Department of the Interior
National Park Service
Yellowstone National Park

HISTORIC STRUCTURES REPORT

for

MOUNT WASHBURN FIRE LOOKOUT

Yellowstone National Park

April 2011

Prepared by Sievert & Sievert CRC
in conjunction with
Montana Preservation Alliance

Historic Documentation & Project Review
provided by National Park Service

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Final Report: April 2011

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EXECUTIVE SUMMARY

DIRECTIVE

This report was prepared under Cooperative Agreement H1233E007, by which the National Park Service [NPS] and Montana Preservation Alliance [MPA] are working closely to strategically plan for management and preservation of highly significant buildings within the boundaries of Yellowstone National Park [YNP]. Under the agreement's task order, this project defines recommended treatments to be used as part of an overall strategic plan to enhance Yellowstone's historic structures associated with the core operations of the park, combined with visitor services and visitor understanding and education of the cultural development of the park's historic built environment. During the first phase of this agreement, MPA and YNP staff are preparing a series of Historic Structures reports on historically and architecturally-significant buildings within the park. Professional and technical services for this first phase were provided by Sievert & Sievert CRC, consultants in the fields of Historic Architecture, Architecture and Structural Design.

This Historic Structures Report [HSR] on the Mount Washburn Fire Lookout is intended to provide a detailed cultural and technical evaluation of the building, to identify and prioritize the deficiencies that exist for the structure, and to derive a plan to stabilize and preserve the building for future generations and for continued use. To accomplish these goals, this report includes a statement of the historic significance of the property, a narrative history of the Fire Lookout, a condition assessment of all materials, an assessment of which materials are original, and a preservation plan that outlines care of those materials based on their originality and condition.

METHODOLOGY

The following research and documentary actions were initiated in the course of reviewing the existing condition of the property:

A. Visual on-site observations were made during several trips to the site during 2007 / 2009. The observations were limited to what could be seen with minimal disturbance to the structure.

B. The facility was photographed during the trips as noted above. Many of those photos are contained within the body of this report.

C. Limited design drawings and drawings for proposed modifications to the building were found on ETIC; drawings contained in this report are from a combination of those design drawings and field measurements taken during site visits as noted above.

D. All materials were assessed on site in regard to condition. The assessment methods and conclusions are reported on in the Evaluation / Assessment section of this report.

E. Limited structural tests were completed during the preparation of this report. The results of those tests are included in the appendix.

F. A building code "overview" is incorporated with this report; specifically to consider code related implications of permitting continued use of the building. Accessibility guidelines are discussed within the building code evaluation as they apply to the building.

G. Historic architectural and engineering methods and practices were reviewed and evaluated as they pertain to the construction of this building.

H. Mechanical and Electrical evaluations were specifically excluded from this report.

I. The 1980 Qwest addition to Mount Washburn Fire Lookout was not accessed and was not addressed as part of this HSR. Any further modifications by Qwest to this structure would require park compliance review.

J. Existing YNP planning and National Register documents were reviewed, historic contextual information was provided by park cultural resources personnel, and additional secondary sources were consulted to supplement the existing knowledge regarding the Fire Lookout and its broader significance.

ADMINISTRATIVE DATA

The Mount Washburn Fire Lookout has been determined eligible for listing on the National Register of Historic Places under Criterion 'A' for its association with the history of the National Park Administration during the New-Deal era, and under Criterion 'C' as a representative of the evolving design of fire lookouts by the National Park Service[1]. The appropriate treatment for the facility is therefore as an **Historic Property** listed in the National Register of Historic Places.

The basic structure that is the subject of this report was constructed in 1939 to replace a stone fire lookout (circa 1921) that could no longer meet the expanded fire directives for the nation's premier park. A 1979 – 1980 addition was added to the fundamental structure to provide enhanced visitor viewing and interpretation, as well as serve increasing communications needs in the central location of the park. The history of Mount Washburn reflects the evolving science and philosophy of responding to fire in the National Parks during the 20th century, and the resulting programs that developed within the federal government and National Park Service. One of five lookouts in Yellowstone Park, Mount Washburn is a prominent and accessible lookout site, and one of three still in use today. Between 1927 and the early 1940s, when today's Mount Washburn lookout station was completed, the National Park Service established a clear set of strategies for addressing fire. John D. Coffman, the first forestry fire-control expert employed by the National Park Service, developed a fire-fighting model emphasizing fire detection and suppression, and initiated a program to upgrade lookouts through New Deal projects. Built by National Park Service personnel, the design of the fire lookout is indicative of the New – Deal styles of architecture that permeated the nation during the re-construction years.[1] Pertinent classification data is as follows:

- Locational references: Historic Structure #0290; LCS ID #050934; Agency Site Number48YE946
- National Register Status: Determined Eligible for Individual Listing on May 5, 2009 (on file),
- Theme: National Park Administration/ Protection
- Category of Significance: Category 1b - *Structures that contribute to the national significance of a park.*
- Period of Significance: 1941 - 1959, as listed in the Determination of Eligibility.
- Significant Historic Contexts: Architecture in the National Parks, Conservation Policies of the NPS and YNP.
- New information and documentation generated during the preparation of this report will be housed with the YNP Cultural Resources records on this property. Currently, the Fire Lookout is being utilized for its intended purposes of fire detection and fire monitoring, with additional utilization for public viewing/interpretation, and as a site for communications.

In 1999, YNP issued a sweeping "State of the Park," report, and noted that many of the park's historic buildings required extensive work to prevent structural damage. "As a way to enhance preservation," the authors stated, "making use of these structures is important, even when it may appear more efficient to construct a new building that meets the need."[2]

In addition, the following stewardship goals were laid

out for Historic Structures:

- Professional staff oversee an interdisciplinary program to inventory, preserve, and cyclically maintain historic structures.
- The most significant resources are evaluated and preserved according to standards for structures on the National Register of Historic Places. Visitor appreciation of park history is enhanced through interpretive efforts.
- Partners and cooperators share responsibility for managing historic structures still in use for visitor services.[3]

The "State of the Park" report specifically addressed Wildland Fire and Communications Systems, with reference to the Mount Washburn Lookout in both discussions. Wildland Fire is an issue of top priority in this vast and exceptional wildland park. Three historic mountaintop fire lookouts in Yellowstone, including Mount Washburn, are still an integral part of park fire management programs, with seasonal staff that live onsite from June through September and communicate with park staff and emergency responders in cases of wildfire in the park.[4]

The topic of Communications Systems integrates with concern for fire safety and management. Authors noted that "staff and visitors expect Yellowstone to provide instant information transfer and cellular phone communication." Such up to date telecommunications "is considered essential for ensuring human health and safety, and to protect park resources." Thus the report noted the commitment to improve radio coverage and system reliability on five peaks, including renovating the Mount Washburn radio site.[5]

In the wake of the damaging 1988 wildfires in Yellowstone National Park, in 2004 the park updated a 1992 wildfire management plan with management objectives that included use of the traditional fire lookouts in the system. Seven fire management units (FMUs) were defined, including the Washburn Range FMU. Mount Washburn is the highest point in the 147,471- acre Washburn Range Fire Management Unit, in the center of the park, encircled by the popular Inner- Loop Road System.[6] Thus it lies in a region of the park that is highly critical to manage, placing emphasis on use and functionality of the Mount Washburn lookout in the heart of the park.

In its 2003 Business Plan, the report summarized the park administration's broad program goals and its responsibilities and strategies for meeting those goals. Both natural and cultural resources were identified program areas for park stewardship, and the park's mission statement notes "Centuries-old sites and historic buildings that reflect the unique heritage of America's first national park are also protected." Responsibilities for meeting this mandate begin with the park's administrative management team and the Cultural Resources Branch of the Yellowstone Center for Resources with valuable support from the YNP Concessions program, private concessionaires and volunteer programs. Since 2003, park visitation has continued its steady climb, and gone from 2.9 million visitors in 2002 to 3.3 million in 2009. Statistics are not complete for 2010, but this is reportedly the largest visitor year to date. The business plan noted the 951 historic structures within the park, and its responsibility for stewardship. The Mount Washburn Fire Lookout is depicted on page 24 of that report, illustrating the remote nature of communications structures within the park.[7]

In May 2000, the YNP Division of Interpretation released a Long-Range Interpretive Plan. Although the interpretive displays at Mount Washburn was not specifically mentioned, the plan outlined Primary Interpretive themes that included Ecosystem, Wilderness and Management, all of which are a focus of the interpretive panels currently atop the mountain, especially in relation to fire management practices in the park.[8]

MAJOR FINDINGS

Historic Structure #0290, the 1939 Mount Washburn Fire Lookout has changed very little over time and retains a high degree of historic integrity; most original materials remain on site and are intact. Nearly all of the exterior materials are original to the building and interior materials are original with the exception of the furring of walls within the second

floor equipment spaces (originally residential) and the introduction of newer doors serving the enclosed viewing area to the South that is part of the 1980 addition. Outwardly, the building exhibits a subtle "Art Deco" architectural style that is a departure from the rustic style of building evident elsewhere in Yellowstone. The Art Deco influence is appropriate to the period of time that the structure was built, and permitted the original designers a vehicle to add interest to this structure that was, by necessity, a massive and prominent feature on the landscape.

The 1980 addition accommodated modern telecommunication use at the lookout, as well as achieving the park's aspiration to use the Mount Washburn site for interpretive purposes, a park goal for Mount Washburn articulated since the 1930s. From its mountain top setting at over 10,000 feet in elevation, Mount Wash-burn has a commanding view of the surround-ing park landscape. The lookout maintains its historic-era role as one of Yellowstone National Park's primary lookout stations. Further, the access road to the lookout is actually the Chittenden Road, an identified and documented potential historic district. The 4.37 mile stretch of roadway, (built prior to the original lookout) leading to and from the lookout is the only remaining historically-intact segment of the road, and thus contributes to the overall historic feel and setting of the lookout. Indeed, the property's ability to seemingly transcend time to articulate its historic significance is perhaps the lookout's strongest overall attribute.

With few exceptions, this building retains exterior integrity. The interior also retains integrity and does not exhibit any significant changes within publicly visible spaces.

In addition to the identification and significance of historic materials, this HSR looks in detail at the condition of the building. The evaluation included building code comparisons, related fire ratings, limitations on mobility impaired access-ibility, materials conservation, and structural requirements for supporting members. In general, the building was evaluated for continued use as a Fire Lookout with secondary emphasis as a Public Viewing / Interpretive site. Work that would be required for these uses was compiled within this report and is summarized below.

RECOMMENDATIONS FOR TREATMENT AND USE

A Summary of Required Improvements to Rehabilitate the Building to Full Use:

Administrative requirements
- Complete wind analysis and seismic analysis as required by building codes.
- Perform comprehensive concrete testing.

Fundamental protection of at-risk elements
- Repair deteriorated concrete bearing walls & details at 1939 portion of structure.
- Provide & install coating over concrete after repaired.
- Repair / replace tile walking surface at Firewatch promenade.

Fire safety
- Add fire alarm and detection systems.

Weatherization and sealing of the exterior building envelope
- Maintain/repair roof membrane over Firewatch.
- Paint steel stairs and railings on exterior of structure.
- Rehabilitate windows; replace selected doors.
- Redesign installation of AC units in window openings.
- Apply caulking (sealants) throughout exterior joinery.
- Consolidate / eliminate unused / improve appearance of selected attached antenna.

Stabilization of site elements
- Repair failed stone retaining wall.

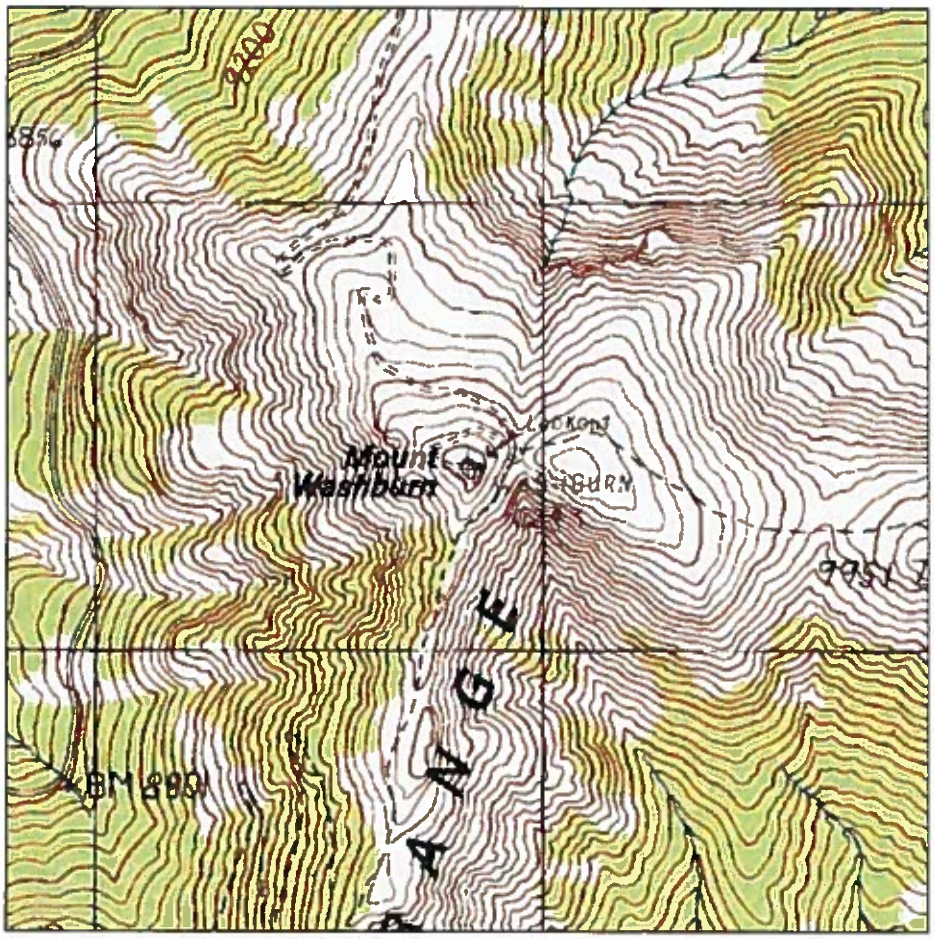
Interior restoration
- Replace hardware at selected openings.
- Minor cleaning, repairs, and painting.

Providing for ADA accessibility
- ADA accessibility exempted from this facility.

Other detailed recommendations that are minor in nature can be found within the *Treatment and Use* section of this report. These include some general clean-up and maintenance activities as well as enhancements that address what might be desired

for the structure as opposed to the minimum that must be done for the building. In addition, it must be noted that a Hazardous Materials Survey was not done during the preparation of this report; if lead-based paints or asbestos materials are encountered they will have to be surveyed and abated.

The Mount Washburn Fire Lookout contributes to the essential protection of Park resources and provides opportunities to enhance visitor appreciation of the natural values represented in Yellowstone National Park. It is essential that the exterior appearance of this structure be maintained. The form and materials of the interior are also significant, albeit austere, and maintaining these values must be done sensitively.



[1] Montana Preservation Alliance, "Yellowstone National Park, Mount Washburn Lookout Consensus Determination of Eligibility," (Yellowstone National Park, National Park Service) 2008.
[2] Yellowstone National Park, The State of the Park (Mammoth Hot Springs: National Park Service) 1999, p. 4-10.
[3] ibid., p. 4-14.
[4] ibid., pp. 2-29 to 2-33 and Yellowstone National Park, 2004 Update of the 1992 Wildland Fire Management Plan (Mammoth Hot Springs: National Park Service) 2004, p. 16 and 53.
[5] Yellowstone National Park, The State of the Park (Mammoth Hot Springs: National Park Service) 1999, pp. 5-16 to 5-20.
[6] Yellowstone National Park, 2004 Update of the 1992 Wildland Fire Management Plan (Mammoth Hot Springs: National Park Service) 2004, p. 16.
[7] Yellowstone National Park, Yellowstone National Park Business Plan (Mammoth Hot Springs: National Park Service) July 2003.
[8] Yellowstone National Park, Division of Interpretation, Executive Summary: Long-Range Interpretive Plan Yellowstone National Park (Mammoth Hot Springs: National Park Service, May 2000) pp. 6-8.

PART 1 – DEVELOPMENTAL HISTORY

NARRATIVE HISTORY AND HISTORIC SIGNIFICANCE

The Mount Washburn lookout is the primary lookout for Yellowstone National Park, established in 1872 as the world's first national park and the setting in which America's conservation movement matured. Situated just northeast of Dunraven Pass and west of the Grand Canyon of the Yellowstone at an elevation of 10,243', the 1941 Mount Washburn Fire Lookout has a commanding view in all directions of a large section of the north/central portion of the park.

Described as always being "one of the main fire lookout stations in the Park,"[i] the current Mount Washburn Lookout replaced an impressive stone masonry lookout station that was built in 1921. Park officials sought a replacement for the original lookout at least as early as 1934, when a June 1 memorandum from Superintendent Roger Toll to park landscape architect Frank Mattson noted that Chief Ranger George F. Baggley sought to renovate the structure, stating that "the windows are so small that the cupola is unsuitable for a fire finding instrument."[ii] Another 1934 memorandum from Chief Ranger Baggley describes the lookout's "present arrangement for fire observation is wholly inadequate."[iii] One 1938 request for funding for a new lookout sought a building which also included an interpretive center, noting that "There are a great many visitors who travel to this point each season, and it is considered advisable to establish a public contact station in addition to the fire lookout at this location."[iv] The original structure was torn down in 1939-40 using Emergency Relief Appropriation Act (ERA) funds (part of the so-called Second New Deal) totaling $288.60.[v]

The construction of today's Mount Washburn Fire Lookout was financed through the Public Works Administration (commonly known as the PWA—another component of the Second New Deal), one of the cornerstone agencies of President Franklin D. Roosevelt's New Deal created to bring the United States out of the Great Depression. Originally budgeted at $11, 475,[vi] the project was completed at a cost of $17,468.59, approximately $6,000.00 over budget.[vii] According to Drawing #2519-B, the lookout's approved design, the lookout was to have included another built section to house a small museum and interpretive displays. However, that portion of the project was not built in 1941, and a scaled-down addition was added c. 1946.[viii]

The c.1946 frame addition was intended as a small interpretive space and as shelter for visitors during changing weather conditions, despite early efforts to create a larger display space. One April 1939 memorandum notes that "between 400 to 700 visitors spend from ten minutes to an hour on Mt. Washburn each day during the peak travel periods...,"[ix] and "...the glassed-in semi-circle at the end of the shelter was planned to afford the public an opportunity of observing protection instruments..."[x] The 1939 architectural renderings of the lookout depict a more elaborate space than the frame addition that was eventually built,[xi] and photographs of the original addition demonstrate that no "glassed-in semi-circle" was ever constructed. It is the 1980 addition that provides both shelter and expanded interpretive services for visitors.

The road which accesses the Mount Washburn Lookout is the Chittenden Road[xii], which connects the lookout to the Grand Loop Road located to the west. Originally built to provide park visitors with unparalleled scenic opportunities near the Washburn summit, today's 4.37 mile long road

provides access to the Mount Washburn Overlook, then continues to the lookout as a restricted road. Originally named the Mount Washburn Road, the highway was officially renamed the Chittenden Road in 1913, in recognition of Hiram Chittenden's substantial engineering contributions to the late-nineteenth and early-twentieth century development of Yellowstone National Park.

The lookout station itself is situated near the summit of Mount Washburn, across a paved, generally circular parking lot that connects to the access road at the north end of the parking lot. A historic-era stone retaining wall encompasses the parking area, and is especially prominent along the south portion of the parking lot, adjacent to the lookout.

Significance Statement

The Mount Washburn Fire Lookout is significant under Criterion 'A' for its associations with the history of the National Park Administration as it relates to park resource protection during the New Deal era. The lookout is further significant under Criterion 'C' for its representation of the evolving design of fire lookouts by the National Park Service. Completed in 1941, its period of significance begins with its construction and continues through 1959 due to the National Register's "50 year" definition of the historic era. However, today's lookout has remained in useful operation since its construction. Today, the building remains a heavily-visited location that reflects Yellowstone National Park's charge with fire control and the interpretive value of the facility developed atop this prominent peak.

The construction of the 1941 Mount Washburn Lookout was an important element of the new fire-fighting model developed by John D. Coffman, the first forestry fire-control expert employed by the National Park Service. Spurred to create a systematic fire-fighting response by the 1926 Glacier National Park fires (a year in which NPS had budgeted only $38,000 for fire management on it's 6,133, 614 acres), NPS hired Coffman, the former supervisor of California (now Mendocino) National Forest, to become the agency's sole fire control expert in 1927.

Coffman "built the beginning of an organized structure to address fire,"[xiii] translating an already effective model of fire planning from the U.S. Forest Service to the needs of the National Park Service. He produced the Park Service's first Forest Protection Requirements report in 1927, and he focused on increasing fire prevention efforts in Glacier National Park, which included increased staffing for the park's existing four lookouts and the construction of a fifth lookout on Mount Brown, completed in 1929. Also in 1929, he wrote a fire control plan for Glacier, the first ever for a national park, and he began to implement the plan in other parks. Later that year, Coffman developed Yellowstone's first fire analysis, and he reported that the two existing fire lookouts—Mount Washburn included—were not up to the task, that "neither lookout contained facilities to allow a spotter to spend the day and night."[xiv] The problems identified by Coffman were still on the mind of Yellowstone Chief Ranger George Baggley in 1934 when he sought funding for a substantial renovation to the original, 1921 lookout.

In 1931, the financial burden on Yellowstone to fight fires was tremendous, and in 1932 the park received over $122,000 in emergency reconstruction and firefighting funds, plus an additional $16,300 for forest protection and fire prevention,[xv] funding that represented five times the amount allocated for the entire agency for firefighting just a few years prior. The funding allowed for greater joint fire planning among federal agencies in the Yellowstone region—in 1932 alone three fire conferences were held in Yellowstone, with John Coffman presenting a three-day symposium on fire training at the first conference.

Despite the emergency appropriations in 1932, the beginning of the Great Depression seemed to signal the end of Coffman's expanded fire planning, which would have required federal funding thought to no longer exist. Yellowstone National Park, with its vast, vulnerable acreage, was especially at-risk to fire. However, the election of Franklin D. Roosevelt in November 1932 and the subsequent introduction of the New Deal radically altered the national park's financial situation. As

one expert has written, "The New Deal provided resources in ways that previous managers could not have imagined...the national parks benefited in all kinds of ways from New Deal programs. The parks received work forces that built trails, firebreaks, and even lookout towers."[xvi] Overall, the impact of New Deal programs on the National Park Service cannot be overstated. The NPS base budget increased from just under $11 million in 1933 to nearly $27 million in 1939. And between 1933 and 1937, federal public works agencies poured more than $150 million into national park projects.[xvii]

Created by the National Industrial Recovery Act on June 16, 1933, the Public Works Administration (PWA) budgeted several billion dollars to be spent on the construction of public works, with the goal of providing employment, improving public welfare, and contributing to a revival of American industry. Between July 1933 and March 1940, the PWA funded the construction of more than 34,000 projects, including airports and electricity-generating dams, as well as seventy percent of the new schools and one-third of the hospitals built nationwide during that time. Among those thousands of projects were the demolition of the 1921 lookout and the construction of the today's lookout atop Mount Washburn.

In 1930, the entire national park system had only seventeen primary lookouts, including the 1921 Mount Washburn lookout. Ten years later, as a result of New Deal funding and labor, sixty primary lookouts and fourteen more secondary lookouts[xviii] (with a corresponding increase in the number of lookout observers) allowed NPS far greater ability to detect and respond to fire than ever before.

Between 1927 and the early 1940s, when today's Mount Washburn lookout station was completed, the National Park Service established a clear set of strategies for addressing fire. The approach of the era was fire detection and suppression and with the vast amount of resources supplied by the New Deal, this methodology appeared to work. New Deal funded lookouts, the Mount Washburn Fire Lookout prominent among them, are a physical manifestation of both the New Deal era and a federal land management philosophy by which fire had become another natural force that human ingenuity could seemingly contain.

Architecturally, the lookout is a radical departure from the late-period Rustic Style of the era. During the mid to late-1930s, architect Albert H. Good, a consultant to the National Park Service, authored guidebooks which described and illustrated the architectural styles and related philosophy of a number of NPS buildings. In *Park and Recreation Structures: Part 1—Administration and Basic Service Facilities* (1938) , Good described the design imperatives behind NPS lookouts, noting that since lookouts are often in prominent locations, viewable for miles by visitors, they should "be designed with thought for their appearance. It is possible by employing native rock or logs in the construction to achieve a certain harmony with the surroundings, especially if, when located on a rocky summit, the structure is blended to it and made to appear to grow out of it." And as park administrators allowed and encouraged public access to the building, "a more pretentious building was desired."[xix]

Yellowstone National Park lookouts such as those on Mount Holmes and Mount Sheridan follow these design directives; however, the Rocky Mountain weather conditions faced atop Mount Washburn are unique and forced park architects and administrators to abandon the traditional architectural approach in favor of a reinforced concrete structure designed to withstand the unrelenting hardship of its environment.

The result was a lookout structure of reinforced concrete, that embodies the classic elements of Art Deco design. Architecturally unique within Yellowstone National Park, it may be one of the few (perhaps the only) lookouts of this construction method and architectural style ever built by the National Park Service. As such, the lookout also achieves National Register eligibility under Criterion C.

Today, the Mount Washburn lookout supports two primary park fire management functions. The first is the lookout's historic use, fire detection, where

the building is staffed by a trained firefighter and equipped with a conventional fire finder, a sighting device used to calculate azimuth and range. The second function is to monitor fires that are allowed to burn for environmental benefit. Secondary duties include a role as a park communications relay station; monitoring airborne fire-fighting traffic; and wildlife monitoring.[xx] As the Yellowstone National Park website notes, "The lookouts play a key role in supporting this aspect of the fire management program."[xxi]

Integrity Statement

Historic Structure #0290, the Mount Washburn Lookout, retains good integrity despite the addition of an array of telecommunications equipment to the property. Major character-defining features of the lookout remain intact, including concrete elements, original windows, doors, and glass-enclosed observation tower. While the accumulation of telecommunications equipment is unfortunate, it does not significantly detract from the lookout's integrity, and the equipment and antennas may not be permanent alterations to the building.

The lookout strongly conveys its original design and function through the unchanged character of the original shape, massing, and scale, despite the 1980 addition to the south elevation of the lookout. The 1980 addition replaces a previous, albeit smaller, wood frame addition built c. 1946 and used to provide basic shelter and interpretive services to lookout visitors.[xxii] The 1980 addition, while accommodating modern telecommunication use at the lookout, also meets the park's aspiration to use the Mount Washburn site for interpretive purposes, a park goal for Mount Washburn articulated since the 1930s. The construction of the addition did not apparently damage the lookout or interfere with its historic use, and its design, though compatible, is "clearly differentiated so that the addition does not appear to be part of the historic resource,"[xxiii] a requirement of the Secretary of the Interior's Standards for Rehabilitation.[xxiv] It should be noted, too, that the 1939 design for today's lookout included an interpretive space to be constructed with the lookout, though the project was scaled back during construction to include only the lookout.

The setting and feeling of the site, atop Mount Washburn with a commanding view from over 10,000 feet, is intact, and the lookout maintains its historic-era role as one of Yellowstone National Park's primary lookout stations. Further, the access road to the lookout is actually the Chittenden Road, an identified and documented potential historic district. The 4.37 mile roadway, (built prior to the original lookout) leading to and from the lookout is the only remaining historically-intact segment of the road, and thus contributes to the overall historic feel and setting of the lookout. Indeed, the property's ability to seemingly transcend time to articulate its historic significance is perhaps the lookout's strongest overall attribute.

ARCHAEOLOGICAL CONSIDERATIONS

In addition to presenting the documented history of the Mt. Washburn Fire Lookout this report is intended to raise the awareness of all cultural values and to create a foundation for continued research into the building; its occupants, designers, and founders; its site or location; and the history of events surrounding the building. Although not the primary purpose of an Historic Structures Report, it must be recognized that understanding the occupation of the site over time has the potential to yield additional information that can contribute to the story of this location from both the standpoint of pre-history as well as history. For this reason it is recommended that all ground disturbing activities be observed with sensitivity regarding archaeological values.

In the case of the Mt. Washburn Fire Lookout it is known that earlier fire lookouts occupied the site before the current facility was built, and that the site was part of the 'Chittenden Road' during the period of written history. Speculatively, the all – encompassing views from the site would also make it a natural place for observation or signaling by

cultures that occupied the geographic area before European occupation of the land.

If buried features related to history or pre-history are encountered or if artifacts are unearthed that are thought to have the potential to add to the history of the facility or occupation of the site prior to construction of the current building we recommend consultation with the Park Archaeologist, Historian, or Historic Architect.

ENDNOTES PART 1 HISTORY & SIGNIFICANCE

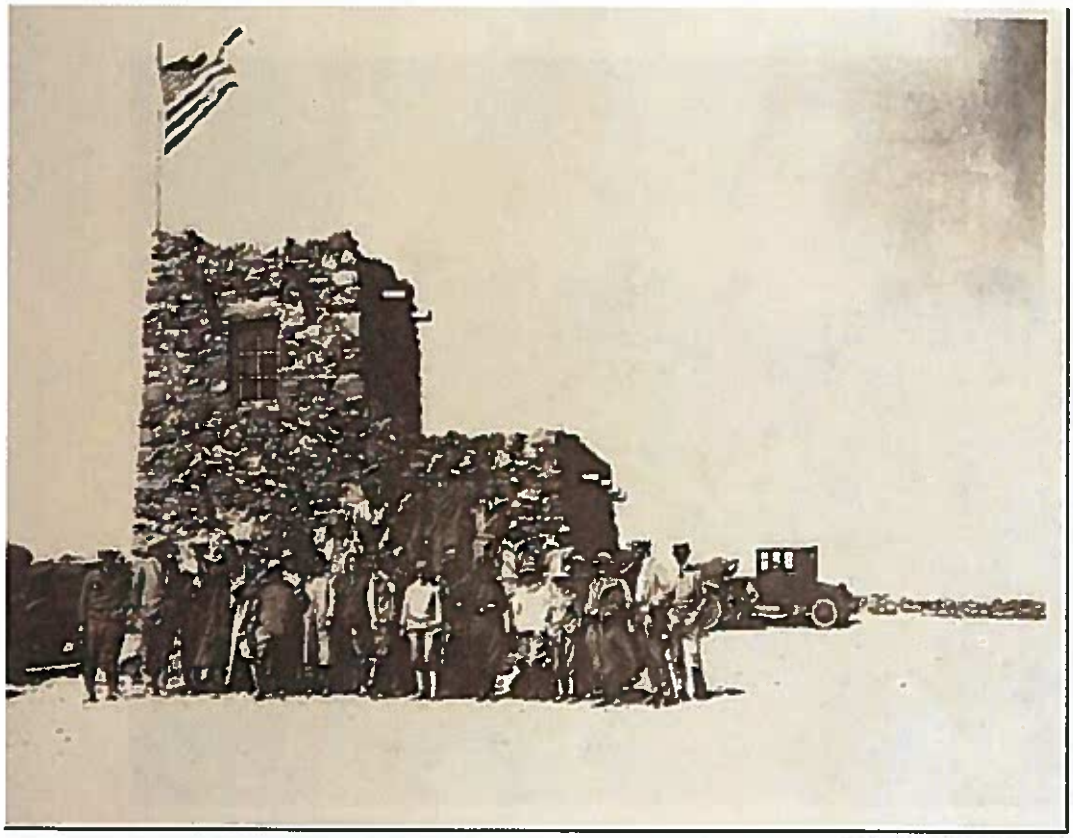
[i] "Final Report on Job OP-267, One Primary and Three Secondary Fire Lookouts." U.S. Department of the Interior, National Park Service, Yellowstone National Park. December 30, 1942.
[ii] "Memorandum for Frank Mattson." From Roger W. Toll, Yellowstone National Park Superintendent, June 1, 1934.
[iii] "Memorandum for Mr. Edwards," from Chief Ranger George F. Baggley, May 22, 1934.
[iv] "Six Year Program 1938-1943, Incl. Yellowstone National Park." Physical Improvements, Buildings—Financial Justification for Mount Washburn, 1938.
[v] "ERA Labor Statement – February, 1940." Yellowstone National Park, 1940.
[vi] Ibid.
[vii] Ibid.
[viii] Final Report on Job OP-267. See footnote 9.
[ix] During this era, park visitors were able to drive to the lookout. Today, direct vehicle access to the lookout is restricted.
[x] "Memorandum for the Acting Regional Director, Region II." From Frank Childs, Regional Forester. National Park Service, April 7, 1939.
[xi] "Fire Lookout and Shelter, Mount Washburn." Department of the Interior, National Park Service, Branch of Plans and Design, 1939.
[xii] The Chittenden Road is the sole element in the Chittenden Road Historic District, an identified and documented potential historic district.
[xiii] Hal K. Rothman, "Blazing Heritage: A History of Wildland Fire in National Parks." Oxford University Press, 2007. p. 47.
[xiv] Ibid, 54.
[xv] Ibid, 55.
[xvi] Ibid, 53.
[xvii] Ibid, 58.
[xviii] Ibid, 59.
[xix] Managing the Matchless Wonders, p. 125.
[xx] Lee H. Whittlesey, "A History of the Mount Washburn Lookout, Yellowstone National Park." January 9, 2009, p. 8.
[xxi] Viewable at http://www.nps.gov/yell/parkmgmt/lookouts.htm. National Park Service, Yellowstone National Park website. Viewed January 2009.
[xxii] The exact construction of the lookout's first frame addition is difficult to determine. Building and Maintenance files for the lookout do not provide a construction date, though a December 30, 1942 final report on the construction of the lookout states that a second section (the wood addition), "was not built at this time, [and] will be for the general use of the public." Construction of the lookout ran several thousand dollars over budget, the likely reason for the delay in building the "second section." However, a 1946 image of the lookout shows the original addition. It is the earliest located image which shows the wood addition.

[xxiv] Viewable at http://www.nps.gov/history/hps/tps/tax/rhb/new01.htm

HISTORIC PHOTOGRAPHS

CONSTRUCTION PHOTO OF 1921 FIRE LOOKOUT
NPS SLIDE FILE 14294, YNP ARCHIVES

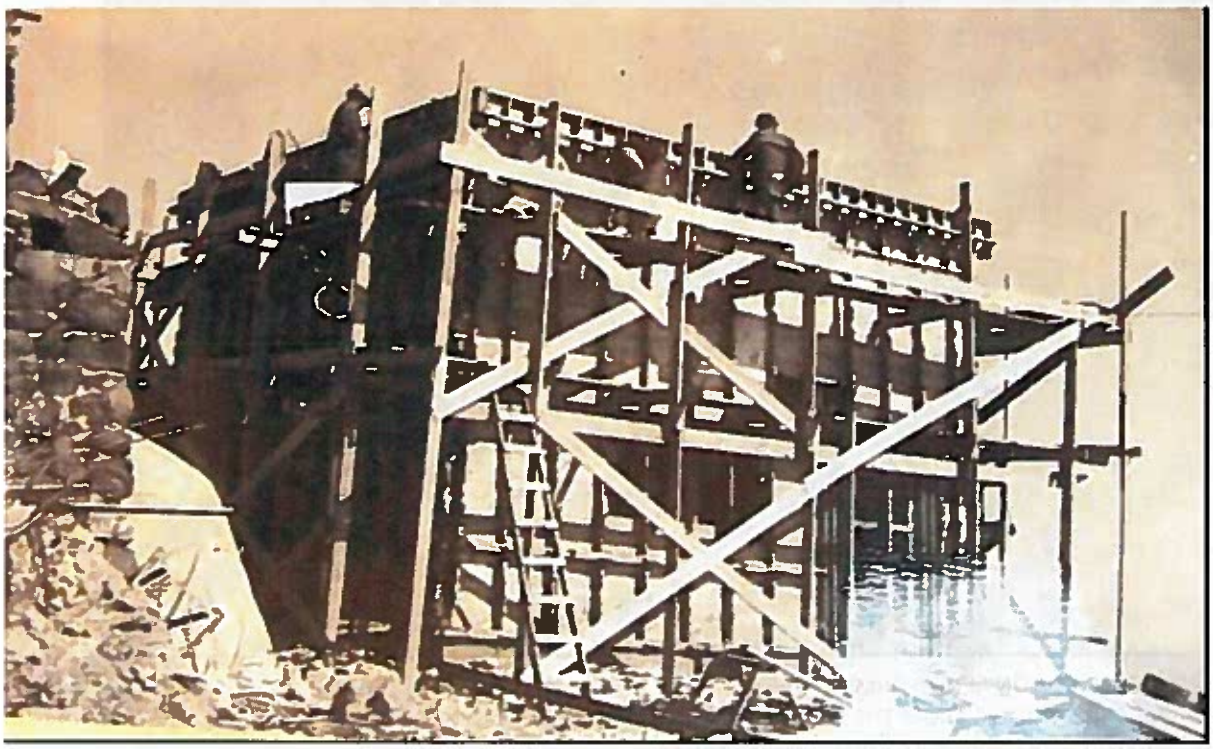
POSTCARD OF 1921 STONE LOOKOUT ON MT. WASHBURN,



VIEW OF 1921 STONE LOOKOUT ON MT. WASHBURN, CA. 1921, NPS SLIDE FILE 03021

CONDITION OF LOOKOUT IN 1936

BEGIN CONSTRUCTION OF 1939 LOOKOUT; 1921 LOOKOUT IN FOREGROUND, YELL 20734-3



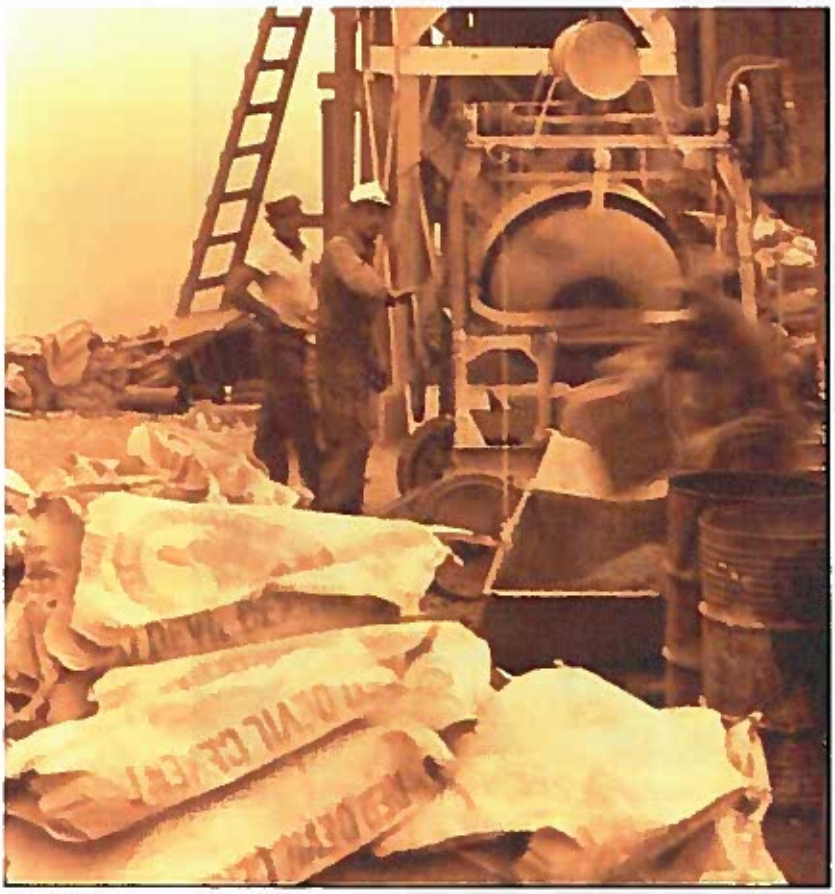
CORNER OF 1921 LOOKOUT IS VISIBLE ON LEFT SIDE OF PHOTO PRIOR TO ITS REMOVAL

FORMING FOR THE CONCRETE FOUNDATION (CIRCA 1939). NOTE THE USE OF BOARD FORMING AND THE INSTALLATION OF SPREADERS WITHIN THE FORMS. THE ADJACENT EMBANKMENTS FROM THE EXCAVATION PROVIDE INSIGHT INTO THE NATURE OF THE SOIL (OR LACK THEREOF) THAT THE STRUCTURE IS FOUNDED UPON.

THE COMPLETED FOUNDATION AFTER FORMING HAS BEEN REMOVED. NOTE THE PRESENCE AND SPACING OF REINFORCING BARS PROTRUDING FROM THE WALLS. THE REBAR EXTENDING FROM THE NORTH WALL IS BELIEVED TO BE FOR ATTACHMENT OF THE MANHOLE AND CHAMBER BELOW.

FORMING IN THE INTERIOR OF THE FOUNDATION FOR THE RECESSED ENTRANCES AND CENTER STAIRWELL. THE STEPS IN THE TOP OF THE FOUNDATION ARE FOR ENTRANCE PASSAGES AND DOORWAYS.

CONCRETE MIXING OPERATION; THE CONCRETE WAS FIELD MIXED ON-SITE WITH THE APPARATUS SHOWN. THE BARRELS MAY HAVE BEEN USED TO TRANSPORT WATER TO THE TOP OF MT. WASHBURN.



"RED DEVIL" BRAND CEMENT WAS USED IN THE CONCRETE MIXTURE. THIS COMPANY IS STILL IN BUSINESS.

VIEW OF THE SCAFFOLD TOWER LOCATED AT THE NE CORNER OF THE NEW LOOKOUT. THE TOP OF THE 1921 FIRE TOWER IS BARELY VISIBLE IN THE FAR RIGHT OF THE PHOTO.

