

AT THE BELMONT CONSERVATION COMMISSION

Applicant : AP Cambridge Partners
Serial No. : DEP 106-0075
Filed : June 12, 2007
Title : RESIDENCES AT ACORN PARK

ORDER OF CONDITIONS
310 CMR 10.05(6)(c)

1: PROCEDURAL HISTORY

On June 12, 2007, AP Cambridge Partners, LLC (“the Applicant”) filed a notice
5 of intent with the Belmont Conservation Commission (“Commission”) describing plans
to construct certain residences at Acorn Park Drive. The Applicant proposes to construct
a 299 unit housing complex with associated parking areas, on-site and off-site utility
connections, and stormwater management devices. The proposed project location is on
undeveloped land in Belmont and Cambridge. The proposed project includes alterations
10 of 61,421 square feet of the 100-foot buffer to Bordering Vegetated Wetlands (“BVW”) and
13,830 square feet of jurisdictional Bordering Land Subject to Flooding (“BLSF”).

The Commission opened the hearing on June 26, 2007. The hearing was
continued at the Applicant’s request on August 7, 2007, September 11, 2007, October 2,
2007, November 5, 2007, and December 4, 2007. The public hearing closed, at the
15 Applicant’s request, on December 4, 2007.

Plans, documents, and other material submitted by the Applicant are attached to
this order. Other materials considered by the Commission during the public hearing
period are listed in Attachment A. Collectively, these materials constitute the record
20 (“Record”) that the Commission reviewed in making its findings and determination and
in issuing this Order for this project.

2: JURISDICTION

The Commission has determined that the Residences at Acorn Park
Development project will require removal, filling, dredging, or alteration of areas that are
significant to one of more of the interests identified in 131 MGL 40. Specifically, the
25 project plan includes the following:

- Removal, filling, and alteration of Bordering Land Subject to Flooding (“BLSF”)
- Removal, filling and alteration in the 100-foot Buffer adjacent Bordering Vegetated Wetlands (“BVW”)

5 Consistent with 310 CMR 10.05(6)(b), the project is subject to the requirement that stormwater be managed according to standards established by the Massachusetts Department of Environmental Protection (“Department”) in its Stormwater Policy.

3: ENVIRONMENTAL SIGNIFICANCE

10 The site under consideration for this project is a 15.6 acre property of which approximately 13 acres are in Belmont. This area has particular environmental significance for the interests of flood control and wildlife habitat protection. Although commonly called the Uplands, the elevation of the site varies from approximately 8 feet above sea level to 23 feet with Little River running along one side at an elevation of about 5 feet. The site is surrounded by marshland located just across Route 2 and Acorn
15 Park Drive, and abutting wetlands and Little Pond on Department of Conservation and Recreation (“DCR”) property. These areas and the site itself serve as important areas for flood storage.

Of the nearly 13 acres, 8.5 acres is described by the Applicant as forested upland and 7.1 acres as forest, scrub shrub and emergent wetlands. The forest, predominantly a
20 stand of mature silver maple trees, is an unusual natural feature in a densely developed urban watershed, and is unique in the upper Mystic watershed area. The Uplands site “... retains, in spite of and possibly because of its history of disturbance, a broad suite of environmental functions and values. Flood storage, flood de-synchronization, water quality attenuation, and wildlife habitat functions appear to have both local and regional
25 value.”¹

According to historical maps, the Alewife watershed area was estuarial tideland until the building of the Cradock Dam. Even prior to the development of the contributing

¹ Forest Characterization Report, Little Pond/Little River, Belmont/Cambridge, Massachusetts Charles, J. Katuska, M.F.S., P.W.S.

municipalities during the past century, the Alewife basin experienced surface flooding. Today the region is intensely urbanized and contains extensive impervious surfaces that further contribute to rapid runoff and flooding.

There have been six recent major flood events (10-yr or greater) affecting areas on and around the site: October 1996 (50 yr), June 1998 (25 yr), March 2001 (25 yr), April 2005, October 2005 and May 2006. Little River has been observed on some occasions to flow backward into Little Pond due to flooding downstream, and it is well known that substantial sections of Acorn Park Drive have been inundated. Data suggest that at 3' NGVD street flooding begins in the lowest lying residential neighborhoods, at 5' NGVD there are sewage backups, and at 8' NGVD Alewife Brook Parkway is under 2-4' of water.² Route 2 and Alewife Brook Parkway have been closed due to Alewife Brook flooding three times in the last six years (October 1996, June 1998, and March 2001).

The current municipal wastewater and stormwater systems of Alewife communities are unable to accommodate floodwaters. While Arlington and Belmont have separate sanitary sewer and storm water systems, Cambridge has a combined sewer overflow system (CSO) that contributes both sanitary waste and storm water flows to the MWRA's interceptor pipe system. The CSOs discharge untreated sanitary waste mixed with stormwater into the Alewife Brook during large or intense rainfall events. In an average year, about 13 CSO events discharge approximately 22 million gallons of combined sewage into Alewife Brook.³ During certain storm events, Acorn Park Drive and other low lying streets become flooded with contaminated water, while residents in areas of low elevation in the three municipalities experience sewage rising up through plumbing fixtures in their basements. In some locations, sanitary manholes overflow onto roadways and yards and into the storm drain system that drains to Alewife Brook.

The resource areas adjacent to the Acorn Park Development are also of particular significance for the protection of wildlife habitat. Additionally, the current wildlife

² Kaiser, Steve, Letter to FHMP on Rain Data and Flood History: Preliminary Analysis of FEMA Report for Middlesex County, November 21, 2007 Summary of Review: November 20, 2007

³ Hammett, Nancy (MyRWA), Perez, Grace et. al., *Mystic River Watershed Assessment and Action Plan*, Fall 2006, prepared for: MA EOEA and MA DEP, P. 3-2

habitat functions of the buffer zone and other non-resource areas of the site complete and complement the habitat of the wetlands and BLSF. As described below, the destruction of the wildlife habitat within the non-resource area would irreparably alter the biological characteristics of the resource areas.

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Pre-development conditions at the site exhibit features of significant, site-specific wildlife habitat value and uniqueness. As such, the Uplands parcel is essential to the integrity of the wildlife habitat function on the entire site and in the adjoining 130-acre Alewife Reservation. Critical features that make the site and its resource areas of particular significance include the following:

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- The site provides wildlife corridors between wetland and upland wildlife habitat.
- Its location in a major flyway makes it an important waystation and overwintering place for migrant birds. (Fairbairn, 2007)
- As one of the largest remaining upland parcels in the Alewife Reservation area, the site provides contiguous, core habitat and refuge for forest-interior wildlife species (Normandeau Associates, 2006).
- While only 5 to 23 feet above sea level, the Uplands are the sole significant natural upland for wildlife using both wetland and upland habitats above the 100-year floodplain in the Alewife area
- The Uplands and the Alewife Reservation provide wildlife habitat for over 90 species of birds and at least 16 species of mammals. (Brown, 2002)
- Seventeen species identified in the Alewife area depend on both upland and wetland habitat. (Alden, 2003)
- The Upland's trees, predominately silver maples, are an excellent food source, and provide cover and nesting cavities, as well as perching opportunities for raptors. (Katuska, 2003)
- The site buffers water resources from major roadways.
- The site offers shade that moderates ground and runoff water temperatures, critical for fisheries. (Katuska, 2003)
- Leaf litter enriches the soil and provides food and shelter for amphibians and reptiles. (Katuska, 2003)

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4. FINDINGS

Based on consideration of the Record, the Commission has determined that a portion of the area where the work is to be done is significant to interests identified in 131 MGL 40.

For reasons listed in section 4.1 and discussed in detail in sections 5.1 to 5.10, the Commission finds that the proposed work fails to comply with standards 1, 2, 3, and 4 of the Department's Stormwater Management Policy, and with certain provisions of the Wetlands Protection Act's (WPA) Regulations.

For reasons listed in section 4.2 and discussed in detail in sections 5.1 to 5.10, the Commission finds that the information submitted by the Applicant is not sufficient to describe the site, the work, and the effect of the work on the interests identified in 131 MGL 40. Therefore, as required by 310 CMR 10.05(6)(c), the Commission finds that it cannot condition the work as proposed, and is therefore issuing an Order prohibiting the work. A specification of the information that is lacking and the reasons why it is necessary follows.

4.1: Summary of Areas of Non-Compliance and Insufficient Information

Stormwater Management Standard #4

1. The Applicant has failed to overcome the burden set forth in Rule 10.03(1) of demonstrating that the proposed stormwater management system will contribute to the interests identified by the Wetlands Protection Act by complying with Stormwater Management Standard #4's requirement that 80% of TSS be removed. (see Section 5.1)
2. The Applicant has failed to provide requested information that adequately supports the accuracy of the Applicant's assumption concerning the TSS removal rates of the proposed Stormceptor and underground infiltration chambers. Accurate information about TSS removal rates of all components of a stormwater management system is reasonably necessary

for establishing compliance with Stormwater Management Standard #4.
(see Section 5.1)

3. The Applicant has failed to provide requested information about any alternative that complies with Stormwater Management Policy #4 for 80% TSS removal, where such compliance is demonstrated on the basis of TSS removal assumptions and invert elevations acceptable to the Commission for the Stormceptors. (see Section 5.1)

Stormwater Management Standard #2

4. The Applicant has failed to overcome the burden set forth in Rule 10.03(1) of demonstrating that the proposed stormwater management system will contribute to the interests identified by the Wetlands Protection Act by complying with Stormwater Management Standard #2's requirement that post-development peak discharge rate not exceed the pre-development peak discharge rate. (see Section 5.2)

5. In response to the Commission's requests, the Applicant has failed to provide a corrected HydroCAD analysis that incorporates assumptions acceptable to the Commission for demonstrating the difference between pre-development and post-development peak discharge rates. Accurate information about pre- and post development runoff is reasonably necessary for establishing compliance with Stormwater Management Standard #2. (see Section 5.2).

6. The Applicant has failed to provide requested information about any alternative that complies with Stormwater Management Standard #2's requirement that the post-development peak discharge rate be less than the pre-development peak discharge rate at each of the analysis points, based on a corrected HydroCAD inputs and analysis prepared by the Applicant's consultant. (see Section 5.2)

7. The Applicant has failed to provide requested information concerning the effect of the untreated discharge of perimeter drains directly into Flared End Structure

(“FES”) outfalls. (see Section 5.2)

Stormwater Management Standard #3

8. The Applicant has failed to overcome the burden set forth in Rule 10.03(1)

5 of demonstrating that the proposed stormwater management system will
contribute to the interests identified by the Wetlands Protection Act by
complying with Stormwater Management Standard #3’s requirement that
(1) the lowest point of each infiltration chamber be at least two feet above
the seasonal high groundwater level; (2) that no infiltration chambers be
located over fill; (3) that no infiltration chamber be located within 100 feet
10 of surface waters; (4) that no infiltration chamber be located too close to a
20% slope; and (5) that all infiltration chambers provide adequate
percolation. (see Section 5.3)

9. The Applicant has failed to provide requested information to support the

15 proposition that test-pit measurements provides an estimate of seasonal
high groundwater level that is more accurate than similar estimates
derived from existing observation wells on the site that were previously
submitted to DEP in an earlier notice of intent. Accurate information
concerning groundwater level is a prerequisite for estimation of seasonal
high groundwater level, knowledge of which is reasonably necessary for
20 establishing compliance with Stormwater Management Standard #3. (see
Section 5.3)

10. The Applicant has failed to provide requested information concerning any
alternative that complies with Stormwater Management Standard #3’s
requirement that the lowest point of each infiltration chamber be at least
25 two feet above the seasonal high groundwater level. (see Section 5.3)

Alteration of Buffer Zone

11. The Applicant has failed to provide requested information concerning any
alternative that avoids alteration of land in the 100-foot buffer adjacent to
BVW on the south or west sides of the site, or in a 25-foot buffer adjacent
30 to BVW bordering the intermittent stream parallel to Frontage Road.

