Inspection Report

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(CIVIL)
2-12-19

79'-0" x 4'-1½"ϕ Boiler House Chimney
Gould Island - Narragansett Bay
Jamestown, Rhode Island

Prepared For:

Credere
"To Believe"
Associates, LLC

PREPARED BY:

BEDNASH CONSULTING, INC.
ROSELLE, IL ~ 630/351-0397

FEBRUARY 12, 2019

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Inspection Gould Island Boiler House Chimney

Report Summary

On February 12, 2019, a representative from Bednash Consulting, Inc., performed an inspection of the Boiler House chimney on Gould Island in Narragansett Bay near Jamestown, Rhode Island. The purpose of the inspection was to examine the condition of the chimney and determine if its current condition posed a safety concern to workers in the adjacent boiler building.

Chimney Description

A General Arrangement drawing showing key dimensions is presented in Appendix A. A description of the chimney is given below.

Configuration	Height:	79'-0" (top of foundation to top of chimney) Top of foundation is 1'-4" to 2'-0" below grade
	Geometry / materials:	Round radial brick
	Top inside diameter:	4'-1½"
	Top outside diameter:	5'-6"
	Top wall thickness:	8¼"
	Base outside diameter:	8'-1"
	Base wall thickness:	12"
Inner Brick Liner	Height:	From base of chimney to ±29' level
	Support condition:	Corbelled supported at 8'-0" level
	Wall thickness:	Appeared to be 4½" radial brick (full height)
Boiler Duct	Size / sill / orientation:	2'-8" x 6'-5" / sill at 9'-3" level, south side
Appurtenances	Exterior step irons:	West side, 10' level to top of chimney
	Lightning protection:	No remaining components
	Attached bracket:	Steel light bracket assembly at 71'-6" (west side)
	Cleanout door:	2' x 3' opening at 6" above grade (north side)

Chimney History

The exact age of the original chimney was unknown but was estimated at 75 years old. Past modifications (dates unknown) are listed below. It is known that the chimney has been idle without being repaired since approximately 1955.

- possible rebuilding of the uppermost 19'
- removal of the original cast iron cap sections
- installation of the existing cement cap
- repointing of exterior joints
- dislodging of nearly all lightning protection components
- installation of the steel bracket most likely used to support a light
- dislodging of the cast iron cleanout door

Inspection Procedure

A visual inspection of the exterior surfaces was performed from grade and the JLG manbasket. The condition of the concrete cap, brick faces, mortar joints, remaining lightning protection components, boiler duct and cleanout opening were inspected. Areas showing cracked or open mortar joints, damage to appurtenances or local defects were noted and photographed. From the access opening near the base, the interior condition of the lower elevations was also inspected. From the top of the chimney, the uppermost interior surfaces were inspected and photographed. All Photographs depicting these findings are presented in Appendix B.

A video camera was also lowered down the chimney to inspect the remaining interior surfaces. A copy of the video accompanies this report.

Inspection Findings

Cement Cap

The top of the brick walls possessed a ±½" layer of cement which covered approximately 50% of the upper surfaces. The cement appeared crudely installed. The overall condition of the remaining cement was poor as numerous cracked and previously dislodged areas were identified. The remaining material was providing very little protection to the top of the brick wall, but moisture infiltration was obvious. No reinforcement existed within the cement. Photos 1 - 8 show the poor condition of the cement cap.

Exterior Surfaces

The exterior condition of the chimney ranged from poor to good. Below is a description of exterior surfaces broken down into the several regions encountered.

Ornamental Head (79'-0" to 75'-0" Levels)

The condition of the uppermost three courses and local areas at the step irons was poor. The water table (cement wash) covering the projecting third course was cracked with areas partially dislodged (Photos 13 – 17). For nearly one-half the perimeter of the third course of bricks (southeast to northwest side), bricks were displaced out-of-plane and in danger of dislodging (Photos 13 and 19). During the inspection, one brick and one section of the water table on the south side were removed by hand for safety reasons (Photos 21 – 22). Between the fourth and ninth courses from the top, mortar joints were recessed and weathered approximately ¼" deep. Local to the step irons on the west side, ten severely spalled bricks were identified through the corbelled courses (Photo 18). The damaged bricks were most likely caused by moisture infiltration and freeze-thaw cycles, but possibly could have been caused by a lightning strike to the upper step irons. A few random spalled bricks were also identified on the south side. Photos 13 – 24 show the condition of the upper ornamental head.

Tapered Region (75'-0" - 17'-0" Levels)

This 58' high region was in fair condition. Except for weathered and recessed mortar joints and random, thin cracks, no significant defects were identified. The cracks were mostly thin (less than ¼" wide) and traversed diagonally or along mortar joints. Few cracked or spalled bricks existed in this region. Photos 25 – 38 show this region of the chimney.

Inspection Findings

Exterior Surfaces

Tapered Region (17'-0" - Grade)

With the exception of the lintel area above the boiler duct opening, exterior surfaces throughout the lower elevations were in relatively good condition. Very few, if any, cracks were identified, and mortar joints remained solid and not recessed. Photos 42 and 47 show this region of the chimney.

Extended Walls (Boiler Duct and Cleanout Opening)

The brickwork above the boiler duct was in very poor condition as numerous bricks were loose or had dislodged. The outer lintel beam appeared to have completely eroded and dislodged. When viewed from above the duct, the condition of the next lintel beam was severely eroded and in need of replacement. The condition of any additional inner lintel beams could not be determined. The side walls and lower corbelled walls of the extended wall remained in good condition. Photos 39 – 46 show the extended wall around the boiler duct.

