Falmouth Conservation Commission
Town Hall Square
Falmouth, MA 02540 January 7, 2003

Honorable Commission members:

As you know, on December 6, 2002, the Buzzards Bay Project National Estuary Program submitted comments on stormwater treatment designs contained in a Notice of Intent (NOI) before the Falmouth Conservation Commission. The proposed development, a commercial retail building and parking lot (Douglas Shearer applicant), is located at Clausons Corner near Rt. 151 and Sandwich Road. The proposed construction activity is within a 100-foot wetland buffer of a jurisdictional wetland under the Town of Falmouth wetland bylaw and supporting regulations. The buffer zone to this wetland area also contains a Massachusetts Threatened Species--*Asclepias purpurescens* (Purple Milkweed). In our December 6 comment letter, we concluded that the applicant failed to submit all materials required by the Falmouth Wetland Regulations (FWR) for stormwater designs, failed to use the methodology required by the FWR, and failed to provide adequate information for the evaluation of stormwater remediation designs pursuant to the FWR.

In response to our December 6 review, on December 23, the Buzzards Bay Project received a letter dated December 19 (attached) from the engineering firm Stephen Doyle & Associates (SDA), to which you were copied. Below we summarize their comments and provide a response. We have reordered certain comments to provide greater continuity.

SDA comment: *"…the reviewer focuses on meeting each and every requirement of the relevant regulations, rather than on evaluating the suitability of the drainage system as proposed. We believe that many of the reviewer's concerns related to runoff do not apply to this project."*
Response: The Buzzards Bay Project knows no other basis with which to review permit applications, other than to apply relevant municipal, state, and federal regulations. Whenever regulations establish specific submission requirements, performance standards, methodologies, or design criteria, these must be adhered to. The suitability of the proposed drainage system can only be evaluated in the context of the Falmouth Wetland Regulations. Our December 6 comment letter focused exclusively on whether the project complied with stormwater treatment designs criteria, performance standards, submission requirements, and methodology identified in the Falmouth Wetland Regulations.

SDA comment: "*The infiltration system as proposed is commonly approved at local, county and state levels."*

Response: This system was not approved under the Falmouth wetland regulations, and may not be approvable as designed. The designs proposed might be permitted in other jurisdictions where they are consistent with applicable regulations. For example, if a project like this one is not near a wetland resource area, the stormwater remediation designs may only be reviewed by a municipal Planning Board. Some Planning Boards have adopted detailed stormwater treatment standards and criteria comparable to the Falmouth Wetland Regulations, some have adopted the state Wetland Protection Act Stormwater Guidance, and some planning boards lack detailed performance standards and criteria and rely on "best professional judgment." Acceptance of comparable designs under other regulatory circumstances does not mean that the designs are consistent with the Falmouth Wetland Regulations.

SDA comment: "*The proximity of the proposed worksite to buffer areas should be noted. A portion of the area to be developed is within a 100-ft buffer area of a kettle hole containing wetlands plants, but located on the developed side of an existing stone revetment, already permitted. …a more complex stormwater design analysis would be required should the Commission determine that full implementation of Falmouth Wetland Regulation 2.0 is required."*
Response: The existence of the revetment, and previous permitting of the revetment, does not negate the need for a permit for the construction of a 7,384 square foot retail building footprint and related paved parking areas. Portions of this project are within the 100-foot buffer of an isolated wetland. Although the site is disturbed, the existing grass and sand on the site has a very different stormwater runoff coefficient than the proposed impervious surfaces. Consequently, the applicant must comply with the Falmouth Wetland Bylaw and the supporting Falmouth Wetland Regulations (FWR), specifically FWR 10.16(3) (Stormwater Management) and FWR 2.00 (Standards and Specifications for Stormwater Management Systems). Application of these regulations is not discretionary on the part of the Commission.

SDA comment: "*The [isolated] wetland [in the kettle hole] is protected by town regulations and is exempted from state regulations owing to its size. The proposed worksite is more than 200 ft from Little Jenkins Pond."*
Response: These statements are correct. Consequently, only the Falmouth Wetland Regulations are applicable and have bearing to this project. The state wetland regulations have no relevance.

