

MEMORANDUM

Date: April 17, 2024

To: Karen Conti, Unit 5
Ellen Jordan, Unit 5-1/2

From: Lisa J. O'Donnell, PE
LJO Engineering, LLC

Subject: 5 & 5-1/2 Albion Street, Amesbury, MA

Re: Site & Building Evaluation



Lisa O'Donnell

This memorandum is intended to address the existing conditions at the building that houses both 5 and 5-1/2 Albion Street, including the backyard of the property, which slopes down to meet Clark's Pond at the rear property line. The discussion here is based on two site visits, September 26, 2022 and April 1, 2024. At the first site visit only a preliminary exterior inspection was performed. At the second site visit the interiors of both units were also visited and the property exterior sreviewed again.

Both inspections were visual inspections and were not intended to measure and/or monitor building or site settlement quantitatively, but were intended to consider observable conditions of the site and evaluate any potential effects on the building.

Background

I was originally contacted by Ms. Conti regarding concerns about a stone retaining wall behind both units, since it has appeared to settle and move both downward and outward, causing the retained soil behind it to settle and shift. The wall clearly shows signs of both settling and leaning outward, and the effects on the soil behind the wall are also clear.

Since the backyard of the property slopes steeply beyond the stone wall, we agreed that this slope is likely undermining the wall. At that time, I advised you that the next step would be having a site survey done, which would need to detail the topography (contours) of the site, to be able to consider the effects of the slope on the stone wall and also to evaluate if this slope could have an effect on the building.

I recommended Gateway Engineering to you to do this survey work and in early 2024 you contracted with them. Their work was completed early this past March, and Gateway shared the site plan and CAD file with me. Since then, I have used their information to develop the attached site profiles, through the corner of each unit that is closest to the slope.

Finally, I made a second visit to your property earlier this month, to both observe the stone wall and retained soil behind it and to observe a list of concerns within the unit at #5 about various

cracks and movement between components of the building. My observations are provided further below.

Soil and slope stability

The attached site profiles (one developed for each unit) mentioned above are important tools to understanding the effects of the steeply sloped back yard. To develop each of these, I drew a line in plan ("line of site profile section below" near the top of each drawing) from the corner of each unit out and perpendicular to the closest site contour, to capture the closest and steepest part of the slope, as a worst-case condition to evaluate. From this line in plan, I transferred the contour locations to a site profile at the bottom of each sheet, using the dotted, vertical lines from the line in plan to the profile.

The profiles are a cross section through the site, at the lines from the plan, that illustrate the angle or steepness of the slope, from the top, by the house, across the back patio areas, to the stone wall, which is noted, and then beyond and down to the pond. To the right on each profile, I have shown the position of the house and also the depth of the basement slab below grade, which is where the building foundation bears.

Since it is the bottom of the foundation walls where the load of the house structure bears on the subsurface soils, I have added dashed lines at angles of 25 and 30 degrees, on each profile of the slopes, extending from the outside corner of the house, at the foundation level. The soil under the house and the soil under the dashed line represents the limit of the subsurface soils that either bear the load of the house and/or help restrain the bearing soils by supporting these from the sides. Considered another way, you could theoretically remove all the soil above the dashed lines and the house would still be supported and stable.

The angles of 25 and 30 degrees show conservative bounds for the internal friction angle of the soil, which is the more technical term for the angle of repose for a soil. This is the angle at which a soil is essentially self-supporting, that is, the angle at which soil could be built-up without requiring separate support, typically in the form of retaining structures. The difference in the two angles that I have shown as examples depends on the type of soils that are underground, which is not something we know. However, this is also not something we are in a position to reasonably explore, since this requires a geotechnical engineer, a soil testing company and a soil sampling drill rig to bore into the ground and take soil samples for laboratory evaluation.

However, the 30-degree angle is very typical for a wide range of common soils and the 25-degree angle is a little more conservative and would represent a poorer soil, which is not as internally strong as a soil with 30-degree (or better) angle of repose. Note also, soils that are stronger are also fairly common, with angles of up to 40-degrees (or more), although using a steeper angle would be unconservative for the exercise here.

Summary of soil profiles

What the profiles attached here show us is that, at both locations considered (which are both "worst-case" conditions for each unit) the building is not at all endangered, or even influenced,

by the steep slopes behind the house. That is, there is sufficient soil under and adjacent to the house, under the dashed angled lines, to safely and soundly support the building structure. This evaluation shows that the building is very unlikely to be compromised, or even affected, by the steep slope and/or the existing retaining wall structure.

