REPORT
TO THE NEW JERSEY PINELANDS COMMISSION

IMPLEMENTATION OF THE ALTERNATE DESIGN TREATMENT SYSTEMS PILOT PROGRAM

November 5, 2009

Background

In 2000, the Pinelands Commission formed a special Pinelands 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 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 New 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 Committee recommended that the Pinelands Commission approve the Amphidrome, Ashco RFS ^{III}, Cromaglass, Bioclere and FAST treatment system technologies to participate in the Pinelands Alternate Design Wastewater Treatment Systems Pilot Program.. 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 utilize 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 were initially authorized only in those municipalities which had adopted an ordinance, certified by the Commission, to implement the alternate design treatment systems pilot program. Amendments to the pilot program were adopted during the program's implementation which resulted in the removal of the Ashco RFS ^{III} treatment technology and the authorization to use the pilot program technologies in each of the Pinelands Area municipalities. Details related to these amendments are provided in the body of this report.

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, 2010 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 and County Participation

Use of the alternative design onsite wastewater treatment systems is authorized in every Pinelands Area municipality as a result of amendments to the CMP which became effective on December 3, 2007. Prior to that amendment, the pilot program technologies were only authorized for use in municipalities that had adopted an ordinance to implement the pilot program. Although most (34 of 40) municipalities adopted the requisite ordinance, the Commission became aware of several applicants in the non-adopting municipality's who were precluded from advancing fully conforming applications due only to the municipality's lack of ordinance adoption. Parcels that could have been previously developed using pressure dosing septic systems were unintentionally precluded from obtaining requisite approvals, even where the applicant proposed to use one of the newly approved pilot program technologies. To remedy this situation, the Commission amended the CMP to authorize the use of the pilot program treatment technologies in each of the Pinelands Area municipalities. The adoption of this amendment has proven to be successful in resolving the hardship experienced by several applicants. Additional details related to this amendment are provided below.

Throughout the duration of the pilot program, each of the Pinelands Area County Health Departments has reviewed proposed engineering design plans, issued regulatory approvals and inspected system installations of the Pinelands pilot program technologies in a manner similar to that by which traditional septic system designs plans are processed. The County Health Departments have played an essential role and have worked cooperatively with Commission staff in administering the approval and monitoring of the pilot program technologies. Continued coordination and cooperation between the county agencies and Commission staff remains an integral component of the management program for these technologies and is essential to their successful long-term use.

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 pilot program systems without individual applicants being subject to the standard $450 NJDEP permit fee or 90 day NJDEP review period. Commission staff consulted NJDEP's Division of Water Quality and Office of Quality Assurance during the development of wastewater sampling protocols and continued this consultation during the analysis of laboratory monitoring data.

Evaluation

The CMP provides (at N.J.A.C. 7:50-10.23(b)) that the Executive Director review the Alternate Design Treatment Systems Pilot Program seven years after its effective date (August 5, 2002) and issue a report to the Commission within three months of said review addressing the pilot program's implementation. This report, dated November 5, 2009 has been prepared to meet this requirement of the CMP.

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, (last rev. August 2005) which specify quality assurance procedures in the collection and transport of samples; (i.e., chain of custody, sample preservation, etc.). In addition, the Commission's protocols require that all laboratory analytical methods 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 to be collected during the first ninety days from system start-up.

The Commission's Land Use and Technology Programs staff has evaluated the available data in the assessment of the technologies and have determined that the available data is suitable for use in determining whether 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 limitations of the quality of data generated through a regulatory monitoring program of this nature.)

The Commission has worked with the technology manufacturers and the certified testing labs in an effort to attain the highest quality data possible. This has included requiring that a complete set of samples (ammonia, nitrate, nitrate, TKN) be collected during every sampling event as total nitrogen concentrations are expressed as the sum of TKN plus nitrate plus nitrite. Failure to simultaneously collect a sample for each parameter has resulted in data being disqualified for use by the Commission and has resulted in the need to collect additional sampling rounds. To attain maximum data quality, the consistent use of a specific laboratory and the employment of consistent laboratory methods is generally preferred. Such consistency could not always be achieved during the implementation of the pilot program as changes in laboratory selection and laboratory method utilization were beyond the control of the Commission. Cost considerations and laboratory workloads and logistics sometimes resulted in changes in laboratory selection on the part of the system vendor or analytical method selection on the part of the laboratory. In the opinion of the Commission's Land Use and Technology Programs staff, sufficient data quality has been ensured through the use of only NJDEP state certified laboratories utilizing only NJDEP/USEPA certified laboratory methods. These program components are typical of methods used to demonstrate regulatory compliance and are commonly accepted industry and regulatory procedures employed by agencies such as the NJDEP in its regulatory compliance programs; (e.g., NJPDES permitting).

In reviewing data from individual onsite wastewater treatment systems, the reader should recognize that numerous factors affect the performance of individual residential systems and direct comparisons from one system (household) to another should be avoided. Samples are "grab" samples, not composite samples and therefore represent only an individual snapshot of system performance. For this and other reasons, it is important to have a relatively large number of systems and sampling events before rendering a final determination related to a technology's capability. Home occupancy, water use, garbage grinders, pharmaceuticals, 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, will 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, likely under-predict concentrations present in current domestic wastewater streams. It is important to note however, that the total mass of nitrogen excreted by individuals remains fixed at approximately 9 lbs.. 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 estimated values based upon dilution modeling and its associated assumptions. Even where effluent levels exceed assumed post treatment concentrations, system discharges may still be meeting total nitrogen loading targets.

As noted, there are four treatment technologies that are currently operational in the Pinelands (Amphidrome, Bioclere, Cromaglass, and FAST). Each has an expected nitrogen removal efficiency of at least 65%. If the total nitrogen contained in the raw influent is 40 mg/l, (as assumed in the Pinelands Septic Dilution Model), 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 when vegetative uptake and rainfall dilution are considered). 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, generally due to the physical configuration of the treatment processes and mixing of raw and nitrified wastewater. Because of these physical limitations, the Commission has not been able to calculate the exact removal efficiencies for the alternate technology systems. Similar difficulties have been reported in similar programs and test facilities elsewhere. Nevertheless, Commission staff recognizes the value in testing the 40 mg/l TN assumption and, as it moves ahead in the second phase of the pilot program, hopes to develop a reliable estimate of this concentration, in the context of current demographics (household size) and water conservation practice.

Effluent sampling data submitted to date have been analyzed and presented in this report. Tables 1, 2, 3, and 4 provide the grand median and running median total overall nitrogen concentrations (mg/l)[1] by the number of samples taken for the Amphidrome, Bioclere, Cromaglass, and FAST wastewater treatment systems respectively. The analysis indicates a grand median of 12.0 mg/l for the Amphidrome system and 11.2 mg/l for the Bioclere system. Both of these grand median concentrations are below the 14 mg/l target which is based upon the Pinelands septic dilution model with an assumed wastewater influent total nitrogen (TN) concentration of 40 mg/l/. The grand median total nitrogen concentration for the Cromaglass system is 26.6 mg/l, and 34.4 mg/l for the FAST system, both significantly greater that the Commission’s 14 mg/l target.

