REPORT
TO THE NEW JERSEY PINELANDS COMMISSION

IMPLEMENTATION OF THE ALTERNATE DESIGN TREATMENT SYSTEMS PILOT PROGRAM

November 3, 2006

Background

In 2000, the Pinelands Commission formed a special Ad Hoc Septic System Committee (Committee) to research alternate septic system technologies that might better meet the water quality requirements of the Pinelands Comprehensive Management Plan (CMP) (N.J.A.C. 7:50-6, Part VII), for residential development on lots smaller than 3.2 acres, where such lots are currently authorized by N.J.A.C. 7:50-5. The Committee was comprised of seven Commission members and one representative from of the Pinelands Municipal Council, Pinelands Preservation Alliance, and the New Jersey Builders Association. In its research efforts, the Committee consulted wastewater engineering professionals, state and regional on-site technology demonstration projects, alternate treatment system technology manufacturers, Pinelands area county health departments, and other state and local agencies. Throughout the process, the Committee coordinated its research and program development efforts with the Jersey Department of Environmental Protection (NJDEP).

For reasons not just limited to septic system considerations, residential development using any of these systems must still conform to the lot size and density requirements contained in the municipal land use ordinances that have been certified by the Commission pursuant to N.J.A.C. 7:50-3. Many municipalities have zoning which permits unsewered residential development on lots of less than 3.2 acres. Based upon its research, the Committee identified five technologies that it determined could be expected to meet Pinelands water quality requirements for residential development on these smaller lots. The approved technologies are the Amphidrome, Ashco RFS ^{III}, Cromaglass, Bioclere and FAST treatment systems. Based upon nitrogen removal expectations and the Pinelands Septic Dilution Model, the Committee concluded the Amphidrome, Cromaglass, Bioclere and FAST systems could be permitted on lots of at least one acre and that the Ashco RFS ^{III} system could be allowed on residential lots of at least 1.5 acres.

Each of the five alternate design treatment technologies utilizes biological nutrient removal processes to reduce nitrogen levels in treated wastewater. The water quality requirements of N.J.A.C. 7:50-6, Part VIII, include provisions which are aimed at controlling the amount of nitrogen that enters the environment because nitrogen in itself is a significant pollutant and because it often serves as an indicator of changes in overall water quality.

The Pilot Program

The Committee unanimously recommended that an interim program be developed for the approval, installation and monitoring of the wastewater treatment technologies and that the interim program provide conditions and safeguards to govern their use. The Pinelands Commission adopted a set of amendments to the CMP which authorized the use of the technologies through the Alternate Design Treatment Systems Pilot Program. These CMP amendments are codified at N.J.A.C. 7:50-10, Part IV. The Pilot Program provides a means to test whether these technologies can be maintained and operated so as to meet the water quality standards of the CMP in a manner that a homeowner can be reasonably expected to follow. The alternate design treatment technologies are authorized only in those municipalities which have adopted an ordinance, certified by the Commission, to implement the alternate design treatment systems pilot program.

Implementation of the alternate design treatment systems pilot program commenced on August 5, 2002, the effective date of the CMP amendments described above. Applications for unsewered residential development on lots smaller than 3.2 aces, received after that date, were required to use a Pinelands alternate design wastewater treatment system. Completed applications received prior to that date were permitted to use a pressure dosing septic system, provided the installation of the pressure dosing system was completed by August 5, 2004.

Prior to each technology being certified for use by the Executive Director, the manufacturers had to provide the Commission with detailed engineering plans and specifications for the technology, a description of an alarm and telephone dialer to alert offsite maintenance personnel of a system malfunction, a monitoring

protocol for the sampling and analysis of effluent samples, a sample system warranty, maintenance contract, deed notice and operation and maintenance manuals.

Each alternate design treatment system must be covered under a five year comprehensive parts and labor warranty and a five year operation and maintenance contract. Quarterly sampling and analysis of treated effluent is required during the initial three years of operation for each system.

Based upon a review of submitted documents, the Executive Director certified the Ashco RSF^{III} gravity system on May 15, 2003, the Ashco RSFII gravity dosing system on July 24, 2003, the Amphidrome system on July 24, 2003, the Bioclere system on November 18, 2003, the Cromaglass system on December 29, 2004 and the FAST system on June 9, 2005.

The pilot program provides that August 5, 2007 is the last day to install an alternate design wastewater treatment system unless the Commission adopts an amendment to the CMP which authorizes installations beyond this date.

Municipal Participation

As indicated above, alternate systems are authorized for use only in those municipalities that have adopted an ordinance to implement the pilot program. Those ordinances must then be certified by the Commission pursuant to N.J.A.C. 7:50-3. To assist the municipalities in this process, sample ordinances were developed by the Commission's Land Use and Technology Office and provided to the 40 Pinelands municipalities in which alternate systems were expected to be needed based upon existing zoning and sewer service. To date, the Commission has certified implementing ordinances to permit use of the pilot program systems in 34 of the 40 municipalities.

