

COPY

EXHIBIT 47

08 July 2019

Daniel A. Vellone, M.S., PG, CPG
Certified Professional Geologist
51 Church Street
Grafton, MA 01519

Grafton Planning Board
Town of Grafton
Grafton Memorial Municipal Center
30 Providence Road
Grafton, MA 01519

RECEIVED

JUL - 9 2019

PLANNING BOARD
GRAFTON, MA

RE: **SP 2019-2 / SPA
DEP#164-970 / WP#792 / SWP#-18-7
Brigati Village LLC Special Permit/Site Plan Approval
Proposed Construction of a 57-Unit Multi-Family Residential Development
41 Church Street & 14 West Street
Grafton, MA**

In advance of the Public Hearing on Monday 08 July 2019 commencing at 7:30 p.m. in Conference Room A at the Grafton Memorial Municipal Center, and any subsequent hearings regarding the above reference application for special permit and site plan approval, it is respectfully requested that the Board give consideration to the following information outlined below.

This information is submitted at the request of the Board as a follow-up to public comment and material submitted to the Board pertaining to the above referenced project provided on Monday 24 June 2019 and recorded as Exhibit 43. These comments are also provided as a follow-up to written comments submitted as Exhibit 42.

Ethics Disclosure:

As previously noted during prior public meetings for the purposed of ethical disclosure, I am the Northeast Regional Geologist for the *United States Department of Agriculture Natural Resources Conservation Service (NRCS)*; however, the comments I have offered to the Board have been submitted as an abutting resident with deeded access to the common driveway on Churchill Condominium III immediately abutting the proposed development.

The findings and conclusions pertaining to the Brigati Village development at 41 Church Street are my personal professional opinion, and should not be construed to represent any official USDA or U.S. Government determination or policy. The interpretation of soil conditions which exist on the proposed site and related engineering geology considerations are based upon review of materials submitted by the applicant, combined with over 20 years of professional practice, licensure as a board-certified Professional Geologist, and graduate degree in civil engineering concentrating in geohydrology and geotechnical engineering.

Relevant Project Exhibit Information:

Exhibit 4. – Site Plans, Drawing Sheet C3.02 – Grading and Drainage Plan shows permanent sediment Basin-1 and Basin-2, located along the western extent of the proposed site development.

Exhibit 37. – Hydrology Computations Addendum dated 23 May 2019.

Exhibit 39. – Graves Engineering, Inc. peer-review letter dated 18 June 2019.

Exhibit 40. – Northeast Geotechnical, Inc. report dated 15 May 2019.

Exhibit 43. – Material submitted at Planning Board Meeting, 24 June 2019.

Discussion of Available Design Information:

Following prior discussions (see Exhibit 28) of the on-site soils “very limited” and unfavorable conditions for subsurface and surface water management in the general area of the sediment Basin-1 and Basin-2 as illustrated on Drawing Sheet C1.02, Existing Conditions Plan (Exhibit 4. Site Plans) and design considerations outlined in the Stormwater Management Report (see Exhibit 6) indicating that the sediment basins will function as an “exfiltration basin” (report page 3, PDF page 5 of 134) and “will infiltrate runoff to approximate existing groundwater recharge” (report page 4, PDF page 6 of 134), post-development hydrology computations addendum dated 24 May 2019 was submitted by the Applicant to Graves Engineering, Inc. for the consideration of exclusion of exfiltration from Basins 1 & 2 (see Exhibit 37). It should be noted that Exhibit 37 (Hydrology Computations Addendum) appears to contain altered design data (in contrast to the original submittal as Exhibit 6) including revised culvert pipe length, pipe slope and material roughness properties (e.g., smooth versus corrugated interior pipe finishes). While these computations are outside my area of professional expertise, these altered design parameters have not been discussed in a report format to document why these changes to the engineering calculations have been made. Additionally, these engineering calculations do not appear to comply with the requirements of 250 CMR 5.03 (see Exhibit 42 discussion) because the calculations do not bear the professional seal of the designer/registrant(s) as required, since this document has been filed with the Town Planning Board as a public authority. Additionally, it is unclear if Exhibit 4., Site Plans have been modified to incorporate these engineering design changes in the proposed development.

Recommended Action: It is respectfully requested that the Planning Board require additional documentation from the applicant of these engineering changes outlined in a report submittal under the seal of a responsible design professional in addition to resubmittal of the Site Plans which may be revised following these design changes (as needed).

