GROTON ENGINEERING, LLC
STRUCTURAL ENGINEERING

FOUNDATION ASSESSMENT
for the
1784 Levi Wetherbee Farmhouse
484 Middle Road, Boxborough, MA 01719
July 17, 2014

CLIENT: Town of Boxborough
Town Hall, 29 Middle Rd.
Boxborough, MA 01719
ATTN: Mr. David Lindberg, Inspector of Buildings

REFERENCE:

A. National Register of Historic Places Registration Form, Certified by Brona Simon on November 3, 2006 for the 1784 Levi Wetherbee Farmhouse and Barn.

ATTACHMENTS:

1. Aerial view of farmhouse - Courtesy of Google Maps

GENERAL:

This review is primarily for the foundation of the Levi Wetherbee Farmhouse with some reference to the framework and emphasis on the chimney foundation . The purpose of this report is for installation of shoring and for getting associated quotes for that construction.

This 28' x 34', 2 ½ story, wood-framed house sets upon a fieldstone foundation on all four sides with an interior fieldstone foundation extension around three sides of the chimney. This chimney has double fireplaces on two floors topped by a chimney riser, that extends up through the roof's ridge. In the basement that double fireplace and chimney stops just below the first floor framing. The chimney system sets upon soil that is held in place by the aforesaid, 3-sided fieldstone retaining wall. The foundation also supports some of the first floor framing and post & beam framing of other floors above. It is the partial collapse of this interior foundation wall and the bulging of the exterior, fieldstone foundation walls that are the primary concerns of this report.

The farmhouse's location is shown encircled on Attachment #1. Its front entrance faces south towards the existing barn. Middle Road once ran between the house and barn but is now to the rear of the house. The house has been vacant for several years now. The Historical Commission members and others are discussing new uses for it. Foundations and framing must be repaired before the house will be safely habitable again.

See Reference A above (not attached) for a thorough description of this house and its history. That document has Continuation Sheets with great information but not about the foundation and framing conditions. It also contains excellent photos of the house that will be useful to any contractor retained to do the repairs..

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SPECIFICS:

Shoring is needed for the following main items needing restoration:

1. All of the fieldstone foundations but most particularly the ones surrounding the chimney.
2. Most of the first floor framing.
3. A few elements of the chimney that might be damaged during the work.

To prepare the house and chimney for this work, shoring must be installed. The Town of Boxborough's Committee wants to focus on preservation of the chimney at this time and is discussing how best to support it until they obtain sufficient funding for repairs. Part of a retaining wall that helps support the chimney and wood framing has collapsed. The Committee members had already covered the basement floor with a plastic membrane and covered it with several inches of sand because of excess moisture in the basement and the need to mitigate that issue.

Shoring contractors, whom I have contacted, are saying that it is better to initially shore up the entire house and chimney rather than just the chimney itself. I suggest that the Committee request proposals that include separate prices for: 1. Just the chimney and; 2. The entire house including the chimney. The benefit of doing the entire house is that, all of the restoration work can be done without installing more shoring.

PHOTO #1 shows a collapsed portion of the interior fieldstone wall that surrounds the central chimney's base. PHOTO #2 shows the stone laying on the sandy floor. The soil behind the fieldstone wall and under the chimney's base is a good gravel with a blend from fine sand to two and three inch stone. The fieldstone walls are all laid up dry, ie, no mortared joints. They are well built but depend on heat radiating from the basement to prevent frost buildup that can damage fieldstone walls.

PHOTO #1 - Wall & Fallen Stone

PHOTO #2 - Fallen Stone

When frost enters soil it causes any moisture therein to freeze and expand. That expansion pushes against the fieldstone that only has friction to resist sliding. When frost leaves in the warmer months, the water-soaked sand slips into the cavities created during the freezing/sliding action. Repetition over a period of years eventually forces stones to slide far enough that they fall out of a wall and cause others to go with them. That is what I believe has happened here. There is still soil behind the remaining wall and under the chimney but how compact and stable it is now, is not known.

The fieldstone retaining wall on the opposite side of the chimney is still in fairly good condition as can be seen in PHOTO #3. Also visible in this photo are the first floor joists of logs rather than sawn or hand hewn lumber. The beams to which the joists are connected, are hand hewn lumber. The wood framing is where it is supposed to be so this retaining wall is still doing its job. On the collapsed fieldstone wall the corresponding wood framing above has lost support.

PHOTO #3 - Other Wall Supporting Chimney

The exterior fieldstone foundation walls are bulging inwards in a few places so are suffering from the same kind of freeze-thaw actions. If not attended to, they will also collapse to some degree. That will cause collapse of the floor joists and the exterior floors and walls above.

The log floor joists are deteriorating from both rot and insect damage. I was able to push my sharp pointed jackknife about an inch into the wood in a number of places. So they have lost most of their original strength and will likely have to be replaced before the house can be re-occupied.

So we have a house that needs foundation, chimney and floor framing restoration. While at the site and discussing restoration or just shoring options for the chimney, I suggested the use of needle beam shoring under just the chimney and extending out beyond those related retaining walls. When discussing this same issue with several companies that install residential shoring they said it is easier and wiser to shore up the entire house including the chimney because the house is relatively small and purely rectangular. Just slightly lifting a chimney while the house is not moved is difficult. Shoring the whole house allows for easier lifting. Once that is done and depending on funds, then the whole house becomes ready for renovation. The house can be lowered back onto the new foundations afterwards. Some wood sill work may have to be done prior to installing shoring and some other work may have to wait until the house is lowered back into place.

