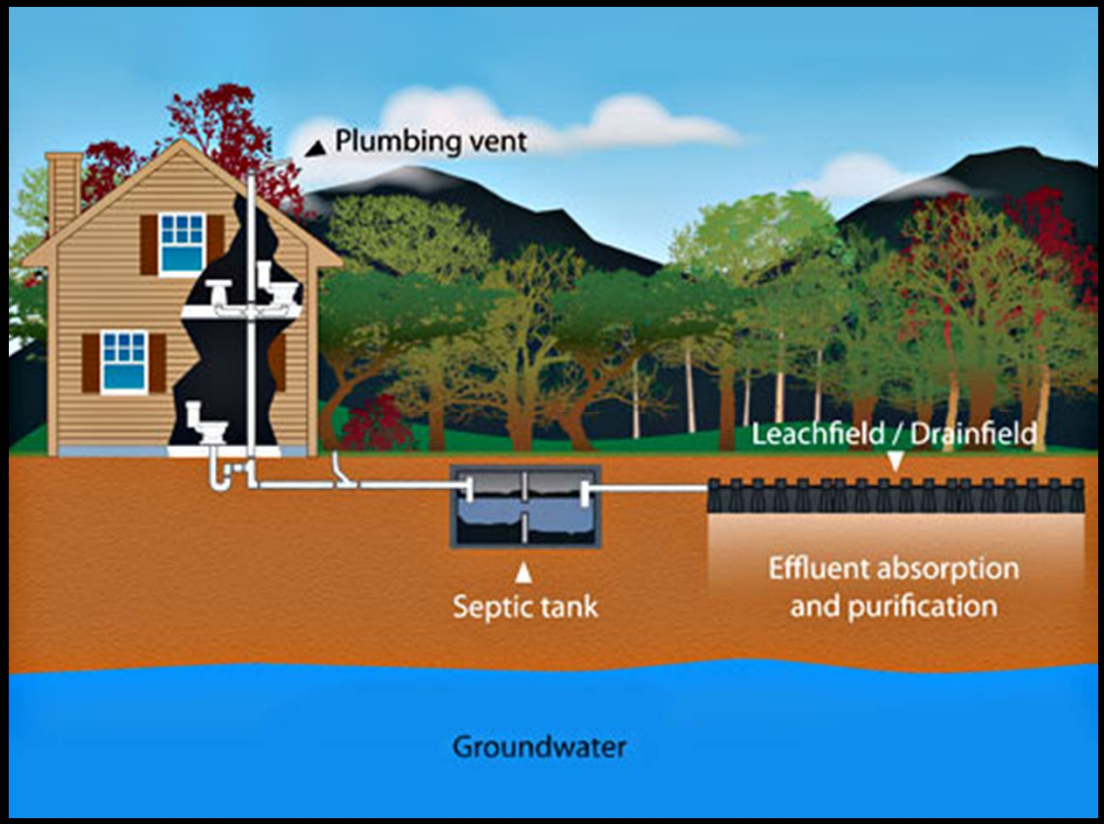
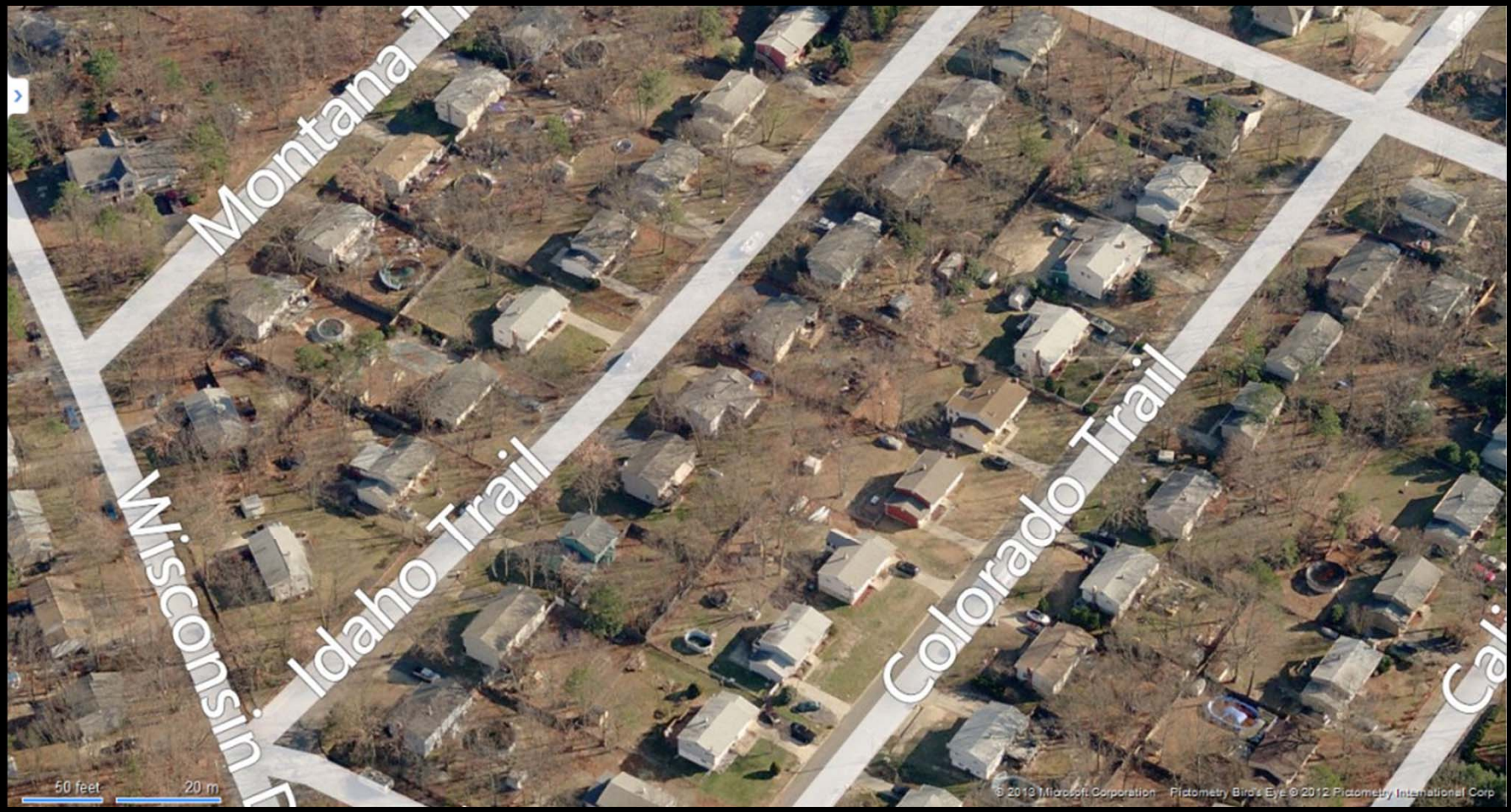
Onsite Wastewater Treatment Systems Pilot Program