During the public presentation to the Board by WDA Design Group at the Monday 24 June 2019 meeting, it was noted that the Grafton Conservation Commission had subsequently provided approval to the Applicant on Tuesday 18 June 2019 with regard to the wetland and stormwater regulations. However, the approval for satisfying the Town’s requirements for stormwater regulations is a separate issue from the engineering design considerations before the Board with regard to “the design and construction of the proposed slope located within the westerly portion of the subject site” and the focus of the geotechnical engineering study for stability prepared by Northeast Geotechnical, Inc. (see Exhibit 40).

It should be noted that the Northeast Geotechnical, Inc. geotechnical engineering study indicates that fill material placement “up to about 13± from existing grades” are proposed to reach finished slope grades (see report page 2). During the public presentation to the Board by WDA Design Group at the Monday 24 June 2019 meeting, it was noted that it was intended to have a ‘net zero’ cut/fill balance for the nearly 20,000 cubic yards of earthwork proposed for the development project. Further, it was presented that only about 800 cubic yards of “import” material was anticipated by WDA Design Group.

However, Northeast Geotechnical, Inc. indicates that “off-site processed gravel fill is recommended for use as structural fill within the proposed slope are where a raise in grade is proposed” (see report page 5). Further, Northeast Geotechnical, Inc. recommends that no more that 10 percent of material should pass the No. 200 sieve by weight. Appendix C of the report includes laboratory testing data prepared by Thielsch Engineering, and Samples S-1, S-2 and S-3 each document that on-site natural glacial till has 25.9 to 42.6 percent silt- and clay-sized particles passing the No. 200 sieve. These soil gradation results are consistent with the *United States Department of Agriculture Natural Resources Conservation Service (NRCS) Web Soil Survey* map unit engineering properties for the Paxon fine sandy loam soil units 305C, 370C and 307E within the general area of the proposed project development, as illustrated on Drawing Sheet C1.02. For these mapped soil units, the Web Soil Survey indicates that 24 to 58 percent of material is passing the No. 200 sieve by weight for subsoil materials at a depth ranging from about 2± to 5± below the ground surface. As a result, it appears that there is an inconsistency in the development plans as verbally presented to the Board by WDA Design Group and the engineering recommendations by Northeast Geotechnical, Inc.

Recommended Action: It is respectfully requested that the Planning Board require these design inconsistencies to be resolved under the seal of a responsible design professional in addition to resubmittal of the Site Plans which may be revised following these design changes (as needed).

The Northeast Geotechnical, Inc. engineering study indicates that “according to WDA, the basins are designed to infiltrate collected stormwater into the underlying soils” (see report page 2). However, as previously documented in Exhibit 37 and Exhibit 39, the proposed stormwater basins, “designated as Basins 1 and 2 on the referenced Grading and Drainage Plan, are located along the top of the proposed slope” are now designed to exclude exfiltration to groundwater. As a result of the revised Hydrology Computations Addendum dated 23 May 2019, the engineering design assumptions presented by Northeast Geotechnical, Inc. in their 15 May 2019 report appear to no longer be consisted with the proposed site development plan. As a result, it appears that there is an inconsistency in the stormwater design submitted to the Board by WDA Design Group and the engineering considerations by Northeast Geotechnical, Inc. for their geotechnical analysis of the slope condition.

Recommended Action: It is respectfully requested that the Planning Board require these design inconsistencies to be resolved under the seal of a responsible design professional in addition to resubmittal of the Site Plans which may be revised following these design changes (as needed).

The Northeast Geotechnical, Inc. engineering study indicates that “Boring no. NEG-2 was terminated upon refusal... which may be indicative of boulders or the bedrock surface” (see report page 3). It is commonly accepted in the allied professions of engineering geology and geotechnical engineering that often the principle topographic features of the landscape are chiefly controlled by the lithology and structure of the underlying bedrock. As noted in Exhibit 43, excerpt from Technical Release 210-60, “the

level of investigation ... and analysis should be commensurate with the complexity of the site ...along with the consequences of failure.”

As noted by WDA Design Group during the public presentation to the Board at the Monday 24 June 2019 meeting, the proposed slope located within the westerly portion of the subject site within approximately 150 feet of Church Street is at a ~30 percent natural slope. Further professional geologist Linda Hutchins, PG has identified to the Board that “this area is mapped as a High Slope and Very High Slope Terrain in the town’s 2016 Hazard Mitigation Plan, and as such poses a landslide hazard” (see Exhibit 20). As previously noted, the Northeast Geotechnical, Inc. engineering study indicates that fill material placement “up to about 13± from existing grades” are proposed to reach proposed finished slope grades.