Particular interests in which these buffer zones are significant include wildlife protection and pollution prevention. Particular effects of any such work on the interests identified in the Wetlands Protection Act include habitat removal for species requiring both upland and wetland habitats, dewatering the BVW by nearby excavations, and discharge of heat, sediment, and other pollutants to resource areas and impaired surface water. (see details at Section 5.6)

Stormwater Management Standard #1

12. The Applicant has failed to overcome the burden set forth in Rule 10.03(1) of demonstrating that the proposed stormwater management system will contribute to the interests identified by the Wetlands Protection Act by complying with Stormwater Management Standard #1's prohibition against providing a new stormwater conveyance that causes erosion in wetlands. (see details at section 5.7)
13. The Applicant has failed to provide requested information concerning an alternative that complies with Stormwater Management Standard #1 by avoiding erosion in resource areas and buffer zones into which new FES structures direct concentrated volumes of stormwater. (see Section 5.7)
14. The Applicant has failed to provide any alternative that avoids drainage of untreated stormwater into a resource area via compensatory flood storage areas CFSA-2 and CFSA-3, thereby violating Stormwater Management Standard #1's prohibition against discharge of untreated stormwater into waters of the Commonwealth. (see Section 5.7)

Unrestricted Hydraulic Connection

15. The Applicant has failed to overcome the burden set forth in Rule 10.03(1) of demonstrating that the roadside ditch connecting the CFSA to the Little River will contribute to the interest of flood control as identified by the Wetlands Protection Act by providing an unrestricted hydraulic connection as required by Rule 10.57(4)(a). (see details at Section 5.8)

16. The Applicant has failed to provide requested information about an alternative that avoids connecting a CFSA to the flooding water body by a hydraulically restricted roadside ditch. (see details at Section 5.8)

5 17. The Applicant has failed to provide requested information about a staging analysis to evaluate the roadside ditch's dual role of accommodating both rising floodwaters and stormwater. Such information is necessary for the Commission to validate the Applicant's position that evaluate whether the roadside ditch can function as an unrestricted hydraulic connection. (see details at Section 5.8)

10 **Thermal Loading**

18. The Applicant has failed to provide requested information about any alternative that would protect the resource area from the discharge of heated stormwater. (see details at Section 5.9)

15 19. The Applicant has failed to provide requested information from which one could determine whether the discharge of stormwater with elevated temperature would result in violations of the Massachusetts Surface Water Quality Standards. Such information is necessary to enable the Commission to determine whether the proposed incursion of runoff would result in an alteration of the resource area, and whether any such incursion would adversely affect the Act's interest in preventing pollution, protecting wildlife habitat, and protecting fisheries. (see details at Section 5.9)

Compensatory Flood Storage Configuration

25 20. The Applicant has failed to provide requested information concerning an alternative that complies with Rule 10.57(4) by providing compensatory storage that is incrementally equal to storage displaced by the proposed project. (see Section 5.5)

21. The Applicant has failed to overcome the burden set forth in Rule 10.03(1) of demonstrating that the proposed CFSA contribute to the interests

identified by the Wetlands Protection Act by complying with Rule 10.57(4)'s requirement that compensatory storage be incrementally equal to storage displaced by the proposed project. (see Section 5.5)

Alteration of BLSF

- 5 22. The Applicant has failed to provide any information concerning an alternative that is consistent with the proposed use of the site and that avoids alteration of BLSF. (see Section 5.4)

Wildlife Habitat Replication Areas

- 10 23. The Applicant has failed to overcome the burden set forth in 310 CMR 10.60(3) of demonstrating that the proposed habitat replication areas have wildlife habitat characteristics similar to those of the lost areas, or that the proposed habitat replication areas have elevations of groundwater relative to the surface similar to the lost areas, and contribute to the interests identified by the WPA by complying with the restoration and replication of altered wildlife habitat standard of 310 CMR 10.60(3) of the WPA. (see
15 Section 5.10)

5. DETAILED DESCRIPTION

The regulations require concurrence by the Conservation Commission that stormwater from activities within the 100 foot buffer zone of any inland resource areas specified in
20 310 CMR 10.51 through 10.60 be managed according to the Department's Stormwater Standards.

Based on the information provided, the Commission cannot concur with such a determination. In particular, the Applicant has failed to provide information necessary to demonstrate compliance with Standards #1, #2, #3, and #4.

- 25 Additionally, there are several other areas where there is insufficient information to ensure the interests of the WPA are protected from proposed alterations to BLSF and the 100 foot buffer to BVW.

5.1. The Applicant has failed to provide sufficient information to confirm compliance with Stormwater Management Standard #4

Stormwater Management Standard #4 states the following:

- 5 *For new development, storm water management systems must be designed to remove 80% of the average annual load (post-development conditions) of Total Suspended Solids (TSS). It is presumed that this standard is met when:*
- 10 (a) *Suitable nonstructural practices for source control and pollution prevention are implemented;*
 - (b) *Storm water management best practices (BMPs) are sized to capture the prescribed runoff volume; and*
 - (c) *Storm water management BMPs are maintained as designed.*

15 The Commission finds that the Applicant has failed to overcome the burden set forth in Rule 10.03(1) of demonstrating that the proposed stormwater management system will contribute to the interests identified by the Wetlands Protection Act by removing 80% of the average annual load (post-development conditions) of Total Suspended Solids (TSS). In particular, the Applicant has failed to demonstrate that stormwater management practices selected, designed, located, sized, and considered sequentially in a treatment train are capable of removing 80% of the average annual load of TSS.

20 In response to requests for information,⁴ the Applicant has failed to provide sufficient information to support the proposition that the stormwater management system would indeed remove 80% of TSS. Accurate information concerning TSS -removal rates of all system components is clearly necessary to determine compliance with Stormwater Management Standard #4. Therefore, the Commission lacks sufficient information to establish compliance with Standard #4.

25 This finding of non-compliance is consistent with testimony provided by Scott Horsley, who, in his 12/4/07 letter to the Commission concluded “[w]e do not believe that the proposed project meets the minimum 80% total suspended solids (TSS) requirement of the Massachusetts Storm Water Policy.”

⁴ See 9/11/07 letter from Mr. Horsley; 11/14/07 letter from Commission; and 12/4/07 letter from Mr. Horsley.

5.1.1 Stormceptor 450i TSS removal rate is unknown

In an effort to treat the majority of the runoff from paved parking areas, the Applicant proposes to install eight STC 450i Stormceptors.

To support the proposition that each Stormceptor 450i is entitled to a credit of
5 77% TSS removal, the Applicant's consultant, Mr. Albrecht of Tetrattech Rizzo, testified that the DEP would routinely credit the Stormceptor 450i with a 77% TSS removal rate. In response to the Commission's request for third-party corroboration of this statement, the Applicant provided STEP Fact Sheet #4 on Stormceptors.⁵

STEP Fact Sheet #4 lacks data regarding the Stormceptor 450i. In fact, in
10 reference to the 450i, STEP Fact Sheet #4 specifically warned that "[u]sers and decision-makers may require additional field test results and new data for these new systems [such as the listed STC 450i] in order to accept a performance rating." Moreover, the Massachusetts Stormwater Policy Handbook⁶ advises that "[i]f the technology has not
15 track record will provide the same level of stormwater control as those that have been in place for a number of years."

Consistent with the advice provided by both the STEP fact sheet, which the Applicant provided, and the Stormwater Policy Handbook, the Commission twice requested that the Applicant provide third-party data on the 450i. In response, the
20 Applicant stated that "[n]o further information will be provided."⁷

A particularly troubling aspect of the Applicant's failure to provide third-party verification of 450i performance is that

1. Either the Applicant is in possession of such information, and has declined to release it, or

⁵ Fact Sheet #4 for the Stormwater Technology prepared by the Massachusetts Strategic Envirotechnology Partnership (STEP), revised February 2003.

⁶ Stormwater Policy Handbook, vol. 1, p. 1-22, March 1997.

⁷ Tetrattech letter dated 11/22/07, page 5.

2. The Applicant has no such information, in which case the Applicant has apparently ignored both STEP's advice to obtain field data concerning the 450i prior to deployment, and the Stormwater Policy Handbook's caveats concerning technology unreviewed by STEP.

5 Since no third-party data appeared to be forthcoming, the Commission requested that Mr. Horsley⁸ research the issue. In his letter of December 4, 2007, Mr. Horsley reported his findings as follows:

10 "Based upon our previous comments, the Applicant has substituted Stormceptor units at a presumed 77% TSS removal rate. Our experience suggests that this TSS removal range is not sustainable using this technology. An independent review of the system by the Center for Watershed Protection showed a removal rate of 53.5% (see attached)"

15 Two references accompanied Mr. Horsley's letter of December 4. Both of these references, which are part of the record, show TSS removal efficiencies of around 50% for the Stormceptor. Both of these references thus show data that directly contradicts the Applicant's undocumented assertion of a 77% TSS removal rate for the Stormceptor.⁹

20 Faced with a significant discrepancy between the Applicant's claimed TSS removal rate for the 450i and the TSS removal rate provided by third parties, the Commission is in no position to determine that the proposed design complies with Stormwater Management Standard #4.

5.1.2 Proposed Stormceptor installation is inconsistent with vendor's manual

The proposed configuration of the Stormceptors contradicts express design warnings from the vendor's technical manual.¹⁰

25 In particular, among the four key constraints set forth in the vendor's technical manual is that "[t]he difference between the inlet pipe invert elevation and the outlet pipe

⁸ Mr. Scott Horsley of Horsley-Witten Group is an expert retained on behalf of the Commission pursuant to 53 MGL 53G.

⁹ The two references are the Center for Watershed Protection study (Watershed Protection Techniques, Vol. 3, No. 1, April 1999) and a review of Stormceptor Monitoring Results 78th Street Maintenance Facility prepared by Clark County Public Works department in Vancouver, Washington in July 2000.

¹⁰ Technical Manual for the Stormceptor System, revised in August 2004.

elevation must be 1" for a one inlet/one outlet configuration and 3" for a multiple inlet, STC450i and STCs (series) configurations."

According to the Applicant's design, the eight Stormceptors, all of which are of the single inlet/single outlet configuration, feature inlet invert elevations that are equal to outlet invert elevations.

The foregoing design flaw was discovered only as a result of detailed review by the Commission. The significance of the flaw is highlighted in Mr. Horsley's report, which points out that

"the invert elevations on the Applicant's plan are shown to be the same at the inlets and outlets of the Stormceptor units. This is not in conformance with the manufacturer's design guidelines and has been shown to significantly decrease the TSS removal performance in the device."

Indeed, at the hearing, Mr. Albrecht admitted that he was unfamiliar with the technical manual.

The Commission is troubled by the realization that those responsible for designing a critical feature of the project, namely its drainage system, would somehow neglect to even consult the technical manual associated with a key component of that system. In the Commission's view, this suggests a need for considerable scrutiny in the review of this project.

Thus far, the Applicant has not presented a modified plan. Instead, at the December 4 hearing, the Applicant dismissed the omission as a minor design flaw, the details of which could be worked out later.

The Commission is reluctant to agree with this position. The design of a drainage system with adequate slope and invert elevations is hardly a mere design detail; it is in fact the major engineering challenge associated with draining a low-lying site having post-development elevations within only two feet of the 100-year flood elevation. In such an environment, every inch counts. Although a one-inch change seems trivial, its ramifications on the overall system are not. For example, without further adjustment, an

incremental lowering of a Stormceptor's outlet invert would require a corresponding incremental change in the elevation of each infiltration basin but without raising the elevation of the top of each infiltration basin. Each such incremental change in elevation would decrease the basin's overall capacity. Given the design constraints of the site, the adverse effect of an invert elevation mismatch in the Stormceptor's performance, and the coupling between elements of the overall drainage system, the Commission regards this correction as being more than a mere design detail.

The Commission further notes a salient characteristic of the Applicant's system, namely its extreme sensitivity to error. In a robust system, small errors will lead to minor consequences. In the Applicant's system, as demonstrated above, small errors can lead to significant consequences. Such a system is inherently unstable; it functions if and only if each component executes its function flawlessly. Even then, without meticulous monitoring, maintenance, and replacement, such a system is prone to failure.

5.1.3 TSS Removal Rate for Underground Infiltration System is Unknown

The Applicant proposes to use an underground infiltration system. In designing the stormwater management system, the Applicant notes that the Department has published standard TSS removal rates for an above-ground infiltration systems. The Applicant then assumes the same TSS removal rates for the underground infiltration system.

