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24179

Sudbury Conservation Commission  
275 Old Lancaster Road  
Sudbury, MA 01776

November 14, 2011

RE: **MassDEP File No. 301-1068** Notice of Intent - Initial Review  
Johnson Farm - 189 Landham Road, Sudbury, MA

Dear Commission Members:

This report contains the findings of my initial review of the Notice of Intent submittal filed by Robert Moss of Madison Place Sudbury LLC (Applicant) under the Massachusetts Wetlands Protection Act (MGL Ch. 131, s. 40), for a residential apartment development at the subject site. This review has been performed per our contract/proposal dated October 12, 2011. We have reviewed the NOI application for general completeness and the project design and documents for compliance with the Mass. Wetlands Protection Act Regulations (310 CMR 10.00 et. Seq.) and for general good engineering practice. Our findings are based on the following submitted documents, plans and information:

- Attendance at the Wetlands Protection Act hearing on October 24, 2011.
- A site visit on October 28, 2011.
- Review of the filed plans and documents including but not limited to:
  1. Notice of Intent and attached documents contained in the NOI booklet (October 4, 2011)
  2. Site Development Plans entitled "Comprehensive Permit Preliminary - Site Development Plans, The Residences at Johnson Farm...." (as updated 10/4/11) containing 20 sheets.
  3. Landscape Plans prepared by Sudbury Design Group dated 8/5/11 (6 sheets).
  4. "Storm Management Plan, The Residences at Johnson Farm...." Dated October 4, 2011 prepared by Tetra Tech.
  5. Letter from Tetra Tech dated October 17, 2011 containing "Supplemental Stormwater Information".
  6. Supplemental Information provided by Tetra Tech dated November 7, 2011 relative to Porous Pavement.
  7. Order of Resource Area Delineation issued by the Conservation Commission, dated 12/31/09.
  8. Plan for ANRAD Application dated revised 11/30/09. This plan shows the wetland resource areas on the site under the Bylaw and Wetlands Protection Act.
  9. Letter to the Conservation Commission by Attorney Jonathan Witten (of Huggins and Witten, LLC) dated October 21, 2011.

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10. Letter to the Conservation Commission by Attorney Jonathan Witten (of Huggins and Witten, LLC) dated November 9, 2011.

- As additional background information and a more complete understanding of the project, the Comprehensive Permit Application filed with the Zoning Board of Appeals for the project dated August 8, 2011 under MGL Ch. 40B was also reviewed.
- For additional information on porous pavement, we reviewed the available information on the UNH Website.

#### **1. Wetlands Resource Areas:**

The boundaries of the wetlands resource areas at the subject property were the subject of an Abbreviated Notice of Resource Area Delineation (ANRAD) and the subsequent issuance of an Order of Resource Area Delineation (ORAD) issued by the Sudbury Conservation Commission 12/31/09. The Resource Areas defined under the Wetlands Protection Act determined by the ORAD included Bordering Vegetated Wetlands (BVW) and Riverfront Area. The determination of "Bank" were included as part of the determination of the Mean Annual High Water Line for the delineation of the Riverfront boundary. The ORAD also included several other Resource Areas protected under the Sudbury Wetlands Administration Bylaw, which are not subject to this NOI filing.

SBNE compared the Final ANRAD Plan approved By the Conservation Commission for BVW, Riverfront and Banks with the plans submitted with the NOI and found the delineations of the Resource Areas depicted are consistent with the approved plan. As these boundaries are fixed per the ORAD, we did not review the delineations other than as described above.

With respect to Buffer Zones, the plans show a 25-foot Buffer from the BVW but do not show the 100-foot Buffer Zone. That line should be shown as it defines the jurisdictional boundary under the WPA and helps in the evaluation of work in close proximity to the wetlands resource areas. The significance of the 25-foot buffer was not discussed in the filing. Based on review of the plans, it appears that the Applicant is attempting to keep major structures and most impervious surfaces out of that area except at the crossing site.

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Relative to Bordering Land Subject to Flooding (BLSF), the National Flood Insurance Program mapping defines the elevation of the 100-year flood along Hop Brook to be Elevation 122.0 (NAVD 88). According to the survey base plan for the subject Site Plans are based on that datum so these elevations and contours shown are directly applicable to the site plans.