The current effluent TN grand median value of 26.6 mg/l for the Cromaglass technology demonstrates improvement over previously reported values. In August 2005, the Commission reported a value of 49.7 mg/l and in August 2008 the reported value was 31.0 mg/l. These improved results suggest progress is being made in the technology’s overall performance, perhaps resulting from retrofits and other corrective efforts employed by Cromaglass Corporation. The Commission will continue to monitor the Cromaglass technology effluent nitrogen values and will enact appropriate measure to either restore continued installation of the technology by lifting the temporary suspension or to institute permanent suspension if deemed suitable.

In the case of the FAST technology, these results are based upon too few samples and too few systems to draw a definitive conclusion at this time. Commission staff will, however, monitor the FAST technology effluent results as they are developed.

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[1] One (1) mg/l = one (1) ppm

Table 1. Amphidrome running median of total nitrogen (mg L^{-1}) by number of sampling events for each wastewater treatment system. The grand median (highlighted value), 25th percentile, 75th percentile, and number of systems sampled (N) per event are provided. (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	10	11	12	13	Grand Median
Amphidrome	1	18.5	25.3	32.1	25.3	20.7	19.6	18.5	17.7	16.9	16.0				16.0
Amphidrome	2	9.5	9.0	8.6	9.0	9.4	9.5	9.5	9.5	9.4	9.4	9.4	9.5	9.5	9.5
Amphidrome	3	18.4	12.1	18.4	50.4	18.4	14.9	12.6	12.0	11.5	12.0	12.6	12.9		12.9
Amphidrome	4	35.2	29.2	23.2	16.4	9.7	8.4	7.8	7.5	7.2	7.5	7.4			7.4
Amphidrome	5	10.0	42.3	51.3	31.8	12.3	31.8	17.8	16.0	17.8	16.4	16.7	15.9		15.9
Amphidrome	6	6.0	33.8	6.9	9.8	12.7	14.8	12.7	11.1	9.5	10.8	9.5			9.5
Amphidrome	7	12.7	10.7	11.0	9.9	8.8	8.6	8.8	9.1	9.5	10.1	10.7	10.1	9.5	9.5
Amphidrome	8	15.2	15.4	15.5	15.4	15.2	12.1	9.9	9.5	9.1	9.0	9.1	9.0		9.0
Amphidrome	9	143.9	79.5	15.1	12.6	10.2	10.0	10.2	10.2	10.2	10.2	10.3	10.2	10.3	10.3
Amphidrome	10	5.8	4.9	5.8	6.6	7.0	6.7	7.0	7.1	7.0	7.2	7.3			7.3
Amphidrome	11	14.9	10.1	6.0	8.4	10.8	12.2	10.8	9.8	10.0	9.5	8.9			8.9
Amphidrome	12	18.8	27.6	36.4	33.6	36.4	38.3	36.4	33.6	30.8	24.8	30.8			30.8
Amphidrome	13	4.7	5.4	4.7	5.2	5.7	5.2	5.3	5.5	5.7	5.5	5.7			5.7
Amphidrome	14	24.5	17.2	9.8	9.7	9.5	9.4	9.4	9.4	9.5	9.4				9.4
Amphidrome	15	4.0	6.3	5.3	5.4	5.3	5.4	5.5	5.4	5.5	5.7	5.9			5.9
Amphidrome	16	11.7	16.7	11.7	11.4	11.2	11.4	11.7	12.5	11.7	11.4				11.4
Amphidrome	17	27.0	47.2	58.2	56.5	54.8	54.5	54.2	54.0	53.8	53.1	52.3			52.3
Amphidrome	18	11.1	12.9	11.1	10.3	11.1	11.8	12.5	12.4	12.5	12.4	12.3	12.1		12.1
Amphidrome	20	16.0	13.4	16.0	14.9	16.0	14.9	16.0	14.9	13.9	14.9	16.0			16.0
Amphidrome	21	7.5	8.1	8.8	10.3	11.9	13.0	11.9	10.6						10.6
Amphidrome	22	36.8	49.3	55.0	45.9	36.8	28.1	19.5	19.4						19.4
Amphidrome	23	25.4	16.2	11.0	10.3	11.0	11.3	11.6	11.9	12.3	11.9	11.6	11.5		11.5
Amphidrome	24	7.3	5.7	6.5	6.9	6.5	6.2	6.5	6.9						6.9
Amphidrome	25	11.6	13.5	15.3	15.6	15.9	16.4	15.9	16.4	16.8	17.8	16.8			16.8
Amphidrome	26	23.9	28.6												28.6
Amphidrome	28	23.9	32.6	41.4	32.6	23.9									23.9
Amphidrome	29	7.4	7.5	7.6	7.5	7.6	7.5	7.6	7.5						7.5
Amphidrome	30	97.1	53.2	9.3	9.9	10.5	9.9	9.3	9.9	10.5	9.9	9.3			9.3
Amphidrome	31	11.8	13.5	12.3	12.9	12.3	12.3	12.3	12.3	12.3					12.3
Amphidrome	32	7.4	7.7	8.0	7.7	8.0	7.7								7.7
Amphidrome	33	6.4	5.0	6.4	6.0	6.4	6.3	6.1	6.3	6.4					6.4
Amphidrome	34	13.9	20.0	13.9	18.3	18.3	16.1	18.3	20.5						20.5
Amphidrome	35	9.0	11.5	13.9	16.0	13.9	12.8	13.9	16.0	13.9					13.9
Amphidrome	36	11.7	12.9	13.6	12.9	13.6	13.8	14.1	14.1	14.1					14.1
Amphidrome	37	9.9	11.0	11.7	11.9	11.7	11.2	11.7	11.9	11.7					11.7
Amphidrome	38	17.3	13.9	10.5	13.2	10.5	9.1								9.1
Amphidrome	41	27.4	26.7	25.9	26.7	25.9	22.0	19.1							19.1
Amphidrome	43	17.2	17.5	17.2	17.5	17.8	19.0	20.1	19.0	17.9	18.1				18.1
Amphidrome	44	15.3	15.9	16.5	17.7	16.5	15.9	15.3	15.1						15.1
Amphidrome	45	26.6	16.7	25.4	17.4	9.5	12.4	9.5	9.4	9.5					9.5
Amphidrome	46	10.4	10.9	11.5	10.9	10.4	10.8	10.4							10.4
Amphidrome	47	17.2	14.5	11.8	11.8	11.8	11.8	11.8							11.8
Amphidrome	48	37.6	28.3	24.2	23.8	24.2	23.8	23.4							23.4
Amphidrome	49	12.0	21.5	14.7	15.0										15.0
Amphidrome	50	22.9	35.4	27.3	37.5	27.3	25.6								25.6
Amphidrome	51	82.0	75.1	68.2	39.1										39.1
Amphidrome	53	12.0	13.9	12.6	12.3	12.0									12.0
Amphidrome	54	9.8	9.5	9.3	9.5										9.5
Amphidrome	55	23.2	18.6	16.6											16.6
Amphidrome	56	18.3	28.7	20.9											20.9
Amphidrome	57	56.0	50.7												50.7
Amphidrome	58	31.8	38.3												38.3
Amphidrome	59	28.1	30.6												30.6
Amphidrome	60	18.1	15.6	14.2											14.2
Amphidrome	61	6.7	7.9	7.2											7.2
Amphidrome	62	3.7													3.7
Amphidrome	63	5.9													5.9
Amphidrome	64	8.3													8.3
Amphidrome	65	48.0	27.3	14.6											14.6
Amphidrome	66	13.1													13.1
Sample # Median		15.0	16.1	13.7	12.9	11.8	12.2	11.8	11.9	11.5	10.8	10.3	10.9	9.5	**12.0**
25th percentile		9.7	11.0	9.3	9.9	9.6	9.4	9.4	9.4	9.5	9.4	9.0	9.9	9.5	9.2
75th percentile		24.1	28.6	19.0	18.0	16.8	16.0	15.9	15.6	13.9	15.5	14.3	12.3	9.9	17.1
N		60	56	52	47	44	42	39	35	29	23	19	8	3	

