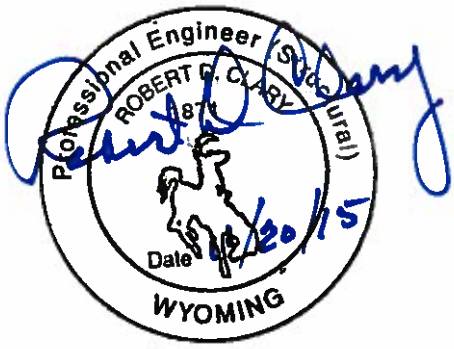
STRUCTURAL INSPECTION REPORT

Cheyenne Pump House Restoration
1504 Dillon Ave
Cheyenne, WY 82001

For

City of Cheyenne
Special Projects Department
2101 O'Neil Ave
Cheyenne, WY 82001



By

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Job No. 215036

November 16, 2015

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Structural Inspection Report

The Cheyenne Historic Pump House, is located at 1504 Dillon Avenue, Cheyenne, Wyoming, and was inspected in the months of September and October of 2015 with access being provided by Robert Bradshaw, Special Projects Director. The inspection and evaluation of the structure was to determine the condition of the historic structure and consider the possibility of restoration. No subsurface inspection was conducted nor the testing of any materials. No other opinions are implied as to the condition or soundness of the unexposed structural members or assemblies.

Photo #1 West Elevation

Photo #2 South Elevation

Building History

A Wyoming Cultural Properties Report was drafted by Ron Sladek of the Tatanka Historical Associates Inc. of Fort Collins, CO. Historical data taken from that report appears in portions of this Structural Report. The facility was the West Side Pumping Station of the City Water Works of Cheyenne originated in 1892. The building is located in the SE quadrant of Block 409, north of Ames Avenue and Southeast of 16th Street. A variety of uses and building remodel have occurred over the years. The use and abuse of the building changed as the usage changed. The Pump house was used to provide water to several entities and morphed into a maintenance and shop facility. It is reported a Holly duplex steam pump with the capacity to process two million gallons of water per day was installed. With a steam pump comes a boiler and a coal fired combustion heat source. A boiler fire must have occurred at some time as the interior roof framing shows severe charring and repair from a substantial structural fire. Further comments as to the extent of the fire damage will be covered throughout this report.

Drawings S1, First Floor Plan; S2, Attic Floor Plan: S3, Truss Details: S4, East & North Elevations; and S5, West & South Elevations are attached to this report for clarification and notes.

Building Materials

The original structure consists of masonry walls of red sandstone, brick, lath and plaster, with interior wood trusses, wood rafters and a shingled roof of tin shingles. The north wing was altered in the 1950s with the removal of the roof framing and a block second floor with a wood frame roof was installed.

In the 1970's, a large addition of steel framing and metal siding added to the east side provided considerable additional space. This addition changed the appearance and the historical standing of the original structure. This report will ignore this addition with the assumption it will be removed to enhance the historical value of the structure. The only reference will be the large openings on the east wall and the infill required to restore the building.

Considerable stone surface deterioration, stone, mortar and brick fallouts are present from the years of exposure to the wind, moisture and lack of maintenance. The repair and/or replacement of the 4" stone veneer will be time consuming and expensive.

Photo #3

Photo #4

The surface deterioration from wind and moisture is indicated in Photo #3 and fallouts of stone due to mortar deterioration, Photo #4.

Photo #5

Photo #5 is of the south side that had a "false front" constructed to support an apparent shed roof. It would appear the false front served to also trap water and snow and allowed the moisture to attack the wood, mortar and masonry units. (Photo #6) Stone and brick fallouts are present, shown in Photo #5, weakening the structure and creating a safety hazard.

Photo #6

Photo #7

Photo #8

The west side of the pump house once carried a shed roof. Photo #7. The upper roof rafters, in Photo #7, were cut off and gives an indication of the changes in the structure and use of the building. The eaves outlooker, shown in Photo #8, appears to have been constructed on the south, west and north sides. This eaves detail may have existed all around the roof line on the original construction.

The north wing addition was added in the 1950's by removing the original roof and adding a second story out of concrete block. The new roof was framed with conventional framing of that time.

