Dark maroon Dark maroon Gray Gray Gray Light gray Green | al Munsell 2.5R 3/4 2.5R 3/4 5Y 6/1 5Y 6/1 5Y 6/1 5Y 8/1 5G 4/4 5Y 3/1 5Y 8/1 | |
| clearly revealing a set of | of evenly applied, thin layers with v rate. Fog Sign Sample 16 Dark maroon Dark maroon Gray Gray Light gray Green Charcoal | al Munsell 2.5R 3/4 2.5R 3/4 5Y 6/1 5Y 6/1 5Y 6/1 5Y 6/1 5Y 8/1 5G 4/4 5Y 3/1 5Y 8/1 5Y 7/1 | |
| clearly revealing a set of | of evenly applied, thin layers with v rate. Fog Sign Sample 16 Dark maroon Dark maroon Gray Gray Gray Light gray Green Charcoal Light gray | al Munsell 2.5R 3/4 2.5R 3/4 2.5R 3/4 5Y 6/1 5Y 6/1 5Y 6/1 5Y 6/1 5Y 8/1 5G 4/4 5Y 3/1 5Y 8/1 5Y 7/1 5Y 7/1 | |
| clearly revealing a set of | of evenly applied, thin layers with v rate. Fog Sign Sample 16 Dark maroon Dark maroon Gray Gray Gray Light gray Green Charcoal Light gray Gray | al Munsell 2.5R 3/4 2.5R 3/4 5Y 6/1 5Y 6/1 5Y 6/1 5Y 6/1 5Y 8/1 5G 4/4 5Y 3/1 5Y 8/1 5Y 7/1 | |
| clearly revealing a set of | of evenly applied, thin layers with v rate. Fog Sign Sample 16 Dark maroon Dark maroon Gray Gray Light gray Green Charcoal Light gray Gray Gray Gray | al Munsell 2.5R 3/4 2.5R 3/4 2.5R 3/4 5Y 6/1 5Y 6/1 5Y 6/1 5Y 6/1 5Y 8/1 5G 4/4 5Y 3/1 5Y 8/1 5Y 7/1 5Y 7/1 | |
| clearly revealing a set of | of evenly applied, thin layers with v rate. Fog Sign Sample 16 Dark maroon Dark maroon Gray Gray Light gray Green Charcoal Light gray Gray Gray Gray Gray Gray | al Munsell 2.5R 3/4 2.5R 3/4 2.5R 3/4 5Y 6/1 5Y 6/1 5Y 6/1 5Y 8/1 5G 4/4 5Y 3/1 5Y 8/1 5Y 7/1 5Y 7/1 5Y 7/1 | |
| clearly revealing a set of | of evenly applied, thin layers with v rate. Fog Sign Sample 16 Dark maroon Dark maroon Gray Gray Light gray Green Charcoal Light gray Gray Gray Gray Gray Gray Gray Gray G | al Munsell 2.5R 3/4 2.5R 3/4 2.5R 3/4 5Y 6/1 5Y 6/1 5Y 6/1 5Y 6/1 5Y 8/1 5G 4/4 5Y 3/1 5Y 8/1 5Y 7/1 5Y 7/1 5Y 7/1 5Y 9/1 | |
| clearly revealing a set of | of evenly applied, thin layers with v rate. Fog Sign Sample 16 Dark maroon Dark maroon Gray Gray Gray Light gray Green Charcoal Light gray Gray Gray Gray Gray Gray Gray Gray | al Munsell 2.5R 3/4 2.5R 3/4 5Y 6/1 5Y 6/1 5Y 6/1 5Y 6/1 5Y 6/1 5Y 8/1 5G 4/4 5Y 3/1 5Y 8/1 5Y 7/1 5Y 7/1 5Y 7/1 5Y 7/1 5Y 7/1 5Y 9/1 5Y 6.5/1 | |
| clearly revealing a set of | of evenly applied, thin layers with v rate. Fog Sign Sample 16 Dark maroon Dark maroon Gray Gray Gray Light gray Green Charcoal Light gray Gray Gray Gray Gray Gray Gray Charcoal | al Munsell 2.5R $3/4$ 2.5R $3/4$ 2.5R $3/4$ 5Y $6/1$ 5Y $6/1$ 5Y $6/1$ 5Y $6/1$ 5Y $8/1$ 5G $4/4$ 5Y $3/1$ 5Y $8/1$ 5Y $7/1$ 5Y $7/1$ 5Y $7/1$ 5Y $7/1$ 5Y $7/1$ 5Y $9/1$ 5Y $3/1$ | |
| clearly revealing a set of | of evenly applied, thin layers with v rate. Fog Sign Sample 16 Dark maroon Dark maroon Gray Gray Gray Uight gray Green Charcoal Light gray Gray Gray Gray Gray Gray Gray Charcoal Light gray Gray Gray | al Munsell 2.5R $3/4$ 2.5R $3/4$ 2.5R $3/4$ 2.5R $3/4$ 5Y $6/1$ 5Y $6.5/1$ 5Y $6/1$ 5Y $8/1$ 5G $4/4$ 5Y $3/1$ 5Y $8/1$ 5Y $7/1$ 5Y | |

49 substrate. The oldest pair of white layers was relatively thick indicating that they were probably not prime

50 51 coats, but were finish coats.

APPENDIX D

1 The seventeenth sample continued the plaster and mortar samples. It came from the equipment room 2 chimney mortar of the fog signal. It was tan in color and was very soft. With a very fast reaction and a 3 small water displacement it was evident that this was composed of a relatively small part of lime in relation 4 to its sand content. The sand sieve analysis revealed fine sand of which well over one-fifth passed all of the 5 sieves and almost one-third was trapped in the finest sieve. 6 7 8 9 Mortar/Plaster/Stucco Analysis Test Sheet 10 11 12 Sample No. 17 Building: Fog Signal, Outer Island, Apostle Islands NL 13 14 Location: Equipment Room Chimney Mortar Sample Description: Tan, very soft, speedy reaction, extremely fast filtering time 15 16 17 18 19 Test No. 1 – Soluble Fraction 20 21 Data: 22 185.1 Container A weight 8. No Hair or fiber type 1. 23 Container A and sample 2. 201.0 9. 3.6 Fines and paper weight 24 3. 760.22 10.<u>3.0</u> Filter paper weight Barometric pressure 25 4. 23 Temperature 11. 197.9 Sand and Container A weight 26 Liters of water displaced 12. 7.6 cc. of sand 5. 0.05 27 6. Champagne Filtrate color 13. 41.6 Weight of graduated cylinder and sand 28 14. 28.87 Weight of graduated cylinder 7. Brown Fines color 29 30 Computations: 15. 15.5 31 Starting weight of sample: No. 2 – No. 1 32 16. 0.6 Weight of fines: No. 9 – No. 10 33 17. 12.8 Weight of sand: No. 11 – No. 1 34 18. .59375 Sand density: No. 12 divided by (No. 13 – No. 14) 19. 35 2.1 Weight of soluble content: No. 15 - (No. 16 + No. 17)20. 0.0020535 Mols. Of CO2: No. 5 x No. 3. x 0.016 divided by (No. 4 + 273.16 C.) 36 37 21. 0.20 Gram weight of CaCO3: 100 x No. 20 38 22. 1.9 Gram weight of Ca(OH)2: No. 19 - No. 21 39 23. .0256 Mols. of Ca(OH)2: No. 22 divided by 74 40 Gram total weight of Ca(OH)2: 74 x (No. 20 + No. 23) 24. 1.74 41 0.09 Gram weight CO2: No. 20 x 44 25. 42 1.04 Gram weight total possible CO2: $44 \times (No. 20 + No. 23)$ 26. 43 27. 8.65 %CO2 gain: No. 25 divided by No. 26 44 45 Conclusions: 28. 15.41 Gram weight of sample: 46 No. 15 – No. 25 47 29. 3.89 Fine parts/volume: No. 16 divided by No. 28 48 30. 49.32 Sand parts/volume: (No. 17 divided by No. 28) x No. 18 49 31. <u>12.42</u> Lime parts/volume: (No. 24 divided by No. 28) x 1.1 50 51 Cement (if present) 32.____Portland cement parts/volume: 52 (No. 16 divided by No. 28) x 0.78

| 1 2 3 | | Natural cement parts/voLime with cement parts | | | d by No. 28) x 0.86 divided by No. 28 x 1.1 | |
|--|---|--|---|--|---|--|
| 2 3 4 5 6 7 | Test No. 2 – Sand Sieve Analysis | | | | | |
| 7 8 9 10 11 12 13 14 15 16 | Sieve No. 10 No. 20 No. 30 No. 40 No. 50 Base | Sieve w/ sand weight <u>107.3</u> <u>107.3</u> <u>100.3</u> <u>104.3</u> <u>97.2</u> <u>73.9</u> | Sieve weight <u>106.8</u> <u>106.4</u> <u>99.3</u> <u>100.8</u> <u>93.2</u> <u>71.2</u> | Sand weight 0.5 0.9 1.0 3.5 4.0 2.7 | Sand ratio <u>3.97</u> <u>7.14</u> <u>7.94</u> <u>27.78</u> <u>31.75</u> <u>21.43</u> | |
| 17 | | | Fog Signa | al | | |
| 18 | | Samp | | Muns | ell | |
| 19 | | Gray | | N 7.0/ | | |
| 20 | | Dark g | gray | N 5.5/ | | |
| 21 | | Gray | | N 7.0/ | | |
| 22 | | Light | gray | N 8.0/ | | |
| 23 | | Gray | | N 7.0/ | | |
| 24 | | Gray | | N 6.5/ | | |
| 25 | TT1 1 1 | a 1 1a ' | · 1 · TI | 1 6 4 | | |
| 26 | | | | | e second floor wall of the fog | |
| 27 28 | signal. It con | sisted of a palette of layers | in varying shades | of gray. | | |
| 28 29 | | | | | | |
| 29 30 | | | Fog Signa | al | | |
| 31 | | G | | | | |
| 51 | | Samn | | Mune | | |
| 32 | | Samp White | | Muns 5V 9/1 | | |
| 32 33 | | White | | 5Y 9/1 | | |
| 33 | | White White | | 5Y 9/1 5Y 9/1 | | |
| 33 34 | | White White Light | | 5Y 9/1 5Y 9/1 5Y 8/1 | | |
| 33 | | White White | gray | 5Y 9/1 5Y 9/1 | | |
| 33 34 35 | | White White Light Gray Dark g | gray | 5Y 9/1 5Y 9/1 5Y 8/1 5Y 8/1 5Y 6/1 | | |
| 33 34 35 36 37 38 | | White White Light Gray | gray gray | 5Y 9/1 5Y 9/1 5Y 8/1 5Y 6/1 5Y 4/1 | | |
| 33 34 35 36 37 38 39 | | White White Light Gray Dark g Gray | gray gray hite | 5Y 9/1 5Y 9/1 5Y 8/1 5Y 6/1 5Y 4/1 5Y 6/1 | | |
| 33 34 35 36 37 38 39 40 | | White White Light Gray Dark g Gray Off-w | gray gray hite gray | 5Y 9/1 5Y 9/1 5Y 8/1 5Y 6/1 5Y 4/1 5Y 6/1 5Y 8.5 | 5/1 | |
| 33 34 35 36 37 38 39 40 41 | | White White Light Gray Dark g Gray Off-w Dark g White White | gray gray hite gray | 5Y 9/1 5Y 9/1 5Y 8/1 5Y 6/1 5Y 4/1 5Y 8.5 5Y 4/1 5Y 9/1 5Y 9/1 | 5/1 | |
| 33 34 35 36 37 38 39 40 41 42 | | White White Light Gray Dark Gray Off-w Dark White | gray gray hite gray | 5Y 9/1 5Y 9/1 5Y 8/1 5Y 6/1 5Y 4/1 5Y 8.5 5Y 4/1 5Y 9/1 | 5/1 | |
| 33 34 35 36 37 38 39 40 41 42 43 | | White White Light Gray Dark g Gray Off-w Dark g White White White | gray gray hite gray | 5Y 9/1 5Y 9/1 5Y 8/1 5Y 6/1 5Y 6/1 5Y 6/1 5Y 8.5 5Y 4/1 5Y 9/1 5Y 9/1 5Y 9/1 | · · · · · · | |
| 33 34 35 36 37 38 39 40 41 42 43 44 | | White White Light Gray Dark g Gray Off-w Dark g White White White White | gray gray hite gray second floor trim | 5Y 9/1 5Y 9/1 5Y 8/1 5Y 6/1 5Y 6/1 5Y 8.5 5Y 4/1 5Y 9/1 5Y 9/1 5Y 9/1 | . It began with a pair of white | |
| 33 34 35 36 37 38 39 40 41 42 43 44 45 | | White White Light Gray Dark g Gray Off-w Dark g White White White | gray gray hite gray second floor trim | 5Y 9/1 5Y 9/1 5Y 8/1 5Y 6/1 5Y 6/1 5Y 8.5 5Y 4/1 5Y 9/1 5Y 9/1 5Y 9/1 | . It began with a pair of white | |
| 33 34 35 36 37 38 39 40 41 42 43 44 45 46 | | White White Light Gray Dark g Gray Off-w Dark g White White White White | gray gray hite gray second floor trim | 5Y 9/1 5Y 9/1 5Y 8/1 5Y 6/1 5Y 6/1 5Y 8.5 5Y 4/1 5Y 9/1 5Y 9/1 5Y 9/1 | . It began with a pair of white | |
| 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 | | White White Light Gray Dark g Gray Off-w Dark g White White White White | gray gray hite gray second floor trim ers with a set of v | 5Y 9/1 5Y 9/1 5Y 8/1 5Y 6/1 5Y 4/1 5Y 6/1 5Y 8.5 5Y 4/1 5Y 9/1 5Y 9/1 5Y 9/1 | . It began with a pair of white | |
| 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 | | White White Light Gray Dark g Gray Off-w Dark g White White White White white ath sample was found on the ided with a pair of white lay | gray gray hite gray second floor trim ers with a set of v Fog Sign : | 5Y 9/1 5Y 8/1 5Y 8/1 5Y 6/1 5Y 4/1 5Y 6/1 5Y 8.5 5Y 4/1 5Y 9/1 5Y 9/1 5Y 9/1 5Y 9/1 5Y 9/1 | /1 . It began with a pair of white rs between them. | |
| 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 | | White White Light Gray Dark g Gray Off-w Dark g White White White white white Samp | gray gray hite gray second floor trim ers with a set of v Fog Sign : | 5Y 9/1 5Y 8/1 5Y 8/1 5Y 6/1 5Y 4/1 5Y 6/1 5Y 8/5 5Y 4/1 5Y 9/1 5Y 9/1 5Y 9/1 5Y 9/1 5Y 9/1 a of the fog signal varying gray layer | /1 . It began with a pair of white rs between them. | |
| 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 | | White White Light Gray Dark g Gray Off-w Dark g White White White white ath sample was found on the nded with a pair of white lay Samp Red | gray gray hite gray second floor trim ers with a set of v Fog Sign : | 5Y 9/1 5Y 9/1 5Y 8/1 5Y 6/1 5Y 6/1 5Y 6/1 5Y 8.5 5Y 4/1 5Y 9/1 5Y 9/1 5Y 9/1 5Y 9/1 5Y 9/1 5Y 9/1 a of the fog signal varying gray layer al Munso 7.5R 3 | It began with a pair of white the between them. | |
| 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 | | White White Light Gray Dark g Gray Off-w Dark g White White White white white Samp | gray gray hite gray second floor trim ers with a set of v Fog Sign : | 5Y 9/1 5Y 8/1 5Y 8/1 5Y 6/1 5Y 4/1 5Y 6/1 5Y 8/5 5Y 4/1 5Y 9/1 5Y 9/1 5Y 9/1 5Y 9/1 5Y 9/1 a of the fog signal varying gray layer | . It began with a pair of white rs between them. | |