Annual Report to the Pinelands Commission

September 13, 2013

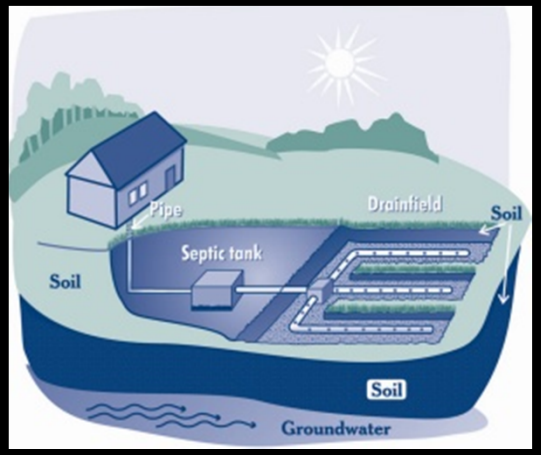
Pinelands Onsite Wastewater Systems Program



Roughly 22,000 septic systems located throughout the Pinelands Area

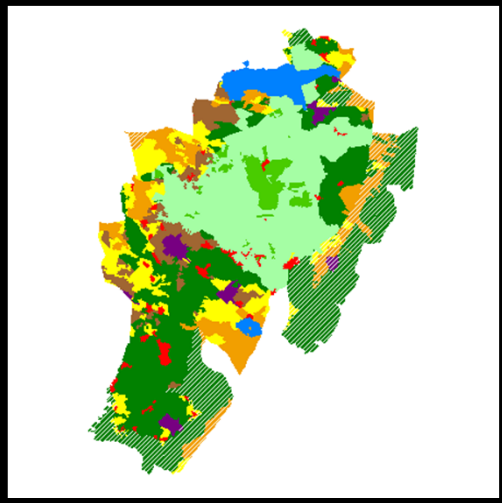
Pinelands Onsite Wastewater Systems Program

STANDARDS FOR INDIVIDUAL SUBSURFACE SEWAGE DISPOSAL SYSTEMS



New Jersey Department
Of Environmental
Protection
N.J.A.C 7:9A

PINELANDS COMPREHENSIVE MANAGEMENT PLAN



New Jersey
Pinelands Commission
N.J.A.C 7:50

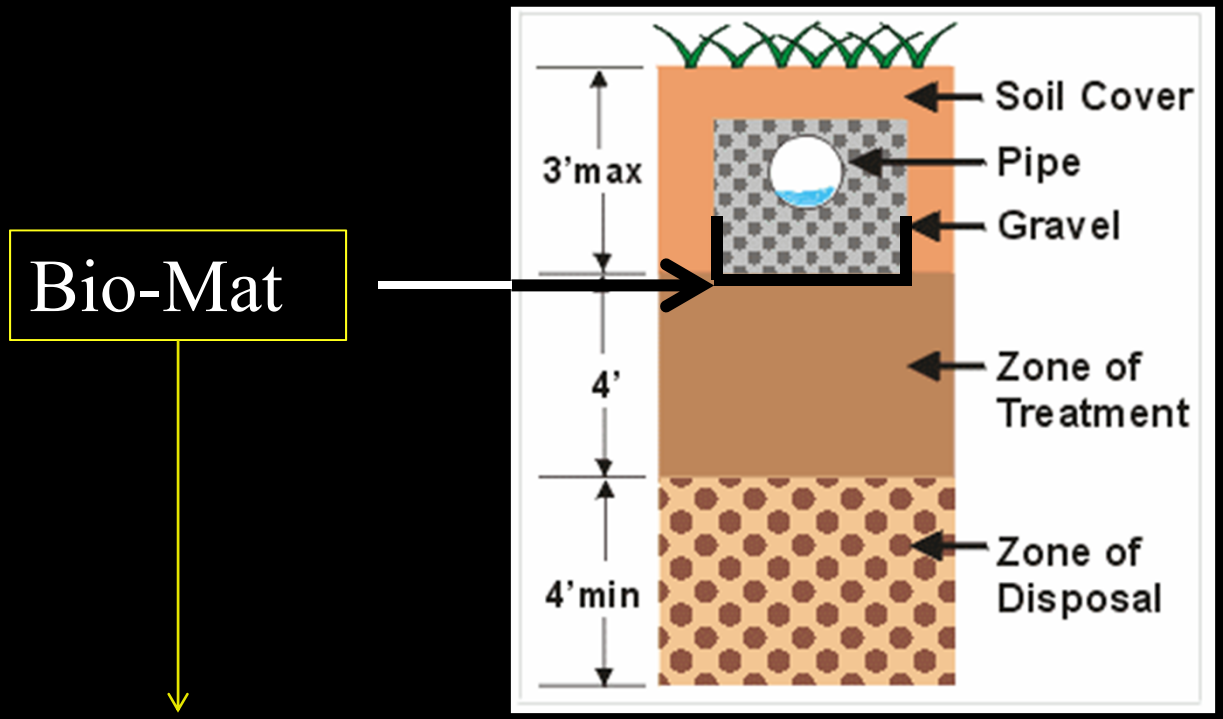
Evolution of Wastewater Treatment Objectives