I would agree that the limit of Land Subject to Flooding below (north of) the cart road would be 122.0. However, the area south of the cart road is above the limit of the NFIP flood study. For such areas, the Regulations at 10.57(2)(a)3 provide that the approving authority may require the Applicant to determine the boundary by engineering calculations. In this case, the Applicant's Engineer has performed calculations that determined the 100 year flood elevation to be at 124.3 +/- . The Engineer used a conservative approach and utilized a 100-year rainfall depth of 8.6 inches rather than 7.0 inches as specified by the Regulations, so the computed elevation may be higher than if the 7.0 inch rainfall depth was utilized. The engineer also did not consider the overtopping of the cart road in his calculations, which would also produce conservative results. However, given the approximate elevation of crest of the cart road, the elevation is probably not too far off and could be used unless more detailed calculations are produced.

The 124.3 elevation appears to be all within the BVW so there is no area that is solely defined as BLSF, however, it is important for the flood value of this area to be recognized, as any proposed a filling or alteration must provide compensating flood storage. This is discussed further in the discussion on the Wetland Replication Area later in this report.

## **2. Limited Project Status**

The project as presently designed proposes the filling and alteration of 10,485 SF of BVW and 10,380 SF of the inner 100 foot of the Riverfront Area. As such, the project as designed cannot meet the general performance standards 310CMR 10.55 and 10.58. The project is being submitted claiming qualification as a Limited Project for an access roadway under 10.53(3)(e) which "the issuing authority may" approve while not meeting the general performance standards for the resource areas. In addition to the information contained in the referenced section, more explanation on this section is contained in DEP Wetlands Policy 88-2: Access Roadways.

A finding that the project qualifies, or does not qualify, for this Limited Project provision is critical for this Notice of Intent submittal. If the project does not qualify,

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the project must be denied because the project does not meet the General Performance Standards as identified above. If the project is found to qualify, the Commission may consider issuing an Order that could approve the project.

The Applicant makes detailed arguments that the project qualifies for this provision. The argument is based on the fact that a substantial portion of "upland" on this site is not accessible without the proposed access driveway and associated wetlands alterations. Supporting information is provided to demonstrate that "there are no reasonable alternative means of access from a public way to the upland area of the same owner...." The supporting information includes an analysis of alternatives. Further review findings on the supporting information are included later in this section.

A detailed argument has also been presented by Attorney Jonathan Witten, representing abutters to the project, supporting his contention that the project does not qualify as a Limited Project. (See letters by Witten 10/21/11 and 11/9/11).

Given the conflicting legal arguments, the final decision on this is a complicated legal matter and beyond the scope of my review. I would recommend that the Commission seek legal counsel, if possible, relative to this matter. Both the Applicant and Attorney Witten cite case law and DEP decisions relative to this question that I recommend be reviewed for applicability to the subject project.

Within the scope of my review, I have the following comments relative to the submitted materials for the Limited Project requirements.

#### Alternatives Analysis – Limited Project Status

Under the Limited Project Access Roadway section 10.53(3)(e), "the issuing authority may require the applicant to utilize access over an adjacent parcel of land ....in which the applicant has, or can obtain an ownership interest." Similar language relative alternatives analysis requirements are contained in the Mass. Water Quality Certification Regulations at 314 CMR 9.06(1)(c)1.

To satisfy this requirement, an Alternatives Analysis has been prepared and submitted to the Conservation Commission as part of the Notice of Intent (NOI) filing. The following are some comments regarding the analysis prepared as it relates to the Limited Project status:

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- a) The analysis looked at abutting properties for alternative means of access to avoid or reduce wetland impacts related to the main stream crossing. The only routes with any possibility related to access from Cutler Farm Road. However, no feasible routes were found that would be available through abutting properties due to various logistics and cost. There is also a blanket statement that Cutler Farm Road would not be suitable for access for this project, as it was not designed to handle the traffic that would be associated with this development. The analysis also looked at alternatives for bridging the wetlands to reduce impacts, which was determined by the Applicant to be cost prohibitive.