The extended wall around the lower cleanout opening was in fair condition. Deterioration of mortar was noted in the joints, but no cracked or dislodged bricks existed. Photos 47 - 48 shows the wall at the cleanout.

Exterior Ladder Rungs

The exterior ladder rungs on the west side (10' level to top) appeared in good condition. Surfaces were deteriorated (rusted, pitted), but no loose or bent rungs were identified. All rungs appeared secure, even at the top local to the spalled bricks (Photo 18).

Lightning Protection Components

Nearly all the original lightning protection components have dislodged from the chimney. No air terminals or upper encircling cable existed, but several pinch anchors were noted on the southeast side near the top. In the northwest quadrant adjacent to the step irons, the remains of a downlead cable were observed between the 70' and 50' level (Photos 27 and 33).

Breeching Duct

The condition of the boiler duct spanning from the power house to the chimney was fair. The steel angles that comprised the outer support system of the duct were deteriorated, pitted and scaled, but the members were still supporting the transite panels. No holes were identified in the duct near the chimney. The duct was unstable and in very poor condition at its connection to the powerhouse wall. Photo 41 shows the duct.

Light Bracket

The steel bracket near the 71' level (west side) was deteriorated and pitted, but the assembly was secure to the masonry wall and did not pose a safety concern. Photos 27 – 28 show what appears to be a light support bracket spanning from the southwest to the northwest quadrants. Anchors securing the bracket did not span the full thickness of the wall.

Along the step irons, a deteriorated electrical conduit existed between the 70' and 50' levels. The surface condition of the conduit was poor, but the conduit was secure to the rungs. Photo 27 and 33 show the conduit.

Inspection Findings

Chimney Interior

The overall interior condition of the chimney varied from poor to fair. Local areas of mortar joints were recessed, and a few spalled bricks were noted along the interior step irons, but no significant structural concerns were identified. Below the 29' level, an inner liner wall existed, preventing an inspection of the outer structural wall.

The average deterioration of mortar, measured from the interior surface of the brick wall, was ¾" in the upper 5' of the chimney and ½" in the region between 5' and 50' from the top. Very few bricks in the upper elevations were spalled or deteriorated; no areas warranted immediate repair. No cracks or bulges were observed throughout the outer structural wall.

The chimney interior contained an independent brick liner. The ± 4" liner wall was supported atop a corbelled shelf at the 8' level and extended to the 29' level. The condition of the uppermost 8' of the liner wall was structurally unstable and numerous loose bricks were identified from around the upper perimeter. The majority of mortar joints in the uppermost 20' of liner were also severely deteriorated (recessed, cracked, or mortar dislodged). The interior condition of the liner wall below the 19' level appeared fair. Surface deterioration of mortar joints and brick faces was evident, but no significant concerns were identified. At the boiler duct opening, bricks in the side walls and lintel areas appeared secure and in good condition (Photos 49 - 50). No concerns were noted along the corbelled courses at the 8' level.

Interior surfaces throughout the height of the chimney possessed no buildup. The base of the chimney possessed approximately 5' of debris and bittersweet growth (Photo 48).

Interior Step Irons

For the full height of the chimney, construction (step) irons existed on the east side and spaced approximately 15" on center. All of the interior rungs appeared severely deteriorated and several were bent over. The interior rungs should not be used for support of personnel or equipment. Photos 10 - 11 show the rungs in the upper elevations.

Cleanout Door

The cast iron cleanout door at the bottom of the north side was missing from the frame and could not be located near the base of the chimney. The remaining frame was deteriorated but was secure to the masonry wall. Photo 48 shows the frame.

Repair Actions

Apart from the loose and unstable bricks throughout the ornamental head and the poor condition of the lintels and extended wall above the entering boiler duct, the condition of the brick chimney was fair. Beyond the upper elevations and above the duct opening, no immediate repairs or maintenance actions are required. Below are the required and suggested maintenance actions for the entire chimney.

Required repairs

1. **Demolish the uppermost 4'.** The nine courses of brick throughout the upper ornamental head should be demolished and the chimney leveled off at the 75' level. All regions of the head should be demolished in a piecemeal fashion and the debris dropped or safely lowered down the exterior of the chimney. No debris should be thrown inside the chimney. Photos 13 – 24 show the upper ornamental head.
2. **Replace the outer steel lintel above the duct.** The remaining outermost steel lintel above the duct opening should be removed and replaced with a new steel lintel beam (channel or rectangular tube section, ±5' long). The new beam should be Grade 50 steel. Shim plates should be used at the ends of the beam to obtain the maximum bearing area under the upper radial brick wall of the chimney. Minor masonry repairs below the ends of the lintel may also be required to install the new beam.