In consideration of the Town’s landslide hazard potential designation as High Slope and Very High Slope Terrain for the existing natural slope, and in consideration of the placement of an additional 13± feet of fill soils on the slope to raise the exiting grade and the construction of two (2) stormwater detention basins that will no longer exfiltrate water to groundwater but rather serve as detention ponds with proposed depths ranging “from about 3± to 7± feet” (see report page 2), it does not appear that the level of subsurface investigation is commensurate with the complexity of the site and the potential consequences of failure.

Recommended Action: It is respectfully requested that the Planning Board require additional subsurface borings, auger probes, or other exploration means and methods to adequately characterize the underlying bedrock surface profile along the proposed slope alignment in order to obtain necessary design input for the slope stability analyses to be submitted under the seal of a responsible design professional.

Exhibit 43 submitted to the Board during the meeting on 24 June 2019 includes several excerpts from industry-accepted professional publications to aid in the general understanding of the current state-of-practice of the allied professions of engineering geology and geotechnical engineering with consideration to slope stability analyses. While the Northeast Geotechnical, Inc. engineering study indicates the commercial software packaged used (2012 GeoStudio – Slope/W program), the report does not appear to document what limit equilibrium analysis method or analytical technique applied or their appropriate engineering assumptions. Additionally, the material properties for each soil type/horizon has not been provided in tabulated form within the report. It would be expected that the following minimum material properties would be modeled (1) pool of detention water considering various storm-event elevations; (2) detention basin structural fill; (3) off-site processed gravel fill to raise natural slope grade; (4) natural subsoils and glacial till; (5) underlying bedrock surface (including the dip/slope of the rock surface profile that may control deep-seated failure slip-surfaces if sloping in a westerly direction towards Church Street).

As outlined in the excerpt from Technical Release 210-60, “document piezometric assumptions included in the analyses and any other variables that will influence stability, along with the basis for the values.” As noted in the Northeast Geotechnical, Inc. engineering study, “the potential for saturated ground conditions and possible breakout along the proposed slope surface” may be a consideration (see report page 5). Technical Release 210-60 goes on to say, “the stability analysis should incorporate zones of saturation and seepage... and evaluate a range of potential seepage conditions to determine the sensitivity of flood storage stability to potential seepage conditions.” As a result, it would be expected

that the various storm events considered within Exhibits 6 and 37 would have corresponding potential seepage conditions that should be modeled within the slope stability analyses. This is also consistent with the guidance outlined in NAVFAC DM 7.1, which indicates that an increase in groundwater pressure through the saturation of a slope should be part of the slope stability evaluation.

Each of the excerpts included within Exhibit 43 submitted to the Board during the meeting on 24 June 2019 outline that a required minimum factor of safety of no less than 1.5 be applied for long-term (permanent) loading conditions. Additional required minimum factor of safety requirements are recommended for temporary (construction loading), short-term (rapid drawdown), and transient (dynamic) loading from earthquake-induced ground motions. The results of the Northeast Geotechnical, Inc. stability analysis does not indicate that each of these various design conditions were given consideration. Further, it does not appear that dynamic stability (pseudo-static) analyses were performed giving consideration to seismic and earthquake loading, because the geotechnical report does not provide for the derivation of seismic design parameters or a discussion of regional seismicity. Additionally, a minimum factor of safety of 1.3 was considered to be “adequate... against slope failure” despite generally accepted practice amongst the allied professions of geotechnical engineering and engineering geology that a factor of safety of no less than 1.5 be considered the minimum, as documented in various literature included within Exhibit 43. As noted in the excerpt from Technical Release 210-60, it is recommended to “clearly document the reasons for not analyzing a condition.” It does not appear that the Northeast Geotechnical, Inc. engineering study documents why certain conditions were not analyzed in support of this site development project.

Recommended Action: It is respectfully requested that the Planning Board require these state-of-practice design considerations to be resolved under the seal of a responsible design professional in addition to resubmittal of the Site Plans which may be revised following these design changes (as needed).

The Northeast Geotechnical, Inc. engineering study indicates that “periodic maintenance of the slope surface over time should be anticipated” (see report page 5). Further, the report recommends earthwork observation and soils testing during construction of the proposed slope. Considerations of this nature are often addressed in an Operation and Maintenance (O&M) Plan.