SDA comment: "*The Falmouth Conservation Commission and state regulations require that the design contain post-development peak discharge rates for the 2-yr and 10-yr, 24-hr storms, and not increase flooding impacts in the event of a 100-yr, 24-hr storm."*
Response: This is incorrect; the applicant has cited the state wetland regulations performance standards. The Falmouth Wetland Regulations differ. FWR 10.16(3)(b) specifies that post-construction runoff peak discharge rates shall not be exceeded for 2, 10, 25, and 100-year 24 hour storm, "nor shall these storm events exacerbate or create flooding conditions, or alter surface water flow paths such as to impact adjacent properties." In addition, post-development runoff shall not exceed the pre-development [i.e. existing conditions, see December 6 letter] runoff volume for the ten (10) year, twenty-four (24) hour design storm." Both the FWR and state wetland regulations require the use of TR55 for calculating stormwater volumes.

FWR 10.16(3)(c) also requires treatment of the "first flush" (1.25 inches) of the stormwater discharge with removal of 80% total suspended solids (same as the state requirements). In addition, this section also specifies that "development in the watershed of a freshwater pond shall incorporate phosphorous removal at a design rate of 50% or greater." Groundwater infiltration of stormwater greater than 100

feet from a freshwater pond will achieve the 50% phosphorus removal for stormwater. This section of the regulations also states "any development in the watersheds of a coastal pond or other nitrogen sensitive embayments shall incorporate physical treatment processes to remove nitrogen at an efficiency rate of 30% or greater." This site is in a coastal pond protection district, and groundwater infiltration of stormwater is generally considered a poor mechanism for nitrogen removal. However, this regulation is ambiguously written in that it does not specify nitrogen removal efficiency in terms of net surface flow losses or nitrogen removal efficiency in terms of loss in discharge to the groundwater. If this section is based on volumes and quality of stormwater that is not infiltrated in the first flush (that is, if only the overflow from the catch basin is considered), infiltration basins can be presumed to meet the 30% removal criteria for up to the 5 year storm or greater.

SDA comment: "*Our design exceeds these [stormwater treatment] requirements, since the proposed drainage system retains all storm water from the new construction onsite."*
Response: The applicant should provide the TR55 calculations, data on size of dry wells, and soil logs at the sites of the BMPs, and other submission requirements identified in the regulations to demonstrate this assertion.

SDA Comment: "*Maximum groundwater levels at the proposed BMP locations: There is a monitoring well (existing) just outside the perimeter of Little Jenkins Pond. Data from this well establish that maximum groundwater is lower than elevation 40 ft. The lowest point of development is elevation 53 ft; the highest elevation is 71 ft. Therefore, the maximum water table is 13 to 22 ft below the finished grade. Further groundwater data can be obtained by testing at the down-gradient infiltrations areas."*
Response: Data from this well may be acceptable. The applicant should identify the precise location of this well and provide the seasonal monitoring well elevation data and other supporting documentation to show the seasonal high water table elevation pursuant to the regulations.

It is worth noting that groundwater and pond levels in parts of Falmouth may fluctuate by three to six feet between dry summers and wet winters. The applicant's plans show the elevation of Jenkins Pond just to the south in June 2001, a drought year, at elevation 39 to 40 feet. The USGS quad indicates a level of 37 feet. The MassGIS contour data (March 2000) indicates the pond is higher than the 39-foot contour taken during March 2000.

The elevation of the boundary of the isolated wetland abutting the proposed construction site is approximately at elevation 44 to 45 feet. In general, areas defined as wetlands typically have groundwater at an elevation of one foot or less below the surface during a portion of the growing season (otherwise it would not be a wetland). This may suggest either a strongly sloping higher water table under the area north of Little Jenkins Pond, or a slightly perched water table. Either situation may have bearing on the performance of the stormwater infiltration structures on the west side of the building because the base of the leaching pit is estimated to be elevation 45 feet.

Section 2.09 (3)(c) of the Falmouth Wetland Regulations require the design be in compliance with the Rhode Island Design and Installation Manual, and FWR 2.09 (3)(c)4 specifically identifies compliance with the specified setback distances. Specifically, there must be a 3-foot separation between the base of the infiltration system and the seasonal high water table, unless the infiltration rate is greater than 7.5 inches per hour, then the separation should be 4 feet.

