PMBA
ENVIRONMENTAL SERVICES
Engineering - Planning - Analyzing - Permitting

November 18, 2011

Allen Knapp, Director
Onsite Water and Sewage, Marina and Engineering Programs
Virginia Department of Health
109 Governor Street, 5th Floor
Richmond VA 23219

Re: HOOT Aerobic Systems Series H Wastewater Treatment System GMP 147
Professional Engineer evaluation

Dear Mr. Knapp:

Enclosed are our findings and evaluation for the HOOT Aerobic Systems, Inc. (HOOT). My evaluation was based on past experience designing aerobic wastewater treatment plants, review of the *Performance Testing and Evaluation Certification Report* by Baylor University (Dec. 14, 2001), Table 5 Sewage Collection and Treatment Regulations and NSF Standard 40 certification and findings. A log transformation analysis of the Baylor and NSF test results was performed to determine if units meet pass/fail expectations listed in GMP 147, as promulgated on April 30, 2009.

The HOOT Series H systems, when properly designed, installed, operated and maintained in accordance with manufacture's recommendations will, in my professional opinion, meet the end the end -of -pipe effluent quality listed in GMP 147 for BOD_5, TSS and FC under the following conditions:

- Continuous disinfection is required to meet pass criteria for effluent fecal coliforms or E. coli (cfu/100ml).

HOOT's Homeowner's Manual was reviewed for compliance with GMP 147. The maintenance schedules accurately reflect, when system is properly operated, the servicing and maintenance needs of the different unit operations

Sincerely,

Peter M. Brooks, P.E., O.S.E.
Principal

COMMONWEALTH OF VIRGINIA
PETER M. BROOKS
013244
PROFESSIONAL ENGINEER

Cc; HOOT System Inc.
Enclosure
Jn 11 -085

3333 JOHN TREE HILL ROAD • POWHATAN, VIRGINIA 23139 • (804) 897-9222 • FAX (804) 897-9223
E-MAIL: pmba@msn.com

EVALUATION OF HOOT SYSTEM SERIES H WASTEWATER TREATMENT TECHNOLOGY
FOR
COMPLIANCE WITH GMP 147 WASTEWATER TECHNOLOGY LISTING

November 18, 2011

SUMMARY
The HOOT Series H Models comply with end-of-pipe effluent quality limits listed in GMP 147. Series H models incorporating timed-discharge (-AN/AW/AS/AT) are capable of meeting proposed Chesapeake Bay nutrient protection levels -Treatment Level 3 (TL-3) plus nitrification and phosphate uptake - because of the ability to operate the unit like a sequestering batch reactor with sludge recirculation to the plant headworks. Effluent disinfection is required to meet FC/E. coli level <200 cfu/100 ml

BACKGROUND
HOOT Aerobic Systems, Inc. (HOOT), 2885 Highway 14 East; Lake Charles, LA 70607. Telephone number 337-474-2804, www: hootsystems.com retained PMBA, Environmental Services, to provide Virginia-licensed PE certification of the HOOT system has required by GMP 147:

- Unit is expected to comply with GMP 147 treatment standards
- The Operation & Maintenance (O&M) Manual reflects the service and maintenance requirements of the product.

FINDINGS
HOOT aerobic treatment unit is certified by the National Sanitation Foundation (NSF) for compliance with Standard 40. The units will easily meet secondary treatment levels of 30/30 for BOD_5 and TSS and is approved to TL-2 treatment levels by the Virginia Department of Health.

HOOT retained Baylor University to provide performance testing and evaluation of the Hoot Model Series 500, 750 and 1000. The Baylor report was published in December 14, 2001 and determined the Interquartile Range for the following parameters

DO	5.37-6.49 mg/l
Temperature	24.36-28.98 C
pH	7.77-8.17 S.U.
BOD_5	2.00-2.00 mg/l
TSS	0.5-1.8 mg/l
VSS	0.5-1.4 mg/l
Settable Solids	5 – 9.25 mg/l

The Interquartile range ("middle fifty") equals the value of the samples less the samples outside of the 25% lowest or highest values.

