



MEMORANDUM

To: Bart Smith
From: Ed Castle, PE
Date: 9 January 2015
Re: KWRU Nutrient Discharge Calculations

The KW Resort Utilities (KWRU) wastewater treatment plant (WWTP) is currently permitted to discharge 0.499 MGD of effluent treated to secondary treatment levels. KWRU has submitted an application for a permit to increase the capacity of the WWTP to 0.849 MGD. It has been claimed by the Petitioners that the proposed increased discharge will cause further degradation of the nearshore waters by increasing the loadings of nitrogen and phosphorus in those waters.

For the purposes of this report, I will ignore the fact that there is no evidence that KWRU's effluent, discharged to the wells or used for irrigation at the Key West Golf Club, actually reaches the nearshore waters. I will instead perform a mass balance on the amount of nitrogen and phosphorus that would be contained in KWRU's effluent.

To determine the amount of nitrogen and phosphorus that would be discharged under the current permit conditions, 5 years of total nitrogen and total phosphorus data were averaged. The raw historical data is attached. The predicted total nitrogen and total phosphorus concentrations for the proposed permit conditions are based on typical performance data for AWT treatment plants. The following table presents the results of the nutrient loading calculations.

Calculations of Mass Loadings of Nutrients

Parameter	Secondary Treatment Conc., 5 years historical data	Predicted AWT Conc.
Total Nitrogen, mg/l as N	13.92	2.25
Total Phosphorus, mg/l as P	3.47	0.75
Permitted Flow, MGD	0.499	0.849
Total Nitrogen Average Daily Discharge, lbs/day	58.0	15.9
Total Phosphorus Average Daily Discharge, lbs/day	14.4	5.3

Net reduction in discharge of Nitrogen, lbs/day =	42.0
Net reduction in discharge of Phosphorus, lbs/day =	9.1
Net annual reduction in discharge of Nitrogen, lbs/yr =	15337
Net annual reduction in discharge of Phosphorus, lbs/yr =	3329

As can be seen, even though an increase in permitted flow has been requested in the proposed permit, an net reduction in discharge of total nitrogen and total phosphorus of 72.4% and 63.2% respectively will be realized under the conditions of the proposed permit.

Date	TN Effluent	TP Effluent	MW1 NO3	Qual. (U)	
JAN/2007	12.90	3.38			
JAN/2007	12.90	4.41			
FEB/2007	18.00	4.59			
FEB/2007	12.00	2.87			
MAR/2007	11.40	3.70			
MAR/2007	6.51	1.98			
APRIL/2007	16.30	5.55			
APRIL/2007	25.30	3.66			
MAY/2007	20.20	4.69			
MAY/2007	13.30	2.74			
MAY/2007	48.20	0.94			
JUN/2007	29.30	3.32	0.01	U	
JUN/2007	15.50	0.45			
JUL/2007	4.44	0.32			
JUL/2007	4.01	0.41			
AUG/2007	7.45	1.71			
AUG/2007	12.50	0.55			
SEPT/2007	10.90	2.08	0.01		
SEPT/2007	8.57	1.87			
OCT/2007	14.80	3.00			
OCT/2007	14.30	2.98			
OCT/2007	17.80	1.40			
NOV/2007	23.30	4.20			
NOV/2007	17.30	4.90			
DEC/2007	26.00	4.72	0.01	U	
DEC/2007	17.20	3.58			
JAN/2008	20.70	4.85			
JAN/2008	17.20	4.08			
FEB/2008	17.30	2.57			
FEB/2008	19.00	2.12			
MAR/2008	19.80	5.22	0.01	U	
MAR/2008	13.40	4.02			
APRIL/2008	8.31	3.14			
APRIL/2008	3.29	4.49			
APRIL/2008	5.53	4.57			
MAY/2008	6.40	4.08			
MAY/2008	6.44	4.46			
JUN/2008	10.50	4.93	0.01	U	
JUN/2008	15.10	5.34			
JUL/2008	16.30	2.94			
JUL/2008	19.80	1.55			
AUG/2008	13.00	2.08			
AUG/2008	7.70	2.28			
SEPT/2008	11.10	3.16	0.01		
SEPT/2008	8.90	3.54			
SEPT/2008	7.15	1.01			
OCT/2008	7.29	0.96			
OCT/2008	4.65	0.90			