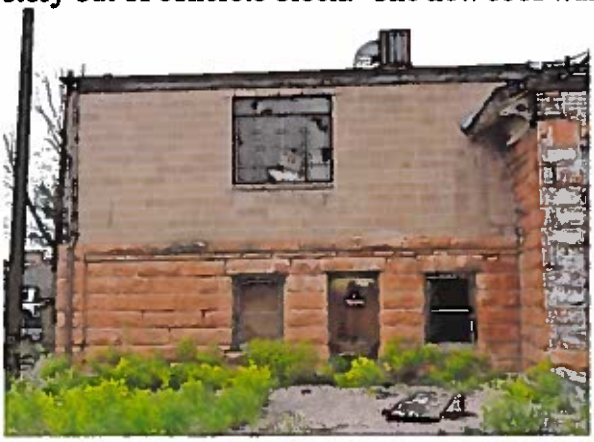

Photo #9

Photo #10

The second floor roof is in poor condition. The block walls are in need of repointing but are in reasonable condition. The windows, interior partitions and stairs are in poor condition. Because the remodel does not fit the historic nature of the building, the removal of the second floor should be considered to restore the historic value of the original structure. This report will assume the removal and further evaluation will not be attempted.

The stone and brick work of the lower floor on the north wing appears to be in as good of condition as the west and south walls.

Two steel framed additions were added in the 1970's to allow large vehicle access thru the east wall. The metal buildings, although structurally sound, encumbers the historical value of the facility and are being considered for removal. The large openings in the east wall of the original structure will have to be infilled, or reframed for lateral stability and to enclose the center core rooms.

Building Interior

Photos #11 and #12 show the interior rooms. #12 shows the pilaster on the west wall that was constructed to support a girder truss in the revised roof framing. A similar pilaster was constructed on the east wall to support the same roof girder truss. It appears the original building construction consisted of a wall across this room with possible door openings. Further subgrade exploration is recommended to determine the location and extent of the supporting footing.

Photo #11

Photo #12

Photo #13

Photo #14

Photo #13 shows the main shop room with a crane rail system mounted to the ceiling structure. The support of the rail system extended to the roof girder system in the attic. The manner in which the rail system was attached to the girders was inappropriate and caused some damage to the trusses. A small tool room was constructed on the south end of the facility as shown in Photo #14. A stair was added for access to the attic where additional storage is evident. See Drawings S2 and S3.

Photo #15

Photo #16

The first level attic is shown in Photo #15. The attic floor follows the ceiling of the south wing. There are three floor levels present in the attic space. Photo #16 shows the top level with the west girder truss and roof rafters. Cables have been wrapped around the girders, Photo #21, to support the crane rail in the shop area below. This attachment caused the joints of the girder to open and changed the girder member loading. The cable wraps were installed to distribute the point loads. Note the charred material of the girder and the rafters.

The Dormer shown in Photo #17, had a presumed purpose of supporting a vent for steam or exhaust. The trusses and the rafters adjacent to this area suffered a severe fire at one time. Photos #18 and #19 show the rafters that were exposed after removal of the siding material installed over the charred members.

The support structure of the total roof area shows damage from the major fire.

Photo #17

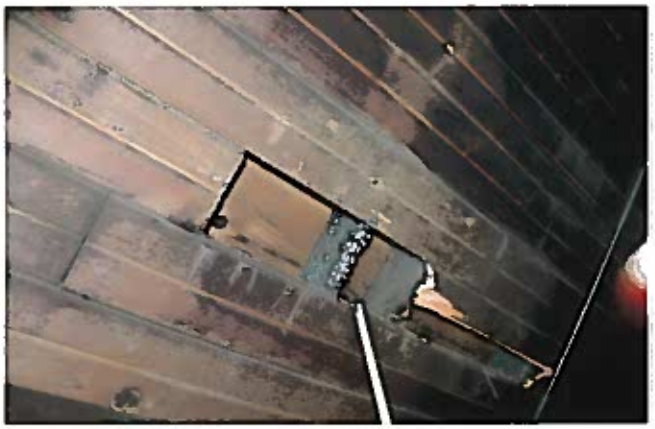

Photo #18

Photo #19

Photo #20 was taken at the north end of the main structure. The rafters supported by large trusses have also been grossly damaged from the fire. Charring varies from 1/8" to 3/16" reducing the member's usable area by 27%. The original span of the rafters was excessive (11' 7") with a single span and only marginally worked by having a continuous double span of 23' 2". Photo #21. Wood heated in a fire to over 150 degrees loses its' flexibility and strength of the material. The resulting strength is unknown but estimated to be inadequate for the anticipated snow loads.

The roof sheathing in some of the burned areas was badly charred resulting in a loss of strength. It was then covered with additional sheathing adding to the dead load of the assembly. Photo #22

Photo #20

Photo #21

The additional weight of the new sheathing and shingles took away some of the support capacity of the already damaged framing. New sheathing and shingles will likely need to be added for the restoration of the building.

Therefore, I recommend all of the sheathing, shingles, rafters and eaves be replaced if a restoration is to be considered.

