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June 21, 2016

Janet DeLonga – Conservation Agent
Town of Norfolk – Conservation Commission
1 Liberty Lane
Norfolk, MA 02056

Re: Norfolk, MA – Lakeland Farms Townhouse Community
Comprehensive Plan – Stormwater Management Peer Review

Dear Ms. DeLonga:

BETA Group, Inc. (BETA) has completed its peer review of the stormwater management design for the referenced project, based on the following materials (all of which were prepared by Andrews Surveying & Engineering, Inc.):

- Lakeland Farms Townhouse Community Site Plan Set, dated April 19, 2016
- Stormwater Management Report entitled 'Lakeland Farms, A Townhouse Community, 84 Cleveland Street, Norfolk, MA,' dated April 19, 2016
- Operation and Maintenance (O&M) Plan, dated April 19, 2016
- Lakeland Farms Townhouse Community Comprehensive Permit Application, dated April 19, 2016

The following are our comments; please note that our focus in this review was the stormwater management system for the development. Where referenced, the term "applicant" refers to either the applicant itself or its design consultants, and the term BMP means "Best Management Practice."

<u>Stormwater Management Report & HydroCAD Model</u>

1) Section 3.3 Recharge to Groundwater (Standard 3) - The Recharge Volume calculation uses 145,134 s.f. as the total impervious area. However, the HydroCAD model includes a total of only 119,621 s.f. of impervious area among watersheds 2S, 3S, 4S, 5S and 6S, which appears to include both ground surface impervious areas and roofs.

   <u>Recommendation</u>: The applicant should review and reconcile the difference between the two (2) total impervious area values. If the greater value is accurate, the HydroCAD model (and potentially the stormwater management BMP designs) will need to be revised. If the lower value is accurate, the corresponding stormwater management report calculations will need to be revised.

2) Section 3.3 Recharge to Groundwater (Standard 3) – Drawdown Time - The report states that the Drawdown Time for the infiltration basin must be calculated using the formula presented in the MA Stormwater Handbook; however, said calculation is not presented, and instead reference is made to the HydroCAD Stage-Storage Calculations for the determination of the drawdown time.

Recommendation: The applicant should follow the requirements of the MA Stormwater Handbook (Volume 3, Chapter 1) for the calculation of the drawdown time in the infiltration basin, which must be less than seventy-two (72) hours.

3) Section 3.3 Recharge to Groundwater (Standard 3) – Mounding Analysis – The mounding analysis performed for the infiltration basin includes input parameters that do not appear to correspond to the basin design from the HydroCAD model. Specifically, the Bottom Infiltrating Area in the mounding analysis is listed as 7,044 s.f., which corresponds to elevation 90.0 in the basin; per the plans and HydroCAD, the bottom of the basin is at elevation 87.0 with an area of 746 s.f. In addition, it is unclear where the length and width dimensions of the infiltration area (160 ft and 30ft, respectively) were taken.

   Recommendation: The applicant should review and revise the mounding analysis to ensure that the input values used correspond to the infiltration basin as it has been designed and modeled in HydroCAD.

4) Section 3.4 Removal of 80% TSS (Standard 4) – Refer to Item 1 above regarding the total impervious area. In addition, it appears that the same calculation for Recharge Volume (Rv) was used for the Water Quality Volume (Vwq) determination, as the total Vwq is identical to the Rv from the previous section (7,257 c.f.). The calculated Vwq based on the 145,134 s.f. total impervious area is 12,095 c.f.

   Recommendation: The applicant should review and reconcile the difference between the two (2) total impervious area values. If the greater value is accurate, the HydroCAD model (and potentially the stormwater management BMP designs) will need to be revised. If the lower value is accurate, the corresponding stormwater management report calculations will need to be revised. In addition, the Vwq calculation should be corrected.

5) Section 3.4 Removal of 80% TSS (Standard 4) – Forebay Sizing – Refer to Item 1 above regarding the total impervious area. In addition, the forebay sizing should be limited to the impervious areas tributary to the infiltration forebay (i.e. only those in watersheds 3S and 4S).

   Recommendation: The applicant should review and revise the total impervious area used in the forebay sizing calculation to reflect only the areas that shall be tributary to the forebay, and not the total impervious areas for the overall site.

6) Section 3.9 Operation and Maintenance Plan (Standard 9) – The O&M Plan Table of Contents lists a Best Management Locus Plan as a figure in the plan; however, the Figure was not in the O&M plan received and reviewed.

   Recommendation: Submit the BMP Locus Plan for review.

7) HydroCAD Printouts – Infiltration Basin Exfiltration Rate – The infiltration basin was modeled using an exfiltration rate of 1.02 inches/hour, which corresponds to the Rawl's rate for sandy loam in NRCS hydrologic soil group "B" soils. This rate was also used in the mounding analysis (converted to 2.04 ft/day), and will presumably be used in the drawdown time calculation when it is performed.