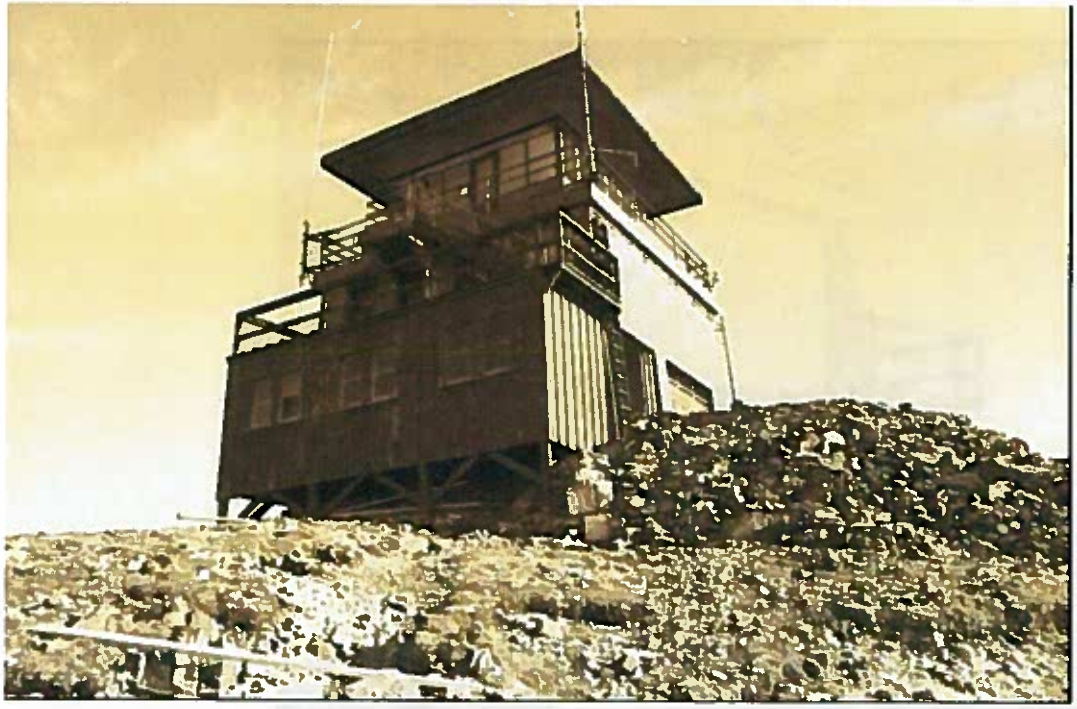
WORK ON THE FIREWATCH STORY AND THE RELATED ROOF STRUCTURE; NOTE THAT THE ORIGINAL 1921 STRUCTURE HAS BEEN REMOVED IN THIS PHOTO. THE ROOF APPEARS TO HAVE BEEN CONSTRUCTED WITH STEEL FRAMING MEMBERS.

WINDOWS AND DOORS ARE BEING INSTALLED IN THIS PHOTO. NOTE THE PLYWOOD WINDBREAK TO SHIELD WORKERS FROM THE PREVAILING WEST-SOUTHWEST WINDS. AN ENCLOSED INTERPRETIVE / VIEWING AREA WAS NOT INCLUDED IN THE ORIGINAL CONSTRUCTION.

NOTE THE STREAMLINED MODERN RAILING DETAILS AT THE PROMENADE SURROUNDING THE FIREWATCH TOP STORY.

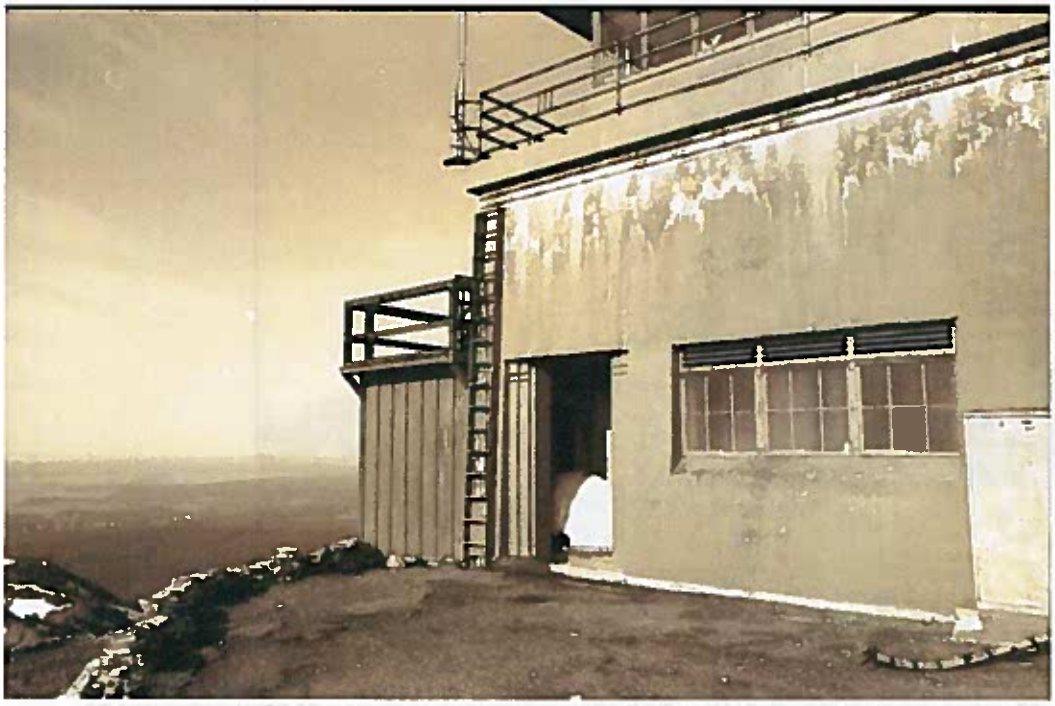
THIS 1946 PHOTO SHOWS A WOOD-FRAME, ENCLOSED VIEWING SPACE ATTACHED TO THE SOUTH WALL (VISIBLE FAR RIGHT). ALTHOUGH THE CONCRETE WALLS WERE BUSH-HAMMERED THE BOARD FORMING IS STILL VISIBLE AND THE WALLS ARE UNCOATED. THE ARTICULATED FASCIA AROUND THE ROOF IS VISIBLE IN THIS PHOTOGRAPH.
(PHOTO: SKINNER YELL 29893-1)

VIEW FROM THE SOUTHWEST (NEAR THE CHITTENDEN ROAD). THE WOODEN VIEWING AREA CAN BE SEEN ATTACHED TO THE SOUTH WALL OF THE LOOKOUT AND THE CHARACTER OF THE TERRAIN NEAR THE SUMMIT OF MT. WASHBURN IS GRAPHICALLY DEPICTED IN THIS PHOTOGRAPH

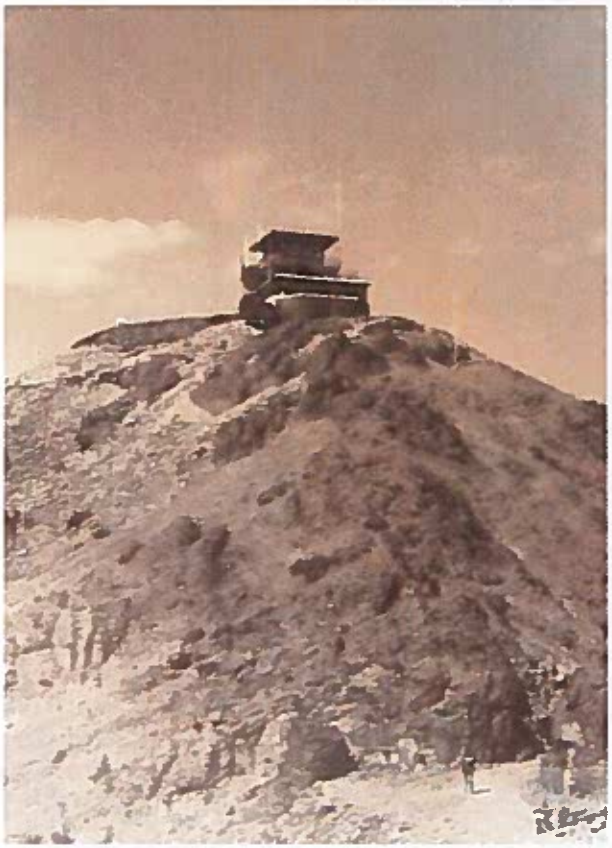


VIEW FROM THE SOUTHEAST (CIRCA 1980). THE ENCLOSED WOOD-FRAME VIEWING AREA CAN BE SEEN ATTACHED TO THE SOUTH WALL OF THE LOOKOUT IN THIS PHOTO. (YELL 29897-1c)

NORTH ELEVATION AS SEEN FROM THE PARKING AREA (1980). COATING OF THE CONCRETE EXHIBITS WEATHERING IN THIS PHOTO. NOTE THAT THE ORIGINAL WINDOWS ARE ALL STILL IN USE IN THIS PICTURE. (YELL 29897-2c)



PARTIAL EAST ELEVATION AS IT APPEARED IN 1980. VENTILATORS ABOVE THE WINDOWS ARE STILL FUNCTIONAL AT THIS TIME.

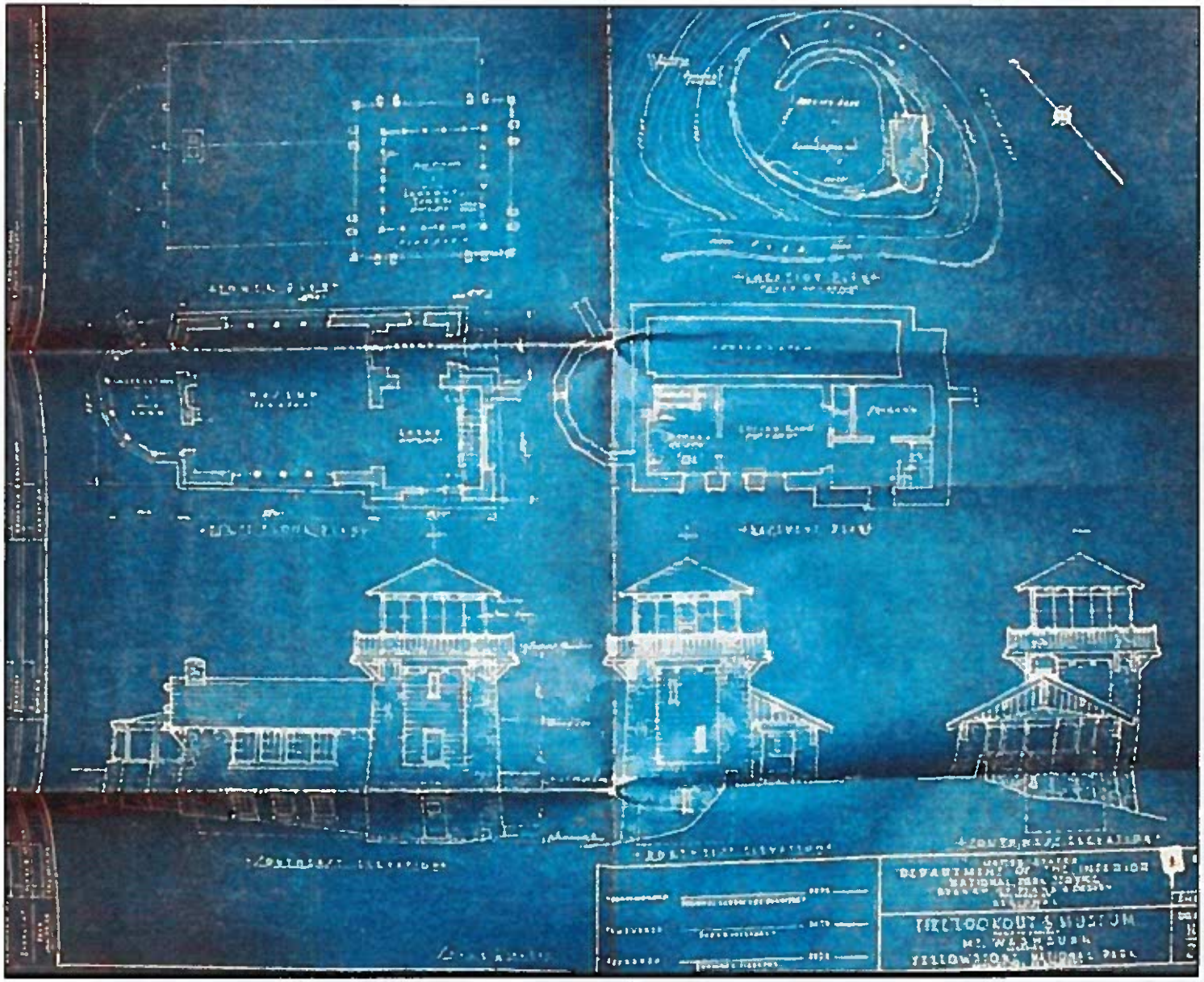


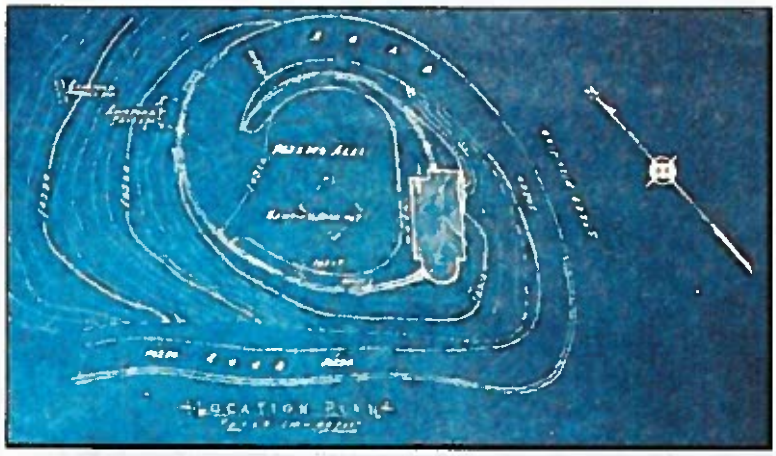
BY 1997 THE WOODEN ADDITION ATTACHED TO THE SOUTH SIDE OF THE LOOKOUT HAD BEEN REPLACED BY A PRECAST CONCRETE INTERPRETIVE/VIEWING AREA. VIEW FROM SOUTHWEST

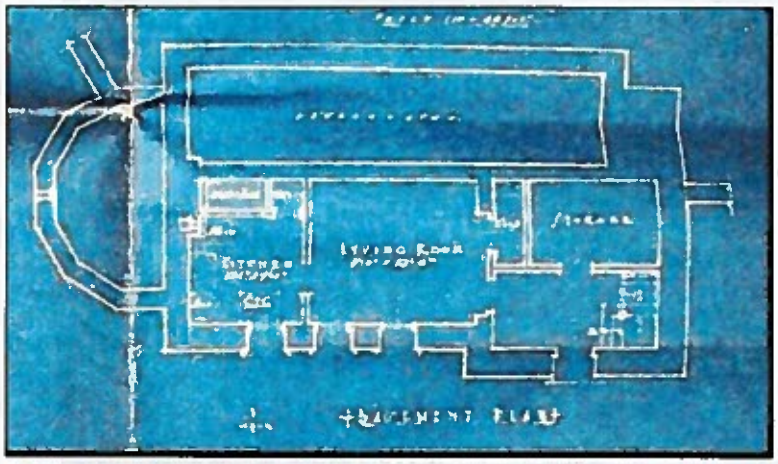
NW VIEW OF THE 1939 LOOKOUT AS IT APPEARED IN 1997 WITH THE NEW PRECAST CONCRETE ADDITION. COMMUNICATION /SIGNALING DEVICES WERE BEGINNING TO APPEAR ON THE STRUCTURE BY THIS DATE.

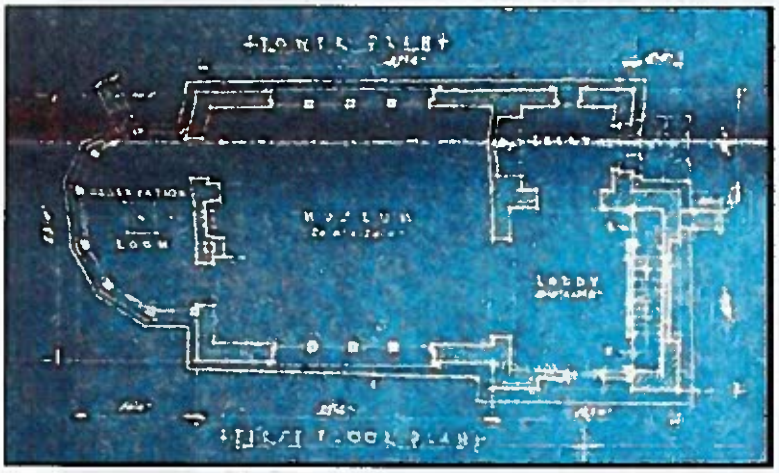
VIEW FROM SOUTHEAST (CIRCA 1997)
(1997 PHOTOS: YELLOWSTONE CENTER FOR RESOURCES, CULTURAL FILE ROOM, WHITE LOOSE-LEAF BOOK MARKED "SNOWSHOE CABINS, MISCELLANEOUS BACK COUNTRY CABINS (AND) LOOKOUTS)

HISTORIC PLANS

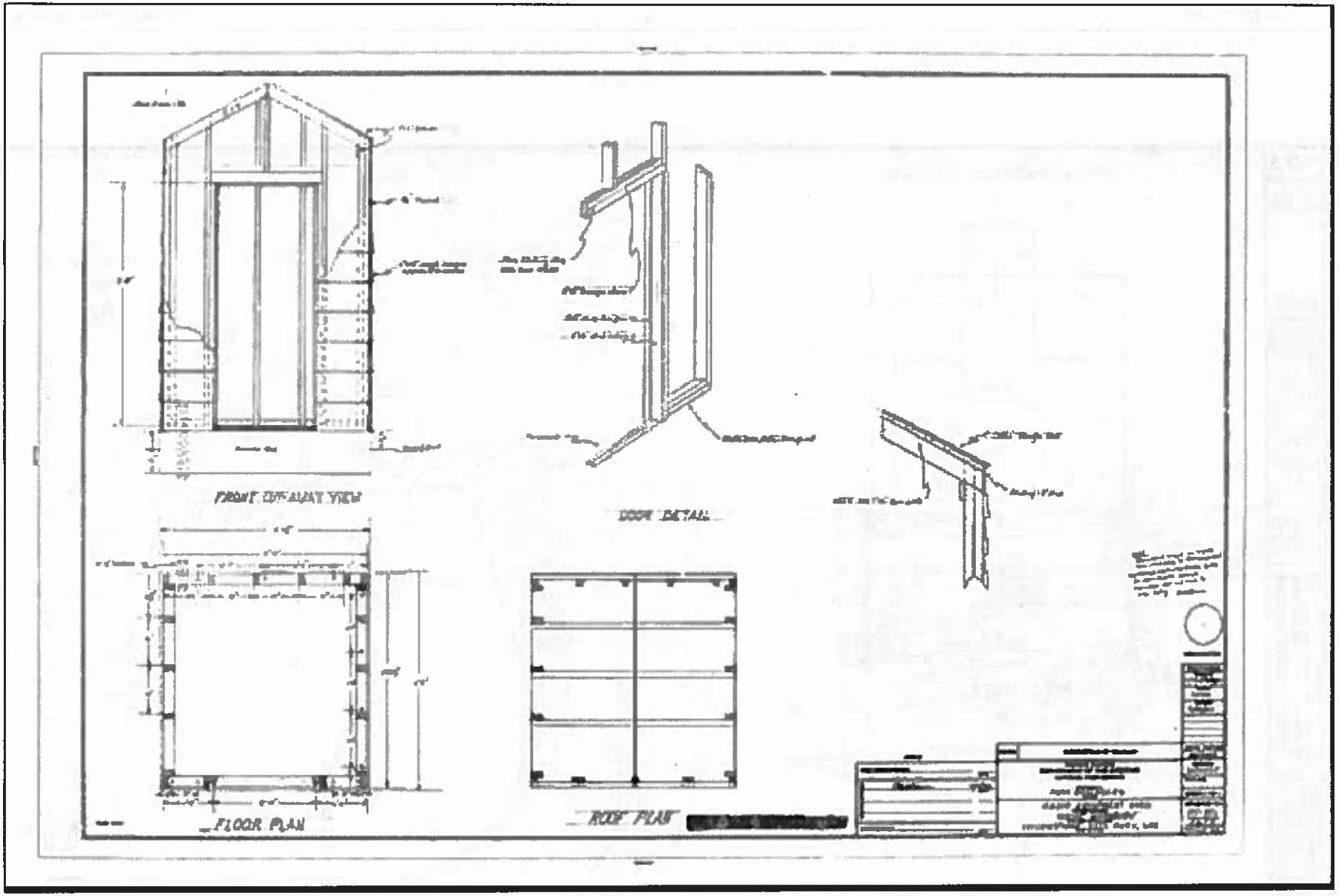




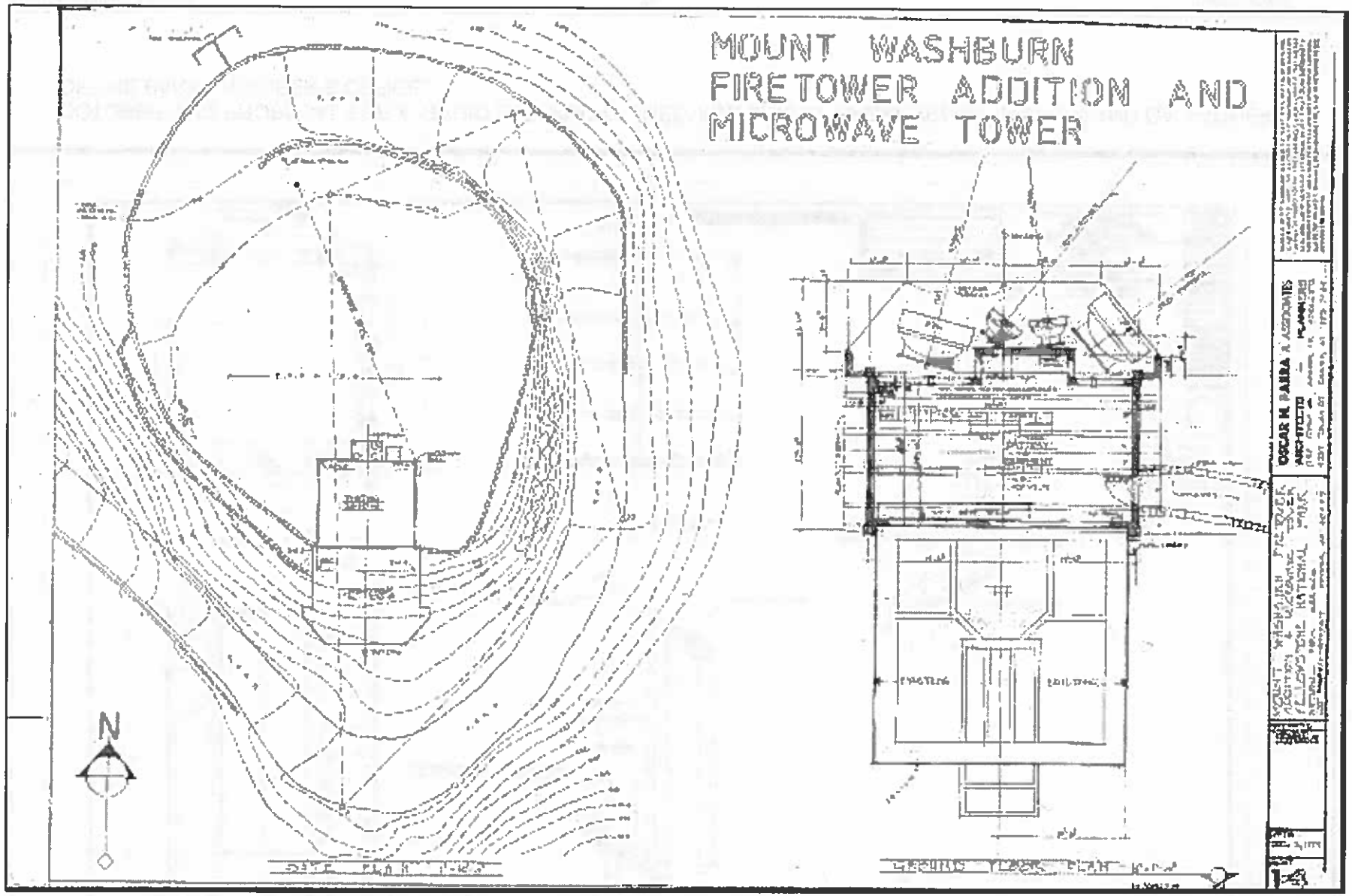


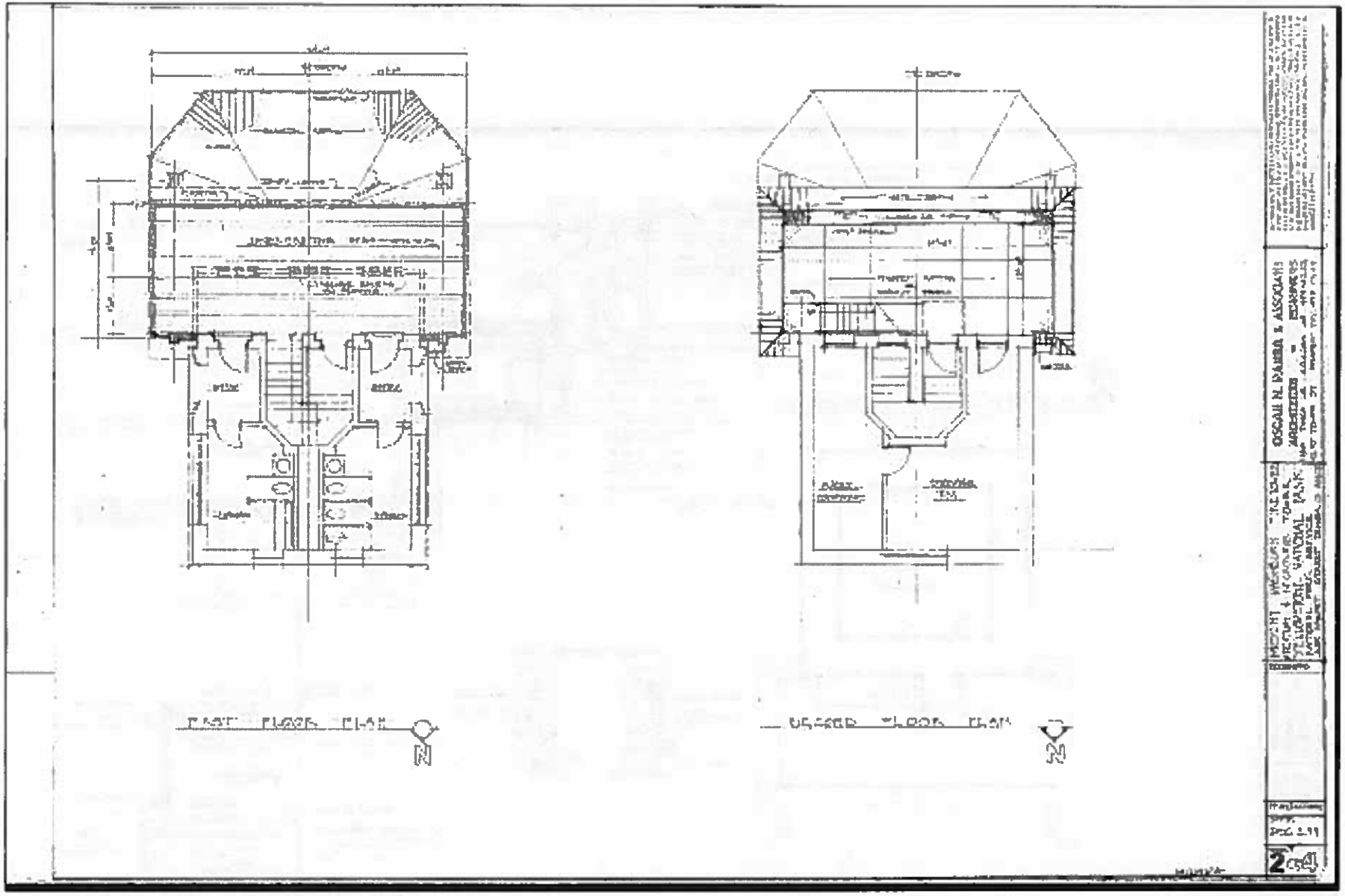


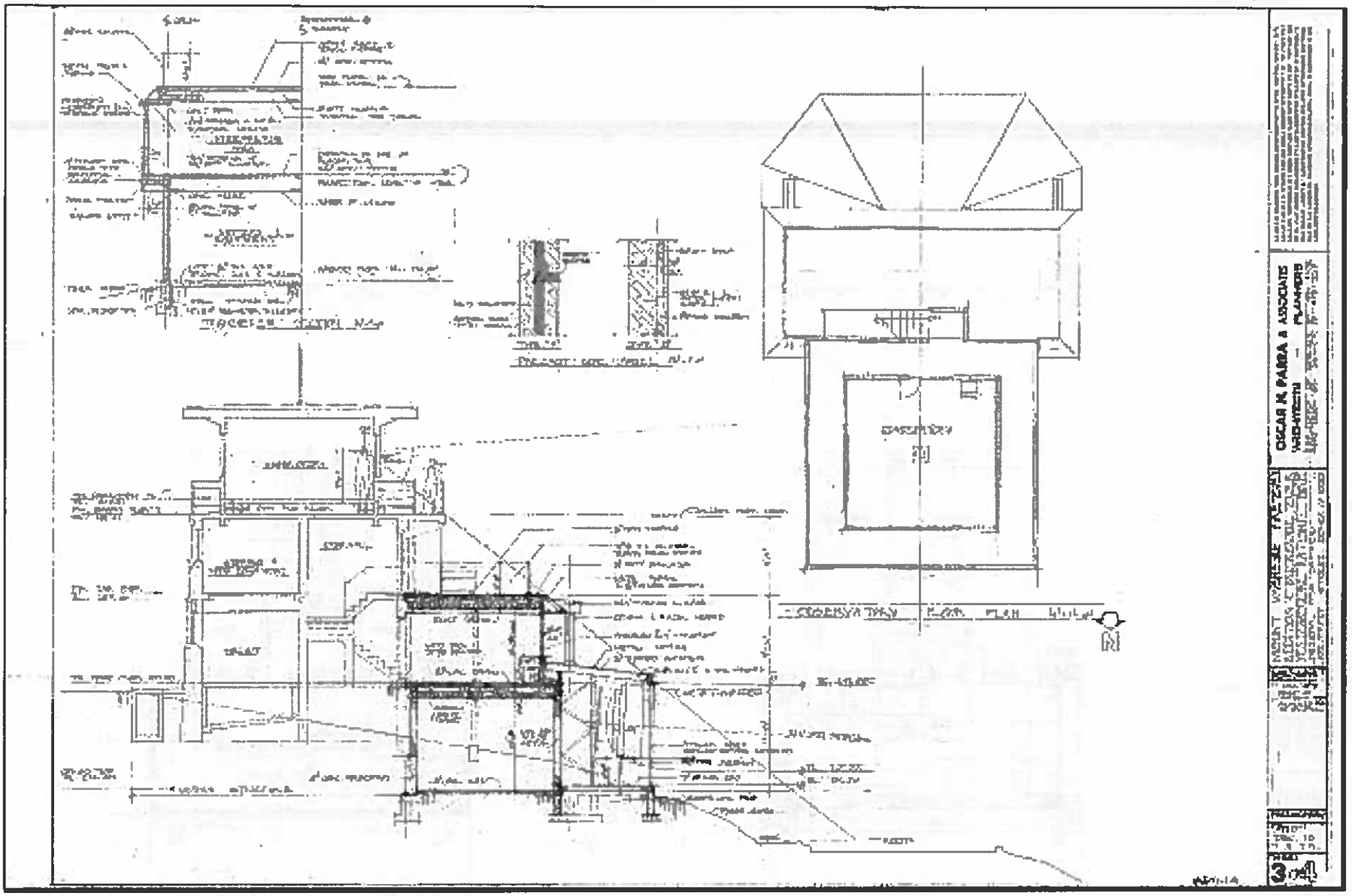
DETAILS FROM THE BLUEPRINT ILLUSTRATED ON PAGE 24.

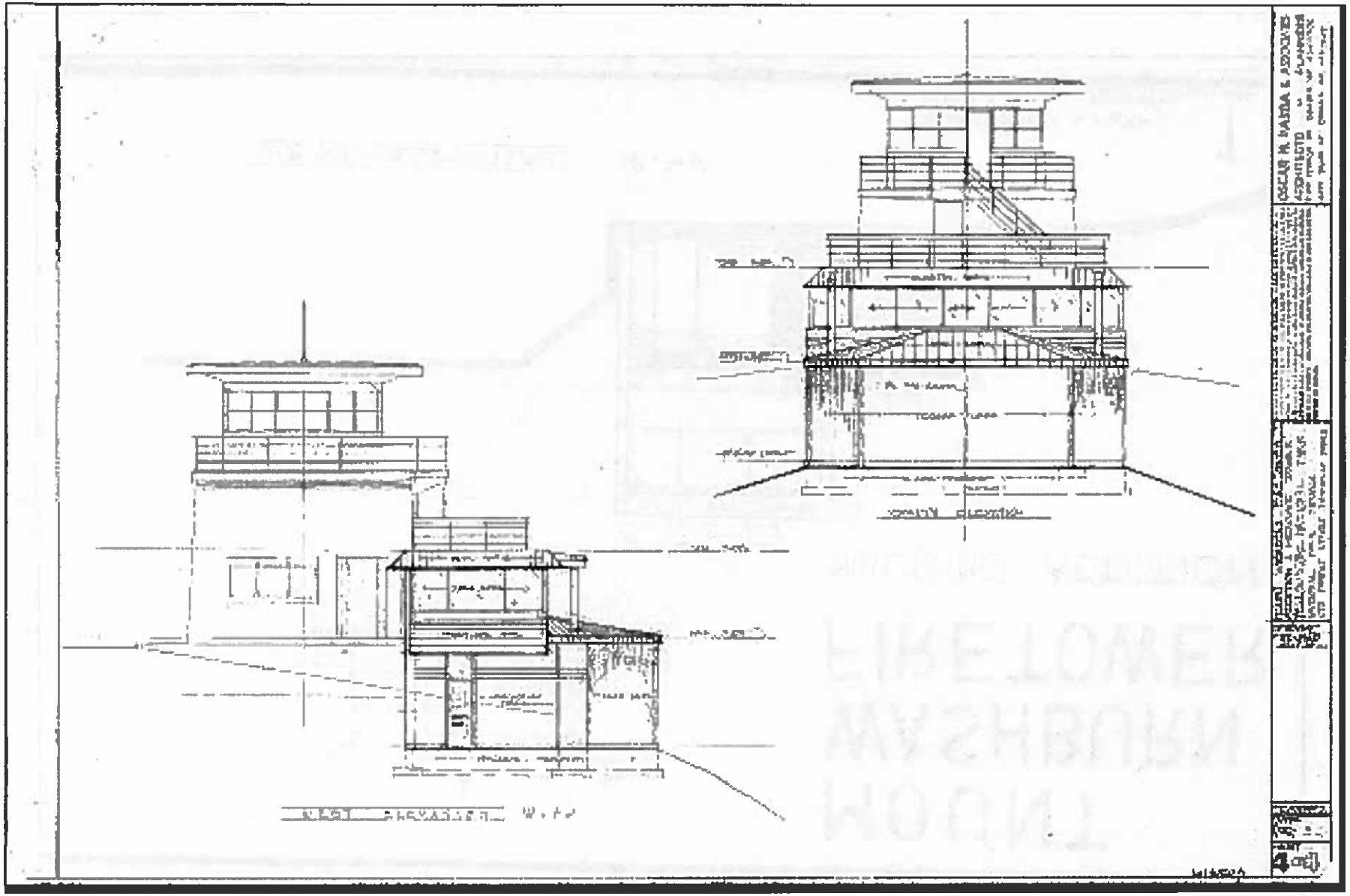


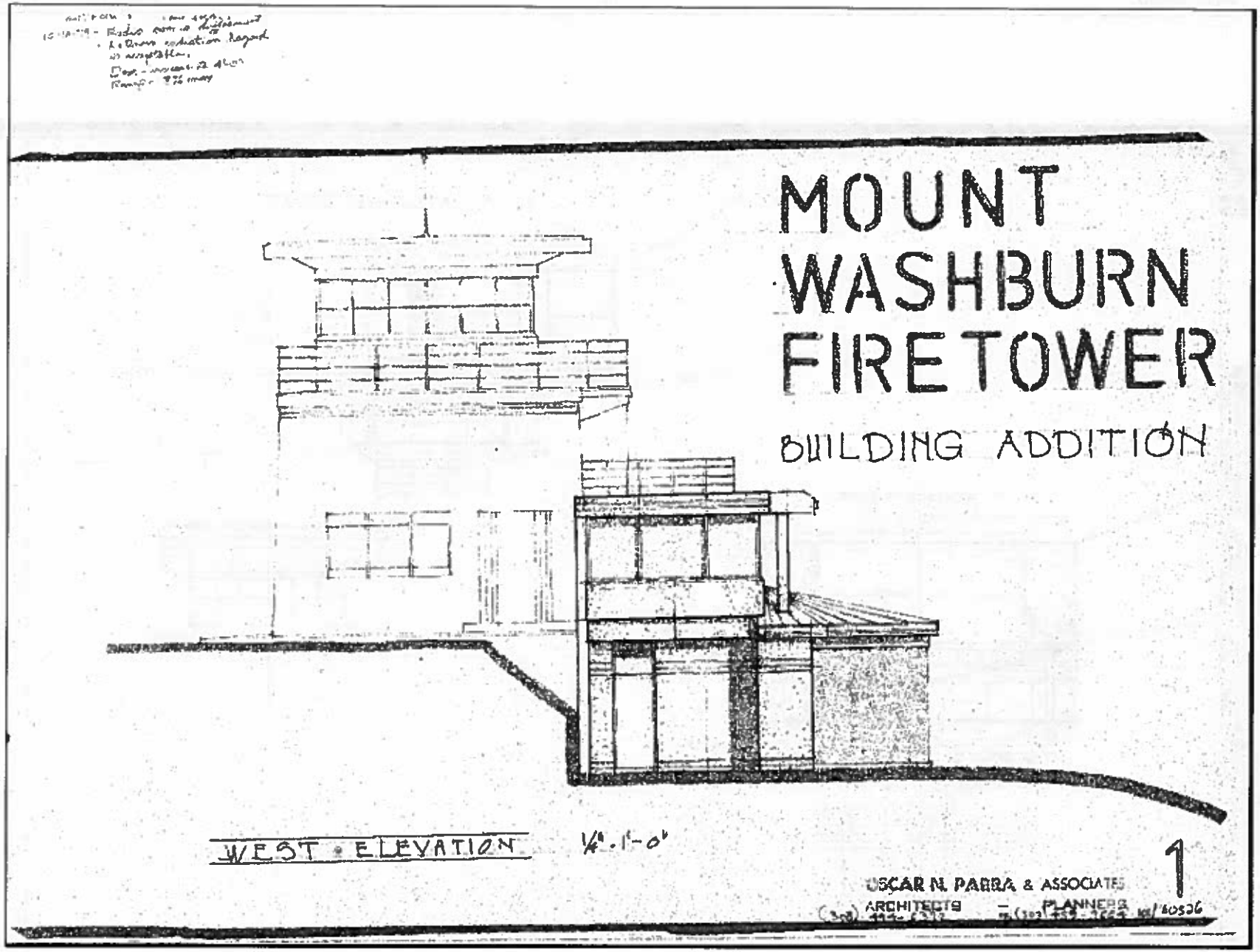
OCTOBER 1962 PROPOSAL FOR A 'RADIO EQUIPMENT SHED' FOR MOUNT WASHBURN BY 'COTTEN AND GALLAGHER' OF THE PARK ENGINEER'S OFFICE.


MOUNT WASHBURN
FIRETOWER ADDITION AND
MICROWAVE TOWER
N








MOUNT
WASHBURN
FIRETOWER
BUILDING ADDITION
WEST • ELEVATION
1/4"-1'-0"
1
OSCAR N. PARRA & ASSOCIATES
ARCHITECTS — PLANNERS

CONDITION ASSESSMENT

Building materials were assessed on site in regard to condition. A rating method and priority system was used for assessing the condition of materials and is described as follows:

Materials Rating System

1. *Historic Material - Preserve (in place)*
2. *Historic Material - Preserve wherever possible; replace with in-kind*
3. *Historic Material - Preserve wherever possible; replace with compatible*
4. *Preserve where there is no reason for removal*
5. *Remove/alter/replace (sensitively)*
6. *Specified treatment not required*

Priority Rating System

Critical *- Requires immediate action to preserve essential historic features and materials experiencing advanced deterioration, or to assure the stability of the building, or to preclude a threat to health or safety.*

Serious *- Materials or assemblies are approaching an advanced state of degradation, or will soon pose a threat to health or safety.*

Minor *- Degradation is minimal and preventative maintenance has not been followed; life expectancy of the material is reduced.*

Evaluation Methodology

- The building was measured with tape measures and hand held devices; measurements were compared with drawings that were done for a 1980 addition to the structure that are on-file with NPS.
- Materials on site were compared with the historic development of construction methods, materials, and technology as developed by architectural, engineering, and preservation disciplines.
- Historic documentation and significance of the structure was reviewed to provide a basis for evaluation and to understand the importance of on-site materials, assemblies, and systems.
- The structure was photographed in its current condition.
- Visual observations of defects were made and incorporated into this report.
- Assemblies that have failed or are approaching failure were recorded photographically.
- Representative structural calculations were done for typical supporting members to confirm their adequacy for continued use. The building was evaluated for resistance to earthquake forces.
- Building codes were reviewed to assess safety for occupancy and the general public; the review includes consideration for potential future uses as well as current uses.
- All documentation discovered while doing research for the facility was reviewed and incorporated in the preparation of this report, including partial drawings of the 1980 addition.