#### COMMENTS

- The use of Cutler Farm Road for access may or may not be a workable solution for the project, but there is no supporting information provided relative to the design traffic capacity, other unacceptable neighborhood impacts, acceptability to the Planning Board, etc. on which to evaluate this.
  - The use of the property at 175 Landham Road (Donovan Property) off the southeast portion of the site was not investigated. That property has access to Cutler Farm Road via a paper street. An access route appears feasible that would be of similar length to the proposed crossing, but would only require a short crossing of a small intermittent stream rather than the long crossing of the perennial stream. The route would require some alteration of the outer Riverfront, which would be significantly less intrusive than the alterations proposed for the direct crossing of the perennial stream. To be complete, this alternative should be investigated.
  - Note that I am not advocating for any particular alternative, only a thorough evaluation given the large amount of wetlands resource area alterations being proposed.
- b) The Analysis looked at several different development schemes for the property including a large condo development, two single family residential subdivisions, a 2 lot ANR for single family houses with no wetland alterations, an apartment building scheme with 24 units with no wetlands alterations at the front of the property, and a minor alteration of the current project plan that eliminates the smaller intermittent stream crossing.

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**COMMENTS**

- The 2 lot ANR Plan, the 24 unit multi-Family Housing plan, and the front portion of the 13 Lot Subdivision Plan consisting of 4 lots all could be developed with no need to cross the perennial stream and would substantially reduce or eliminate the wetland resource area alterations. The 24-unit multi-family apartment building alternative appears that it would serve the same purpose of developing rental apartment housing. It also appears that the latter development scheme could possibly be significantly expanded from what is shown and require only minor intrusions into the Riverfront Area that could be designed to meet the General Performance Standards of the Riverfront Regulations 10.58. Further investigation of this latter alternative appears warranted.
- In the assessment of the alternative of the 24 unit Multi-Family housing project the applicant states *"This alternative keeps all of the work outside of areas subject to the Wetlands Protection Act. However, leaving the substantial westerly upland area comprising 18 acres of the site undeveloped is not a reasonable alternative to provide access to this area controlled by the applicant as contemplated by 310 CMR 10.53(3) and the Mass. DEP Wetland Policy...."* (Underline added). The underlined portion of the statement appears to be a significant portion of the issue of whether this project qualifies as a Limited Project. The letters provided by Attorney Witten provides a contrary opinion as to what was contemplated by 10.53(3). I recommend that the Commission request additional information such as past rulings from DEP or other regulatory guidance supporting the Applicant's contention on this subject.

**3. BVW Mitigation - Wetland Replication Area (WRA)**

According to the filing documents, the project will permanently alter 10,485 SF of Bordering Vegetated Wetland. As mitigation, the construction of a 21,000 SF Wetland Replication Area is proposed. Note that the following evaluation is based on the assumption that the project is found to qualify as a Limited Project under 10.53(3)(e). If the project is found to not qualify under that section, the project as designed cannot meet the general performance standard under 10.55(4) and cannot be approved.

Per 10.53(3)(e) "The applicant shall provide replication of bordering vegetated Wetlands and compensatory flood storage to the extent practicable". The applicant

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is proposing to comply with this by a replication of twice the area the BVW to be lost. The 2:1 replication area is proposed to comply with the Sudbury Wetlands Administration Bylaw Regulations. The Replication Area is generally being designed per the applicable DEP Standards with several important exceptions that, in my opinion, make this design not in conformance with the WPA Regulations and standards. These are as follows:

- a) The proposed WRA is being located between two BVW areas that are at different elevations. The wetland bordering on the perennial stream is to the east of the WRA, and a BVW to the west is at a higher elevation. I have no doubt that the area would become a wetland, however, the plan calls for a 2 foot cut directly adjacent to the westerly wetland. Given the sandy nature of the soils, this will lower the water table at the wetland to the west, which in effect will change the hydrology of that wetland. It would likely change a portion of that area to upland by lowering the water table. This likely impact to the adjacent wetland needs to be addressed, and perhaps a more suitable location found. If the WRA shown is to be reconfigured or modified in the same general location, extensive soil testing in the area would be necessary to define the maximum seasonal groundwater elevations throughout the replication area so that the replication area can be designed to not alter the hydrologic conditions that are supporting the westerly wetland.
- b) The WRA does not address the loss of flood storage at the wetland crossing. By the Engineers calculations contained in the Stormwater Report, the 100-year flood elevation on the upstream side of the cart road is 124.3 ft. This elevation is entirely within the BVW so there is no Bordering Land Subject To Flooding under the WPA, however this adds a value of flood storage to the BVW that must be addressed. (WPA Regs 10.55(4)(b)7.) and per 10.53(3)(e)). In order to provide compensating flood storage, at least a portion of the WRA would need to be upstream of the culvert. Calculations as to the flood storage being lost and compensating flood storage are required.
- c) The proposed wetland being filled is presently a mix of shrub swamp and wet meadow. The plantings being proposed appear to be attempting to create a wooded swamp.