However, these profiles also demonstrate that the slope of the land below and behind the stone wall is steeper than either angle of repose and, therefore, likely not a long-term stable condition, as we have already seen from the movement and damage that the stone retaining wall and the stairs have suffered. That is, we could not draw this same angled line from the bottom of the retaining wall and reliably demonstrate that the soil could support it, unless it was deep enough, below grade, to bear on stable soil within that angle of repose. It is unlikely this is the case – it is probably supported at a shallow depth and is also working to retain the soil behind it, which just adds further lateral loads, essentially pushing it down the slope.

Interior evaluations

At my second site visit this past April 1st, we were joined by Amesbury building officials including the Building Inspector, the Plumbing Inspector and the Electrical Inspector, to observe conditions in Unit #5 which have concerned Ms. Conti. We reviewed numerous locations where hairline cracks in the paint have appeared. According to the owner, these are all fairly recent. In addition, we looked at conditions around utilities and equipment where either plumbing, gas or electrical lines could be impacted by movements of the house. I am in agreement with all the inspectors there that day, that the conditions we observed did not indicate movements that were concerning. Buildings, particularly older homes, do “move” slightly and respond to both temperature and humidity changes over the courses of the seasons. We do not want to dismiss concerns and suggest that the homeowner continue to monitor these.

However, given the slight nature of any cracking that we observed, along with no discernable impact to utilities, combined with the results of the site survey and the site profiles that I've developed to understand the relationship of the building and the rear yard, I do not see any threat to the house from the backyard and/or the retaining wall at this time. It is always wise to continue to observe existing conditions and even develop some baseline measurements that can be checked on a regular interval, however, that is beyond the current scope of the evaluation I am presenting here.

I also did a walk through the unit at 5-1/2 with Ms. Jordan, who has not noticed any cracking or any concerning conditions. A limited visual survey of this unit, mainly towards the rear of the building and in the basement, also did not present any conditions that appeared either concerning or of a nature to require continued monitoring. Again, it is always wise to continue be observant and to pay close attention to any portions of the building that seem to change or shift, for example, new cracks, sticking doors or windows or changes around the foundation area.

Exterior conditions

As already noted above, the retaining wall behind the patio areas behind each unit is in poor condition and obviously failing in spots, as well as likely shifting downhill slowly over time. As I

have described above, the soils below and in front of (downhill) the wall do not appear to provide sufficient support for the wall, based on both observable conditions on site and on the profiles attached that show this area as well. In addition, the wall is further loaded with the retained soil behind the wall, which only exacerbates the situation and stress on the wall. Clearly, this wall needs attention and some kind of remedial and/or replacement work. However, the important note here is that this problem is isolated to this wall and, unfortunately, the soils that it retains in the rear patio areas. However, this localized issue is not a threat to the integrity of the house.

Conclusions

To conclude, please consider the following summary points.

- The retaining wall in the back yard is in poor condition and slowly failing. This condition should be addressed to both stabilize the wall and retain, to the extent feasible, the patio areas behind the wall. This condition is local to the wall and retained soils.
- The house is founded both deep enough and far enough away from the problematic wall that there does not appear to be any threat to the structure of the building from the situation at the wall. This is born out by little, if any, evidence of settlement at the house and by the soil profile exercise in the sheets attached here.
- Continued monitoring of the house and, mainly, the stone wall and patio areas is recommended until repairs can be undertaken.