Historic Building Materials and Assemblies

Site and Site Elements: The impact of this site on the visitor is profound; the elevation of Mount Washburn, expansive views of the surrounding Park, distant views into the states of Idaho, Montana, and Wyoming from the Federal Reserve, and the immediacy of the severe high altitude weather is notable.

The site could be characterized as high mountain steppe terrain that includes high altitude varieties of ground cover, scree slopes, and outcroppings of rock features that stretch upward to the irregular cone shaped peak. Fingers and pockets of timber populate ravines and hollows in the flank of the mountain but stop short of reaching the crown of Mount Washburn.

The site has been accessed by visitors and used by NPS over a significant period of time. In 1903-04 park superintendent Hiram Chittenden spearheaded construction of a road that traversed the Mount Washburn peak. The road is no longer in use. Remnants of the historic Chittenden road follow a ridgeline downward to the southwest from the crown of the mountain, and also circuitously wrap around exposed

faces of the north flank of the peak as it continues on to the timbered park floor below. Portions of the historic road across the north face are currently used by service vehicles that bring supplies to the lookout and also do maintenance on the lookout facility.

The final pitch of road to the top of the peak spirals upward from the Chittenden road immediately below and terminates in an irregular circular parking area on top of the peak. The top of the mountain has been leveled to receive this parking area and to create a base for construction of the fire lookout structure. The access drive was constructed with dry-set stone retaining walls along the outer perimeter of the circular spiral; this stonework likely dates to the time of construction of the Chittenden road. Dry-set stone also surrounds the parking area and forms a natural curb for the paved parking surface.

Public use of the site is currently restricted to pedestrian access and remnants of the Chittenden road serve as a trail for those visitors.

Chittenden road, the volute shaped final pitch of road, and the parking area all have historic significance and associations related to this report; however, incorporation of those features is beyond the scope of this HSR.

Communication assemblies attached to the structure or built near the structure were considered to be non-historic and transient in nature for purposes of this report.

This report evaluated drainage at the perimeter of the lookout structure and the condition of built site features that are attached to the structure.

Although perimeter drainage is low-slope around north, east, and west sides of the building the slopes are positive and negative drainage problems were not noted. Grade access to the lower level antenna structure attached to the south side of the lookout is across natural rock terrain and therefore difficult to evaluate for drainage. Any accumulation of water at these locations could be addressed with minimal site disturbance.

Attached site features are limited to the sanitary waste manholes at the north wall of the 1939 tower. Cast iron manhole covers are embedded into a reinforced concrete slab that covers the waste chamber below.

EXTERIOR MATERIALS

Concrete: Reinforced concrete was selected as the primary material to be used for construction of the 1939 fire lookout. Concrete was used for all sub-surface supporting elements including footings and stem walls, slabs-on-grade at the first floor of the facility, suspended slabs at the 2nd and 3rd floors, battered bearing walls at all (4) sides of the structure, interior stairhall, and partial height wainscot walls around the uppermost fire observation tower. The condition of the exposed concrete at the lookout is of primary concern; **numerous instances of deterioration were documented and it is believed that the deterioration is accelerating.** Soundings of the concrete were taken during visits to the site and additional research was done during preparation of this report. Results of the field and office investigations regarding the 1939 concrete is discussed in detail in appendix 'B'.

Reinforced concrete was also used for the footings, piers, grade beams, and stem walls that supports the 1980 addition that houses the communication antenna and related equipment.

Reinforcing Steel: Photographs taken during construction of the 1939 lookout show steel reinforcing being installed throughout the structural elements supporting the facility. Based on the time period, reinforcing steel is believed to be Grade 40 material and deformations on the steel would be in compliance with ASTM standards.

Precast Concrete: The superstructure of the 1980 addition was constructed with precast beams, columns, and tees. These members were designed by *Oscar N. Parra & Associates; Architects & Planners, Boulder, Colorado* and the drawings are dated December 3, 1979 (rev. 12/10/79). This design is of recent origin and it is likely that detailed information about material properties exist in the files of the designer and NPS may also have copies of that information in internal databases. Generally, precast concrete of this generation was

designed around compressive strengths in the range of 4500 – 7000 PSI, required controlled mechanical vibration in a shop fabrication environment, was cast in metal formwork to achieve a smooth finish, and was air-entrained. The spans of beams and girders at the lookout are relatively short and would not generally require pre-stressing or post-tensioning; these assumptions could be confirmed by review of original specifications.

These members were not explored in greater detail because (a) they are not historic materials, and (b) they are in excellent condition (where visible).

The materials will be 50 years of age in another 19 years; it is **recommended that NPS verify or acquire specifications of the precast materials that could be useful during future evaluations.**

Stone: Dry-set angular stone is used extensively for retainage structures that define the driveways and parking area at the top of Mount Washburn. The origins of the stone have not been documented but it is assumed that it was collected from the immediate area. Individual stones are of intermediate size (averaging 16" to 20" in length) and are very angular and irregular. They are stacked flat (or as flat as possible) with overlapping joinery and the retaining walls are slightly battered. Coloration includes various shades of grey, mauve, russet, and dark shades of reddish ochre.

Steel outlet pipes can be seen penetrating out of the retaining walls at lower elevations along the circular access drive. It is not known if these are active or abandoned, if they are related to the parking area, or if they have a different purpose.

Small sections of the retainage structures have failed along the access drive and at the perimeter of the parking area. **Although beyond the scope of this report, it is recommended that the deficient walls be re-built to match the appearance of the intact walls.**

Roofing Materials: There are three distinct roofing systems incorporated at the lookout; two of these systems were introduced for the 1980 Communications/Interpretive addition.

System 1: The original (nearly) flat overhanging roof over the uppermost lookout area was built in 1939 and maintains the shape and profile of the original design. It is likely that the roof surfacing has been replaced in the intervening 71 years; however, this particular roof was unable to be reviewed during visits to the site. Ladders of sufficient length were not transported to the site and on-site equipment was limited. **It is recommended that NPS Maintenance Records be reviewed to gain more complete understanding of this roof covering system.**

System 2: A combination roof covering / walking surface was installed above the interpretive area in 1980. It serves to protect the enclosed interpretive area below and to also provide visitors with an upper deck outdoor viewing area above the interpretive area. The 1980 drawings that were reviewed describe a composite assembly for this system that included a contractor option for either an elastic roofing membrane or asphalt blocks to be installed above the precast 'T' structural members, and topped by a 2 1/2" section of concrete walking surface. The concrete walking surface has been painted with concrete topping paint. There are minor cracks in the corners of this deck adjacent to anchors for the perimeter railing system. The remainder of the deck visually appears to be in good condition. **It is recommended that the cracks be repaired and that the deck be re-coated.**

System 3: The outer perimeter of the viewing deck (described above), and the roof over the communication antenna room attached to the lower level of the south side of the lookout are roofed with sloped metal roof materials installed over wood framing members. Specific deficiencies were not noted at these roof areas.

Metal Gutters and Accessories: None noted or recommended.

Structural Steel: Structural Steel was used for the construction of the uppermost overhanging roof of the 1939 Lookout (reference historic photographs). Based on the date of construction, it is believed that the steel is A-7 quality and that bolted connections are the equivalent of ASTM A-307 grade material.

Cast Iron: Limited to manhole covers; it is recommended that these covers with their associated foundry stamps be retained and preserved.

Sheet Metal and Flashings: Sheet metal accessories are limited to components associated with the metal roofing materials that were installed above the perimeter of the interpretive area, roofing over the antenna addition, and recent enclosures installed over the ventilators above upper level windows in the 1939 structure. **The enclosures over the ventilators have lost significant amounts of paint and require new coating.**

A heavy-duty angular joint was added at the intersection of the viewing deck to the original 1939 walls of the tower; it is not known if this was part of the 1980 construction or is a more recent installation. It requires new perimeter sealants and re-painting.

Soffit Materials: The underside of the roof overhang that shelters the balcony of the firewatch is protected by a textured plaster soffit that appears to be original to the 1939 construction.

Roof Sheathing at upper Steel roof: Unknown

Fascia: Three fascia applications occur at the Mount Washburn Fire Lookout:

1. The fascia at the upper overhanging roof of the firewatch is a linear design of (3) shaped sheet metal bands that is believed to be attached to wood supporting nailers below. The linear design is important to the Art-Deco stylistic influence of the tower and is an original design feature. With the exception of (1) bent section it is in generally good condition.

2. The fascias of the lower metal roofs around the perimeter of the interpretive area roof and the communication antenna roof consist of preformed flat metal profiles with a bottom drip (or watershed).

3. Although it is not a traditional application in the sense of fascias defining the edge of overhanging roofs, a form of fascia occurs at the top of the cast-in-place concrete walls that surround the 1939 construction. The fascia was formed to be integral with the concrete walls and consists of a wide projecting band of smooth surface concrete located immediately above a series of (3) narrow linear articulations that were regressed into the plane of the wall. These features underscore the subtle Art Deco stylistic influence of the 1939 tower and are significant design features. Portions of this fascia treatment are in poor condition (see appendix 'B' for further discussion regarding concrete materials). **It is recommended that the concrete articulations be repaired and be preserved.**

Exterior Wood Materials (see separate section for doors): Exterior wood materials are limited to wood covers that have been installed over the original ventilators that occur above lower floor 1939 windows, perimeter casings and frames at doors serving the first floor toilets and second floor utility room, and improvisational plywood infill where windows have been replaced with temporary air conditioners. All original wood covers, casings, and frames are in very poor condition; **it is recommended that they be replaced in-kind.**

The 2nd floor of the 1939 tower originally was used as a place of residence for the fire staff of the lookout. Changing the second floor spaces from residential use to spaces that house electrical / communication equipment (which generates heat) prompted the conversion of the three original window openings to use by portable air conditioners. The quality of materials used to infill the window openings around the perimeter of the air conditioners is not commensurate with other materials used at the exterior of the facility, is a source of maintenance, and is in poor condition. **It is recommended that these openings be re-worked and re-designed using more permanent materials.**

Pipe Railings: There are two generations of pipe railing / guardrails installed at the Lookout:

1. A continuous three-rail pipe railing occurs at all four sides of the balcony walkway that circumnavigates the top floor firewatch; it includes vertical pipe supports at regular intervals, exposed tee and 'u' joinery, and is subtly punctuated by a few tripartite vertical pipe accents at selected locations (see photos).

2. A continuous three-rail pipe railing also forms a guardrail along the three exposed sides

of the exterior viewing area that is located above the interpretive space. Although constructed in 1980, it respects the upper rail design by using similar sizes, materials, and connections. The 1980 railing does not include the Art Deco accents visible at the upper level installation.

Mount Washburn Fire Lookout must comply with IEBC building codes (see code section). **It is recommended that a variance be requested from the building official if guardrail heights vary from heights listed in IEBC.**

Quarry Tile Walkway (upper deck): The exterior balcony / walkway that surrounds the firewatch at the upper level is surfaced with 9x9 square quarry tile. The tile is inset into the concrete surface with a mortar setting bed and tooled mortar joints that are relatively wide. Numerous joints are failing; individual tile remain in good condition. **It is recommended that the mortar joints be cut out and new mortar joints installed that include water resistant additives.**

Windows and Glazing: The windows are original to the date of construction (1939 and 1980 respectively).

1. Windows in the lower two floors of the 1939 section of the Lookout are painted industrial steel sash with divided lites, are operable awning assemblies, and are glazed with hexagonal patterned wireglass. Selected panes of glass are cracked, overspray from exterior coating is evident on some windows, and glazing and perimeter sealant is missing at some locations. Paint on interior wall surfaces that are immediately adjacent to the windows is peeling; this is attributed to failure of window weather stripping and severe temperature variations at these locations.

It is recommended that these windows be rehabilitated and preserved.

2. The windows surrounding the 1939 upper floor firewatch are narrow sightline steel fixed windows with a single horizontal division muntin at mid-height of each window unit. **It is recommended that these windows be rehabilitated and preserved.**

3. Windows in the 1980 interpretive area are fixed glazing in anodized aluminum storefront framing. They are in excellent condition.

Exterior doors: There are (2) wood plank doors serving each of the toilet rooms; they are recessed in alcoves with the door into the women's restroom located in the west alcove and the door to the men's room mirrored in the east alcove. The doors are in good condition.

Entrance doors into the 1980 interpretive area are accessed from these same alcoves with entrance to the interpretive area from both the east and west sides of the north wall of the addition. The doors are contemporary hollow metal doors and frames and are unpatterned slab design.

None of the hardware on exterior doors is ADA compliant; however, the site is not accessible by the public (see comments at ADA section of Building Code division of this report).

Exterior stairs and Ladders: A painted steel stair accesses the upper level of the firewatch from the viewing deck below. It incorporates steel stringers, preformed steel pan treads attached with angle brackets, pipe railing that matches the balcony and viewing deck guardrails, and does not have any risers.

A permanent vertical steel ladder is located on the northwest corner of the 1939 tower. This feature is not original to the 1939 construction and the date of its installation is unknown. It provides a second method of egress for firewatch personnel from the top level of the tower in the event of fire and should be retained.

INTERIOR MATERIALS

The fundamental structure for the 1939 tower is reinforced cast-in-place concrete; the concrete material was exposed in the interior and is the final finish for numerous rooms as outlined below. At selected areas the concrete was further treated by painting, sacking and sealing, or by being coated.

The 1980 addition is primarily a precast concrete structure with an attached wood frame shed roofed space for communication antenna. Applied or furred finishes conceal the precast structure at the interior of the public interpretive / viewing space. Exposed structure, exposed wood framing, and unfinished structural wall materials are visible in the equipment and antenna spaces.

Flooring:

Observation / interpretive area 101- Flooring is painted concrete in serviceable condition.

Interior stair 102– Flooring is natural concrete with a sealer.

Storage 103– Flooring is natural concrete with a sealer.

Toilets 104 & 105- Flooring is painted concrete in serviceable condition.

Utility 201– Flooring is natural concrete with a sealer.

Equipment room 202 – not observed.

Work room 203 – not observed.

Firewatch 301 – carpet.

Ceilings:

Observation / interpretive area 101- The ceiling is naturally finished beveled edge knotty pine paneling. Installation of this material is a recent modification to the 1980 design.

Interior stair 102– Ceiling is natural concrete.

Storage 103–Ceiling is natural concrete.

Toilets 104 & 105- Ceilings are painted plaster and are attributed as being original. The intervening furred space may have been introduced as a means of concealing ventilation and electrical wiring within these two spaces. The ceiling in Men's room 105 was in need of repair and painting at the time data was collected for this report.

Utility 201–The ceiling is painted concrete; numerous cracks (minor) occur in this material and repair and coating is recommended.

Equipment room 202 – The ceiling is furred down with wood framing, is insulated, and is finished with painted gypsum drywall. The date of installation of this assembly is unknown.

Work room 203 - The ceiling is furred down with wood framing, is insulated, and is finished with painted gypsum drywall. The date of the installation of this furred assembly is unknown.

Firewatch 301 –The ceiling of the firewatch space is either painted gypsum drywall or painted plaster in good condition.

Ceilings at remaining spaces within the facility exhibit exposed structure.

Interior Walls: Interior walls of the 1939 tower are austere; they consist of exposed concrete, plaster applied over the concrete, or furred gypsum drywall at selected locations as noted.

Stair (102), Storage (103), Utility (201) – exposed concrete

Firewatch (301), Women's (104), Men's (105) – plaster over substrate

Equipment (202), Work room (203) – furred gypsum drywall

The 1980 interpretive / viewing space features a natural stone veneer wainscot below the anodized glazing noted in the 'windows' paragraph above. It is deployed with the bedding planes of the natural stone applied vertically to the face of the wall in the manner of stone flagged flooring. The north wall of this space is the original exterior wall of the 1939 tower which retains its original form and detailing. It has been painted.

Walls in the lower level Radio Equipment space and Antenna enclosure are exposed structure.

Interior Doors: Two interior doors exist within the structure:

1. The door into the storage room from the interpretive / viewing area is a hollow metal door fitted into a hollow metal frame; it

matches the exterior entrance doors into the interpretive area and is in good condition.

2. The door between the 2nd floor utility space and the equipment room is a door that was replaced (attributed to the change in use of the space from residential to equipment use). General maintenance is warranted but there is no reason to change the door if current space utilization remains as is.

Millwork: None noted.

Cabinetry: Original cabinetry in the facility includes original 1939 storage cabinets and countertops within the 3rd floor firewatch area and a single permanent interpretive sign support in the 1980 interpretive / viewing area. The base of the 1980 sign support is clad in flagstone to match the wainscot materials in the room.

The 1939 cabinetry has been painted (including hardware). It is not known if the cabinets were painted originally but colors are not historic and **it is recommended that the exposed hardware be stripped and the metal finishes restored.**

Of particular significance is the base cabinet for the fire survey instrumentation within the firewatch space. This cabinetry should be preserved and rehabilitated.

Interior Stairs: The interior stairway ascending the 1939 tower connects the 1st and 2nd floors only; access to the 3rd floor firewatch utilizes an exterior stair (see above) and access to lower equipment and antenna spaces is at grade from a stepped down terrace on the site.

The interior stairway is concrete throughout with sealed concrete treads and risers and unfinished walls and ceiling. Laitance is evident on the exterior (south) upper wall as well as the ceiling; **the laitance should be removed and the concrete surfaces sealed.**

Hardware: Except as noted above door and window hardware was not inventoried. Generally, the 1980 hardware all appeared to be in good condition, 1939 door hardware should be rehabilitated or sensitively replaced, and window sash locks should be stripped of paint and made operable. **It is recommended that the hardware for the facility be inventoried.**

Furnishings and Equipment: Moveable furnishings within the firewatch lookout area date from various periods of time since the construction of the facility and it was undetermined if any of the furnishings are original.

Moveable furnishings within the interpretive / viewing space consists primarily of seating benches that are of rustic log design (either half-log benches or shaker style legged benches with log legs). The Zeiss telescope within the space is a significant artifact that should be preserved.

Communications, radio, antenna, and supporting data equipment was not reviewed for purposes of this report.

Exterior Painting: An exterior painting system or coating has been applied to all exposed concrete wall surfaces of the 1939 tower.

Mechanical: Existing mechanical systems include fish water supply (disconnected), aquarium and raceway grey water drainage, and a single circa 1940's cabinet heater in the office area. It is not unreasonable to assume that the heating appliance has reached the end of its useful life and that a more energy efficient appliance could be introduced into the facility. Improvements to energy efficiency could also affect how equipment is sized and utilized (see energy section of this report). Revisions to or additions of water and / or waste systems into the facility is dependant upon the uses that the building will be put to.

Electrical: It is assumed that electrical systems would require total renovation if the building is used for any other purpose other than storage; and, conversely, that the existing systems are adequate for the current storage use. It was noted that most conductors were protected by flex conduit and that the exterior panel is of recent manufacture. It is recommended that grounding of the entire system be investigated.

CONDITION ASSESSMENT - (CONTINUED)
MATERIALS INVENTORY

CAT	LOCATION	ELEMENT	DESCRIPTION	QTY	RTG	COND	PRIORIT	REMARKS
SITE								
Site		Site Landscaping	Alpine turf, stone outcroppings, & scree - all sides of building.		4	natural	Minor	Maintain; enhance
Site		Retaining Walls @ drive & parking	Battered dry-set on-site stone (fragmented)		2	Poor/Fair	Serious	Stabilize selected areas
Site		Site Grading	Adequate drainage at site of Lookout		5	Fair	Minor	
Site		Site - Paths and walks	Primary Pedestrian access to the site uses the service road / drive; evaluation of this road is beyond the scope of this report.					
Site		Site - Paths and walks	YNP trails from the SW & SE also access this site; evaluation of those trails is beyond the scope of this report.					
Site		Site - Parking lot paving	Asphaltic concrete		4	Fair	Minor	
Site		Manholes	Conc manholes w/ cast iron covers		2	Good	Minor	
Site		Stone foundations - historic privvy	Stone masonry w/ fragmented mortar		1	Very Poor	TBD	Preserve
Site		NPS Elevation marker	Wood sign w/ wood post supports		3	Poor	Serious	
Site		Perimeter drains @ parking area	Buried steel drain-pipe		5	Fair	Minor	Further Investigation
STRUCTURE								
Structure		Foundation-1939 Lookout Str	Reinf Conc stem wall		4	Good	Minor	
Structure		Conc entry floor slabs - 1939	Reinforced concrete SOG - unpatterned		2	Good	Minor	Add sealants
Structure		1st Fl interior floor slabs (toilets) 1939	Reinforced concrete - unpatterned		2	Good	Minor	Add sealants
Structure		2nd floor structure - 1939	Conc / Conc joist fl structure		1	Good	Minor	
Structure		3rd floor structure - 1939	Concrete slab over SCT filler (INT)		1	Good	Minor	
Structure		3rd floor structure - 1939	Reinf concrete slab (tile pavers) - EXT		1	Good	Minor	
Structure		Roof structure - 1939	Structural steel beams		1	Good	Minor	
Structure		Exterior bearing walls	Reinf conc (tapered & bush hammered)		2	Poor	Critical	
Structure		Foundation-1960 Interpretive area	Reinf Conc fnd / reinf CMU fnd / conc ftg		4	Very Good		
Structure		2nd floor structure - 1960	Precast Concrete (Twin T's)		4	Very Good		
Structure		Roof structure - 1960 Interpretive area	Precast Concrete (Twin T's)		4	Good		
Structure		Wall structure - 1960	Precast column and beams		4	Very Good		
Structure		Foundation- Equipment encl (1960)	Reinf Conc grade beam / footing		4	Very Good		
Structure		Roof structure - equipment addition	Wood framing / PWD sheathing		4	Good		
Structure		Walls - 1960 Equipment enclosure	Tegtar over steel pipe columns		4	Good		

CONDITION ASSESSMENT - (CONTINUED)
MATERIALS INVENTORY

CAT	LOCATION	ELEMENT	DESCRIPTION	QTY	RTG	COND	PRIORIT	REMARKS
ROOF ASSEMBLY								
	FIREWATCH (3RD FLOOR)							
	Roof	Roof surfacing	Membrane		4	TBD		
	Roof	Sheathing	Unknown - T&G Decking?		4	TBD		
	Roof	Insulation - See Ceiling	Unknown					
	Roof	Fascia	Articulated Metal		2	Fair		Minor
	Roof	Soffit	Stucco		2	Fair		Minor
	Roof	Ventilation covers @ window heads	Contemporary covers		5	Poor		Minor
	Roof	Sealants	Various		5	Poor		Minor
	INTERPRETIVE AREA							
	Roof (flat)	Topping	2" Concrete (concealed) - presumed stable		4	Good		
	Roof (flat)	Coating	Material is unknown		5	Poor		Serious
	Roof (flat)	Sealants	Various		5	Poor		Serious
	Roof (sloped)	Covering	Coated Metal		5	Fair		Minor
	EQUIPMENT ENCLOSURE							
	Roof	Covering	Coated Metal		4	Fair		
EXTERIOR WALLS - NON STRUCTURAL ELEMENTS								
	FIREWATCH (3RD FLOOR)							
	Walls	Lower wall area	Reinf concrete		2	Fair		Minor
		Observation glass - upper wall	Sgl pane glazing in steel frames		1, 2	Good		Minor
		Observation glass - upper wall	Sealants		5	Fair		Minor
		Upper wall ventilation louvers	Unknown (covered)					See above
		Exterior passage door (1)	Wd panel door (half lite)		5	Poor		Serious
	1ST & 2ND FLOORS - 1939							
	Walls	Basic wall area	Reinf conc (tapered & bush hammered)		2	Poor/very poor		Critical
		Windows	Sgl pane glazing in divided lite steel frames		2	Fair to Poor		serious Obscure wireglass
		Infilled windows	Return to original appearance		5	Poor		
		Perimeter of wall penetrations	Various sealants		5	Fair to Poor		serious
		First floor exterior doors to interp (2)	HM doors w/o pattern or glazing		4	Good		
		First floor ext doors to restrooms (2)	Original wd plank doors (w/o glazing)		1	Good		Minor
	LOWEST FLOOR - 1980							

CONDITION ASSESSMENT - (CONTINUED)
MATERIALS INVENTORY

CAT	LOCATION	ELEMENT	DESCRIPTION	QTY	RTG	COND	PRIORIT	REMARKS
Walls		East & West exposure	Smooth finish concrete (reinforced)		4	Good		Sealer
		Exterior entry door	HM door w/o pattern or glazing		4	Good	Minor	Paint
1ST FLOOR - 1980 (INTERPRETIVE AREA)								
Walls		Lower wall area	Precast concrete		4	Good		
		Observation glass - upper wall	Sgl pane glazing in aluminum frames		4	Good		
		Observation glass - upper wall	Sealants (Silicone)		4	Good		
EQUIPMENT ENCLOSURE								
Walls		Vinyl membrne	Teglar		4	Good		
INTERIOR								
B1-SIGNAL AREA								
Interior		Ceiling	Exposed wood framing		4	Unknown		
		N. Wall	Exposed CMU		4	Unknown		
		E. Wall	Teglar (interior side)		4	Unknown		
		W. Wall	Teglar (interior side)		4	Unknown		
		S. Wall	Teglar (interior side)		4	Unknown		
		Base	None					
		Flooring	Gravel		4	Unknown		
		Door(s)	AP into Battery / Equipment area		4	Unknown		
		Casing & Trims	None					
		Vapor Barrier	None					
		Ceiling Insulation	None					
B2-BATTERY / EQUIPMENT RM								
Interior		Ceiling	Exposed Structure		4	Good		
		N. Wall	Exposed conc / CMU		4	Good		
		E. Wall	Exposed conc		4	Good		
		W. Wall	Exposed conc		4	Good		
		S. Wall	Exposed CMU		4	Good		
		Base	None					
		Flooring	Exposed Concrete SOG		4	Good		
		Exterior Door	(See exterior walls)					
		Casing & Trims	None					
		Vapor Barrier	None					
		Ceiling Insulation	Blanket insulation		4	Good		

CONDITION ASSESSMENT - (CONTINUED)
MATERIALS INVENTORY

CAT	LOCATION	ELEMENT	DESCRIPTION	QTY	RTG	COND	PRIORIT	REMARKS
101-OBSERVATION / INTERPRETIVE AREA								
Interior		Ceiling	Beveled edge wood - natural finish		4	Very Good		
		N. Wall	Reinf conc (ptd) / storefront w/ stone WC		4	Very Good		
		E. Wall	Alum storefront w/ flagged stone wainscot		4	Very Good		
		W. Wall	Alum storefront w/ flagged stone wainscot		4	Very Good		
		S. Wall	Alum storefront w/ flagged stone wainscot		4	Very Good		
		Base	None					
		Flooring	Concrete (painted)		4	Poor	Minor	re-paint
		Exterior Doors (2)	See exterior walls above					
		Interior door to Storeroom 103	HM door w/o pattern or glazing		4	Good		
		Casing & Trims	None - preserve linear decorative Deco dtls					
		Vapor Barrier	Unknown					
		Ceiling Insulation	Fiberglass batt insulation		4	Good		
		Stone base for interpretive sign	Clad w/ flagged stone		4	Good		
		Viewing feature	Zeiss-Ikon telescope		1	Good		
		Miscellaneous furniture	Wood seating - log & plank		4	Fair		
102-STAIR								
Interior		Ceiling	Board formed concrete		2	Fair	Minor	Clean & seal
		N. Wall	Concrete (smooth; sacked)		1	Good	Minor	
		E. Wall	Concrete (smooth; sacked)		1	Good	Minor	
		W. Wall	Concrete (smooth; sacked)		1	Good	Minor	
		S. Wall	Concrete (smooth; sacked)		1	Good	Minor	
		Base	None					
		Flooring	Concrete (smooth; sacked) T & R		1	Good	Minor	
		Exterior Door (@ upper level exit)	(See exterior walls)					
		Casing & Trims	None					
		Vapor Barrier	None					
		Ceiling Insulation	None					
103-STORAGE								
Interior		Ceiling	Board formed concrete		1	Good		
		N. Wall	Board formed concrete		1	Good		
		E. Wall	Board formed concrete		1	Good		
		W. Wall	Board formed concrete		1	Good		
		S. Wall	Board formed concrete		1	Good		
		Base	None					

CONDITION ASSESSMENT - (CONTINUED)
MATERIALS INVENTORY

CAT	LOCATION	ELEMENT	DESCRIPTION	QTY	RTG	COND	PRIORIT	REMARKS
		Flooring	Concrete (smooth)	1		Good	Minor	Clean & seal
		Interior Door (see room 101)	(See exterior walls)					
		Casing & Trims	None					
		Vapor Barrier	None					
		Ceiling Insulation	None					
104-WOMEN								
Interior		Ceiling	Plaster	1		Good		
		N. Wall	Concrete (painted)	1		Good		
		E. Wall	Concrete (painted)	1		Good		
		W. Wall	Concrete (painted)	1		Good		
		S. Wall	Concrete (painted)	1		Good		
		Base	Concrete (painted)	1		Good		
		Flooring	Concrete (painted)	1		Good		
		Entry Door (see ext wall descriptions)						
		Casing & Trims	None					
		Vapor Barrier	None					
		Ceiling Insulation	None					
		Manhole cover	Patterned cast iron	1		Good		
		Plumbing fixtures	Formed metal WC's	4		Fair	Minor	
		Windows	Ind steel sash w/ obscure wireglass	1		Poor	Critical	
		Window sealant	Various	5		Very Poor	Critical	
105-MEN								
Interior		Ceiling	Plaster	1		Good		
		N. Wall	Concrete (painted)	1		Good		
		E. Wall	Concrete (painted)	1		Good		
		W. Wall	Concrete (painted)	1		Good		
		S. Wall	Concrete (painted)	1		Good		
		Base	Concrete (painted)	1		Good		
		Flooring	Concrete (painted)	1		Good		
		Entry Door (see ext wall descriptions)						
		Casing & Trims	None					
		Vapor Barrier	None					
		Ceiling Insulation	None					
		Manhole cover	Patterned cast iron	1		Good		
		Plumbing fixtures	Formed metal WC; Cast Urinal	4		Fair	Minor	

CONDITION ASSESSMENT - (CONTINUED)
MATERIALS INVENTORY

CAT	LOCATION	ELEMENT	DESCRIPTION	QTY	RTG	COND	PRIORIT	REMARKS
		Windows	Ind steel sash w/ obscure wireglass		1	Poor		Critical
		Window sealant	Various		5	Very Poor		Critical
201-ENTRY & UTILITY								
Interior		Ceiling	Board formed concrete (reinf & painted)		2	Fair		Serious
		N. Wall	Board formed concrete (reinf & painted)		2	Fair		Serious
		E. Wall	Board formed concrete (reinf & painted)		2	Fair		Serious
		W. Wall	Board formed concrete (reinf & painted)		2	Fair		Serious
		S. Wall	Board formed concrete (reinf & painted)		2	Fair		Serious
		Base	None					
		Flooring	Concrete		1	Fair		Minor
		Ext Door	See exterior wall descriptions					
		Casing & Trims	None					
		Interior Door	HM door and frame		4	Good		Minor
		Vapor Barrier	None					
		Ceiling Insulation	None					
202-EQUIPMENT COMM ROOM								
Interior		Ceiling	GPDW over wood furred framing		4	Good		
		N. Wall	GPDW over wood furring		4	Fair		Minor
		E. Wall	GPDW partition		4	Fair		Minor
		W. Wall	GPDW over wood furring		4	Fair		Minor
		S. Wall	GPDW over wood furring		4	Fair		Minor
		Base	WP series wood moldings		5	Fair		
		Flooring	Concrete		1	Good		
		Casing & Trims	WP series wood moldings		5	Fair		Minor
		Interior Door	Wd door frame; door removed		4	Fair		Minor
		Vapor Barrier	Unknown					
		Ceiling Insulation	Fiberglass blanket		4	Unknown		
203-WORK / STORAGE ROOM								
Interior		Ceiling	GPDW over wood furred framing		4	Good		
		N. Wall	GPDW over wood furring		4	Fair		Minor
		E. Wall	GPDW partition		4	Fair		Minor
		W. Wall	GPDW over wood furring		4	Fair		Minor
		S. Wall	GPDW over wood furring		4	Fair		Minor
		Base	WP series wood moldings		5	Fair		

CONDITION ASSESSMENT - (CONTINUED)
MATERIALS INVENTORY

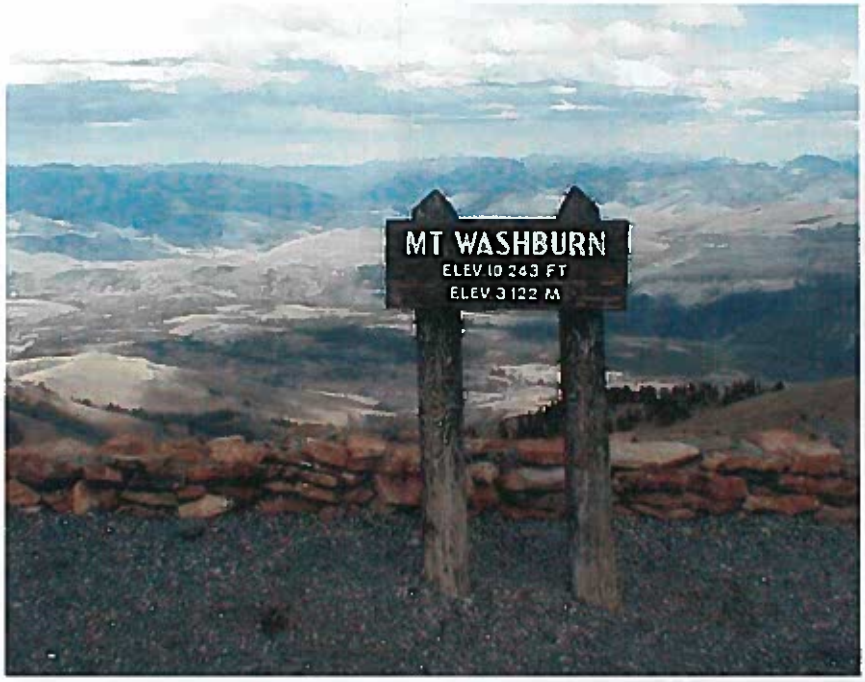
CAT	LOCATION	ELEMENT	DESCRIPTION	QTY	RTG	COND	PRIORIT	REMARKS
		Flooring	Concrete	1		Good		
		Casing & Trims	WP series wood moldings	5		Fair		Minor
		Interior Door	Wd door frame; door removed	4		Fair		Minor
		Vapor Barrier	Unknown					
		Ceiling Insulation	Fiberglass blanket	4		Unknown		
204-VIEWING DECK								
Exterior		Walking / viewing surface	Membrane coating over conc topping	5		Fair		Serious
		Perimeter railing	Steel pipe railing system	4		Good		Minor
		Miscellaneous antenna	Recommend consolidation / removal					
301-FIREWATCH								
Interior		Ceiling	Plaster / GPDW	2		Good		
		N. Wall	Conc (ptd) wainscot & Glass	1		Fair		Minor
		E. Wall	Conc (ptd) wainscot & Glass	1		Fair		Minor
		W. Wall	Conc (ptd) wainscot & Glass	1		Fair		Minor
		S. Wall	Conc (ptd) wainscot & Glass	1		Fair		Minor
		Base	None					
		Flooring	Carpet	5		Poor		Minor
		Casing & Trims	None					
		Vapor Barrier	Unknown					
		Ceiling Insulation	Unknown					
STEEL STEPS/STAIRS TO FIREWATCH LEVEL								
Access/exit		Exterior Stairway	Steel treads; open riser; channel stringers	2		Good		Minor
		Exterior stairway	Steel pipe railing	2		Good		Minor
LATERAL FORCE RESISTING SYSTEM								
Structure		(See Structural Commentary)						
HARDWARE								
Hardware	Public Entry Drs	Hinges; latchset; kickplate	Circa 1980; round rose	4		Good		ADA N/A
	Toilet rm doors	Hinges; latchset; kickplate	Circa 1939; mortise	5		Poor		Minor
	Closet door	Hinges; latchset	Circa 1980; round rose	4		Good		
	Upper stair dr	Hinges; latchset; closer	Replacement; round rose	5		Poor		Serious
	2nd fl entry dr	Hinges; latchset	Replacement; round rose	5		Poor		Serious

CONDITION ASSESSMENT - (CONTINUED)
MATERIALS INVENTORY

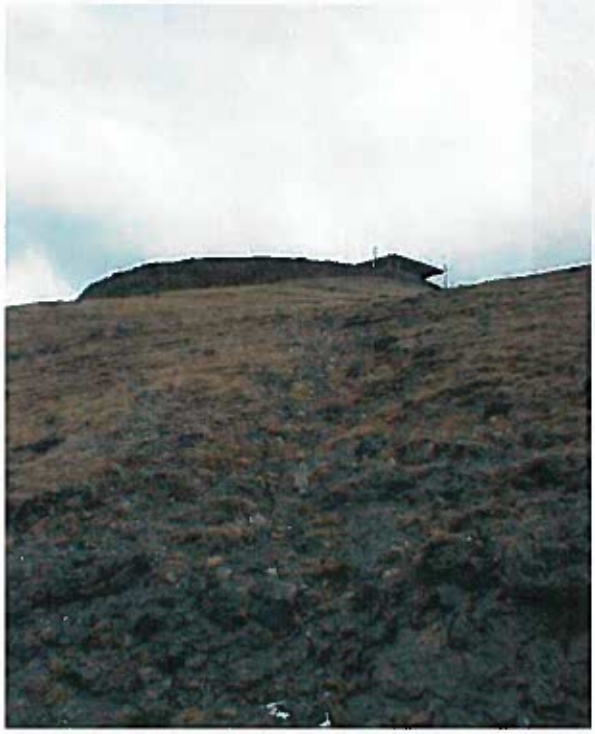
CAT	LOCATION	ELEMENT	DESCRIPTION	QTY	RTG	COND	PRIORIT	REMARKS
	2nd fl int dr	Hinges; latchset						
	Firewatch dr	Hinges; latchset	Circa 1939; escutcheon w/ cylinderlock	5		Poor		Serious
	Entry-tower equip	Hinges; latchset	Circa 1980; round rose	4		Good		
MECHANICAL								
Mech	Toilet ventilation	Ductwork & fan	GI round ducts	4		Fair		Minor
	Waste	Collection cesspool	Original design; waste pumped by NPS	4		Good		
	AC for Comm	Temporary window units	Adapted; improvisational installation	5		Poor		Serious
ELECTRICAL								
Elec	Service	Underground - unknown		TBD				
	Distribution	Lighting & Power	Concealed (1980); exp conduit elsewhere	TBD				
SECURITY								
Security		Security system	None	TBD				
FIRE DETECTION / EXTINGUISHING SYSTEMS								
Fire		Fire Detection	None noted	TBD				
		Fire Alarm	None noted	TBD				
		Fire Extinguishers	None noted	TBD				
		Emergency lighting	None noted	TBD				
ERRATTA								
Protection		Lightning arrestor	None noted	TBD				

CURRENT PHOTOGRAPHS

SITE

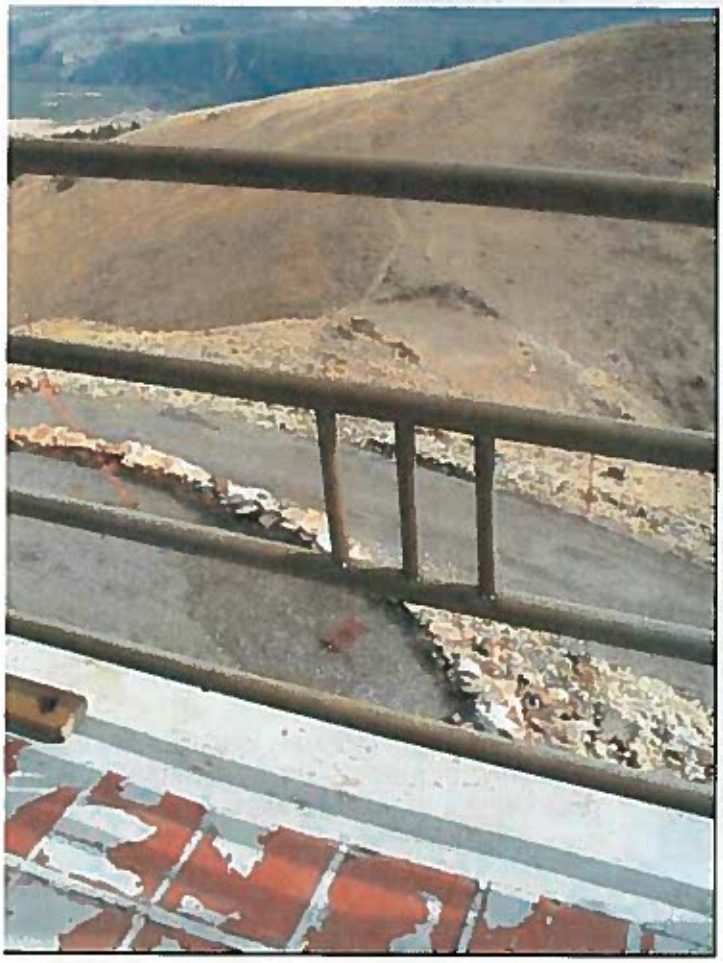


LOOKING NORTH FROM THE NORTH END OF THE PAVED PARKING AREA. Photo credit: Herb Dawson, NPS.