HOOT DESIGN PARAMETERS

Settling Basin	76-80% average daily flow, approx. 20% peak flow (pf=4)
Aeration Basin	120-140% average daily flow
Clarifier (Up flow)	34-40% ave. daily flow
Wet Well	72-80% ave. daily flow

PMBA performed log transformation analyses of the raw $cBOD_5$ and TSS values in the Baylor report. Log transformation is used to more accurately represent biological data collected from a given population by using a logarithmic scale. The transformed data was back transformed to determine pass/fail value. cBOD measures the carbonaceous demand, nitrification demand is not measured and no determination of nutrient removal efficiencies was measured.

HOOT also retained NSF to measure the performance of ultra violet disinfection during different configurations using Salcor 3G UV system to disinfect effluent. All of the configurations produced results with a 30 Geomean <200 feu. Log transformation of these values was also performed, the transformed effluent values <200 feu

LOG TRANSFORMATION DATA & RAW ANALYTIC VALUES

Data analysis calculations are attached. Log transformation was performed in accordance with Excel guidance sheet provided by DOSWS.

PMBA
ENVIRONMENTAL SERVICES
3333 JOHN TREE HILL RD
POWHATAN VA 23139

LOG TRANSFORMATION DATA
FOR
HOOT SYSTEM SERIES H

NOV 8, 2011
JN 11 - 086

HOOT AEROBIC SYSTEM STATISTICAL DATA BASE

CBOD DATA	Log(e) Transformation			TSS DATA
15.6	2.747270914	2.747271	0	15
3.84	1.345472367	1.345472	0	4.3
2.74	1.00795792	1.007958	0	1.7
2.39	0.871293366	0.871293	0	0.9
2	0.693147181	0.693147	0	1.3
2	0.693147181	0.693147	0	1.3
2	0.693147181	0.693147	0	1.7
2	0.693147181	0.693147	0	2.2
2	0.693147181	0.693147	0	1.7
2	0.693147181	0.693147	0	1.3
2	0.693147181	0.693147	0	0.2
2.04	0.712949808	0.71295	0	1.8
2.06	0.722705983	0.722706	0	0.5
2	0.693147181	0.693147	0	1.4
3.67	1.300191662	1.300192	0	2.2
2	0.693147181	0.693147	0	2
2	0.693147181	0.693147	0	4
2	0.693147181	0.693147	0	2.2
2	0.693147181	0.693147	0	1.4
2	0.693147181	0.693147	0	1.4
2.18	0.779324877	0.779325	0	0.9
2	0.693147181	0.693147	0	1.4
3.88	1.355835154	1.355835	0	1.8
2	0.693147181	0.693147	0	1.8
2	0.693147181	0.693147	0	0.4
2	0.693147181	0.693147	0	0.9
2	0.693147181	0.693147	0	2.2
2.15	0.765467842	0.765468	0	0.8
2	0.693147181	0.693147	0	6.2
2	0.693147181	0.693147	0	1.4
2	0.693147181	0.693147	0	1.2
2	0.693147181	0.693147	0	1.8
2	0.693147181	0.693147	0	2.2
2	0.693147181	0.693147	0	2.4
2	0.693147181	0.693147	0	3
3.48	1.247032294	1.247032	0	2.4
3.28	1.187843422	1.187843	0	2.2
7.8	2.054123734	2.054124	0	3
2	0.693147181	0.693147	0	1.2
2	0.693147181	0.693147	0	2.2
2	0.693147181	0.693147	0	1.4
2	0.693147181	0.693147	0	0.9
2	0.693147181	0.693147	0	0.9
2	0.693147181	0.693147	0	0.9
2	0.693147181	0.693147	0	0.5
2	0.693147181	0.693147	0	0.4