| 1 | | Charcoal | N 1.5/ |
|--------------------------------------|------------------------------------|---------------------------------------|---|
| 2 | | Dark gray | N 4.0/ |
| 3 | | Dark gray | N 4.0/ |
| 4 | | Gray | N 7.0/ |
| - - - | | • | N 5.0/ |
| 5 | | Dark gray | |
| 07 | | Dark gray | N 5.0/ |
| 2 3 4 5 6 7 8 9 | | Gray | N 6.5/ |
| 8 | | Gray | N 6.5/ |
| | | Gray | N 6.5/ |
| 10 | | Light gray | N 8.0/ |
| 11 | | White | 5Y 9/1 |
| 12 | | White | 5Y 9/1 |
| 13 | | White | 5Y 9/1 |
| 14 | | | |
| 15 | The twentieth sample was collec | ted from the equipment room of th | e fog signal. It was in excellent |
| 16 | | | int. At the base of the sample, beneath |
| 17 | | | hich may have been a ferrous metal |
| 18 | substrate. It did not appear to be | | men may have been a ferrous metal |
| 19 | substrate. It did not appear to be | an applied paint. | |
| | | | |
| 20 | | | |
| 21 | | Fog Signal | |
| 22 | | Sample 21 | Munsell |
| 23 | | Gray | N 7.0/ |
| 24 | | Dark gray | N 5.5/ |
| 25 | | Gray | N 7.0/ |
| 26 | | Light gray | N 8.0/ |
| 27 | | Gray | N 7.0/ |
| 28 | | Gray | N 6.5/ |
| 29 | | | |
| 30 | Sample 21 came from the exterio | or baseboard trim of the fog signal | It retained a set of varying shades of |
| 31 | gray paint. | si basebbara trini or the rog signar. | it retained a set of varying shades of |
| 32 | gray pante. | | |
| 33 | | | |
| | G 1 22 1/1 | | |
| 34 | | nd plaster sample analysis. It was f | |
| 35 | | y), hardness, brittleness, very small | |
| 36 | | | nd. The sand sieve analysis revealed very |
| 37 | | | han 3% pass all of the sieves. Almost |
| 38 | half was trapped in sieve #40 and | d almost 30% was trapped in sieve | #30. |
| 39 | | | |
| 40 | | | |
| 41 | | | |
| 42 | Ν | /Iortar/Plaster/Stucco Analysis T | est Sheet |
| 43 | | 0 | |
| 44 | | | |
| 45 | Sample No. 22 | | |
| 46 | Building: Eag Si | gnal, Outer, Island, Apostle Islands | - NI |
| | | | 5 INL |
| 47 | Location: Exterio | or brick mortar | fallowed has made a low of an 1 |
| 48 | | naru and brittle, small reaction | followed by prolonged reaction, slow |
| 49 | filtering time | | |
| 50 | | | |
| 51 | | | |
| 52 | Test No. 1 – Soluble Fraction | | |
| | | | |

| 1 | | | | | |
|--------------------------------------|------------------------------------|--|----------------------|--|-----------------------------|
| 1 2 3 4 5 6 7 8 | Data: | | | | |
| 3 | 1. <u>187.8</u> | | | No Hair or fiber | |
| 4 | $2. \underline{227.2}_{760,22}$ | _Container A and samp | | 4.1 Fines and paper | |
| 5 | 3. <u>760.22</u> 4. 23 | Barometric pressure | | <u>3.1</u> Filter paper v | |
| 7 | 4. <u>23</u> 5. 0.08 | Temperature Liters of water displac | | <u>216.6</u> Sand and Cor <u>19.3</u> cc. of sand | itallel A weight |
| 8 | 6. <u>Yellow-green</u> | | | | duated cylinder and sand |
| 9 | 7. Brown | Fines color | | <u>28.7</u> Weight of gra | |
| 10 | 7. <u>Diown</u> | | 11. | <u></u> () eight of giu | |
| 11 | Computations: | | | | |
| 12 | 15. 39.4 | Starting weight of sam | ple: No. 2 – No | o. 1 | |
| 13 | 16. 1.0 | Weight of fines: No. 9 | | | |
| 14 | | _Weight of sand: No. 1 | | | |
| 15 | | Sand density: No. 12 di | | | |
| 16 | 19. <u>9.6</u> | Weight of soluble con | | | |
| 17 | | <u>Mols. Of CO2: No. 5 2</u> | | | - 273.16 C.) |
| 18 19 | 21. <u>033</u> 22. 9.27 | Gram weight of CaCC | | | |
| 19 20 | 22. <u>9.27</u> 231253 | Gram weight of Ca(O) Mols. of Ca(OH)2: No | | | |
| 20 | 23. <u>1255</u> 24. <u>9.51</u> | Gram total weight of (| | | |
| 22 | 25. 0.14 | Gram weight CO2: No | | (110. 20 + 110. 25) | |
| $\frac{1}{23}$ | 26. 5.66 | Gram weight total pos | | x (No. 20 + No. 23) | |
| 24 | 27. 2.47 | | | | |
| 25 | | - | - | | |
| 26 | Conclusions: | | | | |
| 27 | 28. 39.26 | _Gram weight of sampl | e: | No. 15 – No. 2 | |
| 28 | 29. 2.55 | Fine parts/volume: | | No. 16 divided | |
| 29 | 30. 49.15 | _Sand parts/volume: | | | d by No. 28) x No. 18 |
| 30 31 | 31 | Lime parts/volume: | | (No. 24 divide | d by No. 28) x 1.1 |
| 32 | Cement (if pres | ent) | | | |
| 33 | | Portland cement parts/ | volume. | (No. 16 divide | d by No. 28) x 0.78 |
| 34 | | Natural cement parts/v | | | d by No. 28) x 0.86 |
| 35 | 34. | Lime with cement par | ts/volume: | | divided by No. 28 x 1.1 |
| 36 | | 1 | | · · · · · · · · · · · · · · · · · · · | 5 |
| 37 | | | | | |
| 38 | Test No. 2 – Sa | nd Sieve Analysis | | | |
| 39 | ~ . | ~ | ~· · · | ~ | ~ · · |
| 40 | Sieve | Sieve w/ sand weight | Sieve weigh | | Sand ratio |
| 41 42 | No. 10 | 106.9 | 106.7 | $\frac{0.2}{2.6}$ | 0.70 |
| 42 43 | No. 20 No. 30 | <u>109.0</u> 107.8 | <u>106.4</u> 99.3 | <u>2.6</u> 8.5 | <u>9.12</u> <u>29.82</u> |
| 44 | No. 40 | 114.6 | 100.7 | 13.9 | 48.77 |
| 45 | No. 50 | 95.7 | 93.2 | 2.5 | 8.77 |
| 46 | Base | 72.0 | 71.2 | 0.8 | 2.81 |
| 47 | | | | | |
| 48 | | | | | |
| 49 | | ~ | Light | | |
| 50 | | | ple 23 | Muns | |
| 51 52 | | Whit | | N 9.5/ | |
| 52 | | Whit | e | N 9.5/ | |

| White | N 9.5/ |
|-------|--------|
| White | N 9.5/ |

Sample 23 continued the paint layers. It was removed from the exterior siding of the lighthouse. Its analysis revealed eight layers of stark white paint.

9 10 11

8

1

234567

12 Sample 24 continued the mortar and plaster sample analysis. The sample was collected from the exterior 13 block mortar of the lighthouse. It proved to be a classic Portland cement and sand mortar. It was gray and 14 hard. It had a very low water displacement. Its filtering was a matter of almost two days time. It produced 15 gelatinous byproducts with the reaction which dried to a very large quantity of fines. There is no doubt that 16 a large proportion of Portland cement was used in the mortar in relation to the sand content. The sand sieve 17 analysis was unusually interesting in that the sand proved to be virtually identical to that analyzed from the 18 kitchen plaster (sample 22) from the Michigan Island Light. All of it easily passed the largest sieve and 19 almost 10% passed all of the sieves. One-third was trapped in the finest sieve, #50, and over 42% was 20 trapped in the next finest sieve, #40.

21

22 Analysis of sample 25 and the subsequent four other plaster and mortar samples were undertaken on 23 Friday, October 23. The sample 25 came from the exterior brick mortar of the lighthouse. It was tan in 24 color and was moderately soft. With a very low water displacement and a relatively large amount of fines it 25 appears that the mortar consisted of sand and cement. With its color (tan) this was probably natural cement 26 and not Portland cement, which is typically gray. The relatively small sample size probably accounts for 27 the fairly fast filtering time. Cement samples normally filter slowly. Natural cement, as its name implies, is 28 quarried from the ground and is similar to the cements the Romans used for their construction. Portland 29 cement, named after Portland, England where it was invented and first manufactured, is a synthetic cement. 30 The primary difference is that natural cement contains a wider range of possible elements which can affect 31 its performance whereas Portland cement is completely predictable and consistent. As a result, Portland 32 cement is hard, impervious, and brittle. Natural cements tend not to be as hard or impervious or brittle, plus 33 their color is different (shades of gray to white for Portland cement and tan or buff for natural cement). 34 Natural cements were overtaken by Portland cement in the later decades of the nineteenth century as 35 natural cement quarries played out and production costs for Portland cement became 36 competitive. Generally, if one encounters natural cement it is an indication that it is from a nineteenth 37 century structure. The sand sieve analysis revealed fine sand which easily passed the largest sieve. Well 38 over one-quarter of it passed all of the sieves and well over one-third was trapped in the finest sieve, #50. 39 40 Sample 26 was removed from the brick mortar patch of the lighthouse. It was brown in color and was 41 moderately hard. It had a very modest water displacement. Its hardness and water displacement coupled 42 with a slow filtering time and a relatively large proportion of fines points toward a mixture of sand and 43 cement. The brown color of the sample points toward a natural cement rather than a Portland cement, 44 which is typically gray. The sand sieve analysis was quite interesting. It revealed moderately coarse sand. 45 Identical amounts were trapped in sieves #40 and #50 (both over 25%) and in the base and in sieve #20 46 (both almost 15%). The sand in sieve #30 was almost the same in weight as the latter two from the base and sieve #20.

- 47
- 48 49

50 Sample 27 was from the brick mortar patch of the lighthouse. It was gray in color and was relatively soft.

- 51 That softness, coupled with a fast and bubbly reaction, a fair amount of water displacement, as well as a
- 52 rapid filtering time points toward a mixture of approximately five parts of sand to two parts of lime, by

volume. The sand sieve analysis produced a moderate sand which easily passed the largest sieve, but less
than 7% passed all of the sieves. Almost one-fifth was trapped in the finest sieve, #50, and well over 58%
was trapped in the next finest sieve, #40.

5 6 Sample 28 was taken from the mortar of the lighthouse. It was tan in color and moderately soft. Its minimal 7 reaction is typical of a lime and cement mortar. The speed of the reaction coupled with its foaminess, in 8 addition to the relatively large proportion of fines indicates a high probability that the cement was not 9 Portland cement, but natural cement. In addition, natural cement yields a tan color whereas most Portland cement is gray in color. The sand sieve analysis revealed very moderate sand. Over 18% of it passed all of 10 the sieves whereas only slightly over 1% was trapped in the largest sieve. In a curious turn of events equal 11 12 portions were trapped in sieves #20 and #30 (both 13%) and in #40 and #50 (both over 27%). This was 13 extremely similar to the sand of sample 25 above. 14 15

Mortar/Plaster/Stucco Analysis Test Sheet

18 19 24 Sample No. 20 Lighthouse, Outer Island, Apostle Islands NL Building: 21 Location: Exterior block mortar 22 Gray, very hard, small reaction followed by prolonged reaction, gelatinous by-Sample Description: 23 products, extremely slow filtering time 24 25 26 Test No. 1 – Soluble Fraction 27 28 Data: 29 1. 192.0 Container A weight 8. <u>No</u> Hair or fiber type 30 208.6 Container A and sample 9. 8.8 Fines and paper weight 2. 31 760.22 Barometric pressure 10. 3.4 Filter paper weight 3. 4.____23 11. 200.3 Sand and Container A weight 32 Temperature 33 Liters of water displaced 12. 6.0 cc. of sand 5. 0.05 13. 37.1 Weight of graduated cylinder and sand 34 6. Off-white Filtrate color 14. 28.8 Weight of graduated cylinder 35 Fines color 7. Gray 36 37 Computations: 38 15. 16.6 _Starting weight of sample: No. 2 – No. 1 39 5.4 Weight of fines: No. 9 – No. 10 16. 40 Weight of sand: No. 11 – No. 1 8.3 17. 41 .7229 Sand density: No. 12 divided by (No. 13 – No. 14) 18. 42 19. 2.9 Weight of soluble content: No. 15 - (No. 16 + No. 17)43 20. 0.002 Mols. Of CO2: No. 5 x No. 3. x 0.016 divided by (No. 4 + 273.16 C.) 44 0 2 0 Gram weight of CaCO3: 100 x No. 20 21. 45 2.7 Gram weight of Ca(OH)2: No. 19 - No. 21 22. Mols. of Ca(OH)2: No. 22 divided by 74 46 23. .0364 47 Gram total weight of Ca(OH)2: 74 x (No. 20 + No. 23) 24. 2.84 48 0.09 Gram weight CO2: No. 20 x 44 25. 49 1.69 Gram weight total possible CO2: $44 \times (No. 20 + No. 23)$ 26. 50 %CO2 gain: No. 25 divided by No. 26 5.33 27.____ 51 52 Conclusions:

16

| 30. 36.3 | Gram weight of sample Fine parts/volume: Sand parts/volume: Lime parts/volume: | : | | |
|--|---|--|---|--|
| 33 | resent) <u>51</u> Portland cement parts/v <u>Natural cement parts/vc</u> Lime with cement parts | olume: | (No. 16 divide | d by No. 28) x 0.78 d by No. 28) x 0.86 divided by No. 28 x 1.1 |
| Test No. 2 – | Sand Sieve Analysis | | | |
| Sieve No. 10 No. 20 No. 30 No. 40 No. 50 Base | Sieve w/ sand weight <u>106.8</u> <u>106.7</u> <u>100.2</u> <u>104.3</u> <u>96.0</u> <u>72.0</u> | Sieve weight <u>106.8</u> <u>106.4</u> <u>99.3</u> <u>100.8</u> <u>93.2</u> <u>71.2</u> | Sand weight 0.0 0.3 0.9 3.5 2.8 0.8 | Sand ratio 0 3.61 10.84 42.17 33.73 9.64 |
| Sample No | | Plaster/Stucco A | nalysis Test She | et |
| Building. | Lighthouse O | uter Island Anost | | |
| Location: | Lighthouse, Ou Exterior brick | mortar | le Islands NL | |
| Location: | Lighthouse, Ou | mortar | le Islands NL | |
| Location: Sample Deso Test No. 1 – Data: 1. <u>185.5</u> 2. <u>193.8</u> 3. <u>763.02</u> 4. <u>23</u> 5. <u>0.08</u> 6. <u>Yellow-gr</u> | Lighthouse, Ou Exterior brick cription: Tan, moderate Soluble Fraction Container A weight Container A and sample | $\begin{array}{c} \underline{\text{mortar}} \\ \underline{\text{ly soft, fast and bi}} \\ e & 9. \underline{3.7} \\ 10. \underline{2.9} \\ 11. \underline{19} \\ ed & 12. \underline{3.} \\ 13. \underline{3.4} \end{array}$ | <u>e Islands NL</u> <u>ubbly reaction, ra</u> <u>b</u> Hair or fiber Fines and pa <u>c</u> Filter paper <u>0.7</u> Sand and Co <u>4</u> cc. of sand | apid filtering time type per weight weight ntainer A weight uduated cylinder and sand |

| 1 | 22. <u>1.97</u> | _Gram weight of Ca(OH)2: No. 19 – No. 21 | | | | | |
|----------------------------|----------------------|--|---|-------------|--|--|--|
| 2 3 4 5 6 7 | 230266 | Mols. of Ca(OH)2: No. 22 divid | | | | | |
| 3 | 24. <u>4.41</u> | | _Gram total weight of Ca(OH)2: 74 x (No. 20 + No. 23) | | | | |
| 4 | 25. <u>0.15</u> | Gram weight CO2: No. 20 x 44 | | | | | |
| 5 | 26. 2.62 | <u>Gram weight total possible CO2</u> | | | | | |
| 6 | 27. 5.73 | %CO2 gain: No. 25 divided by | No. 26 | | | | |
| 7 | | | | | | | |
| 8 | Conclusions: | | | | | | |
| 9 | 28. 8.15 | Gram weight of sample: | No. 15 – No. 25 | | | | |
| 10 | 29. <u>9.81</u> | Fine parts/volume: | No. 16 divided by No. 28 | | | | |
| 11 | 30. 41.72 | | (No. 17 divided by No. 28) x | x No. 18 | | | |
| 12 | 31. | Lime parts/volume: | (No. 24 divided by No. 28) x | x 1.1 | | | |
| 13 | | | , , , , , , , , , , , , , , , , , , , | | | | |
| 14 | Cement (if pre | esent) | | | | | |
| 15 | | Portland cement parts/volume: | (No. 16 divided by No. 28) x | x 0.78 | | | |
| 16 | | Natural cement parts/volume: | (No. 16 divided by No. 28) x | | | | |
| 17 | | Lime with cement parts/volume | | | | | |
| 18 | | 1 | | | | | |
| 19 | | | | | | | |
| 20 | Test No. $2 - S$ | and Sieve Analysis | | | | | |
| 21 | | - | | | | | |
| 22 | Sieve | Sieve w/ sand weight Sieve | weight Sand weight Sand ratio | | | | |
| 23 | No. 10 | 107.0 106.7 | 0.3 5,56 | | | | |
| 24 | No. 20 | 107.2 106.4 | 0.8 14.81 | | | | |
| 25 | No. 30 | 99.999.2 | 0.7 12.96 | | | | |
| 26 | No. 40 | 102.1 100.7 | 1.4 25.93 | | | | |
| 27 | No. 50 | 94.6 93.2 | 1.4 25.93 | | | | |
| 28 | Base | 72.0 71.2 | | | | | |
| 29 | | | | | | | |
| 30 | | | | | | | |
| 31 | | | | | | | |
| 32 | | Mortar/Plaster/S | tucco Analysis Test Sheet | | | | |
| 33 | | | - | | | | |
| 34 | | | | | | | |
| 35 | Sample No. | | | | | | |
| 36 | Building: | Lighthouse, Outer Islan | d, Apostle Islands NL | | | | |
| 37 | Location: | Brick mortar patch | | | | | |
| 38 | Sample Descr | iption: Brown, moderately hard | l, fast and bubbly reaction, slow filterin | ig time | | | |
| 39 | | | | | | | |
| 40 | | | | | | | |
| 41 | | | | | | | |
| 42 | Test No. $1 - S$ | soluble Fraction | | | | | |
| 43 | | | | | | | |
| 44 | Data: | | | | | | |
| 45 | 1. 188.9 | Container A weight | 8. <u>No</u> Hair or fiber <u></u> type | | | | |
| 46 | 2. <u>199.4</u> | Container A and sample | 9. <u>3.8</u> Fines and paper weight | | | | |
| 47 | 3. 763.02 | Barometric pressure | 10. <u>3.1</u> Filter paper weight | | | | |
| 48 | 4. 23 | Temperature | 11. 193.8 Sand and Container A weig | ght | | | |
| 49 | 5. 0.08 | Liters of water displaced | 12. <u>3.1</u> cc. of sand | | | | |
| 50 | 6. <u>Yellow-gre</u> | en Filtrate color | 13. 33.7 Weight of graduated cylinde | er and sand | | | |
| 51 | 7. <u>Tan</u> | Fines color | 14. 28.8 Weight of graduated cylinde | | | | |
| 52 | | | · – – – | | | | |
| | | | | | | | |

| 15. <u>10.5</u> | | le: No. 2 – No. 1 | | |
|--|--|---|---|---|
| 16. <u>0.7</u> | Weight of fines: No. 9 – No. 10 | | | |
| 17. <u>4.9</u> | Weight of sand: No. 11 | | | |
| 18632653 | Sand density: No. 12 div | | – No. 14) | |
| 19. <u>4.9</u> | Weight of soluble conten | • | | |
| 20. 0.0033 | Mols. Of CO2: No. 5 x 1 | | | + 273 16 C) |
| 21. 0.33 | Gram weight of CaCO3 | | | _////////////////////////////////////// |
| 22. 4.57 | Gram weight of Ca(OH) | | 21 | |
| 230618 | Mols. of Ca(OH)2: No. 22 divided by 74 | | | |
| 24. 4.81 | Gram total weight of Ca(OH)2: 74 x (No. 20 + No. 23) | | | |
| 25. 0.15 | _Gram weight CO2: No. 1 | 20 x 44 | | |
| 26. 2.86 | _Gram weight total possi | ble CO2: 44 x (N | No. 20 + No. 23) | |
| 27. 5.24 | _%CO2 gain: No. 25 divi | ded by No. 26 | | |
| | | | | |
| Conclusions: | | | | _ |
| 28. 10.35 | _Gram weight of sample: | | No. 15 – No. 2 | |
| 29. 6.76 | Fine parts/volume: | | No. 16 divided | 5 |
| 30. <u>29.95</u> | Sand parts/volume: | | | d by No. 28) x No. 18 |
| 31 | Lime parts/volume: | | (No. 24 divide | d by No. 28) x 1.1 |
| Cement (if pres | (ant) | | | |
| | Portland cement parts/vo | lume. | (No. 16 divide | d by No. 28) x 0.78 |
| | Natural cement parts/vol | | · | d by No. 28) x 0.86 |
| | Lime with cement parts/ | | | divided by No. 28 x 1.1 |
| | | | | |
| | 10: 11: | | | |
| Test No. 2 – Sa | nd Sieve Analysis | | | |
| Sieve | nd Sieve Analysis Sieve w/ sand weight | Sieve weight | Sand weight | Sand ratio |
| Sieve No. 10 | Sieve w/ sand weight 106.8 | 106.8 | 0.0 | 0 |
| Sieve No. 10 No. 20 | Sieve w/ sand weight <u>106.8</u> <u>106.7</u> | <u>106.8</u> <u>106.4</u> | 0.0 0.3 | 0 6.12 |
| Sieve No. 10 No. 20 No. 30 | Sieve w/ sand weight <u>106.8</u> <u>106.7</u> <u>99.7</u> | <u>106.8</u> <u>106.4</u> <u>99.3</u> | $\begin{array}{r} 0.0 \\ \hline 0.3 \\ \hline 0.4 \end{array}$ | 0 6.12 8.16 |
| Sieve No. 10 No. 20 No. 30 No. 40 | Sieve w/ sand weight <u>106.8</u> <u>106.7</u> <u>99.7</u> <u>101.9</u> | <u>106.8</u> <u>106.4</u> <u>99.3</u> <u>100.8</u> | | 0 6.12 8.16 22.45 |
| Sieve No. 10 No. 20 No. 30 No. 40 No. 50 | Sieve w/ sand weight <u>106.8</u> <u>106.7</u> <u>99.7</u> <u>101.9</u> <u>94.9</u> | <u>106.8</u> <u>106.4</u> <u>99.3</u> <u>100.8</u> <u>93.2</u> | $ \begin{array}{r} 0.0 \\ 0.3 \\ 0.4 \\ 1.1 \\ 1.7 \\ 1.7 \end{array} $ | $ \begin{array}{r} 0 \\ 6.12 \\ 8.16 \\ 22.45 \\ 34.69 \\ \end{array} $ |
| Sieve No. 10 No. 20 No. 30 No. 40 | Sieve w/ sand weight <u>106.8</u> <u>106.7</u> <u>99.7</u> <u>101.9</u> | <u>106.8</u> <u>106.4</u> <u>99.3</u> <u>100.8</u> | | 0 6.12 8.16 22.45 |
| Sieve No. 10 No. 20 No. 30 No. 40 No. 50 | Sieve w/ sand weight <u>106.8</u> <u>106.7</u> <u>99.7</u> <u>101.9</u> <u>94.9</u> | <u>106.8</u> <u>106.4</u> <u>99.3</u> <u>100.8</u> <u>93.2</u> | $ \begin{array}{r} 0.0 \\ 0.3 \\ 0.4 \\ 1.1 \\ 1.7 \\ 1.7 \end{array} $ | $ \begin{array}{r} 0 \\ 6.12 \\ 8.16 \\ 22.45 \\ 34.69 \\ \end{array} $ |
| Sieve No. 10 No. 20 No. 30 No. 40 No. 50 | Sieve w/ sand weight <u>106.8</u> <u>106.7</u> <u>99.7</u> <u>101.9</u> <u>94.9</u> <u>72.6</u> | <u>106.8</u> <u>106.4</u> <u>99.3</u> <u>100.8</u> <u>93.2</u> <u>71.2</u> | $ \begin{array}{r} 0.0 \\ 0.3 \\ 0.4 \\ 1.1 \\ 1.7 \\ 1.7 \end{array} $ | 0 6.12 8.16 22.45 34.69 28.57 |
| Sieve No. 10 No. 20 No. 30 No. 40 No. 50 | Sieve w/ sand weight <u>106.8</u> <u>106.7</u> <u>99.7</u> <u>101.9</u> <u>94.9</u> <u>72.6</u> | <u>106.8</u> <u>106.4</u> <u>99.3</u> <u>100.8</u> <u>93.2</u> <u>71.2</u> | $ \begin{array}{r} 0.0 \\ 0.3 \\ 0.4 \\ 1.1 \\ 1.7 \\ 1.4 \end{array} $ | 0 6.12 8.16 22.45 34.69 28.57 |
| Sieve No. 10 No. 20 No. 30 No. 40 No. 50 Base Sample No | Sieve w/ sand weight <u>106.8</u> <u>106.7</u> <u>99.7</u> <u>101.9</u> <u>94.9</u> <u>72.6</u> Mortar/P <u>27</u> | <u>106.8</u> <u>106.4</u> <u>99.3</u> <u>100.8</u> <u>93.2</u> <u>71.2</u> laster/Stucco A | 0.0 0.3 0.4 1.1 1.7 1.4 nalysis Test She | 0 6.12 8.16 22.45 34.69 28.57 |
| Sieve No. 10 No. 20 No. 30 No. 40 No. 50 Base Sample No Building: | Sieve w/ sand weight <u>106.8</u> <u>106.7</u> <u>99.7</u> <u>101.9</u> <u>94.9</u> <u>72.6</u> Mortar/P <u>27</u> Lighthouse, Our | <u>106.8</u> <u>106.4</u> <u>99.3</u> <u>100.8</u> <u>93.2</u> <u>71.2</u> laster/Stucco A | 0.0 0.3 0.4 1.1 1.7 1.4 nalysis Test She | 0 6.12 8.16 22.45 34.69 28.57 |
| Sieve No. 10 No. 20 No. 30 No. 40 No. 50 Base Sample No Building: Location: | Sieve w/ sand weight <u>106.8</u> <u>106.7</u> <u>99.7</u> <u>101.9</u> <u>94.9</u> <u>72.6</u> Mortar/P <u>27</u> <u>Lighthouse, Our</u> Brick mortar pa | <u>106.8</u> <u>106.4</u> <u>99.3</u> <u>100.8</u> <u>93.2</u> <u>71.2</u> laster/Stucco A ter Island, Apost | 0.0 0.3 0.4 1.1 1.7 1.4 nalysis Test She | 0 6.12 8.16 22.45 34.69 28.57 et |
| Sieve No. 10 No. 20 No. 30 No. 40 No. 50 Base Sample No Building: Location: | Sieve w/ sand weight <u>106.8</u> <u>106.7</u> <u>99.7</u> <u>101.9</u> <u>94.9</u> <u>72.6</u> Mortar/P <u>27</u> Lighthouse, Our | <u>106.8</u> <u>106.4</u> <u>99.3</u> <u>100.8</u> <u>93.2</u> <u>71.2</u> laster/Stucco A ter Island, Apost | 0.0 0.3 0.4 1.1 1.7 1.4 nalysis Test She | 0 6.12 8.16 22.45 34.69 28.57 et |
| Sieve No. 10 No. 20 No. 30 No. 40 No. 50 Base Sample No Building: Location: | Sieve w/ sand weight <u>106.8</u> <u>106.7</u> <u>99.7</u> <u>101.9</u> <u>94.9</u> <u>72.6</u> Mortar/P <u>27</u> <u>Lighthouse, Our</u> Brick mortar pa | <u>106.8</u> <u>106.4</u> <u>99.3</u> <u>100.8</u> <u>93.2</u> <u>71.2</u> laster/Stucco A ter Island, Apost | 0.0 0.3 0.4 1.1 1.7 1.4 nalysis Test She | 0 6.12 8.16 22.45 34.69 28.57 et |
| Sieve No. 10 No. 20 No. 30 No. 40 No. 50 Base Sample No Building: Location: | Sieve w/ sand weight <u>106.8</u> <u>106.7</u> <u>99.7</u> <u>101.9</u> <u>94.9</u> <u>72.6</u> Mortar/P <u>27</u> <u>Lighthouse, Our</u> Brick mortar pa | <u>106.8</u> <u>106.4</u> <u>99.3</u> <u>100.8</u> <u>93.2</u> <u>71.2</u> laster/Stucco A ter Island, Apost | 0.0 0.3 0.4 1.1 1.7 1.4 nalysis Test She | 0 6.12 8.16 22.45 34.69 28.57 et |
| Sieve No. 10 No. 20 No. 30 No. 40 No. 50 Base Sample No Building: Location: | Sieve w/ sand weight <u>106.8</u> <u>106.7</u> <u>99.7</u> <u>101.9</u> <u>94.9</u> <u>72.6</u> Mortar/P <u>27</u> <u>Lighthouse, Our</u> <u>Brick mortar pa</u> ption: <u>Gray, soft, fast a</u> | <u>106.8</u> <u>106.4</u> <u>99.3</u> <u>100.8</u> <u>93.2</u> <u>71.2</u> laster/Stucco A ter Island, Apost | 0.0 0.3 0.4 1.1 1.7 1.4 nalysis Test She | 0 6.12 8.16 22.45 34.69 28.57 et |