Table 2. Bioclere running median of total nitrogen (mg L^{-1}) by number of sampling events for each wastewater treatment system. The grand median (highlighted value), 25th percentile, 75th percentile, and number of systems sampled (N) per event are provided. (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	10	11	12	Grand Median
Bioclere	1	22.3	13.4	8.8	8.9	8.8	7.8	8.8						8.8
Bioclere	2	10.7	9.8	8.9	9.8	8.9	9.8	10.7	10.8	10.7				10.7
Bioclere	6	17.0	11.4	17.0	12.7	14.4	13.3	12.2						12.2
Bioclere	7	10.4	14.9	10.4	10.2	10.4	10.8	10.4	10.2	10.4	10.8	11.2		11.2
Bioclere	8	11.2	9.6	10.5	9.3	8.6	9.6	10.5	9.6					9.6
Bioclere	9	8.6	8.4	8.6	9.5	10.4	10.7	10.4	9.5	10.4				10.4
Bioclere	10	8.4	8.4	8.4	9.9	9.2	9.7	10.1	9.8	9.6	9.5	9.6	9.9	9.9
Bioclere	11	25.0	17.8	15.4	13.2	15.4	13.2	13.8	14.6	13.8	12.4	10.9		10.9
Bioclere	12	52.8	55.5	52.8	33.0	13.1	12.3	13.1	12.3	13.1	12.3	13.1	13.5	13.5
Bioclere	13	14.2	14.2	14.2	11.4	11.9	11.1	11.9	11.5	11.1	11.2			11.2
Bioclere	14	16.2	24.7	16.2	17.1	16.2	14.5	12.9	12.2	11.4	11.0	11.4		11.4
Bioclere	15	5.2	13.2	10.6	13.0	10.6	13.0	15.3	13.8	15.3	13.8			13.8
Bioclere	16	28.1	25.0	22.0	18.5	22.0	18.5	15.1	14.3	15.1	14.3	15.1		15.1
Bioclere	17	79.8	48.0	16.2	16.2	16.2	16.1	16.0	14.4	12.8	12.9	12.8		12.8
Bioclere	18	13.2	10.5	10.3	9.3	10.3	9.7	9.4	9.8	10.3	9.9	10.3		10.3
Bioclere	19	29.4	30.2	29.4	19.6	9.8	12.5	11.9	13.6	11.9				11.9
Bioclere	20	52.8	42.2	31.6	26.4	21.2	26.4	21.2	17.8	14.5				14.5
Bioclere	21	10.2	10.2	10.3	11.7	10.3	10.2	10.2	9.6					9.6
Bioclere	22	9.7	9.8	10.0	10.1	10.0	9.8	10.0	10.1	10.1	11.5			11.5
Bioclere	23	27.3	18.2	9.1	11.1	9.1								9.1
Bioclere	24	2.4	2.5	2.5										2.5
Bioclere	25	25.9	16.7	9.7	11.3	9.7								9.7
Bioclere	26	1.9	18.8	4.9	8.5	12.1	8.5							8.5
Bioclere	27	34.6	23.9	13.2	13.1	13.1	12.7							12.7
Bioclere	28	24.8	17.3	11.6	10.7	9.7								9.7
Bioclere	29	10.3	13.1	11.0	12.2	12.0								12.0
Bioclere	30	24.9	21.5	18.0	14.1	13.3								13.3
Bioclere	31	4.3	23.0											23.0
Bioclere	32	46.8	42.0	37.3										37.3
Bioclere	33	47.9	31.1	14.3										14.3
Bioclere	34	20.8	17.7											17.7
Bioclere	35	7.3												7.3
Bioclere	36	4.9												4.9
Sample # Median		16.2	17.3	11.0	11.6	10.5	11.1	11.9	11.5	11.4	11.5	11.3	11.7	**11.2**
25th percentile		9.7	10.9	9.7	9.9	9.7	9.8	10.3	9.8	10.4	10.9	10.7	10.8	9.7
75th percentile		27.3	24.3	16.2	13.9	13.2	13.2	13.5	13.8	13.5	12.6	12.9	12.6	13.3
N		33	31	29	26	26	21	19	17	15	11	8	2	

Table 3. Cromaglass running median of total nitrogen (mg L^{-1}) by number of sampling events for each wastewater treatment system. The grand median (highlighted value), 25th percentile, 75th percentile, and number of systems sampled (N) per event are provided. (See Appendix 1 for discussion of data editing.)

