

REF. NEX-2021112.00

June 3, 2021

Ms. Elizabeth Hughes, Town Planner
Town of Concord
141 Keyes Road
Concord, MA 014742

SUBJECT: 146B & 1442 Main Street – 110 & 11B Highland Street – Center & Main
Zoning Board of Appeals Special Permit – Earth Removal Review

Dear Ms. Hughes and Members of the Board:

Greenman-Pedersen, Inc. (GPI) and our Subconsultant, Nobis Group (Nobis) are pleased to assist the Town of Concord Zoning Board of Appeals (ZBA) with review of the Special Permit Application related to Section 7.5 of the Concord Zoning Bylaw for the proposed Definitive Subdivision Plan for 146B & 1442 Main Street and 110 & 11B Highland Street. The following documents were submitted by the Applicant and serve as the basis for the review:

- *Center and Main - Application Materials*
- *Center and Main - Attachment A - Site Photos*
- *Center and Main - Attachment B - Record Deed-Plan*
- *Center and Main - Attachment C - GIS Property Cards*
- *Center and Main - Attachment D - Design Plans - Williams Sparages, LLC*
- *Center and Main - Attachment E - Landscape Slope area Plan*
- *Center and Main - Earth Removal Letter 2-11-21*
- *Center and Main - Exhibit 1 1450 Main St RTC 10.03.18*
- *Center and Main - Exhibit 2 1440 Main St PRD Traffic Consultant Second Review 10-19-18*
- *Center and Main - Exhibit 3 June 2018 ATR*
- *Center and Main - Exhibit 4 Concord Line of site Trucking Plan*
- *Center and Main - Exhibit 5 Patriot Trucking Plan*
- *Center and Main - Exhibit 6 Center and Main earth removal process 11-12-2020*
- *Center and Main - Exhibit 7 MASS DOT Trucking Regs*
- *Center and Main - Exhibit 8 Concord Trucking Plan to 2352 Main St*
- *Geoprobe Report for G-801 through G-806 prepared by Haley & Aldrich and dated October 22, 2020*

The scope of the peer review of these materials includes consideration of the following:

- The minimum practical earth removal required to accomplish the proposed construction based upon review of the design plans and supporting information.
- The intent of the proposed plans to minimize changes in existing grading and accomplish the design objectives.
- The impact of the earth removal on adjacent structures, properties, and the neighborhood.
- Geotechnical considerations regarding the existing subsurface conditions and performed subsurface explorations.
- Potential geotechnical issues regarding the global stability of the proposed slopes and retaining walls as well as potential impact to adjoining properties.
- Hydrogeological issues of groundwater levels due to the excavation.

- Appropriate construction measures related to the excavation and soil compaction in load bearing areas and other altered areas.
- The construction sequencing and proposed operations including dust, stormwater, and erosion control, and potential infrastructure impacts.

Project Understanding

Based on the Design Plans and the Zoning Board of Appeals Application, we understand that the 9± acre property comprised of several individual parcels of land is proposed to be subdivided into a total of 18 lots in support of single-family dwelling developments. Lots 1 through 16 are proposed to be accessed by new roads, referred to as Road A and Road B. Lot A1 and D1 will be accessed from the existing Highland Street and Main Street, respectively. To be able to construct Road A and B, we understand that up to 25 feet of soil needs to be removed. Additionally, extensive soil excavations are required to develop some of the individual lots including 2H:1V cut slopes for the final grading of Lots 1 through 5 and Lot 13. Other areas of the proposed site development will require placement of up to approximately 7 feet of raise-in-grade fill. We understand that approximately 66,000 cubic yards of excess soil will be generated that will need to be hauled offsite.

According to the Zoning Board of Appeals Application and Earth Removal Permit letter, we understand that Symes Development & Permitting, LLC (Symes) will be the developer of the Site. We understand that excavation activities for this project will initially occur over a period of approximately 7 weeks in support of the roadway construction and for rough grading of the proposed lots. Thereafter, after receiving a building permit for each lot, Symes will develop individual lots over a timeframe of 28 to 80 weeks. Development will include the construction of the single-family dwellings, final grading, proposed cut slopes, and landscaping.

This letter presents our peer review comments and is divided into Sections A and B. Section A includes peer review comments related to the general design, proposed earth removal calculations and activities, and construction considerations. Section B includes results of the peer review related to geotechnical and hydrogeological considerations and related recommendations.