| 1 2 3 4 5 6 7 | 1. <u>185.1</u> 2. <u>203.1</u> 3. <u>763.02</u> 4. <u>23</u> 5. <u>0.12</u> 6. <u>Yellow-gree</u> 7. <u>Off-white</u> | Container A and sample Barometric pressure Temperature Liters of water displaced | 9. <u>3.7</u> 10. <u>3.1</u> 11. <u>199</u> 12. <u>8.4</u> 13. <u>42</u> . | Hair or fiber Fines and pap Filter paper v OSand and Cont cc. of sand Weight of grad | ber weight weight tainer A weight duated cylinder and sand |
|---------------------------------|--|---|--|---|---|
| 8 | | | | | |
| 9 10 | Computations: 15. 18.0 | Starting weight of somple: | No 2 No 1 | | |
| 10 | 13. <u>18.0</u> 16. <u>0.6</u> | Starting weight of sample: Weight of fines: No. 9 – N | | | |
| 12 | 10. <u>0.0</u> 17. <u>13.9</u> | Weight of sand: No. $11 - 1$ | | | |
| 13 | 186043 | Sand density: No. 12 divid | | - No. 14) | |
| 14 | 19. 3.5 | Weight of soluble content: | | | |
| 15 | | Mols. Of CO2: No. 5 x No | | | - 273.16 C.) |
| 16 | 21. 049 | _Gram weight of CaCO3: 1 | | | |
| 17 | 22. 3.01 | _Gram weight of Ca(OH)2: | | 21 | |
| 18 | 230406 | _Mols. of Ca(OH)2: No. 22 | - | | |
| 19 | 24. 3.37 | _Gram total weight of Ca(O | | 20 + No. 23) | |
| 20 | 25. 0.22 | Gram weight CO2: No. 20 | | $-20 + N_{-}22$ | |
| 21 22 | 26. <u>2.00</u> 27. <u>11</u> | Gram weight total possible %CO2 gain: No. 25 divide | | $0.20 \pm N0.23)$ | |
| 22 | 27. 11 | | a by No. 20 | | |
| 24 | Conclusions: | | | | |
| 25 | 28. 17.78 | Gram weight of sample: | | No. 15 – No. 2 | 5 |
| 26 | 29. 3.37 | Fine parts/volume: | | No. 16 divided | |
| 27 | 30. 47.24 | Sand parts/volume: | | | l by No. 28) x No. 18 |
| 28 | | Lime parts/volume: | | | l by No. 28) x 1.1 |
| 29 | | - | | | |
| 30 | Cement (if pres | | | | |
| 31 | | Portland cement parts/volu | | | l by No. 28) x 0.78 |
| 32 | | _Natural cement parts/volur | | | l by No. 28) x 0.86 |
| 33 | 34 | Lime with cement parts/vo | olume: | (No. 16 x o.2) | divided by No. 28 x 1.1 |
| 34 | | | | | |
| 35 36 | Test No. 2 Se | nd Sieve Analysis | | | |
| 30 37 | Test $100.2 - 5a$ | ind Sieve Analysis | | | |
| 38 | Sieve | Sieve w/ sand weight S | Sieve weight | Sand weight | Sand ratio |
| 39 | No. 10 | <u>106.8</u> | <u>106.8</u> | | 0 |
| 40 | No. 20 | 106.6 | 106.4 | 0.2 | 1.44 |
| 41 | No. 30 | 101.4 | 99.3 | 2.1 | 15.11 |
| 42 | No. 40 | 108.7 | 100.7 | 8.0 | 57.55 |
| 43 | No. 50 | 95.9 | 93.2 | 2.7 | 19.42 |
| 44 | Base | 72.1 | 71.2 | 0.9 | 6.47 |
| 45 | | | | | |
| 46 | | | | | |
| 47 | | | | | |
| 48 | | | | | |

| | Mortar/. | Plaster/Stucco A | analysis Test She | eet |
|--------------------------|---|---------------------|---|--------------------------|
| Sample No. | 28 | | | |
| Building: | | uter, Island, Apos | stle Islands NL | |
| Location: | Brick mortar | | | |
| Sample Descript | ion: Tan, moderate | ly soft, fast and f | oamy reaction, sl | ow filtering time |
| | | | | |
| Test No. 1 – Solu | uble Fraction | | | |
| | | | | |
| Data: 1. <u>187.8</u> | Container A weight | 8. N | <u>o</u> Hair or fiber | - type |
| | Container A and sampl | | 1 Fines and pa | |
| | Barometric pressure | | 0 Filter paper | |
| | Temperature | | 5.6 Sand and Co | |
| 5. 0.03 | Liters of water displace | ed 12. | 5.9 cc. of sand | C C |
| 6. Yellow-green | Filtrate color | 13. <u>3</u> | 6.5 Weight of gra | aduated cylinder and sar |
| | Fines color | 14. 2 | 8.7 Weight of gra | aduated cylinder |
| Computations: | | | | |
| | Starting weight of sam | ple: No. 2 – No. 1 | | |
| | Weight of fines: No. 9 | | - | |
| | | | | |
| | Sand density: No. 12 div | | – No. 14) | |
| 19. 4.0 | Weight of soluble cont | ent: No. 15 – (No | . 16 + No. 17) | |
| 20. 0.0012366 | Mols. Of CO2: No. 5 x | No. 3. x 0.016 d | ivided by (No. 4 · | + 273.16 C.) |
| | Gram weight of CaCO | | | |
| | Gram weight of Ca(OH | | | |
| | Mols. of Ca(OH)2: No | | | |
| | Gram total weight of C | | 5.20 + No.23) | |
| | Gram weight CO2: No | | $\mathbf{x}_{1} = \mathbf{x}_{1} + \mathbf{x}_{2} = \mathbf{x}_{2}$ | |
| | Gram weight total poss %CO2 gain: No. 25 div | | NO. 20 + NO. 23) | |
| 27. 2.12 | /0002 gaill. No. 25 un | vided by No. 20 | | |
| Conclusions: | | | | |
| 28. 13.86 | Gram weight of sample | e: | No. 15 – No. 2 | 25 |
| | Fine parts/volume: | | No. 16 divided | d by No. 28 |
| | Sand parts/volume: | | · · | ed by No. 28) x No. 18 |
| 31 | Lime parts/volume: | | (No. 24 divide | ed by No. 28) x 1.1 |
| Cement (if prese | , | | | |
| | Portland cement parts/v | | | ed by No. 28) x 0.78 |
| | Natural cement parts/ve | | | ed by No. 28) x 0.86 |
| 34 | Lime with cement parts | s/volume: | (No. 16 x o.2) | divided by No. 28 x 1.1 |
| Test No. 2 – San | d Sieve Analysis | | | |
| Sieve | Sieve w/ sand weight | Sieve weight | Sand weight | Sand ratio |
| NIEVE | | | | |

| 4 | 1. | D | D 1 · | | |
|-------|-----|----|--------------|------|------|
| Appen | dıx | D: | Fabric | Anal | VSIS |

| 1 2 3 4 5 6 7 8 | No. 20 No. 30 No. 40 No. 50 Base | <u>107.4</u> <u>100.3</u> <u>102.9</u> <u>95.3</u> <u>72.6</u> | <u>106.4</u> <u>99.3</u> <u>100.7</u> <u>93.2</u> 71.2 | 1.0 1.0 2.1 2.1 1.4 | 12.99 12.99 27.27 27.27 18.18 |
|--------------------------------------|--|--|--|---------------------------------|---|
| 9 | | | Lighthouse | | |
| 10 | | Sampl | | N | /Iunsell |
| 11 | | White | | Ν | V 9.5/ |
| 12 | | White | | N | V 9.5/ |
| 13 | | | | | |
| 14 | | paint layers and | was from the lighthou | se exter | rior trim. It retained only a pair of |
| 15 | stark white paint layers. | | | | |
| 16 | | | | | |
| 17 | | | | | |
| 18 | | G 1 | Lighthouse | | M |
| 19 20 | | Sampl Off-wl | | | Junsell |
| 20 | | Cream | | | N 8.5/ .5Y 8/3 |
| $\frac{21}{22}$ | | White | | | J 9.5/ |
| $\frac{22}{23}$ | | Tan | | | .5Y 7/5 |
| 24 | | Tan | | | .5Y 7/5 |
| 25 | | Tan | | | .5Y 7/5 |
| 26 | | Tan | | | .5Y 7/4 |
| 27 | | Tan | | | .5Y 7/4 |
| 28 | | Tan | | 2 | .5Y 7/4 |
| 29 | | Tan | | 2 | .5Y 7/5 |
| 30 | | Light l | brown | 1 | 0YR 6/4 |
| 31 | | Cream | | | .5Y 8/2 |
| 32 | | Cream | | 2 | .5Y 8/2 |
| 33 | | | | | |
| 34 | | | | | -colored paint layers represented a |
| 35 | | color. However | , the oldest cream laye | ers were | e lighter and grayer than the tan |
| 36 37 | layers. | | | | |
| 38 | | | | | |
| 39 | | | Lighthouse | | |
| 40 | | Sampl | | N | /Iunsell |
| 41 | | Yellov | | | .5Y 8/8 |
| 42 | | White | · | | V 9.5/ |
| 43 | | White | | | V 9.5/ |
| 44 | | Light l | orown | | 0YR 7.5/5 |
| 45 | | Blue-g | | | G 8/1 |
| 46 | | Blue-g | | 5 | G 8/1 |
| 47 | | Gray | | 5Y 6 | /1 |
| 48 | | • | ark brown | | .5Y 3/2 |
| 49 | | Gray | | 5Y 6 | |
| 50 | | Gray | | 5Y 7 | |
| 51 | | • | ark green | | G 3/4 |
| 52 | | Gray | | 5Y 7 | /1 |

| 1 | WI | nitewash | N 9.5/ | | |
|---|---|--------------------------------|--|--|--|
| 1 2 3 4 5 6 7 8 9 | Sample 31 commenced the second set of samples from the Outer Island Light Complex. Analysis of this set commenced on Monday, October 27, 2009. Sample 31 was collected from the kitchen of the lighthouse. It was in excellent condition. Beneath a set of a dozen paint layers was a relatively thick set of ill-defined whitewash layers. | | | | |
| 8 | | | | | |
| 9 10 | Sa | Lighthouse mple 32 | Munsell | | |
| 11 | Gr | | 5G 6.5/3 | | |
| 12 | | rk brown | .5YR 4/4 | | |
| 13 | WI | | 5Y 9/1 | | |
| 14 | | stel blue-green | 5BG 9/1 | | |
| 15 | Pea | | 10YR 8/5 | | |
| 16 | | | | | |
| 17 | | | e was a complete cleavage between the | | |
| 18 | | | s firmly adhered to its paper substrate. | | |
| 19 | | | with the pastel blue-green layer or that a | | |
| 20 | thin film of dirt had built up over tim | e resulting in the weak adhesi | on between the layers | | |
| 21 | | | | | |
| 22 | | | | | |
| 23 | G | Lighthouse | Marra | | |
| 24 25 | | mple 33 nite | Munsell 5Y 9/1 | | |
| 23 26 | | nite | 51 9/1 5Y 9/1 | | |
| 27 | | nite | 5Y 9/1 | | |
| $\frac{27}{28}$ | | nite | 5Y 9/1 | | |
| 29 | | nite | 5Y 9/1 | | |
| $\frac{2}{30}$ | | nite | 5Y 9/1 | | |
| 31 | | nite | 5Y 9/1 | | |
| 32 | | nite | 5Y 9/1 | | |
| 33 | | nite | 5Y 9/1 | | |
| 34 | | nite | 5Y 9/1 | | |
| 35 | WI | nite | 5Y 9/1 | | |
| 36 | Gra | ау | 5Y 6/1 | | |
| 37 | Bla | ick | N 1.5/ | | |
| 38 | Da | rk gray | 5Y 4/1 | | |
| 39 | Gra | ау | N 6.75/ | | |
| 40 | Gra | - | 5Y 5/1 | | |
| 41 | Gra | - | 5Y 6/1 | | |
| 42 | Gra | - | 5Y 5/1 | | |
| 43 | Gr | - | 5Y 6/1 | | |
| 44 | Gra | | 5Y 5/1 | | |
| 45 | | am | 2.5Y 8/2 | | |
| 46 | | rk brown | 7.5YR 4/2 | | |
| 47 | Gra | ay 5 | Y 7/1 | | |
| 48 49 | Sample 33 was removed from the int | | | | |

49 Sample 33 was removed from the interior door trim of the lighthouse. Its quality was quite excellent with

50 clearly observable paint layers. Despite a very lengthy history of white paint the older layers were primarily 51 gray with a few exceptions. The oldest layer was gray.

| 1 | | | |
|------------------|--|---------------------------------|--|
| 2 3 4 5 | | Lighthouse | |
| 3 | | ple 34 | Munsell |
| 4 | | el blue-green | 5BG 9/1 |
| 5 | | tewash | N 9.5/ |
| 6 | | nt blue-green | 5BG 8/1 |
| 7 | Peac | ch | 7.5YR 7/4 |
| 8 9 | Peac | ch | 7.5YR 7/4 |
| 9 | Peac | ch | 7.5YR 7/4 |
| 10 | Blue | e-green | 5BG 8/1 |
| 11 | Blue | e-green | 5BG 7.5/1 |
| 12 | Blue | e-green | 5BG 8/1 |
| 13 | Bro | wn | 7.5YR 5.5/4 |
| 14 | Blue | e-green | 5BG 6/1 |
| 15 | Blue | e-green | 5BG 6/1 |
| 16 | Blue | e-green | 5BG 7/2 |
| 17 | Whi | te | 5Y 9/1 |
| 18 | | | |
| 19 | Sample 34 was from the wall of bedro | om 1 in the lighthouse. Its qua | ality was excellent, revealing a large |
| 20 | | | probably served as a prime coat for an |
| 21 | original finish coat of blue-green paint | | |
| 22 | | | |
| 23 | | | |
| 24 | | Lighthouse | |
| 25 | San | ple 35 | Munsell |
| 26 | Whi | | 5Y 9/1 |
| 27 | Bro | wn | 7.5YR 4/4 |
| 28 | Bro | wn | 7.5YR 5/4 |
| 29 | Blue | e-green | 5BG 5/2 |
| 30 | Blue | e-green | 5BG 5/2 |
| 31 | Blue | e-green | 5BG 5/2 |
| 32 | Whi | te | N 9.5/ |
| 33 | | | |
| 34 | Sample 35 was found on the wall of be | edroom 1 of the lighthouse. Its | s paint layers were extremely thin and |
| 35 | evenly applied. The oldest white layer | | |
| 36 | original finish layer of blue-green. | | |
| 37 | | | |
| 38 | | | |
| 39 | | Lighthouse | |
| 40 | San | ple 36 | Munsell |
| 41 | Whi | te | N 9.5/ |
| 42 | Whi | tewash | N 9.5/ |
| 43 | Tan | | 10YR 8/4 |
| 44 | Blue | e-green | 5BG 5/2 |
| 45 | Peac | ch | 10YR 8/5 |
| 46 | Whi | te | 5Y 9/1 |
| 47 | Ros | | 10R 7/5 |
| 48 | Tan | | 10YR 8/4 |
| 49 | Blue | e-green | 5BG 6/2 |
| 50 | Blue | e-green | 5BG 6/2 |
| 51 | Gra | Į. | 5Y 6.5/1 |
| 52 | | | |
| | | | |

