ANNUAL REPORT
TO THE NEW JERSEY PINELANDS COMMISSION

ALTERNATE DESIGN TREATMENT SYSTEMS PILOT PROGRAM

August 5, 2009

Background

The Federal and New Jersey Pinelands statutes call for the preservation, protection and enhancement of the unique Pinelands ecosystem and its land and water resources. The exceptional quality of Pinelands water resources are protected and maintained through the control of development and other land uses and through close cooperation and coordination between local, state and federal agencies. To safeguard Pinelands water resources, the water quality provisions of the Pinelands Comprehensive Management Plan (CMP) focus on controlling the amount of nitrogen that enters the environment. Nitrogen is a significant point and nonpoint source pollutant due to its role in the eutrophication of surface water bodies. It is a useful indicator of overall Pinelands water quality and ecosystem health because it is naturally present in very low concentrations in the Pinelands environment.

The Commission's land use program discourages development in important ecological and agricultural areas while directing growth towards more suitable areas. While some of the designated growth areas are served by central sewer systems, others are not. In these unsewered growth areas, municipalities may zone for residential development on lots as small as one acre. One acre lots are also permitted in non-growth areas if certain cultural housing and grand fathered ownership conditions are met. In very limited instances, waivers of strict compliance allow for development of unsewered dwellings on lots as small as 20,000 square feet.

The water quality standards of the CMP permit the use of on-site septic systems (individual subsurface sewage disposal systems) provided that the design of the system and the size of the parcel on which the system is located will ensure that the concentration of nitrogen in the ground water exiting the parcel or entering a surface water body will meet the Commission's water quality standard of two parts per million (ppm). The CMP utilizes the Pinelands Septic Dilution Model to calculate nitrogen loading to groundwater from septic systems and to confirm that proposed loadings do not exceed the assimilative capacity of the environment. When standard values for home occupancy, wastewater volume, wastewater strength and rainfall infiltration are used in solving the model, the model calculates that a minimum 3.2 acre parcel is required to dilute nitrogen to the required 2 part per million (ppm) concentration when conventional septic system technology is used. Conventional septic system technology, typically consisting of a septic tank and effluent dispersal field (and sometimes a pump and dosing tank) is ineffective at removing or attenuating nitrogen levels in wastewater. Thus, unsewered residential development using standard (conventional) septic system technology is permitted only on minimum 3.2 acre parcels.

In order to comply with the Pinelands water quality standard, unsewered residential development on parcels smaller than 3.2 acres requires the use of advanced onsite denitrifying wastewater treatment technology. If the mass of nitrogen contained in the wastewater discharged from an on-site septic system is sufficiently reduced through the use of an advanced treatment system, the CMP allows the minimum lot size required to meet the 2 ppm property line concentration to be reduced from 3.2 acres down to a minimum of 1.0 acre.

The basic principles of biological nitrogen reduction in wastewater are well documented in the engineering literature. In fact, biological nitrification and denitrification is now routinely employed at large centralized sewage treatment plants, especially those that discharge treated effluent to environmentally sensitive receiving waters. These large scale treatment facilities utilize professionally trained and licensed operators and have the ability to enhance nitrogen removal through the use of chemical feed equipment and to make real time process modifications in response to changing influent wastewater characteristics.

The use of biological denitrification technologies at the much smaller scale of individual onsite systems is a relatively recent development. The US EPA as well as number of individual states and regions have developed and are currently administering programs to study the effectiveness of onsite wastewater denitrification treatment technologies. The Ad Hoc Committee On Alternative Septic Systems, convened by the Pinelands Commission in March 2000, conducted a thorough review of this ongoing work to evaluate alternate treatment technologies nationwide, consulted with officials from other state and university programs involved with advanced on-site septic system technologies and management strategies, retained a consultant to assess the technical performance of selected technologies, met with treatment system manufacturers and county health officials, and coordinated research efforts with the New Jersey Department of Environmental Protection (NJDEP). After completing this extensive research, the Committee recommended the establishment of a pilot program to test five specific onsite wastewater treatment systems. The Alternative Design Wastewater Treatment Systems Pilot Program contained in the CMP (N.J.A.C. 7:50-10.21) is authorized as a means to test whether these systems can be operated and maintained so as to meet the water quality standards contained in the CMP with maintenance requirements that a homeowner can be reasonably be expected to follow.

Significant dates pertaining to the pilot program are as follows:

August 5, 2002	Effective date of the pilot program; residential applications received after this date for lots less than 3.2 acres that are not served by public sewer are required to use a Pinelands alternate design wastewater treatment system. Completed applications received prior to this date may use a pressure dosing septic system, subject to additional time constraints.
January 10, 2003	Copies of sample ordinances authorizing the use of the advanced treatment technologies provided to Pinelands Area municipalities with correspondence requesting timely municipal adoption.
July 5, 2003	Start of semi-annual reporting requirement for each manufacturer of an alternate technology treatment system to submit to the Executive Director a report which includes the number of systems installed during the previous six months and since the beginning of the pilot program, a discussion of any installation problems and what has been done to address those problems, an analysis and evaluation of the monitoring results to date and a discussion of any operational or maintenance issues, including the number of systems requiring maintenance or repairs and the nature and success of such maintenance and repairs, and the number of times the automatic dialing alarm system was set off and the reasons for each such occurrence.
August 5, 2003	For completed applications received prior to August 5, 2002, last day to obtain design plan approval from a local/county health department for a pressure dosing septic system.
August 5, 2004	Last day to complete the installation of a pressure dosing septic system for those plans approved prior to August 5, 2003.
August 5, 2006	Executive Director to begin a review of the pilot program and report to the Commission by November 5, 2006 on the implementation of the program. The November 5 Implementation Report addressed nitrogen removal efficiencies of the treatment technologies, maintenance requirements, cost, frequency of system problems, an evaluation of the number of systems installed and a determination as to the adequacy of that number to render a final determination on the effectiveness of the treatment technologies in meeting the purposes and objectives of the State and Federal Pinelands Acts.
November 5, 2006	Executive Director's Implementation Report issued to the Commission on the implementation of the pilot program. Recommendations included removal of the Ashco RSFIII system from the Alternate Design Treatment Systems Pilot Program due to its commercial unavailability, a temporary suspension of new Cromaglass installations based upon non-attainment of effluent total nitrogen targets and extension of the Alternate Design Treatment Systems Pilot Program to allow continued installation of the pilot program system through August 5, 2010 to provide an opportunity for additional system installations and the collection of additional effluent monitoring data.
May 21, 2007	Published proposed amendments to N.J.A.C. 7:50-10.21 - 10.23 in the New Jersey Register based upon recommendations contained in the November 2006 Implementation Report.
August 5, 2007	Under the original pilot program rule, effective August 5, 2002, the last day to install a

	Pinelands alternate design wastewater treatment system was August 5, 2007. Systems installed on or prior to this date are subject to a three year wastewater monitoring requirement, through August 5, 2010, and a five year warranty, and five year service contract, through August 5, 2012.
December 3, 2007	Effective date of CMP amendments extending the pilot program through August 5, 2010.
August 5, 2009	Executive Director to begin a second review of the pilot program and report to the Commission by November 5, 2009 on the implementation of the program based upon amendments to N.J.A.C. 7:50-10.21 – 10.23, effective December 3, 2007.
November 5, 2009	Executive Director's second Implementation Report to be issued to the Commission on the implementation of the pilot program. The November 5, 2009 Implementation Report will address nitrogen removal efficiencies of the treatment technologies, maintenance requirements, cost, frequency of system problems, an evaluation of the number of systems installed and a determination as to the adequacy of that number to render a final determination on the effectiveness of the treatment technologies in meeting the purposes and objectives of the State and Federal Pinelands Acts.
August 5, 2010	Last day to install a Pinelands alternate design wastewater treatment system, pursuant to December 3, 2007 CMP amendments, unless a rule is adopted which expressly authorizes such installations beyond this date. Systems installed on or prior to this date will be subject to the three year wastewater monitoring requirement, through August 5, 2013, and a five year warranty, and five year service contract, through August 5, 2015.

Introduction

Amendments to the CMP establishing the Pinelands Alternate Design Wastewater Treatment System Pilot Program became effective on August 5, 2002. The rule requires that the Executive Director submit an annual report to the Commission describing activity to date on the installation, maintenance and performance data for each alternate design wastewater treatment technology. This seventh annual report is submitted to fulfill the annual reporting requirement to the Commission on the status of the Pinelands Pilot Program for Alternate Design Wastewater Treatment Systems.

Before any of the five alternative technology systems could be used within the Pinelands, the manufacturer of the alternate design treatment system must have submitted and the Executive Director must have approved detailed engineering design plans and system specifications, details on the automatic alarm dialing system, a wastewater sampling protocol, an operation and maintenance manual, a sample five year warranty, a sample five year operation and maintenance contract, and a sample deed notice.

Use of the alternative onsite wastewater treatment systems is now authorized in each of the Pinelands Area municipalities 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 municipalities had adopted the requisite ordinance (34 of 40) the Commission found that applicants in the non-adopting municipalities were subjected to considerable hardship. The December 3, 2007 amendments have been effective in providing those aggrieved applicants with needed relief. Details of this amendment are discussed below.

The CMP also requires that each technology manufacturer or its agent submit a semi-annual report to the Executive Director which includes information on the number of systems installed, a discussion on the installation of systems, an analysis and evaluation of wastewater monitoring results to date, and a discussion of any operational or maintenance issues experienced.

Summary of Program Activity

During the current reporting period of August 2008 through July 2009, the Commission proposed several amendments to the CMP at N.J.A.C 7:50-2.11, 3.35, and 6.85. These amendments, if enacted, will implement the minimum institutional or governmental arrangements necessary to ensure the proper long-term operation of both traditional and alternate design treatment systems. The Commission was able to coordinate the development of its proposed septic system management program with the newly adopted Water Quality Management Planning Rules of the New Jersey Department of Environmental Protection (NJDEP).