PEER REVIEW COMMENTS

A. GENERAL DESIGN AND PLAN REVIEW

Earthwork and Earth Removal Calculations

1. The ZBA Application for Special Permit indicates that the project will require the export of approximately 48,090 cubic yards of fine gravel/sand and 12,600 cubic yards of topsoil/loam, totaling approximately 60,690 cubic yards of excess material to be removed from the site. The Applicant has not submitted the earthwork calculations supporting this quantity, and it is unclear to the peer reviewer if any quantity of material reuse (gravel and/or loam/topsoil) is assumed and included in this calculation in an effort to reduce the overall export. GPI recommends that the Applicant provide the quantity takeoff calculations for review, including any assumed reuse of loam/topsoil and gravel/subgrade.
2. The proposed roadway cross section includes 12" of subbase (4" dense graded crushed stone) over 8" gravel (or 12" reclaimed material if approved by Town Engineer). GPI recommends that the Applicant be required to reuse existing materials from the general excavation to meet the Specification for fills and roadway base to the extent feasible (refer to Geotechnical recommendations in Section B). It is unclear if the earth removal quantity has taken into

consideration any reuse of existing material for construction of fills or the roadway subbase. The Applicant should clarify and provide supporting calculations.

3. A total of 2,168 truck trips are proposed to accomplish the proposed earth removal. Has the Applicant considered the feasibility of combining return trips with the import of select material specified in the plans, such as dense graded crushed stone, stone backfill for subsurface structures, and other select materials to be imported? If this is feasible, the amount of total truck trips entering and leaving the site would be greatly reduced.

Design Review

Section 7.5 of the Zoning Bylaw states that the ZBA must make the following findings:

7.5.3.1 The volume proposed for removal does not exceed the minimum practical removal required to accomplish the construction, development, or improvement in accordance with the plans therefore;

7.5.3.2 The plans submitted in connection with the removal are designed to minimize changes in existing contours to enhance attractive land utilization, effective drainage, suitable road gradients, access or other design considerations; and

7.5.3.3 Effecting the removal will not be detrimental or injurious to abutters or the neighborhood, either by the alteration of existing topography or by a substantial change in the use of the streets in the neighborhood.

GPI reviewed the design plans with consideration of the above sections from the Bylaw, and finds the following:

4. The source of a majority of the earth removal appears to be related to the proposed profiles of Road A and Road B, both of which result in significant earthwork cuts of the highest points of the property. It appears that segments of the profiles of Road A and Road B could be adjusted to result in reduced cut, and additional fill to balance out a quantity of the earthwork cuts. Raising the grade of the roadway profiles by two to three feet, while making driveway grade and roadway drainage adjustments, could significantly reduce the amount of net export required. A profile grade adjustment would also likely change the proposed location of retaining walls currently in cut slopes to the fill slopes. If the Applicant has considered alternatives to the roadway profile grade to reduce earthwork cuts, it would be helpful to provide an alternatives analysis or narrative to support the claim that the current design *does* result in the minimum practical removal required to accomplish the construction. Based upon review of the plans, it appears that the earth removal could be reduced by adjusting the profile of the roadways to better balance cut and fill. It is not readily apparent that this is in fact the design which minimizes removal required and still achieves the proposed development as intended.
5. The narrative submitted with the ZBA Application states the following:

“The maximum permitted centerline street grade (Sheet 3 & 4) in the zoning district will be utilized to provide the minimum practical removal across the entire Roadway Cross Section (Sheet 3).”

It should be noted that the profile of Road B utilizes a maximum centerline grade of 4.60%, which appears to effectively minimize the amount of fill required, rather than the amount of earth removal required. Use of a 1% - 2% roadway profile grade would result in less cut, and more of a balance of cut and fill, thereby reducing the amount of removal required.

Similarly, Road A proposes a maximum roadway centerline grade of 6.80%, which does not appear to reduce the amount of earthwork removal required. The addition of a sag curve (low point) at the beginning of Road A would reduce the amount of removal required, and result in additional fill to balance out the cuts. It is not apparent that the roadway profiles as proposed result in the minimal practical removal required to accomplish the development. While it is impractical for the peer reviewer to provide an alternative detailed design, the Applicant should justify the proposed design by providing analysis of alternative roadway profiles which were considered to achieve the requirement of Section 7.5.3.1 of the Bylaw by balancing the earthwork more effectively.