NOV/2008	8.09	4.44			
NOV/2008	11.20	4.12			
DEC/2008	15.40	5.68	0.01	U	
DEC/2008	13.40	5.63			
JAN/2009	7.88	1.64			
JAN/2009	9.83	2.60			
FEB/2009	13.10	0.72	0.01	U	
FEB/2009	3.55	0.47			
MAR/2009	2.38	0.45			
MAR/2009	3.49	0.72			
MAR/2009	3.69	0.09			
APRIL/2009	3.96	0.78			
APRIL/2009	5.73	1.38			
MAY/2009	2.20	0.25	0.01	U	
MAY/2009	0.94	0.14			
JUN/2009	6.41	4.12			
JUN/2009	7.12	4.51			
JUL/2009	8.35	3.60			
JUL/2009	9.70	5.26			
AUG/2009	9.56	4.92			
AUG/2009	8.14	2.94			
SEPT/2009	15.00	5.03	0.02		
SEPT/2009	14.00	3.59			
SEPT/2009	16.30	3.98			
OCT/2009	19.00	4.94			
OCT/2009	8.18	3.04			
NOV/2009	2.02	0.05	0.01	U	
NOV/2009	9.52	4.04			
DEC/2009	10.90	3.80			
DEC/2009	11.50	3.29			
JAN/2010	9.86	2.65			
JAN/2010	9.30	3.76			
FEB/2010	0.63	2.00	0.01	U	
FEB/2010	12.50	4.07			
MAR/2010	13.40	4.98			
MAR/2010	11.50	5.26			
MAR/2010	9.47	4.91			
APRIL/2010	12.50	5.42			
APRIL/2010	21.10	5.96			
MAY/2010	7.03	5.16	0.01	U	
MAY/2010	14.30	4.10			
JUN/2010	5.83	4.50			
JUN/2010	4.63	3.38			
JUL/2010	6.55	3.80			
JUL/2010	8.00	3.00			
AUG/2010	4.58	2.67	0.09		
AUG/2010	2.97	2.02			
AUG/2010	2.79	1.35			
SEPT/2010	4.34	3.17			

SEPT/2010	5.99	0.37			
OCT/2010	6.08	3.22			
OCT/2010	7.33	3.95			
NOV/2010	8.65	3.39	0.01	U	
NOV/2010	3.85	3.53			
DEC/2010	8.63	2.97			
DEC/2010	7.98	4.32			
JAN/2011	7.86	1.47			
JAN/2011	19.70	3.20			
FEB/2011	38.20	5.48	0.01	U	
FEB/2011	31.70	5.16			
MAR/2011	27.90	4.60			
MAR/2011	23.80	5.19			
MAR/2011	24.40	5.55			
APRIL/2011	18.70	4.72			
APRIL/2011	11.40	2.78			
MAY/2011	13.20	2.53	0.01	U	
MAY/2011	30.70	5.39			
JUN/2011	25.30	4.75			
JUN/2011	33.00	6.97			
JUL/2011	18.50	4.47			
JUL/2011	28.90	4.68			
AUG/2011	30.90	4.66	0.06		
AUG/2011	24.70	4.29			
AUG/2011	28.80	15.80			
SEPT/2011	33.10	5.79			
SEPT/2011	26.50	3.98			
OCT/2011	12.10	3.40			
OCT/2011	18.50	4.60			
NOV/2011	23.30	3.88	0.01	U	
NOV/2011	23.00	4.08			
DEC/2011	32.70	4.81			
DEC/2011	53.80	4.48			
Average	13.92	3.47			