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- d) The plan for the replication is a narrative type. An actual planting plan is recommended for the final plan.
- e) The calculation of the 10,485 SF of permanent BVW alteration appears to be based on the area between the limits of the exterior of the retaining walls. During construction, there will also be alteration of BVW outside of the retaining walls for excavation of footings, installation of erosion controls, etc. The computation of the area must include the total alteration and the plans must include information relative to the restoration of that wetland outside the walls in place.

#### 4. Riverfront Area Performance Standards

For reference, the General Performance Standards are at 10.58(4). The "Wetlands Permitting Summary" contained in the Notice of Intent package contends, *"that the project satisfies the regulatory performance standards for work in the Riverfront Area."* I disagree with this conclusion for the following reasons:

- a) Protection of Other Resource Areas 10.58(4)(a): This section requires that the "work shall meet the performance standards of all other resource area within the Riverfront Area,...." Presuming that the project qualifies as a "Limited Project" the regulations require replication of the BVW and compensatory flood storage. As described above, the project as designed does not meet that standard. If the project does not qualify as a "Limited Project", the project does not meet the General Performance Standards for BVW, so again, this project could not be allowed.
- b) Protection of Rare Species - 10.58(4)(b): Not applicable.
- c) Practicable and Substantially Equivalent Economic Alternatives - 10.58(4)(c):  
I disagree that the applicant has submitted an Alternatives Analysis sufficient to demonstrate that there are "no practicable and substantially equivalent economic alternatives to the proposed project with less adverse effects on the interests identified in M.G.L. Ch. 131 s.40". The reasons include the following:



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- The discussion relative to the Alternatives Analysis, items a) and b) under the Limited Project qualification section earlier in this report is directly applicable to this item. Those sections detail how the Alternatives Analysis performed is not sufficient to meet this standard in two significant areas.
- In addition to the alteration relative to the Limited Project Crossing, the project includes alterations of Riverfront Area including the entirety of Building #10, a portion of Building #5, an "Office Building" for the complex, parking facilities, and related clearing, grading and landscaping. Due to the extensive wetland resource area alterations proposed for the crossing, it would be very important to provide a more thorough evaluation of alternatives to reduce the wetland resource area impacts including Riverfront. Obvious examples to name a few would include:
  - 1) Can the project be reduced to "Avoid" the intrusions into the Riverfront beyond that for the crossing by eliminating the project components identified above?
  - 2) Can the development be consolidated into a smaller number of taller buildings with consolidation of parking and perhaps multi story parking garages to reduce the footprint of the development?
  - 3) Could some of the units be placed at the front of the site in multi-story buildings, reducing the number in the central portion of the site to avoid the additional Riverfront impacts?
  - 4) Could the Office be included in one of the buildings?

Again, I am not advocating for any particular alternative, only a thorough evaluation given the large amount of wetlands resource area alterations being proposed.

The above are only relevant if the project is found to qualify as a Limited Project. If it does not qualify, the above are moot, as the project cannot meet the General Performance Standards of the Riverfront Regulations.

d) No Significant Adverse Impact 10.58(4)(d):

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The Riverfront Area Performance Standards section contained on page 16 of the "Wetland Permitting Summary" states that *"In addition, the project, including the "Limited Project" roadway impacts, affects less than 10% of the Riverfront Area of the site, and thereby complies with the "no significant adverse impact" provision of 310 CMR 10.58(4)(d). Therefore, it is Eco Tec's opinion that the proposed project satisfies the regulatory performance standards for work in Riverfront Area."* Underline added.

I disagree with this conclusion. This project ignores compliance with the provisions of 10.58(4)(d)1.a. That section severely limits work within the 100-foot inner riparian zone, which this project does not meet. This project may be allowed through qualification as a Limited Project, but cannot be approved without that qualification, as it would not meet this General Performance Standard.

#### **5. Bank Performance Standards 10.54(4)(a) Wetland Crossing Culverts**

As part of the Mitigation for the wetland crossings, the Applicant has proposed providing culverts that meet the Mass. Stream Crossing Standards. If there is going to be crossings of the streams on the project, I concur that they should be designed to meet those standards at a minimum. Bridging for the perennial stream crossing has been considered by the applicant and ruled out as too costly. I would concur that the two bridge scenarios analyzed would be cost prohibitive. (This is further discussed below.)

