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VIA EMAIL

July 7, 2020
File No. 04.0029644.02

Ms. Mary E. Casey
Environmental Program Manager
Liberty Utilities
15 Buttrick Road
Londonderry, New Hampshire 03053

Re: Observations and Opinions of Probable Cost - Gas Holder House
Concord Manufactured Gas Plant – 1 Gas Street (Site)
Concord, New Hampshire
DES Site # 198904063, Project RSN # 1479

Dear Mary:

GZA GeoEnvironmental, Inc. (GZA) is pleased to present this letter report summarizing recent observations and providing our opinion of probable cost for options related to the management of the former manufactured gas plant (MGP) gas Holder House structure at the Site. Three possible options were identified by Liberty Utilities and the City of Concord and are referred to as the Monument, Public Use, and Demolition options. GZA's work was performed in accordance with our proposal for services, dated October 8, 2019. We understand that GZA's opinions of probable cost will be shared with the City of Concord for their use. GZA's work and this letter report are subject to the attached **Limitations**.

BACKGROUND

The Site[1] is owned by Energy North Natural Gas, Inc., a Liberty Utilities company, and is currently vacant and largely secured within two chain-link-fenced areas located along Gas Street in Concord, New Hampshire. The majority of the Site is grassed with shrubs and small trees. The Site is occupied by a single aboveground structure. The structure is a brick and timber gas Holder House located in the northwestern portion of the Site, which is included in the Library of Congress collection of Historic American Building Survey/Historic American Engineering Record. In 2018 the building was added to the National Register of Historic Structures. Site features are illustrated on attached **Figure 1**.

[1] The "Site" as used herein refers to the property on which the former MGP was located and is owned by Energy North Natural Gas, Inc., a Liberty Utilities company.

The gas Holder House was built during 1888 to house and protect a gas holder used during the operation of the MGP to process and store manufactured gas. The gas holder is approximately 80 feet in diameter and constructed of riveted iron plate. The sidewalls of the gas holder are approximately 24 feet in height, and the gas holder is open at the bottom.

The Holder House consists of an approximately 88-foot-diameter brick structural wall with a height of approximately 27 feet, and a conical roof (i.e., the Holder House). The Holder House covers an approximately 82.5-foot-diameter, 24-foot-deep belowground masonry-lined pit within which the gas holder sits. The conical roof of the Holder House is constructed of a system of timber rafters and purlins. Sixteen approximately 3-inch by 14-inch primary rafters span from a tension ring atop the masonry wall, to a compression ring at the base of the cupola that sits atop the roof. Numerous approximately 2-inch by 8-inch secondary rafters connect two rings of purlins and the compression and tension rings. The compression ring at the base of the cupola is approximately 30 feet above the top of the masonry wall. The timbers are braced by two rings of purlins, and additional rafters span between the purlins and tension and compression rings. The roof is sheathed with wood and clad with slate shingles. A cupola tops the roof at its peak and rests on the compression ring. Historic drawings illustrating the construction of the gas Holder House are included on attached **Figure 2**.

The gas Holder House originally had no internal supports to allow the gas holder, which occupies the interior of the Holder House, to rise as it filled with gas. The gas holder, constructed of riveted iron plates, does not provide a structural bearing or floor. Sometime after MGP operations ceased at the Site, shoring was constructed within the Holder House and appears to partially support the cupola. Since the iron plate gas holder inside the Holder House does not provide a structural bearing or floor, a platform was previously constructed to support the shoring. A network of beams carries the load of the platform out to the foundation walls. An evaluation of the condition of the shoring and platform supporting the shoring was performed by McFarland Johnson, Inc. (MJI) of Concord, New Hampshire during January 2010 in preparation of a project by GZA to access the cupola to make repairs to damaged window sashes. Based on their evaluation, MJI recommended strengthening the shoring and platform system prior to using the shoring to access the cupola. The cupola is noticeably tilted and appears to be due to movement of certain primary roof rafters.

A tree fell on the north side of the building in June of 2013, damaging the roof structure and supporting masonry wall. Several rafters were damaged, including two primary rafters. Large holes were opened within the roof where the tree impacted the roof, exposing the interior of the Holder House to weather. Cracks have been observed in the masonry bearing wall where the tree impacted the building, and numerous bricks were dislodged from the masonry wall in the area of tree impact.

Access to the portion of the roof damaged by the tree impact and to the cupola was created after completion of a structural survey of the damaged areas of the building. Access was provided by expanding the existing platform system and installing scaffolding towers. In addition, during 2014 the damaged area of sheathing and damaged secondary rafters were removed, and a temporary repair to the roof was made in the area of the tree-impact damage to prevent further damage of the roof due to exposure to weather. Inspection of the roof structure at the time of the repairs revealed significant long-term damage to the roof and wall structures due the passage of time and exposure to weather.

During operation of the MGP, coal tar and oils accumulated within the gas holder as part of the normal operation of the MGP. GZA understands that tars, oils, and oily waters were removed from the holder within the Holder House during 1994 as part of the remediation of the Site. However, coal tar-like odors are noticeable within the

Holder House. It is not known if MGP byproducts were released to the subsurface beneath the Holder House. The New Hampshire Department of Environmental Services (NHDES) has provided the opinion that the Holder House is a physical barrier to exposure of residual MGP byproduct contamination associated with the use of the holder and is considered part of the remedy for the Site. The NHDES has indicated that in the event that the Holder House is demolished, the NHDES will require investigation within the area currently made inaccessible by the Holder House and construction of a cap to replace the barrier presented by the Holder House. In the event that the Holder House is demolished, and contamination is encountered beneath the Holder House, remediation of the area beneath the Holder House may also be required.

OBSERVATION OF THE SCAFFOLDING AND STRUCTURE OF THE HOLDER HOUSE

GZA worked with MJI to perform an observation of the existing scaffolding tower systems and structure of the Holder House. A detailed analysis of overall building stability was not performed as part of our scope of work.

Several areas of significant damage, loose bricks and step cracking in mortar were observed within the entry vestibule on the south side of the structure and the perimeter wall on the northside of the structure proximate to the damaged tension ring at the roof line. Bricks and roof slate that appeared to have fallen from the structure were also noted on the ground surface on the northside of the structure. Damage to the northside perimeter wall identified in 2014 after the structure was damaged by the tree fall in 2013 continues to be an area of significant concern.

MJI compared their recent observations to their observations at the Site during 2010. MJI concluded that the overall condition of the scaffolding present in 2010 and the structure have not changed substantially over the intervening 10 years. A copy of MJI's letter report[2] summarizing their observations and recommendations related to the Holder House is included in **Attachment A**. Key findings of the MJI report related to the scaffolding and roof structure include:

- The structural steel framing and scaffolding erected within the Holder House appeared to be in good condition.