The Department advises that if a proposed element of a stormwater management system differs from those for which standard TSS removal rates have been published in the Department's Storm Water Policy, there must be data to substantiate the TSS removal rate for that component.

In the present case, although both the above-ground infiltration system and the Applicant's underground infiltration system are intended to achieve the same function, namely to facilitate infiltration, they are nevertheless quite different in structure. In particular, the above-ground infiltration systems for which the Department has published standard TSS removal rates are essentially vegetated earthen basins. In contrast, the

Applicant's underground infiltration system is essentially a system of perforated pipes set into a porous material.

5 Despite the foregoing difference, the Applicant has not provided data that would substantiate the TSS removal rate claimed for the proposed underground infiltrations system. Nor has Applicant provided any rational basis for considering the proposed system to be entitled to the TSS removal rate published in the Department's Storm Water Policy, which is clearly intended to apply to a completely different structure.

10 The Commission notes that the two systems are intended to perform the same function. However, this does not necessarily mean that the two systems are equally effective at carrying out that function. The Commission further notes that there are likely to be significant inspection, maintenance and clogging challenges associated with an underground system such as the perforated pipes proposed by the Applicant, and that these challenges will not be present in an above-ground system.

15 In particular, since the proposed infiltration system is underground, it is inevitably more difficult to inspect the entire infiltration area for sedimentation and clogging, more difficult to ensure all sediment is periodically removed by vacuum, and more difficult to replace or rejuvenate the system when it is no longer effective.

20 Further challenges arising from the use of an underground, as opposed to an above-ground infiltration system relate to meeting the site criteria at this particular site. These challenges are more fully described in sections 5.2.2.1 and 5.3 and include factors that can reduce infiltration effectiveness. Such factors include proximity to the seasonal high ground water table, mounding, underlying soil characteristics, and proximity to slopes.

25 The Applicant states that the Department routinely accords the underground infiltration system the same TSS removal rate as the above-ground infiltration system. However, the Applicant has provided no evidence to document this. Accordingly, the Commission regards this statement as a mere conclusory allegation unsupported by any evidence.

In the absence of any evidence showing that the underground infiltration system is entitled to the TSS removal rate claimed, the Commission is unable to establish its compliance with Stormwater Management Standard #4.

5.1.4. Omission of Driveways from TSS Removal Calculation

According to FIG. 7 of Appendix E,¹¹ there exist three driveways that direct runoff onto Acorn Park Drive. This runoff, which is only subject to street-sweeping, appears to have been omitted from the Applicant's calculation of average TSS removal rate.

The omission of these three areas artificially raises the average TSS removal rate for the entire system. Although the areas in question are small, the absence of any margin of error in the average TSS removal rates presented on Appendix E, page 4, renders this omission significant.

5.2 The Applicant has failed to provide sufficient information to confirm compliance with Stormwater Managements Standard # 2

Stormwater Management Standard #2 states the following:

Storm water management systems must be designed so that post-development peak discharge rates do not exceed pre-development peak discharge rates.

As a threshold matter, even in the Applicant's HydroCAD analysis, sub-basin 1R fails to meet Standard #2. The Applicant rationalizes this failure by urging that the excess discharge at sub-basin 1R "is insignificant compared to the overall watershed that it discharges to,"¹² and that the lag between the contribution to peak flow from the site itself and the contributions from other portions of the watershed would mitigate the sub-basin 1R's failure to meet Standard #2.¹³

According to Mr. Horsley, however, "the [Massachusetts Storm Water] Policy does not include exemptions for this Standard for the 2-year and 10-year storms. Such

¹¹ Drainage Report, as revised on 11/21/07.

¹² See Tetrattech letter dated 11/22/07.

¹³ See Drainage Report as revised on 11/21/07, page 13. The Applicant, however, provides no analysis to support the conclusion that a lag exists, and if so, the extent of the lag. Nor does the Applicant make any claims concerning the extent to which any stormwater entering surface water from the site would change.

‘downstream analysis’ is only relevant for examining whether extended detention of the 100-year storm is necessary.”

Notwithstanding the foregoing difficulty with sub-basin 1R, the Commission finds that the proposed project is designed so that post-development peak discharge rates exceed pre-development peak discharge rates, and thus the proposed project does not comply with Stormwater Management Standard #2. This finding is collaborated by Mr. Horsley’s letter of December 4, 2007, which stated that, “[t]he proposed project will result in increases in peak flood rates that are not in conformance with Standard #2 of the Massachusetts Storm water Policy.”

The flaw in the Applicant’s analysis arises from two errors, both of which are related to the Applicant’s failure to provide information that correctly characterizes peak discharge both before and after development. First, the Applicant has over-estimated the pre-development peak discharge. Second, the Applicant has under-estimated post-development peak discharge. The details in support of each of these finding are set forth below.

5.2.1 The Applicant Overestimates Pre-Development Peak Discharges

The Uplands comprise a relatively flat forested parcel shaped somewhat like a contact lens. The parcel features a central rise surrounded by gentle slopes that lead away from the rise in each direction. This topography, coupled with the loose, organic ground cover, leads to a diffuse radial drainage pattern characterized by overland and sheet flow. Such a drainage pattern invites infiltration and evaporation. As a result, the general topography of the Uplands, in its natural state, is ideal for diminishing peak runoff.

Having recognized that such a topography offers no single point of discharge from the property for use in a computer model, the Applicant approximated the continuum of discharge points by defining three design points. These discrete design points are necessary for using TR-20 to simulate site runoff. But it is important to recognize that they are not real; the discrete design points are merely artificial analysis

points required by the TR-20 method. In reality, there are no discrete drainage channels leaving the site.¹⁴

In its TR-20 HydroCAD simulation, the Applicant assumed critical input parameters that are manifestly inconsistent with actual site conditions. Specifically, the
5 Applicant used incorrect values for:

- curve numbers,
- the extent of sheet flow in calculating the time of concentration, and
- soil type.

Details for each of these incorrect assumptions are described in the sections that
10 follow.

5.2.1.1 Curve Numbers Are Inconsistent With Site Characteristics

As used in HydroCAD and Soil Conservation Service (SCS) drainage models, such as TR-20 and TR-55, curve numbers reflect the soil type, ground cover and other
15 site factors influencing drainage. Each type of cover receives a particular curve number. For example, pavement receives a Curve Number of 98, while grass cover in fair condition and type A soils receive a Curve Number of 49.

According to the “Hydrology Handbook for Conservation Commissioners,” the default curve number to be used for all runoff calculations from woodlands in
20 Massachusetts is “woods-good.” Rather than use this state-wide default, the Applicant elected to characterize the forested Uplands as “woods-fair” for all but one watershed.¹⁵ The use of “woods-fair” as a curve number appears inconsistent with both “Hydrology Handbook for Conservation Commissioners,” and with a site having a combination of topography and cover that is ideal for infiltration.

¹⁴ One could argue that the roadside ditch adjacent to Acorn Park Drive is a discrete drainage channel. But this ditch, which appears to be an excavation designed to keep Acorn Park Drive from flooding, appears to receive runoff only from the areas on and near the road. (See 11/16/07 site visit report and photographs.)

¹⁵ Applicant used the “woods-good” curve number for only Subwatershed S-10.

The inputs used in the two HydroCAD simulations are not only inconsistent with reality, in at least one instance, they are also inconsistent with each other. In the pre-development simulation, the Applicant used “woods-fair” for a 2.19 acre wooded portion of sub-basin S-1. But in the post-development simulation, the Applicant used “woods-good” for the 1.054 acres that remained wooded in that same basin.

The Commission asked the Applicant to explain why parcel S-10 was “woods-fair” in the pre-development simulation, when low-infiltration would be advantageous to the Applicant, and “woods-good” in the post-development scenario, when high infiltration would be advantageous to the Applicant. In response, the Applicant stated that CFSA-6 would be within the eastern tip of sub-basin S-10.

However, less than 25% of sub-basin S-10 will be within CFSA-6. Moreover, it is far from clear that CFSA-6 would have runoff properties consistent with a curve number of “woods-fair.”

The Commission finds that the use of Curve Numbers that are inconsistent with the site’s characteristics overestimates pre-development peak discharges, and thereby undermines the HydroCAD results. This hampers the Commission’s ability to establish compliance with Stormwater Management Standard #2.

5.2.1.2 Time of concentration and length of overland flow are inconsistent with site characteristics

The Applicant underestimates the lengths of sheet flow as inputs for each of the four pre-development contributing Drainage Basins: 1S, 2S, 3S, and 4S.

On page 7 of the Drainage Report, the Applicant characterizes runoff from Basin 1S as “sheet flows north to an existing wide drainage channel located along Frontage Road,” which discharges to Little Pond. However, for use in the HydroCAD model, the Applicant re-characterizes the identical runoff as having only 50 feet (of 610 feet) of overland sheet flow.

In the case of Basin 1S, field observations suggest that overland flow exists for at least 100 feet and arguably for much longer. For example, based on field observations

after 0.2 inches of rain in the previous three hours, there was no evidence of a channel or sustained shallow concentrated flow in Basin 1S.¹⁶

On page 7 of the Drainage Report, the Applicant characterizes runoff in Drainage Basin 2S as “sheet flows east to an existing drainage swale adjacent to Acorn Park Drive.” However, for the HydroCAD model, the Applicant re-characterizes the identical runoff as having only 50 feet (of 410 feet) of overland sheet flow.

Based on field observations, overland flow in Basin 2S appears to exist for the entire 410 feet of drainage to the ditch (modeled as a swale) adjacent to Acorn Park Drive. Predictions based on the topographic map were verified with field observations, which revealed no evidence of a channel or sustained shallow concentrated flow in Basin 2S upgradient of the ditch, and no evidence of channeled surface flow between the site west of the ditch and the ditch itself.¹⁷

This pattern of characterizing runoff and then re-characterizing that same run-off continues. For example, on page 7 of the Drainage Report, the Applicant characterizes runoff from Drainage Basin 3S as sheet flows southeasterly to an existing swale along Acorn Park Drive and then to a wetland located adjacent to Acorn Park Drive. For the HydroCAD model, however, the Applicant re-characterizes Drainage Basin 3S as having only 50 feet (of 610 feet) of overland sheet flow.

In reality, within Basin 3S, overland flow exists for much or all of the initial 390 feet of drainage, upgradient to the ditch adjacent Acorn Park Drive. Predictions based on the topographic map were again verified with field observations which revealed no evidence of a channel or sustained shallow concentrated flow in Basin 3S upgradient of the ditch.¹⁸

On page 7 of the Drainage Report, the Applicant characterizes the “runoff in Drainage Basin 4S as “sheet flows southwesterly to Little River.” This suggests that the entire drainage in Drainage Basin 4S to the Little River is sheet flow, which is a

¹⁶ See 11/16/07 site visit report and photographs.

¹⁷ See 11/16/07 site visit report and photographs.

¹⁸ See 11/16/07 site visit report and photographs.

reasonable conclusion from examination of the contours in Figure 1, “Existing Conditions Watershed Map.”

However, once again, for the HydroCAD model, the Applicant re-characterizes the runoff. As far as HydroCAD is concerned, Drainage Basin 4S has only 50 feet (of 410 feet) of overland sheet flow. The depiction of contours in Figure 1 of the Drainage Report was verified with field observations. Contrary to the Applicant’s characterization of flow within Basin 4S, these field observations once again failed to reveal any evidence of a channel or of sustained shallow concentrated flow.¹⁹

For each Drainage Basin, actual site conditions indicate an extended overland sheet flow segment. These actual site conditions should have been assumed for modeling pre-development peak discharge with HydroCAD.

As noted above, the pre-developed site has fairly uniform grade. The Applicant’s re-characterization of the flow is therefore:

- 1) contrary to *The Hydrology Handbook for Conservation Commissioners* (DEP 2002), which states that “where it can be determined that the ground surface has a uniform grade...the overland flow path may be greater than 50 feet”, and
- 2) contrary to the U.S. Soil Conservation Service’s advice that “[t]he maximum flow of 300 feet with a most likely length of 100 feet should be used in overland flow computations for unpaved areas.”²⁰

By assuming that, somehow, overland sheet flow becomes channel flow on a pre-development site with uniform grade within 50 feet, with no indication, based on either contour maps or field observations that such a change occurs, the Applicant artificially raises the predevelopment runoff for this site, and in so doing, seriously undermines the credibility of the Applicant’s HydroCAD model.