Sample 36 was collected from the wall of bedroom 2 of the lighthouse. Its analysis revealed a set of paint layers beneath a relatively thick layering of whitewash with a white paint layer on their surface. The oldest surviving paint layer was gray which may have served as a prime coat for a finish layer of blue-green.

| 5 | | |
|-----------------------------|---|---|
| 6 | Light | house |
| 7 | Sample 37 | Munsell |
| 8 | Light yellow | 5Y 8.5/4 |
| 5 6 7 8 9 10 | Light rose | 5YR 8/4 |
| | | |
| 11 | Sample 37 was collected from the wall of the first floo | or hallway of the lighthouse. It retained only two |
| 12 | layers of paint on its paper substrate. | |
| 13 | | |
| 14 | | |
| 15 | Light | |
| 16 | Sample 38 | Munsell |
| 17 | White | 5Y 9/1 |
| 18 | Warm gray | 5Y 8/2 |
| 19 | Light yellow | 5Y 8.5/4 |
| 20 | Light green | 2.5G 7/2 |
| 21 | Green | 2.5G 5/4 |
| 22 | | |
| 23 | Sample 38 came from the first floor main stair of the l | ighthouse. It revealed five paint layers on its paper |
| 24 | substrate. | |
| 25 | | |
| 26 | | |
| 27 | Light | |
| 28 | Sample 39 | Munsell |
| 29 | White | 5Y 9/1 |
| 30 | White | 5Y 9/1 |
| 31 | White | 5Y 9/1 |
| 32 | Tan | 10YR 7/4 |
| 33 | Tan | 10YR 7/4 |
| 34 | Tan | 10YR 7/4 |
| 35 | | |
| 36 | Sample 39 was removed from the wall of the first floo | |
| 37 | tan layer was a translucent (roughly off-white - 5Y 8.5 | |
| 38 | probably used for wallpaper. The layers were quite thi | n and no substrate remained. |
| 39 | | |
| 40 | | |
| 41 | Light | |
| 42 | Sample 40 | Munsell |
| 43 | White | 5Y 9/1 |
| 44 | Tan | 10YR 8/4 |
| 45 | Tan | 10YR 8/3 |
| 46 | Tan | 10YR 8/3 |
| 47 | Tan | 10YR 8/3 |
| 48 | Gray | 5Y 7/1 |
| 49 | Light blue-green | 5BG 8/2 |
| 50 | Light blue-green | 5BG 8/2 |
| 51 | Rose | 10R 6/4 |
| 52 | Rose | 10R 6/2 |

| 1 2 3 4 5 6 7 8 | Light ros | | 10R 7/2 |
|--------------------------------------|--|--|---|
| 2 | Light blu | ie-green | 5BG 8/1 |
| 3 | Light blu | le-green | 5BG 8/1 |
| 4 | Light blu | 6 | 5BG 8/1 |
| 5 | Dark gra | | 5Y 4/1 |
| 5 | e | 5 | |
| 6 | Blue-gre | | 5BG 5/4 |
| 7 | Blue-gre | en | 5BG 5/4 |
| 8 | | | |
| 9 | Sample 40 was from the wall of the hall of | the lighthouse. It was ex | cellent in quality, revealing a large |
| 10 | array of paint layers with blue-green being | | |
| 11 | and y of paint layers with orde green being | the oldest observed colo | i on the pluster substrate. |
| 12 | | | |
| | | | |
| 13 | | Lighthouse | |
| 14 | Sample | 41 | Munsell |
| 15 | Dark gra | V | N 4.0/ |
| 16 | Gray | 5 | N 5.0/ |
| 17 | | X 7 | N 4.0/ |
| | Dark gra | Lý | |
| 18 | Gray | | N 5.0/ |
| 19 | Dark gra | y | N 4.0/ |
| 20 | Dark gra | l y | N 4.0/ |
| 21 | Dark gra | | N 4.0/ |
| 22 | Whitewa | | N 9.5/ |
| $\frac{22}{23}$ | W linte we | 1511 | 11 9.07 |
| | | | |
| 24 | Sample 41 was collected from the entry sta | | eath a set of dark gray and gray paint |
| 25 | layers was a relatively thick set of ill-defin | ed whitewash layers. | |
| 26 | | | |
| 27 | | | |
| 28 | | Lighthouse | |
| 29 | Sample | 0 | Munsell |
| $\frac{29}{30}$ | | 74 | |
| | Red | | 5R 4/14 |
| 31 | Cream | | 2.5Y 8.5/3 |
| 32 | Cream | | 2.5Y 8.5/3 |
| 33 | Cream | | 2.5Y 8.5/3 |
| 34 | Cream | | 2.5Y 8.5/3 |
| 35 | Citalii | | 2.01 0.075 |
| 36 | | h | - Determine establishes and surface large |
| | Sample 42 was collected from the wall of t | | U I |
| 37 | of paint and the wood substrate were four l | ayers of cream-colored p | baint. |
| 38 | | | |
| 39 | | | |
| 40 | | Lighthouse | |
| 41 | Sample | | Munsell |
| | A | 43 | |
| 42 | Black | | N 0.5/ |
| 43 | White | | 5Y 9/1 |
| 44 | Off-whit | e | 5Y 8.5/1 |
| 45 | | | |
| | | | |
| 46 | Sample 43 came from the window trim of | the lighthouse tower. The | ere were but three paint layers on the |
| 46 47 | Sample 43 came from the window trim of | | |
| 47 | wood substrate of white the oldest off-white | | |
| 47 48 | | | |
| 47 48 49 | wood substrate of white the oldest off-white | | |
| 47 48 49 50 | wood substrate of white the oldest off-white | | |
| 47 48 49 50 | wood substrate of white the oldest off-white | e layer was extraordinar | |
| 47 48 49 50 51 | wood substrate of white the oldest off-whit coat for the white layer. | e layer was extraordinar Lighthouse | ily thin and probably served as a prime |
| 47 48 49 50 | wood substrate of white the oldest off-white | e layer was extraordinar Lighthouse | |
| 47 48 49 50 51 | wood substrate of white the oldest off-whit coat for the white layer. | e layer was extraordinar Lighthouse | ily thin and probably served as a prime |

| 1 | Brown | 2.5YR 4/6 |
|----------------------------|---|--|
| 2 | Gray | N 6.0/ |
| 3 | Black | N 0.5/ |
| 1 2 3 4 5 6 | Gray | N 6.0/ |
| т 5 | White | 5Y 9/1 |
| 5 | | |
| 07 | Gray | 5Y 6/1 |
| 7 | Dark gray | N 4.0/ |
| 8 | Gray | 5Y 5/1 |
| 9 | Dark gray | N 4.5/ |
| 10 | Gray | N 5.5/ |
| 11 | Light gray | N 7.5/ |
| 12 | Gray | N 5.5/ |
| 13 | Dark gray | N 4.5/ |
| 14 | Dark gray | N 4.5/ |
| 15 | ••• | N 5.5/ |
| | Gray | |
| 16 | Dark gray | N 4.5/ |
| 17 | Black, glossy v | arnish |
| 18 | | |
| 19 | | the lighthouse. It proved to be particularly challenging, |
| 20 | although it did reveal a large number of finish lay | ers on its wood substrate. The oldest layer was a very |
| 21 | glossy, very dark varnish. | |
| 22 | | |
| 23 | | |
| 24 | Sample 45 was from the hall plaster of the lighthe | buse. It was warm gray in color and was very soft. It gave |
| 25 | | and sand with an approximate ratio of one part of lime to |
| 26 | | alysis revealed very fine sand. 22 ½% passed all of the |
| 20 | | |
| 27 | sieves whereas only 1% was trapped in the larges | t sieve. Moreover 46 1/2% was trapped in the finest sieve. |
| 28 | | |
| 29 | | |
| 30 | | |
| 31 | Mortar/Plaster/S | tucco Analysis Test Sheet |
| 32 | | - |
| 33 | | |
| 34 | Sample No 45 | |
| 35 | 1 | d, Apostle Islands NL |
| 36 | | d, Apostic Islands INL |
| | | |
| 37 | Sample Description: warm gray, very sort, is | ast and fizzy reaction, extremely slow filtering time |
| 38 | | |
| 39 | | |
| 40 | | |
| 41 | Test No. 1 – Soluble Fraction | |
| 42 | | |
| 43 | Data: | |
| 44 | 1. <u>187.5</u> Container A weight | 8. <u>No</u> Hair or fibertype |
| 45 | 2. 212.1 Container A and sample | 9. <u>3.4</u> Fines and paper weight |
| | | |
| 46 | 3. <u>763.02</u> Barometric pressure | 10. <u>3.0</u> Filter paper weight |
| 47 | 4. <u>23</u> Temperature | 11. 207.8 Sand and Container A weight |
| 48 | 5. <u>0.25</u> Liters of water displaced | 12. <u>12.2</u> cc. of sand |
| 49 | 6. <u>Off-white</u> Filtrate color | 13. 49.1 Weight of graduated cylinder and sand |
| 50 | 7. <u>Warm gray</u> Fines color | 14. <u>28.8</u> Weight of graduated cylinder |
| 51 | | |
| 52 | Computations: | |
| <u> </u> | - comparations. | |