FINAL APPROACH TO MOUNT WASHBURN FIRE LOOKOUT WITH THE DRY – SET STONE RETAINING WALL SURROUNDING THE PARKING AREA.
Photo credit: Ken Sievert.

VIEW SOUTH FROM LOOKOUT. A PORTION OF THE HISTORIC CHITTENDEN ROAD IS VISIBLE. Photo credit: Herb Dawson, NPS.



DETAIL OF ACCESS ROAD AND STONE RETAINING WALLS AS SEEN FROM THE TOP OF THE LOOKOUT. NOTE DRAIN INLET IN PAVEMENT (LOWER CENTER OF PHOTO). Photo credit: Herb Dawson, NPS.

BREACH IN NW CORNER OF RETAINING WALL AROUND PARKING AREA; NOTE STEEL PLATES AND ANCHOR BOLTS IN CENTER OF WALL. Photo credit: Herb Dawson, NPS.

VIEW OF SECTION OF FAILED RETAINING WALL FROM ABOVE. Photo credit: Herb Dawson, NPS.

TYPICAL STONE RETAINAGE STRUCTURE; A STEEL DRAIN PIPE IS VISIBLE IN THE CENTER RIGHT PART OF THE PHOTO. Photo credit: Herb Dawson, NPS.

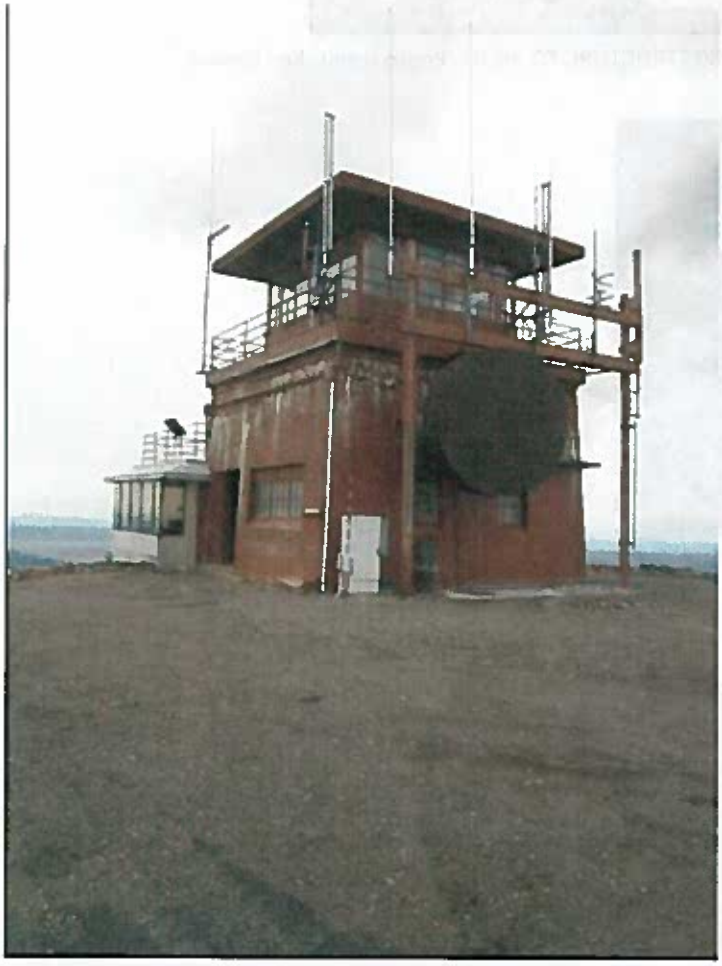
GENERAL VIEW OF THE LOOKOUT AT THE SOUTH END OF THE PARKING AREA. YELLOWSTONE LAKE IS VISIBLE IN THE LEFT BACKGROUND. Photo credit: Herb Dawson, NPS.

EXTERIOR

WEST ELEVATION – 1939 STRUCTURE TO LEFT; 1980 STRUCTURE TO RIGHT. Photo credit: Ken Sievert.

SOUTH ELEVATION – ALL 4 LEVELS OF THE COMPLEX CAN BE SEEN IN THIS PHOTO; FROM BOTTOM TO TOP: 1. 'TEGLAR' WRAPPED EQUIP FLOOR; 2. ENCLOSED INTERPRETIVE FLOOR; 3. OUTDOOR VIEWING DECK; 4. FIREWATCH (TOP LEVEL). Photo credit: Ken Sievert.

EAST ELEVATION – 1980 STRUCTURE TO LEFT; 1939 STRUCTURE TO RIGHT. Photo credit: Ken Sievert.



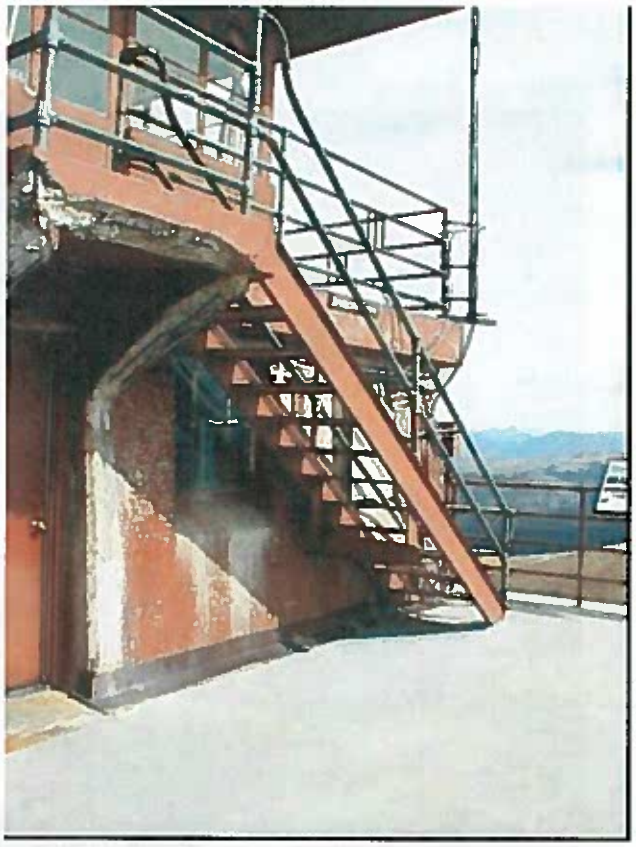
NORTH ELEVATION –TYPICAL VIEW FROM THE PARKING AREA ON TOP OF THE SUMMIT OF MOUNT WASHBURN. THE IMPACT OF ANTENNA & EQUIPMENT FOR COMMUNICATIONS IS VISIBLE IN THIS PHOTO. Photo credit: Herb Dawson, NPS.

EXTERIOR DETAILS

PARTIAL ELEVATION – EAST SIDE. ACCESS INTO THE EQUIPMENT ROOM BELOW THE INTERPRETIVE/ VIEWING AREA IS AT THE LOWER LEFT. Photo credit: Herb Dawson, NPS.

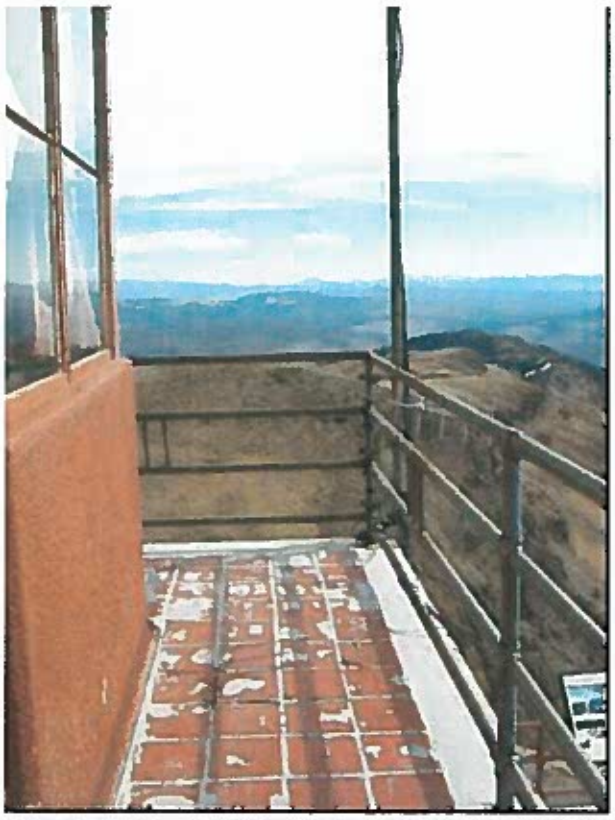
CLOSE UP VIEW OF THE GLAZED PERIMETER OF THE PUBLIC VIEWING/INTERPRETIVE SPACE LOCATED ON THE GRADE LEVEL OF THE PARKING AREA FOR THE FACILITY. Photo credit: Herb Dawson, NPS.

SOUTHWEST CORNER – COMMUNICATIONS DEVICES ARE ORIENTED TO SPECIFIC LOCATIONS IN THE SW QUADRANT OF THE PARK. Photo credit: Ken Sievert.



THE STEEL EXTERIOR STAIR FROM THE VIEWING DECK TO THE FIREWATCH AT THE TOP FLOOR OF THE LOOKOUT. Photo credit: Ken Sievert

EXTERIOR DETAILS – NORTH ELEVATION IS PARTIALLY OBSCURED BY ANTENNA, MICROWAVE RECEIVERS, AND THEIR SUPPORTS. Photo credit: Herb Dawson, NPS.



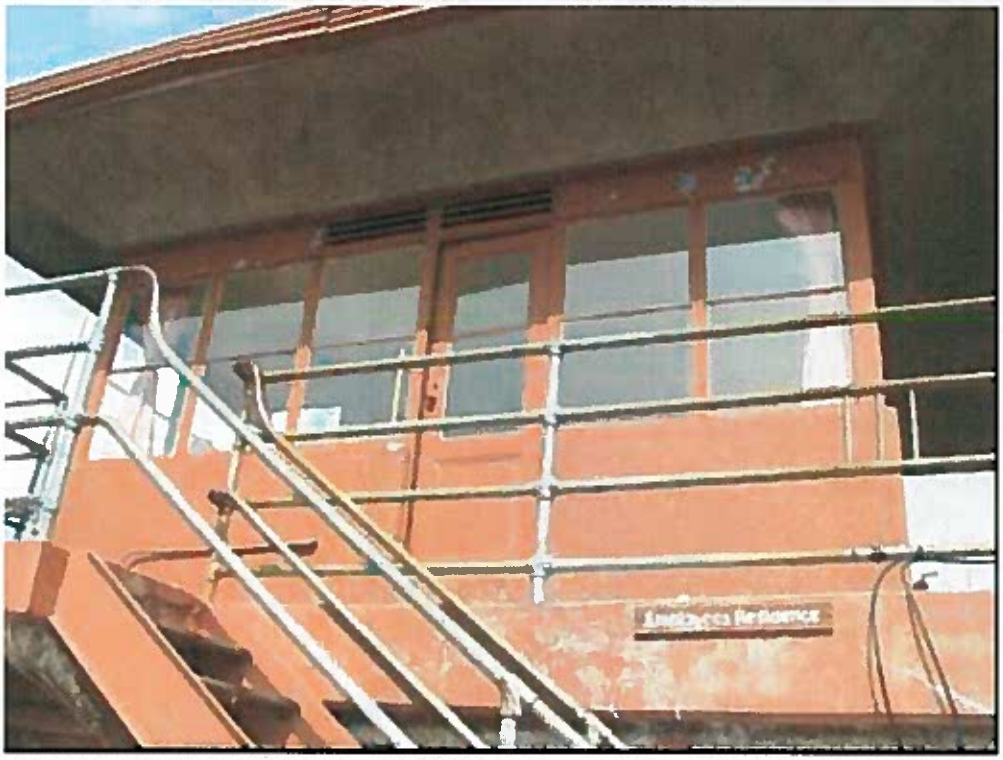
TWO VIEWS OF THE PROMENADE WALKWAY SURROUNDING THE FIREWATCH AT THE TOP FLOOR OF THE STRUCTURE. NOTE THE SUBTLE STREAMLINED MODERN DECORATIONS IN THE RAILING. Photo credits: Herb Dawson, NPS.

DETAIL OF TILE SURFACING AT PROMENADE SHOWING CURRENT DEFICIENCIES IN THE GROUTING AND MORTAR SETTING MATERIALS. Photo credit: Herb Dawson, NPS.

STREAMLINED MODERN "SPEED LINES" IN THE CONCRETE AT THE TOP OF THE BATTERED WALLS OF THE 1939 STRUCTURE. Photo credit: Herb Dawson, NPS.

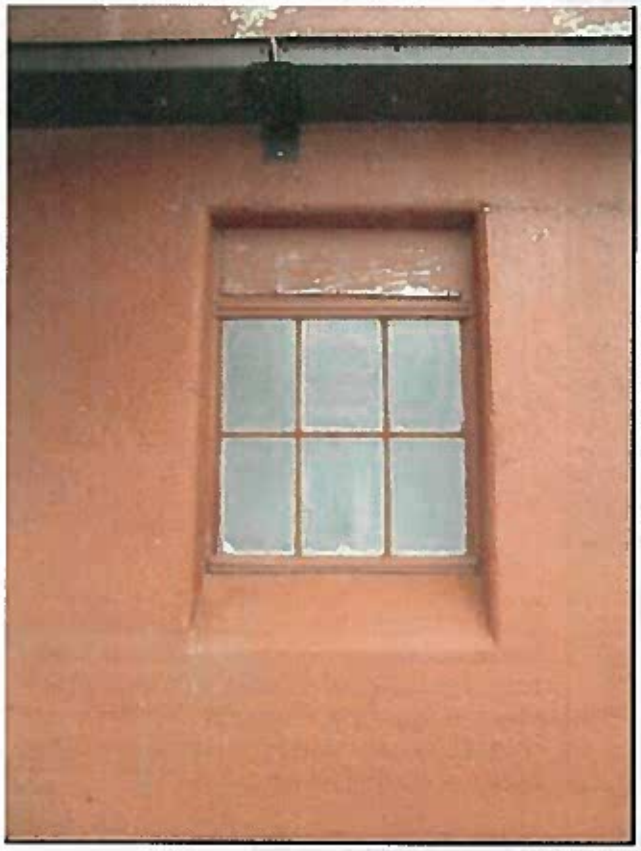
NOTE THAT THE DETERIORATION IN THE CONCRETE SURFACES IS LESS AT LOCATIONS WHERE IT RECEIVED A SMOOTH FINISH AS OPPOSED TO LOCATIONS THAT WERE BUSH HAMMERED. Photo credit: Herb Dawson, NPS.

VIEW OF THE ORIGINAL PLASTER SOFFIT BENEATH THE OVERHANG AT THE ROOF OF THE FIREWATCH. THE ORIGINAL METAL VENTILATORS THAT WERE LOCATED ABOVE THE WINDOWS HAVE BEEN COVERED BY GALVANIZED TIN (AREA WITH FLAKED PAINT). Photo credit: Herb Dawson, NPS.



THIS PHOTO SHOWS THE ARTICULATED METAL FASCIA AT THE EDGE OF THE ROOF ABOVE THE FIREWATCH; NOTE THAT ONE AREA HAS BEEN DISPLACED AND REQUIRES REPAIR. Photo credit: Herb Dawson, NPS.

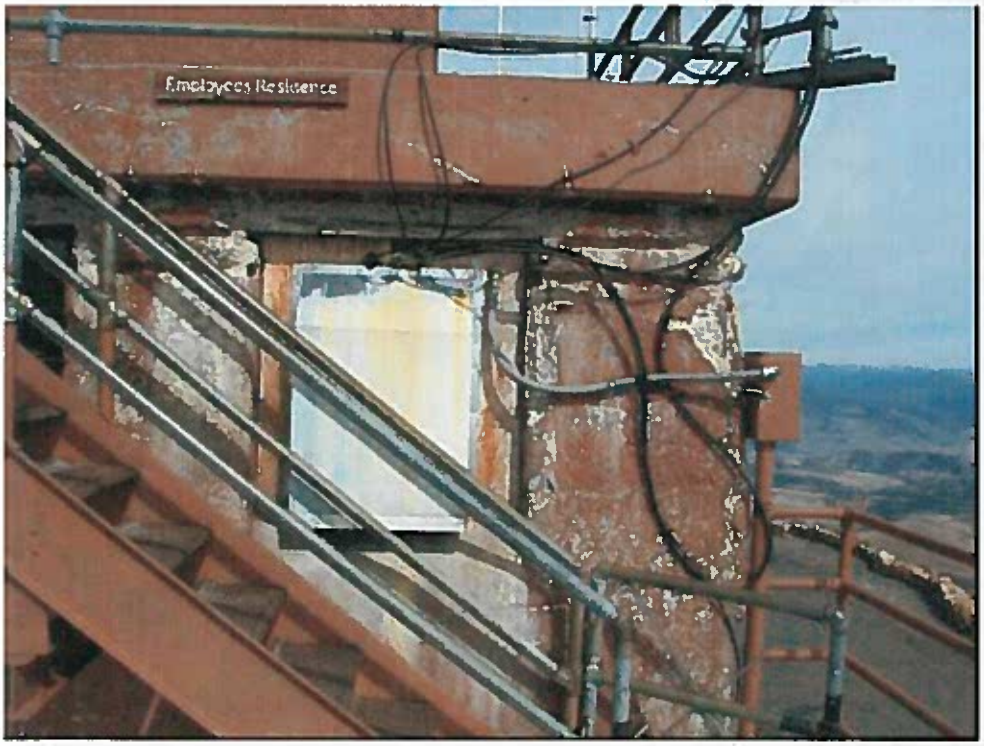
DOORS & WINDOWS



LOWER FLOOR WINDOW AT THE NORTH WALL OF THE 1939 STRUCTURE. THE WINDOW IS AN INDUSTRIAL STEEL SASH WITH OBSCURE WIREGLASS. THE ORIGINAL VENTILATOR ABOVE THE WINDOW HAS BEEN COVERED WITH PLYWOOD. Photo credit: Herb Dawson, NPS.

WEST FACING WINDOW FROM THE WOMEN'S RESTROOM; THE ARCHITRAVE OF THE WEST ENTRY CAN BE SEEN AT THE EXTREME RIGHT SIDE OF THE PHOTO AND THE EMERGENCY ESCAPE LADDER FOR THE FIREWATCH IS VISIBLE TO THE LEFT. NOTE THE BADLY SPALLED CONCRETE BELOW THE WINDOW. Photo credit: Herb Dawson, NPS.

WINDOW INFILL AT THE SE CORNER OF THE SECOND FLOOR (ORIGINAL RESIDENCE AREA). THE INFILL PROVIDES VENTILATION FOR THE EQUIPMENT INSIDE BUT IS MADE OF MATERIALS WITH A SHORT LIFE EXPECTANCY. Photo credit: Herb Dawson, NPS.

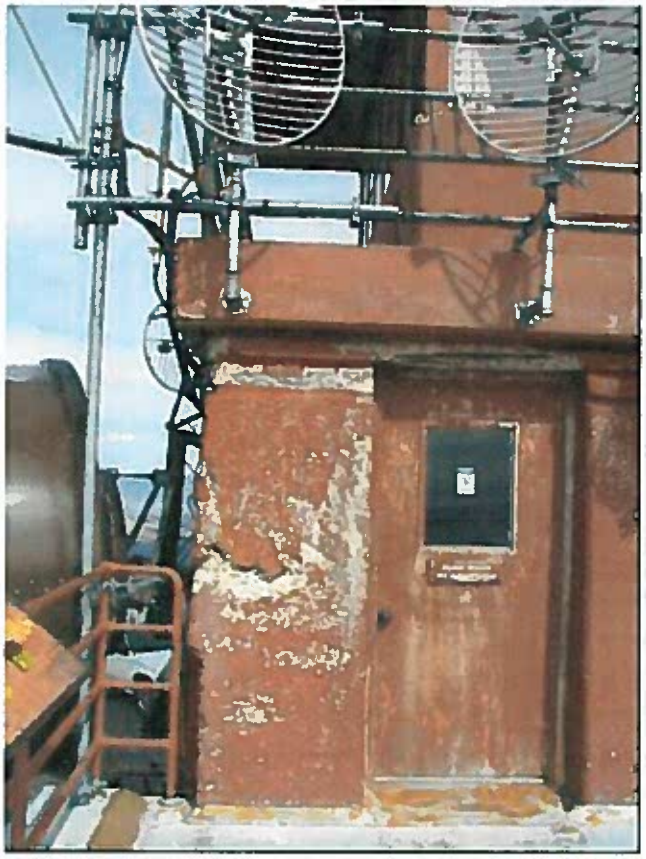


WINDOW INFILL AT THE UPPER BANK OF NORTH FACING WINDOWS OF THE 1939 STRUCTURE. Photo credit: Herb Dawson, NPS.

COMBINED PHOTO SHOWING DETAILS OF BOTH THE GLAZING AND ENTRY DOOR INTO THE FIREWATCH FROM THE PROMENADE AT THE TOP FLOOR OF THE LOOKOUT. BOTH ASSEMBLIES ARE BELIEVED TO BE ORIGINAL TO THE 1939 DATE OF CONSTRUCTION. Photo credit: Ken Sievert.

DOOR AND WINDOW SERVING THE CENTRAL INTERIOR STAIRCASE AS SEEN FROM THE EXTERIOR VIEWING AREA ABOVE THE ENCLOSED INTERPRETIVE SPACE. Photo credit: Ken Sievert.

ORIGINAL 1939 PLANKED ENTRY DOORS FROM THE EXTERIOR ENTRANCE RECESSES INTO THE RESTROOM AREAS. NOTE THE VARIOUS APPLICATIONS OF DOOR HARDWARE. Photo credits: Herb Dawson, NPS.



DOOR INTO SECOND FLOOR UTILITY SPACE AS ACCESSED FROM EXTERIOR VIEWING DECK. Photo credit: Herb Dawson, NPS.

DOOR INTO SECOND FLOOR UTILITY SPACE AS VIEWED FROM INSIDE. THIS DOOR IS A REPLACEMENT HOLLOW METAL ASSEMBLY. Photo credit: Herb Dawson, NPS.

CONDITION OF INDUSTRIAL STEEL SASH WINDOWS IN 1939 BATHROOMS; NOTE THE OBSCURE GLAZING AND THE HEXAGONAL PATTERN WIREGLASS. Photo credit: Herb Dawson, NPS.

CONCRETE

DETERIORATION AND SPALLING OF CONCRETE AT CORNERS AND ARTICULATIONS OF 1939 STRUCTURE; REFER TO DETAILED DESCRIPTIONS REGARDING CONCRETE IN TEXT. All Photo credits: Herb Dawson, NPS.

THE CANTILEVERED SUPPORTS FOR THE EXTERIOR STAIR TO THE FIREWATCH EXHIBIT THE MOST EXTENSIVE DETERIORATION OF THE CONCRETE USED THROUGHOUT THE 1939 STRUCTURE. FLEXURAL REINFORCING STEEL IS EXPOSED AND THE DETERIORATION HAS PENETRATED DEEPLY INTO THE BASIC CONCRETE MATERIALS.
Photo credits: Herb Dawson, NPS.

SW CORNER OF THE UPPER LANDING AT THE EXTERIOR STAIR; THE EMBEDDED SUPPORT FOR THE RAILING AT THE LANDING HAS BEEN EXPOSED BY SPALLING OF THE CONCRETE. Photo credit: Herb Dawson, NPS.

VIEW OF LANDING CORNER FROM WEST SIDE. Photo credit: Ken Sievert

CONCRETE PLINTH BLOCK AT THE NE CORNER OF THE 1939 STRUCTURE; THE PURPOSE OF THIS BLOCK IS UNKNOWN. Photo credit: Herb Dawson, NPS.

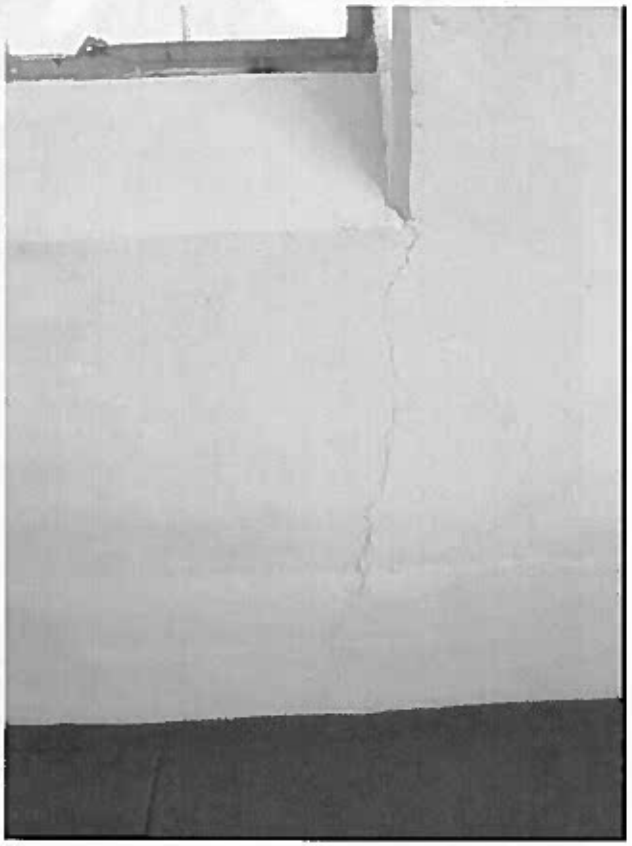
SURFACE SPALLING AT LOWER WEST WALL BELOW WINDOWS INTO LADIES RESTROOM; LOWER WALLS ARE SUBJECTED TO SNOWDRIFTS FOR EXTENSIVE PERIODS OF TIME. NOTE SECONDARY ESCAPE LADDER AT NORTH END OF WALL. Photo credit: Herb Dawson, NPS.

CRACK IN SW CORNER OF PROMENADE AT WALKWAY AROUND FIREWATCH AT TOP OF LOOKOUT. Photo credit: Herb Dawson, NPS.

CONDITION OF TOPPING AT OUTDOOR VIEWING AREA ABOVE ENCLOSED INTERPRETIVE AREA. THE SUBSTRATE HAS BEEN COATED AND DOES NOT EXHIBIT AREAS OF DETERIORATION OR FAILURE. Photo credit: Ken Sievert.

INTERIOR CONCRETE

CRACK AT WEST CORNER OF NORTH WINDOW IN MENS ROOM, ATTRIBUTED TO TYPICAL STRESS CONCENTRATION FROM SHRINKAGE THAT OCCURS AT OPENINGS. Photo credit: Herb Dawson, NPS.



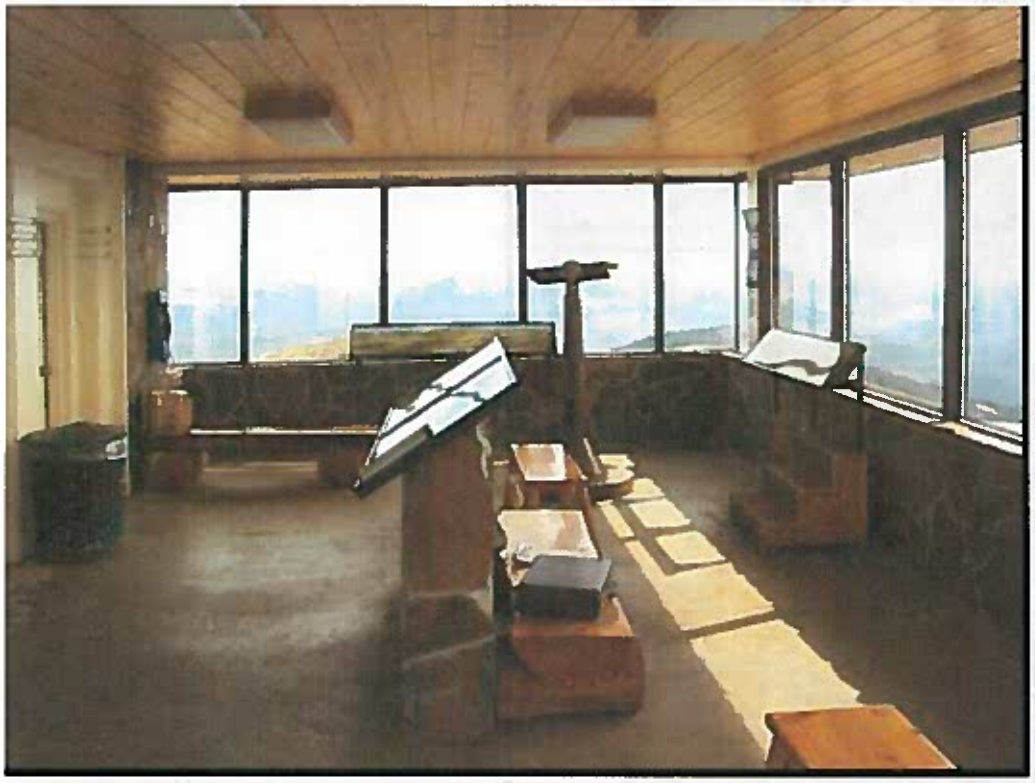
A SIMILAR CRACK AT THE EAST SIDE OF THE SAME WINDOW. Photo credit: Herb Dawson, NPS.

CEILING AND WALL AT INTERIOR OF UTILITY ROOM; THE CONCRETE IS PAINTED AND EXHIBITS NUMEROUS SHRINKAGE CRACKS. Photo credit: Herb Dawson, NPS.

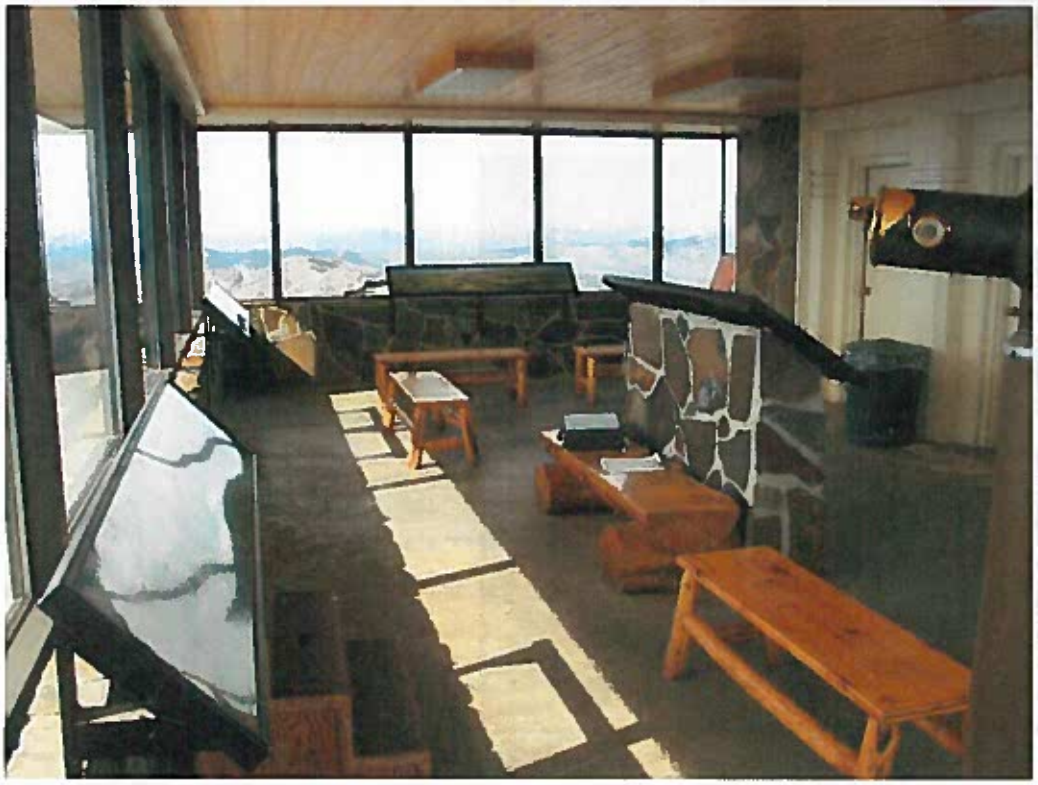
SURFACE OF WEST CONCRETE WALL IN UTILITY ROOM. EFFLORESCENSE HAS FORMED AT THE LARGER CRACKS INDICATING THAT MOISTURE HAS WICKED SOLUBLE SALTS IN THE CONCRETE TO THE SURFACE OF THE WALL. Photo credit: Herb Dawson, NPS.

DIAGONAL CRACK AT SE CORNER OF UTILITY ROOM. Photo credit: Herb Dawson, NPS.

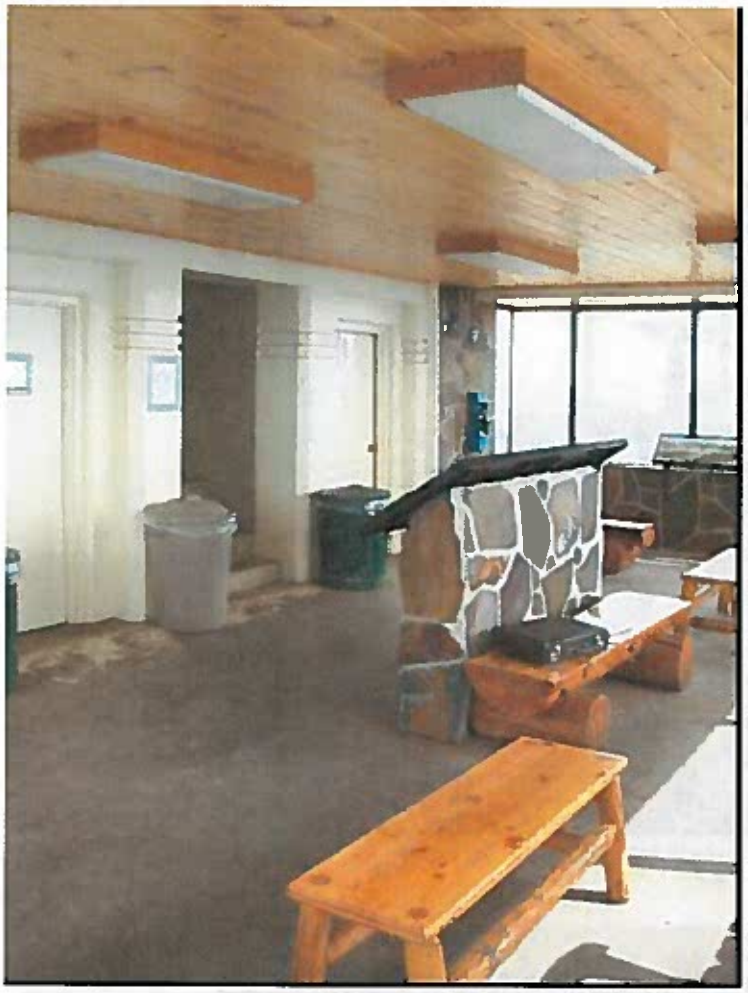
DIAGONAL CRACK BELOW STIFFENING BEAM THAT IS LOCATED BELOW THE EXTERIOR GLAZED WALL OF THE FIREWATCH SPACE ABOVE. CRACK IS ADJACENT TO THE DIAGONAL CRACK PICTURED ABOVE. THE PENETRATION OF THE CONDUIT MAY HAVE CONTRIBUTED TO THIS CRACK AND WAS INAPPROPRIATELY LOCATED AT A HIGH STRESS LOCATION WITHIN THE STRUCTURE. Photo credit: Herb Dawson, NPS.



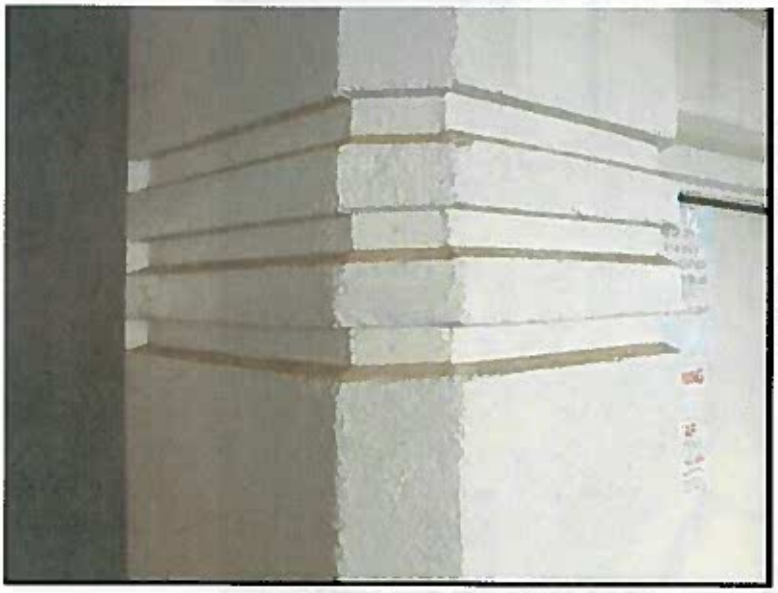
INTERIOR OF THE INTERPRETIVE / VIEWING AREA LOOKING EAST.



INTERIOR OF THE INTERPRETIVE / VIEWING AREA LOOKING WEST. Photo credit: Herb Dawson, NPS.



INTERIOR OF THE INTERPRETIVE / VIEWING AREA LOOKING NE. THE 1939 SOUTH WALL AND THE STAIRWAY TO UPPER LEVELS CAN BE SEEN IN THIS PHOTO. Photo credit: Herb Dawson, NPS.

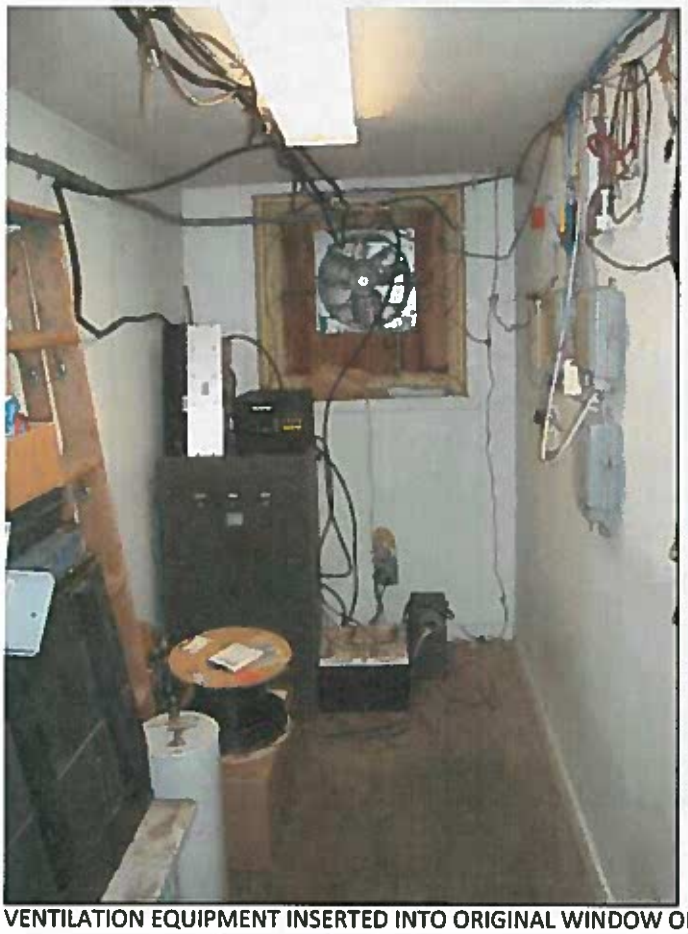


DETAIL OF STREAMLINED MODERN "SPEED LINES" IN THE CONCRETE. Photo credit: Herb Dawson, NPS.

BEDROOM AREA LOCATED IN NW CORNER FIREWATCH SPACE. Photo credit: Herb Dawson, NPS.

ELECTRICAL INSULATOR ON BEDPOSTS TO PROTECT SLEEPING FIREWATCH PERSONNEL DURING THUNDERSTORMS. Photo credit: Herb Dawson, NPS.

MECHANICAL - ELECTRICAL



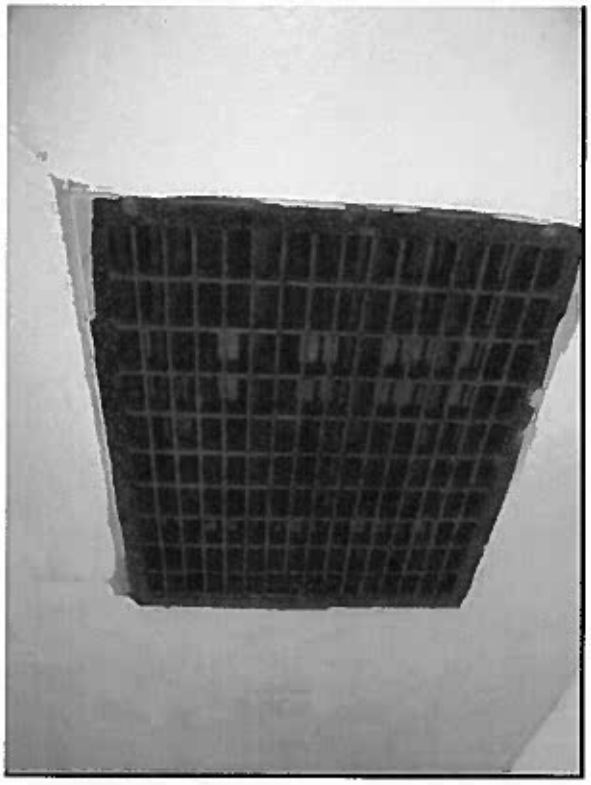
VENTILATION EQUIPMENT INSERTED INTO ORIGINAL WINDOW OPENING AT SE CORNER OF SECOND FLOOR (WORK AREA). Photo credit: Herb Dawson, NPS.