SDA comment: *"Soil logs were submitted and are shown on Sheet 2 details. The SCS soil maps show the soil in Hydrologic Group "A." Other testing done in the vicinity of this project indicates soils typical of the referenced hydrologic group."*
Response: The two test pits and soil logs shown were for what appears to be the septic system under the parking lot on the east side of the building at elevation 72. These test pits are adequate for the stormwater infiltration basin in the same parking lot just to the north. However, the stormwater catch basin on the southwest side of the building, along the rim of the kettle hole, is at elevation 52. The basin to the northwest is at elevation 54 feet. The base of the southwest infiltration basin proposed is approximately eight feet below grade. The invert out elevation is at elevation 49.8 feet, and the base of "typical leaching pit" shown is 4.8' below the inflow pipe. This means the base of the leaching pit is at approximately elevation 45 feet.

This elevation is also the approximate elevation of the isolated wetland, which appears to be at 44 to 45 feet elevation. This is also likely near the annual maximum elevation of the water table in that location, based on the fact that wetland vegetation is present. The test pits for the stormwater BMPs on the west side of the building should be excavated. The regulations require these test pits to be dug to 4 feet below the base of the BMP, which in the case of the infiltration basin proposed on the west side, should be dug to 41 feet. The septic system test pits in the east parking lot were dug down only to elevation 60 feet. It cannot be presumed that these test pits adequately characterize soil types along the rim of the kettle hole at elevation 41 feet, near the water table.

SDA Comment: *"Documentation of BOH observation of soil test holes: Soil evaluations may be conducted at the down-gradient infiltration areas within the 100-ft buffer subsequent to Commission approval for such fieldwork (given the proximity to wetland and flora of concern)."*
Response: The wetlands boundary has already been established at this site, as well as the approximate location of the purple milkweed. In our opinion, no special permission is required to dig a test pit in the buffer zone for the stormwater infiltration basin in the proposed paved parking lot on the west side of the building. This information is essential and a requirement pursuant to FWR 2.04(2)(12): "Soil observation holes shall extend a minimum of four feet below the bottom of any stormwater BMP and be observed by the agent of the Board of Health."

SDA Comment: "*Stormwater management summary of pre- and post-development conditions: Since drainage volume calculations were not made using NRCS TR-55, the form was not filed. Should such calculations be required for this design by the Commission, the form would be included.*
Response: The Falmouth regulations explicitly require the use of NRCS TR-55 for volume calculations and the submission of form 2.15, pre- and post-development conditions. This requirement is not discretionary. The state regulations, incidentally, also require the use of TR-55 for volume calculations.

SDA Comment: *The recharge to groundwater required is .4 in. of runoff (Hydrologic Group "A" for each 1 in. of rain). We are providing a 1.25 in. rainfall storage volume (25 yr, 20 min T.O.C. with I = 3.75 in/hr) and 7.2 in. with infiltration (100 yr, 24 hr duration with I= .3 in./hr.)"*
Response: The 0.4-inch requirement is contained in the state regulations, not the Falmouth regulations. The Falmouth Wetland Regulations require 1.25 first flush treatment, but also 10-year 24-hr storm storage volume. The formula presented above incorporates the Rational Method and is not allowed under the Falmouth Regulations for volume estimates (see comment below).

SDA Comment: "*In this design, flood control is not provided by the rational method. The system was designed without infiltration for 25-year, 1.25 in. storm as described in the calculations, and a 100-yr, 24-hr duration storm was used for flood control. This exceeds the 2- and 10-yr, 24-hr requirement that the post-development runoff be less than or equal to pro-development runoff. Thus, the rational method was not used for volume."*

Response: SDA's "Storm Water Calculation" worksheet dated November 2002, clearly calculates the rates and volumes using the Rational Method,

First, SDA cites the formula Q= CIA (the Mulvaney equation, which is the basis of the Rational Method), which has the terms