A key component of the Alternate Design Treatment Systems Pilot Program related to long term septic system management involved the Pinelands Commission's contracting with Stone Environmental Inc. to assist local entities throughout the Pinelands Area (towns, counties, etc.) in the development and implementation of long term management programs for onsite wastewater treatment systems (OWTS). OWTS are common throughout the Pinelands Area and are a vital component of the region's wastewater infrastructure. The goal of OWTS management is to keep all onsite wastewater systems functioning properly, to enhance the value of properties served by OWTS and to protect ground and surface water from harmful impacts that result when onsite wastewater systems fail. Stone Environmental, Inc. assisted the Commission in the development of detailed onsite system management recommendations for implementation throughout the Pinelands Area in a report entitled Onsite Wastewater Systems Management Manual for the New Jersey Pinelands. These recommendations are intended to provide a road map which municipalities or other local entities may follow to implement their management programs. The report explores several management models and municipalities (and other entities) are given the flexibility to select any single model or combination of model elements that are locally appropriate. This Management Manual, as well as related materials, is posted on the Commission's website at www.nj.gov/pinelands.

The Commission recognizes that the management of onsite systems must be compatible with local needs and capabilities and that local participation in the development and implementation of management programs is essential. For that reason, the Commission worked closely with a wide array of stakeholders who collectively comprised the Commission's Septic System Management Technical Advisory Committee (TAC). Valuable insights were gained from the TAC which consisted of members of the public, elected and appointed officials, and other industry experts. The TAC was instrumental in helping the Commission refine its onsite system management rule proposal.

In May 2009, the Commission provided the NJDEP, Division of Watershed Management with the Final Report on the "Atlantic Coastal Watershed Region Program Grant: Decentralized wastewater Management in the Mullica River Basin and other Pinelands Watersheds". This report serves as the final grant deliverable and summarizes much of the work performed by Commission staff in the development and implementation of the Pinelands Alternate Design Treatment System Pilot Program.

As noted earlier, the Commission enacted several amendments to the Alternate Design Treatment System Pilot Program provisions of the Pinelands Comprehensive Management Plan (CMP) during the period of August 2007 through July 2008. Amendments were adopted to address situations where municipalities had not yet adopted ordinances to implement the pilot program, to address one manufacturer's (ASHCO) inability to provide its technology to Pinelands residents, and to extend the period of the pilot program by an additional three years to better evaluate the treatment technologies.

Under the August 5, 2002 Pilot Program rule, alternative systems were authorized for use only in those municipalities that had adopted an ordinance to implement the pilot program. Those ordinances were then subject to certification by the Commission pursuant to N.J.A.C. 7:50-3. To assist the municipalities in this process, pilot program ordinances were developed by the Commission's Land Use and Technology Office and provided to the 40 Pinelands municipalities in which alternative systems could be used based upon existing zoning. As of August 5, 2007, 34 of the 40 targeted municipalities had adopted implementing ordinances. Six municipalities had not adopted the necessary ordinance.

Commission staff became aware that a number of applicants were precluded from attaining local approval for fully conforming development in at least some of those non-adopting Pinelands Area municipalities. The failure of these six municipalities to adopt necessary ordinances meant that owners of unsewered parcels smaller than 3.2 acres could not attain local approval for development, even for projects which otherwise met all zoning and other land use requirements. To eliminate this hardship, the Commission adopted amendments to N.J.A.C. 7:50-10.21 to authorize the use of the pilot program systems in all Pinelands Area municipalities for the duration of the pilot program, whether or not the specific terms of the program are reflected in a municipal ordinance. As a result of this CMP amendment, which became effective on December 3, 2007, several conforming projects were able to proceed.

The NJDEP has actively participated in the development of the Commission's pilot program. To expedite the approval of the Pinelands pilot program alternate design septic systems, NJDEP issued a Generic Treatment Works Approval (TWA) Permit which allows the use of the five Pinelands pilot program systems without individual applicants being subject to the standard $450 NJDEP permit fee or 90 day review period. The expedited NJDEP Generic TWA Permit has been well received by both the regulatory and development community. It has proven to be an effective instrument by allowing individual applications to be approved directly by the Pinelands county health departments resulting in significant time and expense savings to the applicants.

Commission staff has met with each of the Pinelands Area health departments to facilitate implementation of the pilot program and to assist the health departments in the review of plans and applications and to provide training of inspectors on the alternative treatment technologies. In addition, staff provides training during the annual Onsite Wastewater Treatment Systems continuing professional education course sponsored by NJDEP and Rutgers University. This course is well attended every year by state, local and regional public health professionals, septic system designer engineers, system installers and other onsite system service providers. In addition, staff regularly provides homeowner education related to the use of onsite wastewater systems.

During the duration of the pilot program, Commission staff has participated in several local, regional, and national educational conferences to share the Commissions experiences gained through the pilot program. Highlights include a January 2004 presentation at a USEPA conference in Mt. Kisco, NY, a March 2004 presentation at the New Jersey Environmental Health Association conference in Atlantic City, NJ, a June 2007 presentation at the National Environmental Health Association conference in Atlantic City, NJ, an October 2007 presentation at the Massachusetts Health Officers Association conference in Springfield, MA, a March 2008 presentation at the New England Interstate Water Pollution Control Commission conference in Groton, CT, a June 2008 presentation at the National Environmental Health Association conference in Tucson, AZ and an October 2008 presentation at the Central Pine Barrens (Long Island) Joint Planning Commission conference in Brookhaven, NY. Commission staff has also conducted more than sixteen workshops throughout the Pinelands Area to enhance awareness of the connection between septic system maintenance and clean water, property values and quality of life. In addition, commission staff regularly provides assistance to homeowners, builders, developers and consulting engineers in complying with the requirements of the pilot program.

