

Appendix G
Best Available Treatment Wastewater Analysis

Comparison of Nutrient Contributors from Islamorada Service Area to Groundwater and Marine Waters under Present Conditions versus Wastewater Systems that Meet BAT Standards for Effluent Disposal (10 mg/L BOD, 10 mg/L TSS, 10 mg/L TN, 1 mg/L TP)

Sources of Information:

1. Average daily flow (gpd): Islamorada (2001a) Design/Build/Operate Wastewater Management System(s), Islamorada, Village of Islands.
2. Raw sewage nutrient concentration: Ayres Associates (1998).
3. Nutrient removal by septic systems (TN 4%, TP 15%) Kruczynski (1999, Table 7).
4. Removal of TP from groundwater by chemical reaction with aquifer limestone Kruczynski (1999, p. 22)
5. Removal efficiency of BAT for TN, TP Islamorada (2001a, p. 18), and disposal of BAT effluent to Class V shallow wells Islamorada (2001a, p. 26).

Assumptions:

1. Currently all sewage disposal is by onsite septic systems; no cesspit/cesspool systems.
2. TP is not removed from groundwater by reaction with aquifer limestones. This is a conservative assumption.
3. Raw sewage nutrient concentrations are the same as Big Pine field experiments (Ayres Associates, 1998, p. 5-1).

Calculations:

1. Total wastewater flow = 72,000 gpd x 3.785 L/gal
= 272,520 L/d
2. Total nutrient loading in raw sewage:
TN = 38.4 mg/L x 272,520 L/d = 10,464,768 mg/day
x 0.002204 lbs/mg = 23,441 lbs/day
TP = 8.39 mg/L x 272,520 L/d = 2,286,443 mg/day
x 0.002204 lbs/mg = 5,039 lbs/day
3. Reduction of nutrients by septic systems:

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	Raw Sewage	Septic System Removal	Septic System Effluent	GW Removal	To Seawater
TN	23,441 lbs/d	4%	22,503 lbs/d	0%	22,503 lbs/d
TP	5,039 lbs/d	15%	4283 lbs/d	0%	4283 lbs/d

4. Reduction of nutrients by BAT system:

	Raw Sewage	Effluent Concentration
TN	23,441 lbs/d	10 mg/L x 272,520 L/d = 2,725,200 mg/d x .002204 lbs/mg = 6006.3 lbs/day
TP	5,039 lbs/d	1 mg/L x 272,520 L/d = 272,520 mg/d x .002204 lbs/mg = 600.6 lbs/day

5. Reduction of nutrients in groundwater transit to marine discharge from BAT:

	Septic System Loading	Removal Efficiency	To Seawater
TN	6006.3 lbs/day	0%	6006.3 lbs/day
TP	600.6 lbs/day	0%	600.6 lbs/day

Conclusion:

Replacement of existing OWTS (assumed all septic systems) with wastewater management systems that meet BAT treatment standards would result in 73% reduction in TN input to groundwater (22,503 lbs/day to 6006.3 lbs/day), and 86% reduction in TP input to groundwater (4283 lbs/day to 600.6 lbs/day). In groundwater transit to discharge to the sea negligible TN reduction occurs, and it is assumed here that no TP is removed by chemical reaction with carbonate rocks of aquifer. Thus, benefit of BAT systems in terms of nutrient removal would be in form of 73% reduction in TN; and an 86% removal of TP.