Total Nitrogen Running Median

Number of Sampling Events

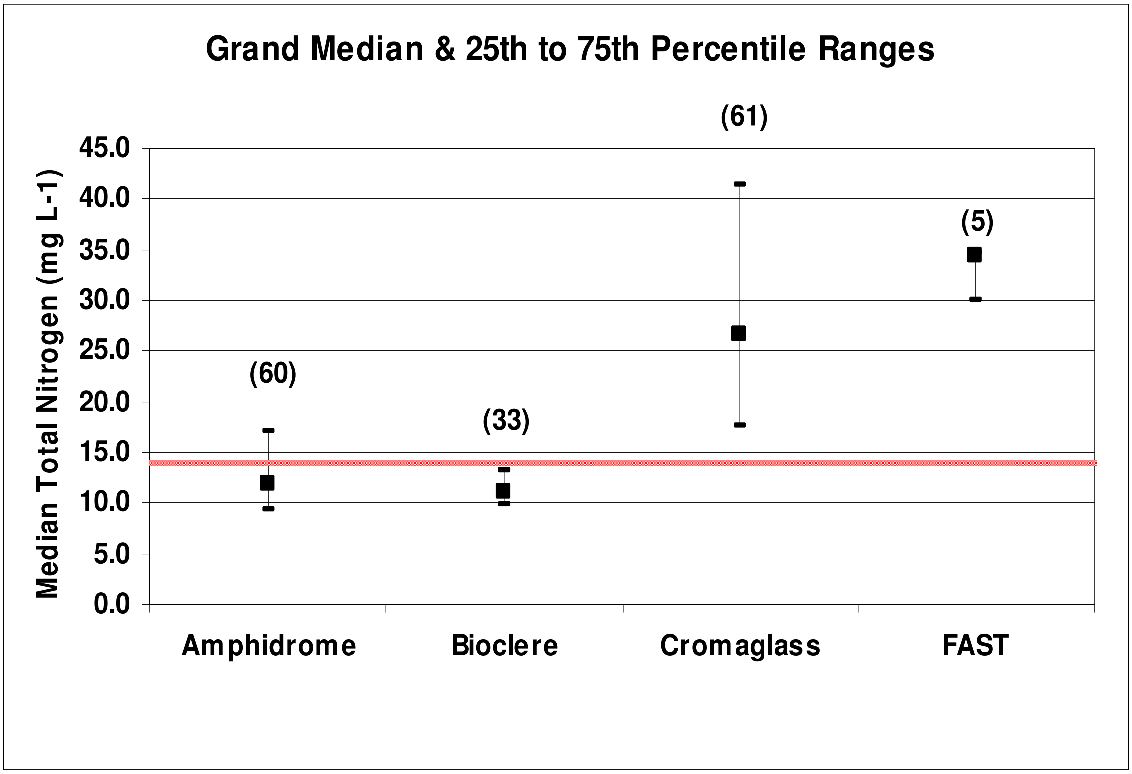
Technology	System	1	2	3	4	5	6	7	8	9	10	11	12	13	Grand Median
Cromaglass	1	140.1	78.6	17.1	32.2	26.3	36.9	43.6	41.0	38.5	35.5	32.5			32.5
Cromaglass	2	49.0	45.0	49.0	45.0	49.0	45.0	41.0	43.8	44.9	43.0	44.9	43.0		43.0
Cromaglass	3	76.5	58.2	50.4	45.2	50.4	47.6	50.4	55.9	50.4	47.6	44.9			44.9
Cromaglass	4	77.2	55.7	77.2	64.4	77.2	83.6	78.8	78.0	77.2	69.1	61.0			61.0
Cromaglass	5	110.6	99.0	87.4	71.8	56.2	45.7	35.1	30.3	25.5	26.5	25.5			25.5
Cromaglass	6	61.6	44.7	47.3	39.0	47.3	50.0	52.7	50.0	47.3	47.3	47.3	47.7		47.7
Cromaglass	7	67.5	52.3	37.1	50.1	42.6	47.8	46.8	49.9	53.0	49.9	51.3			51.3
Cromaglass	8	85.5	61.9	38.3	37.0	38.3	39.9	40.7	41.1	40.7	41.1				41.1
Cromaglass	9	19.7	39.7	19.7	19.6	19.7	19.6	19.5	18.5	19.5	18.5	17.6			17.6
Cromaglass	10	58.5	61.3	58.5	42.2	25.9	23.0	20.1	18.1	20.1	18.1	20.1	18.6	17.2	17.2
Cromaglass	11	35.1	47.2	35.1	34.3	35.1	34.3	35.1	37.4	39.8	40.1	40.5			40.5
Cromaglass	12	30.6	26.5	22.5	19.5	22.5	26.5	22.5	19.5	16.5	15.0	13.6			13.6
Cromaglass	13	17.4	10.8	12.4	14.9	17.4	16.0	14.6	14.0	13.5	14.0	13.5	14.0		14.0
Cromaglass	14	31.7	28.7	31.7	30.9	30.0	29.9	29.7	27.7	25.8	26.6				26.6
Cromaglass	15	18.0	64.0	32.1	38.3	32.1	30.1	28.2	30.1	32.1	30.1	28.2			28.2
Cromaglass	16	25.5	17.1	14.4	17.2	14.4	14.3	14.2	14.3	14.2	13.3				13.3
Cromaglass	17	43.5	56.7	43.5	32.4	43.5	41.6	43.5	52.9	62.3	66.2				66.2
Cromaglass	18	104.4	85.3	66.1	57.6	66.1	60.6	56.3	55.7	55.2	52.1	49.0	47.6	46.2	46.2
Cromaglass	19	67.5	71.7	67.5	42.8	67.5	62.8	58.1	39.6	21.1	39.6	31.1	26.1		26.1
Cromaglass	20	46.3	32.5	18.6	15.2	18.6	28.8	39.0	31.2	23.4	27.3				27.3
Cromaglass	21	45.9	64.2	45.9	38.4	30.9	21.8	14.7	22.8	14.7	15.6	14.7	14.0		14.0
Cromaglass	22	57.6	49.7	41.7	31.0	41.7	40.2	41.7	40.2	38.7	38.2	37.8			37.8
Cromaglass	23	37.4	73.3	37.4	32.7	28.1	32.7	37.4	32.7	37.4	43.7	37.4	32.7		32.7
Cromaglass	24	31.8	32.6	33.5	32.6	31.8	31.2	30.6	28.0	25.5	19.5	24.8	19.2		19.2
Cromaglass	25	52.8	42.8	32.8	35.0	37.3	42.6	47.9	50.3	52.8	53.1				53.1
Cromaglass	26	74.3	68.7	63.2	43.5	23.7	20.2	16.8	16.5	16.8					16.8
Cromaglass	27	90.3	73.2	56.1	70.7	56.1	54.9	56.1	57.7	59.3	60.4				60.4
Cromaglass	28	86.7	56.8	29.6	29.1	28.6	27.8	28.6	29.1	29.6	38.0				38.0
Cromaglass	29	23.5	20.7	23.5	21.1	18.7	18.4	18.7	18.4	18.0	18.4	18.7			18.7
Cromaglass	30	103.3	64.6	25.9	29.6	25.9	29.6	33.4	32.2	31.0	32.2	33.4	32.2		32.2
Cromaglass	31	7.4	34.6	61.9	37.3	32.4	38.5	44.7	44.8	44.7	41.8				41.8
Cromaglass	32	78.3	63.0	50.6	49.1	47.7	34.5	25.3	23.3	21.3	23.3				23.3
Cromaglass	33	76.1	48.0	31.6	25.8	31.6	31.7	31.7	31.7	31.6					31.6
Cromaglass	34	49.5	114.9	49.5	47.8	49.5	51.6	53.8	61.0	68.3	74.1				74.1
Cromaglass	35	43.0	42.9	43.0	47.4	43.0	43.8	44.6	43.8	44.6	43.8				43.8
Cromaglass	36	100.1	90.1	80.1	78.9	77.8	78.9	77.8	63.7	77.8	76.3	74.8			74.8
Cromaglass	37	24.1	21.7	19.3	18.7	18.0	18.7	18.0	18.0	18.0	17.3	16.7			16.7
Cromaglass	38	61.3	49.0	36.8	35.1	33.4	24.5	15.7	16.0	16.3					16.3
Cromaglass	39	11.3	26.3	24.9	26.3	27.7	28.0	28.4	34.8	31.6	30.0	31.6			31.6
Cromaglass	40	17.2	13.5	17.2	18.9	17.2	18.9	17.2	15.5	17.2	17.9				17.9
Cromaglass	41	35.8	23.3	35.8	23.3	15.1	13.1	11.2	12.9	11.2	12.9				12.9
Cromaglass	42	48.2	29.2	10.2	11.6	10.2	11.6	13.1	11.6	10.2	11.6				11.6
Cromaglass	43	79.2	46.9	79.2	47.2	31.4	23.3	15.2	14.9	15.2					15.2
Cromaglass	44	8.3	11.5	14.6	14.6	14.6	14.6	14.5	12.6	10.6	9.8	9.1	9.9		9.9
Cromaglass	45	69.1	46.2	30.6	27.0	23.3	16.8	23.3	27.0	23.3	16.8	23.3			23.3
Cromaglass	46	29.1	24.0	29.1	29.7	29.1	29.7	30.3	31.8	33.4	38.4				38.4
Cromaglass	47	75.1	56.7	38.3	33.7	32.6	35.4	38.3	45.5	52.7	53.7				53.7
Cromaglass	48	30.1	48.0	65.9	48.0	52.7	59.3	52.7	54.6	56.5	60.6				60.6
Cromaglass	49	46.6	26.7	6.8	21.0	28.3	22.7	17.2	22.7						22.7
Cromaglass	50	18.0	22.0	18.0	21.1										21.1
Cromaglass	51	51.6	36.3	21.0	23.0	25.1	23.0	21.0							21.0
Cromaglass	52	18.1	16.6	18.1	29.0										29.0
Cromaglass	53	8.9	8.3	8.9	15.2										15.2
Cromaglass	54	21.2													21.2
Cromaglass	55	22.0	22.3												22.3
Cromaglass	56	21.5													21.5
Cromaglass	57	11.7	17.3	11.9	17.3										17.3
Cromaglass	58	7.1	16.6	26.1											26.1
Cromaglass	59	9.0													9.0
Cromaglass	60	41.5													41.5
Cromaglass	61	39.1													39.1
Sample # Median		43.5	45.6	33.5	32.5	31.5	30.7	31.1	31.7	31.3	36.7	31.3	26.1	31.7	**26.6**
25th percentile		22.0	25.7	20.3	21.6	24.0	22.8	18.9	18.5	18.0	18.3	19.0	16.3	24.4	17.6
75th percentile		69.1	61.5	49.2	43.3	43.4	43.5	44.3	44.8	45.5	47.4	43.8	37.8	39.0	41.5
N		61	56	55	54	50	50	50	49	48	44	26	11	2	