Construction Considerations

6. A Stormwater Pollution Prevention Plan has been included as part of the submitted Design Plans (Sheets 13 and 14). The Plan documents erosion and sedimentation control procedures that will be implemented during construction. In general, the plan is consistent with current recommendations for the control of erosion and sedimentation, dust, and stormwater runoff. The proposed measures include the following:
 - Filter fabric barrier & haybales & Silt Sacks
 - Erosion Control Matting
 - Sediment Basins
 - Velocity Check Dams
 - Cut and Fill Slope Stabilization (Vegetation)
 - Water Truck for Dust Control

In addition to the controls proposed on the plan, GPI recommends the following:

- a) The SWPPP Plan on Sheet 13 depicts the final grading, including lot construction. The SWPPP should be consistent with the phasing of the project, which first requires construction of the ways and interim shoulder grading shown on Sheet 5 of 14. Based on the Earth Removal Letter submitted with the Application, it appears that rough grading for foundations may not occur immediately. Therefore, GPI recommends preparing a SWPPP Plan which includes the interim roadway shoulder grading plan shown on Sheet 5 of 14, rather than the final grading for the site, which may not occur at once or immediately. The locations of sediment basins and stockpile areas will likely require modification to support this initial phase of construction, and these should be provided on the plan. The SWPPP Plan should include a construction sequence for all phases of construction.
- b) Stormwater runoff velocity will increase as slope length and gradient increases. During the Interim Roadway Shoulder Grading shown on Sheet 5 of 14, where exposed slopes will be at their greatest lengths and gradients, consider runoff diversions at the top of slope or mid-slope to avoid runoff over the lengthy exposed slopes. As an alternative if diversions above the slope or mid-slope absolutely cannot be accommodated, provide stabilized slope drains to avoid runoff over the entirety of the exposed slope. Recommend providing details and notes on the plans related to these additional control measures.
- c) Proposed stockpile locations are shown on the SWPPP plans. The Applicant should confirm that these locations and approximate sizes are appropriate for the quantities

of earth anticipated to be stockpiled. Please provide support for the sizing and locations of the stockpile locations shown on the plan as well as maximum slope of piles with any necessary stabilization measures. It appears that additional areas or larger stockpile sites may be required based upon the amount of earth removal proposed. Please also provide a detail of proposed erosion and sedimentation control measures specific to the soil stockpiles.

- d) GPI recommends that the Board require third-party construction inspection for the monitoring of sedimentation and erosion controls during proposed earthwork activities. The Board may consider a requirement that the consultant hired to perform these services be approved by the Board and be at the expense of the developer.

B. GEOTECHNICAL AND HYDROGEOLOGICAL REVIEW

Subsurface Conditions and Performed Subsurface Explorations

Based on the USGS Surficial Geology map of the Hudson and Maynard Quadrangle prepared by W.R. Hansen and dated 1956, the northern portion of the Site is mapped as Outwash Terrace, whereas the southern portion of the Site is mapped as Kames. Both of these deposits are considered glacial deposits consisting typically of mixed sands and gravels.

Based on the test pit logs provided in Attachment D – Sheets 12 and 13 of 14, the following subsurface explorations were performed in support of the proposed development:

- 32 test pits referred to as TP 17-1 through TP 17-32 and performed on December 12, 2017;
- 13 test pits referred to as TP# 19-1 through TP# 19-13 and performed on April 16, 2019;
- 17 test pits referred to as TP D50 through TP D66 and performed on April 17, 2019;
- 10 test pits referred to as TP# 20-1 through TP# 20-10 and performed on June 23, 2020; and
- 6 geoprobe test borings referred to as GP - 801 through GP - 806 and performed on October 22, 2020.

Based on the test pit logs, the generalized subsurface conditions at the site typically consist of 6 to 12 inches of Sandy Loam, underlain by 3 to 24 inches of Loamy Sand, underlain by up to 14.5 feet of medium to coarse Sand. Fill of up to 24 inches was encountered in some test pits overlying the Sandy Loam, except at TP# 19-7, TP# 19-8, TP# 19-9, TP# 19-12, TP# 19-13, and TP D59, where 3.5 to 9 feet of fill was encountered over the Sandy Loam. The estimated seasonal high ground water (ESHGW) reportedly ranged from El. 122 (i.e., at TP 17-19) to El. 127.33 (i.e., at TP D50), with a typical range of El. 123 to El. 125.

The geoprobe test borings encountered 6 to 12 inches of topsoil, underlain by 12 inches to 10.5 feet of poorly graded Sand with gravel or silt, underlain by 10 to 18 feet of glacial outwash deposits consisting of poorly graded medium Sand. No estimated groundwater information is provided on the geoprobe test boring logs.

Because the ESHGW has been identified in the Sand layer (a.k.a. glacial outwash), it would be reasonable to assume that the groundwater gradient is at a low angle and that the groundwater level is relatively uniform across the site changing seasonally from approximately El. 123 to El. 125. This elevation matches

approximately with the existing ground surface of the wetland area located in the northeastern corner of the Site.