Per the MA Stormwater Handbook regarding infiltration calculations using the Static Method, "the Rawls Rates associated with the slowest of the Hydrologic Soil Groups determined to exist at the point where recharge is actually proposed shall be used." It appears that the value was based on the presence of Swansea Muck, 0-1% (map unit symbol 51, HSG B) near, but not apparently within, the southern end of the infiltration basin. In addition, while the two test hole profiles in the vicinity of the basin (310-4 & 310-5) indicate the presence of sandy loam, that material is present only to a depth of 24-26", beneath which the material is fine sand. The infiltration area of the basin actually appears to be wholly contained within the Charlton-Hollis rock outcrop complex (map unit symbol 103C, HSG A), and the proposed elevations of the basin will result in the bottom being close to the underlying fine sand layer.

Recommendation: The lower exfiltration rate used in the HydroCAD model may not be representative of the actual soil conditions that will be encountered in the bottom of the infiltration basin. The applicant should consider the use of the infiltration rate value for loamy sands/HSG A soils (2.41 inches/hour) in the HydroCAD model, drawdown & mounding calculations. In addition, the applicant should consider modifying the infiltration basin section to call for the sandy loam in the bottom of the basin to be excavated to the fine sand layer, and permissive material (e.g. medium sand) used to replace same to the proposed subbase (i.e. below the 6" plantable soil layer) elevation.

Plans

1) General – Schedule 40 PVC pipe is specified for use in the storm drainage system, particularly for elements of the stormwater BMP's.

   Recommendation: The applicant should specify that all PVC pipe and fittings used for exterior/underground storm drainage infrastructure shall be gasketed, and further specify that glued connections shall not be allowed for any exterior/underground PVC pipes.

2) Sheet C-5.0 – Grading & Drainage Plan – The plan calls for earthwork associated with the construction of the Infiltration to take place less than five (5) feet from the flagged bordering vegetated wetland (BVW), specifically between flags 22-23 and 25-26. It is unlikely that disturbance to the BVW itself will be avoided at that close proximity, considering the nature of the proposed work.

   Recommendation: The applicant should consider modifications to the proposed infiltration basin design that would increase the clearance between the limit of the proposed work and the BVW to at least six (6) feet (allowing one (1) foot for soil erosion and sedimentation control (SESC) measures and five (5) feet of clearance between any earthwork and the SESC measures. Such modifications could include steepening the outside slope of the infiltration basin dike from 3:1 to 2:1, and installing permanent geosynthetic slope stabilization in same.

3) Sheet C-7.4 – Construction Details Sheet 4 of 6 – Detail 1, Water Quality/Drawdown Device (Basin 1 & Inf. Basin) calls for the perforated PVC drawdown pipe to be wrapped in filter fabric. Our experience has been that filter fabric wrapping around perforated pipes tends to clog, significantly reducing the effectiveness of the drawdown pipe.

   Recommendation: The applicant should eliminate the filter fabric and specify uniformly graded ¾" washed crushed stone, and during the construction process verify that the stone has been thoroughly

washed, and is free of fine particulates and stone dust, prior to placement. In addition, the low-flow orifice end of the drawdown device should be configured so that the end plug or cap can be readily removed to allow for flushing of the pipe.

4) Sheet C-7.4 – Construction Details Sheet 4 of 6 – Detail 5, Low Flow Drain (Basin 2) does not call for perforated SCH 40 PVC pipe, which would presumably be located in the crushed stone mound section.

   Recommendation: The applicant should specify perforated SCH 40 PVC in the detail, and depict the connection to the solid SCH 40 PVC pipe with a gasketed SCH 40 PVC coupling. In addition, the low-flow orifice end of the low flow drain should be configured so that the end plug or cap can be readily removed to allow for flushing of the pipe.

5) Sheet C-7.4 – Construction Details Sheet 4 of 6 – Detail 8, Outlet Structure 2 (OS2) – Orifice/Grate Detail depicts a single 2" diameter inlet orifice in the front elevation of the detail, while the elevation view in the detail calls for two (2) 3" diameter inlet orifices, as does the HydroCAD model.

   Recommendation: The applicant should revise the front elevation of the detail to depict two (2) 3" diameter inlet orifices.

6) Sheet C-7.5 – Construction Details Sheet 5 of 6 – Details 4 & 5 – Infiltration Basin Cross Sections are mistitled, as only detail 4 is applicable to the infiltration basin.

   Recommendation: The applicant should remove the word "Infiltration" from the title for each detail, and replace it with "Stormwater."

7) Sheet C-7.5 – Construction Details Sheet 5 of 6 – Detail 5 – Basin Cross Section (Basin 2) depicts the low flow drain, but does not depict the location and length of the perforated PVC pipe or the transition to solid PVC pipe (see comment 3 above).

   Recommendation: The applicant should modify the detail to depict the perforated SCH 40 PVC pipe, as well as the coupling between it and the solid SCH 40 PVC pipe beneath the dike.

If you have questions about any of the preceding comments, please feel free to contact either Andy Ogilvie or me at (401) 333-2382. Thank you for the opportunity to participate in this very important project for Norfolk.

Very truly yours,
BETA Group, Inc.

Michael Zavalia, P.E.
Senior Project Engineer

cc: Andrew Ogilvie, P.E. – BETA Senior Project Engineer
Bill McGrath, P.E. – BETA Associate

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