PMBA
ENVIRONMENTAL SERVICES
3333 JOHN TREE HILL RD
POWHATAN VA 23139

LOG TRANSFORMATION DATA
FOR
HOOT SYSTEM SERIES H

2	0.693147181	0.693147	0	0.9
2	0.693147181	0.693147	0	1.8
2	0.693147181	0.693147	0	0.8
2	0.693147181	0.693147	0	1.4
2	0.693147181	0.693147	0	1.2
2	0.693147181	0.693147	0	0.8
2	0.693147181	0.693147	0	1.6
2	0.693147181	0.693147	0	0.8
2	0.693147181	0.693147	0	0.8
2	0.693147181	0.693147	0	1.2
2	0.693147181	0.693147	0	2
2	0.693147181	0.693147	0	0.3
2	0.693147181	0.693147	0	2
2	0.693147181	0.693147	0	1.2
2	0.693147181	0.693147	0	0.6
2	0.693147181	0.693147	0	0.2
2	0.693147181	0.693147	0	0.9
2	0.693147181	0.693147	0	0.9
2	0.693147181	0.693147	0	0.9
2	0.693147181	0.693147	0	0.6
2	0.693147181	0.693147	0	0.4
2	0.693147181	0.693147	0	2.1
2	0.693147181	0.693147	0	4.8
2	0.693147181	0.693147	0	0.7
2	0.693147181	0.693147	0	0.3
2	0.693147181	0.693147	0	0.5
2	0.693147181	0.693147	0	0.5
2	0.693147181	0.693147	0	0.2
3.69	1.305626458	1.305626	0	2
2	0.693147181	0.693147	0	0.6
2	0.693147181	0.693147	0	0.4
2	0.693147181	0.693147	0	0.5
2	0.693147181	0.693147	0	0.7
2.05	0.717839793	0.71784	0	0.5
2	0.693147181	0.693147	0	0.5
2	0.693147181	0.693147	0	0.5
2	0.693147181	0.693147	0	2
2	0.693147181	0.693147	0	0.2
2	0.693147181	0.693147	0	0.7
2	0.693147181	0.693147	0	0.4
2	0.693147181	0.693147	0	0.8
2	0.693147181	0.693147	0	1.1
2	0.693147181	0.693147	0	0.5
2	0.693147181	0.693147	0	0.5
2	0.693147181	0.693147	0	0.7
2	0.693147181	0.693147	0	0.5
2	0.693147181	0.693147	0	1.1
2	0.693147181	0.693147	0	0.9
2	0.693147181	0.693147	0	0.8
2.74	1.00795792	1.007958	0	2.4
2	0.693147181	0.693147	0	1.1
2	0.693147181	0.693147	0	0.4

PMBA
ENVIRONMENTAL SERVICES
3333 JOHN TREE HILL RD
POWHATAN VA 23139

LOG TRANSFORMATION DATA
FOR
HOOT SYSTEM SERIES H

NOV 8, 2011
JN 11 - 086

2	0.693147181	0.693147	0	2.8
2	0.693147181	0.693147	0	0.8
2	0.693147181	0.693147	0	0.3
2	0.693147181	0.693147	0	0.5
2	0.693147181	0.693147	0	0.4
2	0.693147181	0.693147	0	0.3
2	0.693147181	0.693147	0	0.6
2	0.693147181	0.693147	0	1.7
2	0.693147181	0.693147	0	0.6
2	0.693147181	0.693147	0	2.3
2	0.693147181	0.693147	0	0.9
2	0.693147181	0.693147	0	0.9
2	0.693147181	0.693147	0	1.7
2	0.693147181	0.693147	0	1.87
2	0.693147181	0.693147	0	2
2	0.693147181	0.693147	0	0.9
2	0.693147181	0.693147	0	0.5
2	0.693147181	0.693147	0	1.2
2	0.693147181	0.693147	0	0.6
2	0.693147181	0.693147	0	0.6
2	0.693147181	0.693147	0	0.5
2	0.693147181	0.693147	0	0.4
2	0.693147181	0.693147	0	0.2
2	0.693147181	0.693147	0	0.4
2	0.693147181	0.693147	0	0.3
2	0.693147181	0.693147	0	0.4
2	0.693147181	0.693147	0	0.6
2	0.693147181	0.693147	0	0.7
2	0.693147181	0.693147	0	0.9
2	0.693147181	0.693147	0	0.4
2	0.693147181	0.693147	0	0.4
6.79	1.915450942	1.915451	0	0.5
7.02	1.948763218	1.948763	0	0.9
4.84	1.576914721	1.576915	0	0.7
3.91	1.363537374	1.363537	0	0.5
2	0.693147181	0.693147	0	0.8
2	0.693147181	0.693147	0	0.4
2	0.693147181	0.693147	0	0.7
8.86	2.181546765	2.181547	0	0.4
2	0.693147181	0.693147	0	0.5
2	0.693147181	0.693147	0	0.5
2	0.693147181	0.693147	0	0.9
2	0.693147181	0.693147	0	59
2	0.693147181	0.693147	0	4.7
2	0.693147181	0.693147	0	10.8
2	0.693147181	0.693147	0	9.8
2	0.693147181	0.693147	0	4.2
2.59	0.951657876	0.951658	0	2.3
2	0.693147181	0.693147	0	1.9
2	0.693147181	0.693147	0	1.3
2	0.693147181	0.693147	0	0.9
2	0.693147181	0.693147	0	0.9