The following provides the status of municipal ordinance adoption as of the date of this report:

Municipal Ordinance Certified		**Municipal Ordinance Not Adopted or Certified**
Barnegat	Manchester	Berkeley
Bass River	Maurice River	Egg Harbor Township
Berlin Township	Medford	Little Egg Harbor
Buena Borough	Monroe	Plumsted
Buena Vista	Mullica	Port Republic
Chesilhurst	Ocean	Southampton
Dennis	Pemberton	
Egg Harbor City	Shamong	
Estell Manor	Stafford	
Evesham	Tabernacle	
Folsom	Upper	
Franklin	Washington	
Galloway	Waterford	
Hamilton	Weymouth	
Hammonton	Winslow	
Jackson	Woodbine	
Lacey	Woodland	

NJDEP Participation

The NJDEP actively participated in the development of the Commission's pilot program. To expedite the

approval of the pilot program alternate design systems at the local level, NJDEP issued a Generic Treatment Works Approval (TWA) Permit which allows the use of the five pilot program systems without individual applicants being subject to the standard $450 NJDEP permit fee or 90 day review period. Additionally, NJDEP has indicated it will recognize the use of the Pinelands alternate design treatment system technologies in its review of residential subdivision applications which are subject to the Reality Improvement Sewage and Facilities Act, N.J.S.A.58- 23 et seq. Moreover, Commission staff consulted NJDEP's Division of Water Quality and Office of Quality Assurance prior to proceeding with the analysis of laboratory monitoring data.

Evaluation

N.J.A.C. 7:50-10.23 of the Comprehensive Management Plan requires that the Executive Director review the Alternate Design Treatment Systems Pilot Program four years after its effective date (August 5, 2002) and report to the Commission as to the program's implementation no later than November 5, 2006.

The criteria by which the pilot program is to be evaluated are set forth in N.J.A.C. 7:50-10.23(b)1 through 6. The findings from this review are presented below. The numbers used to designate the respective items correspond to the numbers used to identify the required evaluation criteria in N.J.A.C. 7:50-10.23(b).

1. The level of nitrogen in the effluent in each alternate design pilot program treatment system technology based on an evaluation of all monitoring results for that technology under this pilot program.

The CMP requires that the manufacturer of each technology provide for the collection and analysis of effluent samples, on a quarterly basis, for the first three years that each system is in use (for a total of twelve samples per system) and further requires that these samples be analyzed by laboratories certified by the NJDEP. In addition to these CMP requirements, the approved monitoring protocols for each system require that sample procurement be in conformance with the NJDEP Field Sampling Procedures Manual, (May 1992) which specify quality assurance procedures in the collection and transport of samples, i.e. chain of custody, sample preservation, etc. In addition, the approved protocols require that all laboratory analytical procedures be approved by NJDEP's Office of Quality Assurance. Samples of treated effluent are collected from a sample collection port located between the treatment unit and the soil dispersal field. To permit the establishment of biological cultures necessary for the treatment process to develop and stabilize, no samples are required during the first ninety days from system start-up.

The Commission's Land Use and Technology Programs staff have ranked the available data on the basis of a hierarchy of strength in its assessment of the technologies and have determined that the available data, while not perfect, will be useful in determining if the pilot program technologies are capable of meeting the water quality objectives of the Pinelands CMP and the Pinelands Protection Act. (See Appendix 1 for a discussion of the challenges concerning the quality of data generated through a regulatory monitoring program with multiple vendors, laboratories, and private home sites.)

Moving forward, Commission staff intends to work with the technology manufacturers and the certified testing labs to attain the highest quality data possible. This will include requiring that a complete complement of samples (ammonia, nitrate, nitrate, TKN) be collected during every sampling event, thus eliminating the need to discard data from incomplete sampling rounds. The technology manufacturers will be encouraged to choose a lab and to stick with that lab through the program. In addition, the practice of subcontracting analyses between labs will be discouraged to the maximum extent possible. Lastly, laboratories will be requested to keep methodologies consistent whenever possible. However, based upon commonly accepted industry practice and on procedures currently approved for NJDEP regulatory programs, e.g. NJPDES permitting, Commission staff does not recommend disqualifying data where multiple certified labs conduct analyses, where subcontracting between certified labs occurs or where different but NJDEP approved laboratory methods are employed.

In reviewing this data, it must be recognized that many factors affect the individual residential systems and direct comparisons from one system (household) to another should be avoided. For this reason, it is important to have many systems and many sampling events before final conclusions are reached. Home occupancy, water use and cleaning and laundry product usage may vary greatly from one residence to another. These and other variables can markedly impact the concentration of nitrogen in wastewater and can adversely affect the ability of a treatment system to meet established discharge limits. High occupancy within a dwelling can result in abnormally high levels of nitrogen in wastewater given that each person contributes approximately 9 lbs. of nitrogen to the system annually. Water conservation, while certainly desirable, has the potential to result in higher concentrations of pollutants in the wastewater because there is less water available to dilute the pollutants. As a result of significant advances in water conservation, including the use of water conserving fixtures and appliances as well as behavior modifications, assumed values for total nitrogen concentration in domestic effluent, established during the 1960's and 1970's at 40 mg/l, may under predict concentrations present in current domestic wastewater streams. It is important to note however, that the total mass of nitrogen produced by individuals remains fixed at approximately 9 lbs. per year. Thus while the concentration of total nitrogen may typically be greater than the assumed value of 40 mg/l, as evidenced in some reported effluent values, the total mass of nitrogen in the wastewater likely remains constant with dilution model assumptions. Even where effluent levels exceed assumed post treatment concentrations, system discharges may still be meeting total nitrogen loading targets.