- The scaffolding tower which was in place in 2010 is still present within the Holder House and additional scaffolding has been constructed through and around the previously installed scaffolding. An access Stairway, original to the structure, has been removed.

- The addition of the second scaffolding tower in 2014 which partially supports the cupola, and likely some amount of the roof as well, has increased the overall capacity of the system.

- The scaffolding system at the north side of the building installed as part of the temporary roof repair in 2014 appears to be functioning as intended to support the damaged roof area.

- There were several places where holes and openings in the roof were noted. MJI noted that keeping the wood roof members dry and free of rot is critical to the longevity of the structure.

[2] Letter report by MJI titled "*Concord Gasholder Building Evaluation, Concord, NH*," dated January 29, 2020.

- Given the potential for wood rot, the overall capacity of the roof framing is considered marginal. As a result, the structural stability of the entire roof system in jeopardy.

- Bird guano was noted throughout the Holder House. Combined with moisture, bird guano can accelerate steel corrosion. Over time the droppings could cause a reduction in the capacity of both the structural steel beams as well as the scaffolding.

Based on MJI's observations, they recommended the existing scaffolding systems be replaced with an engineered structural steel support system and a roofing replacement project be completed in the near future to make the structure watertight. MJI also noted that that any sort of re-use that results in the structure being used as an occupied building will trigger the "change of use" section of the Building Code. In most cases, this requires a full structural analysis of the entire building for compliance with current Code vertical and lateral load requirements. It was MJI's opinion that a substantial amount of reinforcing would likely be required to meet present day load levels.

REUSE SCENARIOS AND OPINION OF PROBABLE COSTS

GZA evaluated the management options identified by Liberty Utilities and the City of Concord and developed, where possible, an initial opinion of probable cost for each option. Our evaluation considered: 1) MJI's recent observations and recommendations; 2) the results of previous options evaluations by GZA; and 3) GZA's understanding of site conditions including environmental conditions associated with the former MGP operations at the Site.

<u>OPTION 1: REPAIR OF THE HOLDER HOUSE, "MONUMENT OPTION"</u>

This option includes preservation of the Holder House by repairing deteriorated elements and assumes that there will continue to be no public entry or access into the structure. For this option, MJI developed a preliminary concept design of a structural steel support system to replace the existing scaffolding towers and reinforce the existing gas holder building's roof as described in the attached March 5, 2020 memorandum. GZA also worked with North Branch Construction, Inc. of Concord, New Hampshire to develop costs associated with limited structural repair of the perimeter wall and roofing replacement.

Based on our current understanding of the Holder House condition, GZA's initial opinion of probable costs for this option ranges from $1,467,900 to $1,933,150. This option assumes the following:

- A detailed structural review and analysis of the Holder House is performed.

- Repair damaged areas of the perimeter walls and repointing of brick façade.

- Existing entrance vestibule is removed to foundation and not replaced.

- New entry doorway is constructed.

- New interior structural reinforcement system is installed.

- Repair of roof structure and slate roof.

- Modification of existing steel gas holder structure to facilitate installation of new interior structural reinforcement system.
- Securing existing windows and doors.
- Replacement of Site perimeter fencing.
- Repair of existing ground mounted perimeter lighting system.
- Repairs would not be required to meet state or federal historic preservation guidelines requirements or be controlled by federal historic preservation statutes.
- Work will be substantially completed 25-30 weeks from mobilization.

A breakdown of estimated costs and supporting information associated with Option 1 is attached as ***Attachment B****.*

OPTION 2: RENOVATION OF THE HOLDER HOUSE, "THE PUBLIC USE OF INTERIOR OPTION"

This Option includes preservation of the Holder House and construction of a new floor system for the public to use the space. This option would require at a minimum:

- A detailed structural review and analysis of the Holder House and existing masonry lined pit.
- A complete code review and detailed design development.
- An initial repair of the Holder House as needed to preserve the structure as detailed in *Option 1*.
- Removal of metal gas holder and associated appurtenances.
- Partial backfilling of the existing belowground masonry lined pit and installation of a new concrete floor.
- Construction of new floor framing system within the Holder House.
- Reconstruction of entry vestibule and entrance.
- Cleaning, decontamination and finishing of the interior walls to remove or encapsulate residual contamination.
- Design and installation of a vapor mitigation system.
- Upgrade, replacement, or installation of electrical, mechanical, and plumbing systems to support re-use.

As part of our review, GZA identified significant challenges that would need to be considered as part of any reuse design. These issues include:

- Any option to re-use the Holder House that results in the structure being occupied will trigger the "change of use" section of the Building Code. In most cases, this will likely require a full structural analysis of the building for compliance with current Code vertical and lateral load requirements. A substantial amount of reinforcing would likely be required to meet present day load levels.

- The NHDES will require design and installation of a cap over the entire site including areas beyond the limits of the structure as detailed in the approved Remedial Action Plan for the Site.

- Restoration or reuse of the Holder House may trigger certain local, state, or federal historic preservation requirements. Work could also be controlled by federal historic preservation statutes which would impact overall project schedule and costs.

GZA cannot provide an opinion of probable cost for this option without a detailed understanding of the future use of the building and Site. For example, a storage facility and a restaurant will have very different requirements relative to the redevelopment of the building. While structural upgrades and reinforcing will be required by Code, the amount can be influenced by the Use Classification of the building.

GZA anticipates architectural and preliminary engineering costs associated with any potential re-use could range from $100,000 to $200,000 depending on final reuse scenario.

OPTION 3: DEMOLITION OF THE HOLDER HOUSE

This option includes complete demolition and removal of the Holder House and capping in-place the below ground portions of the structure. For this option, GZA worked with Select Demolition, Inc. of Salem, New Hampshire to develop an opinion of probable cost. GZA's initial opinion of probable cost for demolition ranges from $509,600 to $700,700 and assumes the following:

- Permitting and approvals would not require project to meet state or federal historic preservation guidelines requirements or be controlled by federal historic preservation statutes.

- Termination and capping of existing utilities including removal of existing perimeter lighting system.

- Complete removal and demolition of existing above-grade structure.

- Steel salvage will be retained by the contractor.

- Removal and crushing of existing masonry lined pit walls to approximately 3 feet below existing surrounding grades.

- Clean masonry debris and imported fill will be used to backfill masonry lined pit.

- Site grading and restoration of disturbed areas.

- Demolition work would be substantially complete within 4 weeks from mobilization.

1. The NHDES has indicated that in the event that the Holder House is demolished, the NHDES will require investigation within the area currently made inaccessible by the Holder House and construction of a cap

to replace the physical barrier to residual MGP byproducts presented by the Holder House. Costs to perform a limited investigation within the footprint of the holder are estimated to be approximately $75,000 to $100,000. The costs for the limited investigation are in addition to the estimated costs for demolition, capping and Site restoration. Final details and cost of cap design and any required remediation within or adjacent to the footprint of the Holder House are not currently known. The investigation and design of the cap would require approval by NHDES and are the responsibility of Liberty Utilities in all scenarios.