Under the original (August 5, 2002) CMP amendment to adopt the Alternate Design Treatment Systems Pilot Program, the five Pinelands alternate design pilot program technologies were:

1. Ashco RFS III [1]
2. Amphidrome
3. Bioclere
4. Cromaglass
5. FAST

One hundred and seventy-eight (178) Pinelands alternate design treatment systems have been installed and activated to date, with the first system coming online in April 2004. Twenty-one (21) of these alternate design systems were installed during the current reporting year, August 2008 through July 2009. The following table summarizes annual installations of each technology.

[1] Amendments to the CMP, effective December 3, 2007 removed the Ashco RFS III from the pilot program due to the manufacturer's failure to make the system commercially available in the Pinelands during the initial five year period of the pilot program and to otherwise demonstrate the ability or intention for future participation in the program.

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

In accordance with the provisions of the pilot program requirements, prior to being certified for use, the manufacturer of each alternate design treatment system had to submit specific documents to the Executive Director for review and approval.

Ashco-A-Corporation provided the required documentation and based upon a detailed review by Commission staff, the Executive Director approved the Ashco RFS III Gravity system effective May 15, 2003 and the Ashco RFS III Gravity Dosing system effective July 24, 2003. Based upon the Pinelands Septic Dilution Model, the pilot program provided that each Ashco RFS III system would have been eligible to be located on a parcel containing at least 1.5 acres for each dwelling unit that will be served by the system, however, as noted above, the Ashco RFS III has been eliminated from the pilot program.

F.R Mahony & Associates, the manufacturer of the Amphidrome system provided the required documentation and, based upon a detailed review by Commission staff, the Executive Director approved the single family Amphidrome system effective July 24, 2003. Based upon the Pinelands Septic Dilution Model, the pilot program provides that each Amphidrome system be located on a parcel containing at least one acre for each dwelling unit that will be served by the system.

Aquapoint, Inc., the manufacturer of the Bioclere system provided the required documentation and, based upon a detailed review by Commission staff, the Executive Director approved the single family Bioclere system effective November 18, 2003. Based upon the Pinelands Septic Dilution Model, the pilot program provides that each Bioclere system be located on a parcel containing at least one acre for each dwelling unit that will be served by the system.

Cromaglass, Inc., the manufacturer of the Cromaglass system provided the required documentation and, based upon a detailed review by Commission staff, the Executive Director approved the Cromaglass system effective December 29, 2004. Based upon the Pinelands Septic Dilution Model, the pilot program provides that each Cromaglass system be located on a parcel containing at least one acre for each dwelling unit that will be served by the system.

Bio-Microbics, Inc., the manufacturer of the FAST system provided the required documentation and, based upon a detailed review by Commission staff, the Executive Director approved the FAST system effective June 9, 2005. Based upon the Pinelands Septic Dilution Model, the pilot program provides that each FAST system be located on a parcel containing at least one acre for each dwelling unit that will be served by the system.

Installation Summary

The first Pinelands alternative wastewater treatment system was brought online in April 2004. Since then, a total of one hundred and seventy-eight (178) Pinelands alternative wastewater treatment systems have been installed and are currently operational. Of these one hundred and seventy-eight (178) systems, seventy-seven (77) are Amphidrome systems, fifty-six (56) are Cromaglass systems, thirty-eight (38) are Bioclere systems and seven (7) are FAST systems. System type and location are summarized in the table below.

	Atlantic							Burlington						Camden			Cape May		Gloucester		Ocean				Total
System	Estell Manor City	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**

* The majority of systems installed in Pemberton Township are located in the Presidential Lakes subdivision which was created under a prior Commission approval which required the use of pressure dosing septic systems. Pinelands alternate design treatment systems were not required but were used voluntarily by the developer in response to local water quality concerns.

System Permitting and Local Approvals

The pilot program relies upon the cooperation of local construction code officials, county health officials, alternate system manufacturers, certifying engineers and Pinelands staff to coordinate the approval of wastewater system engineering plans, the issuance of building permits, the approval of wastewater system installations and the issuance of certificates to occupy residences served by the alternative onsite treatment technologies. Prior to any Pinelands alternative treatment system being issued a final operational approval, the Pinelands area health departments and the Pinelands Commission are to receive an executed five year maintenance contract, five year warranty, three year wastewater sample and analysis protocol, deed notice, as-built plan and construction certification from the technology manufacturer and the NJ licensed engineer of record. While these documents have been received in the majority of cases, there have been instances of certificates of occupancy being issued prior to all required documentation being received by the health departments and the Pinelands Commission. In these cases, Pinelands staff has had to work with the technology vendors, homeowners and agency officials to obtain the needed documentation after the fact, often a difficult and time consuming task. Pinelands staff continues to work with the local agencies to educate them on the importance of assuring that all necessary documents are on file before issuing local approvals for home occupancy. Staff is also examining the process to determine if there are more effective ways to ensure that the goals of the program are met.

Maintenance Summary

The manufacturer of the Amphidrome system, F.R. Mahony Associates, has 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. There were no problems encountered during the installation of Amphidrome systems during this reporting period

F.R. Mahony Associates reported receiving ten auto alarm dialer notifications during the current annual reporting period, two of which were false alarms. In six instances, the alarm condition was attributable to a float switch hang-up, an air-line leak, or a loose contact or wiring connection. One service call required a programmable logic controller and auto dialer to be replaced and in one instance a return pump required replacement. In each instance, technicians were promptly dispatched and repairs were made under warranty.