As noted, the three treatment technologies that are currently operational in the Pinelands (Amphidrome, Bioclere, and Cromaglass) have an assumed nitrogen removal efficiency of 65%. If the total nitrogen contained in the raw influent is 40 mg/l, a 65% reduction would result in a concentration of 14 mg/l in the treated effluent (and 2 mg/l at the parcel line of a one acre lot). Similarly, if influent nitrogen levels are 80 mg/l, the same 65% removal efficiency would result in effluent concentrations of 28 mg/l. It is noteworthy that the pilot program does not provide for the sampling and analysis of raw influent; therefore the percent removal efficiency of the alternate technology systems cannot be calculated at this time.

Table 1 provides the running median total overall nitrogen concentrations (mg/l) by the number of samples taken for each wastewater treatment system analyzed. It is important to note that Table 1 excludes data that did not meet certain quality control criteria. This is further explained in Appendix 1.

The analysis indicates a grand median of 9.7 mg/l [TN] for Amphidrome systems with 3 or more samples and a grand median of 13.5 mg/l [TN] for the Bioclere systems . Both of these grand median concentrations compare favorably to the 14 mg/l standard which is based upon the Commission's septic dilution model. The grand median total nitrogen concentration for the Cromaglass system is 42.9 mg/l, significantly greater that the Commission's 14 mg/l standard. Figure 1 provides box plots which show the 25^{th} percentile (25% of values below this number), grand median and 75^{th} percentile (25% of values above this number) of total nitrogen concentrations (mg/l) for each sampling event. Again, both the Amphidrome data and the Bioclere data indicate median effluent concentrations that are in general conformance with Pinelands water quality standards whereas the Cromaglass data is consistently above the standard.

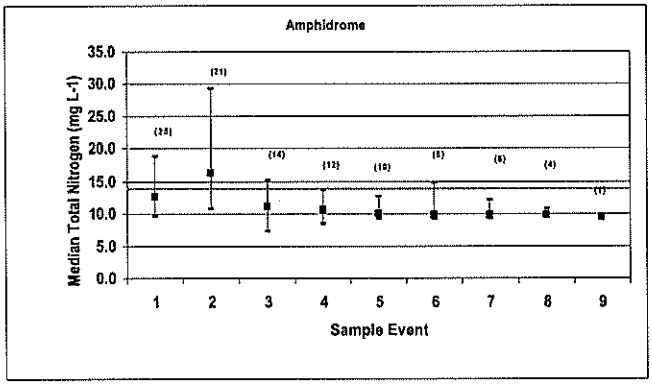
Table 1. The running median of total nitrogen (mg L^{-1}) by number of sampling events for each wastewater treatment system. The grand median, 25th percentile, 75th percentile, and number of systems sampled (N) per event are provided below each technology. (See Appendix 1 for discussion of data editing.)

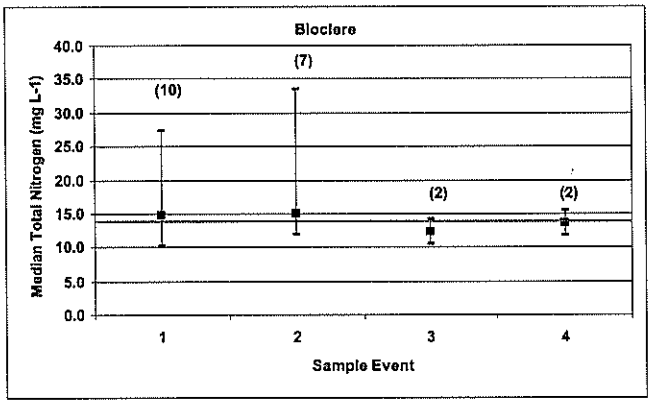
	Total Nitrogen Running Median	Number of Sampling Events								
Technology	System	1	2	3	4	5	6	7	8	9
Amphidrome	1	18.5	25.3	32.1	25.3	20.7	19.6	18.5		
Amphidrome	2	18.4	12.1	18.4	50.5	18.4	14.9	12.6	12.0	
Amphidrome	3	9.5	9.0	8.6	9.0	9.4	9.5	9.5	9.5	9.4
Amphidrome	4	6.0	33.8	6.9	9.8	12.7	14.8			
Amphidrome	5	10.0	42.3	12.3	11.1	12.3				
Amphidrome	6	35.3	29.3	23.2	16.4	9.7	8.4			
Amphidrome	7	15.2	15.4	15.2	12.1	9.1	9.5	9.1		
Amphidrome	8	12.7	10.8	11.0	9.9	8.9	8.7	8.9	9.2	
Amphidrome	9	143.9	79.5	15.1	12.6	10.2	10.0	10.2	10.2	
Amphidrome	10	5.8	4.9	5.8	6.6					
Amphidrome	11	4.7	5.4	4.7	5.2	5.7				
Amphidrome	12	24.5	17.2	9.9						
Amphidrome	13	18.8	27.6							
Amphidrome	14	27.0	47.2							
Amphidrome	15	14.9	10.1							
Amphidrome	16	16.0	13.4							
Amphidrome	17	11.1	12.9	11.1						
Amphidrome	18	11.7	16.7							
Amphidrome	19	7.5								
Amphidrome	20	11.6								
Amphidrome	21	7.3								
Amphidrome	23	11.8								
Amphidrome	24	4.0	6.3	5.3	5.4					
Amphidrome	25	25.4	16.2							
Amphidrome	26	97.1	53.2							
Sample # Median		12.7	16.2	11.1	10.5	9.9	9.7	9.8	9.8	9.4
25th percentile		9.5	10.8	7.3	8.4	9.1	9.3	9.2	9.4	
75th percentile		18.8	29.3	15.2	13.6	12.6	14.8	12.0	10.7	
N		25	21	14	12	10	8	6	4	1
Bioclere	1	8.4	8.4	8.4	9.9					
Bioclere	3	53.0	55.6							
Bioclere	5	5.3	13.3							
Bioclere	6	16.2								
Bioclere	7	13.2	10.5							
Bioclere	8	31.0								
Bioclere	9	52.8	42.2							
Bioclere	10	10.2								
Bioclere	11	16.2	24.7	16.2	17.1					