*A breakdown of estimated costs and supporting information associated with Option 3 is attached as **Attachment C**.*

SITE CONTROL AND SECURITY

The perimeter fence at the Site provides security and is an integral part of the existing remedial strategy, in that it limits the potential for exposure to hazards associated with the Site. GZA is aware that there have been recent incidents of unlawful trespass that have included cutting the fence to enter the Site. We understand that Liberty Utilities has responded to these situations and has made appropriate repairs to remedy the situation, as they have become aware of issues. However, given the overall condition of the site fencing and that the Holder House and site conditions pose risk to anyone entering the Site without appropriate training and personal protective equipment, we recommend replacement and upgrading of the site fencing. Given the logistics associated with new fence installation and the presence of the Holder House, GZA's opinion of probable costs based on review of RS Means 2020 published cost data for fence replacement ranges from $200,000 to $300,000.

We greatly appreciate the opportunity to continue to provide support to Liberty Utilities and look forward to continuing to work with you and the City of Concord to develop an appropriate solution to managing the risks and liabilities associated with the Holder House structure.

Very truly yours,

GZA GEOENVIRONMENTAL, INC.

John C. Murphy, CCM, CHMM
Senior Principal

James M. Wieck, P.G.
Senior Project Manager

Jeffrey D. Rowell, PE
Associate Principal

JCM/JDR/JMW:kr/tmd
p:\04jobs\0029600s\04.0029644.00\04.0029644.02\report\final letter report\final 04.0029644.02 cost letter 070720.docx

Attachments: Limitations
Figures
Attachment A: MJI – Holder Evaluation Letter Report
Attachment B: Estimate - Option 1
Attachment C: Estimate - Option 3

Limitations

USE OF REPORT

1. GeoEnvironmental, Inc. (GZA) prepared this Report on behalf of, and for the exclusive use of our Client at the stated time for the stated purpose(s) and location(s) identified in the Report. Use of this Report, in whole or in part, at other locations, or for other purposes, may lead to inappropriate conclusions; and we do not accept any responsibility for the consequences of such use(s). Further, reliance by any party not identified in the agreement, for any use, without our prior written permission, shall be at that party's sole risk, and without any liability to GZA.

STANDARD OF CARE

2. GZA's findings and conclusions are based on the work conducted as part of the Scope of Services set forth in the Report and/or proposal, and reflect our professional judgment. These findings and conclusions must be considered not as scientific or engineering certainties, but rather as our professional opinions concerning visual observations at the time of our visit and the limited data gathered during the course of our work.

3. GZA's services were performed using the degree of skill and care ordinarily exercised by qualified professionals performing the same type of services at the same time, under similar conditions, and at the same or a similar property. No warranty, expressed or implied, is made.

4. Basis of Opinion of Cost Unless otherwise stated, our opinions of cost are only for comparative and general planning purposes. These opinions are based on our visual observations at the time of our visit, the limited data and the conditions and assumptions described in the Report. The cost estimates may involve approximate quantity evaluations and are not intended to be sufficiently accurate to develop construction bids, or to predict the actual cost of work addressed in the Report. Further, since we have no control over when the work will take place nor the labor and material costs required to plan and execute the anticipated work, our cost opinions were made by relying on our experience, the experience of others, and other sources of readily available information. Actual costs will vary over time and could be significantly more, or less, than stated in the Report.

5. Cost opinions presented in the Report are based on a combination of sources and may include published RS Means Cost Data; past bid documents; cost data from federal, state or local transportation agency web sites; discussions with local experienced contractors; and GZA's experience with costs for similar projects at similar locations. GZA did not attempt to independently verify the accuracy or completeness of all information reviewed or received during the course of this evaluation. Actual costs will likely vary depending on the quality of materials and installation; manufacturer of the materials or equipment; field conditions; geographic location; access restrictions; phasing of the work; subcontractors mark-ups; quality of the contractor(s); project management exercised; and the availability of time to thoroughly solicit competitive pricing. In view of these limitations, the costs presented in the Report should be considered "order of magnitude" and used for budgeting and comparison purposes only. Detailed quantity and cost estimating should be performed by experienced professional cost estimators to evaluate actual costs. The opinions of cost in the Report should not be interpreted as a bid or offer to perform the work. Unless stated otherwise, all costs are based on present value.

6. The opinion of costs are based only on the quantity and/or cost items identified in the Report, and should not be assumed to include other costs such as legal, administrative, permitting or others. The estimate also does not include any costs with respect to third-party claims, fines, penalties, or other charges which may be assessed against any responsible party because of either the existence of present conditions or the future existence or discovery of any such conditions.

ADDITIONAL SERVICES

7. It is recommended that GZA be retained to provide engineering services during any final design, construction and/or implementation of any measures recommended in this Report. This will allow us the opportunity to: i) observe conditions and compliance with our design concepts and opinions; ii) allow for changes in the event that conditions are other than anticipated.

Figures

GENERAL NOTES

1. BASE PLAN PROVIDED BY NATIONAL GRID AS PREPARED BY PAULUS SOKOLOWSKI AND SARTOR, LLC (PS&S) FROM THE SOURCES LISTED UNDER NOTES 2, 4, AND 5.
2. FIGURE REPRODUCED FROM PLANS ENTITLED "PLANT PROPERTY PLAN OF THE CONCORD GAS COMPANY, CONCORD, NH", PREPARED BY K. RICHTER, DATED 01/01/1932, "EXPLORATION LOCATION AND SITE FEATURES PLAN", PREPARED BY SANBORN, HEAD & ASSOCIATES (SHA), DATED JUNE 03, AND CONCORD, NH TAX ASSESSMENT MAPS 26 & 27 OBTAINED FROM THE CONCORD, NH TAX ASSESSORS OFFICE 3/17/04, "PLANS OF PROPOSED US ROUTE 3/WATER ST., WATER ST. BRIDGE, HALL ST., RELOCATED GULF ST., SO. MAIN ST.", BY NHDOT, DATED 2/28/97, AND FORMER UTILITLY PLANS OBTAINED FROM THE CONCORD, NH ENGINEERING DEPARTMENT, "ABUTTING AND DOWN GRADIENT PROPERTIES", LISTED IN NHDES DATABASE, PREPARED BY GEI CONSULTANTS, DATED 06/2005.
3. THE LOCATION OF THE SITE, SITE FEATURES, PROPERTY LINES, BUILDING FOOTPRINTS AND EXPLORATION LOCATIONS ARE APPROXIMATE.
4. PROPERTY BOUNDARIES ARE CREATED FROM PLAN ENTITLED "PROPERTIES LOCATED WITHIN A 1,000–FOOT RADIUS OF THE SITE", DRAWN BY GEI, DATED 06/2005. CERTAIN LOTS WERE HAND–DRAWN BY GEI USING PROPERTY DATA FROM THE CITY OF CONCORD.
5. BASE MAP DEVELOPED FROM GOOGLE PROFESSIONAL IMAGE FILE. DIGITAL AERIAL ORTHOPHOTOGRAPHY WAS COLLECTED FOR THE GAS HOLDER SITE IN OCTOBER 2015.