CLOSE-UP VIEW OF EXPANDING FOAM AND PLYWOOD USED FOR THE FAN INSTALLATION SHOWN ABOVE. Photo credit: Herb Dawson, NPS.

PORTABLE AIR CONDITIONER AND EXHAUST DUCT INSERTED INTO ORIGINAL WINDOW OPENING AT N WALL OF SECOND FLOOR EQUIPMENT AREA. Photo credit: Herb Dawson, NPS.

INTERIOR VIEW OF INSTALLATION SHOWN ABOVE. Photo credit: Herb Dawson, NPS.

MANHOLE COVER TO ACCESS CHAMBER BELOW MEN'S ROOM (WOMEN'S ROOM SIMILAR). Photo credit: Herb Dawson, NPS.

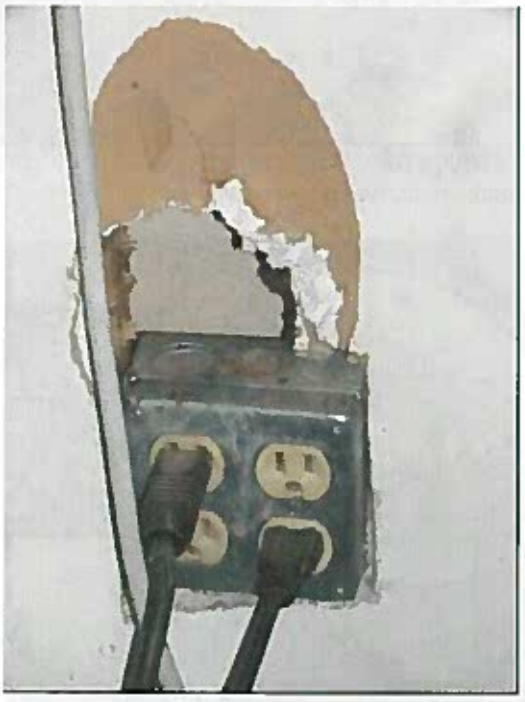


MECHANICAL VENTILATION GRILLE IN CEILING OF MEN'S RESTROOM (TYPICAL OF GRILLES IN BOTH THE MEN'S AND WOMEN'S RESTROOMS). Photo credit: Herb Dawson, NPS.

WATER-LESS TOILETS USED IN BOTH BATHROOMS. Photo credit: Herb Dawson, NPS.

TROUGH TYPE PLUMBING FIXTURE (MEN'S ROOM). Photo credit: Herb Dawson, NPS.

LIGHT FIXTURE IN WOMEN'S ROOM (MEN'S ROOM SIMILAR). Photo credit: Herb Dawson, NPS.



CONTEMPORARY WIRING DEVICES HAVE BEEN INCORPORATED INTO THE FURRED WALLS OF THE SECOND FLOOR OF THE 1939 STRUCTURE. Photo credit: Herb Dawson, NPS.

INTERPRETIVE

INTERIOR OF INTERPRETIVE / VIEWING AREA ON MAIN FLOOR SHOWING INTERPRETIVE PANELS AND VIEWING TELESCOPE. Photo credit: Herb Dawson, NPS.

DETAIL OF VIEWING TELESCOPE VISIBLE IN PHOTOGRAPH ABOVE. Photo credit: Herb Dawson, NPS.

TYPICAL INTERPRETIVE SIGN MOUNTED ON PERIMETER RAILING OF THE SECOND FLOOR OUTDOOR VIEWING AREA. Photo credit: Herb Dawson, NPS.

THIS FASCINATING DEVICE FOR PIN-POINTING THE LOCATION OF FIRES COULD BE FURTHER EXPLAINED FOR VISITORS IN THE INTERPRATIVE AREA BELOW. IT MAY ALSO BE DESTINED FOR REDUCED USE IN THE FUTURE DUE TO OTHER TECHNOLOGICAL ADVANCES. Photo credit: Ken Sievert.

PART 2 – ULTIMATE TREATMENT AND USE

GUIDELINES

Procedural Alternatives

As a Historic Structure that has been determined eligible for listing on the National Register of Historic Places (DOE), any work undertaken on the Mount Washburn Fire Lookout must be done in compliance with ***"The Secretary Of The Interior's Standards For The Treatment Of Historic Properties"*** as administered by the United States Department Of Interior. Those standards include guidelines for four treatment approaches for historic properties as outlined below; in order of importance:

- Preservation – retains all historic fabric through conservation, maintenance, and repair. This approach includes preservation of changes and alterations that have been made over time.
- Rehabilitation – retains all preservable fabric through conservation, maintenance, and repair but allows greater latitude for replacement if the property is more deteriorated. Rehabilitation standards focus attention on the elements that give a property its historic character.
- Restoration – Retains only materials from the most significant time in a property's history while permitting removal of materials applied to the property from other periods of time.
- Reconstruction – Re-creation of a non-surviving site, landscape, building, structure, or object utilizing all new materials.

Recommended Preservation Treatment

The recommended treatment for the Mount Washburn Fire Lookout is the **Rehabilitation** classification as outlined in the "Secretary's Standards for Historic Preservation Projects".

SZ Although the Fire Lookout will continue to be used for its original purpose in the foreseeable future, there are fundamental building elements that have deteriorated to an extent that they may require intervention by methods that have evolved since the date of original construction. Those methods, properly selected and applied, may have the potential to more effectively retain the historic character of the fire lookout for a greater period of time than replacement with in-kind materials. Final selection of appropriate repairs (including in-kind materials) must be based on additional in-depth destructive testing and evaluation. Deteriorated elements include, but are not limited to, exterior decorative concrete details that contribute to the structures architectural qualities, exposed corners of the fundamental bearing wall structure, supports for exterior stairs, and selected areas of deteriorated wall surfaces.

DOI Guidelines define the Rehabilitation classification as follows:

> *When the physical condition of character-defining materials and features warrants additional work repairing is recommended. Rehabilitation guidance for the repair of historic materials such as masonry, wood, and architectural metals again begins with*

the least degree of intervention possible such as patching, piecing-in, splicing, consolidating, or otherwise reinforcing or upgrading them according to recognized preservation methods. Repairing also includes the limited replacement in kind--or with compatible substitute material--of extensively deteriorated or missing parts of features when there are surviving prototypes. Although using the same kind of material is always the preferred option, substitute material is acceptable if the form and design as well as the substitute material itself convey the visual appearance of the remaining parts of the feature and finish. When an entire interior or exterior feature is missing, it no longer plays a role in physically defining the historic character unless it can be accurately recovered in form and detailing through the process of carefully documenting the historical appearance. Although accepting the loss is one possibility, where an important architectural feature is missing, its replacement is always recommended in the ***Rehabilitation*** *guidelines as the first or preferred, course of action. Thus, if adequate historical, pictorial, and physical documentation exists so that the feature may be accurately reproduced, and if it is desirable to re-establish the feature as part of the building's historical appearance, then designing and constructing a new feature based on such information is appropriate. However, a second acceptable option for the replacement feature is a new design that is compatible with the remaining character-defining features. The new design should always take into account the size, scale, and material of the historic building itself and, most importantly, should be clearly differentiated so that a false historical appearance is not created.*

BUILDING CODE CRITERIA

Building Code Review

A building code analysis was done for the Mount Washburn Fire Lookout to determine if there were major areas of concern to be addressed as part of the preservation plan. This analysis is general in nature but it includes the primary elements that impact current and future use of the facility. Additional detailed building code requirements would be considered during subsequent phases of project development or preparation of construction documents; detailed requirements are defined to include those technical issues that would not adversely impact the concepts or recommendations for this structure.

Building Codes reviewed during the preparation of this report included:

- *2006 International Existing Building Code (IEBC).* The provisions of this Code constitute the minimum standards for change of occupancy, alteration, or repair of existing buildings and structures including Historic structures. The purpose of this code is to encourage the continued use or reuse of existing buildings and structures.
- *2006 International Building Code (IBC):* This Code provides minimum standards to safeguard life or limb, health, property and public welfare by regulating and controlling the design, construction, quality of materials, use and occupancy, location and maintenance of all buildings and structures. This code is intended for use with new structures and as a source of criteria for the IEBC by reference.
- *NFPA 101 - Life Safety Code*

Criteria

As applicable to the Mount Washburn Fire Lookout, the IEBC has been determined to be the primary reference for evaluation of the property. If in the process of evaluating the structure an unsafe condition is uncovered, then the appropriate authorities will be duly advised.

The requirements of IBC are generally stricter than those of the IEBC due to the fact that they are applicable to new construction rather than the reuse of existing buildings; however, the two codes are very similar in regard to topics dealing with life – safety issues. Both codes were consulted and are reported on in the following pages in the interest of allowing park administration to evaluate the benefits of attaining a higher standard of safety if cultural values are not compromised and if the cost / benefit ratio is low.

The application of the IBC and its companion code, the IEBC, is a recent development in the Western United States. The IEBC, in contrast to its forerunner the Uniform Code for Building Conservation, is more lenient in regard to recognized historic structures that are to remain as-is or are to be repaired; however, alterations or changes in occupancy quickly shift the emphasis toward new construction criteria depending on the level of impact from the proposed changes. The IBC and the IEBC also require automatic fire sprinkler systems to a much greater extent than the previously used codes. Depending on the nature of the historic property these systems can affect cultural values; at the very least they add considerable expense to the maintenance of the property. Those impacts are identified on the following pages.

Reviewers Are Cautioned that the code information contained in this document is informational only; as projects are developed further research and consultation of the building code is warranted.

The requirements of IEBC differentiate between repair, alteration, change of use, additions, or relocation of existing buildings; generally the more a structure is changed then the more restrictive the application of the building codes. As an example an existing building that is repaired (only) is not required to meet as many provisions of the building code as one that is altered or added to. The IEBC has further established three different levels of alterations to existing buildings for purposes of evaluating code requirements; therefore, doing a code analysis on an existing building is directly tied to knowing how much change is planned for the structure in the future.

To assist in understanding how this may be applied to the Mount Washburn Fire Lookout a code flowchart has been developed that shows which portions of the building code are applied to the various repairs or changes that can occur to existing buildings. The chart is incorporated on the following page.

The code alternative of treating the Fire Lookout as a 'repaired historic building' was investigated and compared to requirements of IBC 2006. That alternative is documented within this section of the report. Conclusions and recommendations from the comparisons may be found at the end of the section.

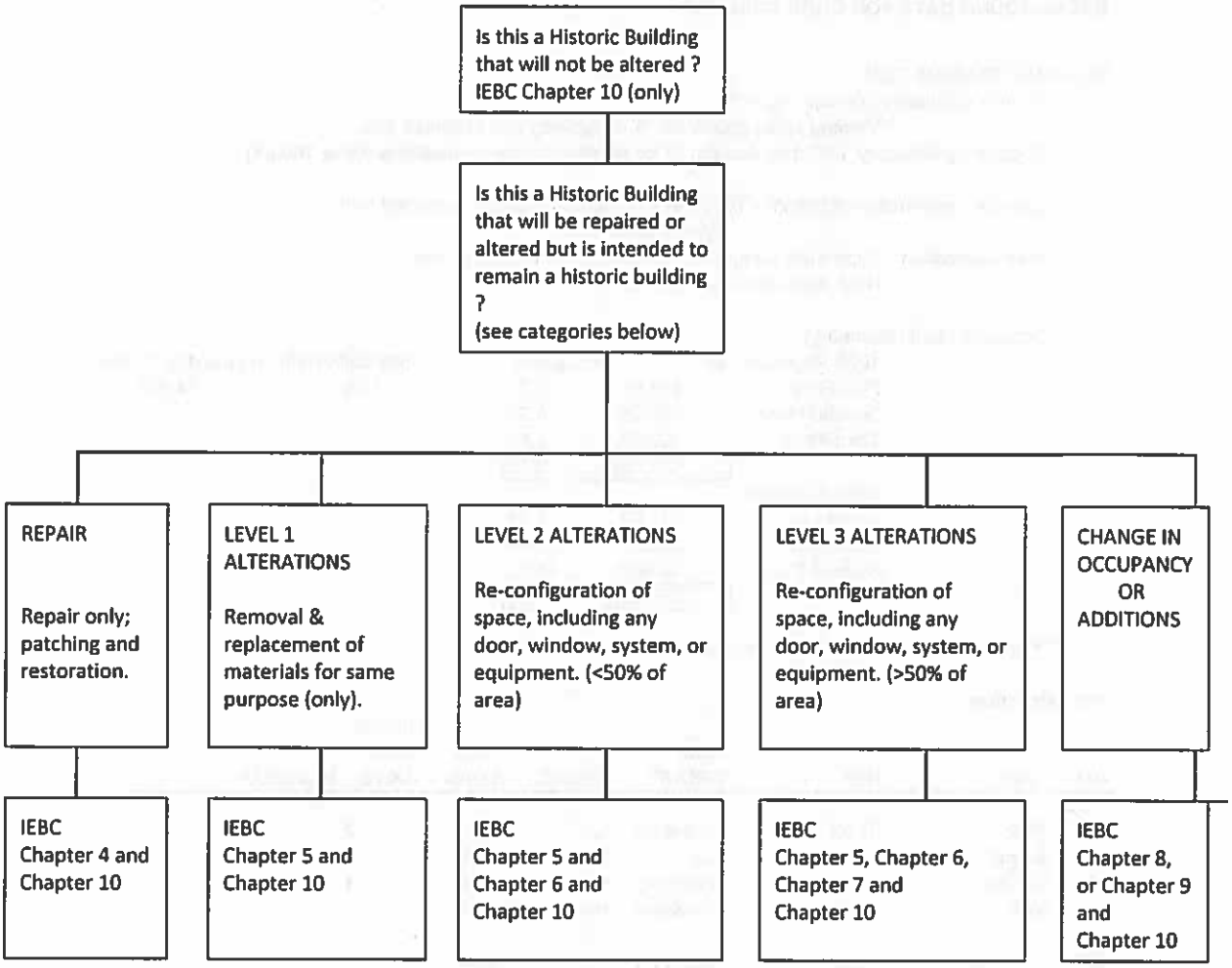
Building Code Flowchart

The following flowchart identifies the path of Building Code analysis to be applied to any Historic property as well as a notation of the criteria that determines which classification is appropriate to the project. Each level has different requirements with the least impactive requirements in the left category and the more restrictive and impactive requirements progressively listed toward the right. The applicable chapters of the IEBC that

apply to the classification are listed below each category for the convenience of the reviewer.

As noted in the first box the fewest requirements would be for an Historic Property that will not be altered.

INTERNATIONAL EXISTING BUILDING CODE (IEBC) FLOWCHART



The Mount Washburn Fire Lookout historic property has been evaluated as a repaired building and a Level 1 Alteration building for comparison on the following pages. This evaluation assumes that the facility will continue to be used as it is currently used as a part of the fire management system for Yellowstone National Park as well as a viewing and interpretive center for the public. It also assumes that the structure will not be significantly altered as a part of this stabilization effort.

BUILDING CODE ANALYSIS

BACKGROUND DATA FOR CODE ANALYSIS

BUILDING INFORMATION:

Primary Occupancy Group - Type 'B'
Viewing areas qualify for 'B' occupancy due to limited size.

Occupancy Category: IBC classification IV for emergency communications (table 1604.5)

Type Of Construction (Existing) - Type II-A if non-combustible or protected roof;
Type III otherwise

Area Separation Separated except for 1st floor access to central stair.
Note: separation not required

Occupant Load (Summary)

	SF**	Occupants	Total Exit Width (in.) req'd @ 0.2/occ.	
1939 Structure				
First Floor	353.51	3.37	74.68	14.936
Second Floor	320.35	3.20		
Third Floor	257.67	2.58		
	931.53	9.15		
1979 Structure				
Lower Level	712.63	2.38		
First Floor	501.57	33.44		
Second Floor	445.60	29.71		
	1659.80	65.53		

** does not include area taken up by walls.

1939 structure

RM	NAME	NSF	OCC. GROUP	SF/OCC	OCC LOAD	NO. OF EXIST EXITS	REMARKS
102	Stair	87.32	accessory	100	0.87	2	
103	Storage	24.81	S-2	300	0.08	2	
104	Women	120.69	accessory	100	1.21	1	
105	Men	120.69	accessory	100	1.21	1	
201	Entry / Utility	44.22	accessory	100	0.44	1	
202	Equip / Comm	158.13	B	100	1.58	1	
203	Work / Stg	118.00	B	100	1.18	1	thru adjoining space
301	Firewatch	257.67	B	100	2.58	1***	exterior stair & emergency ladder
1979 structure							
B1	Encl Signal Area	266.12	B	300	0.89	1	thru adjoining space
B2	Battery / Equip	446.51	B	300	1.49	1	IBC 307.1 exc 11
101	Viewing / Interp	501.57	B	15	33.44	2	IBC 303.1 exc 3
204	Outdoor Viewing	445.60	B	15	29.71	1	IBC 303.1 exc 3
	TOTALS	2591.33					

INTERNATIONAL EXISTING BUILDING CODE (IEBC)
CODE ANALYSIS

Project: Mt. Washburn Fire Lookout

The Mt. Washburn Fire Lookout was evaluated as a repaired historic building (only); it has not been evaluated as a building that is re-configured, altered, or added to.

SECTION	DESCRIPTION	HISTORIC BUILDING TO BE REPAIRED	REMARKS
Historic Building That will be Repaired (only)			
1001.2	Building investigated, evaluated, and written report prepared	X	Investigation & Report Required
1002.0	Repairs may use original or in-kind materials	X	May use in-kind materials
	If building is determined dangerous, no work is required except to correct identified unsafe conditions	X	Unsafe conditions corrected
	Historic Buildings undergoing repairs to comply with Chapter 4 of IEBC	X	*See Below*
	Replacement glazing in hazardous locations must comply with safety glazing requirements in IBC	X	Safety glazing rqmt's apply if glass
	Replacement glazing in ordinary locations may use original (or in-kind) materials	X	replaced at hazardous locations.
Chapter 4 - Repairs			
401.2	Use materials permitted by Code or use like materials	X	May use in-kind materials
401.3	Work shall make building no less conforming to code than it was before the repairs	X	No-less safe
403.1	Cannot use hazardous materials for repair	X	Hazardous materials prohibited
403.2	Replacement glazing to comply with safety glazing requirements.	X	Safety glazing rqmt's apply
404.1	Existing level of fire protection to be maintained.	X	Maintain existing fire resistance
405.1	Existing means of egress maintained.	X	Existing exiting maintained
406.1	Existing level of accessibility maintained.	X	Not Applicable
407.1.1	Seismic Evaluation Required (see IEBC for detailed requirements)	X	Seismic evaluation required
407.1.2	Wind design and analysis is required of existing building undergoing repairs.	X	Wind evaluation required
407.2	Repairs shall not reduce strength or stability of existing building.	X	Existing structural strength maintained
408.0	Electrical repairs may be done with like material except:		
	Receptacles to comply with 406.3(D) of NEC	X	
	Grounding of grounding type receptacles permitted to be grounded to any point.	X	
409.0	Mechanical. must comply with 401.1	X	
410.0	Plumbing:		
	Prohibited materials:		
	Copper and brass traps and tailpieces less than .027" wall thickness	X	
	Solder with more than 0.2 percent lead	X	
	Water closets w/ a concealed trap or unventilated space or with walls not thoroughly washed at each discharge.	X	Waiver required
	Cement, concrete, mastic, hot-pour, or O-ring joints.	X	Waiver required
	Joining of different types of plastic with solvent	X	Waiver required
	Saddle type fittings	X	Waiver required
410.2	Water closets: replacement water closets must comply with International Plumbing Code; maximum capacity shall be 1.6 gallons per flushing cycle.(3.5 gallons for blowout design).	X	Waiver required

IBC 2006 REQUIREMENTS (COMPARISON ONLY)

* general requirements only

** Net square footage (NSF) does not include area taken up by walls.

1939 structure

RM	NAME	NSF	OCC. GROUP	SF/OCC	OCC LOAD	NO. OF EXIST EXITS	EXITS REQD	WIDTH OF EXIT (1017)	WIDTH OF DOOR OPG	REMARKS
102	Stair	87.32	accessory	100	0.87	2	2	44"		44" width is rqmt for stairway; add 35.49 occupants from upper rooms served by stair.
103	Storage	24.81	S-2	300	0.08	2	1	44"	32"	1008.1.1
104	Women	120.69	accessory	100	1.21	1	N/A	N/A	32"	directly to exterior; 1008.1.1
105	Men	120.69	accessory	100	1.21	1	N/A	N/A	32"	directly to exterior; 1008.1.1
201	Entry / Utility	44.22	accessory	100	0.44	1	1**	N/A	32"	** Table 1019.2
202	Equip / Comm	158.13	B	100	1.58	1	1**	**	32"	** Table 1019.2; thru adjoining space
203	Work / Stg	118.00	B	100	1.18	1	1**	**	32"	** Table 1019.2; thru adjoining space
301	Firewatch (compare to section 412.1.3, 1023.2, and table 1019.2)	257.67	B; R-2	100	2.58	1	(1+)	N/A	32"	exterior stair & emergency ladder

1979 structure

B1	Encl Signal Area	266.12	B	300	0.89	1	1	N/A	32"	thru adjoining space
B2	Battery / Equip	446.51	B	300	1.49	1	1	N/A	32"	IBC 307.1 ex 11
101	Viewing / Interp	501.57	B	15	33.44	2	2	N/A	32"	IBC 303.1 ex 3
204	Outdoor Viewing	445.60	B	15	29.71	1	1*	N/A	32"	IBC 303.1 ex 3, 1019.2 *(limit occupancy to 30)*
	TOTALS	2591.33								

Accessibility Considerations (Compliance with the Americans With Disabilities Act)

The Mount Washburn Fire Lookout represents an interesting problem as it relates to accessibility by the mobility impaired. Public use of the site is restricted to pedestrian trail access only, and the lengthy access route to the summit of Mount Washburn is along a maintenance road that originates from a parking area that is located next to the park road system on the Tower Junction-Canyon loop highway. The highway circumnavigates the NW base of the mountain and is several thousand feet lower in elevation than the summit. The maintenance road / trail from the parking area to the summit is lengthy (approx. 3 miles), steep (1400 ft change in elevation), rough, and characterized by exposure to steep side hills as it cuts across the scree and alpine grassed face of the mountain. It could not be traversed by ordinary wheelchairs and the route would be arduous for individuals that used other methods of assistance such as walkers or canes. The primary purposes of the access is for terrain - capable support vehicles that serve the park firewatch personnel stationed at the Lookout, services to the numerous communication towers that share the site, and as a part of the ambulatory trail system within Yellowstone national Park.

In summary, the Mount Washburn site is not accessible and, from the perspective of park visitors, the route to it could be characterized as part of a trail system. The existing webcam at the summit is readily accessible to everyone on the internet and offers one alternative to accessibility.

Presently there are numerous federal and state agencies studying accessibility as it relates to trail systems in outdoor environments. The timing for concurrence, adoption, and implementation of those studies is not known to the originators of this report at this time, and it is felt that it would be premature to encompass ADA impacts into this Historic Structure Report.

ADA evaluation and implementation has therefore been exempted from the overall Recommended Treatment Plan (Preservation Plan) contained within this report.

RECOMMENDED ALTERNATIVES

Preservation Plan

The **Preservation Plan** is derived from review of the historic documentation of the Mount Washburn Fire Lookout, the rating/priority matrix of the condition assessment, and the technical evaluations of fire, code compliance, and structural safety.

The extent of work to be accomplished at the property must be consistent with a high standard of preservation ethics and integrity as mandated by the ***Secretary of the Interior's Standards for the Treatment of Historic Properties.*** The recommendations contained within this Preservation Plan are based on the following rationale:

The proposed treatment of the building is preservation of existing fabric and replacement with in-kind materials to the maximum extent feasible, with consideration to protection of persons and property from life - safety issues. The intent is to sensitively integrate repair materials, incorporate life - safety elements, and provide for continued use of the structure without compromising the historic character.

Continued use of the Lookout will have elements of Preservation, Rehabilitation, and Restoration included within work suggested by this report. Reconstruction is not contemplated.

1. Exterior elements will be rehabilitated at locations where they cannot be preserved, and preserved whenever possible.

2. All interior habitable spaces will be preserved; modifications for life - safety improvements will be treated as rehabilitations within a historic structure.

3. Interior equipment spaces (non-habitable) will continue to evolve with changes of equipment and technology. It is recommended that those changes be pre-qualified to be 'reversible' and not impact character defining features of the facility.

The final appearance of the Lookout is intended to be essentially the same as what we see today; with emphasis on having the building appear well – maintained, less impacted by attached communication assemblies, and to convey a sense of permanence and strength at the summit of Mount Washburn. The building has portrayed that appearance throughout it's history, has maintained those attributes with minimal visual impact from the 1980 addition, and continues to exhibit the design qualities of a unique and highly specialized structure that was created to protect Yellowstone National Park during the evolution of fire suppression, fire prevention, and fire monitoring policies adopted by Park administration.

Priority and Suggested Sequence of Actions

The Priority of Work to be implemented as recommended by this Historic Structures Report is summarized in the following paragraphs. Building elements identified as "critical" or "serious" in the condition assessment portion of this report are reflected in this listing of priorities.

Priority #1
Fundamental Repair / Replacement of at-risk elements has been identified as the first priority of the preservation plan. Concrete testing / repair / replacement of exterior concrete surfaces and assemblies are identified under this priority. Repair of the tile walking surface of the promenade at the Firewatch is included in Priority 1 because of the potential for water to enter lower rooms. Completion of a seismic and wind evaluation to satisfy building code requirements has also been included with this priority.

Priority #2
Fire safety has been assigned as Priority # 2. Adding fire alarm systems, detection systems, and fire extinguishers are the primary concerns. Although occupancy is limited at the Lookout, it is available to the public, and response to incidents is compromised by the remoteness of the site as well as the absence of water.

Priority #3
Rehabilitation and Sealing of the Exterior Building Envelope has been assigned as Priority # 3. Restoration of windows, exterior coating / sealing of exposed concrete, and continued roof maintenance is identified.

Priority #4
Rehabilitation of site retaining walls is listed as Priority # 4. Stabilization of stone retaining walls, drainage of the parking lot, and paving maintenance are included.

Priority #5
Interior restoration is assigned as Priority #5. Minor repair and repainting of the interior is included within this category of work.

Other Priorities:
A listing of other related work to be done to Mount Washburn Fire Lookout and a prioritization of that work is shown on the accompanying table (see p.). The prioritization sequence is based on the condition assessment developed in an earlier section of this report, numerous site visits, and in-office evaluation of the current conditions at the facility.

It is realized that budgetary restraints as well as the logistics of construction sequencing will have an effect on the implementation of this plan; however, the table does reflect the order of importance of preservation activities as determined by this report.

Work that is a related task to the 'serious' or 'critical' Priority but is less urgent is often "packaged" together with the Priority in anticipation of how construction activities are performed, sequenced, and managed; as a consequence 'minor' priorities may be included with (or adjacent to) more tenuous work elements.

Restoration of Concrete Materials at Mount Washburn Lookout - 1939 Portion

Detailed discussion is warranted regarding the concrete materials utilized at Mount Washburn Fire Lookout. Concrete was the fundamental material used for the original 1939 structure, 1939 exterior fenestration, and the interior finish of many of the 1939 spaces.

The 1939 concrete is exhibiting various degrees of deterioration at the facility, most notably at exterior locations with exposed corners, articulations, or decorative detailing. In addition, there are flat portions of the exterior walls that are

also exhibiting spalled surfaces. Locations where surface water can accumulate (for example the wall area beneath window penetrations) exhibit this behavior.

Methods of repairing deteriorated concrete surfaces were researched for this report. Important factors to consider when selecting a repair method are:

- The cause of the failure must be understood. The selected repair method is directly related to the cause of failure.
- Properties of the original material must be known (if possible); the success of the repair will be directly related to compatibility between the original and the repair materials.
- The service and application conditions at the location where the repair is to be done will affect the success of the repair.

Concrete Failure Mechanisms

A number of factors were considered as being the cause of the deterioration. They are:

A. Faulty construction – Information about the construction of Mount Washburn continues to be collected as this report is being prepared. Research materials compiled during the preparation of the DOE for the facility suggests that the lookout was constructed by labor managed directly by NPS during 'New Deal' investment into the National Park system. Construction photographs were also retrieved from archives that provide valuable insight into the original construction. Based upon the archival materials and what is known about engineering and construction practices of the era, the following characteristics of the concrete material at Mount Washburn is assumed:

1. The concrete was field-mixed on-site.

2. The concrete pre – dates the use of air-entraining and would have less resistance to freeze / thaw cycles than is typical of contemporary concrete mixes.

3. The concrete pre-dates the use of plasticizers, super plasticizers, and wetting agents.

4. Typical concrete strengths for 1939 would have been in the 2500 – 3000 PSI range.

5. The cement manufacturer was "Red Devil" hydraulic cement. This company remains in business today.

6. The aggregate source (gravel and sand) is not known. Siliceous aggregates (including quartz) can detrimentally affect concrete performance; if near - site aggregates were used it would be possible that some quartz materials were incorporated in the original mix.

7. It is probable that water would have been transported to the mountain top during the concrete mixing operations. If near – site water was used it would be possible for the water to contain mineralization that is uncharacteristic of typical concrete mixes due to the geothermal nature of the park.

8. The water / cement ratio of the mixture that was used is unknown. This ratio is very important to shrinkage of the concrete and directly effects the formation of cracks in the cured material. Field mixed concrete typically exhibits variable W/C ratios due to the difficulty of controlling the volumes of materials.

9. The concrete contains reinforcing steel; the steel would have likely been Grade 40 material and would have conformed to the deformation characteristics required by today's engineering practices.

10. It is not known if the concrete was vibrated during placement. Mechanical vibrators were not apparent in the construction photographs; typical practices of 1940 would have been "rodding" of the freshly placed materials by hand.

In spite of the field mixed application, cursory observation of the existing structure suggests that the procedures used for the production of

the concrete were systematically applied - based on the uniform performance of the 71 year old material.

It is beyond the scope of this report to obtain laboratory analysis of the aggregates or water. It may be useful to take selected cores of the material to verify the nature of the aggregate materials.

B. Chemical attack – There were no specific areas of the construction identified that exhibited deterioration from chemicals.

C. Movement – The deterioration observed on-site was not attributed to movement. Evidence of subsidence or soil settlement adjacent to the structure was not observed and diagonal crack patterns or fractures from seismic events were not apparent.

D. Freeze/thaw damage –Damage from freeze/thaw cycles is occurring at selected areas that have cracked; however, it is likely that this is occurring as a result of water entering the substrate after cracks were caused by other actions.

E. Mechanical damage – Specific mechanical damage was not noted (with the exception of mounting of communication antenna). Some weathering of the surface of the concrete is apparent from the relentless action of the water, ice, and wind due to the severe environment characteristic of the site.

F. Auxiliary materials (sealants and membranes) – There are minimal penetrations of the 1939 concrete walls that require sealing, and the predominant visible concrete deterioration was not attributed to sealant failure.

G. Time Dependent chemical changes (Carbonation / Electrochemical) damage – Carbonation is believed to be a major contributing factor to the on–site deterioration that is occurring. A brief description of this natural phenomenon follows for clarification:

The manufacture of Portland Cement produces a highly alkaline material that chemically reacts with water to form hardened concrete. This alkaline condition is highest during the early years of a structure's existence, and alkaline compounds serve to provide a protective barrier over encased steel reinforcing. However, alkalis in concrete eventually react with acidic components of the atmosphere, particularly carbon dioxide (CO_2). The reduction of alkalinity eventually neutralizes the protective layer surrounding the steel (known as the passive layer) and the internal reinforcing is subjected to oxidation (rust). Since steel increases in volume as it oxidizes (in a ratio of approx. 20 to 1) it causes spalling of the protective concrete surrounding the reinforcing. The natural process of carbonation in good quality concrete is very slow—on average about 0.04 inches per year.

If average, and assuming typical exposure conditions, at this time the 1939 structure would be carbonated to a depth of 2.84 inches – which is greater than the concrete cover observed on – site.

Although this reactivity with steel reinforcing is detrimental, there are some positive attributes to the process of carbonation. Compressive strength, splitting tensile strength, elastic modulus, bond strength and hardness have all showed a higher value for carbonated concrete when compared with non-carbonated concrete in engineering studies. This may explain the high values obtained during the on – site rebound hammer investigations taken during the preparation of this report.

Conclusion: The failure mechanisms attributed to Mount Washburn Lookout are primarily from carbonation with some secondary effect from freeze/thaw cycles. The cantilevered beams supporting the exterior stair are further vulnerable because of the minute flexural cracking that would physically occur under load.

Concrete Properties

As noted above and based on knowledge of construction practices at the time that the 1939 structure was built, as well as judgment, the existing 1939 concrete could be reasonably assumed to have had the following properties at the time of construction:

Compressive strength – 2500 psi +/-
Tensile strength – 350 psi +/-
Modulus of Elasticity – 2.87 x 10^6 psi +/-
Coefficient of Thermal Expansion - .00055 per degree Fahrenheit

Short of testing, the actual strength of the on-site concrete cannot be known with certainty; for purposes of analysis it is reasonable to assume that the cured strength of the concrete at the time of placement would be reasonable (conservative) to use for evaluation of on-site concrete that is still sound.

Service Conditions

Service conditions for the concrete are severe, due to the volatile weather patterns atop Mount Washburn. An additional complication for repair is created since the surface failure of the existing concrete occurs in both horizontal and vertical surfaces. Repair will have to utilize methods and means to assure adhesion to a full range of sloped surfaces. If low slump hand – troweled repair materials are suitable they could serve to minimize forming at the site.

Access

The logistics of performing construction related activities at the site will be complex. The existing access road (Chittenden road) is currently marginally adequate for light service vehicles; paving no longer exists on the road, some gradients are steep, the geometry of turns might prohibit use by over-length vehicles, and extensive traffic or alteration / improvements to the feature could adversely affect the historic remnants of the road. Transportation of materials or equipment would be limited.

A source of water does not exist at the site; water would typically be required for cementitous repair procedures. Transportation of potable water to the site will be required.

Near site or on-site temporary housing would be necessary for restoration specialists / workers and the length of the season available to them to complete their activities would be very short. The productive season at the site of Mount Washburn is likely even shorter than locations at lower elevations within YNP and weather (notably wind) could affect the application of sensitive materials, and therefore schedules.

Coatings

The nature of the existing coating is unknown. The existing painted coating would have to be removed at deteriorated areas scheduled for repair, as well as all other locations where the coating is not fully adhered. High pressure washing is one method that could be applied for this purpose and DOI procedures would apply (following the preservation ethic of applying the 'gentlest means possible'). Review of coating methodology circa 1980 is recommended, as well as continued research of NPS maintenance records. Cementitous paint is an obvious candidate for the material although troweled coatings (such as 'Thorocoat') were emerging within the industry at that time.

Bush – Hammering

The final report of the original construction states that the exposed concrete surfaces were textured by bush-hammering. Speculatively, this could have had an adverse effect on the rate of carbonation by increasing surface area and lightly fracturing the surface of the finished concrete. For example, the top band of the concrete wall (third floor level) was not textured and also exhibits less deterioration than the adjacent textured surfaces. For consistency, the appearance of the bush-hammer texture would have to be re-created at any repaired areas.

Available Treatments

Concrete repair treatments investigated include:

- Repair with materials *identical* to the original materials. This would require laboratory analysis.
- Repair with materials that are similar to the original materials based on the historic record of materials incorporated into the construction of the feature.
- Repair with plain cementitous mortar that is typical of materials and mixtures readily available in today's construction market.
- Repair with polymer-modified cementitous mortar.
- Repair with polymer resinous mortar.
- Electro-chemical treatment (see separate section on 'Developing Technologies')

Comparison of Treatment Alternatives:
Petrographic analysis of the existing concrete could tell us the ratio of the concrete mix used in the original construction (not including water). Even though we could determine existing chemistry, it is unlikely that the exact grind of the cement or clinker composition could be matched by today's cement plants unless the raw ingredients came from the same quarry.

Further, because what we know of construction practices from the historic record is fairly extensive, and since there are inherent field variables in concrete mixes, extensive laboratory testing may not provide enough benefit to justify the added expense of the procedures. It is recommended that knowledge of 1920-30 construction practices be used as a basis of selecting a preferred repair method and that more exhaustive laboratory analysis be held in abeyance for unforeseen conditions.

Laboratory compressive testing could tell us the strength of the existing concrete in place. It is recommended that selected cores be taken from the site and the resulting compressive tests be correlated with the Schmidt hammer soundings reported on in the appendix. These cores could also serve to examine the nature of the aggregate (discussed above).

Treatment alternatives are summarized in the following table:*

Repair System Property	Plain Cementitous Repair	Polymer modified Cementitous Repair	Polymer Resin Repair
Compressive Strength (psi)	2900-7250	4350-8700	7250 - 14500
Tensile Strength (psi)	435-1088	1088-2175	2175 - 3263
Modulus of Elasticity (psi x 10^6)	2.9–4.35	2.175–3.625	1.45 – 2.9
Coeff of Thermal Expansion (deg F)	.00055	.00055-.00068	.00077 - .00086
Maximum service Temperature (deg F)	>572	212-572	104 - 176
Ease of installation	Most difficult	Moderate	Moderate
Likelihood of success (historic performance)	Poor	Fair	Fair
Color compatibility	Equal	Equal	Poor

*Portions of the table are from *Repairs to Restore Serviceability in Concrete Structures; Mailvaganam & Mitchell; National Research Council of Canada; Construction Technology Update – October 2003.*

As can be seen from the table above, plain cementitous repair materials most closely matches the attributed mechanical properties of the original concrete; however, properties for the polymer modified cementitous repair are very close to the original concrete and receive a higher rating regarding ease of installation and degree of success. Polymer resin repair materials appear to be too strong, too stiff, more reactive to expansion and contraction, and are marginal for maximum service temperature for this outdoor application.

Two additional concerns need to be addressed:

1. The concrete that exists on-site today is not the same as it was when it was placed. It may be harder and more crystalline than it was in 1939.

2. Engineering literature (numerous sources) are reporting that recent experience with repaired concrete exhibits the behavior of achieving successful repairs within the repair area, but accelerating deterioration at surfaces immediately adjacent to the repair area. This is a topic that is being scrutinized by the engineering community and its respective agencies and associations.

If cementitous repair techniques are applied, it is recommended that the Polymer Modified method be used for Mount Washburn Lookout.

Developing Technologies:
Engineering research in recent years has included a focus on better understanding of the alkalinity and electro-chemical processes that occur in concrete structures throughout their useful service life. These efforts have resulted in methods that have demonstrated that natural concrete deterioration can be arrested or reversed, and numerous applications of these methodologies have been incorporated in concrete structures world wide by the international engineering community. However, these are emerging technologies and data for long-term performance does not exist. For purposes of this report, the following technologies are described:

1. Corrosion inhibitors – Generally, this technology is applied as a coating (either Galvanic or Liquid) to reinforcing steel that will be placed in new construction. Epoxy coated rebar and galvanized rebar are examples of this approach. The rebar in-place at Mount Washburn cannot be physically coated with a corrosion inhibitor; however, the principle of introducing inhibitors that could protect existing reinforcing is under study.

An article published in ***The Building Conservation Directory, 1996*** by Dr. John Broomfield addresses corrosion inhibitors as applied to existing structures. The following quotation from that article has been included (emphasis added):

"A recent development is the impregnation (of concrete) with chemical corrosion inhibitors which are widely used in the power generation, chemical and manufacturing industries. Recently, attempts have been made to introduce these chemicals into hardened concrete. If successful, then these could be good, relatively simple methods of increasing the life span, reducing maintenance and providing a 'minimum intervention' method of slowing or stopping corrosion".

2. It has been demonstrated that corrosion of the reinforcing steel can be arrested by making all of the steel a cathode and applying electrical current between the steel and an anode. There must be continuity throughout the steel reinforcing, separation between the reinforcing and the anode(s), and concrete of reasonably good quality before this approach can be considered technically sound for a particular structure. Refinements to this approach have been developed, applied, and are subject to on-going study. Three of those refinements are addressed by the following paraphrased quotations by Dr. Broomfield (from the article referenced above):

A. *"CATHODIC PROTECTION (CP)*
In this process the anodes, power supply and control systems are permanent, and a range of anodes can be used. The aggressive anodic reaction is isolated to a corrosion resistant anode while the harmless cathodic reaction occurs at the surface of the steel reinforcement. This process creates additional hydroxyl ions, rebuilds the passive alkaline layer and repels chloride ions.

CP has been used on hundreds of reinforced concrete structures around the world and has potential for the conservation of historic brick and stone masonry, terracotta and statuary where steel and iron has been used to provide reinforcement or a structural frame".

B. *"ELECTROCHEMICAL CHLORIDE MIGRATION (DESALINATION)*
This process uses a temporary anode, power supply and monitoring system to apply direct current to the steel. The positive charge repels the negatively

charged chloride ions and rebuilds the passive layer over a period of four to six weeks. Although less well proven than CP, the technique has been used to successfully treat more than 50 structures in the UK, continental Europe and North America".

C. *"RE-ALKALISATION*
This system is the equivalent of desalination for carbonated structures. It relies on the principle that the hydroxyl ions produced at the cathode re-alkalise the concrete from the reinforcement outwards. This is linked with a wet anode at the surface that contains calcium carbonate, which moves under electro-osmotic pressure and re-alkalises the concrete from the surface inwards".
"There are more than one hundred re-alkalisation projects completed in the UK and on the continent".

*"**There are certain tests which are specific to the corrosion assessment of steel in concrete, relying on the electrochemical nature of the corrosion process. These are half-cell potential measurement, resistivity measurement and corrosion rate measurement".*

It is beyond the scope of this study and report to determine if one of these emerging technologies is applicable to the deterioration of the concrete at Mount Washburn; however, because of the significance of this structure it is recommended that they be further evaluated as work on the facility is initiated if incorporation of this technology can add longevity to the structure that cannot be attained by other repair methods.