Recommended Action: It is respectfully requested that the Planning Board require the preparation of an Operation and Maintenance (O&M) plan under the seal of a responsible design professional.

In consideration of the following items outlined herein, it is respectfully requested that the Planning Board exercise responsible due diligence in requiring additional information from the applicant in consideration of this project prior to giving consideration to the approval of the applicant’s permit/site plan approval request.

Respectfully submitted,

Daniel A. Vellone, M.S., PG, CPG
Certified Professional Geologist

Engineering Properties--Worcester County, Massachusetts, Southern Part														
Map unit symbol and soil name	Pct. of map unit	Hydrologic group	Depth	USDA texture	Classification		Pct Fragments		Percentage passing sieve number--				Liquid limit	Plasticity index
					Unified	AASHTO	>10 inches	3-10 inches	4	10	40	200		
			<i>In</i>				<i>L-R-H</i>	<i>L-R-H</i>	<i>L-R-H</i>	<i>L-R-H</i>	<i>L-R-H</i>	<i>L-R-H</i>	<i>L-R-H</i>	
305C--Paxton fine sandy loam, 8 to 15 percent slopes														
Paxton	85	C	0-8	Gravelly sandy loam, fine sandy loam, loam, gravelly fine sandy loam	SC-SM, SC, CL, ML, SM, OL, OH, GM, GC, GC-GM, CL-ML	A-1-b, A-2-4, A-2-5, A-5, A-4	0- 0- 21	0- 0- 21	49-90-90	47-90-90	36-76-86	19-44-56	0-30 -60	NP-5 -10
			8-15	Loam, gravelly sandy loam, fine sandy loam	SM, GC-GM, CL-ML, SC-SM, SC, GM, GC, CL, ML	A-4, A-6, A-1-b, A-2-4, A-2-6	0- 0- 7	0- 0- 14	52-91-91	50-91-91	38-76-87	20-44-57	0-21 -32	NP-3 -11
			15-26	Loam, gravelly sandy loam, fine sandy loam	SM, GC-GM, CL-ML, CL, ML, SC-SM, SC, GM, GC	A-6, A-2-6, A-2-4, A-1-b, A-4	0- 0- 6	0- 0- 13	56-85-92	55-85-92	41-71-88	22-41-57	0-19 -29	NP-3 -11
			26-65	Gravelly sandy loam, loam, gravelly coarse sandy loam, gravelly fine sandy loam, fine sandy loam	GM, GC, SM, SC-SM, SC, GC-GM, CL-ML, CL, ML	A-2-4, A-4, A-1-b, A-6, A-2-6	0- 0- 6	0- 0- 12	61-70-94	59-69-93	45-58-90	24-34-58	0-18 -28	NP-3 -11

Engineering Properties--Worcester County, Massachusetts, Southern Part														
Map unit symbol and soil name	Pct. of map unit	Hydrologic group	Depth	USDA texture	Classification		Pct Fragments		Percentage passing sieve number--				Liquid limit	Plasticity index
					Unified	AASHTO	>10 inches	3-10 inches	4	10	40	200		
			<i>In</i>				<i>L-R-H</i>	<i>L-R-H</i>	<i>L-R-H</i>	<i>L-R-H</i>	<i>L-R-H</i>	<i>L-R-H</i>	<i>L-R-H</i>	<i>L-R-H</i>
307C--Paxton fine sandy loam, 8 to 15 percent slopes, extremely stony														
Paxton, extremely stony	85	C	0-2	Moderately decomposed plant material, slightly decomposed plant material, highly decomposed plant material	PT	A-8	0- 0- 0	0- 0- 0	—	—	—	—	—	—
			2-10	Gravelly sandy loam, fine sandy loam, gravelly fine sandy loam, loam	CL, GM, CL-ML, GC, GC-GM, OL, OH, SM, SC-SM, ML, SC	A-5, A-2-4, A-1-b, A-2-5, A-4	0- 0- 24	0- 0- 24	44-88-88	42-87-87	31-74-84	17-43-55	0-40 -60	NP-7 -10
			10-17	Loam, gravelly sandy loam, fine sandy loam	SM, ML, CL-ML, GC, SC-SM, CL, SC, GC-GM, GM	A-2-6, A-2-4, A-6, A-1-b, A-4	0- 0- 7	0- 0- 14	52-91-91	50-91-91	38-76-87	20-44-57	0-21 -32	NP-3 -11
			17-28	Gravelly sandy loam, fine sandy loam, loam	GC-GM, ML, GM, SM, CL-ML, GC, SC-SM, SC, CL	A-1-b, A-2-6, A-4, A-2-4, A-6	0- 0- 6	0- 0- 13	56-85-92	55-85-92	41-71-88	22-41-57	0-19 -29	NP-3 -11