Photo #22

The charring of the three N-S trusses, A-1, A-2 and A-3,shown on Dwg S2, does not appear to be as serious as the rafters. The heavy timber members charred a similar amount (3/16"), but the heavier mass of the member protects it from strength loss.

Photo #21 and #23 show the cable wraps to prevent the truss from spreading with the crane rail loading on the bottom chord. Photo #24 is a closer view of the separation of the joint caused by a compression type of connection being subjected to a tension force application. The truss joints must be tightened up but that can be accomplished with a reasonable cost and effort.

Photo #23

Photo #24

Photo #25 was taken of the SE corner of the center portion roof. Note the burned areas, the rafter spans and the supporting trusses. The foreground trusses have been charred but not as badly as the rafters. The middle ground truss, illuminated by a lantern, does not show any charring and for a while was a mystery as to its' escape from the roof fire. The Girder truss "B", shown on Dwg S2 was designed, assembled and installed after the fire. This provided a large opening in the common wall between the main Pump House and the south addition. The design of the Girder truss was unusual in that the bottom chord (8"x10") was extended an additional 3' to bear on the improvised pilasters constructed onto the original east and west walls of the main room. This extension violates the capacity of the girder truss by exceeding the bending and shear strength of the bottom chord. The correction can be easily made by adding a column at each of the outside panel points and taking the vertical load directly to a column and footing.

Photo #25

One important issue to be considered is what type and size of footing was placed under the bearing walls of the Pump House. There does not appear to be any settlement of the walls and corners of the existing structure. Before we were to proceed to design two additional columns to support the girder truss "B", exploration of the stem wall and footings should be undertaken. This would also allow us to presume and evaluate the footings under the other walls. This is a "must" exploration of the foundation for assurance of the integrity of the footings. This evaluation should proceed if the building is proposed to be restored.

Photo #26

Photo #27

The three E-W trusses, C-1, C-2 and C-3, were located very near the Dormer vent area and exhibit considerable charring. The top and bottom chords, because of their mass, are not damaged in excess. The sloping struts shown in Photos #26 and #27 are smaller, (3 ¾" X 6"), and have been charred down to 3 1/4" x 5 ½", in addition to the potential loss in wood strength capacity because of the heat. The main failure would be the buckling of the compression member. I recommend maintaining a 1" board covering, nailed or screwed to the strut, to assure the restraint to buckle under loading. The existing wood siding can remain if the joint patterns are staggered.

Conclusions and Recommendations

The following is a list of the recommendations for the development of a usable historic building and restoration of a building as part of Cheyenne's history.

1. Building Construction: The original stone and brick building stood for 117 years but has some serious structural problems. A large portion of the red sand stone veneer has weathered and cracked, and will be difficult to replace. Patching of the stone face is not recommended because of color fade and lack of durability in the weather. The exposed brick and mortar will have to be evaluated and replaced as required. The interior wall that was removed to create space, should be infilled to some extent, to provide additional rigidity to the east and west walls from the wind load and to support the main truss girder B1. Considerable amount of repointing and resetting will be required for the stone and brick work.
2. Roof Structure: The roof structure has been subjected to a sizable fire and the rafters should be removed. The rafters and the sheathing, shown in Photo #22, have been evaluated and the snow load capacity has been reduced by approximately 25%. In as much that the continuous two span rafter member design was originally marginal, the fire has rendered them unacceptable.

Photo #28

The sheathing has also been compromised and with potential removal of the rafters and the shingles, the sheathing should also be removed.

The support framing of the roof structure can be salvaged with the protective covering of the "C" trusses as previously described. In some cases, the perimeter plates for the rafter bearing and uplift restraint will need replacing. All other members exposed during demolition and or construction must be evaluated for replacement if the fire has caused structural damage and support loss.

3. The footing must be exposed for an evaluation as to the integrity of the original foundation.
4. The interior wall of the shop area, must be either partially restored, cross braced and have columns added at the truss end panel points to provide the proper bearing for the roof Girder Truss B. A partial wall infill should be considered to provide greater wall stability with the anticipated wind load.
5. The steel shell addition on the east side should be removed and the door openings infilled for appropriate use. A structural evaluation must be made to assure stability.
6. The second story addition on the north end should also be removed and a restoration of the original roof framing restored.
7. No attempt has been made to evaluate the electrical, plumbing and mechanical needs for the historic building.

Call me if you have any questions.

Very truly yours,

Robert D. Clary, P.E. P.C.

215036 Cheyenne Pump House Restoration – Struct Rpt

Attached Dwgs S1, S2, S3, S4 and S5