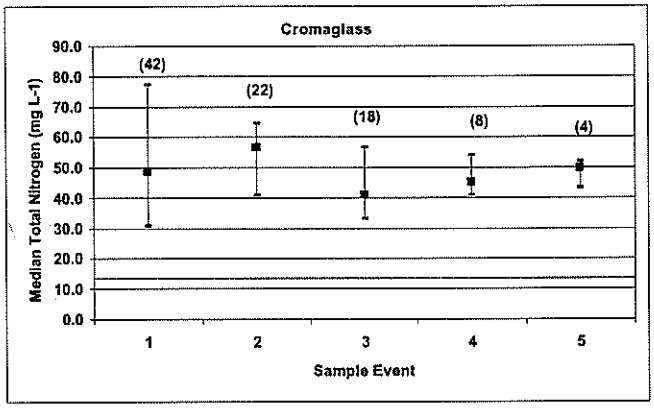
Bioclere	12	10.4	14.9			
Sample # Median		14.7	14.9	12.3	13.5	
25th percentile		10.2	11.9	10.4	11.7	
75th percentile		27.3	33.5	14.2	15.3	
N		10	7	2	2	
Cromaglass	1	31.8	28.8			
Cromaglass	2	30.6	26.5	22.5		
Cromaglass	3	76.5	58.2	50.4	45.2	50.4
Cromaglass	4	49.0	45.0	49.0	45.0	49.0
Cromaglass	5	104.4	85.3	66.3		
Cromaglass	6	31.9	32.7			
Cromaglass	7	78.3				
Cromaglass	8	67.5	71.7	67.5		
Cromaglass	9	45.9	64.3	45.9		
Cromaglass	10	25.5				
Cromaglass	11	46.5	32.5			
Cromaglass	12	52.8				
Cromaglass	13	41.7				
Cromaglass	14	37.4	73.3	37.4		
Cromaglass	15	74.3				
Cromaglass	16	100.1				
Cromaglass	17	79.2				
Cromaglass	18	140.1	78.6	17.1	32.2	26.3
Cromaglass	19	90.3				
Cromaglass	20	49.5				
Cromaglass	21	17.4	10.8	12.4		
Cromaglass	22	67.5	52.3	37.1	50.1	
Cromaglass	23	85.5	61.9	38.3	37.1	
Cromaglass	24	19.7	39.7	19.7		
Cromaglass	25	7.4				
Cromaglass	26	58.5	61.3	58.5	42.2	
Cromaglass	27	23.5				
Cromaglass	28	24.1				
Cromaglass	29	35.2	47.3	35.2		
Cromaglass	31	18.0	64.0	32.1		
Cromaglass	32	8.3				
Cromaglass	33	86.7				
Cromaglass	34	110.6	99.0	87.4	71.8	56.2
Cromaglass	35	61.6	44.7			
Cromaglass	36	43.7	56.9	43.7		
Cromaglass	37	77.2	55.7	77.2	64.4	
Cromaglass	39	11.4				
Cromaglass	40	103.4				
Cromaglass	41	17.2				
Cromaglass	42	76.1				
Cromaglass	43	48.2				
Cromaglass	44	35.8				
Sample # Median		48.6	56.3	41.0	45.1	49.7

25th percentile	30.9	40.9	32.8	40.9	43.3
75th percentile	77.0	64.2	56.5	53.7	51.8
N	42	22	18	8	4

Figure 1. Box plots showing the 25th percentile, grand median, and 75th percentile of total nitrogen (mg L^{-1}) for each sampling event. Individual graphs are presented for each technology. The gray line at 14 mg L^{-1} represents the Pinelands Commission's standard for the use of these systems on one acre lots. The number in parenthesis represents the number of systems included in the median value. (See Appendix 1 for discussion of data editing.)







Based upon the limited data reviewed to date, the Executive Director sees no evidence to support discontinuing the use of the Amphidrome and Bioclere systems, both of which appear to be capable, to date, of achieving an acceptable degree of nitrogen attenuation.

The limited data from the Cromaglass technology indicate significantly higher than expected total nitrogen concentrations in treated effluent from that technology. While the bulk of these systems were just installed in 2006, these data have raised concern with Commission staff and these concerns have been conveyed to the Cromaglass Corporation. In response to elevated nitrogen levels, Cromaglass initially looked at the sample collection devices and procedures and microscopically observed the presence of biological growth in treated effluent. Cromaglass attributes the presence of this growth to poor flocculent formation and settling within the treatment unit. The company has proposed to modify existing units installed in the Pinelands by incorporating four fixed film media cylinders within the aeration compartment of the systems to address the unsatisfactory performance of the technology. Retrofits to existing systems are expected to begin shortly.