PART 3 – RECORD OF TREATMENT

PRESERVATION TREATMENT AND RECOMMENDATIONS

Completion Report

Technical Data

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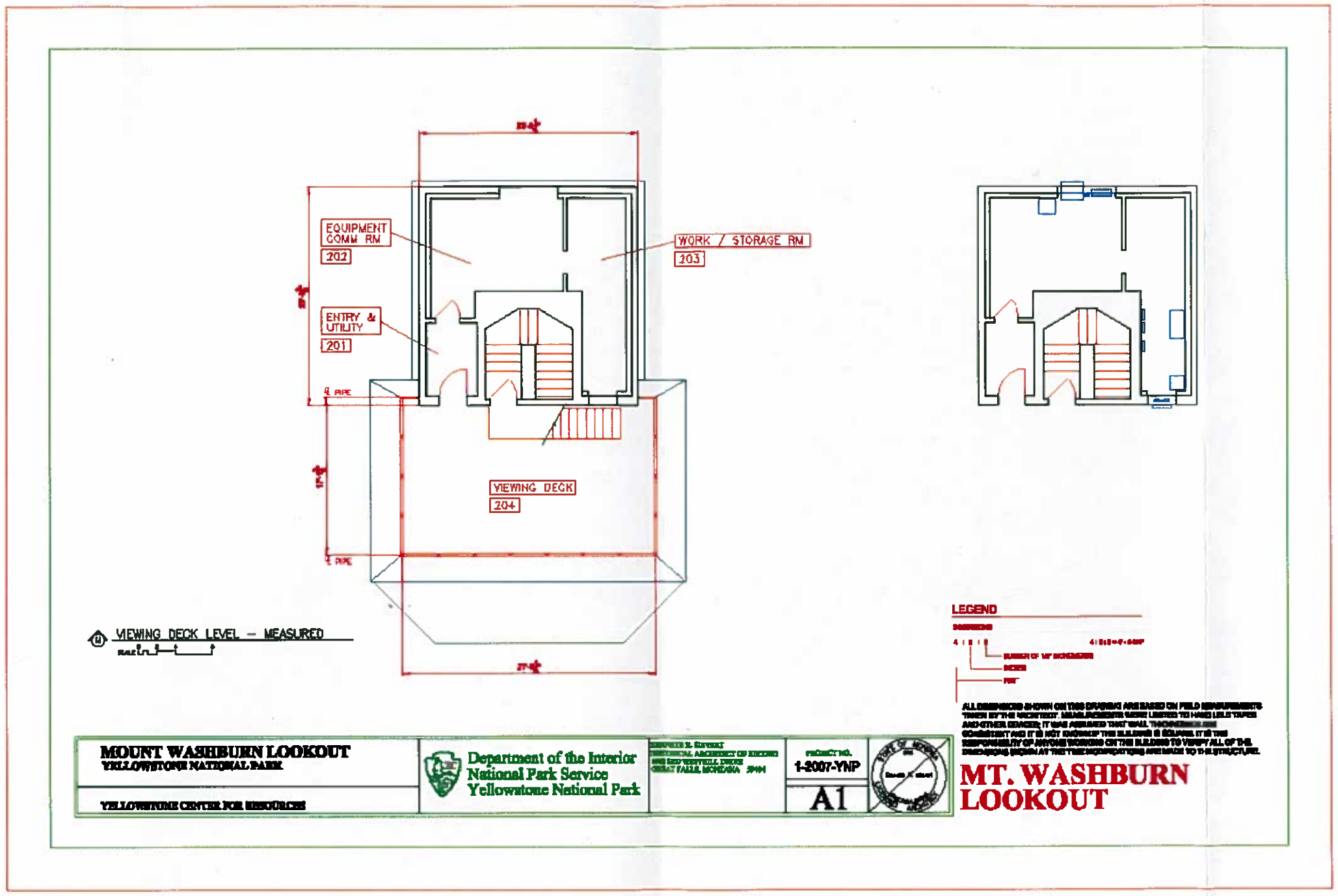
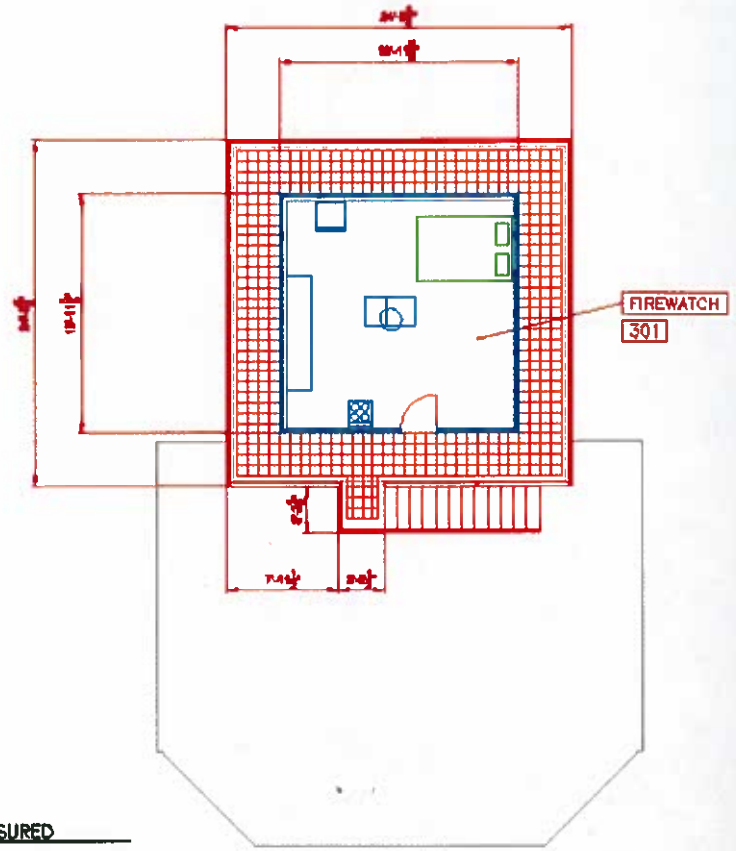
TO BE COMPLETED

WHEN WORK IS IMPLEMENTED AT MOUNT WASHBURN.

APPENDIX A
MEASURED DRAWINGS


EQUIPMENT COMM RM
202
WORK / STORAGE RM
203
ENTRY & UTILITY
201
4 RISE
VIEWING DECK
204
VIEWING DECK LEVEL – MEASURED
LEGEND
ALL DIMENSIONS SHOWN ON THIS DRAWING ARE BASED ON FIELD MEASUREMENTS
MOUNT WASHBURN LOOKOUT
YELLOWSTONE NATIONAL PARK
YELLOWSTONE CENTER FOR RESOURCES
Department of the Interior
National Park Service
Yellowstone National Park
1-2007-YNP
A1
MT. WASHBURN
LOOKOUT



FIREWATCH LEVEL – MEASURED

LEGEND

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MOUNT WASHBURN LOOKOUT
YELLOWSTONE NATIONAL PARK

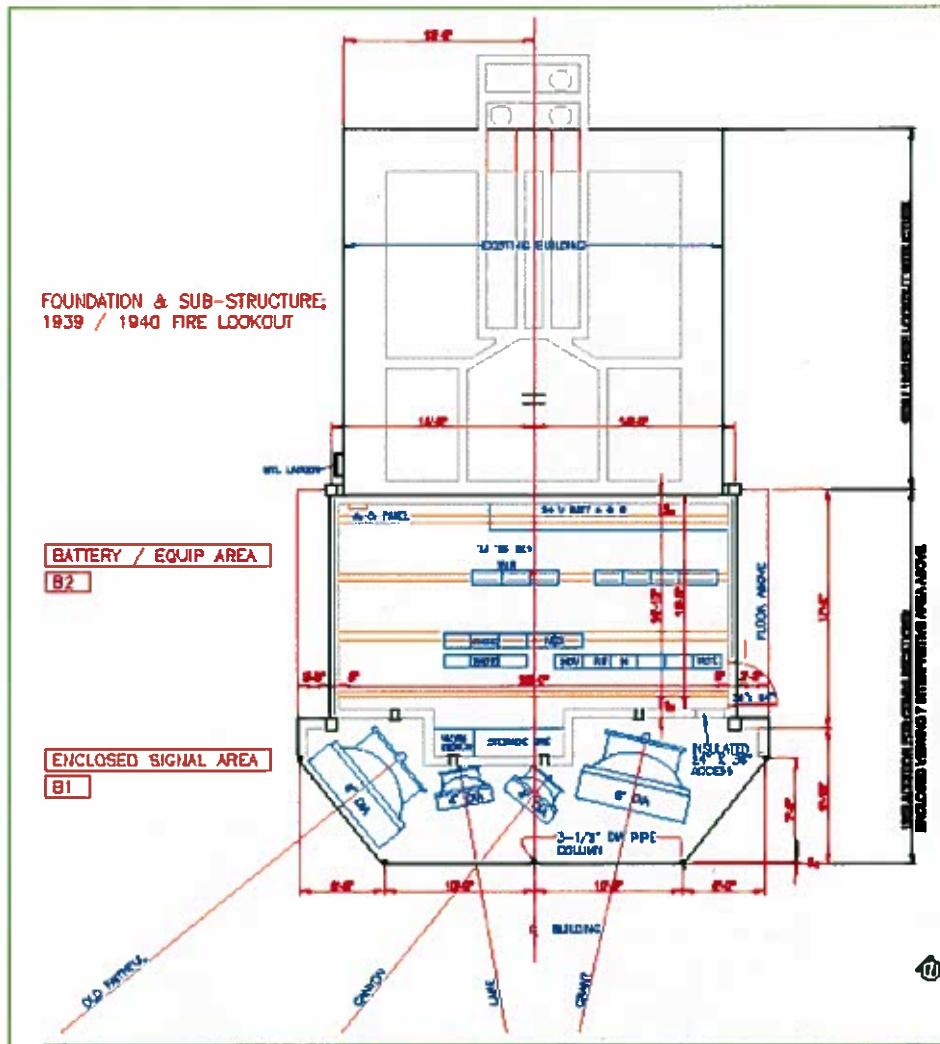
YELLOWSTONE CENTER FOR RESOURCES

Department of the Interior
National Park Service
Yellowstone National Park

PROJECT NO.
1-2007-YNP

A1

MT. WASHBURN LOOKOUT

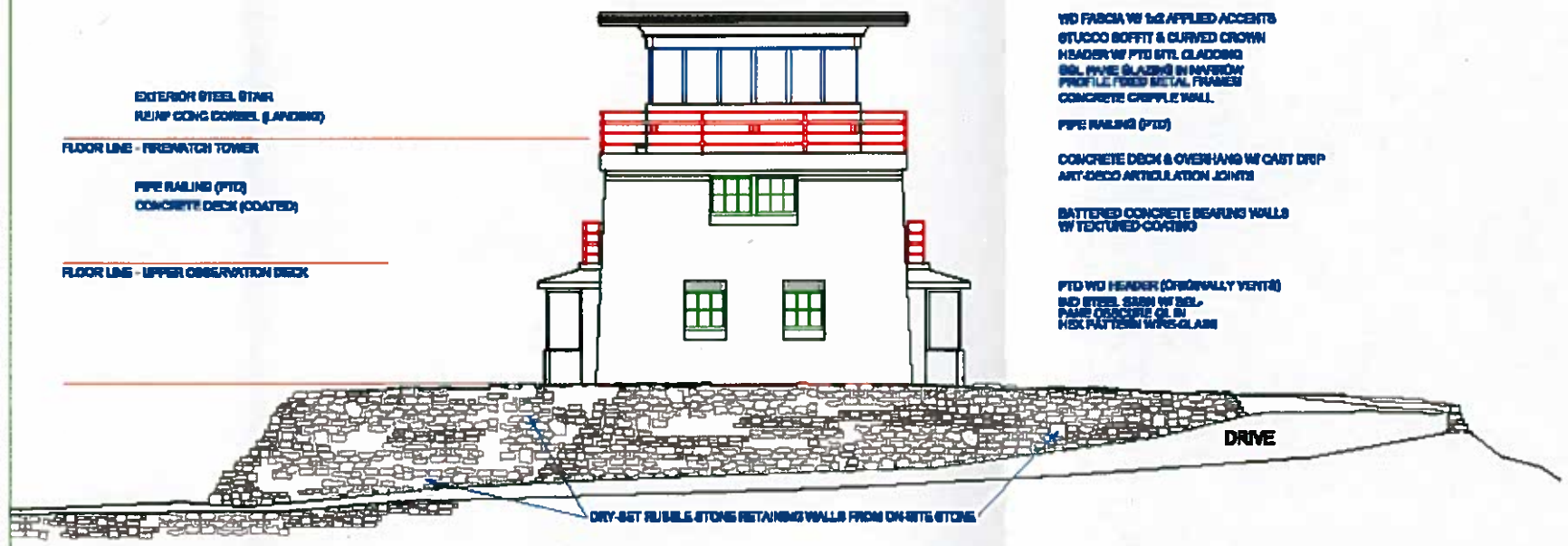


ALL DIMENSIONS AND INFORMATION SHOWN ON THIS DRAWING WERE TRANSLATED FROM 1939 DRAWINGS PURCHASED TO THIS ENDEAVOR FROM GOVERNMENT ARCHIVES. THE LEVEL OF THE STRUCTURE WAS ESTABLISHED DURING SITE VISITS ENGENDERED IN THE FIELD INVESTIGATION PHASE OF THIS PROJECT, AND INTERIOR CONDITIONS, EQUIPMENT PLACEMENT, OR FINISHES COULD NOT BE VERIFIED. THE DRAWINGS FURNISHED AS A BASIS FOR THIS TRANSLATION DID NOT APPEAR TO BE FINAL, AS-BUILT CONSTRUCTION DOCUMENTS, BUT WERE DEVELOPED SIMILAR TO WHAT WOULD BE EXPECTED FOR A PRESENTIAL DOCUMENT.

CERTAIN CHANGES TO THE WING PLAN FOR EXAMPLE, THE LOCATION OF THE ENTRANCE DOOR WERE INCORPORATED ON THIS DRAWING.

PUBLIC (LOWER) LEVEL – MEASURED

MOUNT WASHBURN LOOKOUT YELLOWSTONE NATIONAL PARK YELLOWSTONE CENTER FOR RESOURCES	Department of the Interior National Park Service Yellowstone National Park		1-2007-YNP A1	MT. WASHBURN LOOKOUT



NORTH ELEVATION

LEGEND

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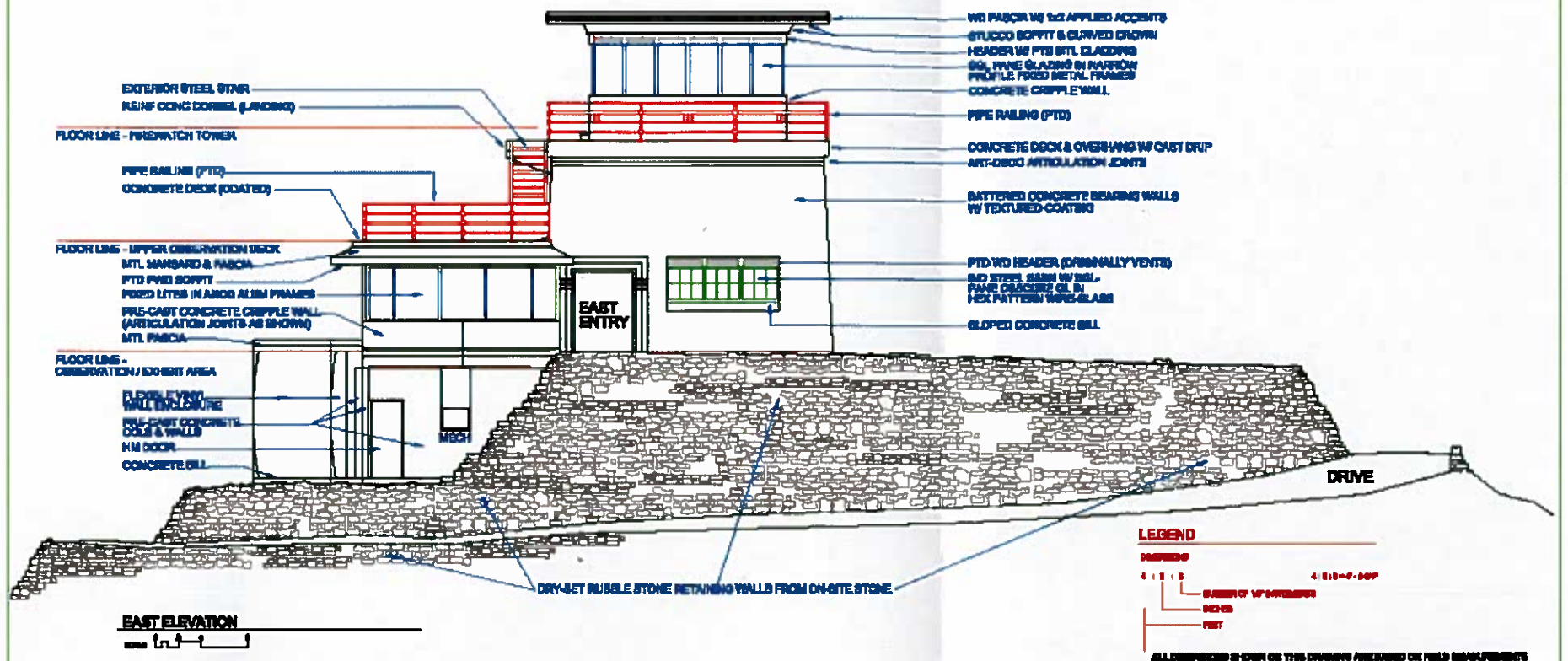
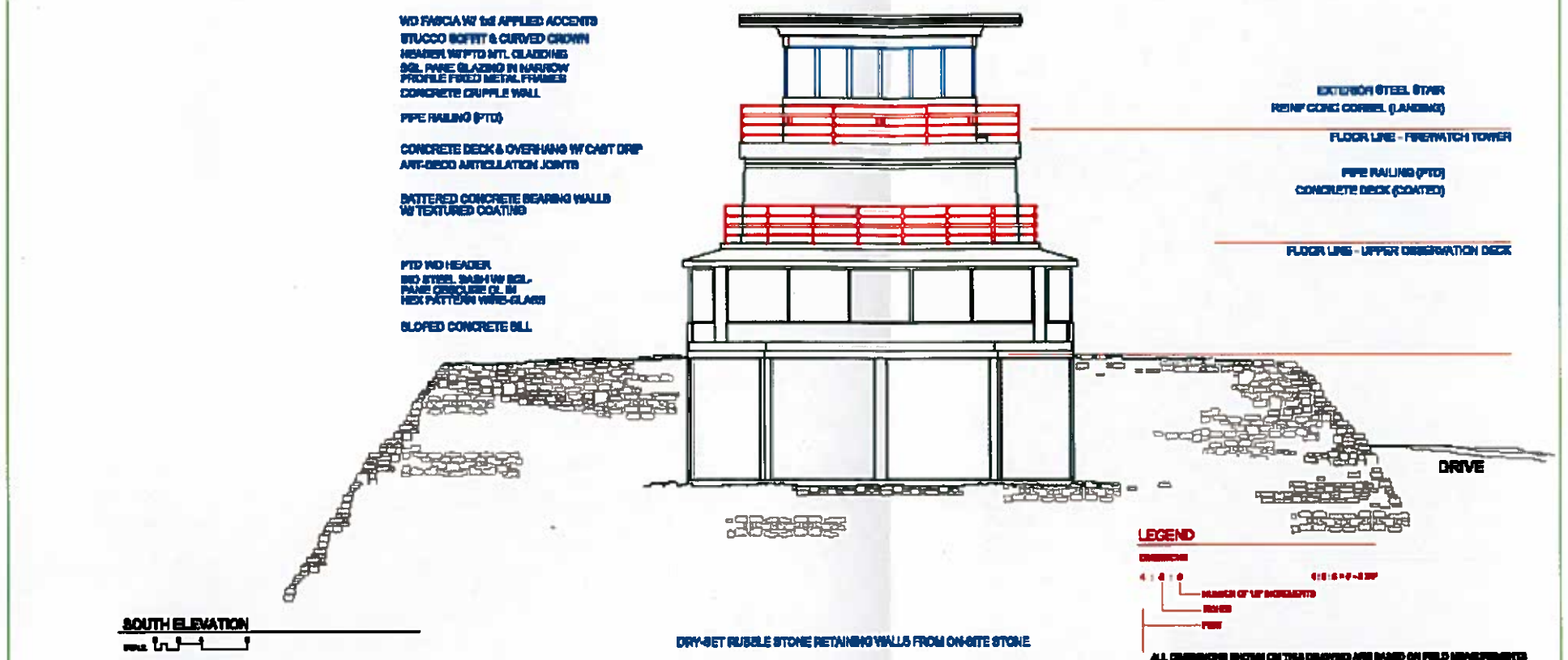
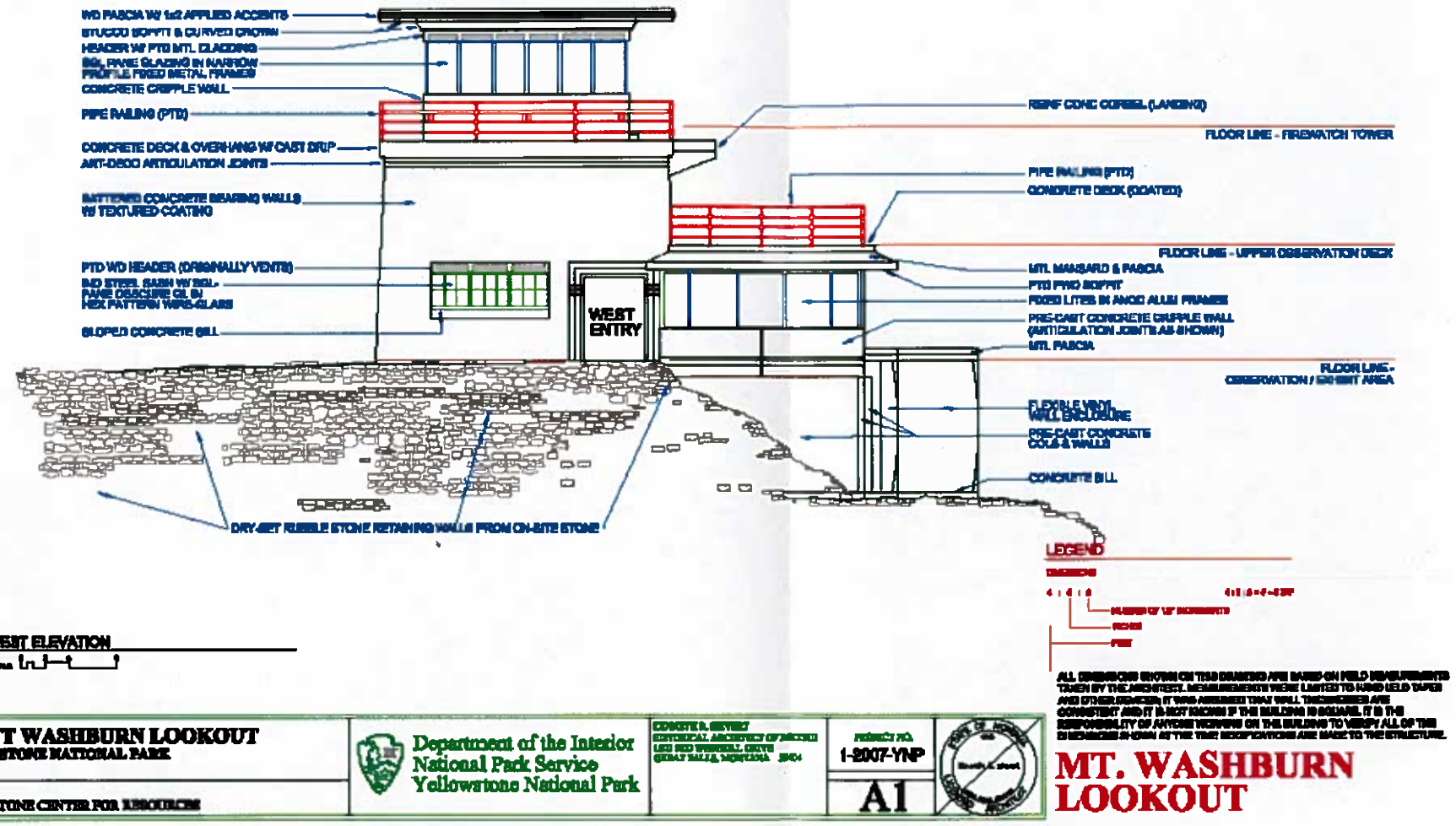
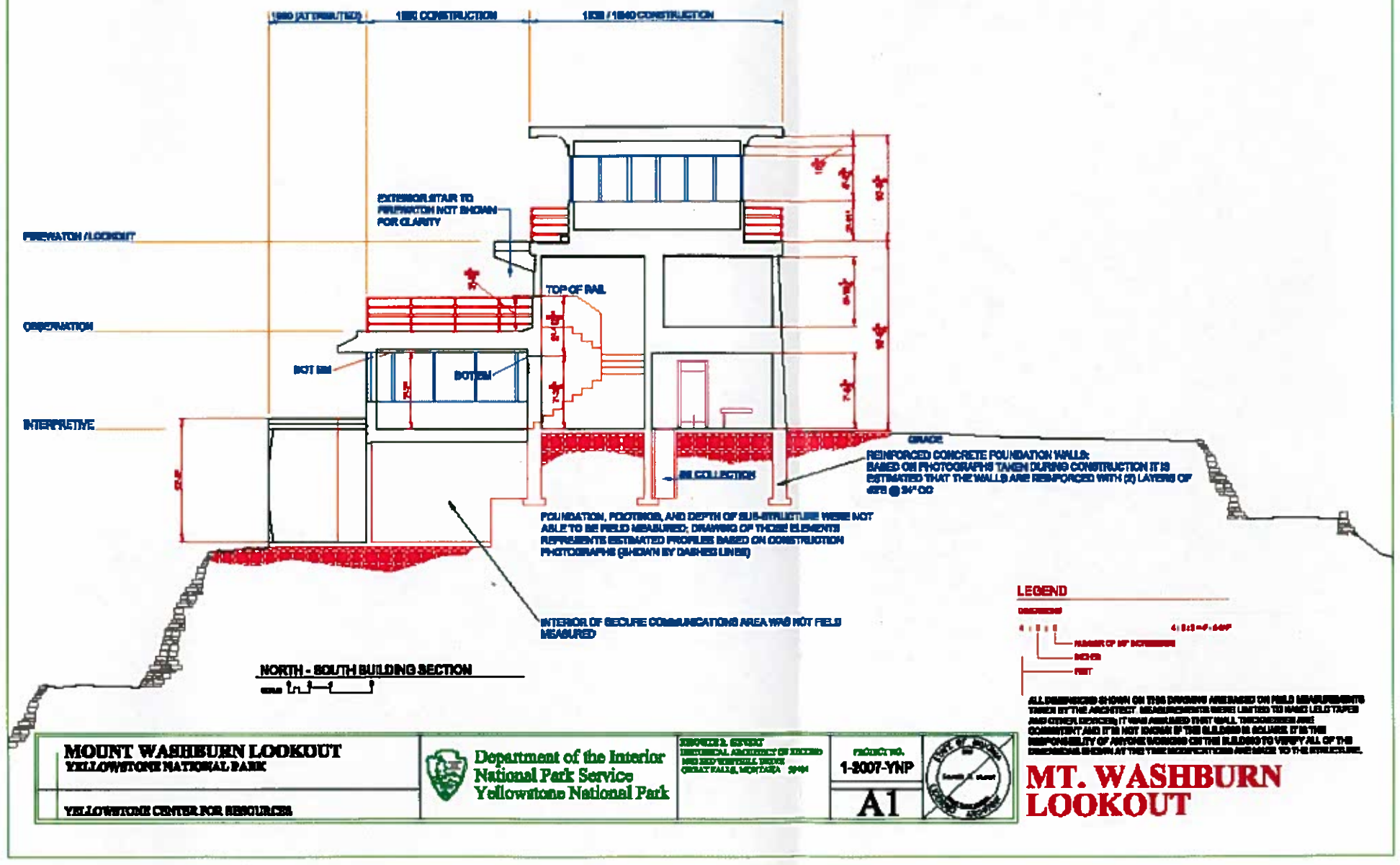
MOUNT WASHBURN LOOKOUT YELLOWSTONE NATIONAL PARK YELLOWSTONE CENTER FOR RESOURCES	Department of the Interior National Park Service Yellowstone National Park		1-2007-YNP A1

MT. WASHBURN LOOKOUT


WD FASCIA W/ 1x2 APPLIED ACCENTS
STUCCO SOFFIT & CURVED CROWN
HEADER W/ PTD MTL CLADDING
SGL. PANE GLAZING IN RAIRDON PROFILE FIXED METAL FRAMES
CONCRETE CRIPPLE WALL
PIPE RAILING (PTD)
CONCRETE DECK & OVERHANG W/ CAST DRIP
ART-DECO ARTICULATION JOINTS
BATTERED CONCRETE BEARING WALLS W/ TEXTURED COATING
PTD WD HEADER (ORIGINALLY VENTS)
WD STEEL SASH W/ SGL. PANE DBACSRE GL IN HEX PATTERN WIRE-GLASS
SLOPED CONCRETE SILL
EXTERIOR STEEL STAIR
REINF CONC CORBEL (LANDING)
FLOOR LINE - FIREWATCH TOWER
PIPE RAILING (PTD)
CONCRETE DECK (COATED)
FLOOR LINE - UPPER OBSERVATION DECK
MTL MANSARD & FASCIA
PTD PWD SOFFIT
FIXED LITES IN ANOD ALUM FRAMES
PRE-CAST CONCRETE CRIPPLE WALL (ARTICULATION JOINTS AS SHOWN)
MTL FASCIA
FLOOR LINE - OBSERVATION / EXHIBIT AREA
FLEXIBLE FLYING WALL ENCLOSURE
PRE-CAST CONCRETE DECK & WALLS
HM DOOR
CONCRETE SILL
EAST ENTRY
MECH
DRIVE
DRY-SET RUBBLE STONE RETAINING WALLS FROM ON-SITE STONE
EAST ELEVATION
LEGEND
MOUNT WASHBURN LOOKOUT
YELLOWSTONE NATIONAL PARK
YELLOWSTONE CENTER FOR RESOURCES
Department of the Interior
National Park Service
Yellowstone National Park
PROJECT NO.
1-2007-YNP
A1
MT. WASHBURN LOOKOUT


WD FASCIA W/ 1st APPLIED ACCENTS
STUCCO SOFFIT & CURVED CROWN
HEADER W/PTD MTL GLAZING
SGL PANE GLAZING IN NARROW PROFILE FIXED METAL FRAMES
CONCRETE CRIPPLE WALL
PIPE RAILING (PTD)
CONCRETE DECK & OVERHANG W/ CAST DRIP
ANTI-DECO ARTICULATION JOINTS
BATTERED CONCRETE BEARING WALLS W/ TEXTURED COATING
PTD WD HEADER
SGL PANE GLAZING IN NARROW PROFILE FIXED METAL FRAMES
HEX PATTERN WIRE-GLASS
SLOPED CONCRETE SILL
EXTERIOR STEEL STAIR
REINF CONC CORBEL (LANDING)
FLOOR LINE - FIREWATCH TOWER
PIPE RAILING (PTD)
CONCRETE DECK (COATED)
FLOOR LINE - UPPER OBSERVATION DECK
DRIVE
LEGEND
SOUTH ELEVATION
DRY-SET RUBBLE STONE RETAINING WALLS FROM ON-SITE STONE
MOUNT WASHBURN LOOKOUT
YELLOWSTONE NATIONAL PARK
YELLOWSTONE CENTER FOR RESOURCES
Department of the Interior
National Park Service
Yellowstone National Park
1-2007-YNP
A1
MT. WASHBURN
LOOKOUT


WD FASCIA W/ 1x2 APPLIED ACCENTS
STUCCO SOFFIT & CURVED CROWN
HEADER W/ PTD MTL. CLADDING
SGL PANE GLAZING IN NARROW PROFILE FIXED METAL FRAMES
CONCRETE CRIPPLE WALL
PIPE RAILING (PTD)
CONCRETE DECK & OVERHANG W/ CAST DRIP
ART-DECO ARTICULATION JOINTS
BATTERED CONCRETE BEARING WALLS W/ TEXTURED COATING
PTD WD HEADER (ORIGINALLY VENTD)
WD STEEL SASH W/ SGL PANE CASCADE GL IN HEX PATTERN WIRE-GLASS
SLOPED CONCRETE SILL
WEST ENTRY
REINF CONC CORBEL (LANDING)
FLOOR LINE - FIREWATCH TOWER
PIPE RAILING (PTD)
CONCRETE DECK (COATED)
FLOOR LINE - UPPER OBSERVATION DECK
MTL MANSARD & FASCIA
PTD PWD SOFFIT
FIXED LITES IN ANOD ALUM FRAMES
PRE-CAST CONCRETE CRIPPLE WALL (ARTICULATION JOINTS AS SHOWN)
MTL FASCIA
FLOOR LINE - OBSERVATION / EXHIBIT AREA
FLEXIBLE VINYL WALL ENCLOSURE
PRE-CAST CONCRETE COLS & WALLS
CONCRETE SILL
DRY-SET RUBBLE STONE RETAINING WALLS FROM ON-SITE STONE
LEGEND
WEST ELEVATION
MOUNT WASHBURN LOOKOUT
YELLOWSTONE NATIONAL PARK
YELLOWSTONE CENTER FOR RESOURCES
Department of the Interior
National Park Service
Yellowstone National Park
PROJECT NO.
1-2007-YNP
A1
MT. WASHBURN
LOOKOUT


1890 (ATTRIBUTED)
1935 CONSTRUCTION
1935 / 1940 CONSTRUCTION
EXTERIOR STAIR TO PREVIATON NOT SHOWN FOR CLARITY
PREVIATON / LOOKOUT
OBSERVATION
INTERPRETIVE
TOP OF RAIL
BOTTOM
NOT SHOWN
GRADE
REINFORCED CONCRETE FOUNDATION WALLS: BASED ON PHOTOGRAPHS TAKEN DURING CONSTRUCTION IT IS ESTIMATED THAT THE WALLS ARE REINFORCED WITH (2) LAYERS OF #5 @ 24" OC
RE COLLECTION
FOUNDATION, FOOTINGS, AND DEPTH OF SUB-STRUCTURE WERE NOT ABLE TO BE FIELD MEASURED; DRAWING OF THESE ELEMENTS REPRESENTS ESTIMATED PROFILES BASED ON CONSTRUCTION PHOTOGRAPHS (SHOWN BY DASHED LINES)
INTERIOR OF SECURE COMMUNICATIONS AREA WAS NOT FIELD MEASURED
NORTH - SOUTH BUILDING SECTION
LEGEND
NUMBER OF 90° INCREMENTS
INCHES
FEET
ALL DIMENSIONS SHOWN ON THIS DRAWING ARE BASED ON FIELD MEASUREMENTS TAKEN BY THE ARCHITECT. MEASUREMENTS WERE LIMITED TO HAND HELD TAPES AND OTHER DEVICES; IT WAS ASSUMED THAT WALL THICKNESSES ARE CONSISTENT AND IT IS NOT KNOWN IF THE BUILDING IS SQUARE. IT IS THE RESPONSIBILITY OF ANYONE WORKING ON THE BUILDING TO VERIFY ALL OF THE DIMENSIONS SHOWN AT THE TIME MEASUREMENTS ARE MADE TO THE STRUCTURE.
MOUNT WASHBURN LOOKOUT
YELLOWSTONE NATIONAL PARK
YELLOWSTONE CENTER FOR RESOURCES
Department of the Interior
National Park Service
Yellowstone National Park
PROJECT NO.
1-2007-YNP
A1
MT. WASHBURN
LOOKOUT

APPENDIX B: CONCRETE

Historical Timeline of Concrete

The following generic table illustrating the development of concrete as a building material has been included since the fundamental material utilized in the Mt. Washburn Fire Lookout is reinforced concrete.

300 BC	Romans used slaked lime made from a volcanic ash called pozzuolana, found near Pozzouli by the bay of Naples, which they used as a cementitious material. Pliny reported a mortar mixture of 1 part lime to 4 parts sand. Vitruvius reported a 2 parts pozzolana to 1 part lime. Animal fat, milk, and blood were used as admixtures
400 AD – 1678	The art of Concrete was lost after the fall of the Roman Empire
1678	Joseph Moxon wrote about a hidden fire in heated lime that appears upon the addition of water.
1756	John Smeaton, British Engineer, rediscovered hydraulic cement through repeated testing of mortar in both fresh and salt water
1779	Bry Higgins was issued a patent for hydraulic cement (stucco) for exterior plastering use.
1796	James Parker from England patented a natural hydraulic cement by calcining nodules of impure limestone containing clay, called Parker's Cement or Roman Cement.
1818	Maurice St. Leger was issued patent for hydraulic cement
1818	Canvass White, American Engineer, found rock deposits in Madison County, New York, that made hydraulic cement with little processing
1820-1821	John Tickell and Abraham Chambers issued hydraulic cement patents.
1822	James Frost of England prepared artificial hydraulic lime (sim to Vicat's) and called it British Cement
1824	Joseph Aspdin, bricklayer and mason in Leeds, England, patented what he called portland cement, since it resembled the stone quarried on the Isle of Portland off the British coast
1828	I. K. Brunel is credited with the first engineering application of portland cement, which was used to fill a breach in the Thames Tunnel
1850s	Jean -Louis Lambot was the first to use reinforced concrete in boats
1867	Joseph Monier patented a design for reinforcing garden tubs, beams and posts
1868	First recorded shipment of portland cement to the US
1850-1880	Francois Coignet, a builder in France, responsible for the first widespread use of concrete in buildings
1871	David O. Saylor established the first portland-cement plant in the US in Coplay, PA
1884	Earnest L. Ransom: patent for a reinforcing system using twisted rods
1887	Henri Le Chatelier of France established oxide ratios to prepare the proper amount of lime to produce portland cement. He named the components: Alite (tricalcium silicate), Belite (dicalcium silicate), and Celite (tetracalcium aluminoferrite). He proposed that hardening is caused by the formation of crystalline products of the reaction between cement and water.
1891	George Bartholomew placed the first concrete street in the USA in Bellefontaine, OH. (still in existence)
1904	Ingalls bldg. using the Ransome system, was the first concrete skyscraper.
1906	The 1906 San Francisco earthquake spurs adoption of building codes in the U.S.
1870s	Francois Hennebique patented the Hennebique system. He was responsible for the widespread acceptance of reinforced concrete

1916	Portland Cement Association founded
1917	The US Bureau of Standards and the American Society for testing Materials established a standard formula for portland cement
1927	Eugene Freyssinet develops successful pre-stressed concrete
1936	The first major concrete dams, Hoover Dam and Grand Coulee Dam, were built.
1940s	Portland Cement Laboratories perfect air-entrained concrete
1970s	Fiber reinforcement in concrete was introduced
1975	Water Tower Place, 859 ft., 9000psi conc. using superplasticizers
1985	Peak shipment of portland cement to the US increased to nearly 3 million barrels

Red Devil

Technical Data Sheet

Water Stop Cement (Hydraulic Cement) – Product No. 0380

Description

Water Stop Cement is quick-setting hydraulic cement that expands as it hardens to form a water-tight seal that stops leaks & seals cracks in concrete & masonry walls.

Directions:

Use according to container label instructions.
NOTE: Patched area should be kept damp for several hours after application.

Key Features

- Quick-setting
- Excellent shelf-life when stored as directed
- Easy to Use
- Expands as it hardens
- Suitable for below-grade applications
- VOC Compliant

Uses

Seal cracks in concrete & masonry walls; suitable for below-grade retaining walls & basement walls.

Physical/Performance Property	Test Method	Typical Result
Base Raw Material	Known	Portland Cement & Calcium Aluminate Cement
Consistency/Appearance	Visual Observation	Powder
Initial Set	Test Lab	3 to 5 minutes
Hard Set	Test Lab	5 to 8 minutes
Shelf Life	Lab 50 C Oven – Accelerated	2 Years Minimum (stored as directed)
Storage Conditions	Test Lab	Store in a cool, dry place in the original, sealed container
Toxicity	Supplier Data Sheets	Non-toxic when used as directed
Mixing Ratio (average consistency)	Supplier Data Sheets	4 Parts Powder to 1 Part Water
Solubility in Water	Test Lab	Insoluble after cure
Color	Visual Observation	Light Gray
VOC Content	Supplier Data Sheets	0% by weight

Clean Up

Clean tools with water before product hardens & clean skin with soap & water.

For Best Results

- Gloves & eye protection should be worn for optimum protection.
- Patched area should be kept damp for several hours following application for best results.

Color

Light Gray

Packaging

HDPE Tubs

Limitations

- Use of clean water recommended.
- Store in cool dry place.

Environmental/Safety/Transportation

Criteria	Evaluation Method	Status
CARB Compliance	Documents Review	Yes
Prop 65 Ingredients	Documents Review	None
UN Proper Shipping Name	Review of Regs	NA
UN Hazard Class	Review of Regs	NA
UN ID Number	Review of Regs	NA
UN Packing Group	Review of Regs	NA
VOC Content	Calculated	0% by weight

CAUTION: NOT FOR INTERNAL CONSUMPTION. KEEP OUT OF REACH OF CHILDREN & PETS. (See MSDS for additional information)

LIMITED WARRANTY

Recommendations for use of this product are based on tests we believe to be reliable. Manufacturer and seller are not responsible for results where this product is used under conditions beyond our control. If not satisfied when used as directed, product will be replaced without charge upon presentation of proof of purchase and used container. This limited warranty only applies to residential use and damages including consequential damage and other remedies are excluded. No other warranties apply, including fitness for a particular purpose.