It is my opinion that meeting the Stream Crossing Standards is feasible at the site. It is also my opinion that this is required in this case to meet the performance standards in this section as well as requirements of the Mass. Water Quality Certification Regulations and the Army Corp standards, both of which will apply to this project. However, I have several issues with the culvert design proposed as follows:

- a) No computations have been submitted supporting that the culverts as designed meet the standards. (Openness Ratio, etc.)
- b) The main stream crossing culvert as designed will lower the flood elevation of the area upstream of the culvert by the Engineers own

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calculations. This needs to be considered and addressed relative to the impacts to the upstream and downstream wetland.

- c) The design detail and the information contained in the "Bank Restoration Protocol" section of the Wetland Permitting Summary provided do not show the information needed to replicate the natural stream channel to meet the Stream Crossing Standards. There are good examples of the natural stream channel upstream and downstream of the culvert on which to base the design.
- d) The channel will be focusing stream flow at one point rather than a broad overtopping of the cart road as the engineers calculations predict. The engineer needs to look a velocities through the culvert and design the channel section for stability accordingly while meeting the wildlife aspects.

The bridging idea as analyzed rules out a very log span. I would, however suggest that the installation of a shorter bridge crossing may have advantages over a span of 12 feet afforded by the culver crossing proposed in being able to replicate the stream section and provide flood overtopping to replicate the flood control aspect of the crossing. Given the scope of the project, I believe the culvert may be designed to work to meet the standard, but I would recommend the Applicant consider a short bridge.

## **6. Land Under Water Bodies and Waterways Performance Standards**

### **10.56(4)(a) Wetland Crossing Culverts**

The perennial stream being altered contains this resource area. This is not mentioned in the Notice of Intent. This needs to be corrected on the NOI form and the compliance with this resource area addressed for completeness of the filing.

Generally the performance standards of this section will be addressed by the culvert or bridge being properly designed in accordance with the Stream Crossing Standards as discussed above.

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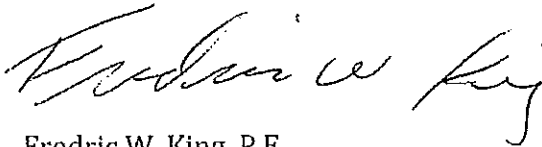
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**7. Stormwater Management 10.05(6)(k)**

The review of compliance with the Mass. Stormwater Management Regulations and Handbook is included in a separate report.

If you have any questions regarding this report, or would like me to look at any other aspect of the WPA Regulations that have not been covered, please feel free to contact me.

Sincerely,



Fredric W. King, P.E.  
Senior Project Manager  
Senior Wetland Specialist.

CC: Deborah Dineen (and for further distribution)

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RE: **MassDEP File No. 301-1068** Stormwater Management - Initial Review  
Johnson Farm - 189 Landham Road, Sudbury, MA

Dear Commission Members:

This report contains the findings of my initial review of the Stormwater Management Plan and Site Plans prepared by Tetra Tech as part of the Notice of Intent under the Mass. Wetlands Protection Act filed by Robert Moss of Madison Place Sudbury LLC (Applicant). The proposed project is a residential apartment development at the subject site. This review has been performed per our contract/proposal dated October 12, 2011.

This report is relative to the project compliance with the Mass. Stormwater Management Regulations per 310 CMR 10.05(6)(k) and the MassDEP Stormwater Management Standards Handbook and with general good engineering practice. Our findings are based on the following submitted documents, plans and information:

- Attendance at the Wetlands Protection Act hearing on October 24, 2011.
- A site visit on October 28, 2011.
- Review of the filed plans and documents including but not limited to:
  1. Notice of Intent and attached documents contained in the NOI booklet (October 4, 2011)
  2. Site Development Plans entitled "Comprehensive Permit Preliminary - Site Development Plans, The Residences at Johnson Farm...." (as updated 10/4/11) containing 20 sheets.
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  5. Letter from Tetra Tech dated October 17, 2011 containing "Supplemental Stormwater Information".
  6. Supplemental Information provided by Tetra Tech dated November 7, 2011 relative to Porous Pavement.
- As additional background information and a more complete understanding of the project, the Comprehensive Permit Application filed with the Zoning Board of Appeals for the project dated August 8, 2011 under MGL Ch. 40B was also reviewed.