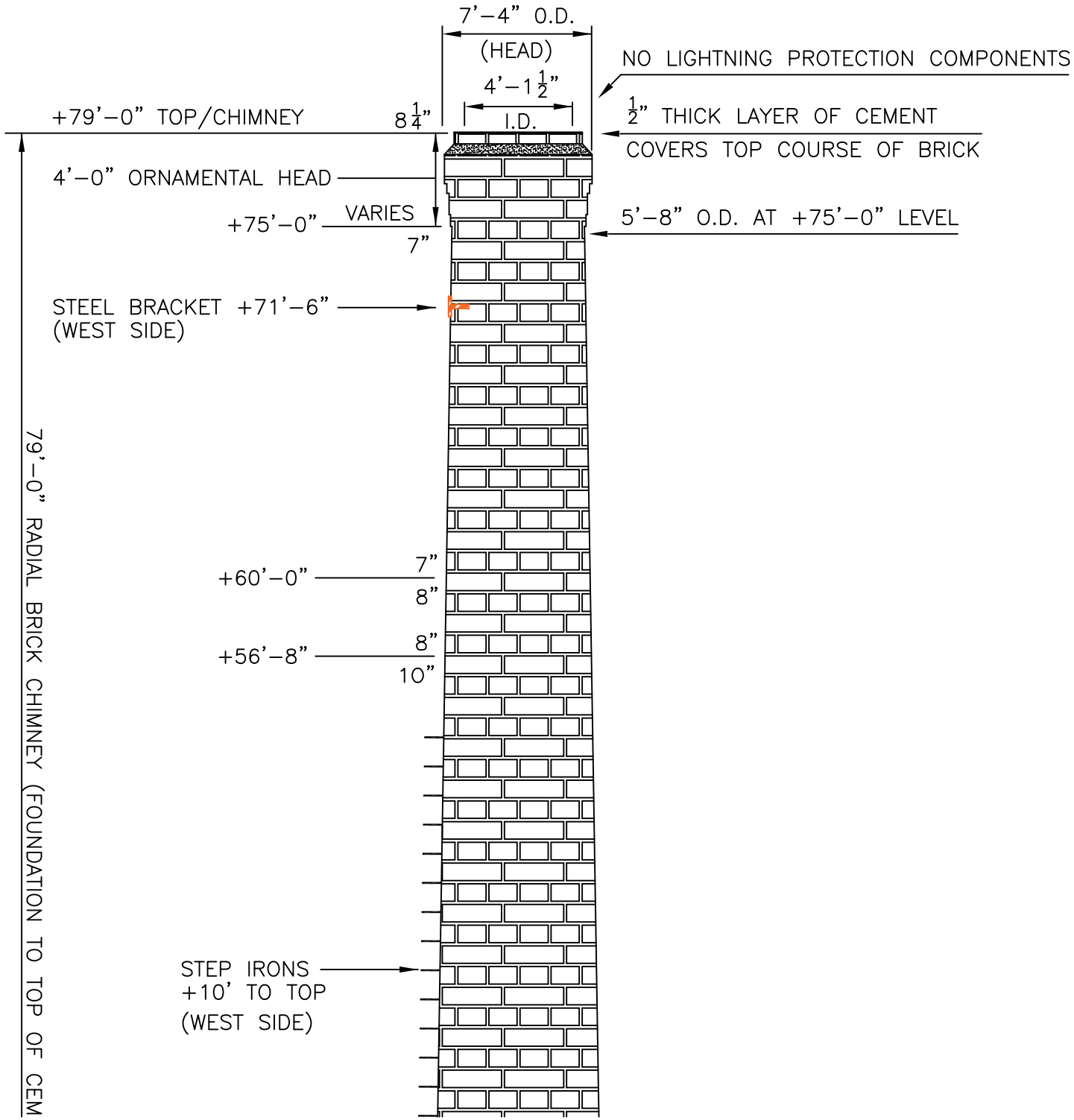
Recommended additional repairs

3. **Install a roof over the top of the chimney.** To prevent continued exposure to the environment, a roof (with one access hatch for future inspections) should be designed and installed atop the chimney. The roof should extend out over the full diameter of the radial brick wall and possess flashing that extends several inches below the uppermost brick course. The roof could be constructed from wood, steel or aluminum.
4. **Repair the brickwork in the extended wall above the duct and install a cover plate.** Upon removal of the existing boiler duct, the extended wall above the duct opening should be repaired by re-laying brick (radial or common) in the two upper corners. One additional steel lintel beam (channel or rectangular tube section, ±5' long) will be required at the outer end of the wall. The added brick shall prevent moisture and snow from entering the wall. A steel or wood cover plate should then be installed over the duct opening and be sealed with silicone or caulk to prevent moisture infiltration.
5. **Install a new lightning protection system.** Two lightning protection air terminals, an upper encircling cable and at least one downlead cable (preferably two) with proper grounding at the base should be installed on the chimney to prevent damage from future lightning strikes. The remains of the one downlead cable (Photo 34) should be removed.
6. **Remove the steel bracket and electrical conduit form the west side.** The anchored bracket at the 71' level (Photos 27 – 28) should be removed from the wall as well as the deteriorated electrical conduit along the step irons (Photo 33).
7. **Remove the soil from around the base of the chimney.** The 16" to 24" deep layer of soil surrounding the base of the chimney should be removed to expose the lower courses of brick and the top of the concrete foundation. The lower courses should be inspected for damage (spalling, cracking, bulging, etc.) and repairs made if necessary.
8. **Remove the accumulated brush and debris from the interior.** The approximate 4' of residue and brush (Photo 48) should be removed from the base of the chimney. The material should first be tested for the presence of heavy metals or hazardous elements.