Table 4. FAST running median of total nitrogen (mg L^{-1}) by number of sampling events for each wastewater treatment system. The grand median (highlighted value), 25th percentile, 75th percentile, and number of systems sampled (N) per event are provided. (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	10	11	12	Grand Median
FAST	1	31.3	45.4	37.9										37.9
FAST	2	27.1	25.8	27.1	34.6									34.6
FAST	3	39.3	34.4											34.4
FAST	4	32.4	23.0											23.0
FAST	5	30.1												30.1
Sample # Median		31.3	30.1	32.5	34.6									**34.4**
25th percentile		30.1	25.1	29.8	34.6									30.1
75th percentile		32.4	37.2	35.2	34.6									34.6
N		5	4	2	1									

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 target for the use of these systems on one acre lots. (See Appendix 1 for discussion of data editing.)



Note: To meet the Pinelands groundwater quality standard of 2 mg/l TN at the boundary of a minimum one acre parcel, the grand median for a treatment technology must meet a target TN value of 14 mg/l. Number in parenthesis (60) represents number of systems evaluated.

Based upon the data reviewed to date, the Executive Director recommends that the Amphidrome and Bioclere systems be authorized for use on minimum parcels of one acre, on a permanent basis. A proposed CMP amendment will be prepared to so authorize such use, if so directed by the Commission.

The data from the Cromaglass technology indicates significantly higher than expected total nitrogen concentrations in treated effluent from that technology. The majority of these systems were installed in 2006. These data have raised concerns with Commission staff and these concerns have been conveyed to the Cromaglass Corporation. In response to these concerns, the Executive Director instituted a temporary suspension on new Cromaglass systems in November 2006, pending satisfactory reductions in effluent total nitrogen concentrations. Cromaglass Corporation has responded by implementing a series of system retrofits characterized by the addition of fixed film media in select systems, reprogramming aerobic/anoxic cycles of select systems, combined fixed film and reprogrammed cycles in select systems and combined fixed film, reprogrammed cycles and new floats and float levels in select systems. Cromaglass reports that thirty-five (35) systems have been retrofitted to date.

Cromaglass Corporation continues its efforts to identify and implement corrective measures through trials on a test unit in Williamsport, Pennsylvania and on another test unit at Penn State University, in Harrisburg, Pennsylvania. Cromaglass Corporation has reportedly analyzed the impact of low alkalinity in source water (onsite well water being typically low in alkalinity vs. community water supplies with typically higher alkalinity), the impact of surfactant (detergent) toxicity or inhibition upon nitrifying bacteria in sequencing batch reactors (SBRs) and the impact that erratic or relatively low flows may have on the ability SBRs to nitrify and denitrify.

More recently, Cromaglass Corporation reports that two new research and development (R&D) projects have been initiated which aim to ultimately reduce nitrogen discharged from treatment systems operating in the Pinelands. One project centers on the installation of a new Cromaglass CA-12D treatment unit at the Kelly Township (PA) Municipal Authority's wastewater treatment plant. This unit will be equipped with an upstream equalization tank and will be "fed" with influent received at the Kelly Township plant. The CA-12D unit and equalization tank will be operated in a manner which will periodically dose the CA-12D with raw influent from the equalization tank at pre-set time intervals to achieve nitrification. Following nitrification, the equalization tank will again dose the CA-12D unit with raw influent (containing soluble cBOD or "carbon") to achieve denitrification. If this modified configuration and mode of operation proves successful in achieving acceptable total nitrogen effluent values at the Kelly Township plant, Cromaglass Corporation would modify and similarly equip systems operating in the Pinelands. A second project will focus on the operation of the discharge pump float level switch in the CA-12D unit. Cromaglass Corporation reports that typical daily discharge volumes have often been observed to be less than the corresponding daily influent volumes. This imbalance reportedly results in the hydraulic overload of the Cromaglass unit and may be responsible for excessive effluent nitrogen levels. Trouble shooting and correcting for this condition is currently underway.

The suspension of new Cromaglass installations will remain in place until such time as Cromaglass Corporation demonstrates sustained nitrogen attenuation consistent with Pinelands water quality requirements. In addition, staff will prepare a proposed CMP amendment which would require Cromaglass Corporation to continue to collect and analyze effluent samples from all Cromaglass systems, beyond the current pilot program three year monitoring requirement, in order to be eligible for a possible future lifting of the temporary suspension on new Cromaglass installations.

Limited data on the FAST system is the result of Bio-Microbics (manufacturer of the FAST technology) late entry into the Pinelands market. Although laboratory results to date do not demonstrate that the FAST technology is meeting Pinelands water quality standards, the Executive Director recommends that the FAST technology be permitted to remain in the pilot program, subject to close monitoring of laboratory data, to facilitate collection of additional data necessary to determine capability of the technology.

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 somewhat more intensive but acceptable degree of maintenance has been required to keep the Amphidrome and Bioclere systems operating at acceptable treatment efficiencies. Maintenance and service on the Cromaglass systems is also more intensive than anticipated. Much of this service is related to efforts on the part of the Cromaglass Corporation to enhance treatment system performance.

Maintenance needed on the FAST system can be described as modest but too few systems are operating at too short a duration to draw conclusions at this time.

In June 2009, the Commission proposed amendments to the CMP which would establish institutional controls on the long-term operation and maintenance of Pinelands alternate design systems (PADS) beyond the five year O&M period provided through the pilot program. The amendment provides for the establishment of Responsible Management Entities (RME), local or regional entities, established by municipal ordinance, to oversee the continuation of O&M services. The proposal establishes a three year renewable permit, to be issued to owners of PADS, which is renewable upon submission of documentation which demonstrates that the PADS is covered by a O&M service agreement which meets minimum criteria established in the rule proposal. The rule proposal establishes minimum qualifications for firms or individuals which provide O&M service. Proposed qualifications include either authorization to service the system from the treatment system manufacture/vendor or the holding of a NJ Wastewater Treatment Plant Operators license level S2 or higher. Extending the eligibility to provide O&M services beyond just those firms or individuals that are authorized by the system manufacturer is intended to provide owners of systems greater choice in selecting a service agent as well as introducing price competition amongst service providers.