Q= peak runoff rate in CFS

C= the runoff coefficient for the Rational Method

I= peak 1 hour runoff intensity for yr storm

A= runoff area

SDA then uses the peak runoff rate Q (in cubic feet per second), and multiplies this by the "Time of Concentration" or T.O.C. [sic] in minutes, times 60 seconds per minute to obtain their estimate of storm water volume ($V=Q \times T_{c\ [in\ minutes]} \times 60$ min/sec). This method is not allowed under the Falmouth regulations (or the State regulations) to estimate the volume of stormwater. This is due in part because 'I' is the peak 1-hour intensity rate from storm tables in the Rational Method. These are different than the peak 24-hour storm volumes in TR-55 (which uses the TP-40 rainfall maps). Stated simply, the volume estimates (and estimated hydrograph) using TR-55 can be very different than the method used by the applicant ($V=Q \times T_c \times 60$). The $Q \times T_c \times 60$ equation has not been considered valid or the method recommended in most jurisdictions' regulations for more than fifteen years.

The problem with SDA's approach is illustrated in November 2002 calculations worksheet submitted. In this case, the applicant estimated the volume for a 25-year storm for the paved "upper lot" (9,865 sq. ft.) as 852 cubic feet, based on their Rational Method derived formula. The stated storage capacity of the upper lot infiltration system is 1,018 cubic feet, which is then presumed to be adequate.

Using TR-55 (the methodology used in the state's and Town of Falmouth's regulations for stormwater volume), the 25-year 24-hour storm volume has a much greater. TR-55 uses about 5.75 inches of rainfall for the 25-year storm for this area of Cape Cod. Considering just the paved area of the upper lot of 7,541 square feet, TR-55 estimates the stormwater volume as

7,541 sq. ft x 5.75/12 ft x 98% runoff on paved= 3,541 cubic feet.

This is about 4.2 times greater than the 25-year 24-hour storm volume 852 cubic feet cited using the Rational Method, and 3.5 times greater than the storage capacity of the stormwater treatment system. The actual storage capacity for a 25-year would in fact need to be larger to account for runoff from the grassy areas.

However, the Falmouth Wetland Regulations do not require storage capacity for the 25-year 24-year storm. Rather, they require only the difference between pre-existing and post-construction conditions for the 10-year 24 hr storm. The 10-year 24-hour storm in TR-55 (based on the TP-40 maps) is about 4.85 inches. Using again the upper parking example above, the impervious surface alone will generate roughly 3,047 cubic feet (7,541 sq. ft x 4.85/12 ft x 98% runoff on paved), still much greater than the so-called 25-year storm volume derived from the Rational Method approach

used by SDA. In fact, a 2-year 24-hour storm (3.5 inches) from the upper parking paved under TR-55 area will generate 2,199 cubic feet, still far greater than the claimed 25-year storm in the Rational method.

As noted above, the 10-year volume requirement is adjusted by preexisting stormwater runoff volumes (the upper drive is already paved). The applicant needs to provide this information on form 2.15 (pre and post construction conditions).

Similarly, other areas of the site need careful review, and the applicant must submit all the requested information. For example, runoff from the roof of the building, which covers 7,384 square feet—almost as large as the parking lot—discharge is to dry wells. The capacity of these drywells, direction of overflow, and design information is needed to determine if these drywells are sized according to the Falmouth Wetland Regulations.

SDA Comment: "*With regard to design issues, many of the reviewer's comments would be relevant if we designed a system in which runoff were not contained."*
Response: Because of the discrepancy between the TR-55 method and the Rational Method employed, as illustrated by the example above, we cannot conclude the stormwater system will contain all stormwater required by the regulations (i.e., the difference in 10-year 24-hr storm pre and post construction). The applicant should submit the necessary data on form 2.15 as required, and provide the TR-55 summary sheets to demonstrate the effectiveness of the system as designed.

SDA Comment: "*Maintenance plan: In line with past Commission policy, names of specific contractors for maintaining stormwater treatment structures are not provided prior to project approval."*
Response: At this time the applicant should identify the party expected to hire the contractor (property owner, tenant?), and include the contractors name with the first maintenance report filed.