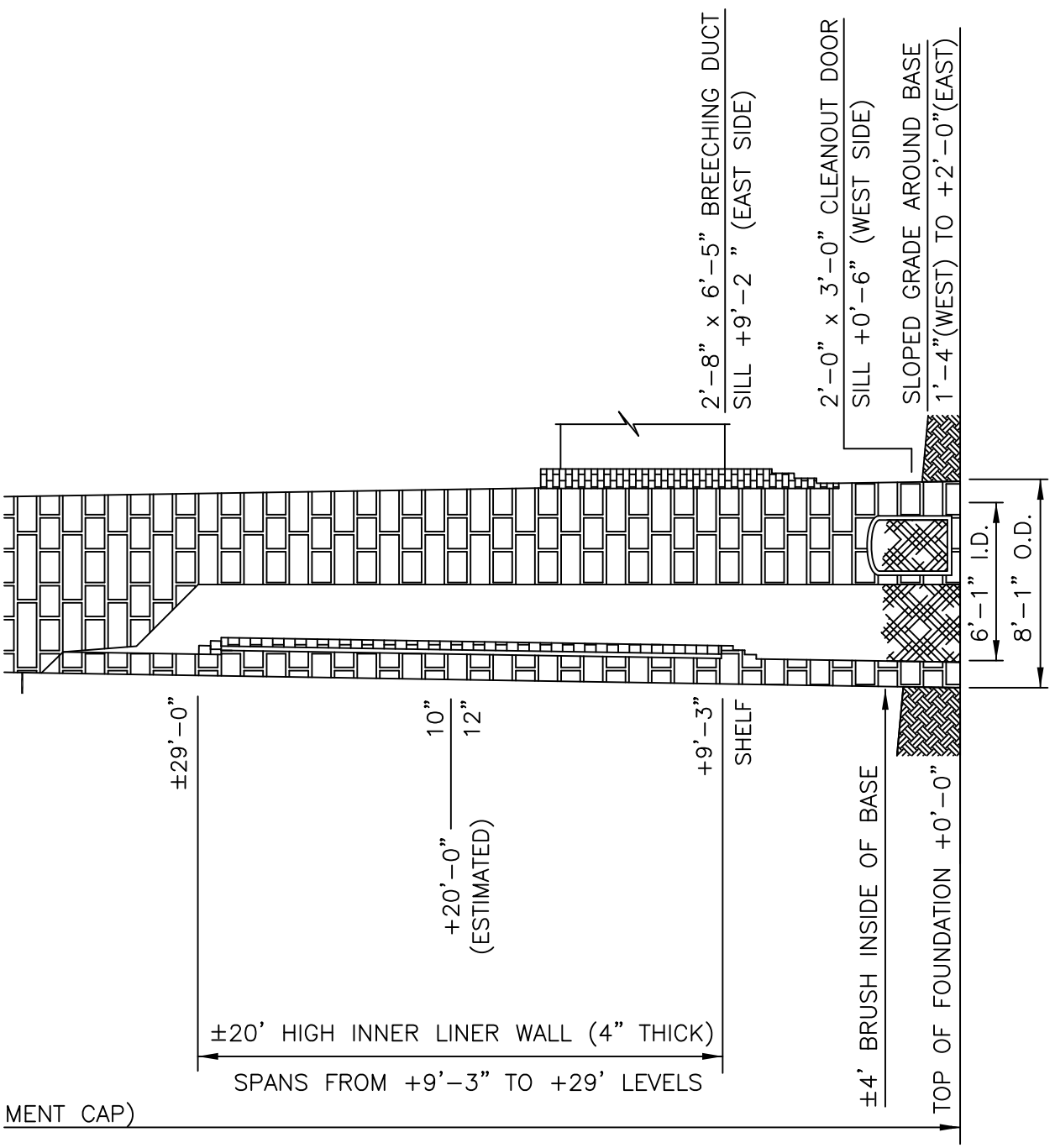
   Safety Note: *Due to the numerous loose and unstable bricks along the top of the inner liner wall at the 29' level (Photo 12), personnel should not enter the base of the chimney until the hazard is eliminated.*
9. **Replace the missing cleanout door at the base.** A new, hinged door should be installed on the existing frame or a new frame and door installed.

Appendix A

General Arrangement Drawing


7'–4" O.D.
(HEAD)
4'–1 1/2"
I.D.
8 1/4"
NO LIGHTNING PROTECTION COMPONENTS
1/2" THICK LAYER OF CEMENT
COVERS TOP COURSE OF BRICK
+79'–0" TOP/CHIMNEY
4'–0" ORNAMENTAL HEAD
+75'–0"
VARIES
7"
5'–8" O.D. AT +75'–0" LEVEL
STEEL BRACKET +71'–6"
(WEST SIDE)
79'–0" RADIAL BRICK CHIMNEY (FOUNDATION TO TOP OF CEM
+60'–0"
7"
8"
+56'–8"
8"
10"
STEP IRONS
+10' TO TOP
(WEST SIDE)

GENERAL ARRANGEMENT DRAWING



REV.	DATE	DESCRIPTION	BY	DESN.	APPD.
–	2-12-19	FOR INFORMATION ONLY	DB	DB	DB

BEDNASH CONSULTING
445 LOCUST LANE
ROSELLE, IL. 60172
(630) 351-0397

PROJECT:
BOILER HOUSE CHIMNEY INSPECTION
79'-0" RADIAL BRICK CHIMNEY
GOULD ISLAND
NARAGANSETT BAY – RHODE ISLAND

DRAWING TITLE:
GENERAL ARRANGEMENT DRAWING

CAD FILENAME:

SCALE:	AS NOTED	PLOT SCALE:	1=1	
DESN: DB	DRWN: DB	DRAWING NO:	26019-1	REV. –
CHKD: DB	DATE: 2-12-19			

Appendix B

Inspection Photographs

Photo 1. Poor condition of the remaining cement cap atop the chimney. Note the deteriorated and dislodged areas of the thin layer of material.