While these are positive and necessary steps, the Executive Director can only determine that at this point in time, Cromaglass is not meeting the minimum water quality standards of the CMP. Installation of new Cromaglass systems should be suspended until such time as data from the retrofitted systems indicate a satisfactory level of performance. The regulatory means to accomplish this suspension is described in N.J.A.C. 10.22(a)5. Pursuant to that regulation, any local approvals for a development proposing the use of the Cromaglass technology will be determined to raise a substantial issue relative to CMP water quality requirements and will be reviewed by the Commission pursuant to N.J.A.C. 7:50-4.31 through 4.42. Notice of any "call-up" hearings scheduled in accordance with this review process and any subsequent determinations made by the Executive Director or the Commission on the relevant applications will be provided to the Cromaglass Corporation. This temporary suspension of the Cromaglass technology may be lifted when and if the results from the retrofitted systems demonstrate the technology's ability to attain treatment levels consistent with Pinelands groundwater standards. This suspension, which will take effect immediately upon the issuance of this report to the Commission, is expressly provided for in the pilot program and does not require the adoption of an amendment to the CMP.

2. The maintenance required for each alternate design pilot program treatment system technology to meet the efficiency set forth in 1. above.

The pilot program provides an effective mechanism to identify and correct problems encountered during system startup by requiring the system manufacturer or agent to be present during the startup of each system. The automatic telephone alarm dialers have met the intended purpose of promptly alerting

operation and maintenance personnel to operational problems and all such problems to date have been promptly remedied. The comprehensive five year warranty protections of the pilot program have prevented homeowners from incurring any cost associated with these service calls. The Commission staff has seen evidence that the technology manufacturers have taken steps to proactively address mechanical operational problems and expects the technology manufactures to continually incorporate component improvements to insure the future robust operation of the systems.

In addition to the replacement of worn or defective mechanical components, system maintenance also includes periodic adjustments to the treatment processes (e.g. modifying batch processing times) as necessary to attain and maintain required treatment efficiencies. To date, Commission staff has observed that a reasonable degree of maintenance has been required to keep the Amphidrome and Bioclere systems operating at acceptable treatment efficiencies. Process control maintenance of the Cromaglass technology has proven to be largely ineffective to date, as evidenced by effluent monitoring results. Future Cromaglass system installations are being suspended until the Cromaglass Corporation implements treatment process modifications as necessary to attain the required treatment system efficiencies.

3. The cost of installing and maintaining each alternate design pilot program treatment system technology.

An integral component of the pilot program is the monitoring by the Commission of treatment system costs. To facilitate the Commission's monitoring of these costs, the CMP requires the manufacturer of the treatment technologies to report on the cost of installation of each individual system.

It should be noted that the total cost of a Pinelands alternate onsite wastewater treatment system consists of at least three separate components, those being the cost of the alternate treatment unit and 5 year service package, the cost of the soil absorption system, and the cost of engineering and installation services. The manufacturers of the treatment unit have direct knowledge of the cost of their equipment and related support services, which in the case of the Pinelands pilot program includes a five year maintenance contract, five year warranty, and three years of quarterly effluent analysis. The manufacturers, however, do not have direct knowledge of the cost of the soil absorption field installation, or the local engineering (soil testing, design services, as-built plans, etc.) of the system. This information is typically supplied by the home builder to the alternate system manufacturer who in turn supplies it to the Commission.

The following summary of alternate design treatment system costs is based upon information provided to the Commission by the system manufacturers, as supplemented by local homebuilders. The Commission continues to work with the NJDEP to identify ways in which overall system costs may be reduced. For example, NJDEP has indicated that a reduction in the minimum required soil absorption field size has scientific merit due to the high quality effluent produced by these systems and that future revisions to the State's septic design standards may incorporate reduced field sizes.

Name of Treatment System Technology	No. of Systems included in this cost analysis	Average Reported Cost per Treatment Unit and 5 year service package *	Average Reported Cost for Engineering, Soil Absorption Field Installation, Electrical Connections, etc. **	Average Reported Overall Cost of the Advanced Onsite Treatment Systems

Amphidrome	26	**$ 21,665**	$ 9,596	$ 31,261
Bioclere	13	**$ 18,560**	$13,564	$ 32, 124
Cromaglass	36	**$18,369**	$16,675	$ 35,044

Table 1. Average Total Cost of Pinelands Alternate Design Wastewater Treatment Systems Note: Cost information is derived from a variety of sources and should be considered to represent approximate cost estimates.

* Cost of the Amphidrome Treatment Unit as sold by F.R. Mahony, Associates including hardware and equipment, 5 year annual maintenance contract, 5 year warranty, 3 years quarterly effluent analysis, pumping of 2000 gallon anoxic tank as necessary for 5 years, and delivery of equipment to job site is $ 14,355. In addition, the average cost of concrete tankage (2000 gal. concrete anoxic tank, concrete reactor vessel and 1000 gal. concrete clearwell), purchased separately from local suppliers, including delivery to the job site, is variable, depending on precast supplier and distance to shipping location.

* Cost of the Bioclere treatment unit as sold by Aqua Point, including hardware and equipment, 5 year annual maintenance contract, 5 year warranty, 3 years quarterly effluent analysis, pumping of 2000 gallon anoxic tank for 5 years, as needed, and delivery of equipment to job site is approximately $ 18,560.

* Cost of the Cromaglass treatment unit as sold by Cromaglass Corp., including hardware and equipment, 5 year annual maintenance contract, 5 year warranty, 3 years quarterly effluent analysis, pumping of anoxic tank for 5 years, as needed, and delivery of equipment to job site is approximately $18,369

** Costs include determination of soil and site suitability (soil logs and "perc" tests), preparation of engineering plans, completion of NJDEP standard application forms, excavation for soil absorption system and tank placement, soil absorption system materials (suitable "K4" replacement soil, stone filter materials and lateral piping, or gravel free chambers, geotextile fabric), installation of all components, electrical connections, surveyor services, as-built plans, engineering construction observation and engineering certifications.