| 1 15. 24.6 Starting weight of sample: No. 2 – No. 1 2 16. 0.4 Weight of fances: No. 9 – No. 10 3 17. 20.3 Weight of samk: No. 11 – No. 1 4 18. 60 Sand density: No. 12 divided by (No. 13 – No. 14) 5 19. 3.9 Weight of Soluble content: No. 15 – (No. 16 + No. 17) 6 20.00103 Mols. Of CO2: No. 5 × No. 3. xolo16 divided by (No. 4 + 273.16 C.) 7 21. 10.3 Gram weight of Ca(OH)2: No. 19 – No. 21 9 23.00387763 Mols. of Ca(OH)2: No. 19 – No. 21 24. 3.63 Gram weight tot Ca(OH)2: No. 19 – No. 23) 25. 0.45 Gram weight tot Ca(OH)2: No. 19 – No. 23 27. 20.83 %CO2 gain: No. 25 divided by No. 26 14 12 26. Cinclusions: 16. Stand parts/volume: No. 16 divided by No. 28) × No. 18 30. 50.43 Sand parts/volume: (No. 16 divided by No. 28) × No. 18 31. 16.53 Lime parts/volume: (No. 16 divided by No. 28) × 0.78 23. Portland cement parts/volume: (No. 16 divided by No. 28) × 0.78 | | | | | | Appendix D: Fabric |
|---|---------------|-------------------|--------------------------------|----------------|-------------------|-------------------------|
| $ \begin{array}{ccccccccccccccccccccccccccccccccccc$ | 1 | 15 24 (| | 1. N. 2. N. 1 | | |
| $ \begin{array}{c c c c c c c c c c c c c c c c c c c $ | | | | | | |
| $ \begin{array}{c c c c c c c c c c c c c c c c c c c $ | $\frac{2}{2}$ | | ē | | | |
| | | | | | NL 14) | |
| | 4 | | | | | |
| 7 21 103 Gram weight of CaC03: 100 x No. 20 8 22 2.87 Gram weight of CaC03: 100 x No. 20 9 22 2.87 Gram weight of CaC03: No. 22 divided by 74 10 24 3.63 Gram total weight of Ca(OH)2: No. 22 divided by 74 10 24 3.63 Gram weight of CaC03: No. 20 x 44 26 2.16 Gram weight of Sample: No. 15 - No. 25 13 27 20.83 %CO2 gain: No. 25 divided by No. 26 14 166 Fine parts/volume: No. 16 divided by No. 28 16 Pine parts/volume: No. 16 divided by No. 28 x No. 18 17 29 1.66 Fine parts/volume: (No. 16 divided by No. 28) x No. 18 18 30 50.43 Sand parts/volume: (No. 16 divided by No. 28) x 0.78 21 Cement (if present) 22 Portland cement parts/volume: (No. 16 divided by No. 28) x 0.78 23 Matural cement parts/volume: (No. 16 divided by No. 28) x 0.78 33 24 34 Lime with cement parts/volume: (No. 16 divided by No. 28) x 0.78 27 Test No. 2 - Sand Sieve Analysis | 2 | | | | | 050 1 (C) |
| 8 22. 2.2.87 Gram weight of Ca(OH)2: No. 19 – No. 21 9 23. 0.0387763 Mols. of Ca(OH)2: No. 22 divided by 74 11 25. 0.45 Gram weight of Ca(OH)2: 74 x (No. 20 + No. 23) 12 26. 2.16 Gram weight of Ca(OH)2: 74 x (No. 20 + No. 23) 13 25. 0.45 Gram weight of Ca(OH)2: 74 x (No. 20 + No. 23) 14 26. 2.16 Gram weight of Sample: No. 15 – No. 25 15 Conclusions: 6 No. 15 – No. 25 No. 16 divided by No. 28 x No. 18 16 29. 1.66 Fine parts/volume: No. 16 divided by No. 28 x No. 18 17 29. 1.66 Fine parts/volume: (No. 17 divided by No. 28) x No. 18 17 30. 50.43 Sand parts/volume: (No. 16 divided by No. 28) x 0.78 18 30. 50.43 Sand ratis/volume: (No. 16 divided by No. 28) x 0.78 23 Portland cement parts/volume: (No. 16 divided by No. 28) x 0.78 33 24 Lime with cement parts/volume: (No. 16 divided by No. 28) x 0.84 1.1 26 | | | | | vided by (No. 4 + | - 273.16 C.) |
| 9 23. 00387763 Mols. of Ca(OH)2: No. 22 divided by 74 10 24. 3.63 Gram total weight of Ca(OH)2: 74 x (No. 20 + No. 23) 12 25. 0.45 Gram weight CO2: No. 20 x 44 12 26. 2.16 Gram weight total possible CO2: 44 x (No. 20 + No. 23) 13 27. 20.83 %CO2 gain: No. 25 divided by No. 26 14 Conclusions: 15 Conclusions: 16 28. 24.15 Gram weight of sample: No. 15 - No. 25 17 29. 1.66 Fine parts/volume: No. 16 divided by No. 28 x No. 18 30 50.43 Sand parts/volume: (No. 17 divided by No. 28) x No. 18 31 16.53 Lime parts/volume: (No. 16 divided by No. 28) x No. 18 10 Cement (if present) 11 Cement (if present) 12 22. Portland cement parts/volume: (No. 16 divided by No. 28) x 0.78 13 33. Natural cement parts/volume: (No. 16 divided by No. 28) x 0.86 14 34. Lime with cement parts/volume: (No. 16 divided by No. 28 x 1.1 15 Test No. 2 - Sand Sieve Analysis 16 107.0 106.8 0.2 1.0 17 No. 30 100.6 10.3.9 19.5 18 No. 30 1002.5 93.2 9.3 | | | | | • / | |
| 10 24. 3.63 Gram total weight of Ca(OH)2: 74 x (No. 20 + No. 23) 25. 0.45 Gram weight CO2: No. 20 x 44 26. 2.16 Gram weight total possible CO2: 44 x (No. 20 + No. 23) 27. 20.83 %CO2 gain: No. 25 divided by No. 26 Conclusions: 16 28. 24.15 Gram weight of sample: No. 15 - No. 25 17 29. 1.66 Fine parts/volume: No. 16 divided by No. 28 18 30. 50.43 Sand parts/volume: (No. 17 divided by No. 28) x No. 18 19 31. 16.53 Lime parts/volume: (No. 16 divided by No. 28) x No. 18 10 22. Portland cement parts/volume: (No. 16 divided by No. 28) x 0.78 23 33. Natural cement parts/volume: (No. 16 divided by No. 28) x 0.78 24 34. Lime with cement parts/volume: (No. 16 divided by No. 28 x 1.1 Cement (if present) 25 Sieve Sieve wisand weight Sieve weight Sand weight Sand ratio 26 No. 10 107.0 27 Test No. 2 - Sand Sieve Analysis Sand weight Association A | | | | | | |
| 11 25. 0.45 Gram weight CO2: No. 20 x 44 26. 2.16 Gram weight total possible CO2: 44 x (No. 20 + No. 23) 27. 20.83 %CO2 gain: No. 25 divided by No. 26 14 Conclusions: No. 15 – No. 25 15. Conclusions: No. 16 divided by No. 28 16. Fine parts/volume: No. 16 divided by No. 28 x No. 18 19. $30.$ 50.43 Sand parts/volume: (No. 17 divided by No. 28) x No. 18 10. 16.53 Lime parts/volume: (No. 16 divided by No. 28) x No. 18 10. 16.53 Lime parts/volume: (No. 16 divided by No. 28) x 0.78 23. | | | | | | |
| 12 26. 2.16 Gram weight total possible CO2: 44 x (No. 20 + No. 23) 13 27. 20.83 %CO2 gain: No. 25 divided by No. 26 14 Conclusions: No. 15 - No. 25 15 Conclusions: No. 16 divided by No. 28 16 28. 24.15 Gram weight of sample: No. 16 divided by No. 28 17 29. 1.66 Fine parts/volume: No. 16 divided by No. 28) x No. 18 18 30. 50.43 Sand parts/volume: (No. 17 divided by No. 28) x No. 18 19 31. 16.53 Lime parts/volume: (No. 16 divided by No. 28) x 0.78 20 22. Portland cement parts/volume: (No. 16 divided by No. 28) x 0.78 21 22. Portland cement parts/volume: (No. 16 divided by No. 28) x 0.78 23 33. Natural cement parts/volume: (No. 16 x o.2) divided by No. 28 x 1.1 26 Test No. 2 - Sand Sieve Analysis Sand weight Sand ratio 31 No. 20 107.2 106.4 0.8 4.0 21 No. 30 100.6 99.3 1.3 6.5 33 No. 40 102.5 93.2 9.3 46.5 < | | | | | 20 + No. 23 | |
| 13 27. 20.83 %CO2 gain: No. 25 divided by No. 26 14 Conclusions: No. 15 - No. 25 16 28. 24.15 Gram weight of sample: No. 16 divided by No. 28 17 29. 1.66 Fine parts/volume: No. 16 divided by No. 28 18 30. 50.43 Sand parts/volume: (No. 17 divided by No. 28) x No. 18 19 31. 16.53 Line parts/volume: (No. 16 divided by No. 28) x 1.1 10 Cement (if present) (No. 16 divided by No. 28) x 0.78 23 | | | | | | |
| 14 Image: Conclusions: 15 Conclusions: 15 Conclusions: 16 28, 24,15 Gram weight of sample: No. 15 – No. 25 17 29, 1.66 Fine parts/volume: No. 16 divided by No. 28 18 30, 50,43 Sand parts/volume: (No. 17 divided by No. 28) x No. 18 19 31. I.65.3 Lime parts/volume: (No. 24 divided by No. 28) x 0.78 20 22 Portland cement parts/volume: (No. 16 divided by No. 28) x 0.78 23. Portland cement parts/volume: (No. 16 divided by No. 28) x 0.78 24 34 Lime with cement parts/volume: (No. 16 divided by No. 28) x 0.78 27 Test No. 2 – Sand Sieve Analysis Sand weight Sand ratio 28 Sieve Sieve w/sand weight Sieve weight Sand ratio 30 No. 10 107.0 106.8 0.2 1.0 31 No. 20 107.2 106.4 0.8 4.0 31 No. 30 100.6 99.3 1.3 6.5 33 No. 40 104.7 100.8 3.9 19.5< | | | | | 10.20 + No.23 | |
| 15 Conclusions: No. 15 - No. 25 16 28 24.15 Gram weight of sample: No. 16 divided by No. 28 18 30 50.43 Sand parts/volume: (No. 17 divided by No. 28) x No. 18 18 31 16.53 Lime parts/volume: (No. 24 divided by No. 28) x No. 18 19 31 16.53 Lime parts/volume: (No. 16 divided by No. 28) x 0.78 23 33 | | 27. 20.83 | $_{\rm CO2}$ gain: No. 25 divi | ided by No. 26 | | |
| 16 $28. 24.15$ Gram weight of sample: No. 15 - No. 25 7 $29. 1.66$ Fine parts/volume: No. 16 divided by No. 28 17 50.43 Sand parts/volume: (No. 17 divided by No. 28) x No. 18 18 $30. 50.43$ Sand parts/volume: (No. 17 divided by No. 28) x No. 18 19 $31. 16.53$ Lime parts/volume: (No. 16 divided by No. 28) x No. 18 19 $31. 16.53$ Lime parts/volume: (No. 16 divided by No. 28) x 0.78 23 Portland cement parts/volume: (No. 16 divided by No. 28) x 0.78 23 Natural cement parts/volume: (No. 16 divided by No. 28) x 0.78 24 34. Lime with cement parts/volume: (No. 16 divided by No. 28) x 0.78 25 Test No. 2 - Sand Sieve Analysis Sand weight Sand weight 26 Test No. 2 - Sand Sieve Analysis Sand weight Sand ratio 27 Test No. 2 - Sand Sieve Malysis Sand weight Sand veight Sand ratio 28 Sieve Sieve w/sand weight Sieve weight Sand weight Sand ratio 30 No. 40 104.7 100.8 3.9 19.5 31 No. 50 102.5 93.2 9.3 | | a 1 1 | | | | |
| 17 29. 1.66 Fine parts/volume: No. 16 divided by No. 28 18 30. 50.43 Sand parts/volume: (No. 17 divided by No. 28) x No. 18 19 31. 16.53 Lime parts/volume: (No. 17 divided by No. 28) x No. 18 19 31. 16.53 Lime parts/volume: (No. 16 divided by No. 28) x 0.78 21 Cement (if present) 32. Portland cement parts/volume: (No. 16 divided by No. 28) x 0.78 23 33. Natural cement parts/volume: (No. 16 divided by No. 28) x 0.78 23 34. Lime with cement parts/volume: (No. 16 divided by No. 28) x 0.78 24 34. Lime with cement parts/volume: (No. 16 divided by No. 28) x 0.78 25 Sieve Sieve Analysis Sand weight Sand weight 26 Test No. 2 – Sand Sieve Analysis 0.2 1.0 0.2 26 No. 30 100.6 0.2 1.0 0.2 31 No. 20 107.2 106.4 0.2 1.0 33 No. 40 104.7 100.8 3.9 1.9.5 34 No. 50 102 | | | ~ | | | _ |
| 18 30. 50.43 Sand parts/volume: (No. 17 divided by No. 28) x No. 18 19 31. 16.53 Lime parts/volume: (No. 24 divided by No. 28) x 1.1 21 Cement (if present) (No. 16 divided by No. 28) x 0.78 23 3 | | | | | | |
| 19 31. 16.53 Lime parts/volume: (No. 24 divided by No. 28) x 1.1 20 Cement (if present) 23. Portland cement parts/volume: (No. 16 divided by No. 28) x 0.78 23 33. Natural cement parts/volume: (No. 16 divided by No. 28) x 0.78 23 33. Natural cement parts/volume: (No. 16 divided by No. 28) x 0.78 24 34. Lime with cement parts/volume: (No. 16 divided by No. 28) x 0.86 24 34. Lime with cement parts/volume: (No. 16 x o.2) divided by No. 28 x 1.1 25 Sieve Sieve Analysis Sand weight Sand ratio 26 Test No. 2 – Sand Sieve Analysis Sand weight Sand ratio 27 Test No. 2 – Sand Sieve Analysis Sand weight Sand ratio 28 Sieve w/sand weight Sieve weight Sand weight Sand ratio 30 No. 10 107.0 106.8 0.2 1.0 31 No. 20 107.7 100.8 3.9 19.5 33 No. 40 104.7 100.8 3.9 19.5 34 No. 50 102.5 93.2 | | | | | | |
| Cement (if present) No. 16 divided by No. 28) x 0.78 32 Portland cement parts/volume: (No. 16 divided by No. 28) x 0.78 33 Lime with cement parts/volume: (No. 16 divided by No. 28) x 0.86 24 34 Lime with cement parts/volume: (No. 16 x o.2) divided by No. 28 x 1.1 25 (No. 16 x o.2) divided by No. 28 x 1.1 (No. 16 x o.2) divided by No. 28 x 1.1 26 Test No. 2 – Sand Sieve Analysis (No. 10 0.2 1.0 29 Sieve Sieve w/sand weight Sieve weight Sand weight Sand ratio 30 No. 10 107.0 106.8 0.2 1.0 31 No. 20 107.2 106.4 0.8 4.0 33 No. 40 104.7 100.8 3.9 19.5 34 No. 50 102.5 93.2 9.3 46.5 35 Base 75.7 71.2 4.5 22.5 36 Lighthouse 39 9.3 46.5 39.7 36 Light gray N 4.5/ 39.7 57.7 71.2 <td< td=""><td></td><td></td><td></td><td></td><td></td><td></td></td<> | | | | | | |
| 21 Cement (if present) 22 Portland cement parts/volume: (No. 16 divided by No. 28) x 0.78 23 33Natural cement parts/volume: (No. 16 divided by No. 28) x 0.86 24 34Lime with cement parts/volume: (No. 16 divided by No. 28) x 0.86 24 34Lime with cement parts/volume: (No. 16 divided by No. 28) x 0.18 26 Lime with cement parts/volume: (No. 16 x o.2) divided by No. 28 x 1.1 27 Test No. 2 - Sand Sieve Analysis Sand weight Sand weight 28 Sieve Sieve w/sand weight Sieve weight Sand weight 30 No. 10 107.0 106.8 0.2 1.0 31 No. 20 107.2 106.4 0.8 4.0 32 No. 30 100.6 99.3 1.3 6.5 33 No. 40 104.7 100.8 3.9 19.5 34 No. 50 102.5 93.2 9.3 46.5 35 Base 75.7 71.2 4.5 22.5 36 Gray N 4.5/ 37 Gray N 4 | | 31. 16.53 | _Lime parts/volume: | | (No. 24 divided | l by No. 28) x 1.1 |
| 22 32Portland cement parts/volume: (No. 16 divided by No. 28) x 0.78 23 33Natural cement parts/volume: (No. 16 divided by No. 28) x 0.86 24 34Lime with cement parts/volume: (No. 16 divided by No. 28) x 0.86 25 (No. 16 divided by No. 28) x 0.86 26 (No. 16 x o.2) divided by No. 28 x 1.1 26 Test No. 2 – Sand Sieve Analysis 27 Test No. 2 – Sand Sieve Analysis 28 Sieve Sieve wight 30 No. 10 107.0 106.4 0.8 4.0 31 No. 20 100.6 32 No. 30 100.6 99.3 33 No. 40 104.7 100.8 3.9 34 No. 50 102.5 93.2 9.3 46.5 35 Base 75.7 71.2 4.5 22.5 36 Sample 46 Munsell 40 Dark gray N 4.5/ 41 Gray 5Y 5/1 42 Dark gray N 5.0/ 44 Lighthouse Gray 34 | | | | | | |
| 23 33 | | | | | | |
| 24 34Lime with cement parts/volume: (No. 16 x o.2) divided by No. 28 x 1.1 25 (No. 16 x o.2) divided by No. 28 x 1.1 26 (No. 16 x o.2) divided by No. 28 x 1.1 27 Test No. 2 – Sand Sieve Analysis 29 Sieve Sieve w/ sand weight Sieve weight Sand weight Sand ratio 30 No. 10 107.0 106.8 0.2 1.0 31 No. 20 107.2 106.4 0.8 4.0 32 No. 30 100.6 99.3 1.3 6.5 33 No. 40 104.7 100.8 3.9 19.5 34 No. 50 102.5 93.2 9.3 46.5 35 Base 75.7 71.2 4.5 22.5 36 Lighthouse Sample 46 Munsell 40 Dark gray N 4.5/ Gray SY 5/1 41 Gray SY 5/1 Light gray N 7.5/ 43 Gray N 5.0/ Charcoal SY 3/1 44 Gray N 5.0/ Charcoal SY 3/1 | | | | | | |
| Zest Test No. 2 – Sand Sieve Analysis Zest Test No. 2 – Sand Sieve Analysis Zest Sieve Sieve w/ sand weight Sieve weight Sand weight Sand ratio Zest No. 10 107.0 106.8 0.2 1.0 Zest No. 20 107.2 106.4 0.8 4.0 Zest No. 30 100.6 99.3 1.3 6.5 Zest No. 30 100.6 99.3 1.3 6.5 Zest No. 50 102.5 93.2 9.3 46.5 Zest Sample 46 Munsell Dark gray N 4.5/ Zest Gray SY 5/1 Dark gray N 4.5/ Zest Gray SY 5/1 Dark gray N 5.0/ Zest Gray N 5.0/ Gray N 5.0/ Zest Gray N 5.0/ Gray N 5.0/ Zest Gray N 6.5/ Gray N 6.5/ Zest Gray N 6.5/ Gray N 6.5/ Zest Gray <t< td=""><td></td><td></td><td></td><td></td><td></td><td></td></t<> | | | | | | |
| Lighthouse Sand Sieve Analysis Test No. 2 – Sand Sieve Analysis Sieve Sieve w/ sand weight Sieve weight Sand weight Sand ratio No. 10 107.0 106.8 0.2 1.0 No. 20 107.2 106.4 0.8 4.0 No. 30 100.6 99.3 1.3 6.5 No. 40 104.7 100.8 3.9 19.5 No. 50 102.5 93.2 9.3 46.5 Base 75.7 71.2 4.5 22.5 State 75.7 71.2 4.5 75.7 State 75.7 71.2 4.5 75.7 Gray N 4.5/ 75.7 </td <td></td> <td>34</td> <td>_Lime with cement parts/</td> <td>volume:</td> <td>(No. 16 x o.2)</td> <td>divided by No. 28 x 1.1</td> | | 34 | _Lime with cement parts/ | volume: | (No. 16 x o.2) | divided by No. 28 x 1.1 |
| Z7 Test No. 2 – Sand Sieve Analysis Z9 Sieve Sieve w/ sand weight Sieve weight Sand weight Sand ratio 30 No. 10 107.0 106.8 0.2 1.0 31 No. 20 107.2 106.4 0.8 4.0 32 No. 30 100.6 99.3 1.3 6.5 33 No. 40 104.7 100.8 3.9 19.5 34 No. 50 102.5 93.2 9.3 46.5 35 Base 75.7 71.2 4.5 22.5 36 Lighthouse 39 Lighthouse 39 Dark gray N 4.5/ 41 Gray Sample 46 Munsell 40 Dark gray N 4.5/ 41 Gray SY 5/1 42 Dark gray N 4.5/ 43 Gray N 5.0/ 44 Lighthouse 45 Gray N | | | | | | |
| 228 Sieve Sieve w/ sand weight Sieve weight Sand weight Sand ratio 30 No. 10 107.0 106.8 0.2 1.0 31 No. 20 107.2 106.4 0.8 4.0 32 No. 30 100.6 99.3 1.3 6.5 33 No. 40 104.7 100.8 3.9 19.5 34 No. 50 102.5 93.2 9.3 46.5 35 Base 75.7 71.2 4.5 22.5 36 Oark gray N 4.5/ $Gray$ Stype 5/1 34 Dark gray N 4.5/ $Gray$ Stype 5/1 36 Dark gray N 4.5/ $Gray$ Stype 5/1 37 Gray Stype 5/1 $Stype 5/1$ $Stype 5/1$ 38 Gray Stype 5/1 $Stype 5/1$ $Stype 5/1$ 39 Gray N 5.0/ $Stype 5/1$ $Stype 5/1$ 39 Gray N 5.0/ $Stype 5/1$ $Stype 5/1$ 39 Gray | | | | | | |
| 29 Sieve Sieve w/ sand weight Sieve weight Sand weight Sand ratio 30 No. 10 107.0 106.8 0.2 1.0 31 No. 20 107.2 106.4 0.8 4.0 32 No. 30 100.6 99.3 1.3 6.5 33 No. 40 104.7 100.8 3.9 19.5 34 No. 50 102.5 93.2 9.3 46.5 35 Base 75.7 71.2 4.5 22.5 36 37 34 No. 50 102.5 22.5 36 Base 75.7 71.2 4.5 22.5 36 37 37 71.2 4.5 22.5 36 37 37 71.2 4.5 22.5 37 37 37 37 37 37 38 Base 75.7 71.2 4.5 22.5 40 Dark gray $N 4.5/$ 37 37 | | Test No. $2 - Sa$ | nd Sieve Analysis | | | |
| 30 No. 10 107.0 106.8 0.2 1.0 31 No. 20 107.2 106.4 0.8 4.0 32 No. 30 100.6 99.3 1.3 6.5 33 No. 40 104.7 100.8 3.9 19.5 34 No. 50 102.5 93.2 9.3 46.5 35 Base 75.7 71.2 4.5 22.5 36 37 39.2 9.3 46.5 22.5 36 75.7 71.2 4.5 22.5 37 38 Lighthouse 39 46.5 38 Sample 46 Munsell 39 46.5 39 $Gray$ $5Y 5/1$ 51 $5Y 5/1$ 41 Gray $5Y 5/1$ $50/7$ 42 Dark gray $N 5.0/7$ $50/7$ 43 Gray $N 5.0/7$ $51/7$ 44 Light gray $N 5.0/7$ $51/7$ 45 Gray $N 5.0/7$ < | | <i>a</i> : | | a | a 1 1 1 | |
| 31 No. 20 107.2 106.4 0.8 4.0 32 No. 30 100.6 99.3 1.3 6.5 33 No. 40 104.7 100.8 3.9 19.5 34 No. 50 102.5 93.2 9.3 46.5 35 Base 75.7 71.2 4.5 22.5 Lighthouse Sample 46 Munsell 40 Dark gray N $4.5/$ 41 Gray $5Y 5/1$ 42 Dark gray N $4.5/$ 43 Gray $5Y 5/1$ 44 Light gray N $7.5/$ 45 Gray N $5.0/$ 46 Gray N $5.0/$ 47 Charcoal $5Y 3/1$ 48 Tan $7.5YR 7/2$ 49 Gray N $6.5/$ 50 Gray N $6.5/$ 51 Dark gray $5Y 4/1$ | | | | | | |
| 32 No. 30 100.6 99.3 1.3 6.5 33 No. 40 104.7 100.8 3.9 19.5 34 No. 50 102.5 93.2 9.3 46.5 35 Base 75.7 71.2 4.5 22.5 36 75.7 71.2 4.5 22.5 36 75.7 71.2 4.5 22.5 36 75.7 71.2 4.5 22.5 36 75.7 71.2 4.5 22.5 36 75.7 71.2 4.5 22.5 36 75.7 71.2 4.5 22.5 36 75.7 71.2 4.5 22.5 36 75.7 75.7 75.7 75.7 75.7 37 75.7 75.7 75.7 75.7 75.7 38 $10ark gray$ $87.5/1$ $10ark gray$ $87.5/1$ 440 $67ay$ $85.0/1$ $75.7/1$ $75.7/1$ | | | | | | |
| 33 No. 40 104.7 100.8 3.9 19.5 34 No. 50 102.5 93.2 9.3 46.5 35 Base 75.7 71.2 4.5 22.5 36 37 4.5 22.5 4.5 22.5 36 75.7 71.2 4.5 22.5 37 38 Lighthouse 39 46.5 38 $Sample 46$ Munsell 40 Dark gray $N 4.5/$ 41 Gray $5Y 5/1$ 42 Dark gray $N 4.5/$ 43 Gray $SY 5/1$ 44 Light gray $N 7.5/$ 45 Gray $N 5.0/$ 46 Gray $N 5.0/$ 47 Charcoal $5Y 3/1$ 48 Tan $7.5YR 7/2$ 49 Gray $N 6.5/$ 50 Gray $N 6.5/$ 51 Dark gray $5Y 4/1$ | | | | | | |
| 102.5 93.2 9.3 46.5 35 Base 75.7 71.2 4.5 22.5 36 Lighthouse 37 $and bark gray$ $N 4.5/$ 38 Light gray $N 4.5/$ 40 Dark gray $SY 5/1$ 41 Gray $5Y 5/1$ 42 Dark gray $N 4.5/$ 43 Gray $5Y 5/1$ 44 Light gray $N 7.5/$ 45 Gray $S 0/$ 46 Gray $N 5.0/$ 46 Gray $N 5.0/$ 46 Gray $N 5.0/$ 46 Gray $N 5.0/$ 47 Charcoal $5Y 3/1$ 48 Tan $7.5YR 7/2$ 49 Gray $N 6.5/$ 50 Gray $SY 4/1$ | | | | | | |
| Base 75.7 71.2 4.5 22.5 Base 75.7 71.2 4.5 22.5 Base Lighthouse Lighthouse Base Sample 46 Munsell Dark gray N 4.5/ Gray SY 5/1 Dark gray N 4.5/ Gray SY 5/1 Light gray N 7.5/ Gray Stol/ Gray N 5.0/ Gray N 6.5/ Gray N 6.5/ Gray N 6.5/ Dark gray SY 4/1 | | | | | | |
| Bits Lighthouse 37 Sample 46 Munsell 39 Dark gray N 4.5/ 40 Dark gray N 4.5/ 41 Gray SY 5/1 42 Dark gray N 4.5/ 43 Gray SY 5/1 44 Light gray N 7.5/ 45 Gray N 5.0/ 46 Gray N 5.0/ 47 Charcoal SY 3/1 48 Tan 7.5YR 7/2 49 Gray N 6.5/ 50 Gray N 6.5/ 51 Dark gray SY 4/1 | | | | | | |
| 37 Lighthouse 39 Sample 46 Munsell 40 Dark gray N 4.5/ 41 Gray 5Y 5/1 42 Dark gray N 4.5/ 43 Gray 5Y 5/1 44 Light gray N 7.5/ 45 Gray N 5.0/ 46 Gray N 5.0/ 47 Charcoal 5Y 3/1 48 Tan 7.5YR 7/2 49 Gray N 6.5/ 50 Gray N 6.5/ 51 Dark gray SY 4/1 | | Base | | /1.2 | 4.5 | 22.5 |
| 38 Lighthouse 39 Sample 46 Munsell 40 Dark gray N 4.5/ 41 Gray SY 5/1 42 Dark gray N 4.5/ 43 Gray SY 5/1 44 Light gray N 7.5/ 45 Gray N 5.0/ 46 Gray N 5.0/ 47 Charcoal SY 3/1 48 Tan 7.5YR 7/2 49 Gray N 6.5/ 50 Gray N 6.5/ 51 Dark gray SY 4/1 | | | | | | |
| 39 Sample 46 Munsell 40 Dark gray N 4.5/ 41 Gray 5Y 5/1 42 Dark gray N 4.5/ 43 Gray SY 5/1 44 Light gray N 7.5/ 45 Gray N 5.0/ 46 Gray N 5.0/ 47 Charcoal SY 3/1 48 Tan 7.5YR 7/2 49 Gray N 6.5/ 50 Gray N 6.5/ 51 Dark gray SY 4/1 | | | | | | |
| 40 Dark gray N 4.5/ 41 Gray 5Y 5/1 42 Dark gray N 4.5/ 43 Gray 5Y 5/1 44 Light gray N 7.5/ 45 Gray N 5.0/ 46 Gray N 5.0/ 47 Charcoal 5Y 3/1 48 Tan 7.5YR 7/2 49 Gray N 6.5/ 50 Gray N 6.5/ 51 Dark gray 5Y 4/1 | | | c I | 0 | | |
| 41 Gray 5Y 5/1 42 Dark gray N 4.5/ 43 Gray 5Y 5/1 44 Light gray N 7.5/ 45 Gray N 5.0/ 46 Gray N 5.0/ 47 Charcoal 5Y 3/1 48 Tan 7.5YR 7/2 49 Gray N 6.5/ 50 Gray N 6.5/ 51 Dark gray 5Y 4/1 | | | - | | | ell |
| 42 Dark gray N 4.5/ 43 Gray 5Y 5/1 44 Light gray N 7.5/ 45 Gray N 5.0/ 46 Gray N 5.0/ 47 Charcoal 5Y 3/1 48 Tan 7.5YR 7/2 49 Gray N 6.5/ 50 Gray N 6.5/ 51 Dark gray 5Y 4/1 | | | | ray | | |
| 43 Gray 5Y 5/1 44 Light gray N 7.5/ 45 Gray N 5.0/ 46 Gray N 5.0/ 47 Charcoal 5Y 3/1 48 Tan 7.5YR 7/2 49 Gray N 6.5/ 50 Gray N 6.5/ 51 Dark gray 5Y 4/1 | | | | | | |
| 44 Light gray N 7.5/ 45 Gray N 5.0/ 46 Gray N 5.0/ 47 Charcoal 5Y 3/1 48 Tan 7.5YR 7/2 49 Gray N 6.5/ 50 Gray N 6.5/ 51 Dark gray 5Y 4/1 | | | | ray | | |
| 45 Gray N 5.0/ 46 Gray N 5.0/ 47 Charcoal 5Y 3/1 48 Tan 7.5YR 7/2 49 Gray N 6.5/ 50 Gray N 6.5/ 51 Dark gray 5Y 4/1 | | | 2 | | | |
| 46 Gray N 5.0/ 47 Charcoal 5Y 3/1 48 Tan 7.5YR 7/2 49 Gray N 6.5/ 50 Gray N 6.5/ 51 Dark gray 5Y 4/1 | | | | gray | | |
| 47 Charcoal 5Y 3/1 48 Tan 7.5YR 7/2 49 Gray N 6.5/ 50 Gray N 6.5/ 51 Dark gray 5Y 4/1 | | | 5 | | | |
| 48 Tan 7.5YR 7/2 49 Gray N 6.5/ 50 Gray N 6.5/ 51 Dark gray 5Y 4/1 | | | | .1 | | |
| 49 Gray N 6.5/ 50 Gray N 6.5/ 51 Dark gray 5Y 4/1 | | | | ai | | |
| 50 Gray N 6.5/ 51 Dark gray 5Y 4/1 | | | | | | 112 |
| 51 Dark gray 5Y 4/1 | | | 5 | | | |
| ey | | | 5 | | | |
| DZ Light gray 5Y 8/1 | | | | • | | |
| | 52 | | Light g | gray | 5 Y 8/1 | |
| | 52 | | | • | | |