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- For additional information on porous pavement, we reviewed the available information on the UNH Website.

### **1. Submittal Documents - General Content**

The Stormwater Management Plan for the project and the Site Plans generally contains the required materials per the Mass. Stormwater Management Regulations and as prescribed in the DEP Stormwater Management Handbook. The materials are generally sufficient to describe the intent of the stormwater design and determine whether the project as designed complies with the requirements with certain exceptions that are outlined in this report.

It is noted that the Site Plans are "Preliminary" and of the nature intended for permitting. As such, they lack certain detailed information necessary for construction. In some areas additional detail is necessary for a complete understanding of the Intent, errors are found, or questions are raised requiring further explanation. Those judged by this reviewer as important for this evaluation are pointed out in this report for correction, additional information or other response from the applicants engineer as necessary.

### **2. Erosion and Sediment Control - Stormwater Pollution Prevention Plan**

The Notice of Intent documents and the narrative of the Stormwater Management Report 1.0 and 3.8 state that a SWPPP was prepared by Eco Tec and submitted with the NOI. SBNE did not receive a copy of the SWPPP for review. The Stormwater Checklist contained in Appendix A indicates that the SWPPP has not been prepared and that the SWPPP will be prepared before any land disturbance.

Note that for a project of this complexity, the preparation of a SWPPP is not strictly required by the Regulations. The Erosion and Sediment Control Plan submitted shows the requirements for Erosion and Sediment Control in a general manner, which is common for this type of filing. With a project of this complexity, it is important that the actual contractor that will be doing the work be involved in the development of the SWPPP. The SWPPP is also time sensitive. A project that begins site work in April will need to be managed much differently than one beginning August.

### **Comments and Recommendations:**

- a. Due to the very close proximity to wetlands of all the work, the working space is extremely tight. Also, it will be imperative that the work be done in

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such a manner to protect the porous pavement bed and underlying soil from over compaction and contamination with fine silt that could seriously affect its performance. The project, therefore, needs to be carefully sequenced. Opening up the entire site and attempting to construct the whole site in one construction operation with all buildings being constructed at one time (although not impossible) is not recommended.

- b. Crossing of the wetland will require significant excavation of wet soils and dewatering in close boundaries. This work should take place during the driest time of year and this operation needs to be carefully planned and detailed.
- c. Per the Construction Sequence included in the Stormwater Report, the porous pavement base and paving is done at the end of Phase 4, prior to finish grading, landscaping and stabilization of the roadsides and adjacent areas that are to be done in Phase 5. This finish work in tight working space will be difficult to control the tracking of mud onto the pavement. It is recommended that as much of the roadside area, stormwater basins, etc., as possible be finished graded and stabilize before the installation of the base and pavement. This would leave only the road edges and planting left to be completed.
- d. Given the tight working conditions in close proximity to the wetlands, the preparation of a SWPPP of the complexity required should not be left to the last minute before construction. This should also be reviewed and approved by the Conservation Commission and other permitting agencies well in advance of construction. If the project is approved, I recommend a condition be placed in the Order requiring submittal of the SWPPP with sufficient time allowed for review and approval. In the meantime, I would recommend that a preliminary SWPPP be prepared that contains the basic requirements per the NPDES Construction General Permit to be utilized as a basic framework for the later complete SWPPP.
- e. Given the earthwork required, the small stockpile areas shown on the plan would not be adequate unless the project is constructed in multiple pieces so that only small areas are worked at any given time.

### 3. Porous Pavement

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The stormwater management system relies primarily on porous pavement systems for water quality treatment, control of peak rates of runoff, volume/recharge control and general compliance the Mass. Stormwater Management Regulations. This stormwater management technique is gaining acceptance as a stormwater BMP and is a recognized LID technique. The use of this BMP to this extent for a project is still quite rare, but examples do exist and there is substantial study and design information available, particularly through the University of New Hampshire. The MassDEP Stormwater Handbook contains guidance on the design and use of porous pavement, much of which utilizes the information developed at UNH, and recommends using the information from that source and a few others.