Cromaglass systems are installed exclusively by Mid State Electric, Cromaglass' authorized treatment system installation contractor. Cromaglass Corporation reported that there were no problems encountered during the installation of the single Cromaglass system installed during this reporting period. Cromaglass Corporation reported five alarm events occurred during the current annual reporting period. Three alarm events were attributed to inoperable discharge pumps and two involved malfunctioning aeration pumps. In each event, alarm response time was prompt and repairs were made under warranty.

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. Aqua Point reported seven alarm events in the current annual reporting period. Six service calls resulted in the replacement of dosing pumps and in once case, a blower fan was replaced. All repairs were made under warranty.

Bio-Microbics, the manufacturer of the FAST system, has designated Site Specific Design, Inc. as the authorized local service agent for the FAST technology. Site Specific Design reports that one system malfunction occurred during the current annual reporting period. This malfunction was attributed to a partial air leak in the blower delivery line. That malfunction was abated under system warranty provisions. There were no installation problems reported during the current annual reporting period.

Overall, each of the technologies has exhibited alarm and repair frequencies that are somewhat greater than was expected at the outset of the pilot program. Commission staff will look to address the frequency of alarm and repair issues in the November 2009 implementation report.

Cost Summary

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 manufacturers 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 stabile 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.

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 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 $ 14,750. 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 cost varies 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 $ 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.

Treatment System Nitrogen Attenuation Summary

The pilot program requires that the technology suppliers arrange for samples of treated effluent to be collected from each system on at least a quarterly basis [approximately every ninety (90) days] for at least three (3) years yielding a total of at least twelve (12) samples per system. Pursuant to the pilot program sampling and testing protocols, samples of treated effluent are collected from a sample collection port located between the treatment unit and the soil dispersal field. Sample procurement is to comply with the latest version of the NJDEP Field Sampling

Procedures Manual. The laboratory analysis of effluent samples is to be performed by laboratories certified by the NJDEP employing analytical methodologies accepted by NJDEP. To permit the establishment of microbial cultures necessary for the treatment process to develop and stabilize, no samples are required during the first ninety days from system start-up. In some instances, technology vendors have permitted the interval between sample collection to exceed the 90 day maximum and Commission staff continues to stress the importance of strict compliance with this and all other provisions of the pilot program rules. If it is determined that a manufacturer or its agent is not adhering to any of the requirements of the pilot program, N.J.A.C. 7:50-10.22(a)5 provides a mechanism for the Commission to make a determination that the proposed future use of a technology raises a substantial issue requiring a hearing pursuant to N.J.A.C. 7:50-4.31 through 4.42. In the event that persistent and substantial non-compliance with the requirements of the pilot program becomes problematic, Commission staff may recommend to the Commission that the substantial issue determination be made.

As discussed previously, there are a total of one hundred and seventy-eight (178) Pinelands alternate design wastewater treatment systems installed and activated to date. While continuing to accumulate, the laboratory data set is still limited at this time for at least some of the technologies, due in part to the limited number of systems representing specific treatment technologies and the relatively short duration of their operation.

As illustrated in Table 1 below, sample results have been evaluated for sixty (60) Amphidrome systems to date. Eight (8) systems have had at least twelve (12) or more analyses evaluated, nineteen (19) systems have had at least eleven (11) analyses evaluated, twenty-three (23) systems have had at least ten (10) analyses evaluated, twenty-nine (29) systems have had at least nine (9) analyses evaluated, thirty-five systems has had at least eight (8) analyses evaluated, thirty-nine (39) systems have had at least seven (7) analyses evaluated, forty-two (42) systems have had at least six (6) analyses evaluated, forty-four (44) systems have had at least five (5) analyses evaluated, forty-seven (47) systems have had four (4) analyses evaluated, fifty-two (52) systems have had three (3) analyses evaluated, fifty-six (56) systems have had at least two (2) analyses evaluated and one (1) systems has had one at least (1) analysis evaluated. A total of four hundred and fifty-seven (457) samples have been used to evaluate these sixty (60) Amphidrome systems. Total reported nitrogen values for each of these Amphidrome systems represents the sum of reported laboratory values for total kjeldahl nitrogen plus nitrite nitrogen plus nitrate nitrogen.

As illustrated in Table 2 below, sample results have been evaluated for thirty-three (33) Bioclere systems to date. Two (2) systems have had twelve analyses evaluated, eight (8) systems have had at least eleven (11) analyses evaluated, eleven (11) systems have had at least ten (10) analyses evaluated, fifteen (15) systems have had at least nine (9) analyses evaluated, seventeen (17) systems have had at least eight (8) analyses evaluated, nineteen (19) systems have had at least seven (7) analyses evaluated, twenty-one (21) systems have had at least six (6) analyses evaluated, twenty-six (26) systems have had at least five (5) analyses evaluated, twenty-six (26) systems have had at least four (4) analyses evaluated, twenty-nine (29) systems have had at least three (3) analyses evaluated, thirty-one (31) systems have had at least two (2) analyses evaluated, and thirty-three (33) systems have had at least one (1) analysis evaluated. A total of two hundred and thirty-eight (238) samples have been used to evaluate these thirty-three (33) Bioclere systems. Total reported nitrogen values for each of these Bioclere systems represents the sum of reported laboratory values for total kjeldahl nitrogen plus nitrite nitrogen plus nitrate nitrogen.