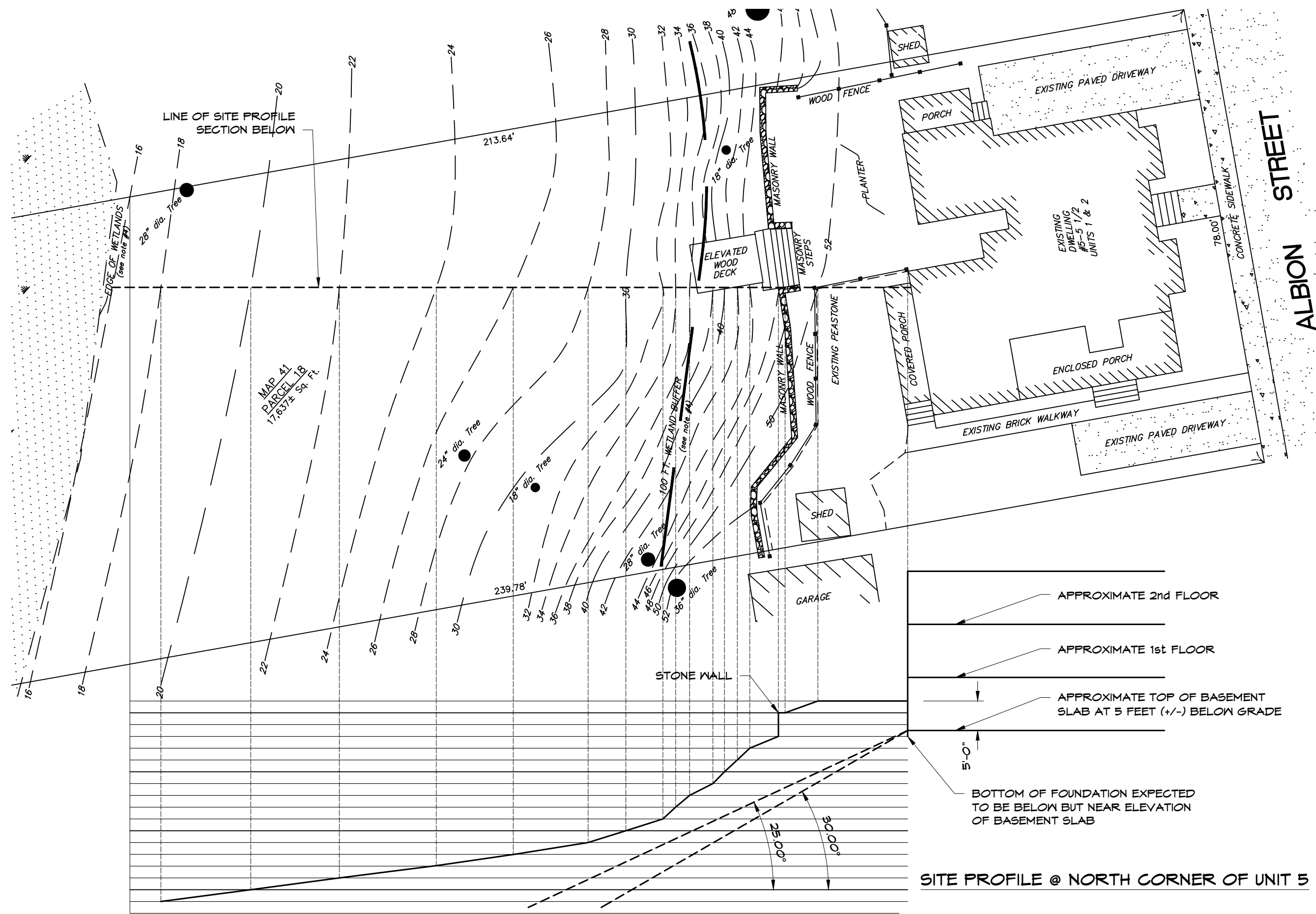
Please let me know if you have any questions or further concerns.

Disclaimer and Limitations

Please be advised that while the above information and any and all statements that I have made regarding your property are based on my engineering knowledge and experience, these are also based on visual observations without ongoing monitoring of any portion of the site or structure. For conditions like this where the sub-surface soils need to be fully understood to be able to quantify and/or predict both current and future strength and stability, extensive (and expensive) soil testing would need to be done, to assess the types of soils below grade and quantify their strength and other properties.

