Fort Worden Pier and Marine Center
Facility Condition Assessment Report

Port Townsend, WA

PREPARED FOR

WASHINGTON STATE PARKS

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1 EXECUTIVE SUMMARY

This report presents the final Facility Condition Assessment Report of the pier and on-pier building located at Fort Worden State Park in accordance with Sitts & Hill Engineers' A/E Services agreement, AE 517-110, dated 30 March 2016. In addition to the condition assessment of the pier and building, this report summarizes a pile condition survey conducted by Collins Engineers, and presents recommendations for maintenance of the on-pier building and phased replacement of the pier structures.

The procedures to assess the various structures followed national standards as applicable, specifics of which are listed in the body of the report. Please also see the main body of the report for limitations on the analysis and field observations made to produce this report.

In general, the piles, under-pier structure, and building were found to be in satisfactory condition, indicating that continued use does not pose an immediate life safety risk. What follows is a summary of major defects for the various structures.

- At least 8 of the approximately 90 piles in the shore approach section of the pier have moderate or severe defects. All of the piles are estimated to be at the end of their projected service life.
- The majority of the floor joists under the building are cantilevered over the supporting pile caps on the East and West sides, dramatically reducing their effective load bearing capacity.
- The siding at the bottom perimeter of the building, as well as the underlying sub-floor, is moderately to severely deteriorated.

Based on the reasoning presented in the body of the report, we recommend phased replacement of the piles and pier structure. Phased replacement leads to the following recommendations

- Phasing of pile and pier replacement is as listed in the body of the report. The shore approach section, which is phase I replacement, is the only phase for which we recommend closing the pier during construction.
- Due to operational concerns, the building and underlying support framing will need to be retained. This requires repairs of the major deficiencies listed in the body of the report. We also recommend further investigations once siding, flooring and other finished are removed in order to verify the extents of any deterioration.
- Remove decayed portions of floor joists under the building, and install new pile cap beams to pick-up cantilevered ends.

Lastly, we are prepared to provide additional services such as preparation of Joint Aquatic Resource Permit Application documents and/or schematic design.

2 INTRODUCTION

2.1 Purpose

Based on conversations with the Washington State Parks Commission (the Commission), it is understood that options are being reviewed for the continued use and maintenance of the building and pier currently located at 532 Battery Way East, Fort Worden State Park. Sitts & Hill Engineers was hired by the Commission to perform a phased evaluation of the pier and building, with the intent to produce a detailed Facility Condition Assessment Report (FCAR) as well as recommendations for how the facility can be repaired or reconstructed in a series of smaller projects or through ongoing maintenance over several years.

2.2 Scope

In accordance with our A/E services agreement number AE 517-110, dated March 30th, 2016, the design and evaluation work for the above-referenced structures is broken down in to three phases. Phase One of the evaluation was to be a preliminary investigation with associated report. The site investigation for the preliminary FCAR was completed on June 6th, 2016, with the subsequent letter report dated October 13th, 2016.

Phase Two is production of a detailed FCAR, with recommendations on a phased construction and/or maintenance scheme for the facility. This report constitutes evaluation Phase Two. Phase Three is work as directed by the Commission to facilitate the implementation of the recommendations in the final FCAR, such as preparation of Joint Aquatic Resource Permit Application (JARPA) documents and/or preliminary engineering of the schematic plans presented in this report.

2.3 Limitations on Scope

The piles, portions of the pier structure, and building underwent a detailed visual and physical inspection to assess their condition and determine any structural deficiencies, whether caused by mechanical damage or deterioration. Detailed structural analysis was not performed, however. The logic behind this concept is that based on the age of the building and the pier, deficient design would be manifest as damage to the structure. If deficiencies are uncovered that are suspected to be caused by insufficient design, further analysis is performed to assess the cause and the ramifications of the defect. As no such damage was discovered for this structure, detailed analysis was not performed.

Structural members concealed from view were not exposed, and no destructive or non-destructive testing was requested or performed. This level of investigation presumes that the structure is adequate for the intended purpose (occupancy), and that it was designed and constructed in accordance with the applicable codes and/or typical practices at the time of manufacture. All elements not visible are assumed to reflect similar conditions to those observed and noted in this report. Hidden defects and/or poor-quality materials could have significant impacts on the conclusions, statements or representations made in this report. It is assumed that by utilizing any aspect of this report, the associated limitations are acceptable.

2.4 Methodology

2.4.1 Piles

The piles and cross-bracing were inspected above and below the waterline by Collins Engineers, Inc. in accordance with American Society of Civil Engineers (ASCE) MOP 101, "Underwater Investigations: Standard Practice Manual"(1). Per that manual, 100% of the piles are to receive Level I inspection (General Visual Inspection), 10% Level II (Close-up Visual Inspection), and 5% Level III (Highly Detailed Inspection, which involves coring of piles). More detailed information about the methodology of each level of inspection can be found in ASCE MOP 101. The complete report produced by Collins Engineers is contained in Addendum 1 attached to this report.

2.4.2 Pier Framing

As identified in the preliminary FCAR, it is believed that the majority of pier framing will have to be replaced as part of the pile replacement process. As such, only a cursory examination (Level I as defined above) of the pier structure above the piles (pile caps, floor joists and decking) was performed. Again as identified in the preliminary FCAR, the structure under the MSC building was examined in more detail.