¹⁹ See 11/16/07 site visit report and photographs.

²⁰ U.S. Department of Agriculture, Soil Conservation Service, Hydrology Technical Note 114, Fed. 1983, revised June 1986, subject: Engineering Hydrology – Time of Concentration, page 2.

In its 11/14/07 letter, the Commission requested that the Applicant provide the basis for the inputs used and re-run the pre-development simulation of peak discharge rates (for the 24-hour storms recurring at 2, 10, 25, and 100 years) for points of analysis 1R, 2R, and 3R using overland flow distances that are consistent with the Applicant's description in the Drainage Report. In the interest of evaluating the model's sensitivity to changes in input, the Commission also requested the Applicant to re-run the HydroCAD analysis of peak discharge rates (for the 24-hour storms recurring at 2, 10, 25, and 100 years) for points of analysis 1R, 2R, and 3R using overland flow distances of 100 feet in each of the four sub-basins. The Applicant appears to have ignored both of these requests.

5.2.1.3 Runoff and infiltration calculations assume different soil conditions at the same locations

In designing the three infiltration basins for site drainage, the Applicant used site observations (test pits and percolation tests) to characterize the permeability of the site soils.

However, in selecting inputs for the pre-development HydroCAD analysis, the Applicant ignored these field observations. Instead of using data representative of actual site conditions, the Applicant relied exclusively on United States Department of Agriculture ("USDA") maps. The Applicant chose to do so even though:

(1) data representative of actual site conditions was readily available; and

(2) the Applicant had already used this data for design of infiltration basins.

In an effort to explain why these site observations were good enough to use for designing infiltration basin, yet not good enough for HydroCAD runoff simulations, the Applicant states "[t]he USDA soils mapping is used for planning purposes and does not necessarily provide exact type and locations of soils. The on-site soil assessment by Tetra Tech Rizzo provides a more accurate mapping of the soils."²¹ "Although the NRCS Soils

²¹ Tetrattech letter of 10/16/07, page 21.

Maps define on site as Freetown Muck [type D], our test pitting program and the five (5) observation wells did not reflect such soil types.”²²

5 The Applicant’s explanation makes little sense. The whole point of computer simulation is to model reality. To the extent the Applicant knowingly uses an incorrect soil type in a computer simulation, the result of the simulation cannot help but lose credibility.

10 In its revised HydroCAD analysis of the existing conditions, the Applicant fails to apply this same logic to the use of the type D soils. It appears in fact that the Applicant has indulged in cherry-picking. The Applicant appears to have used site observations to design structures in which high permeability is desirable; and then switched to soil maps in those cases where low permeability is desirable.

15 It appears to the Commission that either the soil is permeable, or it is not. Therefore, either the infiltration basin design is flawed and the HydroCAD analysis is correct, or vice versa. They cannot both be correct. The soil does not change its permeability to suit the needs of the designer. The Applicant’s incorrect assumption that the site contains Type D soils with no infiltration capacity in the November HydroCAD analysis results in an overestimation of the pre-development peak runoff. It is also inconsistent with assumptions made in connection with the design of the infiltration basins.

20 **5.2.2 The Applicant Underestimates Post-Development Peak Discharges**

Along with over-estimating the pre-development peak discharges, the Applicant has underestimated the post-development peak discharges.

5.2.2.1 Applicant overestimates effectiveness of infiltration basins

25 In its application of the HydroCAD model based on TR20, the Applicant has underestimated the post-development peak by incorrectly estimating the effects of the infiltration basins without appropriately considering site conditions. In the HydroCAD calculations carried out thus far, the Applicant incorrectly assumes that essentially all

²² Tetrattech letter of 10/16/07, page 23.

stormwater entering the infiltration basins will indeed be infiltrated.²³ This assumption is highly questionable for three reasons:

First, in its operation and maintenance plan and letter of 10/16/07, Tetra Tech proposed to allow half-a-foot of sediment to accumulate before cleaning an infiltration basin. The Commission recognizes that sediment accumulation compromises a basin's ability to infiltrate. This reduction in infiltration capacity was not accounted for in modeling the post-development peak discharge. In recognition of this deficiency, the Commission requested that the Applicant estimate the extent to which six inches of sediment at the bottom of the infiltration basin would compromise the basin's ability to infiltrate. However, this was never addressed any the HydroCAD analysis.

Second, the Commission has received direct evidence of groundwater levels higher than those assumed in the design of the infiltration basins.²⁴ Water entering the infiltration basins that is precluded from infiltration due to this high ground water will be discharged from the site as stormwater. Nowhere is this additional water accounted for in the HydroCAD analysis, which assumed that essentially all stormwater entering the infiltration basins would infiltrate. As a result, the Applicant has under-estimated the post-development peak discharge.

Third, the assumption that essentially all stormwater entering the infiltration basins would in fact infiltrate relies on a superior O/M implementation, non-clogging, and timely replacement of infiltration basins when needed. Even when open excavations are covered with grating or grass, infiltration basins and infiltration trenches carry a "high" maintenance burden.²⁵ The Acorn Park design, in which infiltration chambers are buried beneath parking lots, further raises the already high maintenance burden associated with infiltration basins. By failing to realistically appraise these O/M

²³ In fact, in at least one case, more water leaves the infiltration basin than actually enters it. In particular, according to page 15 of the 11/28/07 HydroCAD results submitted in the Drainage Report of 11/21/07 (an inconsistency in dates that has yet to be explained), during a 24-hour 2-year design storm, .205 acre feet of water enters IC-1, but .206 acre feet manages to leave. This physically unrealizable result raises additional concerns regarding the Applicant's assumptions.

²⁴ See Section 5.3, *infra*.

²⁵ See National Management Measures to Control Non-point Source Pollution from Urban Areas, EPA-841-B-05-004, November 2005, page 5-57.

difficulties and to account for these in the simulation results, the Applicant underestimates post-development peak discharges.

The Commission is unable to determine, based on the information provided, the extent to which six inches of sediment at the bottom of the infiltration basin would compromise the basin's ability to infiltrate; the extent to which HydroCAD results presented in the notice of intent rely on the assumption that essentially all stormwater entering the infiltration basins will indeed be infiltrated; and the extent to which the correction of the foregoing assumption would affect infiltration calculations relevant to Standard #3.

In its review of the Applicant's HydroCAD analysis, Scott Horsley recommended changing the HydroCAD exfiltration rates to reflect clogging over time. Mr. Horsley pointed out that "as referenced in the 'Hydrology Handbook for Conservation Commissioners' (DEP. 2002) on page 2-8, the Rawl's table should be used to determine appropriate (longer-term) design infiltration rates (used in HydroCAD as 'exfiltration' rates) based on soil texture that take into account some clogging over time." Based in this, Mr. Horsley further recommended the use of a slower percolation rate in IC-3.

5.2.2.2 The Applicant ignores groundwater from Perimeter Drains

The Applicant has provided a perimeter drain to capture and remove groundwater from the building footings. This perimeter drain discharges groundwater into the stormwater management system. This groundwater is water that, but for the development, would not have been discharged from the site. Accordingly, the Commission regards this groundwater as being a constituent of any post-development discharge. The HydroCAD analysis completely ignores the existence of this groundwater.

Applicant's failure to quantify the groundwater flows and to accommodate groundwater into the sizing of the drainage system may have resulted in the design of an undersized stormwater management system. By letter of 9/11/07, the Commission requested clarification of the extent to which groundwater would impact the design of the drainage system. In a response submitted on 10/16/07, the Applicant stated that

“[h]igh groundwater associated with garage foundations will be discharged into the project drainage system.... This has not been quantified at this time since final building design plans have not been completed.”

5 Based on the information submitted, the Commission could not confirm that the sizing of the stormwater management system would be adequate to accommodate groundwater discharged from the perimeter drains. The Commission remains concerned that an undersized system would result in the periodic failure of the system, and the subsequent release of untreated stormwater runoff into a resource area.

10 **5.2.3 The Applicant’s erroneous assumptions materially affect results.**

 Because of the deficiencies in the Applicant’s assumptions, the Commission asked the Horsley-Witten Group to run the HydroCAD model using more appropriate inputs. In this revised HydroCAD model, Horsley-Whitten Group modified the Applicant’s HydroCAD inputs to utilize 100 feet of sheet flow for the pre-development
15 conditions, and to use “woods-good” in place of “woods-fair” as curve numbers. In the resulting simulation, as presented in Scott Horsley’s 12/4/07 letter, post-development peak flows for the 100-year storm for points of analysis R1, R2 and R3 exceed the corresponding pre-development peak flows.

 For sub-basin R1, which discharges untreated parking lot runoff directly into the
20 Resource Area, the increase in peak discharge is particularly extreme: a three fold increase in the case of the 2-year, 24-hour design storm.

 Based on the result of the Horsley-Whitten simulation, the Commission concurred with Scott Horsley’s recommendation “that the Applicant revise the storm water calculations and treatment system as needed to meet Standard #2,” and requested this
25 analysis of the Applicant. The Applicant rejected this request.

5.3 The Applicant has failed to provide sufficient information to confirm compliance with Stormwater Management Standard #3.

Stormwater Management Standard #3 states:

30 *Loss of annual recharge to groundwater should be minimized through the use of infiltration measures to the maximum extent practicable. The*

annual recharge from the post-development site should approximate the annual recharge from the pre-development or existing site conditions, based on soil types.

5 The Stormwater Policy Handbook indicates that compliance with Stormwater Management Standard #3 requires at least two feet of clearance between the bottom of an infiltration basin and the SHGL.

10 The Applicant's design features at least two infiltration basins that are less than two feet above the SHGL. In addition, at least one infiltration chamber, namely IC-3, fails to conform to the Department's site criteria because of its proximity to surface water, its proximity to a steep slope, and its placement over fill. Therefore, the Applicant's design fails to meet Stormwater Management Standard #3.

5.3.1 Estimate of SHGL

15 The Applicant estimated seasonal high groundwater level ("SHGL") on the basis of water levels from test-pits scattered across the site. The Commission notes that the digging of these test-pits was a violation of Special Conditions #23 of the Superseding Order of Conditions,²⁶ which states:

*"The applicant shall notify the Department and the Conservation Commission 72 hours before any activity is to begin on the project site."*²⁷

20 According to the SHGL estimate derived from test-pit data, one infiltration chamber ("IC") was exactly two feet above SHGL, and all other ICs were slightly more than two feet above SHGL.

25 The Commission also received, from Mr. Horsley, an estimate of SHGL derived from wells on the site. According to the SHGL estimate derived from well-data, even in the absence of groundwater mounding, IC-1 and IC-3 have floors that are only slightly more than twelve inches above SHGL. The estimate also indicates that IC-2 is so close to being within two feet of the SHGL that even minimal groundwater mounding under IC-2 would result in IC-2 also being less than 2 feet from the seasonal high groundwater level.

²⁶ DEP 106-0042.

²⁷ DEP 106-0042.

In testifying before the Commission, Mr. Albrecht agreed that the most accurate way to estimate SHGL was to use well-data, not test-pit data. The Commission therefore presumes that absent a credible reason to the contrary, well-data is inherently more reliable than test-pit data.

5 As a basis for discrediting the well-data, the Applicant pointed out:

1. That certain wells were missing their caps, thus allowing rainwater to enter the wells and raise the water level,
2. That vagrants roaming the site may have vandalized the wells,²⁸
3. That water may have seeped into an annular gap between the well and the
10 surrounding soil, thereby corrupting the measurement, and
4. That wells 4 and 5 showed an unusually large jump between two measurements taken five weeks apart.

With regard to the first point, Mr. Horsley testified that the effect of any rainwater entry would be negligible. The Commission agrees with this observation.

15 With regard to the second and third points, the Applicant has not provided any plausible scenarios for how vagrants could have rendered the 2001 measurements unreliable. Nor has the Applicant provided any proof that the well-data has been corrupted by water seeping into the annular gap.