SDA Comment: "*The reviewer states that the pretreatment is inadequate. The catch basin and infiltration basins as proposed remove more than 80 percent of the T.S.S., and dry wells are used to remove 80 percent T.S.S. without a catch basin from roofs (see attached BMP list from Storm Water Management, Vol.1 and our T.S.S. calculations.)."*
Response: The applicant has cited the DEP manual for overall system performance, not the Falmouth Wetland Regulations requirement for pre-treatment. The catch basins are considered pretreatment for the infiltration basins, and catch basins alone provide a maximum of 25% TSS removal. Under the Falmouth regulations, the 80% TSS removal must be achieved before discharge to the infiltration basin. This requirement is to lengthen its functional lifespan of the infiltration system.

SDA Comment: "*Storm water purification first flush requirements is for .5 in. The proposed system provides pretreatment without infiltration of 1.25 in."*
Response: The Falmouth Wetland Regulations first flush definition is 1.25 inches, not 0.5 inch. Pretreatment for TSS is required prior to discharge in the infiltration basin in the Falmouth regulations. This pretreatment requirement is to lengthen the functional lifespan of the infiltration basin.

SDA Comment: "*Applying the Rhode Island method, which does not use infiltration, will result in a small system with overflow, and we would therefore not comply in Hydrologic Group "A"*

groundwater recharge requirement mistype of system would be suitable where no groundwater discharge is required - i.e. Hydrologic Group "D."
Response: This statement is incorrect. The Rhode Island method is employed by the state of Rhode Island where all types of soils can be found, including sands and gravels (Hydrologic Group "A"). Infiltration systems can, and are employed in Rhode Island. Even in sandy soils on Cape Cod, overflows are often employed in stormwater treatment. This is especially true on retrofit projects where there may insufficient space for large storage units. The inclusion of the Rhode Island Method in the Falmouth Wetland Regulations means there is no credit for infiltration when sizing storage capacity volumes in stormwater treatments systems. This will not result in "a small system with overflow." In fact, the method will require even greater storage capacity than now shown on the plans as noted above. This will become immediately evident with the application of the TR-55 program to this site.

SDA Comment: "*To meet these requirements, this system would have a lower drain to empty the structure for the 2- to 10-yr storm, set at the 2-yr storage elevation; and an overflow weir for the 10- to 100-yr storm. This type of system is not applicable to this project. Moreover, stormwater overflow owing to reduced infiltration at this site conflicts with our design requirement under Town of Falmouth Zoning Bylaw Section 240-112 B.(3): "Uncontaminated runoff should be directed in such a way as to recharge the groundwater within the lot where it originates, unless an alternative location is approved."*
Response: The statement is incorrect. The Falmouth Wetland Regulations set a minimum standard, not a maximum standard. The applicant need only demonstrate their system exceeds that minimum standard by applying the TR-55 methodology. If the Planning Board has standards that are more rigorous, these should be followed. This is a fundamental tenant in the application of environmental regulations under different jurisdictions. Furthermore, the Falmouth Wetland Regulations do not require an overflow pipe. They just recognize that every system has a certain capacity, and asks where flow beyond that capacity may go.

However, as noted earlier, the system capacity for the upper parking lot (assuming that this is representative) is for less than the 2-year 24-hour storm, and is in fact closer to a storage capacity of 1.25 inches of rain (pollution control), not the 4.85 inches of a 10-year storm based on TR-55. For the proposed stormwater treatment, the infiltration basins have no overflow, and that is acceptable if that is the design desired. Heavy rains will top the stormwater treatment system, particularly after a number of years when fine sediments slow the infiltration capacity of the basin. This will result in standing water in the parking lot while the water infiltrates into the leaching basin. This is not necessarily a bad thing, because the standing water in the parking lot during a 10-year storm can help achieve the desired storage capacity. This technique is often employed in certain heavily paved commercial areas to achieve regulatory storage capacity requirements.

SDA Comment: "*The external reviewer reports on the proposed design's compliance with the Falmouth Wetland Regulations, but does not provide a quantitative assessment of the proposed design's suitability for the site."*
Response: The only applicable criteria are those requirements established by the Falmouth Wetland Regulations. The existing stormwater system capacity of the upper parking lot area appears to be for somewhat more than 1.25 inches of rain, or the first flush under the regulations. It does not appear to have the capacity for the 10-year storm volume as defined under the Falmouth regulations. Application of the TR-55 methodology and the Rhode Island Methodology will require even greater storage capacity of the stormwater system than proposed.