The criteria for examination of the under-building structure was in general in accordance with Naval Facilities Engineering Command (NAVFAC) MO-111.1, "Inspection of Wood Beams and Trusses"(2). It was also supplemented by the visual assessment methods and defect background information identified in the "Wood and Timber Condition Assessment Manual"(3) published by the US Forest Products Society. Field notes and photographs were used to compile condition rating logs per MO 111.1, which are presented in Appendix A.

Access to the pier structure under the MSC building was limited, however, by a couple of factors. The primary limitation on access is that the structure is high enough above the Mean High Tide level that close up examination is not possible by boat on all but the very highest tides. On the days of the field inspection, the under-pier structure was still 10 to 12 feet above the high tide mark for those days.

As the structure was not accessible for examination by boat, access was obtained through the system of under-pier catwalks that service the aquarium plumbing of the MSC building. Brief examination was made of the framing under the North and South wall support framing by climbing from a boat onto the diagonal framing. As the majority of framing under the building appeared to be in similar condition, the condition of those members examined in depth was extrapolated to the whole of the structure under the building.

2.4.3 MSC Building Evaluation

The assessment of the MSC building was broken down in to two parts: architectural review per the 2015 International Building Code (IBC)[(4)] and structural assessment. The architectural review was focused primarily on compliance with the accessibility provisions of chapter 11 of the IBC. The structural assessment is discussed in further detail below.

The structural assessment covered both the gravity and lateral load resistance systems of the building. As the structure is historical in nature, meaning it was constructed at a time when minimal building codes were in effect for this type of structure, it is deemed acceptable for its intended purpose at the time of its construction. This notion is reinforced by structure's 70+ year history.

The primary purpose of the structural assessment, therefore, was to determine damage or deterioration that would indicate insufficient performance or reduce the gravity or lateral load carrying capacity of the structure. As with the pier framing, the guide documents used for the assessment were NAVFAC MO-111.1 and the Timber Assessment Manual. Once again, condition logs per MO-111.1 were created using field notes and photographs, and are presented in Appendix A.

3 SUMMARY OF FINDINGS

3.1 General

Figure 1 below shows the general layout of the pier and names the main pieces.

Figure 1 Existing Pier Layout and Naming Conventions

3.2 Summary of Pier History

The following synopsis represents the construction and alteration timeline of the present pier as discovered during the site investigations. It was compiled based on interviews with Fort Worden State Park maintenance staff and volunteers at the Puget Sound Coast Artillery Museum, as well as historical records and available construction document.

3.2.1 Circa 1944

This is the estimate of the original construction of the pier and building. One of the historical pictures in the Artillery Museum shows the area where the pier now exists in 1943, and only the older two piers are seen. However, drawings and records from 1948 to 1950 name the pier, and show the other two piers in the 1943 photograph as gone (or only piles). The construction of the MSC building out of nominal lumber also correlates to a late WWII era structure.

3.2.2 Mid 1980s

Based on personnel interviews, the existing pier decking and stringers were likely replaced around this timeframe. As the construction of the strong-backs and struts used to reinforce the wave brake use glued laminated beams, they were likely added at this time as well. Glued laminated beams did not come into wide usage until the mid-1950s. The glues used in earlier versions would not likely have held up as well as those present on the pier.

3.2.3 Circa 2000

A major remodel of the MSC building took place around this time, based on dates of associated design drawings and documentation. From available documents, it appears the entire inside of the building was gutted and re-furbished. This likely included removal and replacement of the flooring and floor joists, as well as addition of the aquariums and classroom space in the building. Additionally, the mezzanine and storage tank above the offices on the South end of the building were likely additions at this time. Lastly, the doors on at least the North and West sides of the building date to this remodel.

3.3 Piles

What follows is a summary of the results of the report produced by Collins Engineers regarding the underwater investigation of the piles. The complete report is contained in Addendum A attached to this report.

The overall condition of the piles is listed as, “SATISFACTORY”. Per the definitions in Table D-1 of the Collins Engineers’ report, satisfactory condition is one in which the majority of the “structural members show some minor deterioration.” Minor deterioration, or minor defect, is as defined in the Collins report and as outlined in the above-referenced manuals. Please see the RECOMMENDATIONS section below for a qualitative explanation of “satisfactory”.

A total of 288 piles of the 333 inspected had minor defects, with the remainder varying between moderate and severe defects. The highest concentration of moderate to severely deteriorated piles was on the approach finger, with at least 8 of the approximately 90 piles listed as having moderate or severe defects.

3.4 Pier Framing

Outside of the MSC building, the pier framing consisted of what appeared to be pre-cast concrete panel decking over nominal 4x14 pressure treated stringers at 24-inches on center over 12”x12” treated pile caps. Under the MSC building, the pier framing consisted of nominal 2x flooring over 4x6 structural sub-floor over floor joists. The floor joists consisted of nominal 4x14 creosote treated members at 4’-0” on center in-filled with untreated, nominal 4x14 joists at approximately 16” on center. The floor joists bear on 12” x 12” pile caps, which were either creosote treated (grids 34 and 37) or what appear to be untreated beams (grids 35 and 36). The untreated pile caps appear to extend North to South only for the distance under the building, and appear to have been replaced at the same time as the infill floor joists (likely the circa 2000 remodel).

For the reasons discussed elsewhere, only in-depth examination of the framing under the MSC building was made. The results of that examination are detailed below.