LEGEND

BOSTON AND MAINE RAILROAD

APPROXIMATE SITE BOUNDARY

N

0 10 20 40 60
SCALE: 1"=20'

GAS HOLDER HOUSE OPTIONS EVALUATION
CONCORD MANUFACTURED GAS PLANT
GAS STREET SITE (SITE)
CONCORD, NEW HAMPSHIRE

DES SITE #198904063, PROJECT RSN #1479
SITE LAYOUT / FEATURES

PREPARED BY:
GZA GeoEnvironmental, Inc.
Engineers and Scientists
5 COMMERCE PARK NORTH, SUITE 201
BEDFORD, NEW HAMPSHIRE 03110
(603) 623-3600

PREPARED FOR: Liberty Utilities

PROJ MGR: JMW	REVIEWED BY: SRL	CHECKED BY: JMW	FIGURE	
DESIGNED BY: JMW	DRAWN BY: MR	SCALE: 1" = 20'	1	
DATE: May 2020	PROJECT NO. 04.0029644.01	REVISION NO.	SHEET NO.	

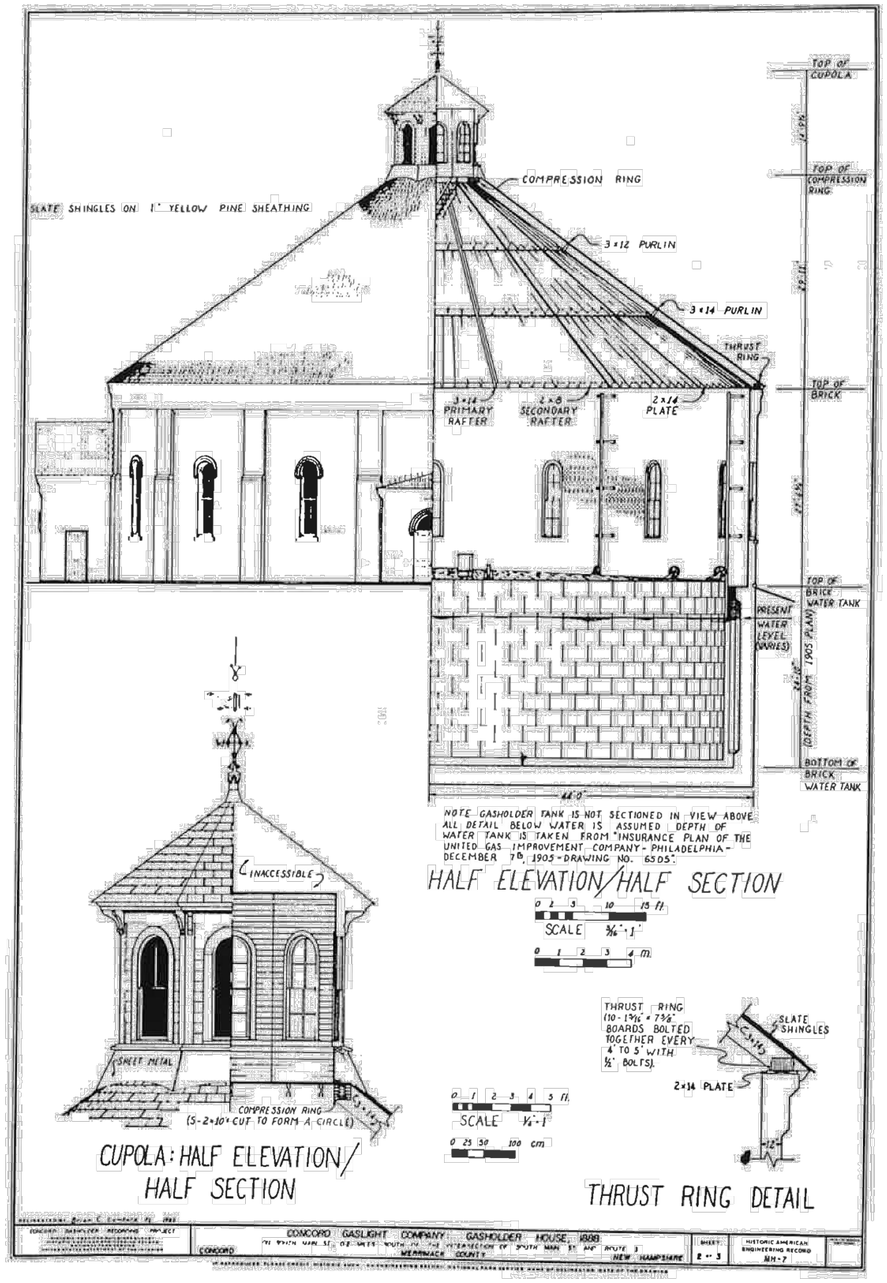


Figure 4. *Elevation and section drawings of 1888 gasholder house.* HAER, drawing by Brian Lombard, 1982.