Engineering Properties--Worcester County, Massachusetts, Southern Part														
Map unit symbol and soil name	Pct. of map unit	Hydrologic group	Depth	USDA texture	Classification		Pct Fragments		Percentage passing sieve number--				Liquid limit	Plasticity index
					Unified	AASHTO	>10 inches	3-10 inches	4	10	40	200		
			<i>In</i>				<i>L-R-H</i>	<i>L-R-H</i>	<i>L-R-H</i>	<i>L-R-H</i>	<i>L-R-H</i>	<i>L-R-H</i>	<i>L-R-H</i>	
			28-67	Gravelly fine sandy loam, gravelly coarse sandy loam, fine sandy loam, loam, gravelly sandy loam	SC-SM, CL, SC, ML, GC-GM, CL-ML, GM, GC, SM	A-4, A-2-6, A-6, A-1-b, A-2-4	0- 0- 6	0- 0- 12	61-70-94	59-69-93	45-58-90	24-34-58	0-18 -28	NP-3 -11

Engineering Properties--Worcester County, Massachusetts, Southern Part														
Map unit symbol and soil name	Pct. of map unit	Hydrologic group	Depth	USDA texture	Classification		Pct Fragments		Percentage passing sieve number--				Liquid limit	Plasticity index
					Unified	AASHTO	>10 inches	3-10 inches	4	10	40	200		
			<i>In</i>				<i>L-R-H</i>	<i>L-R-H</i>	<i>L-R-H</i>	<i>L-R-H</i>	<i>L-R-H</i>	<i>L-R-H</i>	<i>L-R-H</i>	<i>L-R-H</i>
307E--Paxton fine sandy loam, 15 to 35 percent slopes, extremely stony														
Paxton, extremely stony	75	C	0-2	Moderately decomposed plant material, slightly decomposed plant material, highly decomposed plant material	PT	A-8	0- 0- 0	0- 0- 0	—	—	—	—	—	—
			2-10	Gravelly sandy loam, fine sandy loam, gravelly fine sandy loam, loam	CL, GM, CL-ML, GC, GC-GM, OL, OH, SM, SC-SM, ML, SC	A-5, A-2-4, A-1-b, A-2-5, A-4	0- 0- 24	0- 0- 24	44-88-88	42-87-87	31-74-84	17-43-55	0-40 -60	NP-7 -10
			10-17	Loam, gravelly sandy loam, fine sandy loam	SM, ML, CL-ML, GC, SC-SM, CL, SC, GC-GM, GM	A-2-6, A-2-4, A-6, A-1-b, A-4	0- 0- 7	0- 0- 14	52-91-91	50-91-91	38-76-87	20-44-57	0-21 -32	NP-3 -11
			17-28	Gravelly sandy loam, fine sandy loam, loam	GC-GM, ML, GM, SM, CL-ML, GC, SC-SM, SC, CL	A-1-b, A-2-6, A-4, A-2-4, A-6	0- 0- 6	0- 0- 13	56-85-92	55-85-92	41-71-88	22-41-57	0-19 -29	NP-3 -11

Engineering Properties--Worcester County, Massachusetts, Southern Part														
Map unit symbol and soil name	Pct. of map unit	Hydrologic group	Depth	USDA texture	Classification		Pct Fragments		Percentage passing sieve number--				Liquid limit	Plasticity index
					Unified	AASHTO	>10 inches	3-10 inches	4	10	40	200		
			<i>In</i>				<i>L-R-H</i>	<i>L-R-H</i>	<i>L-R-H</i>	<i>L-R-H</i>	<i>L-R-H</i>	<i>L-R-H</i>	<i>L-R-H</i>	<i>L-R-H</i>
			28-67	Gravelly fine sandy loam, gravelly coarse sandy loam, fine sandy loam, loam, gravelly sandy loam	SC-SM, CL, SC, ML, GC-GM, CL-ML, GM, GC, SM	A-4, A-2-6, A-6, A-1-b, A-2-4	0- 0- 6	0- 0- 12	61-70-94	59-69-93	45-58-90	24-34-58	0-18 -28	NP-3 -11

Data Source Information

Soil Survey Area: Worcester County, Massachusetts, Southern Part
 Survey Area Data: Version 11, Sep 11, 2018