| 1 | | Delas | CX7 4/1 |
|---|------------------------------------|---|--|
| 1 | | Dark gray | 5Y 4/1 |
| 2 | | Dark green | 5G 4/4 |
| 3 | | Whitewash | N 9.5/ |
| 1 2 3 4 5 6 7 8 9 | | eath a very large number of paint la | asement stair wall of the lighthouse. It ayers was a thick accumulation of |
| | | | |
| 10 | | Lighthouse | |
| 11 | | Sample 47 | Munsell |
| 12 | | White | N 9.5/ |
| 13 | | Whitewash | N 9.5/ |
| 14 | | | |
| 15 16 17 | | ement wall of the lighthouse. Bene ich were virtually indistinguishabl | eath a layer of white paint was a very e from each other. |
| 18 | | | |
| 19 | | Lighthouse | |
| 20 | | Sample 48 | Munsell |
| 21 | | Pastel blue-green | 5G 9/1 |
| 22 | | Dark green | 5G 3/4 |
| 23 | | Gray | 5Y 7/1 |
| 24 | | Pastel peach | 5YR 9/2 |
| 25 | | Pastel peach | 5YR 9/2 |
| 26 | | Light peach | 7.5YR 8/3 |
| 27 | | Pastel peach | 5YR 9/2 |
| 28 | | Light peach | 7.5YR 8/3 |
| 29 | | Off-white | 5Y 8.5/1 |
| 30 | | Gray | 5Y 5/1 |
| 31 | | Green | 10GY 7.5/4 |
| 32 | | Pale green | 2.5G 9/3 |
| 33 | | i ulo Broom | 2.0 0 7/0 |
| 34 | Sample 48 was collected from th | e wall of bedroom 3 of the second | floor of the lighthouse. Its quality was |
| 35 | | layer may have served as a prime of | |
| 36 | excellent. The oldest pare green | layer may have served as a prime c | toat for a ministreoat of green. |
| 37 | | | |
| 38 | | Lighthouse | |
| 38 39 | | Lighthouse | Muncoll |
| | | Sample 49 | Munsell |
| 40 | | Blue-green | 5BG 5,5/2 |
| 41 | | White | N 9.5/ |
| 42 | | Tan | 7.5YR 7/2 |
| 43 | | Light green | 10G 7/2 |
| 44 | | Light green | 10G 7/2 |
| 45 | | Light green | 10G 7/2 |
| 46 | | Dark green | 10G 3/4 |
| 47 | | | |
| 48 | Sample 49 came from the wall o | f the closet of bedroom 3 on the se | cond floor of the lighthouse. It retained |
| 49 | | | th dark green being the oldest observed |
| 50 | layer on its white plaster substra | | |
| 51 | - 1 | | |
| 52 | | | |
| | | | |