The purpose of this report is for installation of shoring and for getting associated quotes for that construction. But I want to make a few suggestions for the work to be done afterwards, via future quotes.

Replace existing fieldstone foundations with 12" concrete ones that have 4" exterior shelves to carry a veneer of fieldstone. The 8" portion, exposed to the interior of the basement, can rise up to the first floor framing and be attached thereto. The wood floor joists, sills and other damaged framing can be replaced with like kind at greater expense or replaced with today's conventional lumber that meets code.

SUMMARY:

The Town of Boxborough's Committee and the Historical Commission both want to save the house and, toward that end, get shoring installed to facilitate restoration work. This report suggests that the committees obtain comparative quotes for: 1. Just the chimney and; 2. The entire house including the chimney. Framing conditions that have to be rectified before installing shoring are to be at the judgement of the shoring contractor.

The collapsed and bowed conditions of the existing fieldstone foundations warrant this action as soon as possible so as to prevent more foundation collapses that could damage parts of the house that are in good condition, including the impressive central chimney and its fireplaces.

The use of whole house shoring will facilitate overall restoration of the house and ultimately be less than the cost for shoring the chimney only and then having to install more shoring to complete the other work. That is the judgement of contractors to whom I have spoken and now I have to agree. In the longterm it is a wiser move.

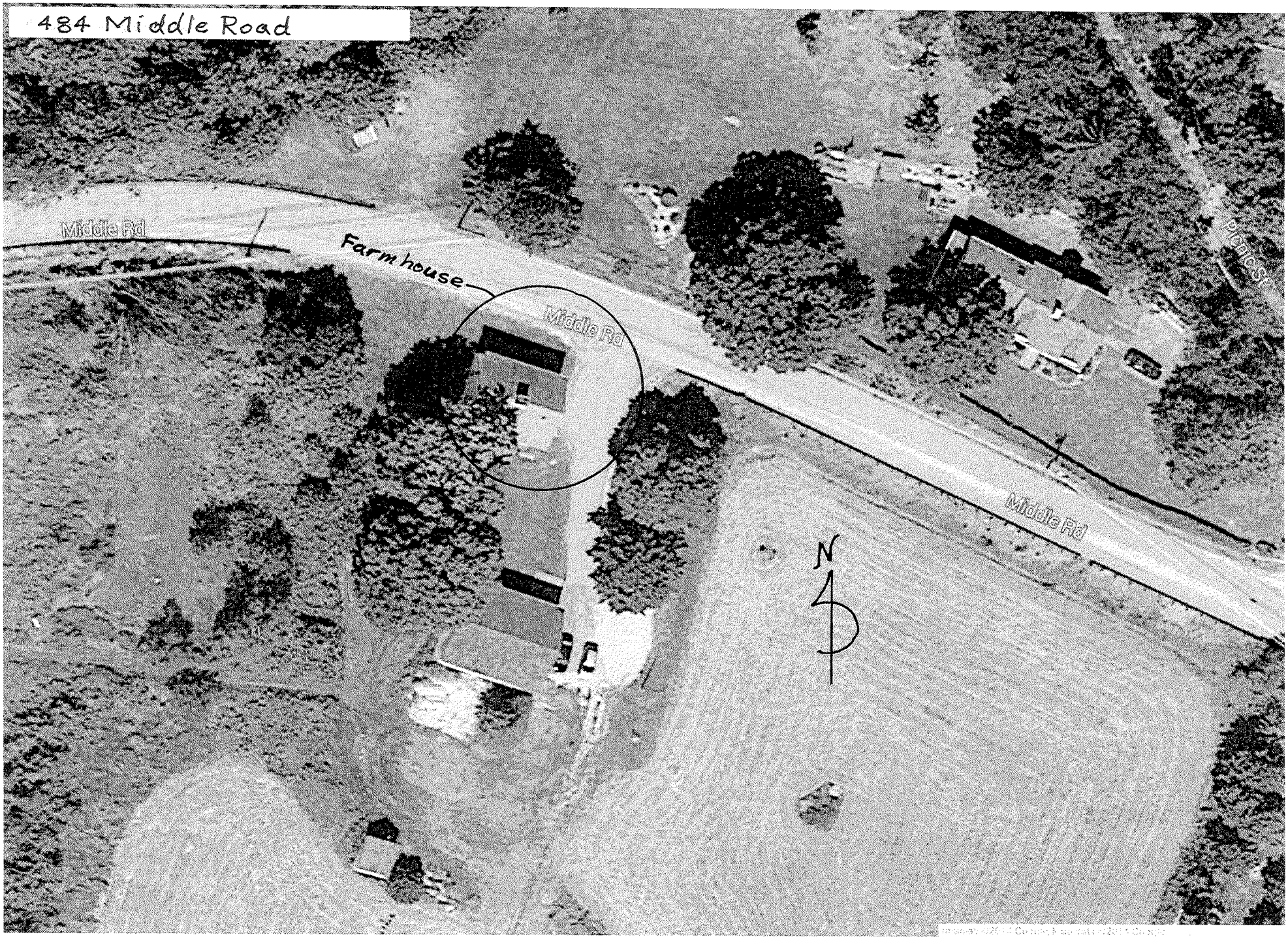
This completes my review and report. It is based on over 55 years of experience dealing with old wooden structures on fieldstone foundations and on what I could visually see without doing any localized or other demolition to expose hidden conditions. If you have any questions or requests please contact me.

Thank you for using my structural engineering services. It has been a pleasure serving you.

Respectfully submitted,
Groton Engineering, LLC

Lynwood Valentine Prest, P.E., S.E., BASE
President

C/c: File



ATTACHMENT 1