Additional Buzzards Bay Project notes:
We wish to call attention to the Commission and applicant FWR 2.05 (5):

> *"Discharges to Closed Depressions. Notwithstanding the provisions of FWR 10.16(3)(b), where the discharge of stormwater is to a closed depression (e.g. kettle hole) with no outlet for storms up to the one hundred (100) year, twenty-four (24) hour design storm, the discharge shall be non-erosive and no other rate or volume standards are required."*

This section of the regulation eliminates FWR 10.16(3)(b), requirement relating to flood for 2, 5, 10, 25, and 100-year storms. The explanation for this exclusion is the presumption that there is no "down stream flooding" in discharges to depressions. Consequently, only the first flush (1.25 inch) standard and other section of FWR 10.16(3) would be presumed necessary to protect water quality, groundwater, and other interest of the regulations.

To demonstrate that this exclusion is justifiable, the applicant would have to employ TR-55 for a hydraulic study of the watershed surrounding the kettle hole, and consider all the discharges during the 100-year 24-hour storm. The situation is complicated by the fact that this isolated wetland is separated by a two-foot elevation at its minimum between it and Little Jenkins Pond. Therefore, it would have to be demonstrated that the isolated wetland could handle the 100-year storm without overtopping to Little Jenkins Pond.

Even if this were shown, FWR 10.19, protection of Rare Species, would be more difficult to overcome with the lower standard of just treating the first flush (1.25") and no additional storage capacity, because rainfalls greater than 1.25 inches occur several times each year. The applicant could voluntarily create additional stormwater capacity to overcome presumptions of FWR 10.19. This could be achieved by using the parking lot for additional stormwater storage capacity.

The applicant should ensure compliance with other Rhode Island stormwater design manual setback requirements, in addition to those previously mentioned. Nearly half the property is identified in the Zone 2 of a public well. The regulations require a 400 separation between stormwater infiltration systems and public wells, but the Zone 2 in this case likely exceeds this 400-foot setback. Also note that there is a 100-foot setback is required from private wells if any are present nearby. In addition, no infiltration system is to be sited within 100 feet a septic system. The proposed infiltration system on the east side of the building is within 60 feet of the septic system.

Final Recommendations
In our opinion, there is nothing unique or difficult about this site to prevent compliance with the Falmouth Wetland Regulations Stormwater sections, nor are there any impediments toward using the methodologies explicitly required in the regulations. Compliance with the Falmouth Wetland Regulation Stormwater Management Sections can be achieved as follows:

1) Complete the TR-55 calculations for the existing design, including submission of form 2.15 as required by the regulations. Provide TR-55 worksheets for review.
2) Dig 12-foot test pits and prepare soil logs at the two proposed BMP locations on the West side of the property (northwest and southwest property corners) under the inspection of the Falmouth Health Agent.
3) Provide designs and capacity of the proposed roof runoff dry wells.
4) Provide the information about the groundwater monitoring well near Little Jenkins Pond including its location and seasonal high water elevation data as described in FWR 2.04(2)(a)(13).

5) Improve pre-treatment to 80% TSS removal before discharge to the infiltration basins as required by the regulations. This can be achieved by the use of swirl separators or other devices.
6) Provide a 100-foot separation between the infiltration basins in the east side parking lot and the septic system.
7) Consider sloping the parking lot and slightly depressing the west side basins and enclosing the entire parking lot with a berm or curb to create a storage capacity in the parking lot to accommodate the difference in runoff from preexisting conditions and paved condition for the 10 year storm per TR-55. (If the existing designs are presumed adequate for the 100-year storm as stated, there should be no concern about parking lot flooding.)

If you need further assistance from the Buzzards Bay Project, please do not hesitate to call me.

Sincerely,

Joseph E. Costa, PhD
Executive Director

cc. Paul Somers, NHESP
Steve Pisch, Falmouth Engineer
William Riley, Rycon Corporation
Douglas Shearer, owner