Photo 2. Poor condition of the remaining cement cap atop the chimney.

Photo 3. Poor condition of the remaining cement cap atop the chimney (north side).

Photo 4. Very poor condition of the remaining cement cap atop the chimney (south side). Note the region where the cement has completely dislodged.

Photo 5. Poor condition of the remaining cement cap atop the chimney (east side).

Photo 6. Poor condition of the remaining cement cap atop the chimney (west side).

Photo 7. Close-up of the remaining deteriorated cement cap atop the chimney.

Photo 8. Close-up of the remaining deteriorated cement cap atop the chimney.

Photo 9. Fair interior condition of the upper elevations (northwest side).
No concerns were seen with brick faces but mortar joints were recessed up to ¾" near the top.

Photo 10. Fair interior condition of the upper elevations looking down from the top.
No concerns were seen with brick faces. Local areas of mortar joints were recessed ¾" to 1".

Photo 11. Fair interior condition between the 60' and 50' levels. Mortar joints were only slightly recessed in this region.

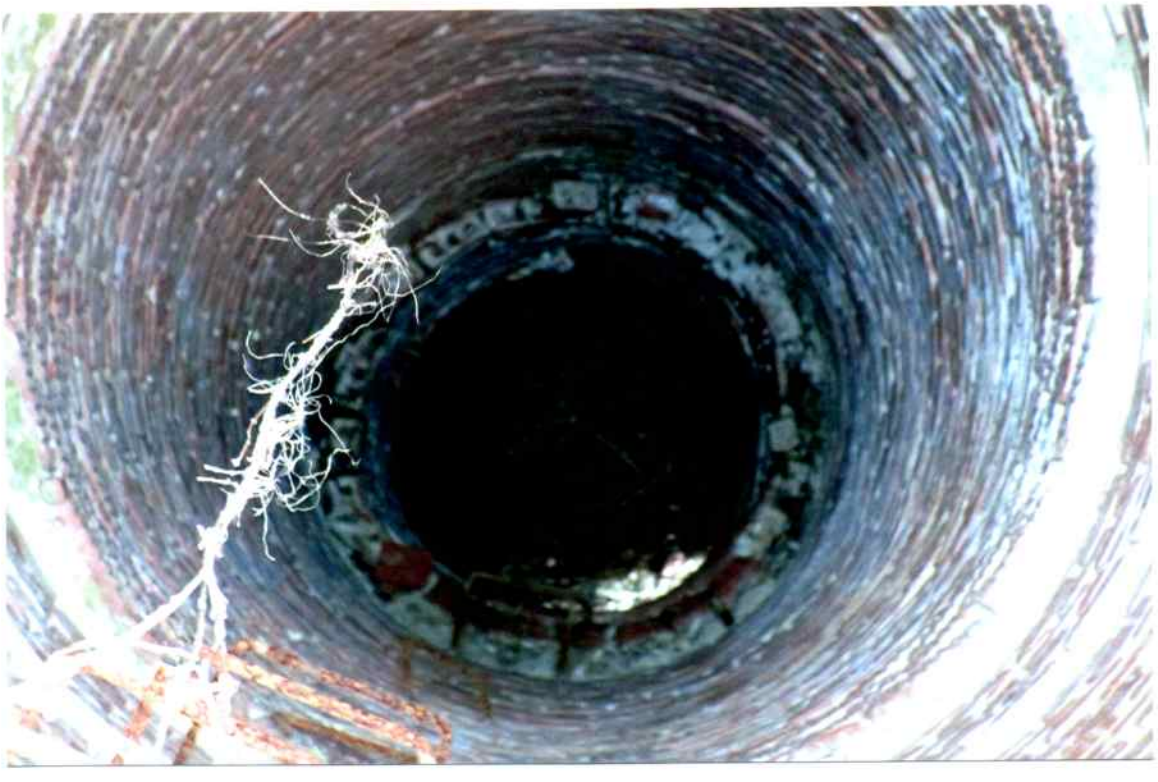


Photo 12. Poor condition along the top of the inner liner wall near the 29' level. Numerous loose and unstable bricks were seen along the top of the inner liner wall.

Photo 13. Poor exterior condition of the upper elevations (northwest side). Note the cracked water table (cement wash). Several bricks were in danger of dislodging.

Photo 14. Close-up of loose and unstable sections of the water table (west side). Sections on this side were in danger of dislodging.

Photo 15. Close-up of cracked and loose sections of the water table (north side).

Photo 16. Close-up of cracked and loose sections of the water table (northeast side).

Photo 17. Close-up of cracked sections of the water table (east side).

Photo 18.
Poor exterior condition of the upper 5' of the northwest side. Approximately 10 spalled bricks were seen below the loose and unstable course under the water table.