| | Lighthouse | <u>,</u> | |
|---------------------|--|---|----------|
| | Sample 50 | Munsell | |
| | White | 5Y 9/1 | |
| a 1 a a | | | |
| - | noved from the trim of bedroom 4 of the v white paint on its wood substrate. | second floor of the lighthouse. It i | retained |
| | Lighthouse | 2 | |
| | Sample 51 | Munsell | |
| | Light blue-green | 5BG 8/1 | |
| | White | N 9.5/ | |
| | Tan | 7.5YR 7/3 | |
| | Tan | 7.5YR 7/3 | |
| | Tan | 7.5YR 7/3 | |
| | Light green | 10G 7/2 | |
| | Light green | 10G 7/2 | |
| | Gray | 10YR 7/1 | |
| | Gray | 5Y 7/1 | |
| | Dark gray | 5Y 3/1 | |
| | Dark green | 10G 3/4 | |
| | - | | |
| counterpart, sample | n the wall of the closet of bedroom 4 of e 49, it revealed a surprisingly large num sh layer was dark green. | • | |
| counterpart, sample | e 49, it revealed a surprisingly large num | ber of paint layers in light of its lo | |
| counterpart, sample | e 49, it revealed a surprisingly large num sh layer was dark green. Lighthouse Sample 52 | ber of paint layers in light of its lo Munsell | |
| counterpart, sample | e 49, it revealed a surprisingly large num sh layer was dark green. Lighthouse Sample 52 Light green | ber of paint layers in light of its lo Munsell 7.5GY 7.5/2 | |
| counterpart, sample | e 49, it revealed a surprisingly large num sh layer was dark green. Lighthouse Sample 52 Light green White | ber of paint layers in light of its lo Munsell 7.5GY 7.5/2 N 9.5/ | |
| counterpart, sample | e 49, it revealed a surprisingly large num sh layer was dark green. Lighthouse Sample 52 Light green White Warm gray | ber of paint layers in light of its lo Munsell 7.5GY 7.5/2 N 9.5/ 5Y 7/2 | |
| counterpart, sample | e 49, it revealed a surprisingly large num sh layer was dark green. Lighthouse Sample 52 Light green White Warm gray Warm gray | ber of paint layers in light of its lo Munsell 7.5GY 7.5/2 N 9.5/ 5Y 7/2 5Y 7/2 | |
| counterpart, sample | e 49, it revealed a surprisingly large num sh layer was dark green. Lighthouse Sample 52 Light green White Warm gray Warm gray Warm gray | ber of paint layers in light of its lo Munsell 7.5GY 7.5/2 N 9.5/ 5Y 7/2 5Y 7/2 5Y 7/2 5Y 7/2 | |
| counterpart, sample | e 49, it revealed a surprisingly large num sh layer was dark green. Lighthouse Sample 52 Light green White Warm gray Warm gray Warm gray Warm gray Warm gray | ber of paint layers in light of its lo Munsell 7.5GY 7.5/2 N 9.5/ 5Y 7/2 5Y 7/2 5Y 7/2 5Y 7/2 5Y 7/2 | |
| counterpart, sample | e 49, it revealed a surprisingly large num sh layer was dark green. Lighthouse Sample 52 Light green White Warm gray Warm gray Warm gray Warm gray Tan | ber of paint layers in light of its lo Munsell 7.5GY 7.5/2 N 9.5/ 5Y 7/2 5Y 7/2 5Y 7/2 5Y 7/2 10YR 8/5 | |
| counterpart, sample | e 49, it revealed a surprisingly large num sh layer was dark green. Lighthouse Sample 52 Light green White Warm gray Warm gray Warm gray Warm gray Tan Tan | ber of paint layers in light of its lo Munsell 7.5GY 7.5/2 N 9.5/ 5Y 7/2 5Y 7/2 5Y 7/2 5Y 7/2 10YR 8/5 10YR 8/2 | |
| counterpart, sample | e 49, it revealed a surprisingly large num sh layer was dark green. Lighthouse Sample 52 Light green White Warm gray Warm gray Warm gray Warm gray Tan Tan Tan Tan | ber of paint layers in light of its lo Munsell 7.5GY 7.5/2 N 9.5/ 5Y 7/2 5Y 7/2 5Y 7/2 5Y 7/2 10YR 8/5 10YR 8/2 10YR 8/2 | |
| counterpart, sample | e 49, it revealed a surprisingly large num sh layer was dark green. Lighthouse Sample 52 Light green White Warm gray Warm gray Warm gray Warm gray Tan Tan Tan Tan Tan Tan | ber of paint layers in light of its lo Munsell 7.5GY 7.5/2 N 9.5/ 5Y 7/2 5Y 7/2 5Y 7/2 5Y 7/2 10YR 8/5 10YR 8/2 10YR 8/2 10YR 8/2 | |
| counterpart, sample | e 49, it revealed a surprisingly large num sh layer was dark green. Lighthouse Sample 52 Light green White Warm gray Warm gray Warm gray Warm gray Tan Tan Tan Tan Tan Tan Tan Tan | ber of paint layers in light of its lo Munsell 7.5GY 7.5/2 N 9.5/ 5Y 7/2 5Y 7/2 5Y 7/2 5Y 7/2 10YR 8/5 10YR 8/2 10YR 8/2 10YR 8/2 10YR 8/2 | |
| counterpart, sample | e 49, it revealed a surprisingly large num sh layer was dark green. Lighthouse Sample 52 Light green White Warm gray Warm gray Warm gray Warm gray Tan Tan Tan Tan Tan Tan Tan Tan Tan Tan | ber of paint layers in light of its lo Munsell 7.5GY 7.5/2 N 9.5/ 5Y 7/2 5Y 7/2 5Y 7/2 5Y 7/2 10YR 8/5 10YR 8/2 10YR 8/2 10YR 8/2 10YR 8/2 10YR 8/2 10YR 8/2 | |
| counterpart, sample | e 49, it revealed a surprisingly large num sh layer was dark green. Lighthouse Sample 52 Light green White Warm gray Warm gray Warm gray Warm gray Tan Tan Tan Tan Tan Tan Tan Tan Tan Tan | ber of paint layers in light of its lo Munsell 7.5GY 7.5/2 N 9.5/ 5Y 7/2 5Y 7/2 5Y 7/2 5Y 7/2 10YR 8/5 10YR 8/2 10YR 8/2 10YR 8/2 10YR 8/2 10YR 8/2 10YR 8/2 10YR 8/2 | |
| counterpart, sample | e 49, it revealed a surprisingly large num sh layer was dark green. Lighthouse Sample 52 Light green White Warm gray Warm gray Warm gray Warm gray Tan Tan Tan Tan Tan Tan Tan Tan Tan Tan | ber of paint layers in light of its lo Munsell 7.5GY 7.5/2 N 9.5/ 5Y 7/2 5Y 7/2 5Y 7/2 5Y 7/2 10YR 8/5 10YR 8/2 10YR 8/2 10YR 8/2 10YR 8/2 10YR 8/2 10YR 8/2 10YR 8/2 10YR 8/2 10YR 8/2 10YR 8/2 | |
| counterpart, sample | e 49, it revealed a surprisingly large num sh layer was dark green. Lighthouse Sample 52 Light green White Warm gray Warm gray Warm gray Warm gray Tan Tan Tan Tan Tan Tan Tan Tan Tan Tan | ber of paint layers in light of its lo Munsell 7.5GY 7.5/2 N 9.5/ 5Y 7/2 5Y 7/2 5Y 7/2 5Y 7/2 10YR 8/5 10YR 8/2 10YR 8/2 10YR 8/2 10YR 8/2 10YR 8/2 10YR 8/2 10YR 8/2 10YR 8/2 10YR 8/2 5BG 6/1 | |
| counterpart, sample | e 49, it revealed a surprisingly large num sh layer was dark green. Lighthouse Sample 52 Light green White Warm gray Warm gray Warm gray Warm gray Tan Tan Tan Tan Tan Tan Tan Tan Tan Tan | ber of paint layers in light of its lo Munsell 7.5GY 7.5/2 N 9.5/ 5Y 7/2 5Y 7/2 5Y 7/2 5Y 7/2 10YR 8/5 10YR 8/2 10YR 8/2 10 | |
| counterpart, sample | e 49, it revealed a surprisingly large num sh layer was dark green. Lighthouse Sample 52 Light green White Warm gray Warm gray Warm gray Warm gray Warm gray Tan Tan Tan Tan Tan Tan Tan Tan Tan Tan | ber of paint layers in light of its lo Munsell 7.5GY 7.5/2 N 9.5/ 5Y 7/2 5Y 7/2 5Y 7/2 5Y 7/2 10YR 8/5 10YR 8/2 10YR 8/2 10 | |
| counterpart, sample | e 49, it revealed a surprisingly large num sh layer was dark green. Lighthouse Sample 52 Light green White Warm gray Warm gray Warm gray Warm gray Tan Tan Tan Tan Tan Tan Tan Tan Tan Tan | ber of paint layers in light of its lo Munsell 7.5GY 7.5/2 N 9.5/ 5Y 7/2 5Y 7/2 5Y 7/2 5Y 7/2 10YR 8/5 10YR 8/2 10YR 8/2 10 | |

forms of latex paint. The oldest dark green layer was firmly adhered to its plaster substrate.

| 1 | | | |
|---------------------------------|-----------------------------------|---|---|
| 2 | | Lighthouse | |
| 3 | | Sample 53 | Munsell |
| 4 | | Pastel blue-green | 5G 9/1 |
| 2 3 4 5 6 7 8 | | e wall of bedroom 1 of the second paint on its very brittle paper subs | floor of the lighthouse. It revealed a trate. |
| 8 9 | | | |
| 10 | | Lighthouse | |
| 11 | | Sample 54 | Munsell |
| 12 | | Brown | 5YR 6/4 |
| 13 | | Brown | 5YR 6/4 |
| 14 | | Brown | 5YR 6/4 |
| 15 | | Brown | 5YR 6/4 |
| 16 | | Brown | 5YR 6/4 |
| 17 | | Warm gray | 5Y 7/2 |
| 18 | | Wallin Bruy | 51 1/2 |
| 19 | Sample 54 came from the wall o | f the third floor stair of the lightho | use. It was challenging as the paint |
| 20 | | | gray as the layer that could be exactly |
| 20 | identified. | peared unevenity with only warm s | gray as the layer that could be exactly |
| 22 | laentinea. | | |
| 22 | | | |
| 23 24 | | Lighthough | |
| 24 25 | | Lighthouse | Managell |
| 25 | | Sample 55 | Munsell |
| 26 | | Brown | 5YR 6/4 |
| 27 | | Brown | 5YR 6/4 |
| 28 | | Brown | 5YR 6/4 |
| 29 | | Brown | 5YR 6/4 |
| 30 | | Brown | 5YR 6/4 |
| 31 | | White | 5Y 9/1 |
| 32 | | White | 5Y 9/1 |
| 33 | | White | 5Y 9/1 |
| 34 | | White | 5Y 9/1 |
| 35 | | Tan | 10YR 8/3 |
| 36 | | Blue-green | 5BG 6.5/1 |
| 37 | | Blue-green | 5BG 6.5/1 |
| 38 | | Dark gray | 5Y 4/1 |
| 39 | | Blue-green | 5BG 6.5/1 |
| 40 | | Blue-green | 5BG 6.5/1 |
| 41 | | Blue-green | 5BG 6.5/1 |
| 42 | | Blue-green | 5BG 5/1 |
| 43 | | Blue-green | 5BG 6.5/1 |
| 44 | | Dark blue-green | 5BG 4/1 |
| 45 | | | |
| 46 | Sample 55 was removed from the | e trim of the third floor of the light | thouse. It was excellent in its quality. |
| 47 | | | ample was a large array of additional |
| 48 | paint layers with dark blue-green | | impre was a large array of additional |
| 49 | particitation and and once green | | |
| 50 | | | |
| 51 | A number of conclusions can be | drawn from the analysis, as follow | 7 |
| 52 | r number of conclusions call be | arawn nom the analysis, as follow | r. |
| 54 | | | |

1 1. There was a relatively high degree of consistency between the samples so that comparisons could 2 3 easily be made between the samples. 4 5 6 7 2. A number of samples had so few layers that one of the following conclusions can be reached: The oldest layers had either weathered away over time, which is probable with exterior a. paint. 8 9 They may have been stripped. b. 10 11 The element itself had been replaced or is of recent date. c. 12 13 Other coverings such as wallpaper may have preceded the paint and were removed prior to d. 14 painting. Wallpaper was a popular covering, especially for damaged plaster. 15 16 3. There is no doubt that several of the buildings had various elements which were whitewashed as 17 their probable original finish. 18 19 4. Many of the samples revealed lengthy sequences of layers so that positive conclusions can be 20 reached for those samples and other samples can be evaluated in relation to them 21 22 5. When it is states "sample detached from substrate" (sample #15 for example) there is not 23 necessarily an implication that can be directly drawn. It simply means that there was no substrate 24 or indication of a substrate beneath the oldest layer. There may be any number of reasons for this, 25 as follow: 26 27 The substrate may have been hard and impervious such as metal or stone so that it was a. 28 impossible to remove the substrate with the sample. 29 30 b. There may have been a natural cleavage between the substrate and the oldest finish layer. This 31 is typical found when linseed oil was used as a prime coat on wood or when calcimine paint 32 remains on the surface of plaster. 33 34 c. There may have been cleavage between layers so that only those layers above that cleavage 35 survived the sampling process. 36 37 It does mean that it is impossible to identify a prime coat so that one is left to speculate as to the 38 relative age of the oldest layer. It also means that older finish layers may have been left behind in 39 the sampling process. 40 41 6. As can be seen with many of the mortar sample discussions no relative ratios of sand to Portland 42 cement or sand to Portland cement and lime has been stated. The acid reduction method which was 43 used is better than other methods for determining lime to sand ratios. Hence, they were provided 44 for those samples composed of sand and lime. For samples containing Portland cement, the best 45 this form of testing can do is to indicate the presence of Portland cement and the sand itself. 46 47 The primary goal in repointing is to achieve a compatible mortar. This can be done for lime and 48 sand samples that were analyzed. It can also be done for Portland cement samples with a bit of trial 49 and error. If the mortar is very hard then a higher ratio of Portland cement to sand will work. One 50 must take into consideration any deterioration of the masonry as a result of the mortar. If this has 51 been the case it may be advisable to use a softer mortar for repointing. 52

patching.

| The other primary mode of mortar analysis is spectrographic testing. Unfortunately, it also cannot accurately determine exact ratios of Portland cement to sand and/or to lime. |
|---|
| The secondary goal is to match the appearance of the mortar, which depends to a very large extent on the sand. This is where acid reduction testing shines. It provides and exact calculation of the |
| sand grain sizes as well as a sample of the sand for matching of color. If the sand is carefully |
| matched then the appearance will be successful. This is especially critical in partial repointing and |

7. There are instances where the narrative of the mortar make up refers to Portland – but the data sheet following does not include it in line #32. The reason for this is that rather than a number for lime content, the calculation is made for lime with Portland cement content. If the sample merely had Portland cement and sand there would be a number for Portland cement



As the nation's principal conservation agency, the Department of the Interior has the responsibility for most of our nationally owned public lands and natural resources. This includes fostering sound use of our land and water resources; protecting our fish, wildlife, and biological diversity; preserving the environmental and cultural values of our national parks and historical places; and providing for the enjoyment of life through outdoor recreation. The department assesses our energy and mineral resources and works to ensure that their development is in the best interests of all our people by encouraging stewardship and citizen participation in their care. The department also has a major responsibility for American Indian reservation communities and for people who live in island territories under U.S. administration.

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