HUMAN PATHOGENS – (BACTERIA, VIRUSES, PROTOZOA & HELMINTHES)

NUTRIENTS – (NITROGEN & PHOSPHOROUS)

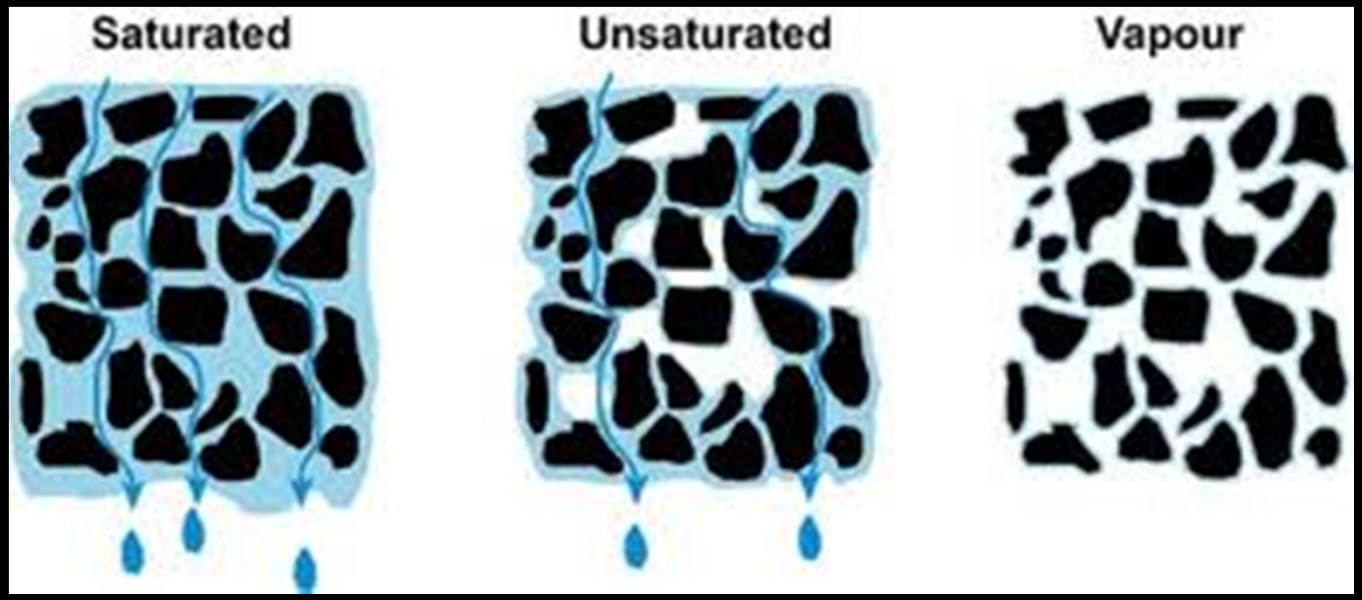
PERSONAL CARE PRODUCTS – (PHARMACEUTICALS, ETC.)