Stability of Proposed Slopes

Based on Appendix D – Sheet 6 of 14, we understand that 2H:1V cut slopes are proposed at Lots 1 through 5 and at Lot 13, and landscaped stone walls are proposed at Lot 3 and Lot 4. We understand that these cut slopes and stone walls will be constructed by Symes. We estimate that the proposed 2H:1V cut slopes will have the following top and bottom elevations as well as an approximate slope height:

Table 1 – Estimated Top and Bottom Elevations of Proposed 2H:1V Cut Slopes.

Lot I.D.	Approx. Proposed Top of Slope Ground Surface Elevation ¹	Approx. Proposed Bottom of Slope Ground Surface Elevation ¹	Approximate Slope Height ²
1	164 - 168	156 - 160	6 to 8 feet
2	168 - 170	154 - 156	14 feet
3	170	150 - 152	18 to 20 feet
4	168 - 170	146	22 to 24 feet
5	160	140 - 142	18 to 20 feet
13	158	144 - 146	12 to 14 feet

Notes:

¹ Based on Attachment D – Sheet 6 of 14

² Does not include the temporary condition during the basement construction and/or septic system installation, which could add an additional slope height of up to approximately 8 feet.

2H:1V cut slopes constructed in sandy soils with the bottom of the slope at least 15 feet above the groundwater table are typically stable if they are protected from surface soil erosion. However, the slopes could potentially temporarily be unstable during the construction of the building foundation and/or septic system installation. Additionally, retaining wall designers often do not perform a global stability for retaining walls constructed on or at the toe of a slopes. Furthermore, if a retaining wall will be constructed on a slope, the bearing capacity of the foundation soil needs to be reduced to have an adequate factor of safety. Therefore, we recommend including the following provisions as a condition for the ZBA application:

Geotechnical Recommendation No. 1

As part of the building permits for Lots 1 through 5 and for Lot 13, the developer shall retain a professional engineer licensed in the Commonwealth of Massachusetts to provide a global slope stability analyses for the proposed cut slopes and a design for retaining walls, or wall systems, that have a combined exposed wall height of over 4 feet considering the temporary condition during construction as well as the permanent condition. The global slope stability analysis of the cut slopes and retaining wall designs shall be submitted to the Town of Concord with the building permit application.

We recommend that the submitted global slope stability analyses and retaining wall design(s) be reviewed by either the Town of Concord or by an external consultant retained by the Town.

HYDROGEOLOGICAL IMPACT ON GROUNDWATER LEVELS DUE TO THE EXCAVATIONS

As previously discussed, it would be reasonable to assume that the groundwater level is fairly uniform across the Site, changing seasonally from approximately El. 123 to El. 125. Based on Appendix D – Sheet 6 of 14, we understand that the finished floor elevation for the proposed Lots 1 through 16 building foundations ranges from El. 127 to El. 152.5. Final grades for the proposed roadways range from El. 133 to El. 156, and proposed utilities in the roadway, such as sewer, water, and stormwater management structures, are generally located above El. 125. Therefore, we anticipate that the groundwater level will not be lowered due to the proposed development including the proposed excavations.

Because lowering of the groundwater level is not anticipated, the proposed excavations will not cause settlements of the existing adjacent residential buildings, including those at Center Village Drive, as long as the proposed slopes are stable. However, this assumes that the ESHGW is as presented in the test pit logs and will not change over time. To make sure that the groundwater level is accurate, we recommend that the following additional subsurface explorations be performed which may be included as a condition for the ZBA application:

Geotechnical Recommendation No. 2

The developer shall perform two test borings with Standard Penetration Tests (SPT) at least two months prior to any excavation activities at the site. One boring should be performed near the top of the proposed cut slope of Lot 4, and the second boring should be performed near the top of the proposed slope of Lot 13. The test borings shall be advanced to at least El. 115 or refusal, whichever occurs first. A groundwater monitoring well shall be installed in each boring. The groundwater monitoring wells need to be located and protected so that they will not be destroyed during the proposed construction activities. The screen of the monitoring well should be installed from approximately El. 120 to El. 130.

Prior to any excavation activities at the site, at least three (3) groundwater measurement readings shall be taken approximately four weeks or longer apart to confirm the anticipated groundwater level and to assess variability of the readings. Once the excavation activities commence at the site, additional groundwater level readings shall be performed approximately every 30 days until at least 6 months after the rough grading of the lots have been completed.