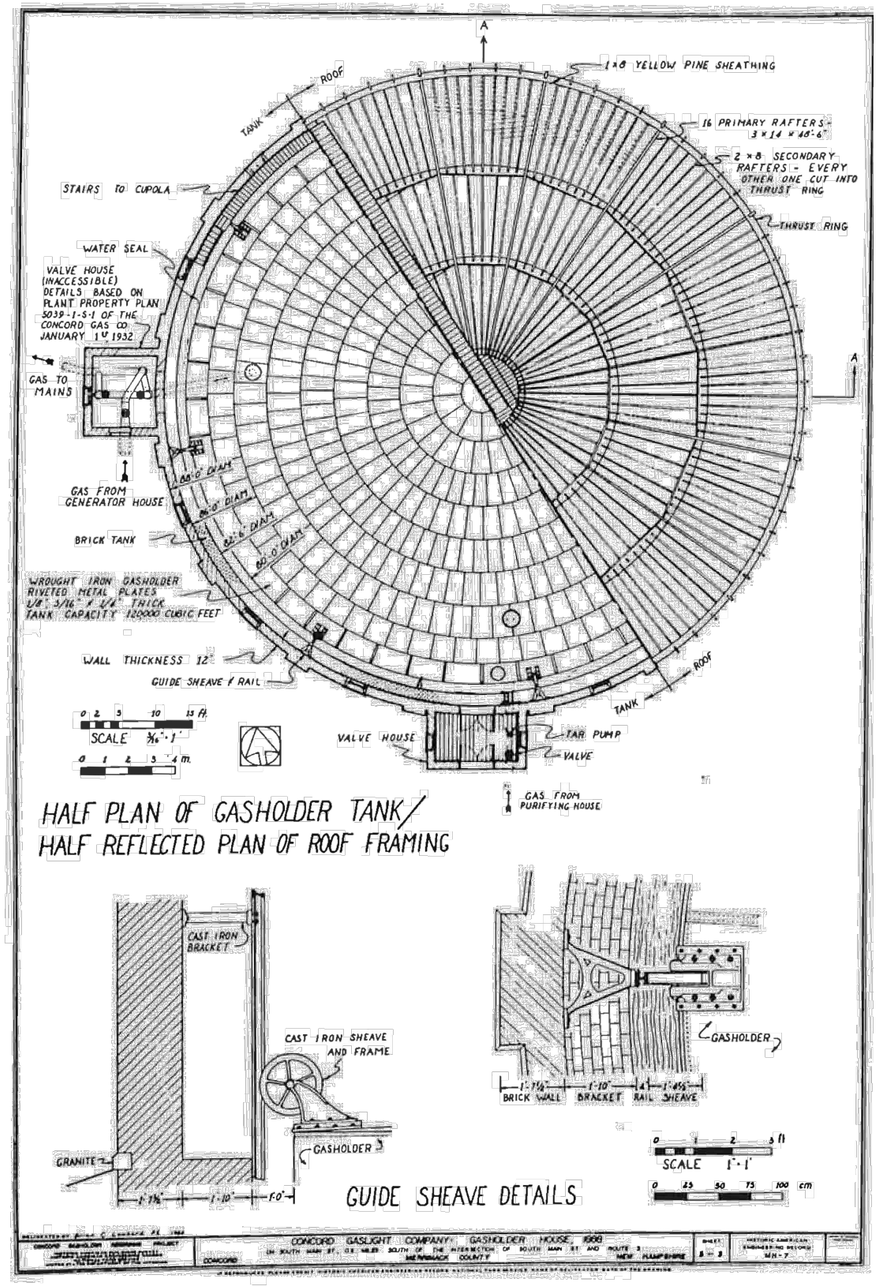


Figure 8. *Roof plan and details of guide sheaves.* HAER, drawing by Brian Lombard, 1982.

GENERAL NOTES

1. DRAWINGS TAKEN FROM "THE CONCORD (NEW HAMPSHIRE) GASHOLDER: LAST SURVIVOR FROM THE GAS-MAKING ERA," BY WILLIAM L. TAYLOR.
2. PHOTOGRAPHS TAKEN BY GZA DURING JUNE 2013.

GAS HOLDER HOUSE OPTONS EVALUATION
CONCORD MANUFACTURED GAS PLANT
GAS STREET SITE (SITE)
CONCORD, NEW HAMPSHIRE

DES SITE #198904063, PROJECT RSN #1479
SITE LAYOUT / FEATURES

PREPARED BY:
GZA GeoEnvironmental, Inc.
Engineers and Scientists
5 COMMERCE PARK NORTH, SUITE 201
BEDFORD, NEW HAMPSHIRE 03110
(603) 623-3600

PREPARED FOR:
Liberty Utilities

PROJ MGR: JMW	REVIEWED BY: SRL	CHECKED BY: JMW	FIGURE 2
DESIGNED BY: JMW	DRAWN BY: MA	SCALE: NOT TO SCALE	
DATE May 2020	PROJECT NO. 04.0029644.01	REVISION NO.	SHEET NO.

Attachment A: MJI – Holder Evaluation Letter Report

McFarland Johnson

McFarland-Johnson, Inc.
40 Farrell Street
South Burlington, VT 05403-6112
Phone: 802-862-9381
Fax: 802-862-7450
Web: www.mjinc.com

January 29, 2020

Mr. Benjamin Cook
GZA GeoEnvironmental, Inc.
5 Commerce Park North Suite 201
Bedford, NH 03110

Project #18649.00

Re: Concord Gasholder Building Evaluation
Concord, NH

Dear Mr. Cook:

The writer visited existing Concord Gas building in Concord, NH on January 22, 2020 and presents our findings in this report. The purpose of our site visit and this subsequent report was to view the current condition of the shoring system and comment on the overall condition of the structure.

Our report is based entirely on our field observations, and we did not review any existing building drawings or other documentation.

Observations:

We first viewed the site and provided a report almost exactly 10 years ago, with a visit on January 19, 2010 and a report dated February 3, 2010.

To a large extent, the overall condition is very much the same as it was 10 years ago. There have been three notable changes since our last visit however, as discussed below.

1. Based on our memorandum dated February 10, 2020, new C12 channels have been added to the top of the W16 main support girders. This was done as the W16's initially had limited capacity due to their unbraced lengths. The addition of the channel has increased their load carrying capacity.

2. An entirely new shoring structure has been constructed at the center of the building. The shoring system which was in place in 2010 is still present, the new shoring was simply constructed through and around the existing shoring. See photo #1. The new shoring system has a different geometry and style than that of the existing. We looked for and did not find any markings to indicate a model number or find any other information which would allow us to determine its capacity from a catalog or manufacturer's product data sheet.

   We note that the stairs which were present on the original shoring system have been partially removed, presumably to facilitate the installation of the new shoring. In 2010 we felt comfortable using the shoring stair system to climb the shoring and to document the conditions at the base of the cupola. With the removal of several flights of stairs, we did not climb the shoring system. We feel that a full tie-off system is required to

climb the shoring as it is currently configured.

3. A completely new shoring structure has been erected on the north quadrant of the building. See photos 2 and 3. We understand this was erected some time ago when a large tree fell and impacted the roof. The shoring system is constructed both inside and outside of the building. The shoring system is supported on a grid of what looks to be 8x8 wood timbers supported on structural steel beams spanning East-West. The structural steel beams are supported by two W16 structural steel beams which span from the center support pier to the perimeter ledge of the building. At the perimeter ledge the two W16 beams rest on timber cribbing. We did not observe a positive attachment method, such as lag bolts, to anchor the steel beams to the wood cribbing, nor did we see much of a positive attachment/anchorage system for the wood cribbing itself.

   This shoring system on the interior of the structure is connected to a similar height and size shoring system on the exterior of the building. Horizontal struts are extended through the window openings connecting the two systems.

   We were only able to observe the interior shoring system from some distance as access to it was only via a narrow scaffolding plank which required a harness tie-off system to safely cross.

Summary and Recommendations:

Overall, the structural steel framing and shoring is in good condition.

