● Ecology
● Soil & Wetland Studies
● Water Quality Monitoring ● GPS
● Environmental Planning & Management
● Ecological Restoration & Habitat Mitigation
● Aquatic, Wildlife and Listed Species Surveys
● Application Reviews ● Permitting & Compliance

April 6, 2016

Town of Mansfield
Inland Wetlands Agency
14 Park Place
Mansfield, CT 06226-2217

Re: **WETLANDS ASSESSMENT-SUPPLEMENTAL: *REVIEW OF STORMWATER SYSTEM***
Lodges at Storrs, Hunting Lodge Road, Mansfield, CT

REMA Job No.: 15-1860-MNS18

Dear Agency Members:

REMA ECOLOGICAL SERVICES, LLC (REMA), is providing herein a summary of our findings and recommendations of a detailed review of the proposed stormwater management system for the above-referenced student housing proposal. Our main objectives were to ensure protection of water quality and protection of the hydrologic regimes of the receiving waters, namely the regulated wetlands and watercourses associated with the site.

1.0 Water Quality Protection

During the planning process for the development proposal, REMA worked closely with the applicant, site planners, and civil engineers, identifying potential issues and exploring various planning and engineering solutions. The primary objective was to maintain existing water quality of surface waters, specifically that of the eastern intermittent watercourse (Wetland C), and of the site's documented vernal pool habitat (Wetland A).

As explained in the Engineering Design and Drainage Report ("the Drainage Report"), prepared by F. A. Hesketh & Associates, Inc. (dated 3/18/16, revised 3/24/16), primary

objectives of the stormwater management system included compliance with CT DEEP's Stormwater Quality Manual (2004) ("the Manual"). Specifically, two primary design and sizing objectives were taken into account, the Groundwater Recharge Volume (GRV), and the Water Quality Volume (WQV). For a review of the storm drainage designs implemented at the site, please refer to Section E, of the aforementioned Drainage Report.

The GRV ensures that groundwater regimes are maintained to continue providing seasonal shallow groundwater flow to the site's wetlands and streams, thus also indirectly contributing positively to water quality. The WQV is defined as the volume of stormwater generated and conveyed as runoff, during the water quality precipitation event, or a 1-inch storm. This is based on a national study[1] that found that approximately 90% of runoff, on an annual basis, is generated during storm events of 1-inch or less. The same national study also found that the great majority of runoff constituents, which could contribute to water quality degradation, are also generated during such storms. The national study, determined that a reduction of total suspended solids (TSS)[2] by at least 80%, on an annual basis, should be the goal for any new development, because studies showed that the concomitant reduction of other runoff constituents, such as nutrients and heavy metals, were also high at this level of TSS reduction[3].

The proposed stormwater management system (SMS) partitions the runoff generated on impervious surfaces into several catchment areas and provides treatment trains which include a significant infiltration component, using below ground, low-profile infiltration units. In accordance with the Manual, above-ground primary treatment is also utilized at each of the catchment areas. This is accomplished via water quality basins, which are in essence bioretention basins (a.k.a. rain gardens; see below).

The WQV is met in all of the catchment areas treating runoff from the site's impervious surfaces,[4] except in one case. This is the system that treats the southern portion of the internal circulation roadway that links the northern and southern sections of the residential community. The primary reason for this is the location of the selected wetland restoration site, which interfered with the ability of increasing the size of Bioretention Area #6. This is a

[1] USEPA Nationwide Urban Runoff Program
[2] TSS are those particles that are 100 microns in size or less (i.e very fine sand and finer).
[3] Percentages of Pollutants adhering to TSS (various citations): Total Phosphorus: 60%; Total Nitrogen: 50%; Iron: 85%; Lead: 55%.
[4] The design also includes many pervious parking surfaces, distributed across the site; these are considered Low-Impact Development (LID) practices.

design recommended by REMA, and several mitigating factors were considered. First, we desired that as much of the previously filled wetland is restored as possible, providing substantive mitigation to off-set the direct impacts to wetlands associated with the main access roadway. Second, the discharge point at this location is to the upper reaches of Wetland C1, an area of dense vegetation, and moderate microtopography, and without a distinct stream channel. This allows for discharge dispersal and a long flow path before the outlet channel of this wetland area, and conveyance to the eastern intermittent watercourse of Wetland C3/C4. Even so, the design includes a hydrodynamic separator (Stormceptor), which alone can provide very good water quality renovation, and thus, the 80% TSS removal would be met. We note that two additional hydrodynamic separators are being provided in conjunction with below-ground infiltration and above-ground bioretention, to provide exceptional treatment for the site's main roadway. This recognizes the fact that roadways generate more runoff constituents than parking lots.

Bioretention areas, also known from their smaller and simpler siblings, rain gardens, are known for providing exceptional stormwater quality renovation. In fact, bioretention areas such as those proposed have consistently been found to be highly effective through real world testing at University of New Hampshire's Stormwater Center[5]. These best management practices (BMPs) provide physical, chemical, and biological renovation of runoff, by combining dense vegetation and a specialized media that filters runoff, which is either infiltrated to the ground or discharges to upland areas for further polishing before reaching the downgradient wetlands.