3.4.1 Flooring

In general, the existing flooring appeared to be newer. Deterioration of the flooring was consistent with the nature of the facility, and consisted primarily of wear ruts and un-even shrinkage of softer “summer” growth rings. From underneath, the sub-floor showed minimal deterioration.

3.4.2 Floor Joists

As mentioned above, the floor joists under the MSC building consisted of creosote-treated members and untreated infill joists. The creosote-treated joists spanned from pile cap to pile cap, and showed minimal signs of deterioration. At the ends that extend past the building walls (East and West sides), the joists showed some discoloration indicative of surface water flow. The treated joists, however, had no indication of deterioration due to the exposure.

The infill joists did not bear on the pile caps at the East and West ends. As shown in Figure 2 below, the joists running from grid 36 toward 37 cantilever over the pile cap only, as they do not run over the pile cap from grid 36 to 35. The distribution of treated versus infill joists can also be seen in Figure 2.

Figure 2 Floor Joists Under MSC Building, East End

The East ends of the infill joists are underneath the building proper, but they are still influenced by the sheet flow from the walls due to poor drainage detailing. As such, the exposed ends of all the untreated joists observed were moderately deteriorated, as indicated by discolored wood and low resistance to awl penetrations. The deterioration generally appeared to extend only a few inches in from the ends of the joists, as shown in Figure 4 below.

The West ends of the infill joists generally extended past the building wall face. As such, the deterioration at the ends of the joists extended further into the members than the East end. Discoloration and soft wood were generally evident 8 to 12 inches from the end of the joists. Figure 3 shows a typical example of joist end deterioration.

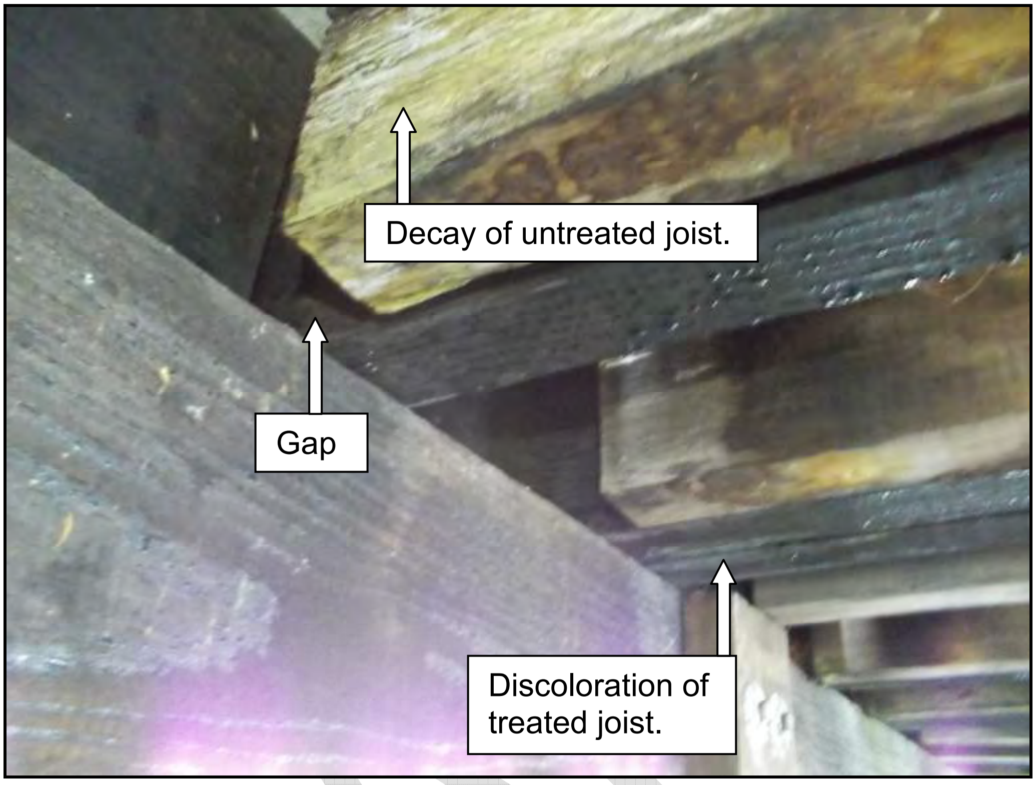

Figure 3 Decay of Untreated Joist, West End

As mentioned above, the building walls appeared to bear directly on the 4x sub-flooring. The wall base does not have a mechanism for sheet flow to escape past the pier framing. As such, significant water collects at the base of the wall, as evidenced by the severe deterioration of the sub-floor members at the wall base. Figure 4 shows the perimeter sub-floor framing and joists at the East side of the building from the underside of the decking. Please see also Figure 7 in the MSC Building section for a view from the topside of the decking.