The addition of the second shoring system which supports the cupola, and likely some amount of the roof as well, has increased the overall capacity of the system. With both shoring systems in place, it is our opinion that the cupola is in no danger of any immediate future movement or settlement unless a usually large wind or snowstorm were to occur. It should be noted that we have not performed any structural analysis to determine the capacity of the shoring system or the lateral stability of the building.

The new shoring system at the north side appears to be functioning as intended to support the damaged roof area.

While all of the shoring is performing its intended purpose of supporting the cupola or portions of the roof, we reiterate our statement of 2010 that at some point it all should be removed and replaced by a structural steel support system. Conceptually this could be sets of steel columns (with some horizontal beams and bracing), supported on new steel beams which would clear span the space. The columns would, at a minimum, extend up to the compression ring around the base of the cupola. As stated in our report of 2010, the large wood beams which run from the cupula down to the eave have a significant sag in them and are likely undersized for the snow loads. Installing columns which supported these at midspan would greatly increase the capacity and overall stability of the roof system.

There were several places where we could see daylight through the roof. Where the tree hit the roof, it looks as though there may be a large gap in the roof edge, see photo #4. Keeping the wood roof members dry and free of rot is critical to the longevity of the structure. As previously documented, we believe the overall capacity of the roof framing is marginal. A reduction of the framing capacity due to rot will put the structural stability of the entire roof system in jeopardy. Also, we observed a significant amount of bird droppings throughout. Combined with moisture, bird droppings can accelerate steel corrosion. In the long term, the droppings could potentially cause a reduction in the capacity of both the structural steel beams as well as the shoring. Therefore, we strongly recommend a roofing project be completed in the near future to make the structure watertight. The penetrations for the shoring system through the windows should be sealed tightly such that no birds can enter the building in that manner.

We did note as we were walking around the outside of the building that at some point in future the bottom courses of masonry near the ground should be repointed. This is low priority as compared to the reroofing.

We understand the Owner of the building is contemplating future uses for it. We note that its very likely that any sort

of re-use that results in the structure being used as an occupied building will trigger the "change of use" section of the Building Code. In most cases, this requires a full structural analysis of the building for compliance with current Code vertical and lateral load requirements. We believe a substantial amount of reinforcing would be required to meet present day load levels. While not impossible, it would likely be a significant undertaking.

In summary, the overall condition of the building has not changed substantially in 10 years. We do believe there is some urgency in the need to make it watertight and to keep birds out. Longer term planning should see the temporary shoring replaced with new permanent structural steel framing.

If you have any questions or comments regarding this report, please do not hesitate to ask. We appreciate the opportunity to provide a structural engineering service to you.

Very truly yours,

McFARLAND-JOHNSON, INC.

Chad E. Phillips, P.E.
Senior Project Manager

Attachment: Photographs

Photo #1-Center Shoring Systems

Photo #2-Shoring System at North Side

Photo #3-Exterior Shoring

Photo #4 – Roof Edge North Side

Attachment B: Estimate - Option 1

PRELIMINARY ESTIMATE - Option 1: Repair of the Holder House, "Monument Option"

Date: 5/18/2020
GZA Project No.: 04.0029644.02

GZA GeoEnvironmental, Inc.
5 Commerce Park North, Suite 201
Bedford, New Hampshire 03110

Client: Liberty Utilities
Job Name: Concord Holder House - Option 1
City: Concord
State: New Hampshire

Option 1: Repair of the Holder House, "Monument Option":

This option assumes preservation of the Holder House by repairing deteriorated elements to preserve the building and assumes that there will continue to be no public entry or access into the structure.

Item No.	Quan.	Description		Unit Cost	Units		Total
1	1.0	Structural Evaluation of Holder House	$	50,000.00	Est	$	50,000.00
2	1.0	Planning, Permitting and Approvals	$	35,000.00	Est	$	35,000.00
3	30	Temp Facilities and Site Control	$	2,000.00	Weeks	$	60,000.00
4	1.0	Interior Demolition and Holder Preparation	$	75,000.00	Est	$	75,000.00
5	1	Construct Interior Steel Reinforcement Structure MJI Estimate +10% Mark-up	$	220,000.00	Est	$	220,000.00
6	1.0	Demolition of Vestibule, filling foundation and repair of entry	$	15,000.00	Est	$	15,000.00
7	1.0	Perimeter Wall Repair and repair of roofing system North Branch Estimate +10% Mark-up	$	670,000.00	Est	$	670,000.00
8	1.0	Repair Perimeter Lighting	$	50,000.00	Est	$	50,000.00
9	1.0	Replacement of Perimeter Site Fencing - 1500LF	$	250,000.00	Est	$	250,000.00
10	160.0	Engineering Oversight - 10 Hour Days	$	1,100.00	Day	$	176,000.00
11	160.0	Project Management	$	500.00	Day	$	80,000.00
					ESTIMATED TOTAL	$	1,681,000.00
						$	-
		Cost Range			**-10%**	**$**	**1,467,900.00**
					15%	**$**	**1,933,150.00**

Notes:

1. Estimates should be considered preliminary and are based on broad assumptions and general site observation. Actual costs will vary based on final engineering, design, permitting and construction sequencing.
2. Copies of Estimates from MJI and North Branch Construction are attached.
3. Estimated costs have been prepared based on assumptions and scope presented in GZA's Observations and Opinions of Probable Cost Letter Report prepared for Liberty Utilities, dated May 18, 2020.
4. This estimate should be considered an order-of-magnitude estimate only and should be considered a Class 5 Estimate as defined by American Association of Cost Engineers (AACE) publication 17R-97

Prepared by:

John C. Murphy, CCM, CHMM 5/18/2020

Description	Quantity	Labor Amount	Material Amount	Subcontract Amount	Equipment Amount	Total Amount
1000 GEN CONDITIONS						
Project Management		25,480				25,480
Supervision		35,420				35,420
Mobilize / Layout		520			500	1,020
Fees and Permits			3,000			3,000
Mileage and Superintendent Vehicle			161		3,500	3,661
Temp Power			2,100			2,100
Temp Lighting				2,000		2,000
Temp Phone			700			700
Temp Water			350			350
Temp Toilet			450			450
Barricades/Raillings		2,080	600			2,680
Plan Duplicating			1,750			1,750
Security Fence				3,750		3,750
Progressive Clean-up and Dumpsters		7,280	2,800			10,080
Signage		65	200			265
Trailer and Storage		520	1,400		2,304	4,224
Data Processing			900			900
Security and Safety		36,400	1,400			37,800
GEN CONDITIONS		***107,765***	***15,811***	***5,750***	***6,304***	***135,630***
	1,581.00 Labor hours					
2000 DEMO AND SITE						
Sitework				10,000		10,000
Remove Stump				750		750
Selective Demo		7,800		5,000		12,800
Shoring				20,000		20,000
Scaffolding				75,000		75,000
DEMO AND SITE		***7,800***		***110,750***		***118,550***
	120.00 Labor hours					
4000 MASONRY						
Masonry Sub				56,000		56,000