As illustrated in Table 3 below, sample results have been evaluated for sixty-one (61) Cromaglass systems to date. Eleven (11) systems have had at least twelve (12) analyses evaluated, twenty-six (26) systems have had at least eleven (11) analyses evaluated, forty-four (44) systems have had at least ten (10) analyses evaluated, forty-eight (48) systems have had at least nine (9) analyses evaluated, forty-nine (49) systems have had at least eight (8) analyses evaluated, fifty (50) systems have had at least seven (7) analyses evaluated, fifty (50) systems have had at least six (6) analyses evaluated, fifty (50) systems have had at least five (5) analyses evaluated, fifty-four (54) systems have had at least four (4) analyses evaluated, fifty-five (55) systems have had at least three (3) analyses evaluated, fifty-six (56) systems have had at least two (2) analyses evaluated and sixty-one (61) systems have had at least one (1) analysis evaluated. A total of five hundred and fifty-six (556) samples have been used to evaluate these sixty-one (61) Cromaglass systems. Total reported nitrogen values for each of these Cromaglass systems represents the sum of reported laboratory values for total kjeldahl nitrogen plus nitrite nitrogen plus nitrate nitrogen.

As illustrated in Table 4 below, sample results have been evaluated for five (5) FAST systems to date. One (1) system has had four (4) analyses evaluated, two (2) systems have had at least three (3) analyses evaluated, four (4) systems have had at least two (2) analyses evaluated and five (5) systems have had at least one (1) analysis evaluated. A total of twelve (12) samples have been used to evaluate these five (5) FAST systems. Total reported nitrogen values for each of these FAST systems represents the sum of reported laboratory values of reported laboratory values for total kjeldahl nitrogen plus total nitrite/nitrate nitrogen.

When evaluating data from single family wastewater treatment systems, it is important to recognize that 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. The number of individuals occupying a dwelling can result in abnormally high or low 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 less water is 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 ppm, may under-predict concentrations present in current domestic wastewater streams. It is important to note however, that estimates of the total mass of nitrogen excreted by humans remains constant at approximately 9 lbs per year. It is evident from wastewater analyses conducted for the pilot program that there is a wide range in the concentration of total nitrogen in septic tank effluent. Even if concentrations of nitrogen in domestic wastewater frequently exceed 40 ppm, the total mass of nitrogen in the effluent is likely consistent with estimated values utilized in the Pinelands septic dilution model due to the use of less water. As a result, even where effluent values exceed assumed post treatment concentrations, system discharges may still be meeting total nitrogen mass loading targets, even if the observed concentrations do not.

The four certified treatment technologies that are currently operational in the Pinelands (Amphidrome, Bioclere, Cromaglass and FAST) have an assumed nitrogen removal efficiency of 65%. If the total nitrogen contained in the raw influent is 40 ppm, a 65% reduction would result in a concentration of 14 ppm in the treated effluent (and 2 ppm at the parcel line of a one acre lot based upon the Pinelands septic dilution model). Similarly, if influent nitrogen levels range up to 80 ppm, the same "successful" 65% removal efficiency would result in effluent concentrations of 28 ppm. 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. Commission staff continues to explore the potential to develop a means to characterize present day influent total nitrogen concentrations from domestic sources.

Excessive use of certain cleaning and laundry products as well as the use of certain medications can stress the bacteria that provide biological nitrification and denitrification. Because of this, education of system users is an important component of any wastewater management program.

In recognition of these factors, all of the alternative treatment system vendors have developed homeowner user manuals which provide critical information to the owners of the alternative treatment systems. In addition, several vendors have developed questionnaires which they've provided to system users which are aimed at identifying laundry and cleaning product usage and any other condition which might lead to non-compliant sample results. Staff encourages all of the technology vendors collect and analyze this type of information to better understand user characteristics and to enhance compliance with effluent discharge limits.

Effluent Monitoring Data

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

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

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 and an influent 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.

In the case of the FAST technology, these results are based upon too few samples and too few systems to draw a definitive conclusion. Commission staff will, however, closely monitor the FAST technology effluent results as they are developed. The current value (26.6 mg/l) for the Cromaglass system is somewhat improved over the value reported in August 2008 (31.0) and represents a modest improvement of the technology's overall performance, perhaps resulting from retrofits and other corrective efforts being employed by Cromaglass Corporation. The Commission will continue to monitor the Cromaglass system closely and will retain the temporary suspension on new Cromaglass installations as Cromaglass Corporation continues to work on improvements. See appendix 1 for a discussion of data limitations and editing methods.