The total cost of the alternate design treatment technologies is approximately twice that of the cost of a pressure dosing septic system. Pressure dosing septic systems were required to be used on lots smaller than 3.2 acres prior to the implementation of the Pinelands Alternate Design Treatment Systems Pilot Program however, their use for nitrogen attenuation has been terminated based upon a previous study of their effectiveness by the Commission's Science Office. The estimated cost for a pressure dosing septic system does not include five year operation and maintenance services, 5 year warranty, and effluent sampling.

4. The problems associated with the installation, operation and maintenance of each alternate design pilot program treatment system technology and the frequency with which each such problem occurs, the measures taken to eliminate any such problem and the success of those measures.

The CMP requires each technology manufacturer to report to the Commission on the frequency and nature of system startup and operational problems.

Amphidrome

In 2004, the manufacturer of the Amphidrome system, F.R. Mahony Associates, reported one startup problem related to improper wiring to the system blower and one mechanical operational problem related to a float switch component. In 2005 F.R Mahony reported no problems at startup and a total of eight

operational problems. In one case, a low liquid level was caused by a pipe seal failure, there was one instance of odor generation due to improper venting, one problem due to an inaccessible control panel, and five instances requiring system micro-processor adjustments. In 2006, F.R. Mahony Associates reported several startup problems including several instances where a dedicated phone line was not available, one instance where a non-conforming electrical junction box was used, and one incorrectly installed pipe connection. Mechanical operational problems reported in 2006 include a system programming error, an incorrect float switch setting, a malfunctioning system controller and a blower pipe break. Each problem was promptly diagnosed and corrected and homeowners incurred no charge as a result of system warranty protections. In no case was there a public health concern related to any of these incidents. F.R. Mahony also reported one administrative problem involving a contract dispute with a client related to the pre-paid operational and maintenance contract requirement. The owner of that system is currently looking to execute a maintenance agreement with a maintenance service provider other than F.R. Mahony Associates.

Cromaglass

In 2005, the Cromaglass Corporation reported no startup problems and three mechanical operational problems. One operational problem was traced to a telephonic alarm dialer and two problems were the result of power surges, likely caused by lighting. In 2006, the Cromaglass Corporation again reported no problems at system startup. There were three instances of aeration / discharge pump replacements reported and one instance of sludge residuals removal reported by Cromaglass in 2006. In each instance, the mechanical problems were diagnosed promptly and corrected at no cost to the homeowner as a result of system warranty coverage. In no case was there a public health concern related to any of these incidents. In additional to the startup and mechanical problems reported for the Cromaglass technology, the manufacturer has acknowledged the system's inability to attenuate nitrogen levels to the degree expected. Cromaglass has proposed retrofits to its systems to address this treatment issue. The details of those retrofits are discussed in the System Testing Summary section below.

Bioclere

In 2005, Aqua Point, the manufacturer of the Bioclere system reported that there were no problems during system startup and one mechanical operational problem related to a lighting induced power surge. In 2006 Aqua Point reported one problem related to the unavailability of a telephone line for connection to the telephonic alarm dialer at startup. There were no mechanical operational problems reported during 2006. Aqua Point reports that they have taken steps to address the availability of a telephone line at startup. Correction of all reported problems was made at no cost to the homeowner due to system warranty protections. In no case was there a public health concern related to any of these incidents.

5. The number of systems of each technology that have been authorized under the pilot program.

The first Pinelands alternate design pilot program treatment system was brought online in April 2004. From April 2004 through August 2006, a total of eighty-five (85) of these systems have been installed and activated. Another ten (10) alternate design treatment systems have been installed during the period of August 5, 2006 through mid October 2006. The following table summarizes installations by technology type and year of installation.

Technology	Installed in 2004	Installed in 2005	Installed in 2006	Total Installed
Amphidrome	7	10	11	28
Bioclere	--	2	11	13
Cromaglass	--	5	39	44
Total Installations	**7**	**17**	**61**	**85**

It is apparent that the number of new systems brought online has increased steadily since the inception of the pilot program. Based upon existing development applications in process, it appears that the trend toward an increased number of installations will continue before ultimately leveling off and then, conceivably declining as available lots are built out. This trend toward increased numbers of installations is supported by the fact that 10 systems were installed in the two months since August 2006. Applications filed with the Commission to date indicate that as many as 70 additional applicants are currently pursuing development using alternate design treatment systems. Of course, many economic and other factors are likely to affect the pace and number of future installations, including new home starts, mortgage interest rates, etc.

The following table provides a summary of the system technologies and the municipalities in which they are currently operating.

	Atlantic			Burlington			Camden		Cape May	Gloucester	Ocean			Total
System	Folsom	Hamilton	Mullica	Pemb	Taber	Woodland	Waterford	Winslow	Woodbine	Franklin	Jackson	Lacey	Manch.	
Amphidrome	1	11	1	8	3		1	1		1		1		28
Bioclere		1		8	1	1			1		1			13
Cromaglass		4		20	1			2			11		6	44
TOTAL	**1**	**16**	**1**	**36**	**5**	**1**	**1**	**3**	**1**	**1**	**12**	**1**	**6**	**85**

To date, approximately 50 % of the alternate design wastewater treatment systems have been installed in the Pinelands Forest Area, 21 % in the Pinelands Regional Growth Area, 12 % in the Pinelands Rural Development Area, 10 % in Pinelands Towns, 5 % in Pinelands Villages, and 1 % in the Pinelands Agricultural Production Area. The relatively high percentage of systems in the Forest Area is the result of a relatively large subdivision currently under development in that Pinelands management area in Pemberton Township. This subdivision received a waiver of strict compliance for Pinelands density standards a number of years ago.