Moreover, the Commission notes that:

- 20 1) those measurements were taken by a professional engineering firm that did not question them in 2001 when they were first recorded; and

²⁸ TTR response of 11/22/07, page 9 (“There has also been a history of vandalism at the site, as well as vagrants living on the site...”).

2) those same measurements were deemed reliable enough to submit to the Commission, and ultimately to the Department, in connection with the Notice of Intent filed shortly thereafter.

5 The question of whether the well-data is faulty is best answered by seeing if that data is reasonable. The Applicant's fourth point is therefore the most directly relevant to the reliability of the well-data. We therefore discuss this point in some detail.

10 With regard to the fourth point, the Applicant draws attention to a large jump between the 2/23/01 and 4/02/01 measurements in both wells 4 and 5.²⁹ The Applicant suggests that the heavy rainfall just before the 4/2/01 measurement raised the water level far too much and far too soon for that data to be reliable.

15 The Applicant's position would be more persuasive if measurements had in fact been taken daily between 2/23/01 and 4/02/01. However, for reasons unknown, the Applicant failed to monitor the wells on a regular basis. As a result of the Applicant's failure to do so, there are no measurements in the five weeks preceding the allegedly questionable measurement. In the absence of such measurements, there is no way to determine just how quickly the water level jumped in response to the heavy rainfall immediately preceding the 4/2/01 measurement.

20 For example, referring to the OW-4 data,³⁰ one sees a 4.6 level on 2/23/01 and a 7.6 level on 4/2/01. The Applicant appears to be assuming that the level on 4/1/01 was still 4.6, and that it somehow jumped three feet in the course of the next 24 hours, which is a clearly unreasonable result.

The difficulty with the Applicant's position is that although there exists data showing a 4.6 level on 2/23/01, there is no evidence confirming that the level was still 4.6 on 4/1/01. It is equally likely, if not more so, that the level climbed slowly from 4.6 to 7.1

²⁹ TTR response of 11/22/07, page 9 ("There are a few measurements (OW B-4 and OW B-5) that are suspect since heavy rainfall events affected groundwater levels soon after the rainfall").

³⁰ Appendix D, Drainage Report revision of 11/21/07.

during the five weeks that elapsed between measurements. Thus, the Commission disagrees that this jump is sufficient to discredit the data.

Moreover, if one considers the slope of the lines connecting the test well measurements in time, one finds that the slopes associated with wells 4 and 5 between 2/23/01 and 4/2/01 are not inconsistent with slopes associated with similar consecutive measurements from the remaining wells. Moreover, the slopes between any two consecutive measurements in wells 4 and 5 are not inconsistent with slopes associated with consecutive measurements in the other wells. These findings are inconsistent with the Applicant's theory that vagrants roaming the property had vandalized the wells prior to the 2001 measurement.

To estimate SHGL from measured well-data, one typically applies a correction factor based on the Frimpter method. This provides yet another reason for relying more heavily on the well-data, namely that the well-data was obtained at the time of year when the groundwater is ordinarily at its highest level. As a result, the Frimpter method's correction for obtaining SHGL from measured data is a relatively small fraction of the measured water level. The estimate of SHGL based on well-data thus relies much more heavily on actual measured data than it does on the Frimpter correction.

In contrast, the test-pit data was obtained at a time of year when groundwater is ordinarily lower. As a result, a relatively large correction is needed for obtaining the SHGL from the test-pit measurements. The resulting estimate of SHGL thus relies more heavily on the correction factor itself, and not on the measured water level.

5.3.2 The Applicant is discrediting data relied upon in valid Superseding Order of Conditions for the same site

The Applicant's attempt to now discredit the well-data is further hampered by its reliance on the same well-data in connection with the Notice of Intent filed in April 2003, which ultimately resulted in a superseding order of conditions that remains valid until April 29, 2008.³¹

³¹ DEP 106-0042, issued September 30, 2004.

If the well-data is invalid then the superseding order-of-conditions relies on invalid data. As far as the Commission knows, the Applicant has never notified the Department that its superseding order of conditions relies on invalid data. It is difficult to reconcile the Applicant's failure to notify the Department with its current attempt to discredit that same well-data.

As best understood by the Commission, and as agreed upon by Mr. Albrecht, the most accurate way to estimate SHGL is to use well-data, not test-pit data. Nevertheless, the Applicant has chosen to rely on test-pit data, even though wells already exist on the site. Moreover, the Applicant has refused to consider further well monitoring.³²

Given the importance of accurate groundwater measurements on the site, the Commission remains puzzled as to why the Applicant would knowingly adopt a less accurate measurement when a more accurate one is readily available.

5.3.3 Groundwater mounding

At the public hearing, both Mr. Horsley and Mr. Bruce Jacobs testified that long-term and short-term groundwater mounding beneath three infiltration basins were likely to compromise, if not eliminate, the effectiveness of those basins under certain conditions. Accordingly, the Commission requested that the Applicant provide information concerning groundwater mounding.

The Commission has received the Applicant's estimate of the extent to which groundwater mounding is expected to occur. However, the Applicant's estimate is inconsistent with, and in fact less than, an estimate provided by Bruce Jacobs.

The Applicant's estimate suggests that the mounding effect is insufficient to breach the two foot barrier if SHGL is derived from test-pit data. However, as discussed above, when the Applicant's groundwater mounding model is applied to an estimate of

³² TTR Response of 11/22/07, page 10 ("Applicant respectfully agrees to disagree with the Conservation Commission regarding installation of additional monitoring wells to restart a monthly groundwater monitoring program. Adequate information (test pits, soil evaluation, and percolation tests) is available and is supported by MA DEP as part of our stormwater management design.")

SHGL derived from monitoring well-data, the clearance between the SHGL level and the infiltration basin falls well under the two-foot limit.

The Applicant has repeatedly assured the Commission that the Department routinely accepts test-pit data for estimating SHGL. The Commission agrees that reliance on test-pit data may be suitable in those sites for which SHGL levels are so far below the infiltration basin that errors will make little difference. However, in a site such as that under consideration, in which there is essentially no margin for error, the Commission regards it as prudent to rely on the most accurate possible data.

5.3.4 IC-3's proximity to a slope is inconsistent with DEP Site Criteria

The Department's site criteria for an infiltration trench states that the

“distance from any slope greater than 20% to any under ground trench: minimum 100 feet.”³³

The Department's site criteria for infiltration basin states that the

“distance from any slope greater than 15% - a minimum of 50 feet.”³⁴
(page 3.F-7).

IC-3 is located within about 25 feet of a 40% slope, as shown on Figure C-4 by a change of 4 vertical feet within a distance of about 20 feet from IC-3. This is inconsistent with both of the foregoing criteria.

The Commission recognizes that the infiltration trenches and infiltration basins described in the Handbook are open at the surface, whereas the Applicant proposes to construct buried “infiltration chambers.”

However, the reasons for why infiltration structures, such as trenches and basins, should be kept away from steep slopes do not depend on whether the infiltration structure has a cover. Accordingly, it seems reasonable to suggest that the infiltration chamber should also be kept away from steep slopes.

³³ See Stormwater Management Manual, vol. 2, pages 3.E-8

³⁴ See Stormwater Management Manual, vol. 2, pages 3.E-7

5.3.5 IC-3's Proximity to an Intermittent Stream is Inconsistent with DEP Site Criteria

The Department's site criteria for an infiltration trench states that:

- 5 “distance from any surface water of the Commonwealth (other than surface drinking water supplies and their tributaries): minimum of 150 feet down slope and 100 feet upslope.”

For an infiltration basin, the Department's criteria require that the basin be 100 feet from surface water.

- 10 IC-3 is located only about 75 feet away from an intermittent stream that runs parallel to Frontage Road and about 70 feet from the BVW. This is inconsistent with the Department's site criteria.

5.3.6 IC-3 Fails to Meet DEP Minimum Infiltration Rate

The Department's minimum acceptable soil infiltration rate for an infiltration trench or infiltration basin is 0.5 inches per hour.

- 15 On October 22, 2007, the Applicant developed two test pits within the proposed boundary of IC-3. Percolation test results from these two test pits indicate that the top 110 inches of soil was fill and that water “could not perc below 110”.

Based on the foregoing, it appears that IC-3 fails to meet this site criterion.

5.3.7 IC-3 is Improperly Placed over Fill

- 20 The Department's site criteria for both an infiltration trench or infiltration basin include the requirement that they not be placed over fill material.

As indicated in the test pit logs for TP-A and TP-B located in the footprint of IC-3, the top 110” or 9’2” of soil excavated was fill. Accordingly, IC-3 does not meet this DEP site criterion.

25 5.3.8 Infiltration basin designs are inconsistent with EPA storm water guidance

In addition to the infiltration chambers failing to meet DEP site criteria, both the infiltration basins' location and use of percolation tests in their design are not recommended in EPA guidance.

For example in National Management Measures to Control Nonpoint Source Pollution from Urban Areas, EPA-841-B-05-004, November 2005, page 5-10, the EPA guidance states that

[t]he overall hydrologic benefits of infiltration practices may also vary depending on site characteristics and the frequency and intensity of storms. Holman-Dodds et al. (2003) modeled the potential for infiltration techniques to reduce the adverse hydrologic effects of urbanization. The study indicated that the greatest reductions in flow are achievable when rainfall is limited and relatively frequent, and when soils are relatively porous.

Infiltration facilities require deep layers of porous soils (i.e., sands and gravels) to function properly.³⁵ The EPA generally does not recommend the use of infiltration structures in soils having clay content in excess of 30% or silt/clay content in excess of 40%. (WMI, 1997b). According to the EPA, infiltration facilities are unsuitable:

- In areas with high water tables;
- In areas with shallow depth to impermeable soil layers;
- On fill sites, which have low permeability;
- On steep slopes;
- In areas where infiltration of runoff would likely contaminate ground water;
- In areas where there is a high risk of hazardous material spills; or
- Where additional groundwater could form sinkholes.

Based on observations made using test pits, IC-3 lies over nine feet of fill. It was this test-pit that, according to the Applicant, “could not perc below 110.”

The EPA further recommends against using test pits to design infiltration structures.

Hydrogeologic-based evaluations originated with the development of the percolation test in the 1920s. Although the percolation test is simple to conduct and can

³⁵ National Management Measures to Control Nonpoint Source Pollution from Urban Areas, EPA-841-B-05-004, November 2005, page 5-57

provide some information on relative infiltration rates, it suffers from the following flaws:

it cannot discern what controls the rate of water loss from a hole;

it cannot accurately predict infiltration rates at equilibrium operation or

5 it cannot accurately predict infiltration rates in downgradient zones through which the effluent will migrate.

As a result of these flaws, the EPA cautions against the reliance on test pit data for the design of infiltration structures.³⁶

10 **5.3.9 IC-3's Failure to Meet Site Criteria Impairs its Function in Connection with Standards #2 and #4**

Based on the failure of IC-3 to conform to three of the Department's site criteria, as well as the failure of IC-1 to meet one of the Department's site criteria, the proposed development as currently designed does not attain Standard #3.

15 Furthermore, this failure to attain the Department's site criteria bring into further question the effectiveness of IC-3 in removing TSS (as part to the treatment train strategy to meet Standard #4) and the effectiveness of IC-5 in reducing peak discharge rates (as part of strategy to meet Standard #2).

Accordingly, it is the Commission's finding, based on the weight of the evidence, that the proposed design fails to meet stormwater management guideline #3.

20 **5.4 The Applicant has failed to provide an alternative that avoids alteration of land in the BLSF**

The Commission has observed that much controversy exists surrounding the adequacy of measures taken to mitigate alterations to the buffer zone that impact the interests of the Act in adjoining resource areas. Many of these difficulties would be
25 circumvented if such alterations could be avoided.

³⁶ National Management Measures to Control Nonpoint Source Pollution from Urban Areas, EPA-841-B-05-004, November 2005, page 6-14

The Commission invited the Applicant to provide an alternative design that avoids alteration of land in any BLSF, the 100 foot buffer adjacent to BVW on the south or west sides of the site, or within a 25-foot buffer adjacent to BVW bordering the intermittent stream parallel to the Frontage Road.³⁷ The Commission further requested that, to the extent any such alternative was viewed as impracticable, the Applicant provide documentary evidence to support such impracticability.