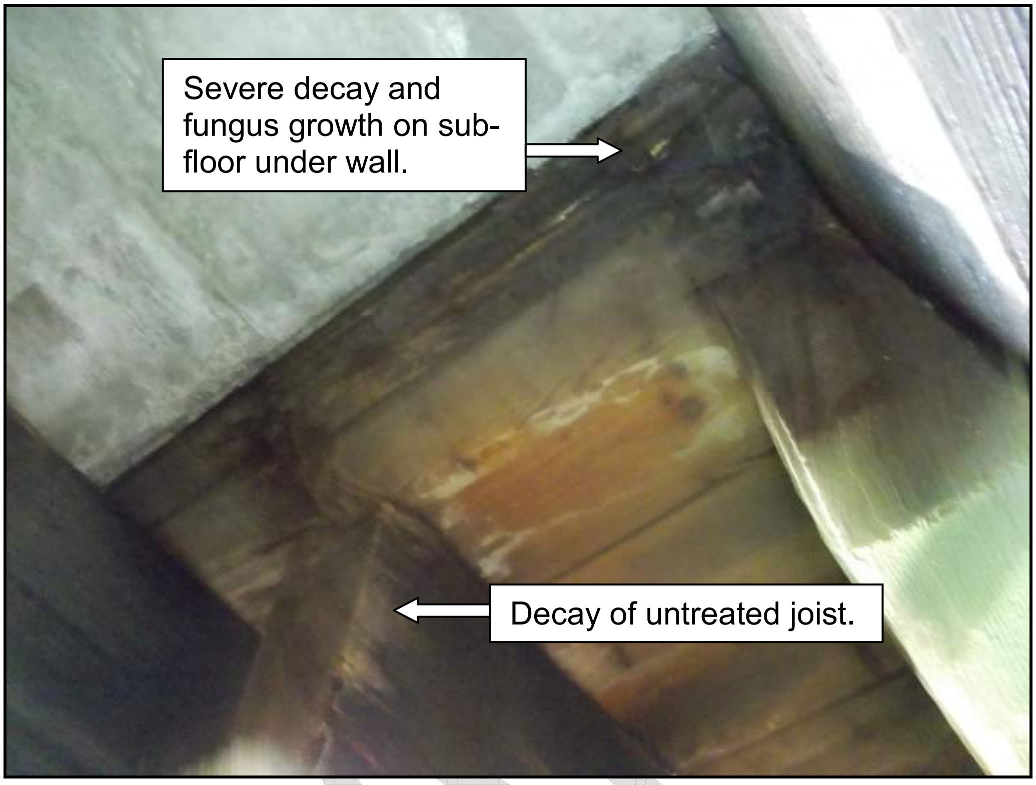

Figure 4 Floor Joists Under MSC Building, West End

3.4.3 Pile Caps

The condition of the pile caps under the building varied slightly based on whether or not they were preservatively treated. The piles at grids 34 and 37, with portions that appeared to be either creosote treated (not incised) or pressure treated (incised), were in generally good shape. Hammer blows yielded solid soundings, and awl penetrations were minimal. Visible discoloration and general lightening of the creosote was present, but it appeared that the preservative treatment was still functional.

The untreated pile caps at grids 35 and 36 were in physically similar shape to the preservatively treated beams. The hammer soundings were solid, and awl penetrations were minimal. These pile caps appeared to be retaining more surface moisture, however, based on physical contact and the presence of green moss or other biological growth. Figure 5 shows a typical example. The presence of the growth does not indicate an issue in and of itself, but it could portend high enough humidity levels to cause premature deterioration of the pile caps. This is especially true when contrasted with preservatively treated pile caps.

Figure 5 Biological Growth on Untreated Pile Cap

3.4.4 Framing at Downspouts

One area of moderate to severe deterioration of the underlying framing is at the termination of the downspouts. The downspouts terminate above the pier decking, which have rough-hewn holes that appear to be intended to provide drainage back to the bay. The area around these holes and the downspout connection show significant signs of inadequate drainage, such as moss accumulation and discoloration. The downspouts appear to create significant splash, as evidenced by the discoloration, biological growth and deterioration of the surrounding siding. Please see Figure 6 for a typical example.

Figure 6 Downspout Outfall at Pier Deck

3.5 MSC Building

The MSC building is one-story with plan dimensions of approximately 30-feet wide by 90-feet long. The roof is composite shingles over what is believed to by roofing felt over plywood or horizontal wood sheathing. The section of plywood sheathing noted from inside the building attic, approximately two-thirds of the Southeastern facing section of roof, was likely replaced during the most recent re-roof activity, which is believed to have taken place circa 2000. The roof sheathing is supported on site-built, double-pitched roof trusses on 2'-0" on center that have dimensional lumber, nailed gussets at the joints.

The roof trusses sit on what appears to be a 2x6 ledger that is lag-bolted or nailed into each wall stud, with the studs aligning with the rafters. Each stud is carried up to the underside of the sheathing on the side of the roof truss, where it is tapered to match the roof slope. The ceiling joists/bottom chords terminate at the outside of the wall stud, whereas the roof rafter extends beyond the wall face about one foot forming a soffit that has been sheathed on the underside with wood lap sheathing. The soffit sheathing has small round vents approximately every two feet.

The walls appear to be supported directly on the wood sub-flooring, which spans between the floor joists. The exterior of the walls are sheathed with horizontal wood lap siding, with the inside sheathed with gypsum wall board. Visible at the roof gables is evidence of uncoated building felt and/or Kraft-paper backing behind the lap siding. There is little evidence of insulation in the walls.

What follows is a brief description of the observed findings for each major structure of the building.

3.5.1 Roof

Both the parks maintenance staff and MSC personnel related the fact that the roof often leaks during winter storms that have rain combined with significant wind. Our review of the roof structure, however, revealed no signs of significant deterioration due to water infiltration. In other words, the roof trusses and sheathing showed no noticeable discoloration, the members where sound when struck with a hammer, and they had minimal awl penetrations when probed. In addition, the site-built joint nailing was tight with no visible splitting, and we observed no signs of excessive loading. Overall, the roof appeared to be in good shape.