PMBA
ENVIRONMENTAL SERVICES
3333 JOHN TREE HILL RD
POWHATAN VA 23139

LOG TRANSFORMATION DATA
FOR
HOOT SYSTEM SERIES H

NOV 8, 2011
JN 11 - 086

	2	0.693147181	0.693147	0	0.7
	2	0.693147181	0.693147	0	0.7
	2	0.693147181	0.693147	0	1.4
	2	0.693147181	0.693147	0	1.1
					2.2
					1.4
					1.8
					1.8
					2
					1.9
					2.5

	CBOD				**TSS**
COUNT	154	# data pts.	154	0	161
MEAN	0.782871	average	0.782871	0	0.031222
STND DIV	0.300538		0.300538	0	4.865494
SQRT COUNT	12.40967	Count sqrt	12.40967	0	12.68858
STD ERR	0.024218	Std/sqrt	0.024218	0	0.383455
Upper 99% Probablity	2.608131	TINV	2.608131	0	2.606711
STD ERR UPPER T	0.063164	STD Err x TINV	0.063164	0	0.999555
Uppper 99% Confidence	0.846035		0.846035	0	1.030778
Uppper 99% T Conf Int	**2.330389**	Log transformed	2.330389	0	**2.803245**

PMBA
ENVIRONMENTAL SERVICES
3333 JOHN TREE HILL RD
POWHATAN VA 23139

LOG TRANSFORMATION DATA
FOR
HOOT SYSTEM SERIES H

NOV 8, 2011
JN 11 - 086

Log(e)
Transformation

2.70805	2.70805	0
1.458615	1.458615	0
0.530628	0.530628	0
-0.105361	-0.105361	0
0.262364	0.262364	0
0.262364	0.262364	0
0.530628	0.530628	0
0.788457	0.788457	0
0.530628	0.530628	0
0.262364	0.262364	0
-1.609438	-1.609438	0
0.587787	0.587787	0
-0.693147	-0.693147	0
0.336472	0.336472	0
0.788457	0.788457	0
0.693147	0.693147	0
1.386294	1.386294	0
0.788457	0.788457	0
0.336472	0.336472	0
0.336472	0.336472	0
-0.105361	-0.105361	0
0.336472	0.336472	0
0.587787	0.587787	0
0.587787	0.587787	0
-0.916291	-0.916291	0
-0.105361	-0.105361	0
0.788457	0.788457	0
-0.223144	-0.223144	0
1.824549	1.824549	0
0.336472	0.336472	0
0.182322	0.182322	0
0.587787	0.587787	0
0.788457	0.788457	0
0.875469	0.875469	0
1.098612	1.098612	0
0.875469	0.875469	0
0.788457	0.788457	0
1.098612	1.098612	0
0.182322	0.182322	0
0.788457	0.788457	0
0.336472	0.336472	0
-0.105361	-0.105361	0
-0.105361	-0.105361	0
-0.105361	-0.105361	0
-0.693147	-0.693147	0
-0.916291	-0.916291	0