5.5 Configuration of proposed CFSA is inconsistent with Rule 10.57(4)

The Commission finds that the configuration of the proposed CFSA at the south-east corner of the site is inconsistent with Rule 10.57(4)(a). As a result, the CFSA causes an impermissible alteration of a resource area.

The general performance standards under Rule 10.57(4)(a) for BLSF require that

“[c]ompensatory storage...shall be incrementally equal to the theoretical volume of water up to and including the 100-year flood elevations, which would be displaced by the proposed project.”

Thus, according to the rule, for each value of elevation, the storage lost must be *equal to* storage gained. This standard is consistent with the overall purpose of the Act, which is to prevent alteration of a resource area.³⁸

As best understood by the Commission, in drafting the standard, the Department wisely recognized that if, at some elevation, storage lost differs from storage gained, an alteration has occurred. In doing so, the Department evidently recognized that alteration could occur in two ways:

(1) by causing a net loss in storage, and

(2) by causing a net gain in storage.

In recognition of this, the Department precluded both types of alteration in one stroke by requiring that the storage “shall be incrementally *equal to*” the lost storage.

³⁷ Request for Alternatives, issued at 12/4/07 hearing.

³⁸ 131 MGL 40 states that “[n]o person shall...alter...any land subject to...flooding.”

The standard is often relevant where development results in a net loss of storage, since this results in the inundation of land that is normally not subject to flooding. Such inundation represents an alteration of a resource area.

5 However, had this been the Department's only concern, the rule would have read "shall be incrementally *greater than or equal to*" the lost storage. But this is not what the rule says. The rule requires that the storage gained and lost at each elevation be *equal*. This would result in a net difference of zero at that elevation, a result which is entirely consistent with the Act's intent in preventing alteration of a resource area.

10 Accordingly, Rule 10.57(4)(a) is equally relevant to any development that results in a net gain of storage. Such development tends to deprive the benefits of periodic flooding from those portions of the resource area that have historically been subject to periodic flooding. This too is an alteration of the resource area.

15 The Commission recognizes that among the eight interests that the Act seeks to protect is "flood control." Flood "control" is broader than just flood "prevention." Within the context of the Act, which seeks to prevent alteration of a resource area, the Commission understands "flood control" to mean controlling floodwaters to ensure that no alteration of the resource area occurs.

20 The Applicant proposes a CFSA that, at some elevations, provides considerably more flood storage capacity than is necessary to compensate for storage capacity lost at that elevation. While this may be desirable to prevent flooding, that is not the Act's purpose. The Act seeks to prevent alteration of a resource area, not flooding. With this in mind, a CFSA that overcompensates alters the resource area just as much as a CFSA that undercompensates. Further, such a CFSA unnecessarily alters the buffer zone and does so in a way that directly impacts the resource area, as discussed in section 5.6.

25 The proposed CFSA provides as much as a hundred-fold increase in flood storage at certain elevations. As a result, it fails to comply with Rule 10.57(4)(a).

The Commission recognizes the existence of a zoning requirement that there be a net gain in flood storage capacity. However, the Commission's jurisdiction is limited to

application of the Wetlands Protection Act, and does not extend to reconciling any conflicts between state law and municipal law.

5.6 The Applicant has failed to provide sufficient information to demonstrate that alterations in the 100-foot buffer adjacent to BVW protect the interest of the WPA.

5 Based on a review of the materials in the Record, the Commission has determined that much of the 100-foot buffer adjacent to BVW is essential to the protection of the interests of the WPA. These portions of the 100-foot buffer are the 100-foot buffer adjacent to BVW on the south or west sides of the site and in the innermost 25 feet of the 100-foot buffer adjacent to BVW bordering the intermittent stream parallel to Frontage
10 Road. As described below, these buffer zones are significant to the WPA interests of wildlife habitat protection, pollution prevention, and protection of fisheries. Particular effects of the proposed alteration that would be adverse to the foregoing interests of the Wetlands Protection Act are: habitat removal for species requiring both upland and wetland habitats, dewatering of bordering vegetated wetland by nearby excavations, and
15 the discharge of heat, sediment, and other pollutants into resource areas and impaired surface water.

During the public hearing process, the Applicant twice altered the boundaries of work within the 100 foot buffer in an attempt to somehow shoehorn both the paved areas and the excavated compensatory flood storage areas within the confines of the limited
20 unprotected area available on the site.

During the December 4, 2007 hearing, in recognition of the Applicant's difficulties in rearranging the project to suit the confines of the site, the Commission requested "[a]n alternative that protects the interests of the WPA by not altering land in the BLSF, the 100-foot buffer adjacent to BVW on the south or west sides of the site, or in
25 a 25-foot buffer adjacent to BVW bordering the intermittent stream parallel to Frontage Road."

The Applicant refused to consider providing any alternative and requested closure of the public hearing. As a result, the Applicant has not provided a reasonable alternative that does not alter land in the 100-foot buffer adjacent to BVW on the south or west sides

of the site, or in a 25-foot buffer adjacent to BVW bordering the intermittent stream parallel to Frontage Road in order to protect the interests of the WPA.

The Commission finds that the proposed construction will lead to the following results, all of which will adversely affect the interests that the Wetlands Protection Act seeks to protect.

5.6.1 Wetlands Dewatering

Excavation within the 100-foot buffer is likely to cause a permanent change in local ground water elevations, thereby de-watering the existing BVW on the south side of the project. Of particular concern are the excavations for CFSA-2, CFSA-3 and Underground Basin-2 at the south end of the development. CFSA-2 and CFSA-3 are within about 55 feet of BVW. To give a sense of just how close 55 feet actually is, it may be useful to note that 55 feet is about 10% less than the distance between pitcher and batter at Fenway Park. Underground Basin-2 is only about 25 feet from the BVW.

This particularly vulnerable BVW extends north-easterly from the 3 to 4 foot elevation of Little River to the southern portion of the development property, where the wetland reaches an elevation of 8 to 11.4 feet.³⁹ This BVW relies, for its continued existence, on the availability of a water table having elevations comparable to those immediately north of the BVW. Unfortunately, this happens to be precisely where excavations for a CFSA and an underground basin are proposed. Therefore, alteration of this Buffer Zone during construction of the permanent excavation for the CFSA and the temporary excavation for the Underground Basin are likely to eliminate this BVW by lowering the water table upon which it relies.

For the preservation of this southern BVW, the Commission finds it necessary that the proposed development avoid altering land within the 100-foot buffer adjacent to BVW on the south side of the site.

³⁹ For example the developer's test pit log estimated the high water table at TP-1 in this BVW to be 9.2 feet. See also Tetra Tech's response that, "BVW along the south side ranges in elevation from 8 to 11.2 feet.")

5.6.2 Loss of wildlife habitat necessary for the wildlife habitat protection interests of the BVW

Work within the 100-foot Buffer Zone is likely to result in the significant loss of wildlife habitat. As a result, the proposed work is likely to adversely affect the Wetlands Protection Act's interest in protection of wildlife habitat.

The alteration of the Buffer Zone would likely alter the biological characteristics of the BVW, Little River and other resource areas by removing the adjoining uplands habitat essential for the complete life cycles of numerous species. This would degrade its value as a wildlife habitat.

The Uplands and Alewife Reservation contain wildlife habitats for over 90 species of birds and at least 16 species of mammals, all of which depend on this land for food or temporary shelter during migration.⁴⁰

The region is particularly valuable because its wetland habitat adjoins its upland habitat. Numerous species thrive in this combination of adjoining wetland and upland habitats. For example, more than three out of four freshwater-dependent amphibian, reptile, mammal, and bird species in Massachusetts also require upland habitats for survival.⁴¹ Of these upland-dependent species, over three out of four will roam into the uplands up to 100 feet beyond the wetland. These species would thus routinely use the entire buffer zone.

Within just the Alewife area, seventeen species are known to depend on both upland and wetland habitats during their life cycles. The proposed project would essentially deforest and devegetate all land beyond the 100 foot buffer and replace it with approximately 4.56 acres, or about two soccer fields worth, of buildings and parking lots. The resulting loss of habitat and of a corridor between upland and wetland habitats would considerably restrict the movement of flightless species, and would pose considerable difficulties even for those species capable of flight.

⁴⁰ See Brown, David. Migrant and Breeding Bird Survey. 2002.

⁴¹ See Boyd, Lynn. 2001

Thus, to avoid adversely impacting the Act's interest in preserving the resource area's ability to function as a wildlife habitat, the Commission finds it necessary that the proposed development avoid altering any land within the 100-foot buffer adjacent to BVW on the south or west sides of the site, or within a 25-foot buffer adjacent to BVW bordering the intermittent stream parallel to Frontage Road.

5.6.3 Loss of pollution prevention

Work within the buffer zone is likely to increase the discharge of pollutants to resource areas and to waters of the Commonwealth.

Buffer areas such as those surrounding the planned development serve as a vegetated buffer, dissipating heat and filtering out sediment and associated pollutants. Alterations or reductions of vegetated buffer zones frequently and predictably result in adverse effects on their bordering resource areas.⁴² These adverse effects include, but are not limited to, increased runoff that sweeps pollutants, fill material, and other substances into the bordering resource areas.

On the south side of the site, straddling the Belmont/Cambridge line, the Applicant proposes to excavate a compensatory flood storage area. This would replace vegetation with a sloped compacted bowl having a reduced ability to filter pollutants. Then, after having reduced the area's ability to filter pollutants, the Applicant proposes to flush untreated runoff from the parking lot south of Building A into this bowl. This parking-lot runoff would then proceed out of the bowl, and down the roadside ditch. To the extent this roadside ditch is an "unrestricted hydraulic connection" to Little River, as the Applicant asserts, the ditch then guides the parking lot's untreated runoff into a protected resource area. As a result, the proposed alteration would adversely impact the Act's interest in prevention of pollution.

As pointed out by Mr. Horsley in his December 4, 2007 letter, Little River is directly a tributary to the Alewife River, which is designated as a Class B water body

⁴² See sources cited in Belmont Conservation Commission Wetlands Setback Policy, January 9, 2007, see also Rule 10.53(1).

with regards to Massachusetts Surface Water Quality Regulations (314 CMR 4.00). This part of Alewife Brook is listed by the Commonwealth as being impaired (not meeting Surface Water Quality Standards) for metals, nutrients, organic enrichment/low dissolved oxygen, pathogens, oil and grease, and taste and odor.⁴³ Discharges which cause or contribute to these impairments are not allowed. Further, Massachusetts' anti-degradation provisions in the Massachusetts Surface Water Quality Regulations (314 CMR 4.00) also preclude new discharges that affect the designated uses of the receiving water bodies.

The Applicant has failed to present information showing that untreated parking lot runoff is consistent with the Surface Water Quality Regulations as they apply to the relevant portion of Alewife Brook Parkway and its direct tributaries.

In the interest of avoiding an alteration that would adversely affect the Act's interest in prevention of pollution, the Commission finds it necessary that the proposed development avoid alteration of any land in the 100-foot buffer adjacent to BVW on the south or west sides of the site or in a 25-foot buffer adjacent to BVW bordering the intermittent stream parallel to Frontage Road.

5.6.4 The Applicant has failed to provide evidence that alteration within the innermost 25 feet of the buffer zone will not adversely affect the interests of the Act

In drafting the rules, the Department has recognized that the location of work within a buffer zone affects the likelihood that that work will adversely affect the interests identified in the Wetlands Protection Act. For example, Rule 10.53(1) states that

“[t]he potential for adverse impacts to resource areas from work in the buffer zone may increase with the extent of the work and the proximity to the resource area.”