The notable exception to the roof condition was the roof drainage. The roof has k-style gutters on the long side of the building, with downspouts on the four corners. As identified in section 3.4.4 above, the drainage system is inadequate and causing deterioration of the surrounding structures.

3.5.2 Walls

In conjunction with the framing at the base of the wall, the exterior sheathing on the walls had the most evidence of deterioration. With the exception of where siding had been recently replaced, all four sides of the building at the base had siding that was easily penetrated with an awl and did not sound firm under hammer blows. Please see Figure 7 for a typical example. This deterioration generally extended from the bottom course up the wall between 12 and 18 inches.

Figure 7 Building Siding at Base, North End

Observations from the attic also revealed deterioration of sections of the South gable end siding. The deterioration was uneven, with a few courses showing decay and adjacent ones being sound. The deterioration was evidenced by soft siding and fungus growth. The North end of the building was not accessible during the inspection, but is presumed to be similar.

3.5.3 Doors and Windows

The original building did not appear to have standard swing-open personnel doors, but rolling barn style doors. The barn doors currently on the structure are likely original, with the South and West doors still functional. The North door appears to have been altered to become fixed, now functionally siding rather than a door. The condition of the exterior barn doors varied, but they were generally sound with only slight softness near the bases where wood end grain was exposed. The South door was the only one that showed structural distress, with wood spitting at the rolling door hardware as evidenced in Figure 8.

Figure 8 South End Rolling Door at Corner Hardware

Swing-open personnel doors have been retrofitted into the North, West, and South sides of the building. The doors on the West and South are fitted into infill behind the existing rolling doors, whereas the North door has been placed in the wall beside what was the rolling door opening. All of the doors appeared to be constructed of wood. The doors on the North and West were in fair to good condition, with minimal peeling of the paint or obvious damage. The insulated lights in the West double door were un-broken, and did not have evidence of seal failure. The South door showed some fading of the clear finish, and some discoloration (greying) at the bottom due to finish deterioration and minor water damage.

The windows consisted of three types. The East and West sides had what appeared to be the original wood, single pane windows placed high on the walls. The infill around the West personnel door has what appears to be wood or wood clad side and transom lights using insulated glass. Lastly, the South end has what appear to be aluminum frame infill windows above and to the East of the door. Again, the infill windows appear to use insulated glass.

The condition of the newer windows on the South and West sides is good. The seals on the lights appeared to be functional, and the trim was sound. The original wood window condition varied. The sills were generally sound, but the bottom of at least one mullion was soft up to approximately 2-inches above the sill. The remainder of the wood in the windows was aged, but sound, and the paint was aged but still generally adhered. The glazing putty showed signs of deterioration, separating from the glass in multiple locations and caked or spalling in others. Figure 9 shows the typical condition of the original wood windows.

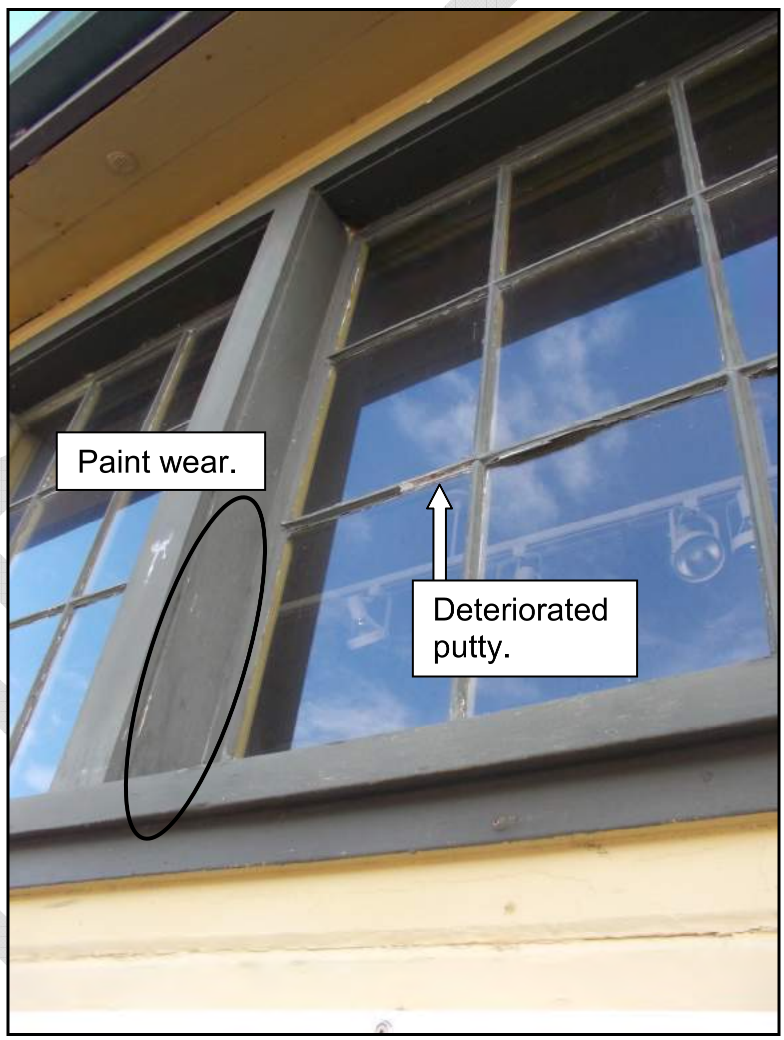

Figure 9 Wood Windows, West Side

3.5.4 Accessibility

It appears that most of the modifications to the building that affect accessibility, such as addition of the personnel doors, were performed during the remodel that occurred around the year 2000. As such, the installed components are compliant with current requirements. For instance, the personnel door widths meet the required minimum width, and the thresholds are compliant with the required maximum height and profile. Transitions from the existing pier, however, generally have measurements that exceed the threshold requirements for accessibility.

