Appendix B

NUTRIENT LOAD CALCULATIONS

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Based on the following formula derived from the *Aggregate Emission Data Estimation Technique Manual – Tropical Aquaculture (2000)* prepared by the Department of Environment and Heritage.

NITROGEN

$N_E = N1 + N2 - (NC + NS + NV + NRS)$

Where: N_E = total nitrogen in effluent (kg Total N/100kg crop)

N1 = the amount of total N contained in feed multiplied by the amount of feed (kg) to produce 100 kg of crop

N2 = the amount of total N contained in fertilizer multiplied by the amount of fertilizer (kg) to produce 100 kg of crop

NC = the amount of total N contained in 100 kg crop (29g/kg wet weight)

NS = the amount of N contained in sediment (14%) multiplied by N1

NV = the amount of N volatilised (3%) multiplied by N1

NRS = the amount of N contained in the remaining stock (4%) multiplied by N1

N1: The proposed feed contains 7% N. At a food conversion ratio of 1:1.82, 100 kg crop requires 180 kg of feed. 180 kg feed contains 0.07 x 180 kg = 12.6 kg N

N2: An initial dose of 6.6 kg urea/ha will be applied to start an algal bloom. This equals 3.1 kg elemental N per ha (MW of urea = 60.06, urea contains 2 N, thus the nitrogen content of urea is 46.7% or 3.1 kg out of 6.6 kg urea). Estimated crop per ha is 5 tonne, so per 100 kg crop 0.06 kg N is applied in the form of urea.
The algal bloom will be sustained by the application of 1-2 kg N per ha per week. Per 100 kg crop this equals 2 kg N x (100kg/5000kg) x 20 weeks = 0.8 kg N

NC: 29g N/kg x 100 kg = 2,900 g N = 2.9 kg N

NS: 0.14 x 12.6 kg N = 1.76 kg N

NV: 0.03 x 12.6 kg N = 0.38 kg N

NRS: 0.04 x 12.6 kg N = 0.50 kg N

N_E = 12.6 kg N + (0.06 + 0.8) kg N – (2.9 + 1.76 + 0.38 + 0.50) kg N = 4.51 kg N

This is the amount of nitrogen in the effluent per 100 kg crop, equalling 45 kg N / tonne which is similar to the Fisheries Department estimate of 56 kg N/ tonne.

The water exchange for 1 crop cycle (10%) is 180,000 m^3/ha. Crop per ha is estimated at 5 tonne. The estimated N concentration in the effluent thus equals :

(5 x 45 kg N)/180,000,000 L = 1.25 mg/L

PHOSPHORUS

P_E = P1 + P2 – (PC + PS + PRS)

Where: P_E = total phosphorus in effluent (kg Total P/100kg crop)
P1 = the amount of total P contained in feed multiplied by the amount of feed (kg) to produce 100 kg of crop
P2 = the amount of total P contained in fertilizer multiplied by the amount of fertilizer (kg) to produce 100 kg of crop

PC = the amount of total P contained in 100 kg crop (3.4g/kg wet weight)

PS = the amount of P contained in sediment (84%) multiplied by N1

PRS = the amount of P contained in the remaining stock (4%) multiplied by N1

P1: The proposed feed contains 0.7% P. At a food conversion ratio of 1:1.82, 100 kg crop requires 180 kg of feed. 180 kg feed contains 0.007 x 180 kg = 1.26 kg P

N2: An initial dose of 2.7 kg TSP/ha will be applied to start an algal bloom. This equals 0.35 kg elemental P per ha (TSP contains 47% P_2O_5 or 1.27 kg P_2O_5, which in turn consists of 27% P or 0.35 kg P). Estimated crop per ha is 5 tonne, so per 100 kg crop 0.007 kg P is applied in the form of TSP.
The algal bloom will be sustained by the application of 0.5-1 kg P per ha per week. Per 100 kg crop this equals 1 kg P x (100kg/5000kg) x 20 weeks = 0.4 kg P

PC: 3.4g P/kg x 100 kg = 340 g P = 0.34 kg P

PS: 0.84 x 1.26 kg P = 1.06 kg P

PRS: 0.04 x 1.26 kg P = 0.050 kg P

P_E = 1.26 kg P + (0.007 + 0.4) kg P – (0.34 + 1.06 + 0.05) kg P = 0.21kg P

This is the amount of phosphorus in the effluent per 100 kg crop, equalling 2 kg P / tonne which is much less than the Fisheries Department estimate of 15 kg P/ ton.

The water exchange for 1 crop cycle (10%) is 180,000 m^3/ha. Crop per ha is estimated at 5 tonne. The estimated P concentration in the effluent thus equals:

(5 x 2 kg N)/180,000,000 L = 0.055 mg/L