PMBA

ENVIRONMENTAL SERVICES

LOG TRANSFORMATION DATA
FOR
HOOT SYSTEM SERIES H

NOV 8, 2011
JN 11 - 086

-0.105361	-0.105361	0
0.587787	0.587787	0
-0.223144	-0.223144	0
0.336472	0.336472	0
0.182322	0.182322	0
-0.223144	-0.223144	0
0.470004	0.470004	0
-0.223144	-0.223144	0
-0.223144	-0.223144	0
0.182322	0.182322	0
0.693147	0.693147	0
-1.203973	-1.203973	0
0.693147	0.693147	0
0.182322	0.182322	0
-0.510826	-0.510826	0
-1.609438	-1.609438	0
-0.105361	-0.105361	0
-0.105361	-0.105361	0
-0.105361	-0.105361	0
-0.510826	-0.510826	0
-0.916291	-0.916291	0
0.741937	0.741937	0
1.568616	1.568616	0
-0.356675	-0.356675	0
-1.203973	-1.203973	0
-0.693147	-0.693147	0
-0.693147	-0.693147	0
-1.609438	-1.609438	0
0.693147	0.693147	0
-0.510826	-0.510826	0
-0.916291	-0.916291	0
-0.693147	-0.693147	0
-0.356675	-0.356675	0
-0.693147	-0.693147	0
-0.693147	-0.693147	0
-0.693147	-0.693147	0
0.693147	0.693147	0
-1.609438	-1.609438	0
-0.356675	-0.356675	0
-0.916291	-0.916291	0
-0.223144	-0.223144	0
0.09531	0.09531	0
-0.693147	-0.693147	0
-0.693147	-0.693147	0
-0.356675	-0.356675	0
-0.693147	-0.693147	0
0.09531	0.09531	0
-0.105361	-0.105361	0
-0.223144	-0.223144	0
0.875469	0.875469	0
0.09531	0.09531	0
-0.916291	-0.916291	0

PMBA

ENVIRONMENTAL SERVICES

LOG TRANSFORMATION DATA
FOR
HOOT SYSTEM SERIES H

NOV 8, 2011
JN 11 - 086

1.029619	1.029619	0
-0.223144	-0.223144	0
-1.203973	-1.203973	0
-0.693147	-0.693147	0
-0.916291	-0.916291	0
-1.203973	-1.203973	0
-0.510826	-0.510826	0
0.530628	0.530628	0
-0.510826	-0.510826	0
0.832909	0.832909	0
-0.105361	-0.105361	0
-0.105361	-0.105361	0
0.530628	0.530628	0
0.625938	0.625938	0
0.693147	0.693147	0
-0.105361	-0.105361	0
-0.693147	-0.693147	0
0.182322	0.182322	0
-0.510826	-0.510826	0
-0.510826	-0.510826	0
-0.693147	-0.693147	0
-0.916291	-0.916291	0
-1.609438	-1.609438	0
-0.916291	-0.916291	0
-1.203973	-1.203973	0
-0.916291	-0.916291	0
-0.510826	-0.510826	0
-0.356675	-0.356675	0
-0.105361	-0.105361	0
-0.916291	-0.916291	0
-0.916291	-0.916291	0
-0.693147	-0.693147	0
-0.105361	-0.105361	0
-0.356675	-0.356675	0
-0.693147	-0.693147	0
-0.223144	-0.223144	0
-0.916291	-0.916291	0
-0.356675	-0.356675	0
-0.916291	-0.916291	0
-0.693147	-0.693147	0
-0.693147	-0.693147	0
-0.105361	-0.105361	0
4.077537	4.077537	0
1.547563	1.547563	0
2.379546	2.379546	0
2.282382	2.282382	0
1.435085	1.435085	0
0.832909	0.832909	0
0.641854	0.641854	0
0.262364	0.262364	0
-0.105361	-0.105361	0
-0.105361	-0.105361	0

LOG TRANSFORMATION DATA
FOR
HOOT SYSTEM SERIES H

NOV 8, 2011
JN 11 - 086

	ENVIRONMENTAL	SERVICES
-0.356675	-0.356675	0
-0.356675	-0.356675	0
0.336472	0.336472	0
0.09531	0.09531	0
0.788457	0.788457	0
0.336472	0.336472	0
0.587787	0.587787	0
0.587787	0.587787	0
0.693147	0.693147	0
0.641854	0.641854	0
0.916291	0.916291	0
	161	0
	0.031222	0
	0.855648	4.00985
	12.68858	0
	0.067434	0.31602
	2.606711	0
	0.175782	0.82377
	0.207005	0.82377
	1.229988	1.57326