North Branch Construction

Description	Quantity	Labor Amount	Material Amount	Subcontract Amount	Equipment Amount	Total Amount
MASONRY				***56,000***		***56,000***
6000 ROUGH CARPENTRY						
Fasteners / Equipment			12,500		27,500	40,000
Tension Ring		7,800	374			8,174
Roof Rafters		24,440	4,724			29,164
Roof Sheathing		2,600	2,000			4,600
ROUGH CARPENTRY		***34,840***	***19,598***		***27,500***	***81,938***
	536.001 Labor hours					
7000 THERMAL/MOIST						
Slate Roofing				75,000		75,000
THERMAL/MOIST				***75,000***		***75,000***

North Branch Construction

Estimate Totals

Description	Amount	Totals	Hours	Rate	Cost Basis	Cost per Unit	Percent of Total	
Labor	150,405		2,237.001 hrs				24.71%	
Material	35,409						5.82%	
Subcontract	247,500						40.66%	
Equipment	33,804						5.55%	
Other								
	467,118	**467,118**					**76.75%**	**76.75%**
CM's Contingency	70,068			15.000 %	T		11.51%	
Gen'l. Liab. Ins.- Commercial	401			0.162 %	C		0.07%	
Umbrella Insurance	943			0.155 %	T		0.16%	
Const. Mngr. Fee	64,624			12.000 %	T		10.62%	
Performance & Payment Bond	5,490				B		0.90%	
Total		***608,644***						

North Branch Construction

McFarland Johnson

53 Regional Drive
Concord, NH 03301
Phone: (603) 225-2978
Fax: (603) 225-0095
www.mjinc.com

MEMORANDUM

TO: Benjamin Cook

FROM: Chad Phillips

DATE: March 5, 2020

SUBJECT: Concord Gasholder Building

PROJECT NO.: 18649.00

☐ **Urgent** ☒ **For Review** ☐ **Please Comment** ☐ **Please Reply** ☐ **Please Recycle**

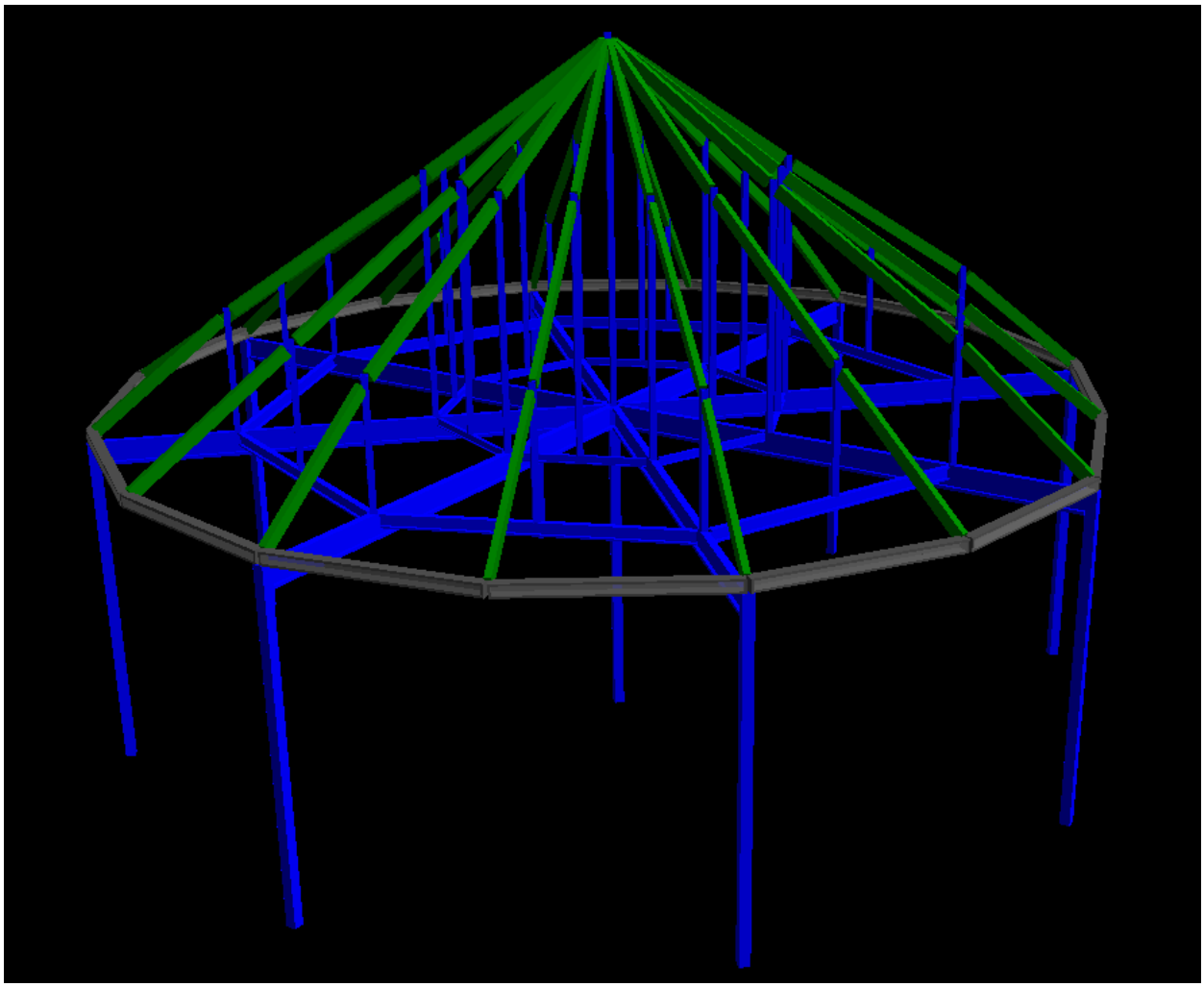
We have conducted a limited preliminary design to develop a concept to reinforce the existing gasholder building roof framing. The intent of the reinforcing is to stabilize the building and to provide an alternate structural support for the roof framing. We have not analyzed the capacity of the existing wood roof framing, however we believe that the long main girders that run from the cupola down to the top of the existing brick perimeter wall are substantially overstressed.

Our concept is to support those girders at their third points, which would theoretically increase their bending moment capacity by a factor of nine. This would be accomplished by adding new structural steel columns at the third points of each of the main girders. These columns are supported by a platform of new steel beams located at the elevation of the top of the brick wall. The new steel platform is in turn supported by new steel columns located around the perimeter of the wall as well as at the center of the structure. See the conceptual sketch on the following page. All the new structural steel beams and columns are colorized in blue. The wood beams which would be supported by the new steel are colorized in green.