In general, the engineers have designed the systems following the design recommendations and specifications developed by UNH. In my review of the plans and documents, I did note several possible problem areas and have some questions and comments relative to the design and calculations for the design engineers as follows:

- a. The engineer uses an "extended time of concentration" of 481 minutes to model the time for the subcatchment runoff to reach the pavement storage reservoir. If you assume 5 minutes of the  $T_c$  to be the time to reach the pavement, the infiltration time for runoff to reach the storage layer translates to approximately 3.9 inches per hour. Given the materials in the pavement and base section, this rate seems somewhat slow. The report states that this rate is based on data produced by UNH. Some additional information on that should be provided.
- b. In the porous pavement information contained in the MassDEP Stormwater Handbook, it states that the "storage reservoir must be completely flat so that runoff can infiltrate through the entire surface". The model of the porous pavement ponds also indicates this is being done for each section of porous pavement. The plans, however, do not indicate the bottom elevation of each particular section of reservoir. They only indicate that the bottom is 31 inches below the pavement surface, which would mean that the reservoir slopes with the surface grade. The example cross sections contained in the October 17, 2001 Supplemental Stormwater Information provided by Tetra Tech indicate the reservoir base grade follows the surface slope. If that is the case, then the computer model of the reservoir would not be correct. Additional information indicating the reservoir elevations need to be shown



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on the plan and should be designed as flat for each section. Alternatively, additional information is necessary as to why the reservoir need not be flat and why it is appropriate to model the reservoir as if it were flat.

- c. Each section of reservoir is at a different elevation with no physical separation between sections. What stops stored water from moving from a higher reservoir to an adjacent one with a lower elevation?
- d. In a couple of areas, separation to groundwater is less than indicated on the plans.
  - One is at the location of the Typical Pavement Section in Figure S-1 of the October 17, 2011 Tetra Tech letter. The Section indicates a groundwater elevation of 124.5, which is the elevation, determined at the test holes on the northwest side of that section. However, there is an isolated wetland at Building 6 at elevation 127 and the wetland directly behind Building 6 is at between 127 and 126.4. Will this have any implications as to the concept?
  - The other location is at the area near Building 4 where the water table on the north side of the road is at 127.4 and on the south side of the road, the wetland nearby is at 130.4. This would place the reservoir for that section less than 2 feet above the water table and may not provide the minimum 2 foot separation to groundwater required. The engineer should look at that section to see if any adjustments are necessary.
- e. It is clear how the systems are supposed to work at the typical sections where there is ample distance between the storage reservoir and the surrounding natural landscape elevations. However, additional explanation as to how the porous pavement system works in the area of the three culvert crossings should be provided. The MassDEP recommends a 20-foot setback to foundations walls. At these sections, the reservoir is designed to be about 5 feet from the walls and well above the adjacent wetland terrain. It is my understanding from the Engineer's presentation at the last hearing that the wall will be a segmental block type of wall. What prevents the runoff exfiltrating from the reservoir from following the path of least resistance and short circuit out through the wall, or from following the exterior of the culvert through the wall and acting as a direct discharge point?

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- f. For the 6-inch subdrain to work as modeled in the hydrologic calculations, the orifice holes must be on the top of the pipe, or the invert needs to be 6 inches off the bottom of the storage reservoirs. This information needs to be added to the plans.

#### **4. Outlet Ponding Areas (Rain Gardens)**

The outlet ponding areas are designed to receive runoff from the buildings and the surrounding landscape, provide an overflow outlet from the porous pavement storage reservoirs, and allow water from the building runoff to utilize the pavement reservoir for infiltration so the systems act together for the intended function. I do not have any issue with this concept. I do have the following comments on a couple of points:

- a. The plans lack any detail on the design of these basins. The written Stormwater report describes the intent. The detail of these needs to be placed on the plans. Of particular concern is the overflow spillway. Per the plan, it looks like the basin would simply overtop the vegetated bank as a "level spreader". In reality, this would not occur and the flow would find a low point on the bank and would likely erode the bank. Dimensions are contained in the hydrologic model as to the width of the level spreader. An actual level spreader with a stabilized embankment to bring the overflow to the natural terrain at the wetland should be provided.
- b. The ponding area to the east of Building 4 is below the level of the adjacent wetland and may be below the water table. The engineer should look at this to see if there is an issue, as the bottom may not drain properly.