The proposed CMP amendment enables municipalities to provide management services directly or to delegate management authority to a third party such as a county health department, utility authority, engineering consultant or other duly authorized entity. One option under consideration is for the Pinelands Commission to offer municipalities the opportunity to contract directly with the Commission to manage O&M service agreement requirements. Under such a partnership, municipalities would need to cooperate closely with Commission staff in managing the long-term use of Pinelands alternate design treatment systems through the administration of local adopted implementing ordinances.

As of the date of this report, the CMP amendments described above have been proposed and the public comment period has been completed. A recommendation for adoption of all or a portion of the amendments will be submitted to the Commission before the end of the year.

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

The pilot program incorporates the monitoring of treatment system costs. To facilitate monitoring of these costs, the CMP requires the manufacturer of the treatment technologies to report on the cost of installation of each individual system.

The total cost of an onsite wastewater treatment system consists of at least three separate components, those being the cost of the alternative treatment unit and 5 year service package, the cost of the soil absorption system, and the cost of engineering and other installation services. The manufacturer of the treatment unit supplies information on 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, other installation costs, or the cost for engineering (soil testing, design services, as-built plans, etc.) of the system. This information is typically supplied by the homeowner or 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 the local homeowner or builder. The reported cost of the treatment units, including the five year service package, has remained relatively stable over the duration of the pilot program. Changes in overall costs, from year to year, are reflective of the variability in non-treatment unit items such as the cost and quantity of replacement soil and stone utilized in each system, and associated trucking and labor costs. While the average cost of the Amphidrome, Bioclere and Cromaglass treatment units themselves remained essentially constant during the period of 2006 to 2009, the average overall system costs, including labor, excavation, engineering, soil absorption field materials, electrical connections, etc. has fluctuated from year to year, increasing by approximately $1600 and $200 for the Amphidrome system and Cromaglass system, respectively, and decreasing by approximately $2300 for the Bioclere. Change in cost information is unavailable for the FAST system during this time period.   Cost variability is attributable to the randomness of the specific design requirements of individual systems. For example, one year may include a number of large or deep, and therefore, costly systems whereas another year may not.

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 (N.J.A.C. 7:9A) may incorporate reduced field sizes. In addition, it is noteworthy that indirect cost savings may result from the use of these advanced treatment technologies. These savings may come as a result of avoiding or significantly delaying costs associated with the replacement of failed soil absorption fields. Because these types of systems typically remove up to 98 % of total suspended solids (TSS) and biochemical oxygen demand (BOD) , the likelihood of failure of absorption fields receiving such high quality effluent is greatly reduced.

The table on the following page summarizes treatment system cost data established to date.

Summary of cost data as of August 2009

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	49	$ 21,750	$11,148	$ 32,898
Bioclere	35	$ 16,750	$12,984	$ 29,734
Cromaglass	41	$22,345	$12,920	$ 35,265
FAST	6	$18,250	$13,572	$ 31,822

Table 1A. 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 $14,750. 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 approximately $7000. Tank costs vary depending on precast supplier and proximity 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 $16,750.

* 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 and electrical hookup of unit by Cromaglass mandatory mechanicals installer is approximately $22,345.

* Cost of the FAST treatment unit as sold by Bio-Microbics., including hardware equipment, 5 year annual maintenance contract, 5 year warranty, 3 years quarterly effluent analysis, pumping of residuals for 5 years, as needed, and delivery of equipment to job site is approximately $18,250.

** 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 average cost of a pressure dosing septic system although the cost of a pressure dosing system would not include five year operation and maintenance services, 5 year warranty, and effluent sampling, nor would the pressure dosing system provide the enhanced treatment of wastewater . This comparison is made because pressure dosing septic systems had been required on lots smaller than 3.2 acres prior to the implementation of the Pinelands Alternate Design Treatment Systems Pilot Program. Their use for nitrogen attenuation was terminated on August 5, 2004 based upon the findings of a Pinelands Science Office study. The total cost of the alternate design treatment technologies may be as much as two to three times the cost of a conventional septic tank leach field system; however, such system may only be used to serve development on a 3.2 acre or lager parcel, whereas the alternate design technologies may be used on minimum one acre parcels.

The costs associated with the purchase, installation and operation of the Amphidrome and Bioclere wastewater treatment systems seems to be reasonable in the context of the level of wastewater treatment achieved and the opportunity these systems afford in permitting residential development of parcels between 1.0 and 3.2 acres.

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

The manufacturer of the Amphidrome system, F.R. Mahony Associates, has instituted an effective program to assist contractors and engineers with the proper installation of the technology. The firm offers installer training with each system delivered and provides ongoing technical support to address contractor inquiries. This installer support program has virtually eliminated installation problems associated with installers who are inexperienced with the technology.

The Amphidrome technology incorporates sophisticated process controls, wastewater pumps, and other mechanical components that require periodic service and parts replacement. The pilot program incorporates a five year warranty period so that parts and service needed during this period are covered under warranty. The automatic alarm dialer system which alerts service personnel of a system error has proven to be a reliable means to identify and remedy operational errors. Annual reporting of service needs by the system manufacturer demonstrates that the frequency of service and repair calls on the treatment system were at somewhat greater rates than were originally anticipated at the outset of the pilot program. Approximately twenty-nine alarm events occurred during the six year period between 2004 and 2009. The most frequent condition necessitating response from the service provider was attributable to system float switch (10 events), followed by logic controller errors (8 events).

Bioclere

Aqua Point, the manufacturer of the Bioclere system has also instituted an effective program to assist contractors and engineers on the proper installation of the technology. The firm offers installer training with each system delivered and provides ongoing technical support to address contractor inquiries. This installer support program has virtually eliminated installation problems associated with installers who are inexperienced with the technology.

Like the other technologies, the Bioclere technology incorporates sophisticated process controls, wastewater pumps, and other mechanical components that require periodic service and parts replacement. As noted above, the pilot program incorporates a five year warranty period so that parts and service needed during this period are covered under warranty. The automatic alarm dialer system which alerts service personnel of a system error has proven to be a reliable means to identify and remedy operational errors.

Annual reporting of service needs by the system manufacturer demonstrates that the frequency of service and repair calls on the treatment system were at somewhat greater rates than were originally anticipated at the outset of the pilot program. Approximately eleven alarm events occurred during the five year period between 2005 and 2009. The most frequent condition necessitating response from the service provider was attributable to recirculation pump failure (6).

Cromaglass

Cromaglass systems are installed exclusively by Mid-State Electric (MSE), Cromaglass' authorized treatment system installation contractor. By utilizing only MSE as its only authorized installer, Cromaglass Corporation maintains tight control over the installation of the technology. This arrangement ensures that there are no installation errors attributable to inexperienced installers.

Like the other technologies, the Cromaglass technology incorporates sophisticated process controls, wastewater pumps, and other mechanical components that require periodic service and parts replacement. As noted above, the pilot program incorporates a five year warranty period so that parts and service needed during this period are covered under warranty. Annual reporting of service needs by the system manufacturer demonstrates that the frequency of service and repair calls on the treatment system were at somewhat greater rates than were originally anticipated at the outset of the pilot program. Approximately nineteen alarm events occurred during the five year period between 2005 and 2009. The most frequent condition necessitating response from the service provider was attributable to pump failure (10) followed by denite valve failure (6).