There are no Ashco RFS ^{III} or FAST treatment technologies installed in the Pinelands to date. Ashco-A Corporation, the manufacturer of the Ashco RFS ^{III}, reports that they have been unable to locate a local concrete precaster for their product and that shipping of concrete tank components from Ashco-A Corporation's location in West Virginia is cost prohibitive. Ashco-A Corporation is aware that Commission staff is recommending that the Ashco RFS ^{III} be removed from the pilot program due to its non-participation. Biomicrobics, the manufacturer of the FAST system, advised Commission staff in October 2006 that it has recently designated the firm Site Specific Design, Inc. to market and support the FAST system in the Pinelands. Biomicrobics has requested that the FAST system be retained in the pilot program.

6. Whether the pilot program, when viewed in its entirety, has served to further the purposes and objectives of the Pinelands Protection Act, the Federal Act and this Plan.

Under the pilot program, a total of 85 alternate design treatment systems were approved and installed during the evaluation period (August 2002 to August 2006). While not insignificant, this relatively limited use of the pilot program has provided the Executive Director with insufficient data from which to draw any definitive conclusions as to the impact of the program on the purposes and objectives of the Pinelands Protection Act, the Federal Act and the CMP. The recommendations outlined in the following section are designed to provide an opportunity for the installation of additional systems and an increase in available data so that such conclusions may be made during the next evaluation of the pilot program.

Conclusions and Recommendations

The CMP currently permits the **installation** of the alternate design wastewater treatment systems only until August 5, 2007 unless a rule is adopted by the Commission which expressly authorizes such installations beyond that date. The Executive Director recommends that the Commission amend the CMP to permit continued installations of the authorized technologies until August 5, 2010. This extension would provide an opportunity for new installations of these technologies and the review of subsequent effluent monitoring prior to the Commission's making its final determination of the ability of the treatment technologies to meet Pinelands water quality standards.

The CMP also provides that the Commission may repeal the pilot program as it pertains to one or more technologies if it is determined that the pilot program has not been implemented or has not been successful for one or more of the treatment system technologies. The CMP provides that upon said repeal, any subsequent local approval for a development that is proposing to use a repealed technology be determined to raise a substantial issue with CMP water quality standards through the Commission's call up process. The Executive Director recommends that a CMP amendment be adopted to remove the Ashco RSF^{III} technology from the pilot program based upon its non-participation to date and the fact that the manufacturer has not demonstrated its intention or ability for future participation. As noted previously in this report, the Executive Director will also be temporarily suspending use of the Cromaglass technology, pending the outcome of efforts being undertaken by Cromaglass Corporation to retrofit existing systems to improve nitrogen attenuation. This temporary suspension does not require the adoption of an amendment to the CMP.

The CMP provides that the Commission may authorize the Executive Director to extend the pilot program to **monitor** the alternate design wastewater treatment systems by two years, until August, 5, 2008, based upon a finding that the number of monitoring events for any alternate design pilot program technology is not adequate to evaluate that technology under the current pilot program. The resultant small number of systems available for review, especially those with less than three sampling events, is considerably less than the 40 systems (for each technology) that would ideally be reviewed prior to deciding on the effectiveness of a treatment technology. (Groves et al. 2005) This suggests that the Pinelands alternate design pilot program be extended for select technologies to allow for the analysis of data for the Commission's determination of the effectiveness of each technology to attain Pinelands groundwater quality standards.

Such a two year extension does not require a CMP amendment. However, the Executive Director recommends that the **monitoring** provisions of the pilot program be extended for **three years**, until August 5, 2009, to provide for additional monitoring of the Amphidrome, Bioclere, Cromaglass and FAST technologies. A second comprehensive review of the pilot program would be completed at that time. It should be noted that even with this *additional* one year extension, it is possible that an adequate number of systems and sampling events may not exist to conclusively determine performance levels for the Bioclere and Fast technologies, and may need to further extend the pilot program when conducting its assessment in 2009. An amendment to the CMP is necessary to extend the monitoring provisions of the pilot program for the recommended three year duration.

The CMP provides that the alternate design treatment systems must be covered under a five year maintenance contract that cannot be cancelled and is renewable. The maintenance contract must provide for the manufacturer or its agent to inspect the system at least once a year and to undertake any necessary maintenance or repairs determined to be necessary. In a related matter, the Commission has recently engaged a consultant to assist local entities with the development and implementation of institutional and government arrangements to ensure adequate long term maintenance and monitoring of onsite wastewater systems, particularly upon termination of the pilot program. Implementation of the local or sub-regional institutional arrangements for the long term management of onsite technologies may occur after the five year maintenance contract for a few systems expires. If that initial expiration period approaches before

long term management arrangements are in place, Commission staff will encourage the affected homeowners to extend their maintenance contracts.