The groundwater level readings and SPT information will also be necessary in support of the global slope stability analysis for the proposed cut slopes as well as for the design of the retaining walls. Additionally, the groundwater level readings will confirm that the excavation activities did not have an adverse effect on the groundwater level.

Construction Considerations

Based on the performed test pit information, we believe that the proposed permanent and temporary excavations will be constructed in a Type C soil according to OSHA excavation regulations contained in 29 CFR Part 1926 Subpart P, latest edition. According to this OSHA regulation, temporary excavations constructed in a soil Type C cannot have a slope that is steeper than 1.5H:1V. Temporary excavations deeper than 20 feet may need to be benched and/or shored. Contractors are familiar with these OSHA requirements and these requirements need to be strictly followed, where applicable.

Additionally, presented below are earthwork recommendations for the retaining walls and raise-in-grade fill placement.

Geotechnical Recommendation No. 3

We recommend that the following general subgrade preparation and backfill material placement guidance be considered for the proposed retaining walls. However, these general recommendations may need to be modified based on the subsurface conditions encountered in the recommended supplementary test borings and/or the proposed retaining wall type.

- Place at least 6 inches of compacted fill meeting the gradation requirements for Crushed Stone (MassDOT M2.01.4) or Gravel Borrow (MassDOT M1.03.0 Type b) below the bottom of the proposed retaining wall footings.
- Prior to placing any fill below the retaining walls, the subgrade should be proof-compacted with at least four (4) passes of a vibratory compactor.
- Proposed retaining walls should be backfilled with free draining soils such as Gravel Borrow that has less than 8 percent passing a No. 200 sieve such that no water pressure develops behind the walls.
- Extra care should be used when compacting soil adjacent to walls. Hand-operated rollers or plate compactors weighing not more than 250 pounds should be used within a lateral distance of 5 feet of walls.

Geotechnical Recommendation No. 4

We recommend that the following subgrade preparation, fill placement, and compaction requirements be considered for proposed raise-in-grade fill areas.

- Prior to placing any fill, the proposed raise-in-grade areas should be stripped of existing topsoil/vegetation, unsuitable materials, and other existing structures. Thereafter, the subgrade should be proof-compacted with at least six passes of a vibratory drum roller compactor with a minimum static drum weight of 10,000 pounds.
- Fill material meeting the gradation requirements for Gravel Borrow (MassDOT M1.03.0 Type b) should be used as raise-in-grade fill below the proposed dwelling footprints, roadways, and other structures including the zone of influence. The fill material should be compacted to at least 95 percent of the maximum dry density as determined by Modified Proctor Tests (ASTM D-1557, Method C). The zone of influence is defined as that area within a line projecting outward and downward from the outside edges of the proposed structure or roadway at a one horizontal to one vertical (1H:1V) slope. Loose lift thicknesses of the fill should be placed no greater than 12 inches.
- Protect subgrades from frost at all times during construction. Fill should not be placed over frozen soil.
- Raise-in-grade fill material placed within proposed landscaped areas should meet the gradation requirements for Ordinary Borrow (MassDOT M1.01.0) or Gravel Borrow (MassDOT M1.03.0 Type a) and should be compacted to at least 90 percent of the maximum dry density as determined by Modified Proctor Tests (ASTM D-1557, Method C).

- Some of the existing soil at the site may meet the gradation requirements for Gravel Borrow, but it is up to the contractor to confirm that it meets the requirements.

Additional Geotechnical Comments:

During our review we noticed a few discrepancies in Attachment D which we recommend should be corrected for consistency as follows:

1. Test pits TP 17-1 through TP 17-32 are not shown on Attachment D – Sheet 6 of 14 and should be added.
2. The elevation of test pit TP 17-22 is listed on Attachment D - Sheet 11 of 14 as 160.6. However, based on the existing contour lines shown on Sheet 6 of 14, the elevation is approximately at El. 155. The designer should review and revise, if necessary.
3. The ESHGW on Attachment D – Sheet 11 of 14 for test pit TP 17-20 is listed at “below 169.5”. Based on the test pit log, we suspect that it should read “below 159.5”.

GPI and Nobis are appreciative of the opportunity to assist the Town of Concord with the review of this Application. Should you have any questions, or require additional information, please contact Lindsey DiTonno directly at 978-570-2997 or by e-mail at lditonno@gpinet.com.

Sincerely,

GREENMAN-PEDERSEN, INC.



Lindsey DiTonno, PE
GPI Project Manager

NOBIS GROUP



Kurt Jelinek, PE
Associate / Director of Transportation