TDS Number: 0390TD
Date of Issue: September 5, 2008
SEE MSDS FOR ADDITIONAL DATA/INFORMATION

APPENDIX C

PARTICIPANTS IN THE PREPARATION OF THIS REPORT

This report has been prepared as part of ***Cooperative Agreement H1233E007*** between the Montana Preservation Alliance and it's related contractors; and the National Park Service, Yellowstone National Park.

The purpose of the agreement referenced above is to create Historic Structures Reports for selected historic properties as a first phase to address treatment of Historic Structures in Yellowstone National Park. The U.S. Commissioner's Residence and Jail has been identified as one of those historic properties.

The primary partners in the co-operative agreement are:

National Park Service – Yellowstone National Park
Montana Preservation Alliance
Sievert & Sievert CRC – Professional consultants in the fields of Historic Architecture, Architecture, and Structural Design.

Participants in the preparation of this report, including their areas of expertise, are:

Chere Jiusto – MPA; Director – history, chronology, and historic significance of Mount Washburn Lookout.

Jim Jenks, Historian – history, chronology, and historic significance of Mount Washburn Lookout.

Kenneth R. Sievert A.I.A.; A.S.C.E. (aff). – technical author; principal investigator of materials, structural assemblies, materials conservation, and building codes; project manager for S&S.

Herbert E. Dawson – YNP Historic Architect; – contributions throughout.

Lee H. Whittlesey M.A., J.D., Ph.D. (hon) – YNP Historian – history and chronology of Mount Washburn Lookout

Tobin Roop – Chief; Branch of Cultural Resources; Yellowstone National Park. Project Manager.

APPENDIX D

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Global RF Solutions℠
PREDICT, DETECT, PROTECT

1900 W. Chandler Blvd Ste 15-228
Chandler, AZ 85224
(480) 814-1393
www.grfs.net

Evaluation of Human Exposure to Radio Frequency Emissions

Analysis of Washburn Fire Watch Tower Yellowstone Park, WY

LIMITED WARRANTY

Global RF Solutions warrants that this analysis was performed using substantially the methods that are referenced and described in this report and based entirely upon the information on the antenna site that was collected during our visit. Global RF Solutions disclaims all other warranties either expressed or implied, including, but not limited to, implied warranties of merchantability and fitness for a particular purpose.

In no event will Global RF Solutions be liable to you or by any other person for damages, including any loss of profits, lost savings, or other special, exemplary, punitive, incidental or consequential damages arising out of your use or inability to use the analysis whether such claim is based on breach of warranty, contract, tort or other legal theory and regardless of the causes of such loss or damages. In no event shall Global RF Solutions entire liability to you under this Agreement exceed an amount equal to the price paid to for the analysis.

TABLE OF CONTENTS

1. SUMMARY AND CONCLUSION

Summary:

An analysis of this Communications Facility has been completed to determine if it is compliant with guidelines set forth by the Federal Communications Commission (FCC) with regards to maximum human exposure limits. This facility is also a residence with untrained personnel living here. Therefore, the FCC Public limit will apply to all readily accessible locations. This site was surveyed on Monday, September 27th, 2010. This determination of FCC Compliance is applicable to all transmitting equipment at this location. This has been accomplished with the use of predictive modeling software and measurements performed with a Narda SRM3000, PN3001/01 selective radiation meter serial #N-0016 and an SRM E-Field Probe PN3501/02 serial #H-0368. Additionally, a Narda 8715 meter and 8722D probe were utilized to verify that the point to point microwave equipment is below the FCC limits. The meters and probes are properly calibrated per the manufacturers' specifications.

The Radio Frequency Power Density predictions have been done using 100% transmitter duty cycle. This will predict a worst-case scenario for safety reasons. The predictive software tool utilizes a cylindrical model that provides spatially averaged power density that is calculated in one square foot increments (pixels). The composite RF fields are displayed as a percentage of the exposure limit. The software tool utilized for predictive analysis is RoofView®, a product developed by Richard Tell Associates, Inc. The FCC recognizes this software tool as a valid means of determining Maximum Permissible Exposure levels (MPE).

Conclusion:

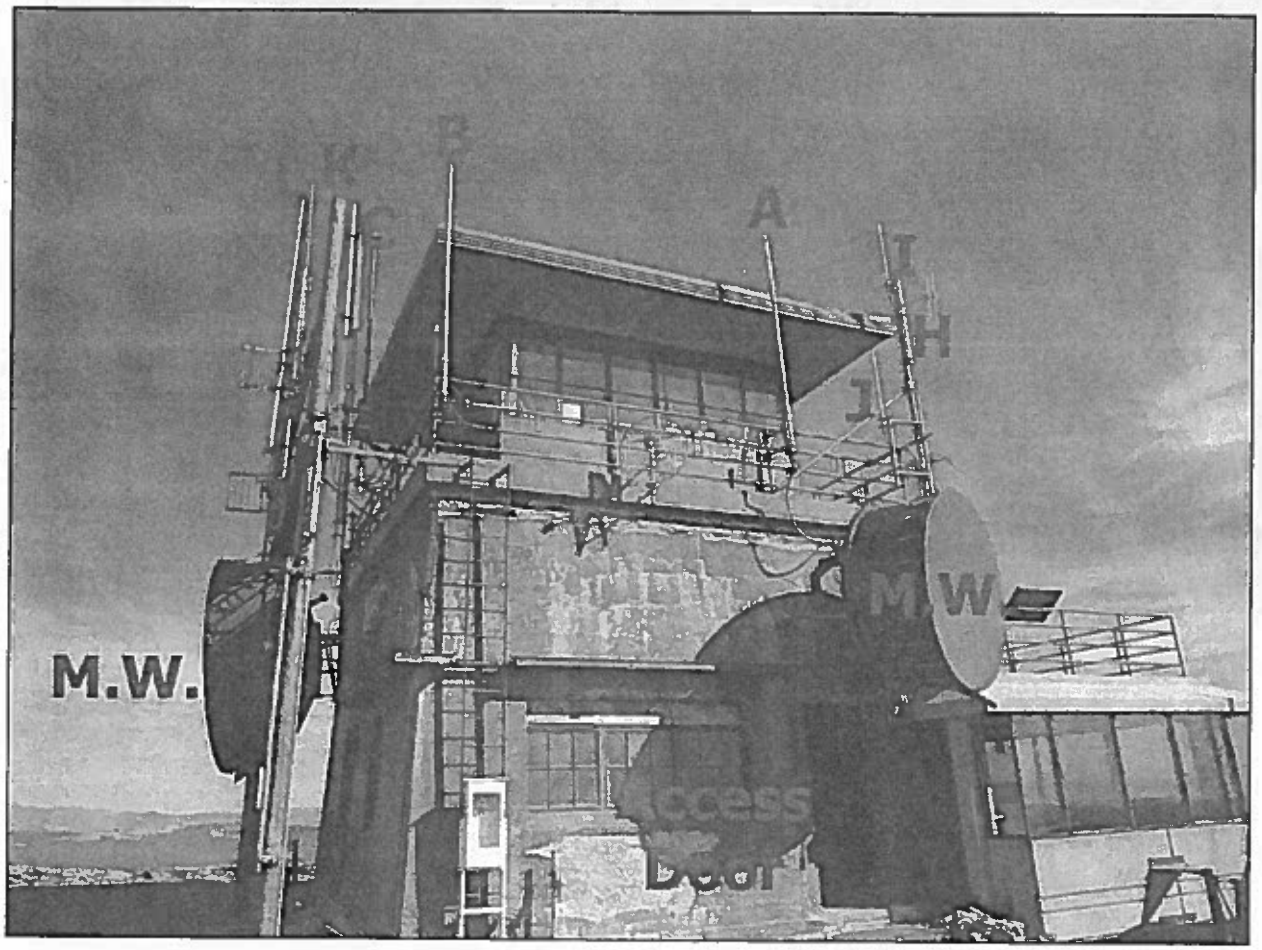
The predictive software analysis has shown that one area that is readily accessible at this site, **may exceed** the maximum permissible exposure levels for the FCC Public standards near antenna "E". The RoofView® calculation is conservative and has used a 100% uptime power setting. Antenna "E" has two separate transmitters connected to it. Both transmitters would have to be transmitting simultaneously for an extended period of time for this area to actually exceed the FCC Public limit. Since it is extremely unlikely that this will ever occur, this area will not be considered to be an issue regarding Human RF Exposure. The only other noteworthy measurement was adjacent to antenna "A" which belongs to Alltel. The spatial average does not exceed the FCC Public limit (17.3% Public) and RoofView® concurs with this finding. As long as no significant changes are made to this site, **it will remain compliant** with FCC guidelines. See the Recommendations section for further details.

2. SITE DESCRIPTION

Site ID: N/A			**Site Name: Washburn Fire Watch Tower**			
Date of Evaluation	**September 27th, 2010**		**Site Evaluator (name): Marv Wessel**			
Site Type	**Building**	**XX**	**Tower/Monopole**		**Water Tower**	
Address: End of Chittendon Road, Yellowstone Park, WY						
GPS NAD83	**N 44 47.85**		**W 110 26.03**		**Structure Height AGL**	**30'**
Access Restricted	**No**					

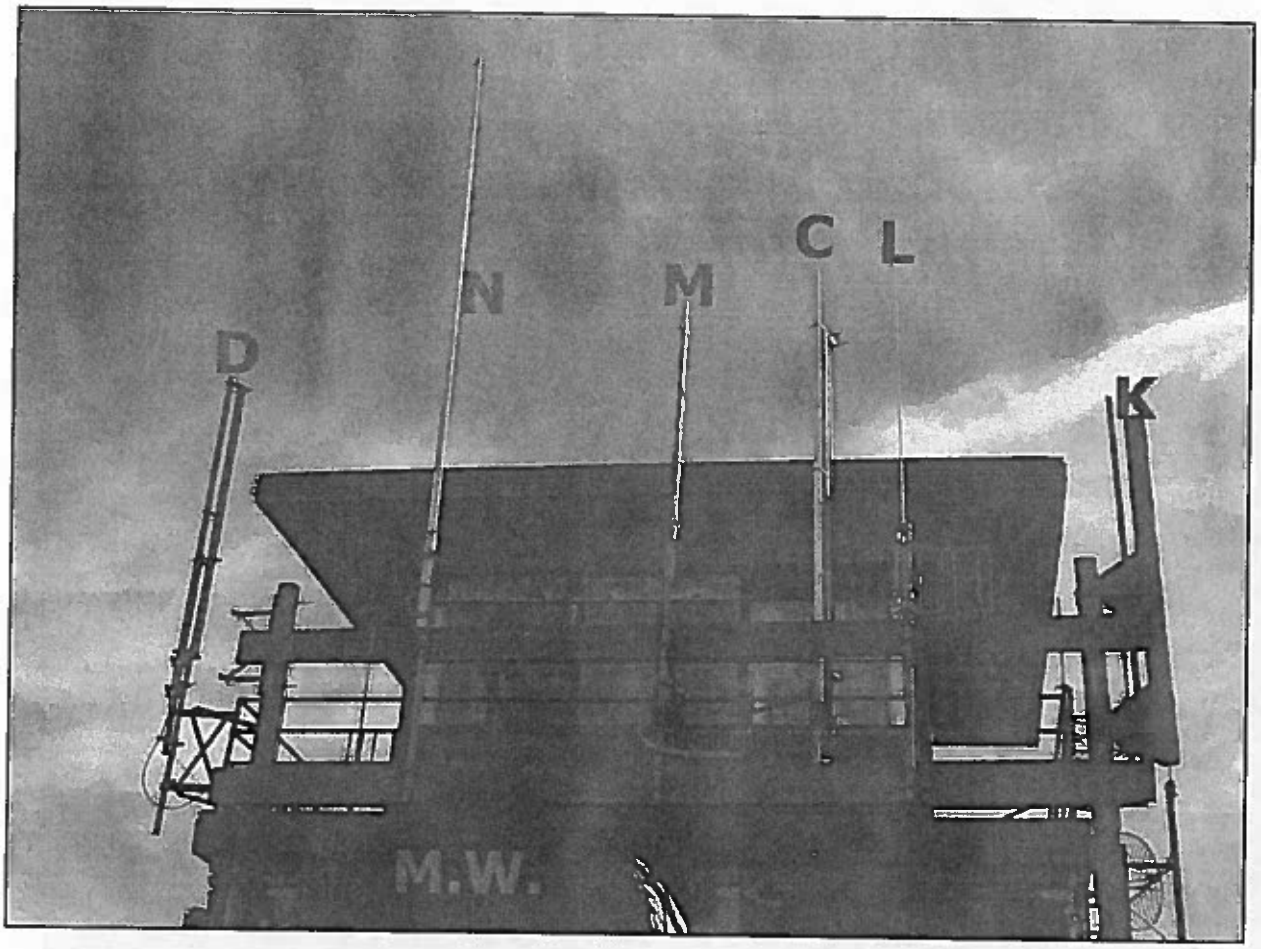
This communications site is located on a building that serves as a fire watch tower & residence. Antennas are mounted all around the top level (residence) on the railing. Access is not restricted to EME awareness trained personnel and an RF safety plan is not in place.

These are photographs of the Washburn site:



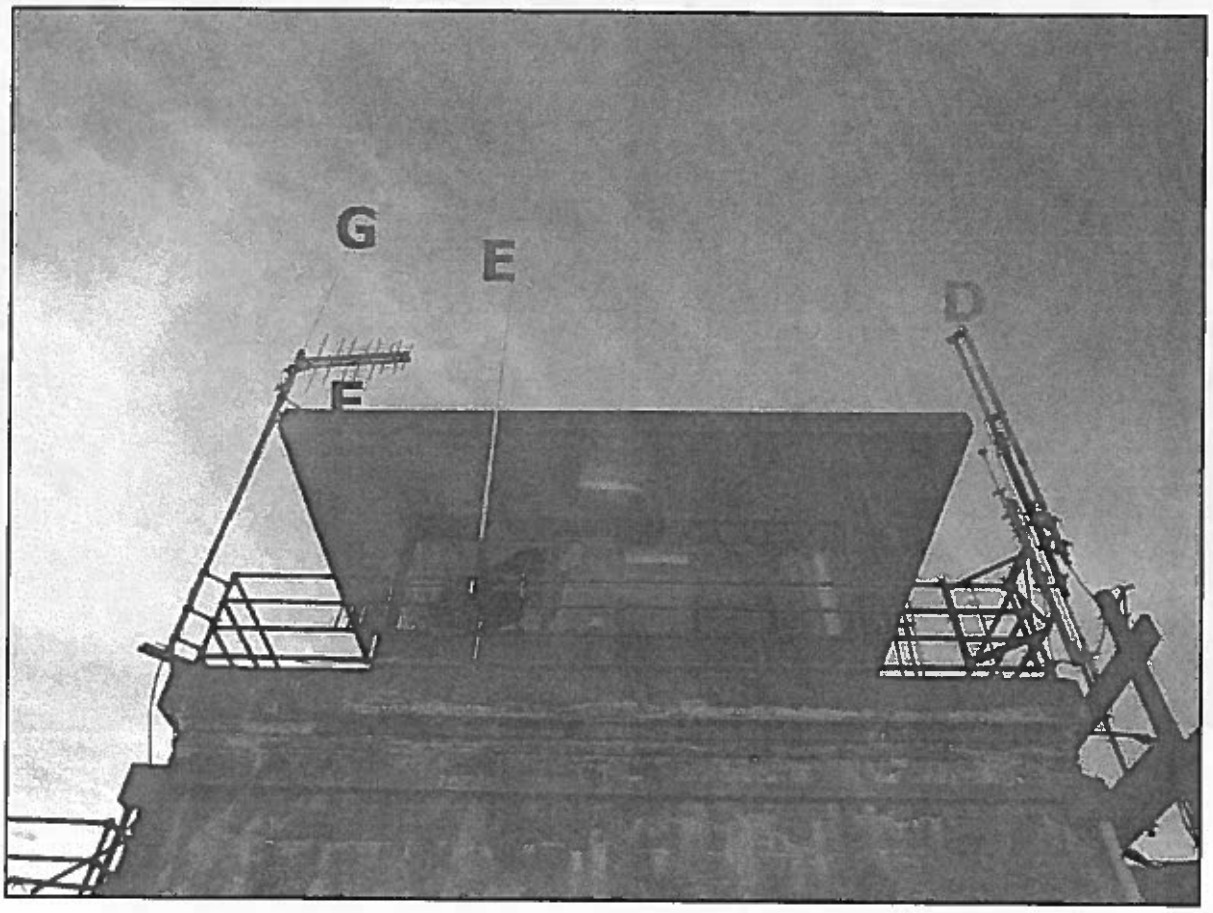
2. SITE DESCRIPTION (continued)

These are photographs of the Washburn site:



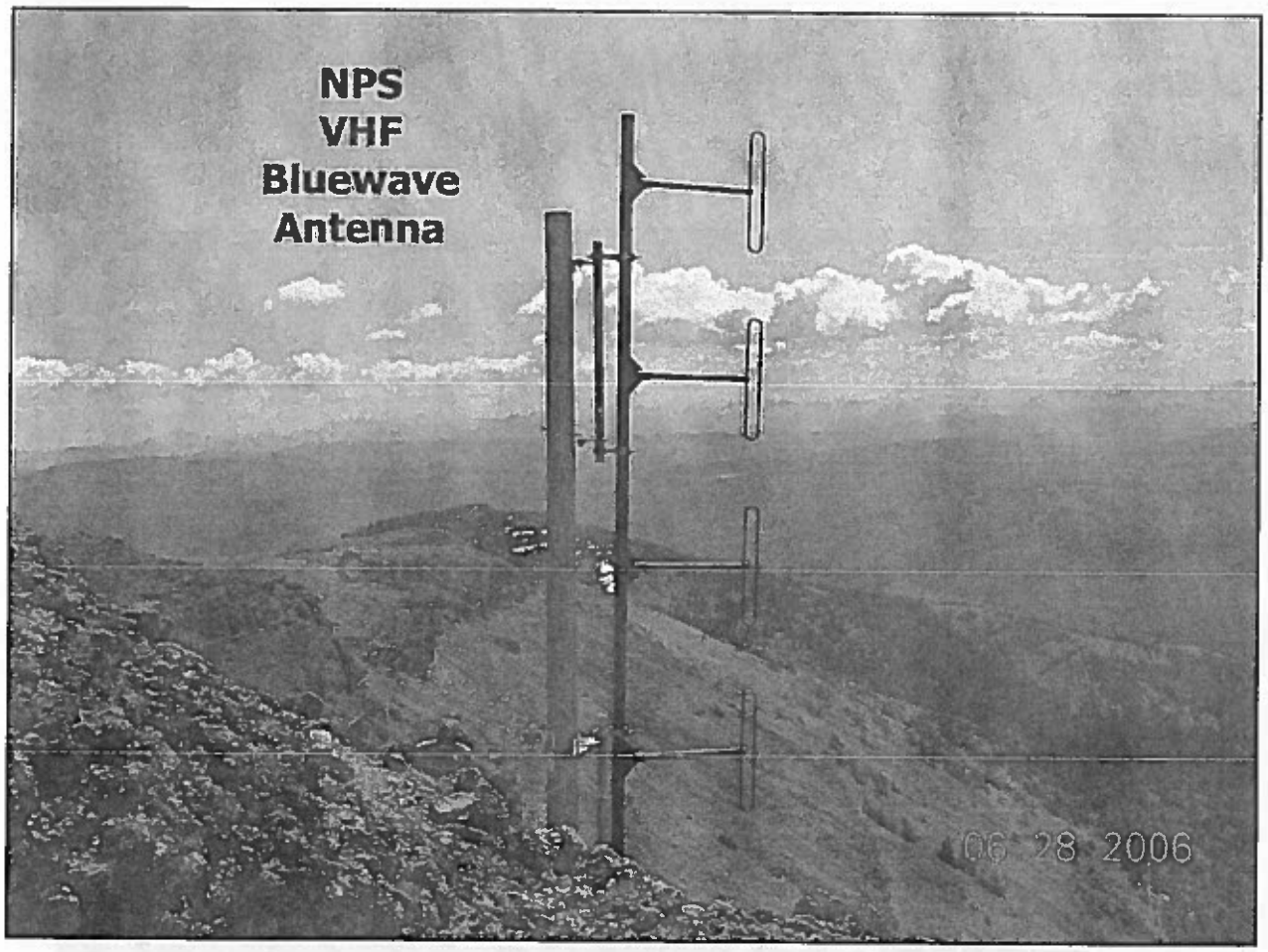
2. SITE DESCRIPTION (continued)

These are photographs of the Washburn site:



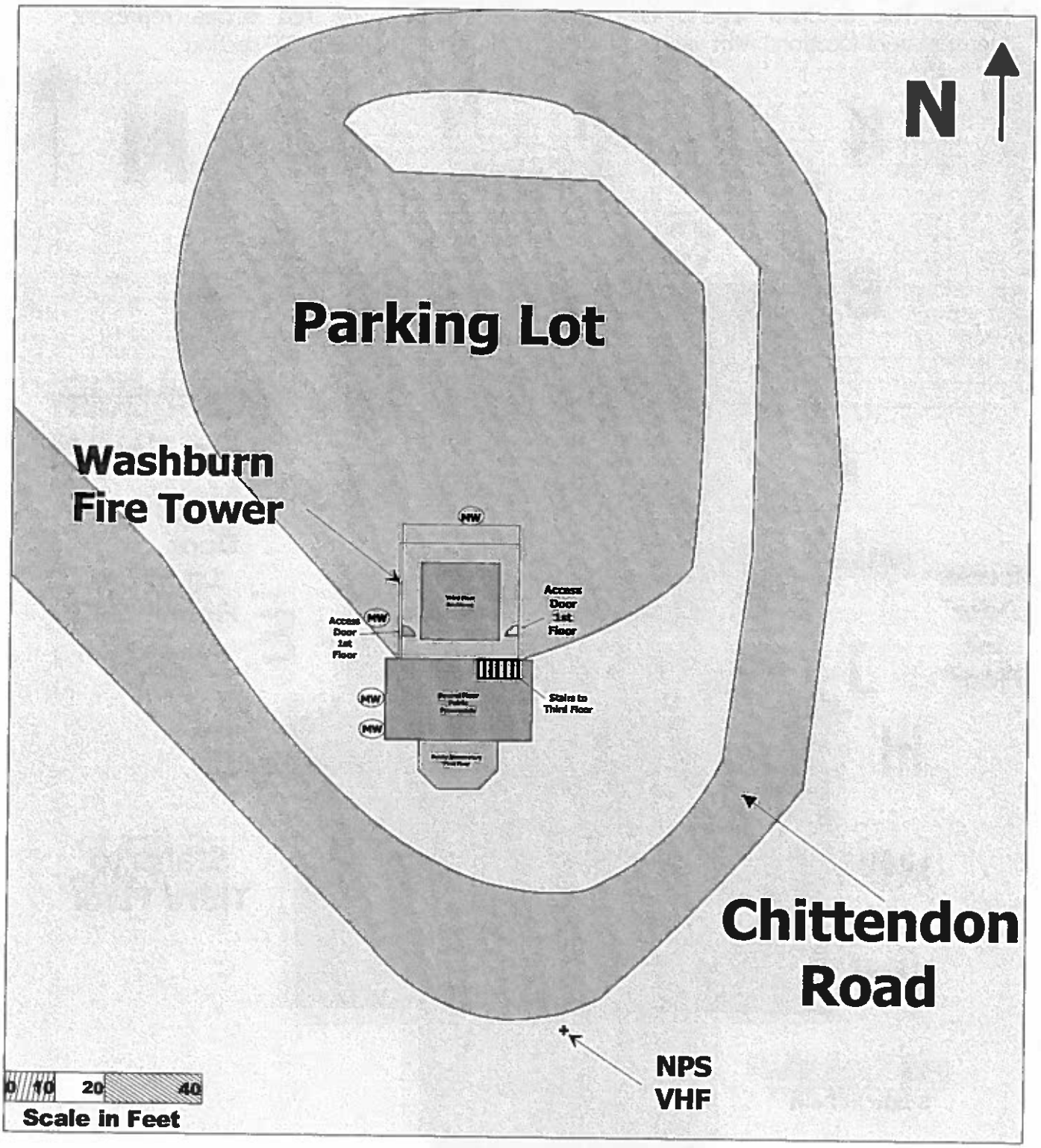
2. SITE DESCRIPTION (continued)

These are photographs of the Washburn site:



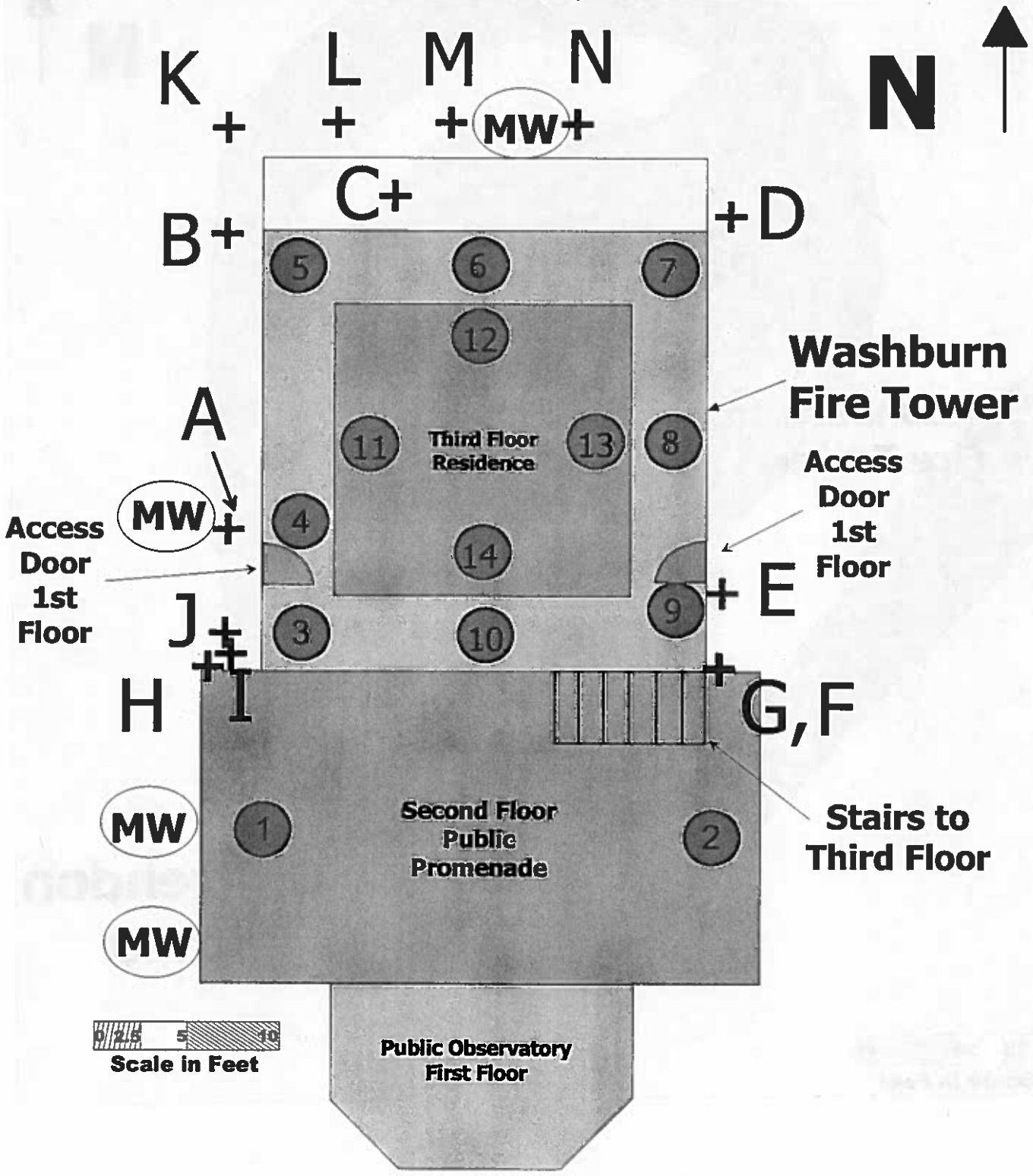
2. SITE DESCRIPTION (continued)

This drawing depicts the layout of the Washburn communications facility.



2. SITE DESCRIPTION (continued)

This drawing depicts the details of the antenna layout of the Washburn communications facility. The antenna legend is on the next page. The red circles represent measurement locations with values that are displayed in the RESULTS section.



2. SITE DESCRIPTION (continued)

This is the antenna legend for the drawing on the preceding page.

ID	Name	(MHz) Freq	Input Power	Calc Power	Mfg	Model	(ft) X	(ft) Y	(ft) Z	(ft) Type Aper	dBd Gain	BWdth Pt Dir
A	Alltel	875.00000		100.0	Antel	BCD 80010	-2.0	8.0	4.0	9.5		0;360
B	Alltel	875.00000		0.0	Antel	BCD 80010	-2.0	24.0	4.0	9.5		0;360
C	Verizon	885.00000		0.0	Decibel	Unkown	7.0	26.0	4.5	11.0		180;10
D	Verizon	885.00000		100.0	Decibel	Unkown	25.0	25.0	4.5	11.0		180;10
E	R.K. Contractor	456.80000		63.1	Omni	Unkown	25.0	4.0	3.7	13.0		0;360
F	USGS	450.00000	10.0	10.0	Yagi	Unkown	25.0	0.0	13.0	3.0		45;10
G	NPS	163.00000	100.0	100.0	Omni Whip	Unkown	25.0	0.0	14.0	8.0		0;360
H	Teton	800.00000	50.0	50.0	Folded Dipole	Unkown	-3.0	0.0	10.0	2.0		0;360
I	Teton	452.45000	50.0	50.0	Omni	Unkown	-2.0	1.0	12.0	4.0		0;360
J	Teton	452.45000		0.0	Omni	Unkown	-2.0	2.0	4.5	4.0		0;360
K	NPS	16.32500	10.0	10.0	Cellwave	Unkown	-2.0	30.0	0.0	10.0		0;360
L	Disconnected	150.00000		0.0	Omni Whip	Unkown	4.0	30.0	6.0	8.0		0;360
M	2 Way	451.00000	120.0	120.0	Omni Whip	Unkown	10.0	30.0	6.0	8.0		0;360
N	NPS	172.50000	50.0	50.0	Omni Whip	Unkown	17.0	30.0	6.0	18.0		0;360

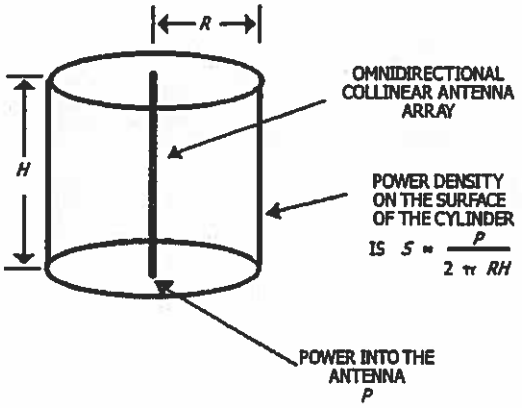
3. ANALYSIS

Site Modeling:

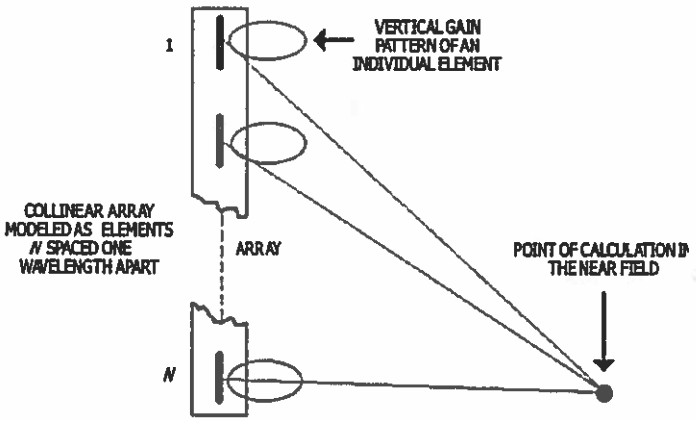
Electromagnetic energy (EME) exposure situations have been modeled at this site by using the following techniques. A cylindrical model in the near field of a vertical collinear antenna is run through a computer calculation engine. This model was used to compute the average power density on the surface of an imaginary cylinder, with a height equal to the antenna's aperture, and a radius equal to the distance of interest.

The collinear antenna model estimates the number of elements in the array and in the gain pattern of each element. The power density in the near field of the antenna is calculated by combining the contributions from each element in the array. The completed calculations of these models are plotted in the RESULTS section. The software tool utilized for predictive analysis is RoofView®, a product of Richard Tell Associates, Inc.

CYLINDRICAL RADIATION MODEL



COLLINEAR ARRAY MODEL FOR NEAR FIELD



3. ANALYSIS (continued)

The field survey defines exclusion areas at the site. Electromagnetic energy (EME) fields were assessed through direct measurement at the transmitter site, using properly calibrated field probes.

An SRM-3000 Selective Measurement Device was used for the measurement phase of this survey. This meter represents the latest generation of equipment designed to measure RF energy by Narda Safety Test Solutions.

This device uses an isotropic antenna that is calibrated to measure Radio Frequency power densities using specific selectable frequencies. Tables representing the level of RF power measured at different locations at this site are listed in the FCC Public % of Standard.

Measurements were made for SMR, PCS, Cellular, paging, land mobile, etc., and commercial broadcast frequencies that includes FM radio and television.

Narda SRM-3000

4. RESULTS

The spatial average RF Power density levels for transmitting antennas were measured in locations indicated on the site drawing (page 10 red numbered circles), and are listed in the tables below according to service type, frequency range and percentage of FCC Public standard each frequency range contributes to the measurement location.

narda Safety Test Solutions

Measurement 1

Standard: FCC GP

Service	Value	Lower Frequency	Upper Frequency
TV 2-6	0.1448600 %	54.000 MHz	88.000 MHz
FM Radio	0.0445680 %	88.000 MHz	108.000 MHz
Aero & Mobile	0.1006000 %	108.000 MHz	174.000 MHz
TV 7-13	0.0447660 %	174.000 MHz	220.000 MHz
Land Mobile	0.0051826 %	450.000 MHz	470.000 MHz
TV UHF	0.0399550 %	470.000 MHz	697.000 MHz
700 LTE	0.0067650 %	728.000 MHz	793.000 MHz
Land Mobile	0.0014718 %	806.000 MHz	824.000 MHz
SMR (Nextel)	0.0013260 %	850.000 MHz	869.000 MHz
A Cellular	0.0280700 %	869.000 MHz	880.000 MHz
B Cellular	0.0022958 %	880.000 MHz	890.000 MHz
A Cellular	0.0001149 %	890.000 MHz	891.500 MHz
B Cellular	0.0004031 %	891.500 MHz	894.000 MHz
Paging	0.0002064 %	929.000 MHz	932.000 MHz
PCS A	0.0011776 %	1930.000 MHz	1945.000 MHz
PCS D	0.0004335 %	1945.000 MHz	1950.000 MHz
PCS B	0.0014343 %	1950.000 MHz	1965.000 MHz
PCS E	0.0004599 %	1965.000 MHz	1970.000 MHz
PCS F	0.0005051 %	1970.000 MHz	1974.990 MHz
PCS C	0.0013322 %	1975.000 MHz	1990.000 MHz
Others	0.1884600 %		
Total	0.5143800 %	54.000 MHz	1990.000 MHz

4. RESULTS (continued)

narda Safety Test Solutions

Measurement 2

Standard: FCC GP

Service	Value	Lower Frequency	Upper Frequency
TV 2-6	0.1419000 %	54.000 MHz	88.000 MHz
FM Radio	0.0471660 %	88.000 MHz	108.000 MHz
Aero & Mobile	0.1070800 %	108.000 MHz	174.000 MHz
TV 7-13	0.0473930 %	174.000 MHz	220.000 MHz
Land Mobile	0.0053129 %	450.000 MHz	470.000 MHz
TV UHF	0.0407620 %	470.000 MHz	697.000 MHz
700 LTE	0.0070958 %	728.000 MHz	793.000 MHz
Land Mobile	0.0015701 %	806.000 MHz	824.000 MHz
SMR (Nextel)	0.0013337 %	850.000 MHz	869.000 MHz
A Cellular	0.0280190 %	869.000 MHz	880.000 MHz
B Cellular	0.0027165 %	880.000 MHz	890.000 MHz
A Cellular	0.0000907 %	890.000 MHz	891.500 MHz
B Cellular	0.0003670 %	891.500 MHz	894.000 MHz
Paging	0.0001866 %	929.000 MHz	932.000 MHz
PCS A	0.0012447 %	1930.000 MHz	1945.000 MHz
PCS D	0.0005028 %	1945.000 MHz	1950.000 MHz
PCS B	0.0014797 %	1950.000 MHz	1965.000 MHz
PCS E	0.0005779 %	1965.000 MHz	1970.000 MHz
PCS F	0.0004523 %	1970.000 MHz	1974.990 MHz
PCS C	0.0014502 %	1975.000 MHz	1990.000 MHz
Others	0.1869300 %		
Total	0.6236300 %	54.000 MHz	1990.000 MHz

narda Safety Test Solutions

Measurement 3

Standard: FCC GP

Service	Value	Lower Frequency	Upper Frequency
TV 2-6	0.1405800 %	54.000 MHz	88.000 MHz
FM Radio	0.0450440 %	88.000 MHz	108.000 MHz
Aero & Mobile	0.1056600 %	108.000 MHz	174.000 MHz
TV 7-13	0.0466630 %	174.000 MHz	220.000 MHz
Land Mobile	0.0054061 %	450.000 MHz	470.000 MHz
TV UHF	0.0401240 %	470.000 MHz	697.000 MHz
700 LTE	0.0067910 %	728.000 MHz	793.000 MHz
Land Mobile	0.0014454 %	806.000 MHz	824.000 MHz
SMR (Nextel)	0.0013747 %	850.000 MHz	869.000 MHz
A Cellular	1.8932000 %	869.000 MHz	880.000 MHz
B Cellular	0.0422700 %	880.000 MHz	890.000 MHz
A Cellular	0.0001081 %	890.000 MHz	891.500 MHz
B Cellular	0.0007944 %	891.500 MHz	894.000 MHz
Paging	0.0002073 %	929.000 MHz	932.000 MHz
PCS A	0.0013239 %	1930.000 MHz	1945.000 MHz
PCS D	0.0004724 %	1945.000 MHz	1950.000 MHz
PCS B	0.0013262 %	1950.000 MHz	1965.000 MHz
PCS E	0.0004305 %	1965.000 MHz	1970.000 MHz
PCS F	0.0004479 %	1970.000 MHz	1974.990 MHz
PCS C	0.0014819 %	1975.000 MHz	1990.000 MHz
Others	0.1848600 %		
Total	2.5200000 %	54.000 MHz	1990.000 MHz

4. RESULTS (continued)

narda Safety Test Solutions

Measurement 4

Standard: FCC GP

Service	Value	Lower Frequency	Upper Frequency
TV 2-6	0.1450100 %	54.000 MHz	88.000 MHz
FM Radio	0.0446850 %	88.000 MHz	108.000 MHz
Aero & Mobile	0.1065500 %	108.000 MHz	174.000 MHz
TV 7-13	0.0454530 %	174.000 MHz	220.000 MHz
Land Mobile	0.0055441 %	450.000 MHz	470.000 MHz
TV UHF	0.0389910 %	470.000 MHz	697.000 MHz
700 LTE	0.0073679 %	728.000 MHz	793.000 MHz
Land Mobile	0.0015269 %	806.000 MHz	824.000 MHz
SMR (Nextel)	0.0013471 %	850.000 MHz	869.000 MHz
A Cellular	16.7670002 %	869.000 MHz	880.000 MHz
B Cellular	0.0199980 %	880.000 MHz	890.000 MHz
A Cellular	0.0000810 %	890.000 MHz	891.500 MHz
B Cellular	0.0012322 %	891.500 MHz	894.000 MHz
Paging	0.0002203 %	929.000 MHz	932.000 MHz
PCS A	0.0013408 %	1930.000 MHz	1945.000 MHz
PCS D	0.0004151 %	1945.000 MHz	1950.000 MHz
PCS B	0.0013943 %	1950.000 MHz	1965.000 MHz
PCS E	0.0004367 %	1965.000 MHz	1970.000 MHz
PCS F	0.0004449 %	1970.000 MHz	1974.990 MHz
PCS C	0.0014272 %	1975.000 MHz	1990.000 MHz
Others	0.1859600 %		
Total	17.3759995 %	54.000 MHz	1990.000 MHz

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Measurement 5

Standard: FCC GP

Service	Value	Lower Frequency	Upper Frequency
TV 2-6	0.1334300 %	54.000 MHz	88.000 MHz
FM Radio	0.0434930 %	88.000 MHz	108.000 MHz
Aero & Mobile	0.1064700 %	108.000 MHz	174.000 MHz
TV 7-13	0.0457350 %	174.000 MHz	220.000 MHz
Land Mobile	0.0056343 %	450.000 MHz	470.000 MHz
TV UHF	0.0395360 %	470.000 MHz	697.000 MHz
700 LTE	0.0069014 %	728.000 MHz	793.000 MHz
Land Mobile	0.0016144 %	806.000 MHz	824.000 MHz
SMR (Nextel)	0.0013653 %	850.000 MHz	869.000 MHz
A Cellular	4.8709002 %	869.000 MHz	880.000 MHz
B Cellular	0.2776300 %	880.000 MHz	890.000 MHz
A Cellular	0.0000938 %	890.000 MHz	891.500 MHz
B Cellular	0.0402930 %	891.500 MHz	894.000 MHz
Paging	0.0001711 %	929.000 MHz	932.000 MHz
PCS A	0.0012525 %	1930.000 MHz	1945.000 MHz
PCS D	0.0004040 %	1945.000 MHz	1950.000 MHz
PCS B	0.0014388 %	1950.000 MHz	1965.000 MHz
PCS E	0.0005761 %	1965.000 MHz	1970.000 MHz
PCS F	0.0004656 %	1970.000 MHz	1974.990 MHz
PCS C	0.0015844 %	1975.000 MHz	1990.000 MHz
Others	0.1822900 %		
Total	5.7613001 %	54.000 MHz	1990.000 MHz