Commission staff have been made aware of a number of circumstances where owners of unsewered parcels smaller than 3.2 acres have been denied the ability to develop those parcels, in a manner that is consistent with all other municipal land use and environmental standards, due to a municipality's failure to adopt an ordinance to permit the installation of a Pinelands alternate design treatment system. This circumstance has resulted in considerable hardship on landowners who are proceeding in good faith to develop their properties in full conformance with certified municipal master plans and land use ordinances. The Executive Director recommends adoption of a CMP amendment to require all Pinelands municipalities to authorize the use of the alternate design treatment technologies so as to alleviate this hardship on these aggrieved landowners. Such CMP amendments could provide for some exceptions.

Draft CMP amendments to implement the above described staff recommendations will be provided to the Commission's CMP Policy and Implementation Committee for its consideration in January 2007.

Appendix 1

Data Editing

It should be noted that the retained data set includes instances where analyses for multiple parameters (from a single sampling event) were performed by different (certified) laboratories under subcontract, i.e. nitrite and nitrate by one lab and total kjeldahl nitrogen by another lab, and where different (NJDEP approved) methodologies were used on various sampling dates from a single system location. In all of these instances, both the laboratories and analytical methods utilized were DEP approved and/or certified. Where laboratories reported analyte values as "Not Detected" the Commission's analysis assigned a concentration of one-half the laboratory reporting limit to that parameter when computing the total nitrogen mass in the sample.

Data Accuracy

While not optimal, and to be avoided as much as possible, it is apparently typical for a regulatory monitoring program of this nature to encounter difficulty in generating data that would meet the rigorous standards required of a peer reviewed research project. This difficulty is the result of the many variables that cannot be controlled where treatment technologies are operating under real world conditions. Apart from these real world assessment programs, a number of technology test centers (National Sanitation Foundation (NSF), US Environmental Protection Agency Environmental Technology Verification (ETV)) routinely conduct benchmark tests to determine what a treatment system is capable of doing. Such trials are conducted under rigidly controlled conditions. While these benchmark studies measure what a technology is capable of achieving, they do not assess what a technology actually achieves in widely ranging real world applications. Moreover, while standard assessment protocols are well developed for test center benchmark trials, there are currently no similar standard assessment protocols for evaluating actual field performance of treatment technologies. As recently as September 2006, the NSF's Joint Wastewater Committee formed a Field Performance Task Group to address this issue and the group hopes to develop a draft field performance protocol by September 2007. In December 1999, New Jersey, Massachusetts and Pennsylvania, acting under a Memorandum of Understanding (MOU) originally entered into in June 1996, agreed to work on the development of a standard protocol for approving innovative and alternate onsite wastewater treatment technologies. In its September 2005 report, released as a result of that MOU, this multi-state consortium acknowledged the dearth of third-party peer-reviewed, replicable data related to field trials of onsite wastewater systems. The group advises however, that even in the absence of "pure" data, regulators should exercise caution before throwing out "imperfect" data while assessing onsite system performance. The consortium instead recommends that regulators rank data on the basis of a hierarchy of strength, and to not to allow the perfect to be the enemy of the good. The consortium produced a report for the New England Interstate Water Pollution Control Commission, entitled *Variability and Reliability of Test Center and Field Data: Definition of Proven Technology From a Regulatory Program Viewpoint.* In its report, the consortium concludes that all non-fraudulent field performance data on alternate design wastewater treatment systems is valuable in regulatory decision making, even if that data is not gathered in a completely controlled study.[1]

The Pinelands pilot program involved multiple uncontrolled variables including homeowners, private

[1] Groves. T.W., F. Bowers, E. Corriveau, J. Higgens, J. Heltshe, and M. Hoover. 2005. Variability and Reliability of Test Center and Field Data: Definition of Proven Technology From a Regulatory Program Viewpoint. Project No. WU-HT-03-35. Prepared for the National Decentralized Water Resources Capacity Development Project, Washington University, St. Louis, MO, by the New England Interstate Water Pollution Control Commission, Lowell, MA.

laboratories, operation/maintenance companies, and wastewater technology vendors, all engaging in standard industry and marketplace practices. Some of these practices are regulated, such as laboratory certifications, while others are not. As a result of these real world conditions, it should be emphasized that the monitoring provisions of this pilot program were not do intended, do not need to, and probably cannot rise to the level of peer-reviewed, journal-published research, but instead are intended to provide a statistically sound measure of the field performance of the pilot program systems. Variables that were not controlled in the pilot program include variability in the make up of households serviced by the systems, variability of wastewater flow and strength characteristics, variability in individuals involved in sample collection, variability in laboratories performing the analysis (including subcontracting between laboratories), and variability in laboratory personnel, equipment and analytical methods. To the extent feasible, staff and the vendors will work to reduce said variability. Additionally, all samples were collected as grab samples (as opposed to composite samples) and are thus greatly affected by wastewater usage conditions which prevailed just prior to the sampling event and do not necessarily characterize long term effluent characteristics.

Prior to conducting the data analysis, data were edited, sorted and evaluated by Commission staff. Where obvious errors in the data were evident, i.e. exceeding a maximum sample holding time or a lab reporting error, such data were discarded. When values for the various nitrogen parameters, (e.g. nitrate, nitrite, total kjeldahl nitrogen) were not collected during a single sampling event, the results of the individual parameters were not used in computing total nitrogen concentrations. After discarding such data and consulting with NJDEP's Office of Quality Assurance and Division of Water Quality, Bureau of Nonpoint Pollution Control, approximately 85% of the submitted laboratory results were retained for analysis.