Table 1. Amphidrome 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. (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, 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, 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

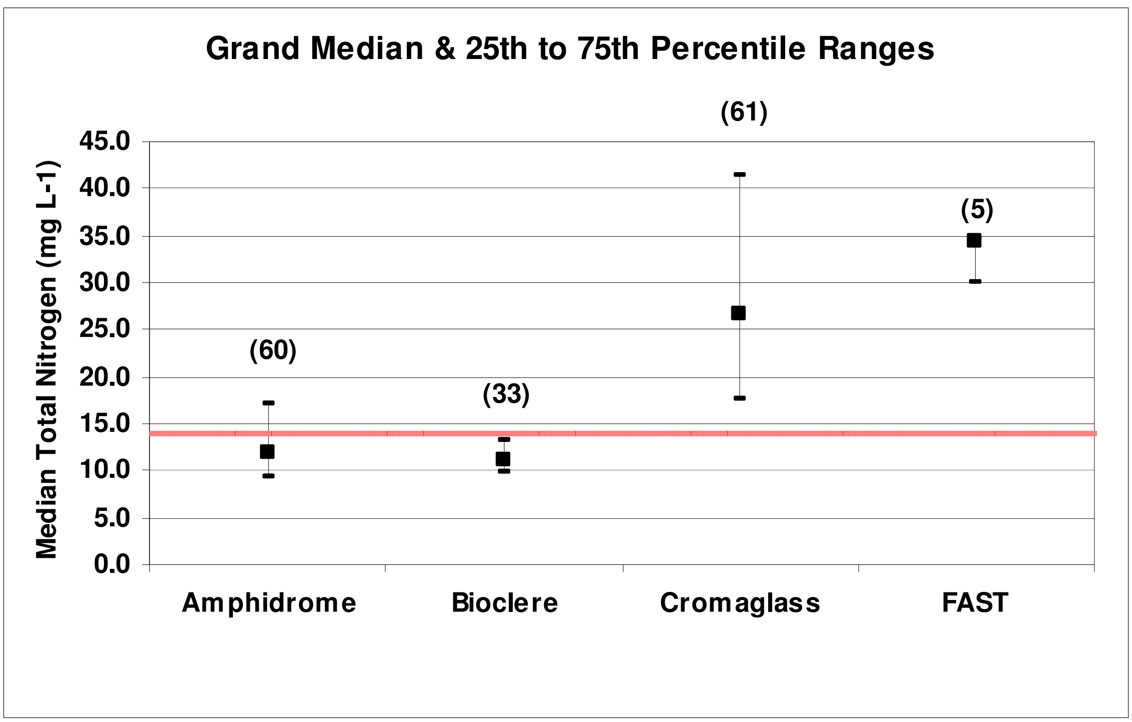
		Number of Sampling Events													
Technology	System	1	2	3	4	5	6	7	8	9	10	11	12	13	Grand Median
Cromaglass	1	140.1	78.6	17.1	32.2	26.3	36.9	43.6	41.0	38.5	35.5	32.5			32.5
Cromaglass	2	49.0	45.0	49.0	45.0	49.0	45.0	41.0	43.8	44.9	43.0	44.9	43.0		43.0
Cromaglass	3	76.5	58.2	50.4	45.2	50.4	47.6	50.4	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, 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 ppm 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.

Cromaglass Retrofits

As discussed above, the Commission 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.

While the Cromaglass technology appears to have benefited from these retrofits, as evidenced by total nitrogen levels improving from 42.5 mg/l in 2006 to 34.3 mg/l in 2007 to 31.0 mg/l in 2008 and to 26.6 in 2009, the retrofits have not yet resulted in improvements to the degree necessary to lift the temporary suspension on new Cromaglass installations. 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 of 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

Other Issues in 2009

One remaining challenge to meeting the water quality standards of the CMP will be the development and implementation by Pinelands Area municipalities of institutional programs to address the continued approval, use and maintenance of advanced onsite treatment technologies. To achieve this goal, septic system management programs should be implemented by the municipalities prior to the conclusion of this pilot program. Moreover, July 2008 amendments to the NJDP Water Quality Management Planning Rules now require all New Jersey municipalities to implement septic system management programs. This DEP requirement applies to all septic systems, not just advanced treatment technologies.

It is only through such programs that the long-term maintenance and monitoring of the alternative technologies as well as conventional or traditional septic systems can be ensured. In the absence of a septic system management program, the ability to permit unsewered residential development on lots between one and three acres may be jeopardized. Absent a meaningful management program, rezoning of these parcels would likely be necessary. Further, routine maintenance of septic systems is currently required in the CMP, although to date, there has been no effort to enforce that requirement.

To meet these water quality objectives, the Commission engaged Stone Environmental, Inc. to develop a Septic System Management Manual to assist local governments establish institutional arrangements for the long term management of onsite wastewater treatment systems. Commission staff, working with Stone Environmental conducted a series of meetings with septic system management technical advisory groups, undertook an analysis of the legal basis for local entities to require the management of septic systems and produced two septic system management manuals for the Commission. Simultaneously, the Commission undertook an aggressive public outreach and education program in 2008 and 2009 to convey to the public and elected officials, the relationship between septic systems and clean water, property values and quality of life in unsewered communities. The Commission will continue to work with all of the Pinelands Area municipalities in the future to achieve implementation of septic system management programs.

The Executive Director will issue an implementation report on the pilot program in November 2009. The implementation report will provide the Executive Director's recommendations on future actions related to the pilot program, including the status of institutional controls to assure continued proper operation and maintenance of the pilot program technologies.

To advance the transfer of information acquired through the Pinelands alternate design treatment systems pilot program, Commission staff continues to share all data with NJDEP and posts data contained within the annual reports on the Commission's web site.