We estimate that this framing system would be about 21 tons of new steel. Considering the logistical challenges in installing the framing inside of the existing building, we estimate a unit cost of approximately $7,000 per ton, which would result in a conceptual cost of approximately $150,000.

Beyond the cost of the steel, some concrete piers will need to be constructed at the base of the perimeter columns and possibly at the center support as well. We would recommend an additional $50,000 be budgeted for concrete and other miscellaneous work.

Therefore, a conceptual project estimate would be in the range of $200,000. This excludes any work to replace the existing roof and roof deck, which as previously mentioned, should be done soon to prevent deterioration of the existing wood framing from rot and moisture.



CONCEPTUAL REINFORCING SCHEME

Attachment C: Estimate - Option 3

PRELIMINARY ESTIMATE - Option 3: Demolition of the Holder House

Date: 5/18/2020

GZA Project No.: 04.0029644.02

GZA GeoEnvironmental, Inc.

5 Commerce Park North, Suite 201
Bedford, New Hampshire 03110

Client: Liberty Utilities
Job Name: Concord Holder House - Option 3
City: Concord
State: New Hampshire

Option 3: Demolition of the Holder House:
This option assumes complete demolition and removal of the Holder House and capping in-place the below ground portions of the structure.

Item No.	Quan.	Description		Unit Cost	Units		Total
1	1.0	Planning, Permitting and Approvals	$	15,000.00	Est	$	15,000.00
2	4	Temp Facilities and Site Control	$	2,000.00	Weeks	$	8,000.00
3	1	Site Demolition	$	577,000.00	Est	$	577,000.00
		Select Demolition Estimate +10% Mark-up					
4	1.0	Remove Perimeter Lighting system, utility disconnects	$	5,000.00	Est	$	5,000.00
5	20.0	Engineering Oversight - 10 Hour Days	$	1,100.00	Day	$	22,000.00
6	20.0	Project Management	$	500.00	Day	$	10,000.00
					ESTIMATED TOTAL	$	637,000.00
						$	-
		Cost Range			**-20%**	**$**	**509,600.00**
					10%	**$**	**700,700.00**

Notes:

1. Estimates should be considered preliminary and are based on broad assumptions and general site observation. Actual costs will vary based on final engineering, design, permitting and construction sequencing.
2. The NHDES has indicated that in the event that the Holder House is demolished, the NHDES will require investigation within the area currently made inaccessible by the Holder House and construction of a cap to replace the physical barrier to residual MGP byproducts presented by the Holder House. Costs to perform a limited investigation within the footprint of the holder are estimated to be approximately $75,000 to $100,000. The costs for the limited investigation are in addition to the estimated costs for demolition and Site restoration.
3. Final details and cost of cap design and any required remediation within or adjacent to the footprint of the Holder House are not currently known. The investigation and design of the cap would require approval by NHDES.
4. Copy of Estimate from Select Demolition is attached.
5. Estimated costs have been prepared based on assumptions and scope presented in GZA's Observations and Opinions of Probable Cost Letter Report prepared for Liberty Utilities, dated May 18, 2020.
6. This estimate should be considered an order-of-magnitude estimate only and should be considered a Class 5 Estimate as defined by American Association of Cost Engineers (AACE) publication 17R-97.

Prepared by:

John C. Murphy, CCM, CHMM 5/18/2020

Select Demo Services LLC.
New England's Premier Specialty Contractor

(603) 386-0391

NH: 40 Lowell Road Salem NH, 03079
CT: 270 Murphy Road Hartford CT, 06114
Fax 1-603-458-7389

Date:
2/19/2020

GZA

5 Commerce Park North
Bedford, NH

Telephone: 603-213-3828 Email: benjamin.cook@gza.com

Attention: Benjamin Cook

Proposal: **Concord Holder House**
Street Address: South Main Street & Water Street
City and State: Concord, NH
Floor(s):

12470

We are pleased to submit our pricing as follows based on drawings:

Building Demolition:

Demolition to include the complete demolition and removal of structure .
Included is the removal of below grade foundation walls to 3 feet below grade. Removal of any deep foundation is not included elements (i.e. piles, caissons, etc.) is excluded
Pulverize foundations wall to elevation 3 feet below grade
Backfill hole with processed material and or imported crushed concrete
Regrad surface, loam and seed impacted area
Demolition permit & DEP filing included

Budget Proposal : $524,623.00

Inclusions

Union Labor wage rates and benefits
One (1) mobilization is assumed for work to be performed
Work is assumed to be performed during standard 8 hr. weekday shifts
All work in accordance with all local, state, and federal safety regulations; standard insurance certificate to be provided
We assume continuous access/egress for equipment required to perform our work
Dust control and water consumption fees included (GC to provide water source on site)
Demolition debris/trash and concrete/masonry material will be legally disposed at approved facilities
All ferrous and non-ferrous metals to be considered sole property of Select Demo Services
Demolition plan showing means, methods, equipment, and locations included
If priced Site Unseen, a site visit to confirm existing conditions is to occur prior to mobilization

Exclusions

Premium/Overtime, 2nd shift, and multiple mobilizations
Engineering, PE survey, shoring, and layout
Items to be salvaged by owner or GC
Any Hazardous Material Survey or testing/abatement/handling of hazardous materials including but not limited to asbestos, PCB's, mastics, regulated wastes, mercury, guano, mold, soils, oils, etc. to the extent they are not quantified and included in our proposal.
Non-quantified and unidentified materials, including <1% asbestos-containing materials
Support of excavation, cofferdams, dewatering, rock excavation, and disposal of excavated soil
Cut, cap, relocation/abandonment and make safe of utilities
Police/Fire details (i.e. flagmen), security, traffic & pedestrian control, road closures
Temporary power (GC to supply proper electric needs for abatement), temporary lighting, temporary water source
Disposal of water runoff generated by dust control or wheel washing operations
Rodent control, erosion control, temp fencing, tree protection, roadway protection, temp protection/weather protection
Any hardscape removals(i.e. paving, walks, curb, etc.) beyond building footprint not identified in scope above
Any site restoration (i.e. paving, fencing, sidewalks, landscaping, etc.)

Winter conditions/snow removal
Survey/layout, pre/post surveys, video, and photos
Independent testing or monitoring (i.e. noise, dust, soils, vibration, compaction) or any inspection by independent consultants

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Bonding - Can be furnished upon request
Net 30 days and retainage shall be held for only sixty (60) days.

Thank You for the opportunity to let Select Demo Services provide quality work for you.

Dominic Ignagni ASPE

Senior Project Exective
Cell: 617-719-1557
dignagni@selectdemoservices.com

www.SelectDemo.com
www.SelectPaint.com
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www.KTownDisposal.com