In recognition of the Department's observation, the Commission has implemented a Policy stating

“absent clear and convincing evidence to the contrary, that any activity, other than minor activities as defined by the Massachusetts Wetlands Protection Act Regulations (310 CMR 10.02(2)(b)(1)), within twenty-five (25) feet of a resource

⁴³ Massachusetts 2004 Integrated List of Waters.

area boundary may cause a significant adverse impact on the resource area, and should therefore be prohibited.”⁴⁴

The Applicant proposes to carry out work within the 25 feet of the BVW bordering the intermittent stream parallel to Frontage Road. Consistent with the policy’s requirement of clear and convincing evidence to demonstrate lack of an adverse impact on the interests of the Act, the Commission requested that the Applicant “[p]rovide a construction and development alternative that avoids this [buffer zone] impact through compliance with the Belmont Conservation Commission Wetlands Setback Policy and not altering the BVW Buffer in a manner that potential causes adverse impacts to the BVW.”⁴⁵

In response, the Applicant stated that the Policy was not a Wetlandss By-law, and was therefore not enforceable.

The Commission notes that the Policy merely makes explicit what is in Rule 10.53(1), namely that for purposes of the Act, it is entirely appropriate to treat different portions of the buffer differently. The Policy therefore clarifies what is already implicit in the Rules. It does so by specifying exactly how the Commission proposes to enforce Rule 10.53(1).

In adopting the Policy, the Commission chose to carry out Rule 10.53(1) by requiring a higher burden of proof for work within the 25-foot inner buffer. The imposition of a burden of proof is consistent with the Rules. For example, Rule 10.03(1) already imposes on the Applicant the burden of demonstrating to the Commission that the proposed work within a buffer zone will contribute to the protection of the interests of the Act.

The Applicant has not responded to this request for an alternative. Thus, the proposed plans continue to be in conflict with the Commission’s 25 foot Setback Policy, Rule 10.03, and Rule 10.53.

⁴⁴ *Belmont Conservation Commission*, Wetlands Setback Policy, Jan 9, 2007.

⁴⁵ Commission’s letter to Applicant, November 14, 2007

5.6.5 Summary of Insufficient Information for Work in Buffer Zone

In summary, the Commission has determined the much of the 100-foot buffer adjacent to BVW is essential to the protection of the interests of the WPA.

5 In response to requests for alternatives, the Applicant has attempted to carefully reconfigure compensatory flood storage areas to minimize alterations to the 100-foot buffer adjacent to BVW, while maintaining the overall footprint of the project.

10 At the close of the public hearing, the Applicant failed to provide an alternative, requested by the Commission, that avoids altering land within the 100-foot buffer adjacent to BVW on the south or west sides of the site, or within a 25-foot buffer adjacent to BVW bordering the intermittent stream parallel to Frontage Road in order to protect the interests of the WPA.

15 In the Commission's view, the underlying cause of impacts due to Buffer Zone alterations appears to be that the extent of development is inappropriate for the constraints imposed by the hydrological constraints of this particular parcel, and its critical location. This assessment is summarized in Mr. Horsley's letter of December 4, 2007 to the Commission, which states: "[t]he proposed project as currently designed will result in increased flooding, hydrologic changes to the surrounding wetlands and water quality impacts."

20 5.7 The Applicant has failed to provide sufficient information to confirm compliance with Stormwater Management Standard #1.

Stormwater Management Standard #1 states:

No new storm water conveyances (e.g. outfalls) may discharge untreated storm water directly to or cause erosion in wetlands or waters of the Commonwealth.

25 5.7.1 Discharge from FES -1

The Applicant proposes discharging into a resource area through a narrow, largely dirt-banked roadside ditch that is prone to erosion. A significant portion of the ditch lies within the 100-foot buffer to BVW adjacent to the Little River. To the extent the ditch is an "unrestricted hydraulic connection," as the Applicant claims, one would expect

stormwater to flow swiftly down the ditch and into the resource area, eroding the ditch as it does so.

The Applicant has failed to overcome the burden of demonstrating that that erosion and sedimentation of the wetland can and will be controlled as water funnelled
5 into the roadside ditch erodes surrounding soil.

The Commission has requested information concerning erosion and sedimentation.⁴⁶ However, no such information has been forthcoming. Accordingly, the Commission is unable to establish compliance with Stormwater Management Standard #1.

10 The Applicant's HydroCAD analysis projects a 65% increase in peak runoff during a 10-year 24-hour storm through the ditch as a result of development.⁴⁷ An independent analysis carried out by Mr. Horsley projects an increase of 130%, which is double the Applicant's estimate. In either case, it is abundantly clear that development will significantly increase run-off through the ditch. Given the substantial increase in run-
15 off, it is reasonable to expect water to erode the ditch and to carry sediment, along with other pollutants from the development, into the wetlands.

The significant discrepancy in run-off estimates suggests a fundamental difficulty in establishing what should be a fairly basic parameter of the design. In view of the foregoing discrepancy, the Commission cannot reasonably establish compliance with
20 Stormwater Management Standard #1.

5.7.2 Discharge of untreated stormwater into resource area

The Applicant proposes a "new stormwater conveyance" (i.e., FES -1) that will "discharge untreated storm water directly to...wetlands." This water will originate from the southern parking area, entrance drives, and groundwater.⁴⁸

⁴⁶ See letter of November 14, 2007, page 24.

⁴⁷ See Drainage Report, Table 7 on page 13. which indicates pre and post peak runoff of 5.7 cfs and 3.2 cfs respectively for a 10-year 24 hour storm..

⁴⁸ *Id.*

In particular, the Applicant proposes to drain approximately half an acre of pavement through FES -1 directly into CFSA-2 and CFSA-3, from which it eventually proceeds to wetlands and into the Little River. The Applicant also proposes to direct roof drainage and water from perimeter foundations and drains into CFSA-2 and CFSA-3.

5 As indicated in Appendix E of the Applicant's Drainage Report, this half-acre portion of pavement will be swept. However, street sweeping by itself is not a "treatment" of stormwater sufficient to comply with Standard #1. Thus, the FES that discharges runoff from the half acre of pavement into CFSA-2 and CFSA-3 amounts to a discharge from a new stormwater conveyance to wetlands and waters of the
10 Commonwealth. As such, it represents a violation of Stormwater Management Standard #1.

In response to an inquiry about the proposed discharge of untreated water, Tetra Tech stated that Stormceptor units will be provided for only "the majority of pavement runoff."⁴⁹

15 The Applicant appears to be interpreting Stormwater Management Standard #1 as saying that it is proper to direct untreated runoff into the wetlands provided only that most of the runoff is treated. The Applicant has not cited any authority for this interpretation of Stormwater Management Standard #1.

In fact, the plain language of Stormwater Management Standard #1 suggests that
20 it is improper to discharge any amount of untreated stormwater runoff into the wetland.

5.8 The Applicant has failed to show an unrestricted hydraulic connection between CFSA and Little River

The proposed design fails to provide an unrestricted hydraulic connection between the compensatory flood storage and the Little River as required by Rule 10.57.⁵⁰

⁴⁹ Response 15, page 6, letter dated 10/16/07.

⁵⁰ Rule 10.57(4)(a)(1) "Such compensatory volume shall have an unrestricted hydraulic connection to the same waterway or water body."

The Applicant proposes to connect a CFSA to Little River by a roadside ditch extending along Acorn Park Drive. The Applicant initially suggested that this roadside ditch would amount to the “unrestricted hydraulic connection” as required by Rule 10.57 because it lacked a valve or other control device for regulating the flow through the connection. Several weeks later, the Applicant submitted a letter stating that, according to an unnamed source at the Department, a “restricted hydraulic connection” was any connection other than an open channel connection, and that consequently, the ditch was an unrestricted hydraulic connection.⁵¹

The Commission regards either of the foregoing interpretations of “unrestricted” as being inconsistent with the Act because both interpretations would lead to anomalous results. These anomalous results are as follows:

According to the Applicant’s initial interpretation, an extremely wide channel that connects two bodies, but happens to have a valve in place, would be a “restricted” hydraulic connection, whereas a channel that is barely wide enough to support capillary action between two bodies would be regarded as “unrestricted” simply because it lacked a valve. This result is inconsistent with common sense.

According to the Applicant’s replacement interpretation, an extremely wide pipe connecting two bodies would be a “restricted” hydraulic connection, whereas a narrow open channel filled with numerous obstacles to flow would be “unrestricted” simply because it is an open channel. Under this second definition, it is impossible for any open channel whatsoever to be “restricted.” This result is also inconsistent with common sense.

In drafting the rules, the Department no doubt recognized that, depending on the details of their respective structures, a pipe and an open channel can provide either an unrestricted or a restricted hydraulic connection. Accordingly, it is the Commission’s view that in drafting the rules, the Department carefully chose the word “unrestricted” to refer to a functional characteristic, not a structural one. In an effort to identify this

⁵¹ TTR Response of 11/22/07, page 9 (“Our hydraulic connection is via an open channel, and based on a conversation with a MADEP project reviewer, a restricted hydraulic connection is one where there is a pile and/or an underground structure.”) [emphasis in original]

functional characteristic, it is useful to consider what type of hydraulic connection that would advance the Act's interest in flood control.

Among the interests protected by the Act is that of flood control. It is apparent that any CFSA that fails to respond promptly to a change in a river's elevation cannot possibly protect the Act's interest in flood control. Therefore, consistent with the Act's interest in flood control, the Commission regards an "unrestricted hydraulic connection" between two bodies as one that enables a change in elevation at one body to cause an equal change in elevation at the second body within a reasonably brief interval.

It is apparent from the foregoing interpretation of "unrestricted" that one cannot possibly determine whether a hydraulic connection is unrestricted without knowing at least some rudimentary details concerning the dynamic characteristics of the hydraulic connection. The Commission has requested information to establish the dynamic characteristics of the hydraulic connection. However, the Applicant has provided no such information, other than conclusory assertions regarding the proposed hydraulic connection.

Although the roadside ditch is unquestionably a hydraulic connection, the limited size of the ditch, coupled with its dual role of transporting both floodwaters and stormwater, suggest to the Commission that the resulting hydraulic connection is a restricted hydraulic connection.

The Commission has invited the Applicant's submission of information to overcome the burden of proving that the dynamic properties of flow in the roadside ditch between the CFSA and the Little River are such that the hydraulic connection may indeed be regarded as "unrestricted." However, no such information has been forthcoming.

In the absence of evidence to the contrary, the Commission finds that the dimensions of the roadside ditch along Acorn Park Drive result in a restricted hydraulic connection that fails to advance the Act's interest in flood control, and that fails to comply with Rule 10.57(4)(a)(1).

5.9 Thermal/water quality impact

In an initial report, Mr. Horsley drew the Commission's attention to the possibility that runoff from the parking lot and rooftops could carry a bolus of heat into the waters within the resource area, and that such heat could raise the temperature of the water by an amount in excess of that permitted by the Surface Water Quality Regulations (314 CMR 4.00). Moreover, Rule 10.04 defines a change in water temperature as an alteration of a resource area.

The Commission further noted that such excess thermal loading is likely to occur in summertime, when the volume of waters within the resource area would be at its lowest point. In recognition of this, the Commission requested that the Applicant provide information from which it would be possible to assess the impact of thermal loading on waters within the resource area.

The Applicant's communication of October 16, 2007 responded by listing three practices that the EPA recommends for mitigating thermal impact. In its response, the Applicant essentially states that impervious surface area has been minimized. However, since the minimized surface area is non-zero, the Applicant must have some constraint in mind that sets an absolute lower bound below which the impervious surface area may not fall. The Applicant has declined to articulate what the constraint is that sets this lower bound, and why the constraint itself cannot be lowered.

The Applicant further states that some runoff has been redirected to a bio-filter strip, and that certain measures have been taken to promote groundwater infiltration. Finally, Applicant agreed to consider the possibility of a white roof.

Essentially, the Applicant states that some steps to reduce thermal loading have been taken, and that other steps are under consideration. However, considering a step is not the same as committing to a step. Moreover, the Applicant has not articulated any rational basis for determining the extent to which thermal loading would alter the resource area or result in Surface Water Quality violations under either the present plan or any alternatives.

The extent to which the Applicant has made efforts to avoid altering the resource area is irrelevant to determining whether impermissible alterations would in fact occur and whether violations of the surface water quality rules are likely. Accordingly, the Commission regards the Applicant's response as non-responsive.

5 As of the close of the public hearing, the Applicant had not provided information from which one could reasonably assess the magnitude of the alteration and the extent to which adverse impacts are minimized.

An alteration of water temperature has an impact on prevention of pollution, protection of wildlife habitat, and protection of fisheries.⁵² Accordingly, in the absence of
10 such information, the Commission has no basis for assessing the effect of the work on at least these interests identified in 131 MGL 40.