#### **5. Long Term Pollution Prevention Plan (LTPPP)**

The LTPPP includes the basic requirements for the maintenance of the stormwater systems. Given the importance of the proper maintenance of the stormwater system, including the porous pavement, it is recommended that this basic information be built into a detailed maintenance manual for use by the manager of the site. The manual would provide information on specific items to note on inspections of each bmp, what problems to watch out for, etc. There would need to

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be more specific information on exactly what maintenance is required for the rain gardens (such as not allowing trees to grow on the berms, vegetation management, depth of accumulated sediment that would trigger removal, etc. It is also be recommended that a more rigorous inspection and monitoring schedule be required for the first few years of operation on which to base adjustments to the maintenance program to reflect the actual maintenance required for the site specific conditions.

Maintenance of the porous pavement is critical for this facility. The written documentation is not consistent on the number of times that cleaning is required. In one place the document states bi-annual, in others it states quarterly, in others it states quarterly up to monthly as necessary. The actual program needs to be made explicitly clear, and what inspections should be looking for to trigger requiring cleaning.

The spill of oil or toxic material onto the porous pavement would need special treatment that responders should be notified of. For example, you cannot hose off the surface and collect the water for removal. The contaminated pavement and portions of the base may need to be removed. The actual procedures need to be clearly spelled out.

## 6. Hydrologic Model and Calculations

This review is based on the Stormwater Management Report and Plans as dated October 4, 2011. It is our understanding that the Engineer is in the process of revising the calculations regarding the off-site watershed so my comments will be regarding the on-site portions of the stormwater model. The following are my findings based on the October 4, 2011 information:

### a. Existing Conditions Model

- The existing culvert at the cart road at the perennial stream was measured in the field by SBNE during the site visit as a 31" x 50 inch CM pipe arch. This is likely a standard 32 X 49 pipe that is slightly depressed in place. The dimensions used in the model are 32.4" x 53.8", which is not far off, but the model assumes a box culvert rather than a pipe arch. The model did not indicate any correction factor applied to adjust the capacity. Was one applied? If not, the model needs to be adjusted.

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- The pond model of the area upstream of the culvert does not include any storage and the overtopping of the cart road is not considered on the model. This should be included to properly model the flood elevation on the upstream side of the cart road and the discharge to the downstream area.
- The discharge from the culvert is directly added to the Design Point DP-1. This flow should be routed through the stream reach. Per the Tc calculations for Subcatchment 1-B, the travel time for that reach is 13 minutes, so it may be significant.
- Rainfall Depths used for the calculations are from the Sudbury Stormwater Bylaw. These are larger than the TP-40 data but I have no objection to using these larger rainfall depths.

b. Proposed Conditions Model

- There appears to be an error in the model regarding the routing of Subcatchment 2-D. The proposed conditions model shows that subcatchment flowing west through the proposed culvert as part of the watershed to DP-2. The existing conditions model shows that area draining to the east as part of the watershed to DP-1. Based on the Topo information available, the Existing Conditions model appears to be correct.
- The proposed box culvert at the perennial stream (modeled as Pond 1P) is modeled as a clean 12' x 4' box culvert with an n value of 0.013. This does not take into consideration the construction of the streambed in the culvert. It is also noted that the culvert would significantly lower the flood elevation of the upstream wetland. See the comments made in the separate SBNE Wetlands review report also dated 11/14/11 for additional information on the stream crossing standards.
- Discharge from Pond 1P above is also added directly to the Design Point 1 reach. As with the existing conditions, this should be routed through the stream reach.
- The Pond 1P is also modeled with no flood storage considered. This is necessary for the evaluation of wetland impacts and a better representation of downstream discharges
- The discharges from the smaller ponding areas around the site are also added directly to the main design points DP-1 and DP-2. In my opinion, this would be an allowable conservative simplification, as flood routing all these small discharges through reaches to the design point would most

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likely result in lower proposed conditions flows than the model predicts as presently configured.

- The exfiltration rate from the porous pavement storage reservoir is set at 0.27 inches per hour, which is the infiltration rate of a silt loam. Based on the profile of the pavement sections, it is my opinion that this is conservative in most cases around the site and is appropriate.
- See the related comments above in this report relative to the Porous Pavement design, responses to which may affect the model.

It is noted that stormwater issues are also being reviewed separately for the Sudbury Zoning Board of Appeals by Hancock Associates under the Comprehensive Permit Filing presently underway. The Commission should also consider that review when it is available.

If you have any questions regarding this report, or would like me to look closer at any other aspect related to Stormwater that have not been covered, please feel free to contact me.

Sincerely,



Fredric W. King, P.E.  
Senior Project Manager  
Senior Wetland Specialist.

CC: Deborah Dineen (and for further distribution)