FAST

Bio-Microbics, the manufacturer of the FAST treatment technology has designated Site Specific Design, Inc. (SSD) to act as their authorized agent over seeing all sales and installation in the Pinelands. SSD has provided installation training and support during the installation on the FAST treatment systems and this on-site support has resulted in no installation problems to date. The automatic alarm dialer system which alerts service personnel of a system error has proven to be a reliable means to identify and remedy operational errors. Few such errors have been experienced with the FAST system to date. One service call was necessary to repair a blower unit leak during the first year of the technology's participation in the pilot program.

Commission staff expects that market pressure will act to impose the strongest incentive for manufacturers and service providers to develop and maintain robust treatment technologies. The incentive to produce a more reliable product is maximized in the face of increased competition between system manufacturers and service providers. For this reason, as well as others, Commission staff is recommending the introduction of additional advanced treatment technologies that have been demonstrated to successfully reduce effluent nitrogen concentrations through independent, third party testing programs. The proposed introduction of additional technologies into an expanded Pinelands pilot program is discussed in the Recommendations section of this report.

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 2009, **a total of one hundred and seventy-eight (178)** systems have been installed and activated. The following table summarizes installations by technology type and year of installation.

Technology	**Installed 2004**	**Installed 2005**	**Installed 2006**	**Installed 2007**	**Installed 2008**	**Installed 2009**	**Total Installed**
Amphidrome	7	10	11	29	13	7	77
Bioclere	-	2	11	9	7	9	38
Cromaglass	-	5	39	7	4	1	56
FAST	-	-	-	-	2	5	7
Total	7	17	61	45	26	22	178

Year to year variability occurred during the period of 2004 through 2009, reflecting fluctuations in residential construction activity during this period. It is apparent that new systems continued to be brought online in every year during this period, even during periods of reduced housing starts. Their continued use demonstrates a need for advanced treatment systems, necessary for residential development to occur on parcels smaller than 3.2 acres in the Pinelands. More than 514 applications proposing the use of more than 1002 Pinelands alternate design treatment system have been filed with the Commission to date. Economic and other factors are likely to affect the pace and number of future installations, including new home starts, mortgage interest rates, etc., but the data suggest a continuing need for access to advanced treatment technologies.

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	Estell Manor	Galloway	Folsom	Hamilton	Mullica	Hammonton	Egg Harbor	Pemberton	Washington	Medford	Tabernacle	Woodland	Evesham	Waterford	Chesilhurst	Winslow	Woodbine	Dennis	Franklin	Monroe	Jackson	Lacey	Manchester	Stafford	
Amphidrome		1	3	12	3	3	1	11	1	3	3	2		3		8		1	1		8	1	11	1	77
Bioclere	1			9	4	1		10			1	2	1		1	6	1				1				38
Cromaglass			1	4				22			1					4			1		13		10		56
FAST												1				4			1	1					7
TOTAL	**1**	**1**	**4**	**25**	**7**	**4**	**1**	**43**	**1**	**3**	**5**	**5**	**1**	**3**	**1**	**22**	**1**	**1**	**3**	**1**	**22**	**1**	**21**	**1**	**178**

As noted earlier, the Ashco RFS ^{III} treatment technology was eliminated from the pilot program during CMP amendments in 2007 to address the manufacturer's inability to deliver systems to area residents.

Staff believes that an adequate sample size is available to render a conclusion regarding the Amphidrome and Bioclere technologies. Staff evaluated four hundred and fifty seven (457) discrete sampling events from the Amphidrome technology and two hundred thirty-eight (238) sampling events from the Bioclere technology. These sample results demonstrate the continued ability of the Amphidrome and Bioclere treatment technologies to achieve substantial compliance with target effluent concentrations necessary to permit residential development served by these technologies on minimum one acre parcels. Based upon these findings, staff recommends that the Amphidrome and Bioclere technology be authorized for permanent use, subject to future amendments to the CMP which would establish the terms and conditions for their continued use. Staff anticipates providing the Commission with a proposed rule proposal to do so in January 2010. As noted earlier, staff is also working on amendments to the CMP related to the long-term operation and maintenance of onsite wastewater treatment systems.

Although the sample size for the Cromaglass system consists of five hundred and fifty-six (556) discrete sample events, staff cannot recommend at this time that the Cromaglass technology be released from the pilot program. As noted earlier, the Commission has imposed a temporary suspension on new Cromaglass installations pending demonstration by the technology manufacturer that the system can attain compliance with Pinelands water quality standards. Retrofits and process modifications have resulted in modest improvements in the performance of the technology but not to the extent necessary. Cromaglass Corporation continues to research system performance. Staff recommends that the Cromaglass system be retained in the pilot program pending the outcome of these research efforts. By allowing the Cromaglass technology to remain in the pilot program in conjunction with the current suspension on new installations, the Commission will provide the firm with both the opportunity and the incentive to continue to improve the performance of the technology.

With only twelve discrete sampling events, the sample size for the FAST technology is currently too small to determine whether or not this technology is capable of attaining compliance with Pinelands water quality standards. Staff recommends that the FAST technology remain in the pilot program to permit continued installations and monitoring, until such time that an adequately sized data set is available for review. Staff will continue to monitor the FAST system's performance and will take necessary steps to halt new installations if improved treatment performance is not demonstrated with future sampling events.

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.

The pilot program has facilitated the installation of one hundred seventy-eight alternate design treatment systems, representing four advanced onsite treatment technologies during the period of August 2002 through August 2009. The pilot program has demonstrated that advanced treatment technologies are currently available for residential use, which, with proper operation and maintenance, can achieve substantial compliance with the purposes and objectives of the Pinelands Protection Act, the Federal Act and the CMP. While the pilot program has provided a basis for staff to recommend the broader use of certain advanced treatment technologies, staff recommends that the pilot program be extended to permit additional review of those technologies that have not yet demonstrated their ability to meet the purposes and objectives of the State and Federal Act as well as the CMP.

The recommendations outlined in the following section are designed to provide for the continued use of the Amphidrome and Bioclere technologies on a permanent basis, subject to future amendments to the CMP which would establish the terms and conditions for their continued use. Additional recommendations are related to the continuation of the pilot program for the Cromaglass and FAST technologies to provide for additional monitoring and data collection by Commission staff. Lastly the Executive Director recommends that the pilot program be expanded to provide an opportunity for the use and monitoring of certain additional advanced, denitrifying treatment technologies which have been tested and demonstrated to effectively remove nitrogen from domestic wastewater.

Conclusions and Recommendations

The Pilot Program provided a means to test whether select onsite wastewater technologies could be maintained and operated to meet the water quality standards of the CMP in a manner that a homeowner can be reasonably expected to follow. The pilot program has been successful in identifying two advanced treatment technologies that can be expected to achieve compliance with Pinelands water quality standards when used at appropriate densities established through the Pinelands septic dilution model and land use zoning requirements. The continued use of onsite advanced treatment technologies is essential to the efficient use and orderly development of designated growth areas of the Pinelands. The pilot program has also demonstrated that the successful cooperation between municipal, county, NJDEP and Pinelands staff has resulted in the development and implementation of administrative procedures essential to the management of the pilot program technologies.

The pilot program utilizes a combination of regulatory requirements and market based incentives to achieve desired a desired outcome with respect to treatment system efficiency, durability and cost. It has always been an objective of the pilot program to make suitable advanced treatment system technology available to Pinelands Area residents at the lowest possible cost. Moving forward, staff believes that increasing competition between system manufactures and service providers is likely to have the greatest effect on controlling and perhaps reducing overall costs for advanced technology use. The desire to control costs was one element of the staff's decision to recommend that NJ licensed wastewater treatment plant operators be authorized to provide O&M services after the expiration of initial five year service contracts. It is likely that staff will recommend other relatively minor adjustments to the current pilot program rules to increase program efficiencies in the upcoming CMP amendment proposal.