4. RESULTS (continued)

narda Safety Test Solutions

Measurement 6

Standard: FCC GP

Service	Value	Lower Frequency	Upper Frequency
TV 2-6	0.1363200 %	54.000 MHz	88.000 MHz
FM Radio	0.0482240 %	88.000 MHz	108.000 MHz
Aero & Mobile	0.1040600 %	108.000 MHz	174.000 MHz
TV 7-13	0.0460530 %	174.000 MHz	220.000 MHz
Land Mobile	0.0052648 %	450.000 MHz	470.000 MHz
TV UHF	0.0398470 %	470.000 MHz	697.000 MHz
700 LTE	0.0065794 %	728.000 MHz	793.000 MHz
Land Mobile	0.0015845 %	806.000 MHz	824.000 MHz
SMR (Nextel)	0.0014114 %	850.000 MHz	869.000 MHz
A Cellular	0.7631200 %	869.000 MHz	880.000 MHz
B Cellular	0.5205500 %	880.000 MHz	890.000 MHz
A Cellular	0.0000946 %	890.000 MHz	891.500 MHz
B Cellular	0.0193740 %	891.500 MHz	894.000 MHz
Paging	0.0001790 %	929.000 MHz	932.000 MHz
PCS A	0.0011943 %	1930.000 MHz	1945.000 MHz
PCS D	0.0004699 %	1945.000 MHz	1950.000 MHz
PCS B	0.0013727 %	1950.000 MHz	1965.000 MHz
PCS E	0.0004207 %	1965.000 MHz	1970.000 MHz
PCS F	0.0004833 %	1970.000 MHz	1974.990 MHz
PCS C	0.0014034 %	1975.000 MHz	1990.000 MHz
Others	0.1864800 %		
Total	1.8845000 %	54.000 MHz	1990.000 MHz

narda Safety Test Solutions

Measurement 7

Standard: FCC GP

Service	Value	Lower Frequency	Upper Frequency
TV 2-6	0.1397800 %	54.000 MHz	88.000 MHz
FM Radio	0.0435930 %	88.000 MHz	108.000 MHz
Aero & Mobile	0.1030100 %	108.000 MHz	174.000 MHz
TV 7-13	0.0454150 %	174.000 MHz	220.000 MHz
Land Mobile	0.0055429 %	450.000 MHz	470.000 MHz
TV UHF	0.0391300 %	470.000 MHz	697.000 MHz
700 LTE	0.0067410 %	728.000 MHz	793.000 MHz
Land Mobile	0.0015653 %	806.000 MHz	824.000 MHz
SMR (Nextel)	0.0014019 %	850.000 MHz	869.000 MHz
A Cellular	0.2834700 %	869.000 MHz	880.000 MHz
B Cellular	0.8123200 %	880.000 MHz	890.000 MHz
A Cellular	0.0000945 %	890.000 MHz	891.500 MHz
B Cellular	0.0566000 %	891.500 MHz	894.000 MHz
Paging	0.0001680 %	929.000 MHz	932.000 MHz
PCS A	0.0012582 %	1930.000 MHz	1945.000 MHz
PCS D	0.0004038 %	1945.000 MHz	1950.000 MHz
PCS B	0.0013248 %	1950.000 MHz	1965.000 MHz
PCS E	0.0004538 %	1965.000 MHz	1970.000 MHz
PCS F	0.0004465 %	1970.000 MHz	1974.990 MHz
PCS C	0.0013575 %	1975.000 MHz	1990.000 MHz
Others	0.1841600 %		
Total	1.7282000 %	54.000 MHz	1990.000 MHz

4. RESULTS (continued)

narda Safety Test Solutions

Measurement 8

Standard: FCC GP

Service	Value	Lower Frequency	Upper Frequency
TV 2-6	0.1357900 %	54.000 MHz	88.000 MHz
FM Radio	0.0470270 %	88.000 MHz	108.000 MHz
Aero & Mobile	0.0993650 %	108.000 MHz	174.000 MHz
TV 7-13	0.0464740 %	174.000 MHz	220.000 MHz
Land Mobile	0.0052415 %	450.000 MHz	470.000 MHz
TV UHF	0.0395160 %	470.000 MHz	697.000 MHz
700 LTE	0.0066771 %	728.000 MHz	793.000 MHz
Land Mobile	0.0015967 %	806.000 MHz	824.000 MHz
SMR (Nextel)	0.0012594 %	850.000 MHz	869.000 MHz
A Cellular	0.5408000 %	869.000 MHz	880.000 MHz
B Cellular	0.0708710 %	880.000 MHz	890.000 MHz
A Cellular	0.0000922 %	890.000 MHz	891.500 MHz
B Cellular	0.0093072 %	891.500 MHz	894.000 MHz
Paging	0.0001467 %	929.000 MHz	932.000 MHz
PCS A	0.0011320 %	1930.000 MHz	1945.000 MHz
PCS D	0.0004242 %	1945.000 MHz	1950.000 MHz
PCS B	0.0012417 %	1950.000 MHz	1965.000 MHz
PCS E	0.0003818 %	1965.000 MHz	1970.000 MHz
PCS F	0.0005029 %	1970.000 MHz	1974.990 MHz
PCS C	0.0013034 %	1975.000 MHz	1990.000 MHz
Others	0.1866800 %		
Total	1.1957999 %	54.000 MHz	1990.000 MHz

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Measurement 9

Standard: FCC GP

Service	Value	Lower Frequency	Upper Frequency
TV 2-6	0.1425200 %	54.000 MHz	88.000 MHz
FM Radio	0.0437640 %	88.000 MHz	108.000 MHz
Aero & Mobile	0.1022200 %	108.000 MHz	174.000 MHz
TV 7-13	0.0472900 %	174.000 MHz	220.000 MHz
Land Mobile	0.0057098 %	450.000 MHz	470.000 MHz
TV UHF	0.0393570 %	470.000 MHz	697.000 MHz
700 LTE	0.0068634 %	728.000 MHz	793.000 MHz
Land Mobile	0.0015585 %	806.000 MHz	824.000 MHz
SMR (Nextel)	0.0013347 %	850.000 MHz	869.000 MHz
A Cellular	0.1169300 %	869.000 MHz	880.000 MHz
B Cellular	0.0191860 %	880.000 MHz	890.000 MHz
A Cellular	0.0000879 %	890.000 MHz	891.500 MHz
B Cellular	0.0030456 %	891.500 MHz	894.000 MHz
Paging	0.0002006 %	929.000 MHz	932.000 MHz
PCS A	0.0011359 %	1930.000 MHz	1945.000 MHz
PCS D	0.0004328 %	1945.000 MHz	1950.000 MHz
PCS B	0.0013871 %	1950.000 MHz	1965.000 MHz
PCS E	0.0004657 %	1965.000 MHz	1970.000 MHz
PCS F	0.0005323 %	1970.000 MHz	1974.990 MHz
PCS C	0.0015087 %	1975.000 MHz	1990.000 MHz
Others	0.1840300 %		
Total	0.7195600 %	54.000 MHz	1990.000 MHz

4. RESULTS (continued)

narda Safety Test Solutions

Measurement 10

Standard: FCC GP

Service	Value	Lower Frequency	Upper Frequency
TV 2-6	0.1408200 %	54.000 MHz	88.000 MHz
FM Radio	0.0453300 %	88.000 MHz	108.000 MHz
Aero & Mobile	0.1049700 %	108.000 MHz	174.000 MHz
TV 7-13	0.0450490 %	174.000 MHz	220.000 MHz
Land Mobile	0.0056107 %	450.000 MHz	470.000 MHz
TV UHF	0.0392550 %	470.000 MHz	697.000 MHz
700 LTE	0.0070344 %	728.000 MHz	793.000 MHz
Land Mobile	0.0015965 %	806.000 MHz	824.000 MHz
SMR (Nextel)	0.0013976 %	850.000 MHz	869.000 MHz
A Cellular	0.6388900 %	869.000 MHz	880.000 MHz
B Cellular	0.0172010 %	880.000 MHz	890.000 MHz
A Cellular	0.0000893 %	890.000 MHz	891.500 MHz
B Cellular	0.0013194 %	891.500 MHz	894.000 MHz
Paging	0.0001714 %	929.000 MHz	932.000 MHz
PCS A	0.0012859 %	1930.000 MHz	1945.000 MHz
PCS D	0.0004216 %	1945.000 MHz	1950.000 MHz
PCS B	0.0013452 %	1950.000 MHz	1965.000 MHz
PCS E	0.0004386 %	1965.000 MHz	1970.000 MHz
PCS F	0.0004663 %	1970.000 MHz	1974.990 MHz
PCS C	0.0014263 %	1975.000 MHz	1990.000 MHz
Others	0.1890900 %		
Total	1.2431999 %	54.000 MHz	1990.000 MHz

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Measurement 11

Standard: FCC GP

Service	Value	Lower Frequency	Upper Frequency
TV 2-6	0.1381400 %	54.000 MHz	88.000 MHz
FM Radio	0.0459460 %	88.000 MHz	108.000 MHz
Aero & Mobile	0.1073600 %	108.000 MHz	174.000 MHz
TV 7-13	0.0465070 %	174.000 MHz	220.000 MHz
Land Mobile	0.0054540 %	450.000 MHz	470.000 MHz
TV UHF	0.0400270 %	470.000 MHz	697.000 MHz
700 LTE	0.0070840 %	728.000 MHz	793.000 MHz
Land Mobile	0.0015651 %	806.000 MHz	824.000 MHz
SMR (Nextel)	0.0012896 %	850.000 MHz	869.000 MHz
A Cellular	8.6633997 %	869.000 MHz	880.000 MHz
B Cellular	0.1076200 %	880.000 MHz	890.000 MHz
A Cellular	0.0000970 %	890.000 MHz	891.500 MHz
B Cellular	0.0038383 %	891.500 MHz	894.000 MHz
Paging	0.0001835 %	929.000 MHz	932.000 MHz
PCS A	0.0012280 %	1930.000 MHz	1945.000 MHz
PCS D	0.0003497 %	1945.000 MHz	1950.000 MHz
PCS B	0.0013110 %	1950.000 MHz	1965.000 MHz
PCS E	0.0004851 %	1965.000 MHz	1970.000 MHz
PCS F	0.0004956 %	1970.000 MHz	1974.990 MHz
PCS C	0.0013930 %	1975.000 MHz	1990.000 MHz
Others	0.1857000 %		
Total	9.3594999 %	54.000 MHz	1990.000 MHz

4. RESULTS (continued)

narda Safety Test Solutions

Measurement 12

Standard: FCC GP

Service	Value	Lower Frequency	Upper Frequency
TV 2-6	0.1360300 %	54.000 MHz	88.000 MHz
FM Radio	0.0452060 %	88.000 MHz	108.000 MHz
Aero & Mobile	0.1060800 %	108.000 MHz	174.000 MHz
TV 7-13	0.0454790 %	174.000 MHz	220.000 MHz
Land Mobile	0.0056230 %	450.000 MHz	470.000 MHz
TV UHF	0.0397760 %	470.000 MHz	697.000 MHz
700 LTE	0.0066831 %	728.000 MHz	793.000 MHz
Land Mobile	0.0015935 %	806.000 MHz	824.000 MHz
SMR (Nextel)	0.0013885 %	850.000 MHz	869.000 MHz
A Cellular	0.3491700 %	869.000 MHz	880.000 MHz
B Cellular	0.3051100 %	880.000 MHz	890.000 MHz
A Cellular	0.0000988 %	890.000 MHz	891.500 MHz
B Cellular	0.0266170 %	891.500 MHz	894.000 MHz
Paging	0.0001619 %	929.000 MHz	932.000 MHz
PCS A	0.0012682 %	1930.000 MHz	1945.000 MHz
PCS D	0.0004360 %	1945.000 MHz	1950.000 MHz
PCS B	0.0012665 %	1950.000 MHz	1965.000 MHz
PCS E	0.0004587 %	1965.000 MHz	1970.000 MHz
PCS F	0.0003970 %	1970.000 MHz	1974.990 MHz
PCS C	0.0015199 %	1975.000 MHz	1990.000 MHz
Others	0.1853900 %		
Total	1.2596999 %	54.000 MHz	1990.000 MHz

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Measurement 13

Standard: FCC GP

Service	Value	Lower Frequency	Upper Frequency
TV 2-6	0.1368100 %	54.000 MHz	88.000 MHz
FM Radio	0.0446930 %	88.000 MHz	108.000 MHz
Aero & Mobile	0.1048900 %	108.000 MHz	174.000 MHz
TV 7-13	0.0455830 %	174.000 MHz	220.000 MHz
Land Mobile	0.0059436 %	450.000 MHz	470.000 MHz
TV UHF	0.0399520 %	470.000 MHz	697.000 MHz
700 LTE	0.0063839 %	728.000 MHz	793.000 MHz
Land Mobile	0.0014700 %	806.000 MHz	824.000 MHz
SMR (Nextel)	0.0014087 %	850.000 MHz	869.000 MHz
A Cellular	1.1553000 %	869.000 MHz	880.000 MHz
B Cellular	0.2886700 %	880.000 MHz	890.000 MHz
A Cellular	0.0000861 %	890.000 MHz	891.500 MHz
B Cellular	0.0107880 %	891.500 MHz	894.000 MHz
Paging	0.0001993 %	929.000 MHz	932.000 MHz
PCS A	0.0012685 %	1930.000 MHz	1945.000 MHz
PCS D	0.0004456 %	1945.000 MHz	1950.000 MHz
PCS B	0.0012676 %	1950.000 MHz	1965.000 MHz
PCS E	0.0004720 %	1965.000 MHz	1970.000 MHz
PCS F	0.0004967 %	1970.000 MHz	1974.990 MHz
PCS C	0.0014422 %	1975.000 MHz	1990.000 MHz
Others	0.2006100 %		
Total	2.0481999 %	54.000 MHz	1990.000 MHz

4. RESULTS (continued)

narda Safety Test Solutions

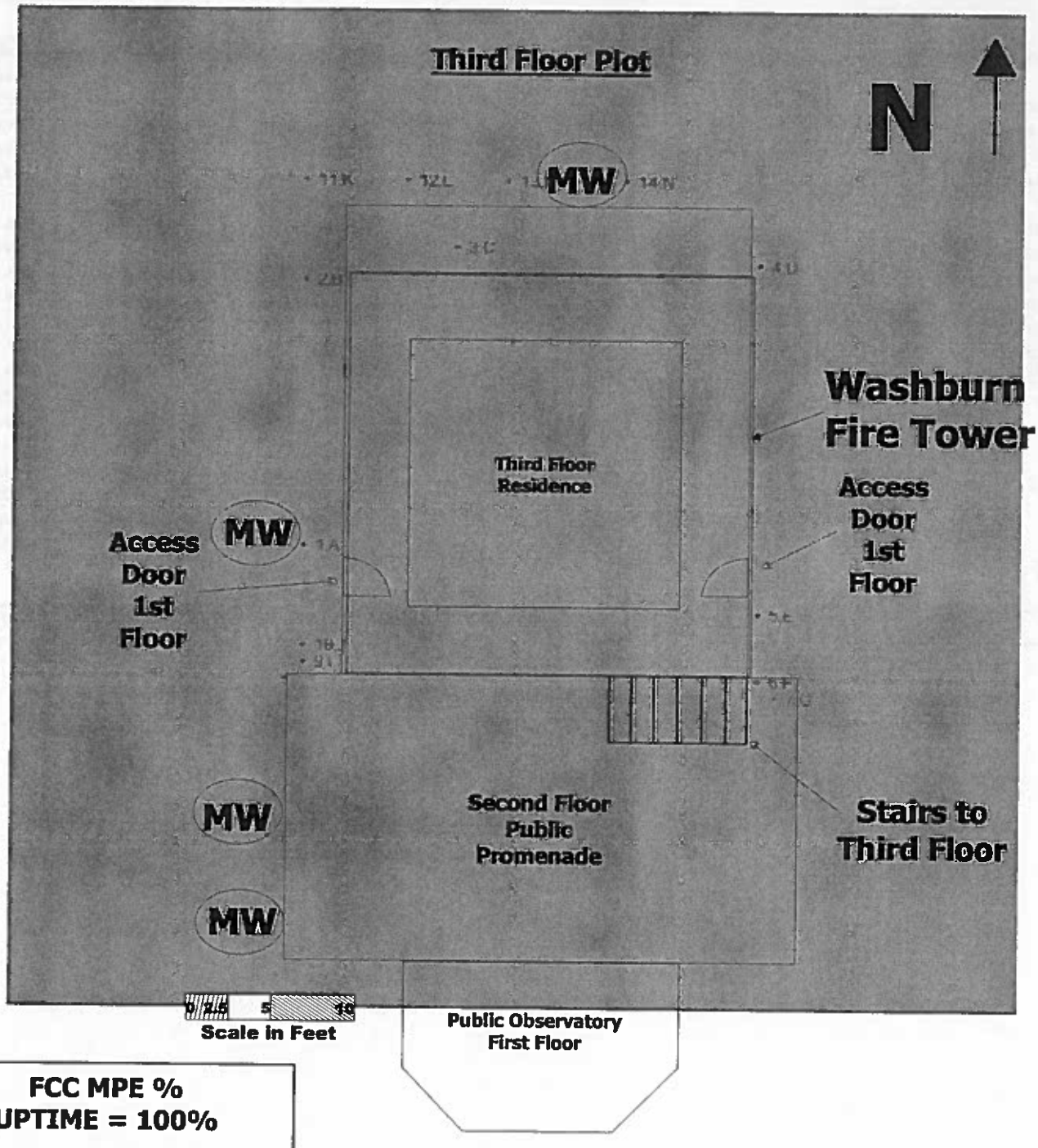
Measurement 14

Standard: FCC-GP

Service	Value	Lower Frequency	Upper Frequency
TV 2-6	0.1311900 %	54.000 MHz	88.000 MHz
FM Radio	0.0480540 %	88.000 MHz	108.000 MHz
Aero & Mobile	0.1057900 %	108.000 MHz	174.000 MHz
TV 7-13	0.0458500 %	174.000 MHz	220.000 MHz
Land Mobile	0.0054070 %	450.000 MHz	470.000 MHz
TV UHF	0.0397410 %	470.000 MHz	697.000 MHz
700 LTE	0.0065776 %	728.000 MHz	793.000 MHz
Land Mobile	0.0015015 %	806.000 MHz	824.000 MHz
SMR (Nextel)	0.0014387 %	850.000 MHz	869.000 MHz
A Cellular	2.3413999 %	869.000 MHz	880.000 MHz
B Cellular	0.0857720 %	880.000 MHz	890.000 MHz
A Cellular*	0.0001014 %	890.000 MHz	891.500 MHz
B Cellular	0.0037205 %	891.500 MHz	894.000 MHz
Paging	0.0001897 %	929.000 MHz	932.000 MHz
PCS A	0.0011667 %	1930.000 MHz	1945.000 MHz
PCS D	0.0004612 %	1945.000 MHz	1950.000 MHz
PCS B	0.0014032 %	1950.000 MHz	1965.000 MHz
PCS E	0.0004191 %	1965.000 MHz	1970.000 MHz
PCS F	0.0004388 %	1970.000 MHz	1974.990 MHz
PCS C	0.0015740 %	1975.000 MHz	1990.000 MHz
Others	0.1845700 %		
Total	3.0067999 %	54.000 MHz	1990.000 MHz

4. RESULTS (continued)

This is the predicted software plot for the third level (top floor) using the FCC PUBLIC and FCC OCCUPATIONAL standard. The grid is in 10-foot increments. This shows that the FCC Public MPE limits can be exceeded at this site but mostly in inaccessible locations.

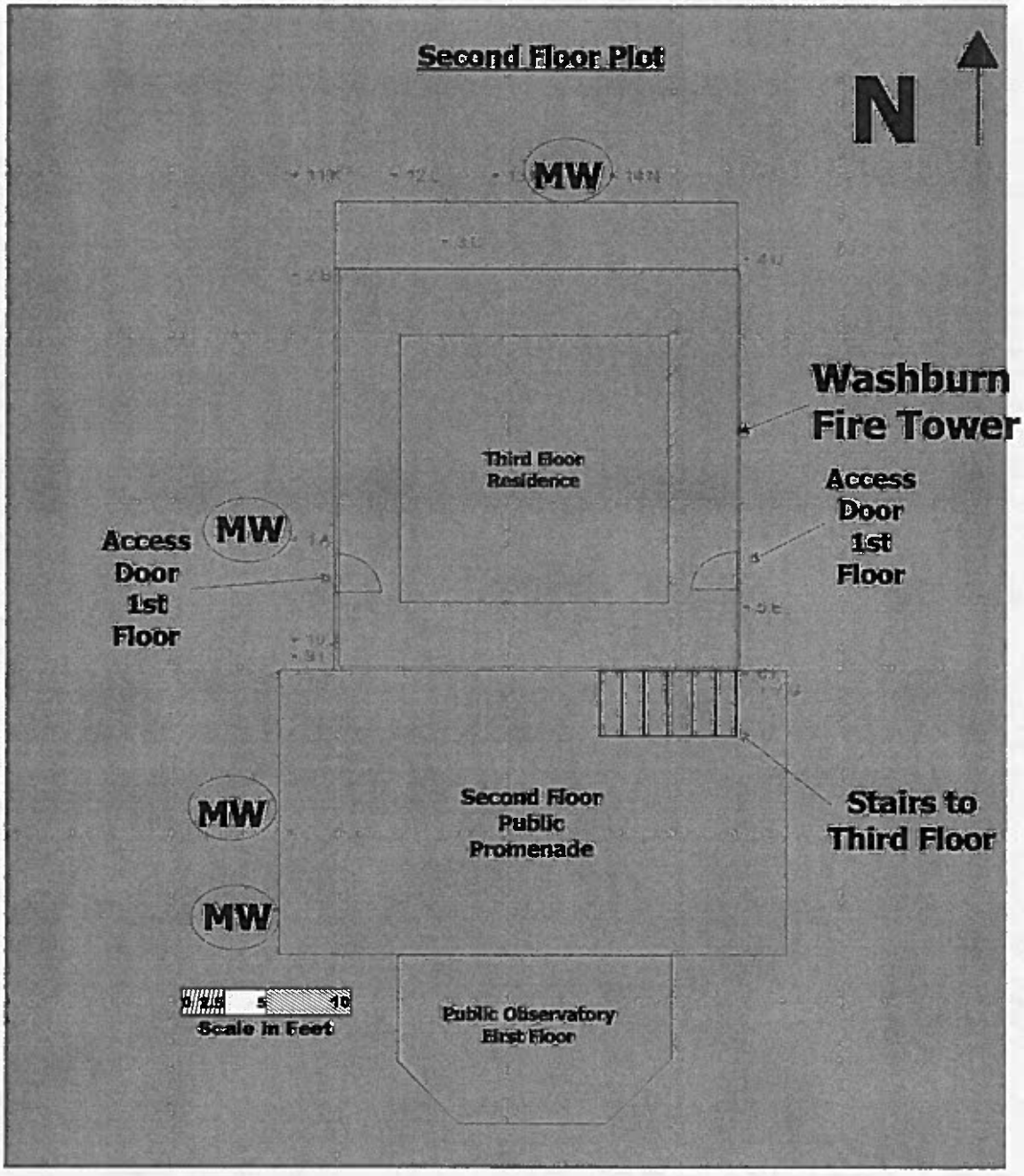


FCC MPE %
UPTIME = 100%

GREEN= <100% Public
BLUE= 100% - 500% Public
YELLOW= 100%-1000% Occupational
RED=>1000% Occupational

4. RESULTS (continued)

This is the predicted software plot for the second level using the FCC PUBLIC and FCC OCCUPATIONAL standard. The grid is in 10-foot increments. This shows that the FCC Public and OCCUPATIONAL MPE limits cannot be exceeded at this level.

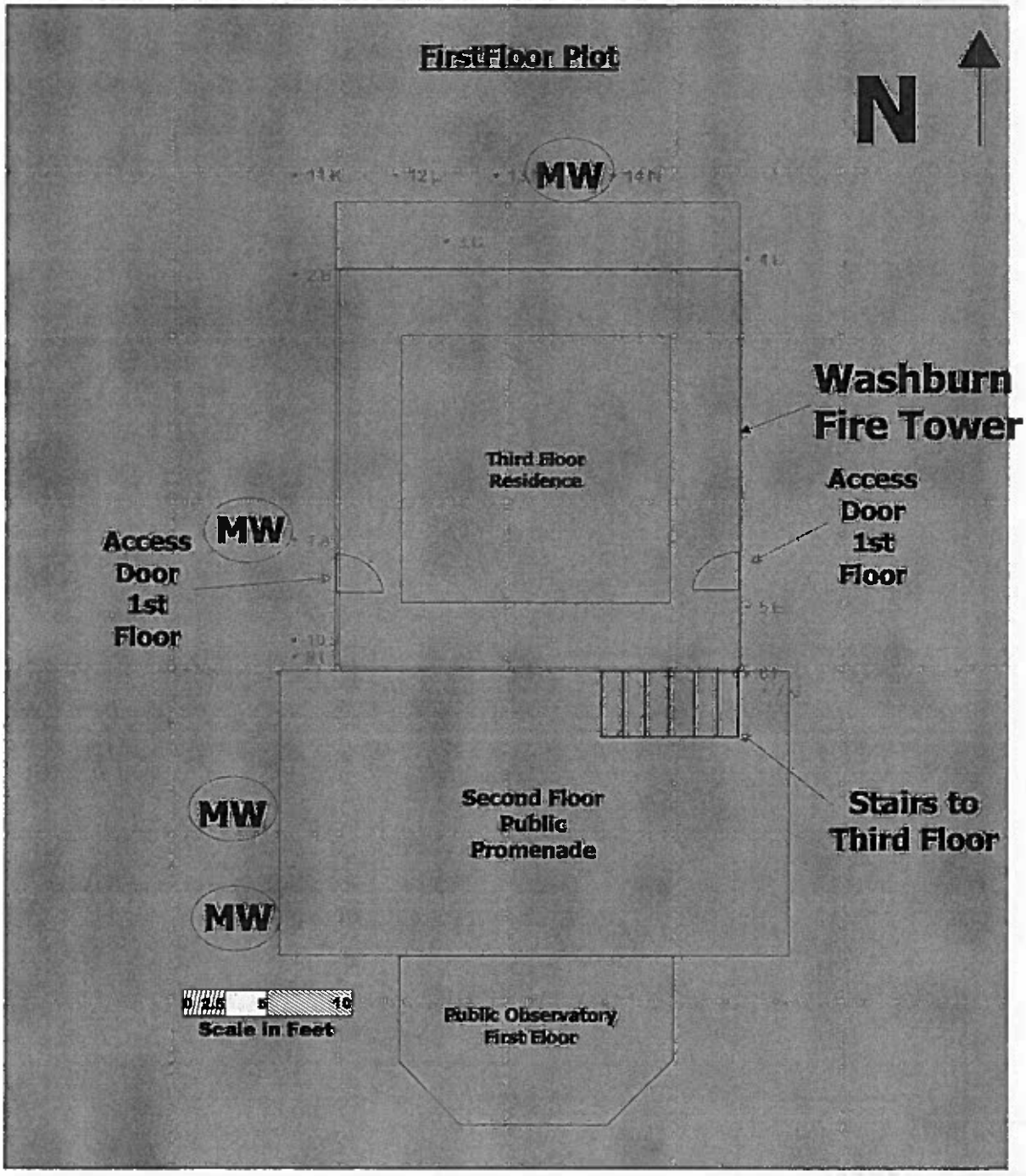


FCC MPE %
UPTIME = 100%

GREEN= <100% Public
BLUE= 100% - 500% Public
YELLOW= 100%-1000% Occupational
RED=>1000% Occupational

4. RESULTS (continued)

This is the predicted software plot for the first level (ground) using the FCC PUBLIC and FCC OCCUPATIONAL standard. The grid is in 10-foot increments. This shows that the FCC Public and OCCUPATIONAL MPE limits cannot be exceeded at this level.



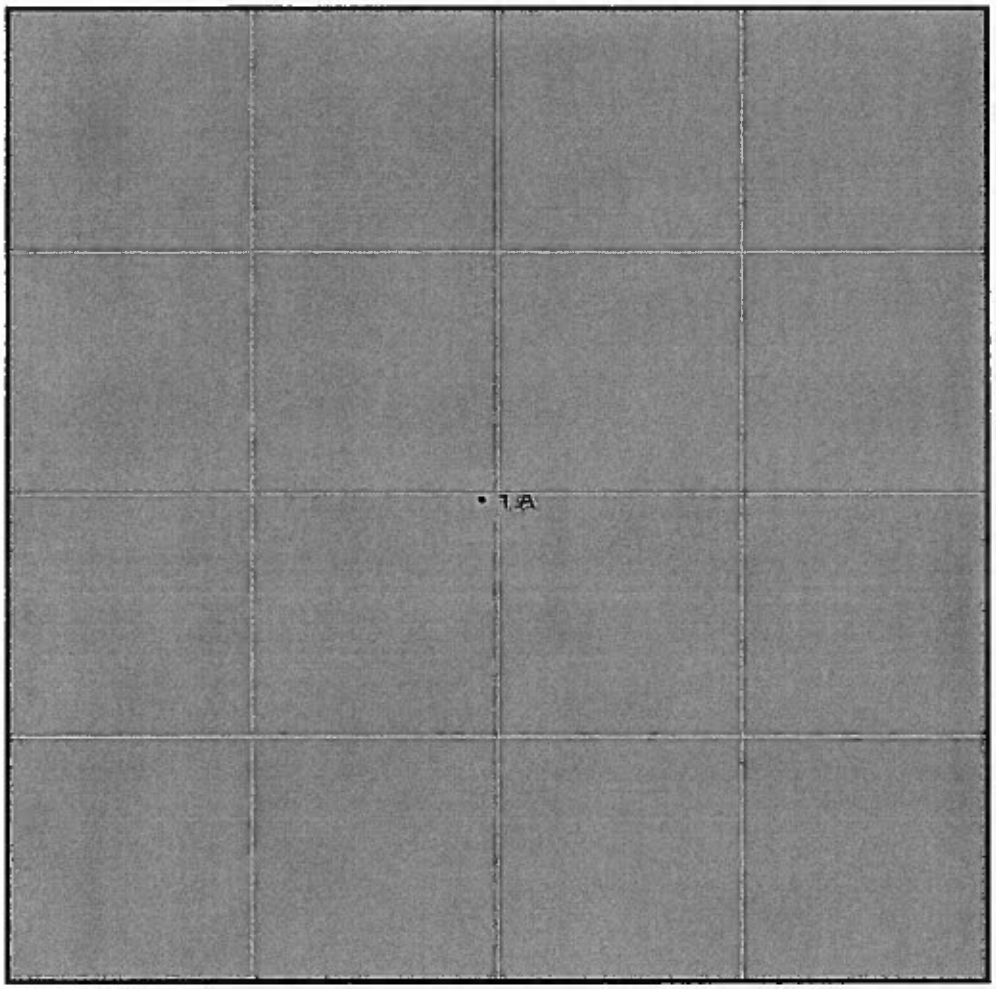
FCC MPE %
UPTIME = 100%

GREEN= <100% Public
BLUE= 100% - 500% Public
YELLOW= 100%-1000% Occupational
RED=>1000% Occupational

4. RESULTS (continued)

This is the predicted software plot for the area around the NPS Bluewave VHF 165 MHz transmitter located to the South of the watch tower using the FCC PUBLIC and FCC OCCUPATIONAL standard. The grid is in 10-foot increments. This shows that the FCC Public MPE limits can be exceeded at this level up to a distance of 1 foot from the antenna.

ID	Name	(MHz) Freq	Input Power	Calc Power	Mfg	Model	(ft) X	(ft) Y	(ft) Z	Type	(ft) Aper	dBd Gain	BWidth Pt Dir
A	NPS	165.00000	100.0	100.0	Bluewave	Folded Dipole	20.0	20.0	4.5		15.0		



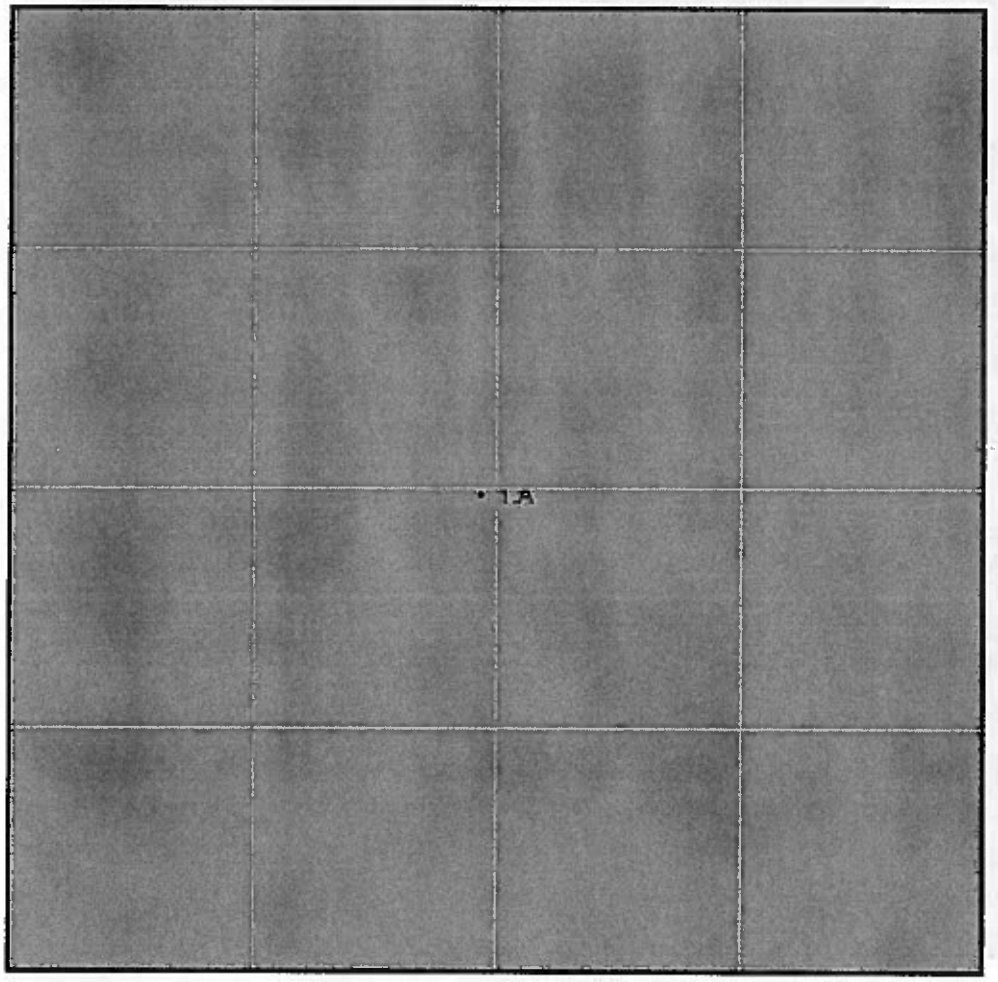
FCC MPE %
UPTIME = 100%

GREEN= <100% Public
BLUE= 100% - 500% Public
YELLOW= 100%-1000% Occupational
RED=>1000% Occupational

4. RESULTS (continued)

This is the predicted software plot for the area around the NPS Bluewave VHF 165 MHz transmitter located to the South of the watch tower using the FCC PUBLIC and FCC OCCUPATIONAL standard. The grid is in 10-foot increments. The transmit duty cycle was reduced to 10% to present a more probabable exposure situation.This shows that the FCC Public and OCCUPATIONAL MPE limits cannot be exceeded at this location.

ID	Name	(MHz) Freq	Input Power	Calc Power	Mfg	Model	(ft) X	(ft) Y	(ft) Z	(ft) Type	Aper	dBd Gain	BWidth Pt Dir
A	NPS	165.00000	100.0	100.0	Bluew ave	Folded Dipole	20.0	20.0	4.5		15.0		



FCC MPE %
UPTIME = 10%

GREEN= <100% Public
BLUE= 100% - 500% Public
YELLOW= 100%-1000% Occupational
RED=>1000% Occupational

5. RECOMMENDATIONS

All wireless licensees' at this site are currently compliant with FCC rule for human exposure. Site access to the top floor is restricted but not controlled by an RF safety plan.

To remain compliant, any upgrades or changes in configurations of the existing license holders must be reviewed by competent persons to ensure this site remains compliant. Due to the duty cycle & bandwidth available to cellular/PCS equipment, it's strongly advised that any capacity upgrades or additional equipment installations include the use of directional antennas to ensure the RF energy is directed away from the building (Residence).

The NPS VHF antenna mounted on the hillside south of the watch tower has been analyzed as well. With the transmitter operating 100% of the time a very small area around the antenna (1 foot) may exceed the FCC Public limit. When analyzed at a conservative 10% duty cycle, the FCC Public limit will not be exceeded. Since this antenna is mounted on a hillside in a reasonably inaccessible location (extreme slope) and has been demonstrated by RoofView® at 10% duty cycle to not exceed the FCC Public limit, this antenna does not present an exposure risk to the general public.

Landlord must ensure that antenna access will be restricted to personnel that have been authorized by the licensees (EME Awareness trained personnel only). This would include all maintenance personnel and contractors directly accessing the antenna areas.

6. Engineering Certification

I, Michael Burgett, am registered as a Professional Engineer in the State of Arizona. I am a subcontractor to Global RF Solutions in Chandler, Arizona. It is under this agreement between Global RF Solutions and EDI Electrical Designs, Inc that I provide RF Compliance services, subject to the Federal Communication Commission Maximum Permissible Exposure (MPE) standards as stated in OET65.

I am knowledgeable of the Rules and Regulations of the Federal Communication Commission (FCC) and of the Occupational Safety and Health Administration (OSHA), both in general and specifically as they apply to the FCC's Guidelines for Human Exposure to Radio-frequency Radiation.

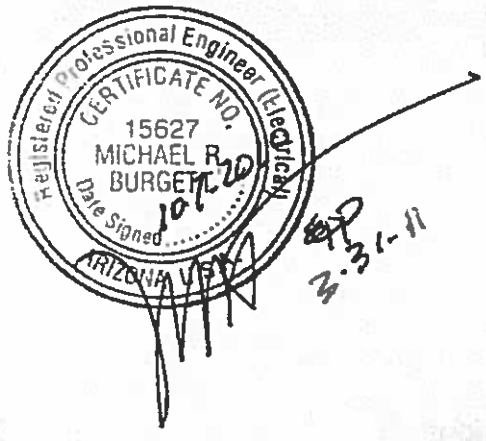
The survey modeling of the environment of the site identified as:

Site ID: N/A		**Site Name: Washburn Fire Watch Tower**
Date of Evaluation	**September 27, 2010**	**Site Evaluator (name): Marv Wessel**

have been performed in order to determine compliance with the controlled environment and uncontrolled environment Maximum Permissible Exposure levels.

The modeling evaluation was conducted using software (RoofView®) provided by Richard Tell Associates, Inc.

I have reviewed this Site Safety Evaluation and believe it to be true and accurate to the best of my knowledge.



Michael R. Burgett
Registered Professional Engineer
State of Arizona Registration Number 15627

APPENDIX A- LIMITS FOR MAXIMUM PERMISSIBLE EXPOSURE (MPE)

(REFERENCE= TABLE 1. Title 47 CFR)

(A) Limits for Occupational/Controlled Exposure

Frequency Range (MHz)	Electric Field Strength (E) (V/m)	Magnetic Field Strength (H) (A/m)	Power Density (S) (mW/cm^2)	Averaging Time $\|E\|^2$, $\|H\|^2$ or S (minutes)
0.3-3.0	614	1.63	(100)*	6
3.0-30	1842/f	4.89/f	($900/f^2$)*	6
30-300	61.4	0.163	1.0	6
300-1500	--	--	f/300	6
1500-100,000	--	--	5	6

(B) Limits for General Population/Uncontrolled Exposure

Frequency Range (MHz)	Electric Field Strength (E) (V/m)	Magnetic Field Strength (H) (A/m)	Power Density (S) (mW/cm^2)	Averaging Time $\|E\|^2$, $\|H\|^2$ or S (minutes)
0.3-1.34	614	1.63	(100)*	30
1.34-30	824/f	2.19/f	($180/f^2$)*	30
30-300	27.5	0.073	0.2	30
300-1500	--	--	f/1500	30
1500-100,000	--	--	1.0	30

f = frequency in MHz*Plane-wave equivalent power density

NOTE 1: ***Occupational/controlled*** limits apply in situations in which persons are exposed as a consequence of their employment provided those persons are fully aware of the potential for exposure and can exercise control over their exposure. Limits for occupational/controlled exposure also apply in situations when an individual is transient through a location where occupational/controlled limits apply provided he or she is made aware of the potential for exposure.

NOTE 2: ***General population/uncontrolled*** exposures apply in situations in which the general public may be exposed, or in which persons that are exposed as a consequence of their employment may not be fully aware of the potential for exposure or can not exercise control over their exposure.