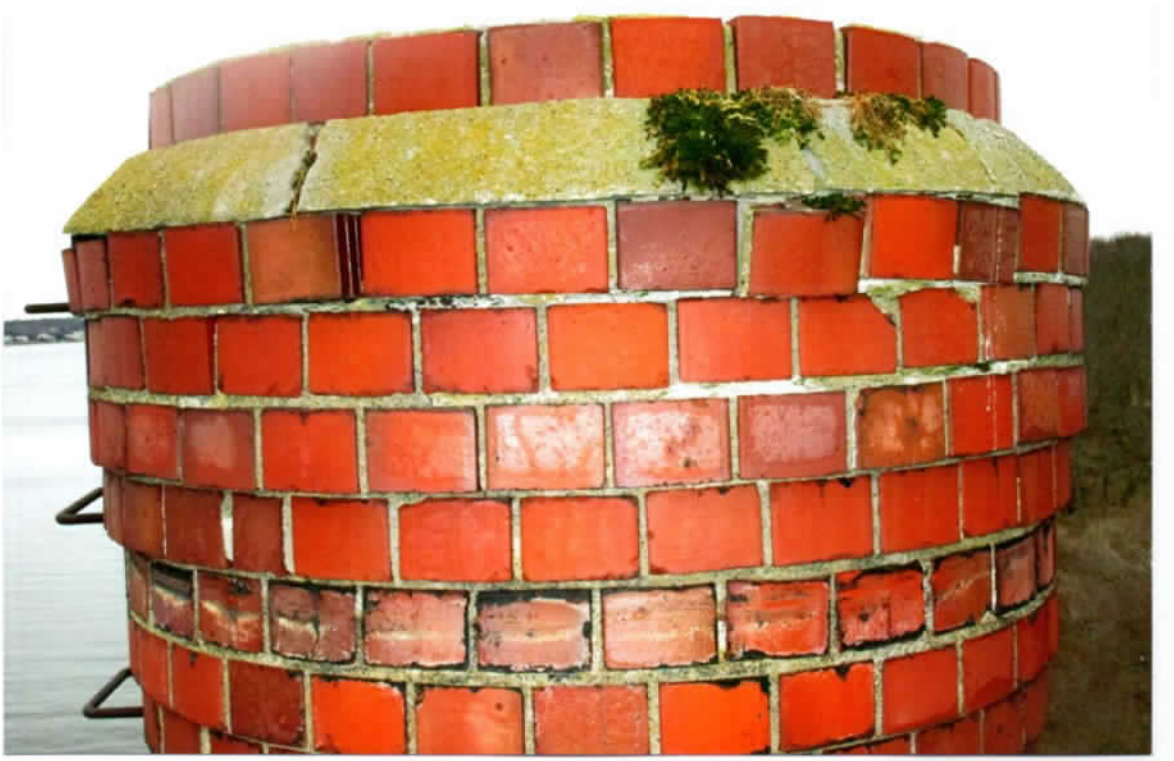


Photo 19. Poor condition of the upper 4' of the south side.
Several loose and unstable bricks were seen below the water table.

Photo 20. Fair exterior condition of the west side between the 75' and 70' levels.
Mortar joints were only slightly recessed in this region.

Photo 21. Close-up of unstable bricks and sections of the water table (southeast side). The one brick and small section of cement water table were removed during the inspection.

Photo 22. Picture showing the upper southeast side after removing the one brick and small section of cement water table.