4 RECOMMENDATIONS

4.1 General Recommendation Strategy

Part of our scope of work was to make recommendations regarding the maintenance, repair or replacement of the facility. The recommendations that follow for each of the major constructions of the pier are based on the following factors(5):

- Facility mission and required life.
- Extent of damage and deterioration.
- Estimated life expectancy with and without repairs or maintenance.
- Projected load capacities
- Problems associated with mobilization of equipment, personnel, and materials to accomplish the repair/maintenance.
- Economic trade-offs.

4.2 Piles

The overall condition of the piles was identified as, "SATISFACTORY" in the Collins Engineers' report. In general terms, satisfactory condition means that the majority of elements evaluated have only minor defects or deterioration that will not significantly impair the load carrying capacity of the pier. In other words, the pier is not so compromised by the pile condition that it should not be occupied or has a high potential for partial collapse under current load conditions. Satisfactory condition does not directly indicate the load carrying capacity of the pier, however, nor does it correlate to a remaining expected service life.

As such, the satisfactory rating in and of itself cannot be used to determine a strategy for the ongoing maintenance of the structure (except as noted below). Additional information and assessment needs to be used in concert to make any recommendations. Therefore, all of the factors listed above form the strategy used to generate the recommendations regarding the piles.

As listed in the Summary of Findings, the highest concentration of piles with moderate to severe defects was in the shore approach section of the pier. The pier in this area is not very wide, so a single pile cap spans the entire width of the pier and each pile cap is supported by only three piles. As such, defects in a single pile have a disproportionate effect on the loading that can be applied to the pile cap. For this reason alone, we recommend that the piles of the shore approach section of pier be replaced in the next 5 to 10 years. Once it has been deemed necessary to replace a section of the pier, the above-referenced decision making strategy leads to the recommendation of complete replacement based on the following reasoning.

First, the piles of the shore approach will need to be repaired or replaced in order to maintain vehicle access loading. Strengthening or repair of the existing deteriorated piles is not entirely practical, especially considering some piles have already been jacketed (repaired), so replacement becomes a more relevant option.

Next, the piles would likely have to be strengthened or replaced to accommodate future activities. We understand that the long term desire of the MSC is to add display and event space on the Northwest wing of the pier, such as a pavilion type structure. The existing piles may not be capable of carrying the required loads for such a facility. If they were deemed capable of carrying the required loading in their current condition, they would likely require reinforcing or repair in the near future based on projected age.

It is estimated that the pier and building were constructed toward the end of World War II, making the structures 70-plus years old. Consensus of life expectancy of creosote treated piles in a saltwater environment is between 50 and 70 years[6]. Although the current condition of the piles is listed as satisfactory, maintenance and/or selective replacement will likely accelerate in the coming years because they are near the end of their projected service life. Repeated mobilizations to replace or strengthen piles would rapidly make total replacement the most economically viable option.

Lastly, there are issues surrounding permitting and economic feasibility. Environmental permitting of in-water work often takes month or years for approval, even for construction related to major repairs of the existing structure necessary to maintain functionality. The expectation within the permitting agencies is also that once major repair projects become necessary on a regular basis, capital replacement should be reviewed as the least environmentally intrusive option in the long term. It is also understood that funding for capital replacement, especially that done in smaller construction phases, is more readily available than straight maintenance funds. The predicted increase in maintenance requests due to an aging facility, triggering enhanced scrutiny from the review agencies, combined with permitting lead times that may hamper facility use or funding access, further strengthen the recommendation to replace the piles as part of a single permit with phased construction.

In summary, it is our opinion that the condition of the piles in the shore approach section of the pier warrants replacement as soon as environmental permitting and funding can be arranged. Based on the age of the remainder of the piles and the reasoning presented above, we recommend phased replacement of the remainder of the piles as outlined in the General Phasing Plan below. We wanted to re-iterate, however, that it is our opinion that the current condition of the pier is such that continued occupancy does not present a life safety hazard.

4.3 Pier Framing

The most economically feasible way to demolish the existing piles is by removal of the pier framing to fully expose the piles. Where the decking and pier framing is readily available, we recommend removal in order to facilitate pile withdraw. Further discussion is made in the next report section for areas where the framing is not readily available, such as under the MSC building.

The framing could potentially be re-used if the re-configured pier uses similar spans. Framing of the reconstructed pier, as identified in the Lastly, it was noted that the pile caps and floor joists under the building were not preservatively treated. Untreated members in a marine environment generally have a faster deterioration rate than treated members, and are more susceptible to decay even if they are not directly immersed in salt water. Therefore, in addition to removing the decayed portions of the members and adding pile caps to alleviate the cantilevered ends, we recommend preparing and painting the remaining untreated members. In addition to painting, we recommend allocation of budget to fully replace approximately 10% of the members as may be deemed necessary upon closer examination during construction.