The plans call for the bottom of the bioretention basins to be covered with shredded bark mulch. Upon further research, REMA recommends instead that they be seeded to grasses and forbs using the attached specialized seed mix by Ernst Conservation Seeds (i.e. ERNMX-180). This will result in a dense vegetative cover which will further enhance this BMP's runoff renovation effectiveness. We recommend that annual mowing be conducted at these basins during the first half of June, in a given year. Skipping a year would also be as effective to discourage woody vegetation, promote rigorous growth, and provide habitat and aesthetic functions and values.

[5] Only Bioretention Basin #6, does not use the same design as in other locations, which include an underdrain.

Based on our review, it is our professional opinion that the proposed stormwater management system will effectively treat runoff and be protective of the regulated resources' water quality, post-development.

2.0 Maintenance of Wetland Hydrology

By providing many stormwater discharge points, and exceptional infiltration throughout the site, the design has succeeded in maintaining the groundwater regime at the site, which is important for wetland hydrology. Moreover, during the planning process we identified two wetland areas that were potentially more susceptible to changes in hydrology. These were the vernal pool habitat embedded in Wetland A, and the western hillside seepage wetland (i.e. Wetland B).

For Wetland A and B, the design engineer was able to convey portions of the existing contributing watersheds directly to the wetland resources, bypassing impervious surfaces. Since a portion of the off-site watershed that is conveyed to Wetland A is presently developed, a bioretention basin (i.e. No. 3), is employed to ensure treatment. In addition, this bioretention area allows discharge more than 100 feet from the edge of the vernal pool, allowing further infiltration and polishing.

Based on review, it is our professional opinion that the hydrologic regimes of the site's regulated wetlands and watercourses will be maintained post-development.

Respectfully submitted,

REMA ECOLOGICAL SERVICES, LLC

Sigrun N. Gadwa, MS, PWS
Professional Wetland Scientist
Registered Soil Scientist

George T. Logan, MS, PWS, CE
Professional Wetland Scientist
Registered Soil Scientist, Certified Senior Ecologist

VIA E-MAIL & HAND-DELIVERY

Attachments: ERNMX-180 (Rain Garden Seed Mix)

Rain Garden Mix

ERNMX #	ERNMX-180
Cost Per Pound	$38.34
Seeding Rate	20 lb per acre with a cover crop of grain rye at 30 lb per acre
Mix Type	Upland & Meadow Sites
Species List (click for details)	38% River Oats, PA/VA Ecotype blend (Chasmanthium latifolium (Uniola latifolia), PA/VA Ecotype blend) 20% Virginia Wildrye, PA Ecotype (Elymus virginicus, PA Ecotype) 10% Fox Sedge, PA Ecotype (Carex vulpinoidea, PA Ecotype) 4% Purple Coneflower (Echinacea purpurea) 3% Tall White Beardtongue, PA Ecotype (Penstemon digitalis, PA Ecotype) 3% Blackeyed Susan, Coastal Plain NC Ecotype (Rudbeckia hirta, Coastal Plain NC Ecotype) 3% Lanceleaf Coreopsis, Coastal Plain NC Ecotype (Coreopsis lanceolata, Coastal Plain NC Ecotype) 2% Ohio Spiderwort, PA Ecotype (Tradescantia ohiensis, PA Ecotype) 2% Oxeye Sunflower, PA Ecotype (Heliopsis helianthoides, PA Ecotype) 2% Autumn Bentgrass, PA Ecotype (Agrostis perennans, PA Ecotype) 2% Partridge Pea, PA Ecotype (Chamaecrista fasciculata (Cassia f.), PA Ecotype) 2% Marsh (Dense) Blazing Star (Spiked Gayfeather), PA Ecotype (Liatris spicata, PA Ecotype) 1.5% Smooth Blue Aster, NY Ecotype (Aster laevis (Symphyotrichum laeve), NY Ecotype) 1% Wild Senna, VA & WV Ecotype (Senna hebecarpa (Cassia h.), VA & WV Ecotype) 1% New England Aster, PA Ecotype (Aster novae-angliae (Symphyotrichum n.), PA Ecotype) 1% Swamp Milkweed, PA Ecotype (Asclepias incarnata, PA Ecotype) 1% Path Rush, PA Ecotype (Juncus tenuis, PA Ecotype) 1% Soft Rush (Juncus effusus) 0.8% Wild Bergamot, Fort Indiantown Gap-PA Ecotype (Monarda fistulosa, Fort Indiantown Gap-PA Ecotype) 0.5% Mistflower, VA Ecotype (Eupatorium coelestinum (Conoclinium c.), VA Ecotype) 0.5% Blue False Indigo, Southern WV Ecotype (Baptisia australis, Southern WV Ecotype) 0.5% Early Goldenrod, VA Ecotype (Solidago juncea, VA Ecotype) 0.2% Slender Mountainmint (Pycnanthemum tenuifolium) Total: 100%