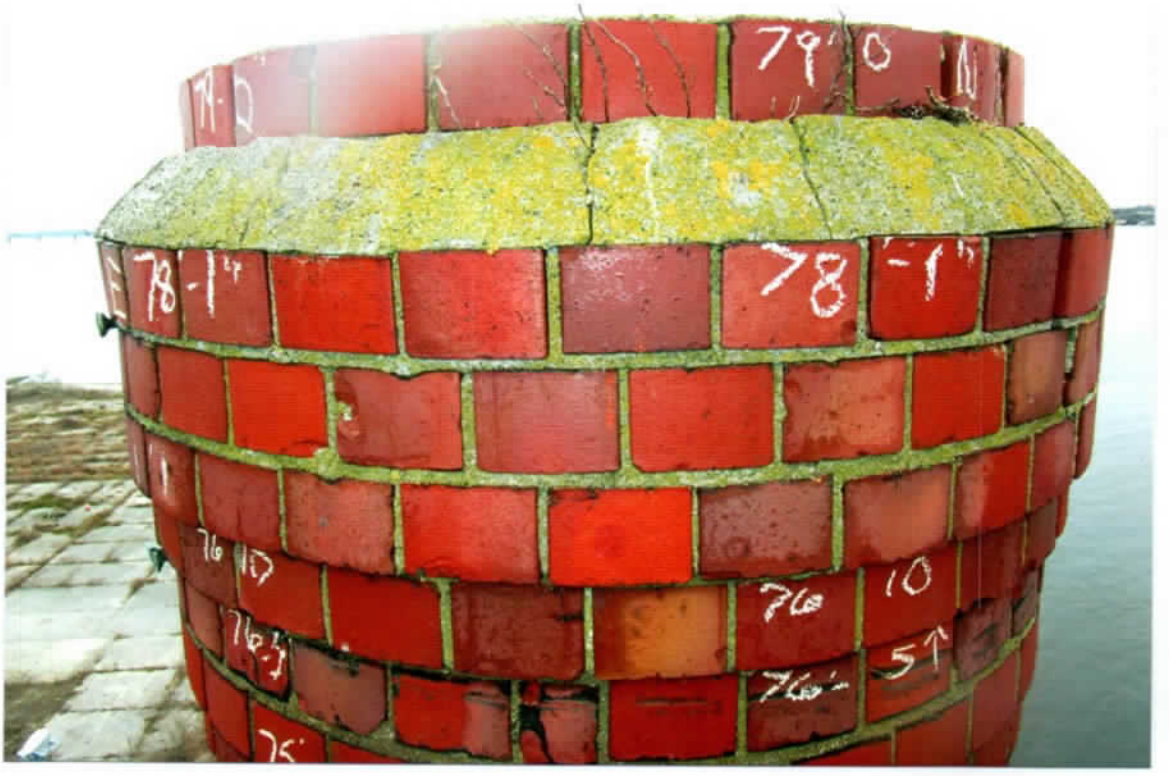


Photo 23. Fair condition of the uppermost 4' of the northeast side. Note only the cracked sections of cement along the water table.

Photo 24. Fair condition of the northeast side between the 77' and 75' levels. No obvious or immediate concerns were seen in this region.

Photo 25. Fair exterior condition of the west side between the 75' and 70' levels. Note the spalled bricks in the courses below the uppermost step iron.

Photo 26.
Fair exterior condition of the northwest side between the 70' and 50' levels. Mortar joints were slightly recessed. No obvious structural concerns (cracks, bulges) were identified in this region.

Photo 27. Fair condition of the anchored steel bracket at the 71'-6" level (northwest side). The bracket was deteriorated but secure to the wall.

Photo 28. Fair condition of the anchored steel bracket at the 71'-6" level (southwest side). The bracket was deteriorated but secure to the wall.

Photo 29. Fair exterior condition of the northeast side local to the 70' levels. Mortar joints were only slightly recessed in this region.

Photo 30. Fair exterior condition of the northeast side local to the 60' levels. Mortar joints were only slightly recessed in this region.

Photo 31.
Fair exterior condition of the south side between the 70' and 50' levels. Mortar joints were slightly recessed. No obvious structural concerns (cracks, bulges) were identified in this region.

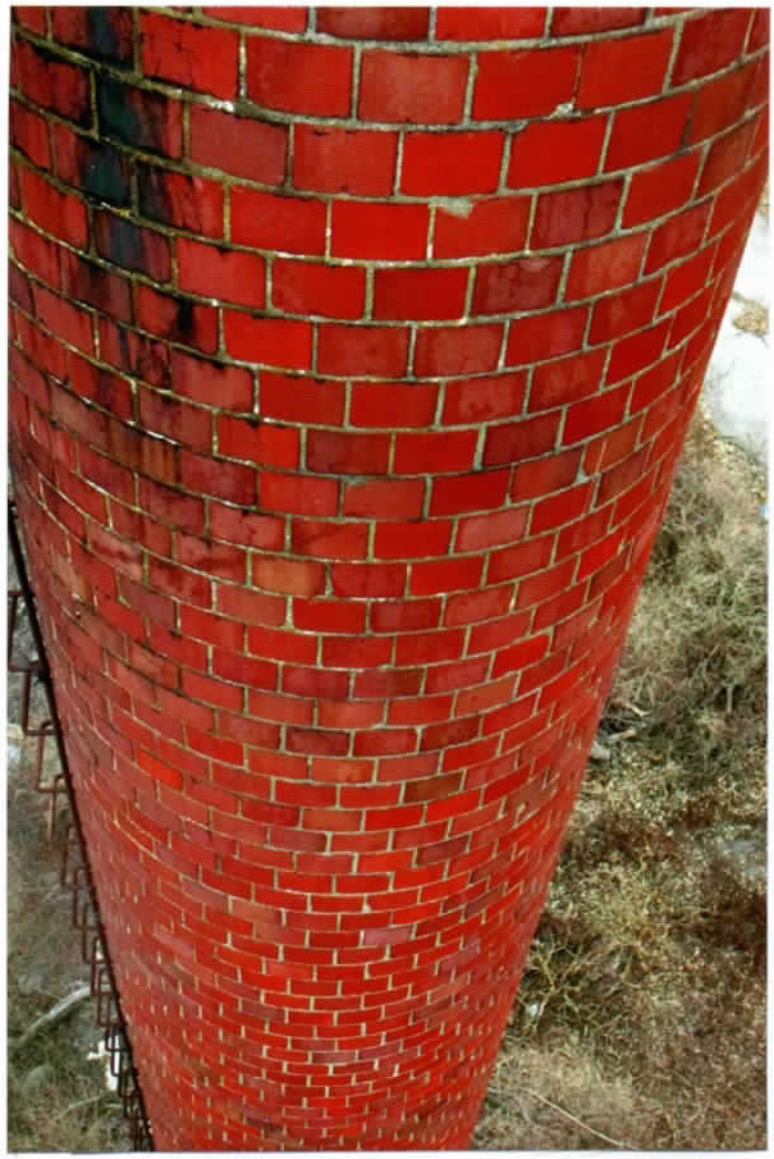


Photo 32.
Fair exterior condition of the south side between the 55' and 45' levels. No obvious structural concerns (cracks, bulges) were identified in this region.

Photo 33.
Fair exterior condition of the southwest side below the 70' level. Note the broken and hanging lightning protection cable adjacent to the lower step irons. All step irons (ladder rungs) were secure.