5.10 The Applicant has Failed to Provide Sufficient Information to Demonstrate that the Proposed Wildlife Habitat Replication Area Protects the interest of the WPA.

15 The Applicant proposes to eliminate certain BLSF that currently serves as wildlife habitat, and to replace the wildlife habitat with replication areas. The Applicant is permitted to do so provided that the replication areas carry out the functions formerly carried out by the lost wildlife habitat.

The rules for evaluating the extent to which a replication area replaces existing
20 wildlife habitat function are found in Rule 10.60(3). According to Rule 10.60(3)(d), in evaluating the extent to which the replication areas succeed in mitigating for the lost wildlife habitat, the Commission should consider

25 "interspersed and diversity of vegetation, water, and other wildlife habitat characteristics of the replacement area, as well as its location relative to neighboring wildlife habitats".

In addition, according to Rule 10.60(3)(b), the Commission should ensure that

⁵² Alewives have traditionally been harvested and sold as bait fish. Hence, despite its apparently urban environment, the resource area has supported some commercial fishing activity. The importance of this activity to the Commonwealth is apparent from a recent state-ordered moratorium on the taking of migrating alewives from urban rivers due to their decreasing numbers.

"the elevation of groundwater relative to the surface of the replacement area shall be approximately equal to that of the lost area."

The Applicant proposes two habitat replication areas to compensate for the loss of wildlife habitat: one located in the southeast portion of the site ("Southeast Replication Area"), and another located in the northeast portion of the site ("Northeast Replication Area").

5.10.1 Location of proposed replication area undermines existing wildlife habitat's function as a corridor

Consistent with Rule 10.63(d), the Commission first considers whether the proposed replication area and existing wildlife habitat have a difference in "location relative to neighboring wildlife habitats."

Among the functions of the existing wildlife habitat is that of providing a corridor between uplands and wetlands. Such a corridor is essential to many species that require access to uplands and wetlands. Severing this corridor would place at least seventeen species at risk.⁵³ Other species whose existence in the area would be jeopardized include vernal pool species.⁵⁴

The existing wildlife habitat carries out the function of providing a corridor between upland and wetland. In particular, the relationship of Area A to other sites allows it to function as a corridor between core wildlife habitat and the wetlands. The absence of any significant obstructions along this corridor enables wildlife to negotiate the terrain relatively easily.

The Applicant proposes to replace this existing wildlife habitat with a replication area adjacent to four large buildings set amidst an expanse of impervious material. Even in the absence of any noise or traffic, these buildings, their associated ancillary structures, and the impervious area surrounding them, are likely to obstruct free passage of wildlife through the area.

⁵³ Among these species are the painted turtle, mink, American beaver, green-winged teal, and hooded merganser.

⁵⁴ Exemplary vernal pool species include leeches, caddisfly larvae, dobsonfly larvae, and planorbid snails.

The Northeast Replication Area in particular has characteristics that substantially undermine its ability to carry out the functions of the wildlife habitat that it purports to replace. For example, this area is to be bordered by Frontage Road and Acorn Park Drive on two sides, by part of the BVW on a third side, and by a newly-constructed retaining wall on the fourth side. The retaining wall will be several feet tall. Thus, after entering the Northeast Replication Area through the BVW, one could continue onward by either scaling a retaining wall, by crossing a freeway access road, or by crossing the street that serves as the main access point for a 299 unit housing complex. This configuration renders the Northeast Replication Area largely inaccessible to most small mammals and invertebrates.

Furthermore, the relationship between the Northeast Replication Area and surrounding wildlife habitats is not conducive to carrying out the lost wildlife habitat's function of providing a corridor between those habitats. Thus, the Northeast Replication Area's "location relative to neighboring wildlife habitats"⁵⁵ is such that it cannot possibly "maintain the wildlife habitat functions of the lost area."⁵⁶

It is apparent to the Commission that, as a result of their differences in "location relative to neighboring wildlife habitats," the proposed replication area would be unable to carry out the functions now being carried out by existing wildlife habitat. This results in a substantial loss of wildlife habitat function. As a result, the Commission finds that the replacement of existing wildlife habitat with the proposed replication area would fail to protect the Act's interest in the protection of wildlife habitat.

5.10.2 Replacement of existing contiguous wildlife habitat with fragmented wildlife habitat undermines use for acreage-dependent species

The proposed replication area would fragment a large and contiguous expanse with smaller areas. These smaller areas, when added together, result in acreage that is comparable to that lost, thereby satisfying Rule 10.60(3)(a).

However, in drafting the rules, the Department has recognized that the usefulness of wildlife habitat is not a function of its acreage alone. In particular, 10.60(3)(d) requires

⁵⁵ Rule 10.60(3)(d).

⁵⁶ Rule 10.60(3)(d).

consideration of “other wildlife habitat characteristics of the replacement area...insofar as necessary to maintain the wildlife habitat functions of the lost area.”

Among the characteristics of the existing wildlife habitat is that it provides a large and contiguous expanse of forest. The uninterrupted extent of the contiguous habitat is particularly useful for species that require greater acreage. (Brown, 2002).

The proposed replication areas would, because of their smaller uninterrupted expanses, fail to carry out the wildlife habitat function of providing sufficient acreage for those species that require such acreage to thrive. Accordingly, the replacement of existing wildlife habitat with the proposed replication areas would fail to protect the Act’s interest in the protection of wildlife habitat, particularly for those species that requires larger uninterrupted parcels to thrive. This would result in a substantial loss of existing wildlife habitat function.

5.10.3 Proposed replication areas are exposed to pollution from runoff

According to Rule 10.60(3)(d),

“water, and other wildlife habitat characteristics of the replacement area...shall be similar to that of the lost areas”

Among the useful characteristics of any wildlife habitat is that it provide an area that is relatively free of pollution that may be harmful to wildlife.

Among the characteristics of the existing wildlife habitat is that it is not exposed to untreated runoff from any parking lots. As a result, the existing wildlife habitat is free from pollution associated with parking lot runoff. Accordingly, the existing wildlife habitat effectively carries out the function of providing an area that is relatively free of pollution.

Upon completion of the project, the Southeast Replication Area will receive runoff having an untreated constituent and a treated constituent. The untreated constituent originates at the parking lot south of Building A. Because it originates at a parking lot, the untreated constituent is likely to include soluble de-icing materials, oils, antifreeze, and other assorted automotive fluids.

It follows therefore that among the characteristics of the replication area is that it is exposed to pollution from parking lot runoff. Over time, the pollutants would tend to accumulate. A replication area that is exposed to an accumulating load of pollutants from parking lot runoff is clearly quite different from one that is not. In particular, such a replication area cannot be said to provide an area that is relatively free of pollution.

Accordingly, the proposed replacement of existing wildlife habitat with replication area would result in a substantial loss of the ability to provide an area that is relatively free of pollution. As such, the proposed replacement adversely impact's wildlife habitat and is therefore inconsistent with the Act's interest in protection of wildlife habitat.

By providing wildlife habitat that shares space with a compensatory flood storage area, the Applicant has effectively created a self-cleaning wildlife habitat. In normal operation, flood water from the Little River will occasionally fill the wildlife habitat. As it recedes, it carries the pollutants with it, thus periodically cleansing the replication area and restoring it to its original pristine state.

Unfortunately, this flooding only makes matters worse. After such a flood recedes, the pollutants that have been accumulating in the replication area would now be in the resource area itself. Accordingly, the self-cleansing configuration of the replication area also harms the Act's interest in prevention of pollution.

5.10.4 Proposed replication areas fail to replicate existing lighting and sound conditions

Rule 10.60(3)(d) requires consideration of

“other wildlife habitat characteristics of the replacement area...insofar as necessary to maintain the wildlife habitat functions of the lost area.”

Among the characteristics of any wildlife habitat are the extent to which the wildlife habitat is exposed to light and noise. The existing wildlife habitat is relatively dark and quiet. The replication areas, however, are likely to be noisy and bright.

Among the habitat characteristics of the Northeast Replication Area are its vulnerability to noise disturbance and to intrusion of artificial light from the adjacent parking area, from building E, and from Acorn Park Drive.

Like the Northeast Replication Area, the Southeast Replication Area is also vulnerable to noise disturbance and intrusion of artificial light originating from buildings and traffic associated with the new development, the adjacent parking area, and building A. Artificial lighting from the upper stories of building A are likely to illuminate the Southeast Replication Area at night. In the wintertime, when the leaves are no longer present, artificial lighting from lower stories will contribute to such illumination. Vehicle and ambient noise from the parking area and Building A are likely to intrude into the Southeast Replication Area.

In contrast, the existing wildlife habitat that these replication areas purport to replace, namely the existing BLSF impact areas B and D located at the rear of the property are not vulnerable to noise disturbance or intrusion from artificial light.

In sum, the Applicant proposes to mitigate the loss of a dark and quiet wildlife habitat with a bright and noisy replication area. The Commission finds that a bright and noisy replication area does not serve the same wildlife habitat function as a quiet and dark area. Accordingly, the replacement of existing wildlife habitat with the proposed replication areas leads to a substantial loss in wildlife habitat function and is likely to harm the Act's interest in protection of wildlife habitat.

5.10.5 Groundwater elevations in replication area do not match those in lost area

According to Rule 10.60(3)(b),

“the elevation of groundwater relative to the surface of the replacement area shall be approximately equal to the lost area.”

Groundwater in the Applicant's wildlife habitat replication areas appears to be much lower relative to the surface of the replacement area than groundwater in the lost areas. Accordingly, it appears that the proposed replication areas are inconsistent with Rule 10.60(3)(b).

5.10.6 Proposed replication areas fail to provide cover and food comparable to those provided by lost areas

Among the functions of any wildlife habitat are those of providing food and cover. The rules provide for the preservation of this function by requiring the

5 Commission to consider

"interspersed and diversity of vegetation, water, and other wildlife habitat characteristics of the replacement area"

The construction of the Southeast Replication Area would require removal of three of the largest diameter silver maple trees remaining. Because the Southeast
10 Replication Area is likely to be wet, it is unclear that any trees would be able to survive or grow to such a large size.

The harm to the wildlife habitat is not, however, limited to removal of three trees. The existing wildlife habitat also includes a mature silver maple forest that provides food and cover for many species.(Katuska, 2003). The existence of a mature upland forest
15 provides cover that is essential to many avian species, including birds of prey and migratory birds (Brown, 2002) (Fairbairn 2007).

The proposed replication area lacks any such forest. As a result, replacement of the existing wildlife habitat with the replication area would result in a significant change in Rule 10.60(3)(d)'s "interspersed and diversity of vegetation." The replacement of
20 existing wildlife habitat with replication areas thus results in substantial loss of a key function of the existing wildlife, namely that of providing food and cover for its resident species. As a result, the proposed replacement is inconsistent with the Act's interest in protection of wildlife habitat.

5.10.7 Summary of Losses in Existing Wildlife Habitat Function

25 Adverse effects on wildlife habitat result from the alteration of any habitat characteristic found in 310 CMR 10.60(2). As described above, the location of the two habitat replication areas relative to neighboring wildlife habitats are not similar to the locations of the lost BLSF areas, the groundwater elevations relative to the surface of the two habitat replication areas are not similar to those of the lost BLSF areas, and a number
30 of the wildlife habitat characteristics of the two habitat replication areas are not similar to

the locations of the lost area. These differences result in substantial loss or diminution of existing wildlife habitat function. Thus, the Commission finds that the two habitat replication areas fail to provide the replacement value necessary and are not in compliance with the standards for the restoration and replacement of altered habitat found in 310 CMR 10.60(3).

6. CONCLUSION

For reasons discussed above, and pursuant to Rule 10.05(6)(c), the Belmont Conservation Commission finds that information submitted by the Applicant is insufficient to describe the site, the work, or the effect of the work on the interests identified in the Wetlands Protection Act and to demonstrate compliance with both certain Department Stormwater Standards and with certain provisions of the Wetlands Protection Act. Accordingly, the Belmont Conservation Commission issues this order prohibiting work on the site.

Attachment A - List of Information Considered Other Than That Cited by the Applicant

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