The Commission has an opportunity to introduce certain additional advanced treatment technologies into the pilot program as a result of technological advances, market place developments and the findings of two independent technology verification programs, described below. These programs provide the Commission with a mechanism to identify potentially suitable technologies that have been pre-screened for nitrogen removal by the verification program prior to being eligible to undergo additional testing through the Pinelands pilot program to ensure that these technologies can be maintained and operated so as to meet Pinelands water quality standards. Authorizing certain additional pre-screened technologies for use in the pilot program, where those technologies are held to the same rigorous standards as the existing Pinelands alternate design treatment system pilot program technologies, will enable the use of suitable technology in the Pinelands Area and will foster additional marketplace competition..

The CMP currently permits the **installation** of the alternate design wastewater treatment systems only until August 5, 2010 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 installation of the Amphidrome, and Bioclere systems on a permanent basis, subject to institutional controls which ensure the long-term proper use, operation and maintenance of these systems, without restricting such installations to the provisions of the pilot program. The Executive Director further recommends that the Commission amend the CMP to permit continued installations of the Fast technology until August 5, 2013 as part of the pilot program. This extension would authorize new installations of the FAST technology which would afford Commission staff the opportunity to review effluent monitoring data from both existing FAST installations as well as from future installations. Enlargement of the data set for the FAST technology is considered essential for staff to reach a conclusion as to the ability of the FAST treatment technology to meet Pinelands water quality standards. The Executive Director also recommends that the Commission amend the CMP to permit the Cromaglass technology to continue participation in the pilot program until August 5, 2013, subject to the continued suspension of all new installations until such time as the Executive Director makes a final determination on the ability of the Cromaglass technology to achieve compliance with Pinelands water quality standards. The Executive Director recommends that the Commission amend the CMP to expand the pilot program to include those advanced, denitrifying treatment technologies whose potential to meet Pinelands water quality standards has been demonstrated through testing by the United States Environmental Protection Agency (USEPA) Environmental Technology Verification (ETV) program or through the National Sanitation Foundation (NSF) / American National Standards Institute (ANSI) - NSF/ANSI Standard 245 testing program.

The USEPA created the ETV program in 1995 to help accelerate the entrance of new environmental technologies into the marketplace. ETV verification utilizes EPA technology experts to create efficient and quality assured testing procedure to verify the performance of various innovative technologies. The ETV program operates several verification test facilities to assess the performance of a broad range of environmental technology categories using standardized tests and unbiased reporting. The ETV program verifies performance of a wide range of environmental technologies including air monitoring, water monitoring, and soil and site suitability characterization systems. An objective of the ETV program is to facilitate technology acceptance and permitting at the state and local level. The ETV program also verifies the performance of decentralized residential wastewater nutrient reduction treatment technologies. The ETV program has verified the performance of six residential nutrient reduction technologies, two of which have also attained NSF/ANSI Standard 245 certification.

NSF was originally established in 1944 in the University of Michigan's School of Public Health, Ann Arbor Michigan. Now known as NSF International, the organization is a private, independent, not-for profit entity which certifies food safety, drinking water, and wastewater treatment products. The organization is accredited by the American National Standards Institute (ANSI) to develop American National Standards for the testing and evaluation of various products, including onsite wastewater treatment technologies. The NSF/ANSI Standard 245 certification is awarded to nitrogen reducing, residential wastewater treatment systems having rated capacities between 400 and 1,500 gallons per day. NSF/ANSI certified systems must also comply with the NSF/ANSI Standard 40 for the reduction of CBOD5 and TSS. The NSF/ANSI Standard 245 certification has been awarded to seven residential nutrient reduction technologies.

These two verification programs have identified eleven (11) onsite residential nutrient reduction technologies that have the potential to meet Pinelands water quality standards when used on parcels smaller than 3.2 acres. Three of the technologies (Bioclere, Amphidrome and FAST) are currently participating in the pilot program. Staff recommends that a limited number (perhaps three) of the eight remaining verified technologies be considered for inclusion in the Pinelands pilot program based upon past experience. Limits on the number of additional technologies are necessary to ensure adequate participation and generation during the piloting period. Criteria for the selection and the process for selection of additional technologies will be discussed in the proposed CMP amendment.

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 one year, until August, 5, 2010, 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. Such a one year extension would not require a CMP amendment but is insufficient to provide adequate data. The Executive Director recommends that the monitoring provisions of the pilot program be extended for four years, until August 5, 2014, to provide for additional monitoring of the Cromaglass and FAST technologies and until August 5, 2017 to facilitate monitoring of select additional technologies whose selection by the Commission for participation in the pilot program will be based upon the result of USEPA ETV or NSF Standard 245 testing. A second comprehensive review of the pilot program would be completed in November 2014 relative to the FAST and Cromaglass technologies and in November 2017 relative to select USEPA ETV and NSF Standard 245 technologies. It should be noted that even with this additional pilot program extension, it is possible that the Commission may still be without an adequate number of systems and sampling events, and may need to further extend the pilot program when conducting its assessments in 2014 and 2017. An amendment to the CMP would be necessary to extend the monitoring provisions of the pilot program for the recommended four and seven year durations.

The CMP provides that the Executive Director may repeal the pilot program as it pertains to one or more technologies if it is determined that pilot program has not been implemented or has not been successful for one or more of the treatment system technologies. The CMP also 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 does not recommend elimination of the Cromaglass technology from the pilot program at this time. As noted previously in this report, the Executive Director has instituted a temporarily suspension on the use of new Cromaglass installations, pending the outcome of efforts being undertaken by Cromaglass Corporation to retrofit, modify and research existing systems to improve nitrogen attenuation. This temporary suspension does not require the adoption of an amendment to the CMP.

In June 2009, the Commission proposed amendments to the CMP which would provide for the implementation of long-term onsite wastewater treatment system management programs at the local or regional level. The rule proposal provides much flexibility in the way that municipalities could meet this management objective, authorizing municipalities to manage systems directly or to delegate management authority to a third party. While the CMP amendments were originally designed to pertain to both advanced systems as well as traditional septic systems, the CMP Policy and Implementation Committee subsequently directed staff to pursue only those CMP management provisions that relate to advanced treatment systems. With regard to traditional septic systems, the Committee decided to rely upon recently adopted NJDEP septic system management rules which govern the management of traditional septic systems. Those NJDEP rules would be enforceable by NJDEP.

Implementation of the institutional arrangements for the long term management of onsite technologies, may, in at least some instances, result in expiration of existing five-year operation and maintenance service agreements . As a result some number of alternate design treatment technologies would be without an operation and maintenance service agreement during the interim period between the adoption of relevant CMP amendments and the establishment of institutional management measures. To address this gap in maintenance coverage, the Executive Director recommends the Commission adopt an amendment to the CMP to require the renewal or replacement of all operational and maintenance contracts which expire during this interim period until such time as the management program can assure adequate management and maintenance of the alternate design systems.

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 late November 2009.

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. nitrate 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

It is 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]

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[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.

The Pinelands pilot program involved multiple uncontrolled variables including homeowners, private 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 do not 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. 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, nitrate, 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. 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