In June 2009 the Commission proposed amendments to the CMP related to the implementation of septic system management programs throughout the Pinelands Area. A public hearing on the rule proposal was held on July 15, 2009. The rule amendment would require that all Pinelands Area municipalities adopt an ordinance requiring that all traditional/conventional septic systems be inspected at least once every three years and pumped as necessary and that all advanced treatment systems (those subject of the Pinelands Alternate Design Wastewater Treatment Systems Pilot Program) be covered under an approved operation and maintenance agreement. Details of the rule proposal may be viewed on the Commission's web site at http://www.state.nj.us/pinelands/cmp/amend/ . The public comment period on the rule proposal ends on August 14, 2009. The staff expects that the Commission will consider whether management rules should be adopted in the later part of 2009.
The existing pilot program is limited to residential development because the Pinelands Ad Hoc Septic System Committee determined that insufficient data were available to establish specific nitrogen removal efficiencies for the highly variable characteristics of non-residential (commercial and institutional) wastewater. The CMP allows non-residential applicants to propose to use an advanced treatment system (in lieu of dilution based upon parcel size) only on a case by case basis. Many Pinelands Towns and Villages could benefit from the use of pre-approved alternative treatment technologies by commercial establishments. Although the Commission staff remains ready to assist municipalities explore the use of "community" systems to serve multiple residential and commercial buildings, the Commission may wish at some future point to authorize pre-approved specific advanced treatment technologies for commercial uses as part of a closely monitored pilot program.

In 2008 the Commission approved the first of two advanced onsite wastewater treatment systems (Amphidrome technology) for use by commercial operations (retail pharmacies) to meet ground water quality standards in unsewered Regional Growth and PinelandsTown management areas. As systems have proven their capability for N-reduction, the critical component of these commercial (non-NJPDES) approvals was the establishment of mechanisms to ensure the long term operation and maintenance of these systems.

The limited number of operating alternative treatment systems and the limited analyses upon which to evaluate these systems led the Commission to adopt amendments to the CMP in 2007 which authorize the extension of the pilot program until August 5, 2010.

Future Steps

Commission staff will continue to work with the local government officials, especially the Pinelands Area health officials and construction code officials, to achieve the objectives of the pilot program and assure required documentation is received prior to the issuance of construction approvals and certificates of occupancy. In addition, Commission staff will continue to work with the alternate design treatment systems technology vendors and their agents to assure adherence to the requisite sampling, analysis and reporting requirements of the pilot program.

Further, in an effort to expand the number of treatment system choices available to Pinelands residential applicants, staff will continue to keep abreast of emerging small scale denitrification technologies and may return to the Commission in the future to recommend new rule making to allow the introduction of additional technologies to the pilot program. Several alternative systems are undergoing evaluation in other technology demonstration projects and preliminary results indicate that some of these systems, if used on appropriately sized lots, may also meet the water quality requirements of the CMP. A likely benefit to introducing additional proven technologies may be lower system costs resulting from increased competition among the approved technology vendors.

All advanced treatment systems require a higher level of maintenance to achieve optimum treatment efficiencies as compared to standard septic systems. Because of this, the CMP specifies that municipalities will be encouraged to allow community treatment systems to be installed in larger residential developments where lots between one and 3.2 acres are currently authorized. However, experience indicates that developers are frequently disinclined to propose a community treatment system because of delays in acquiring the necessary wastewater management plan amendments. Greater use of community treatment systems might be achieved if an expedited process for wastewater management plan amendments in the Pinelands could be developed. Moreover, Commission staff will work with the NJDEP to facilitate the approval of appropriate community wastewater treatment systems in unsewered Pinelands Regional Growth Areas, Towns and Villages.

Appendix 1

Data Editing

Total nitrogen (TN) is reported herein as the sum of kjeldahl nitrogen plus nitrate nitrogen plus nitrite nitrogen. 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 (DEP certified) laboratories under subcontract, i.e. nitrate and nitrite 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. In some instances, these state certified laboratories reported kjeldahl nitrogen values (sum on ammonia nitrogen plus organic nitrogen) at higher levels than ammonia values. Laboratory managers consistently reported that such variation is consistent with standard laboratory reporting protocols and does not constitute lab error. Nevertheless, where such reporting occurred, the data was not included in this analysis. 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.

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, more than 85 % of the submitted laboratory results were retained for analysis.

Data Accuracy

It is typical for a regulatory pilot program of this nature to generate data that would not meet the rigorous standards required of a peer reviewed research project. Because of the uncontrolled variables associated with such a pilot program, the reader should understand that a pilot program of this nature is not research. Uncontrolled variables are significant and numerous where treatment technologies are operating under real world conditions. Apart from these real world pilot 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.[2]

On April 16, 2007, the NJDEP, Division of Watershed Management, Bureau of Environmental Analysis and Restoration issued a technical report entitled Nitrate as a Surrogate of Assessing Impact of Development Using Individual Subsurface Sewage Disposal Systems on Ground Water Quality. In that report, NJDEP relied upon datasets from the USGS National Water Information System (NWIS) and the New Jersey Ambient Ground Water Quality Monitoring Network (AGWQMN) to establish an ambient nitrate concentration of 2 mg/L in NJ groundwater. In that analysis, DEP acknowledges retaining data with questionable precision, rather than abandoning data, to conduct its analysis.

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.

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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