Photo 34.
Fair exterior condition of the southwest side at the 60' level. Note the broken and hanging lightning protection cable. All step irons (ladder rungs) were secure.

Photo 35.
Fair exterior condition of the southwest side below the 30' level. Note only the bittersweet vines growing along the step irons. Random deteriorate and open mortar joints were seen in this region.

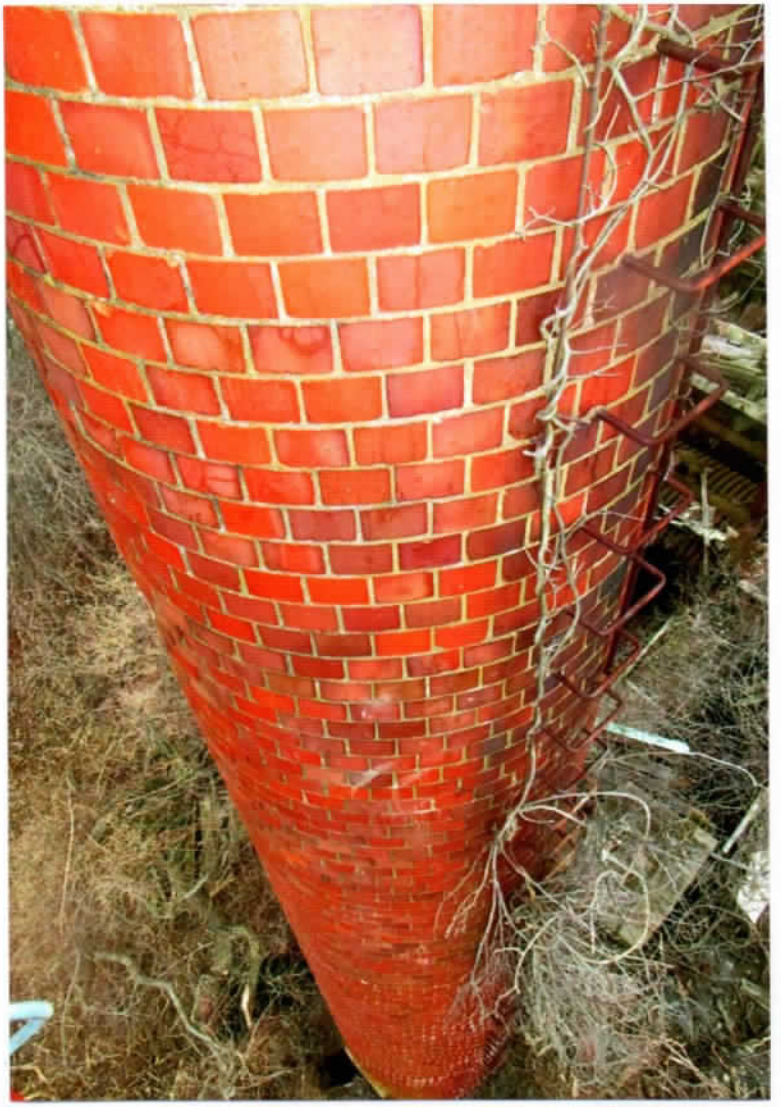


Photo 36. Fair exterior condition of the southwest side near the 20' level. A few random deteriorate and open mortar joints were seen in this region.

Photo 37.
Fair exterior condition of the north side below the 30' level. A few short diagonal cracks and random open mortar joints were seen in this region.

Photo 38. Fair condition of the east side near the 20' level.
Note the open joints along the three courses. No cracked bricks were identified.

Photo 39. Very poor condition of the extended wall and lintels above the boiler duct opening. Numerous dislodged bricks were identified, and the condition of the lintel beams was poor.

Photo 40. Very poor condition of the extended wall and lintels above the boiler duct opening. Numerous dislodged bricks were identified, and the condition of the lintel beams was poor.

Photo 41. Poor condition of the boiler duct extending from the boiler house to the chimney. The steel angle frames were severely eroded. The duct was not in danger of collapsing.

Photo 42. Fair exterior condition of the south side in the 5' above grade. A few random deteriorate and open mortar joints were seen in this region below the entering duct.

Photo 43.
Fair exterior condition of the extended wall (southwest side) local to the duct opening. No immediate concerns were seen throughout the masonry wall in this region.

Photo 44.
Fair exterior condition of the extended wall (southwest side) in the lower elevations above grade. No immediate concerns were seen throughout the masonry wall in this region.

Photo 45.
Fair exterior condition of the extended wall (southeast side) local to the duct opening. No immediate concerns were seen throughout the masonry wall in this region.

Photo 46.
Fair exterior condition of the extended wall (southeast side) in the lower elevations above grade. No immediate concerns were seen throughout the masonry wall in this region.

Photo 47. Fair exterior condition of the lower north side local to the cleanout opening. A few open mortar joints were identified. Note the missing cleanout door.

Photo 48. Deteriorated and pitted frame of the original cleanout opening. Note the accumulated brush and debris on the interior.

Photo 49. Overall good interior condition of the inner liner wall local to the duct opening. No obvious concerns were seen with the lower structural wall or corbelled support of the liner.

Photo 50. Overall good interior condition of the inner liner wall below to the duct opening. No obvious concerns were seen with the lower structural wall or corbelled support of the liner.