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Martha's Vineyard Community Services Redevelopment Nitrogen Analysis

Acronyms:

DB: Day Break
DS: Disability Services
ECP: Early Childhood Program
HSP: Head Start Program
ICC: Island Counseling Center
IWYC: Island Wide Youth Collaborative
MVC: Martha's Vineyard Commission
MVCS: Martha's Vineyard Community Services
MVRHS: Martha's Vineyard Regional High School
PH: Project Headway
WQMP: MVC Water Quality Management Policy v13 (1/12/18)

Site Conditions:

Locus lies entirely within the Lagoon Pond Watershed.
Adjusted Nitrogen Load Limit: 1.87 kg/acre/year per WQMP
Locus does NOT lie within Zone II of the Farm Neck municipal well
Proposed MVCS Lease Lot: 4.90 acres (remaining MVRHS property: 7.44 acres)

Project Notes:

Until municipal sewer system capacity is expanded and additional sewer flow is allocated to MVCS, the relocated ECP/HSP will be served by an on-site sewage disposal system. MVCS agrees to connect ECP/ HSP to municipal sewer when available or continue use of on-site disposal if preferred by the Oak Bluffs Wastewater Department. For analysis, it is assumed that the ECP/HSP operates on weekdays year-round resulting in 261 days of annual use. Note that after MVC review, design of the actual system for Oak Bluffs Board of Health review and approval will be based on the Title V flow rates as listed above. Landscaping program will be fertilizer free after initial establishment of plantings, therefore, no landscaping nitrogen load is assumed.

Runoff Areas:

Roof area runoff to subsurface disposal: 1,200 sq ft (1/2 IWYC roof)
Roof area runoff to vegetated surface disposal: 33,244 sq ft (remaining roof + solar)

Impervious pavement to subsurface disposal: 10,340 sq ft
Impervious pavement to vegetated surface disposal: 11,790 sq ft
Pervious pavement to subsurface disposal: 19,540 sq ft
Pervious pavement to vegetated surface disposal: 4,970 sq ft

Waste Water Parameters:

Effluent strength based on WQMP:
Untreated: 26.25 mg/l after attenuation
Standard Denitrification Treatment: 19 mg/l
Enhanced Denitrification Treatment: 9 mg/l

Flows based on WQMP:
Office space: 115 GPD/1000 sf
Day care facility: 6 GPD/person (60% of Title V) - "infants" and "toddlers"
Elementary school: 3 GPD/person (60% of Title V) – "preschool", "pre-K", and staff

Analysis:

$[N(r) + N(l) + N(w)] < N(a)$

N(r) Runoff N-load:
Roof runoff to subsurface disposal:
(3.91 ft/yr)(90%)(1,200 sf)(28.32 l/cf)(0.75 mg/l) / (1M mg/kg) = 0.09 kg/yr
Roof runoff to vegetated surface disposal:
(3.91 ft/yr)(90%)(33,244 sf)(28.32 l/cf)(0.38 mg/l) / (1M mg/kg) = 1.26 kg/yr
Impervious pavement runoff to subsurface disposal:
(3.91 ft/yr)(90%)(10,340 sf)(28.32 l/cf)(1.50 mg/l) / (1M mg/kg) = 1.55 kg/yr
Impervious pavement runoff to vegetated surface disposal:
(3.91 ft/yr)(90%)(19,540 sf)(28.32 l/cf)(0.75 mg/l) / (1M mg/kg) = 1.46 kg/yr
Pervious pavement runoff to subsurface disposal:
(3.91 ft/yr)(65%)(11,790 sf)(28.32 l/cf)(1.50 mg/l) / (1M mg/kg) = 1.27 kg/yr
Pervious pavement runoff to vegetated surface disposal:
(3.91 ft/yr)(65%)(4,970 sf)(28.32 l/cf)(0.75mg/l) / (1M mg/kg) = 0.27 kg/yr

N(r) total: = 5.90 kg/yr

N(l): Landscape N-load:
N(l) is assumed to be zero as no "maintained" landscape is proposed after initial establishment of vegetation.

N(w): Waste water N-load:

Estimated flow:

21 staff @ 3 GPD/person =	63 GPD
25 infants & toddlers @ 6 GPD/person =	150 GPD
40 pre-school & pre-K @ 3 GPD/person =	120 GPD
Proposed HSP office space: 403 sf @ 115 GPD/1000 sf =	47 GPD
Total:	380 GPD

N(w) with enhanced denitrification:
(380 GPD)(3.785 l/gal)(9.00 mg/l)(261 days/year) / (1M kg/mg) = 3.38 kg/year

N(a): Allowable N-load:
(1.87 kg/acre/yr)(4.9 acres) = 9.16 kg/yr

Required: [N(r) + N(l) + N(w)] < N(a)

[5.90 kg/yr + 0.00 kg/yr + 3.38 kg/yr] > 9.16 kg/yr by 0.12 kg/yr (1.3%)