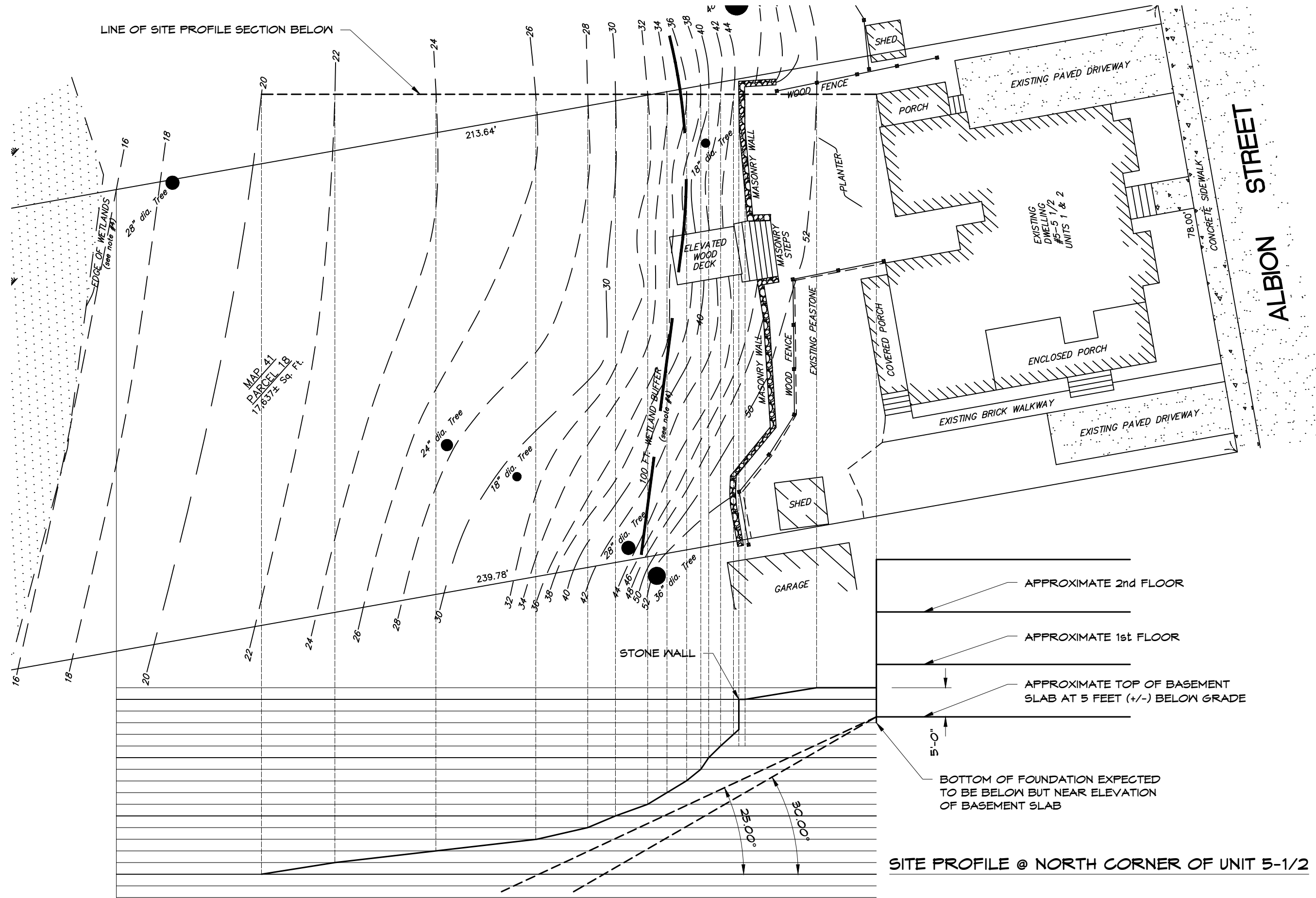
Therefore, I make no warranties and/or guarantees about either my statements, except that they are based on sound engineering judgment and principles, or any future conditions of the site or building and cannot, therefore, assume liability for any conditions in the future.

Attached: SP-1 & SP-2 dated 04-16-24



SITE PROFILE @ NORTH CORNER OF UNIT 5

PROJECT 5 & 5-1/2 ALBION STREET, AMESBURY, MA PREPARED FOR K. CONTI & E. JORDAN	BY LJO	JOB NO. 1585	LJO ENGINEERING, LLC PO BOX 888, ESSEX, MA 01929 LisatheEngineer@comcast.net CELL: 978-289-4411	
		DATE 04-16-24	PAGE SP - 1	
	SUBJECT SLOPE PROFILES OF REAR LOT PROFILE #1			



SITE PROFILE @ NORTH CORNER OF UNIT 5-1/2

PROJECT	5 & 5-1/2 ALBION STREET, AMESBURY, MA PREPARED FOR K. CONTI & E. JORDAN			LJO ENGINEERING, LLC PO BOX 888, ESSEX, MA 01929 LisatheEngineer@comcast.net CELL: 978-289-4411	
	BY	LJO	JOB NO.	1585	
	SUBJECT	SLOPE PROFILES OF REAR LOT PROFILE #2	DATE	04-16-24	PAGE SP - 2