General Phasing Plan below, uses pile bent spacing that maximizes the steel pile capacities. As such, it has spans too long for the standard lumber sizes used in the existing pier. Our current recommendation, therefore, does not re-use the existing lumber framing except as noted in the next section.

4.4 MSC Building

It is understood that continued use of the building on the pier is of paramount importance to the MSC. Also, significant investment has already been made to the interior of the building. As such, the building and attendant framing was evaluated with the end goal of keeping the building.

As identified in the Summary of Findings section, however, there are some deficiencies of the building condition and structural framing that need to be addressed. The two largest of these deficiencies are the deteriorated perimeter beams on the East and West sides of the building, and the fact that the infill floor joists do no bear on the pile caps on the East and West ends. The following sketch, Figure 10, shows a conceptual plan for addressing these issues within the context of the schematic design presented in the following section.

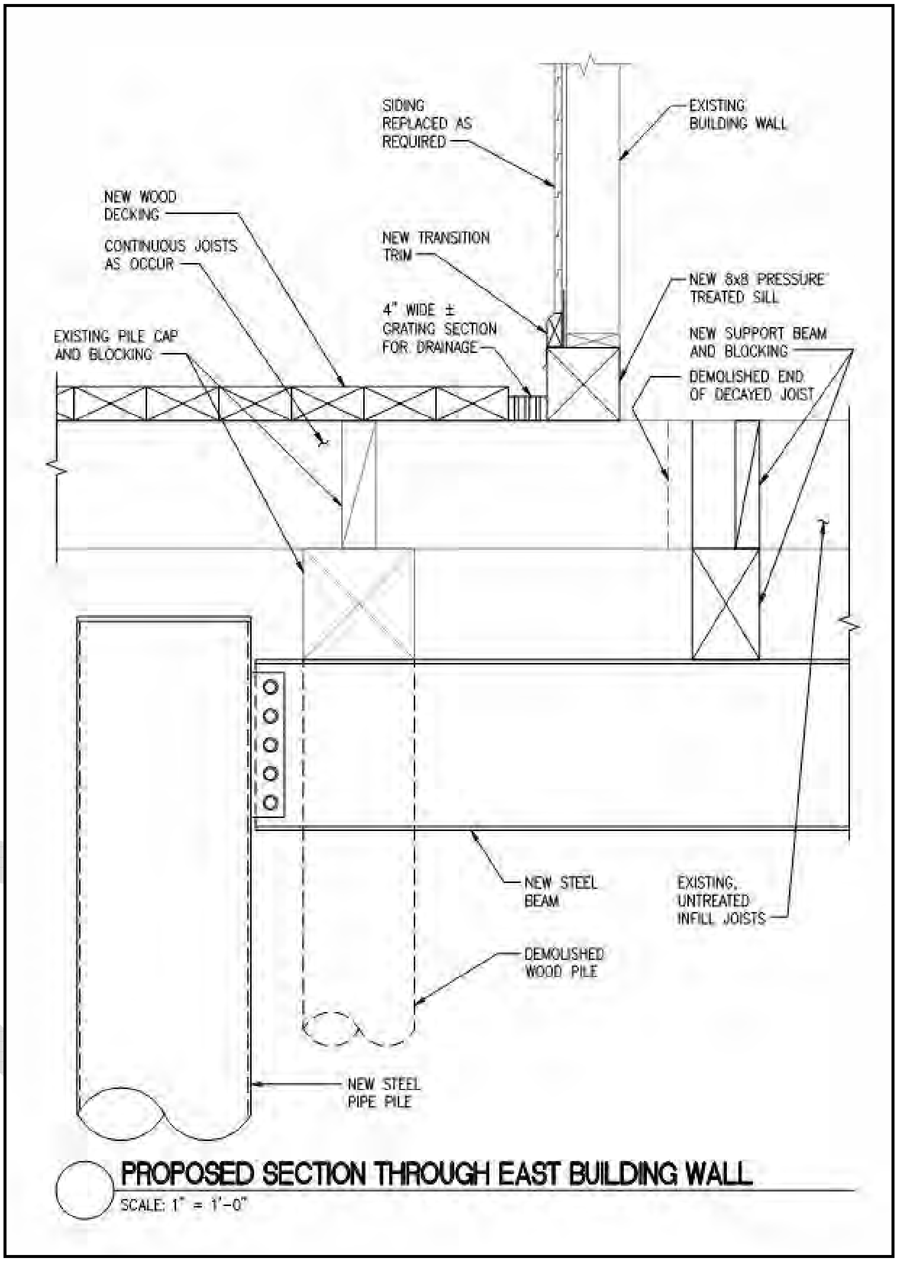

Figure 10 Schematic Sketch of Building Perimeter Framing

In addition to the major structural issues above, the field investigation revealed several areas of “soft” siding that will should be remedied. The deteriorated siding was found around the base of the building on all four sides (except for a section that appeared to have been replaced on the SE of the building). Soft and noticeably decaying siding was also found on the South gable end. The North gable end was not accessible during the investigation, but should be reviewed for deteriorated siding as well. It is our recommendation that all of this siding be removed to a height of sound wood, and the underlying framing be examined for signs of decay. We also recommend that the attic ventilation be reviewed, as it appears that inadequate ventilation is one of the causes of the siding deterioration of the gable end siding.

