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MV-11023

Island Grown Farm Nitrogen Analysis (Development Envelope only)

Acronyms:

N(a): Allowable annual nitrogen load
N(w): Annual wastewater nitrogen load
N(r): Annual runoff nitrogen load
N(l): Annual landscape nitrogen load
WQMP: MVC Water Quality Management Policy v13 (1/12/18)
EIC: Education and Innovation Center

Site Conditions:

Locus lies within the Lagoon Pond Watershed
Adjusted Nitrogen Load Limit: 1.87 kg/acre/year per WQMP
Locus lies within Zone II of the Lagoon Pond municipal well
Development envelope (residential and agricultural) area: 6.46 acres
(Total property area: 40.84 acres)

Project Notes:

The proposed project includes:

1. Proposed four year-round residential units within two proposed buildings along with three seasonal yurts which are assumed the equivalent of 1.5 year-round units for this analysis.
2. Proposed year-round office space of 1600 square feet within EIC
3. Proposed year-round meeting space of 24 seats within EIC
4. A farm worker staff of 12 employees independent of office and residential flow
5. Proposed pole barn (dry)
6. Two proposed agricultural buildings (dry)
7. Proposed propagation building
8. Continued use of existing greenhouse
9. Continued use of food storage building
10. Continued use of workshop building (existing apartment within to be abandoned)
11. Continued use of chicken coop (incorporated into composting operation)
12. Continued use of composting operation (disposal outside of development envelope)

Runoff Areas:

Roof area runoff to vegetated surface disposal: 52,637 sq ft
Pervious driveway/parking to vegetated surface disposal: 35,414 sq ft
Balance of development envelope: 193,346 sq ft

Wastewater Parameters:

Effluent concentration:

Untreated: 26.25 mg/l
Standard Denitrification Treatment: 19 mg/l
Enhanced Denitrification Treatment (NitROE by Klean Tu): 8 mg/l

Flows based on WQMP:

Office space: 115 GPD/1000 sf
Residential unit (one to four bedrooms): 67,700 GPY
Meeting space: 6 GPD/seat (60% of Title V)
Farm workers: 6 GPD/worker (60% of Title V)

Analysis:

N(r) Runoff N-load:

Roof runoff to vegetated surface disposal:
 $(3.91 \text{ ft/yr})(90\%)(52,637 \text{ sf})(28.32 \text{ l/cf})(0.38 \text{ mg/l}) / (1\text{M mg/kg}) = 1.99 \text{ kg/yr}$

Pervious pavement runoff to vegetated surface disposal:
 $(3.91 \text{ ft/yr})(65\%)(35,414 \text{ sf})(28.32 \text{ l/cf})(0.75\text{mg/l}) / (1\text{M mg/kg}) = \underline{1.91 \text{ kg/yr}}$

N(r) total: = 3.90 kg/yr

N(l): Landscape N-load:

N(l) is assumed to be zero as no “maintained” landscape is proposed within the development envelope after initial establishment of vegetation.

N(w): Wastewater N-load:

Estimated annual flow:

5.5 dwelling units @ 67,700 GPY =	372,350 GPY
1600 sf office @ 115 GPD/1000 sf x 365 day/year =	67,160 GPY
24 seat meeting space @ 6 GPD/seat x 365 day/year =	52,560 GPY
12 workers @ 6 GPD/worker x 365 day/year =	<u>26,280 GPY</u>
Total:	518,350 GPY

N(w) with NitROE by Klean Tu denitrification system:

$$(518,350 \text{ GPD})(3.785 \text{ l/gal})(8 \text{ mg/l}) / (1\text{M kg/mg}) = 15.70 \text{ kg/year}$$

N(a): Allowable N-load:

$$(1.87 \text{ kg/acre/yr})(6.46 \text{ acres}) = 12.08 \text{ kg/yr}$$

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

$$[3.90 \text{ kg/yr} + 0.00 \text{ kg/yr} + 15.70 \text{ kg/yr}] = 19.60 \text{ kg/yr} > 12.08 \text{ kg/yr}$$

7.52 kg/yr (62%) over allowable

Mitigation per WQMP:

overage x \$315/kg/year x 40 year project life

$$7.52 \text{ kg/year} \times \$315/\text{kg/year} \times 40 \text{ years} = \$94,752$$