The original wood windows should undergo maintenance soon to prevent more rapid deterioration and potential water infiltration. At the least, the glazing putty should be replaced, and the exterior should be prepared and painted. Additionally, the personnel doors should be prepared and painted or sealed. If the South rolling door is to remain operational, the split headrail should be repaired.

In regards to the roof, it was noted that a portion of the sheathing had been replaced with plywood. This likely occurred during the last re-roof of the building (during the 2000 remodel?), and could have been done to repair water damage. We detected no water damage to the roof trusses, but this issues should be reviewed during the next re-roofing. Also during the next re-roofing, we recommend review and potential replacement of the existing horizontal wood sheathing with exterior rated plywood. Plywood will improve the performance of the roof both structurally and as a substrate for a waterproofing membrane and roofing.

Lastly, it was noted that the pile caps and floor joists under the building were not preservatively treated. Untreated members in a marine environment generally have a faster deterioration rate than treated members, and are more susceptible to decay even if they are not directly immersed in salt water. Therefore, in addition to removing the decayed portions of the members and adding pile caps to alleviate the cantilevered ends, we recommend preparing and painting the remaining untreated members. In addition to painting, we recommend allocation of budget to fully replace approximately 10% of the members as may be deemed necessary upon closer examination during construction.

4.5 General Phasing Plan

As indicated above, it is our opinion that the piles have reached the end of their expected useful life and should therefore be replaced. Also discussed was the fact that the most economical method of pile removal is demolition of the pier decking and framing. Lastly, we understand that the MSC building will be retained in its current location, so alternate means of pile removal under the building needs to be implemented. All of these factors, in combination with the funding restraints of the Parks Commission, lead to a replacement construction sequence that is broken down into phases that are manageable in terms of budget. Additionally, the most efficient phasing makes each piece small enough in scope to be completed in a single fish window.

With these constraints in mind, we propose the following phasing as illustrated in Figure 11. Each of these option is detailed further below.

Figure 11 Schematic Pier Construction Phasing Plan

4.5.1 Phase I

Phase I is the replacement of the shore approach section of the pier, to include a portion of the main body of the pier. The extension into the main body of the pier was provided to maintain access to the MSC building during the other phases. As mentioned above, the condition of this portion of the pier warranted replacement in the near future in order to provide continued vehicle access. For this reason, it is also the first section that we recommend be replaced.

It is understood that the MSC desires to have the building operational (open to the public) during the construction process. There is a potential means of construction of this first phase that would allow access with some temporary interruptions. This scheme would place the structural piles to the outside of the existing pier, and then replace the framing and decking in sections. It is possible that alternating halves of the pier could be kept open during this process.

Trying to maintain public access during construction, however, would greatly increase the construction time and cost. For this reason, it is our recommendation that the first construction phase be conducted without maintaining public access to the pier. The construction could be completed in an estimated 2 to 3 months, during the winter months of the fish window, and the pier framing could then be placed completely within the existing over-water coverage. This second point would potentially ease permitting issues. Temporary services to the MSC building (water and power) could likely be put into place to prevent complete closure of the facility.

4.5.2 Phase II

Phase II is the NW wing and North portion of the main body of pier. This section could easily be removed and replaced, and public/MSC building access could be easily maintained on other portions of the pier. The new structure on the NW wind could be designed with extra capacity to accommodate a future display pavilion for the MSC.

4.5.3 Phase III

Phase III is the remaining outboard portion of the main body of the pier. Again, public access and access to the MSC building can be easily maintained. Additionally, the piles to be used for the support of the East side of the building can be put in without affecting the existing building framing.

4.5.4 Phase IV

Phase IV is the smallest construction area, but also the most complicated. It encompasses the area underneath the building, into which cross framing will have to be threaded, and the reconstruction of the float access stair. Despite replacing framing underneath the building, it is our opinion that the MSC can be kept accessible to the public by using the door on the South end of the building. This is the main reason why Phase I construction extends into the main body of the pier.

Please note that the above phasing should not be confused with the "evaluation" phasing, of which this report has been identified as "phase two". The above is for construction sequencing.

4.6 Concluding Recommendation

Part of our scope of work entailed preparedness to create a preliminary design or render Joint Aquatic Resource Permit Application (JARPA) application assistance. To that end, Appendix B contains schematic design drawings that present a conceptual design for the new facility. With some modification, these design drawings could be converted to the format and sizing required for a JARPA submittal.

5 GLOSSARY

Destructive Testing: Evaluation measures for specific parts of a building that involve partial removal or demolition in order to be examined or tested.

Fish Window: The time period during which in-water construction work is allowed by the US Army Corp of Engineers and the Federal Department of Fish and Wildlife as part of the effort to prevent undue distress to spawning fish. For the Puget Sound, the fish window generally stretches from around mid-June to mid-February.

Gravity Force Resistance System: The portions of the building that resist the effects of building weight or snow load.

Lateral Force: "Sideways" loads generated by wind or earthquakes.

Lateral Force Resistance System: The means by which the building or structure resists the effects of wind or earthquakes.

NAVFAC: Naval Facilities Engineering Command.

Non-destructive Testing: Evaluation measures using ultrasound, electrical resistance, radiography or the like in order to determine specific design properties of the part of the building being tested without partial demolition or removal of the evaluated element.

Seismic: Those effects or as related to earthquake ground motions.

6 REFERENCES

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