Wastewater renovation via soil-treatment systems



- Wastewater solids, dead and living microorganisms, microbial secretions, insoluble compounds and non-degradable synthetic fibers.
- 3/16 to 1-3/8 thick with permeability on the order of 0.25 inches per hour (K1)
- Removes organic material and non-viral pathogens

Soil as a treatment medium – basis for an unsaturated zone of treatment



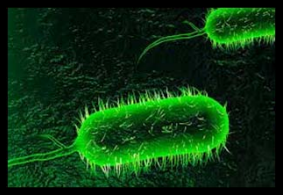
- Unsaturated flow increases travel time and maximizes contact with soil particle surfaces (via surface tension)
- In unsaturated soils, soil pores contain both air and water enabling aerobic microbes to treat the wastewater.
- Provides mechanical filtration and adsorption site for pollutants

Wastewater-borne human pathogens

- Protecting water supplies from pathogenic organisms

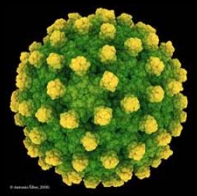
Bacteria

- *Typhoid bacillus* — Typhoid fever
- *Salmonella species* — Salmonella infection
- *Shigella species* — Bacterial dysentery
- *Vibrio cholera* — Cholera



Viruses

- Hepatitis virus — Infectious Hepatitis (A)
- Parvo virus — Viral gastroenteritis



Protozoa

- *Giardia lamblia* — Giardiasis
- *Entamoeba histolitica* — Amebic dysentery
- *Cryptosporidium parvum* — Cryptosporidiosis

Helminthes

- Intestinal worms — Tape, Hook & Round worms

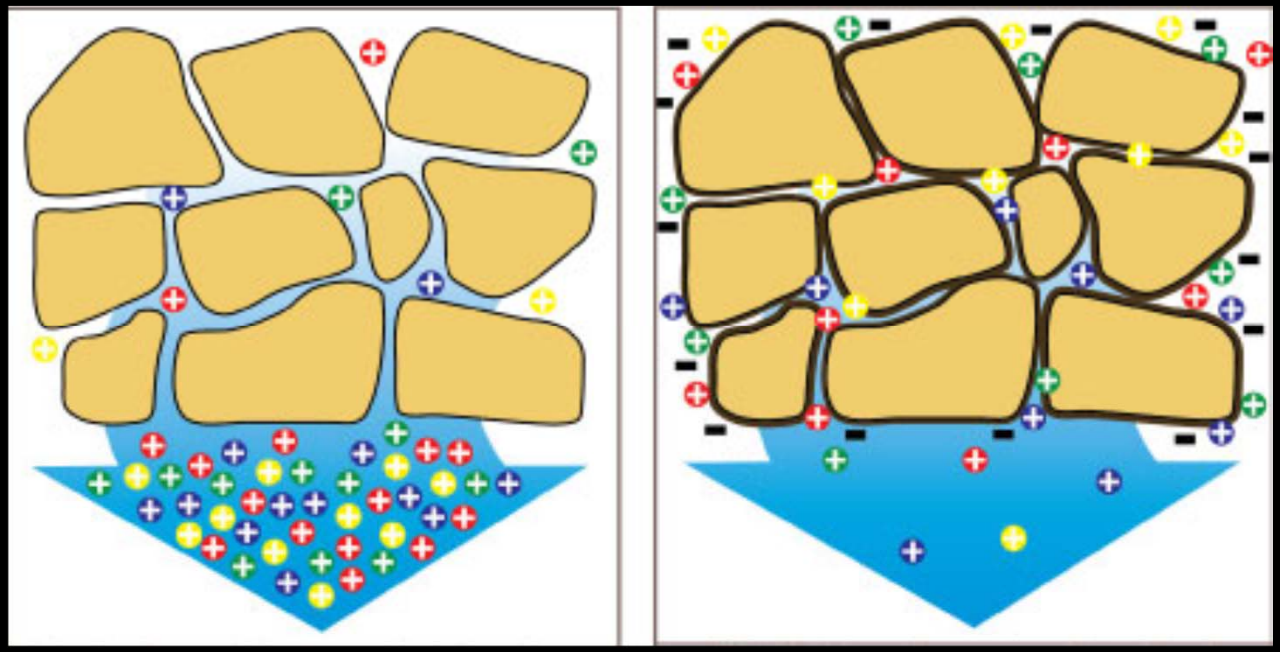
Wastewater-borne human pathogens

- Presence in septic tank effluent and raw wastewater

	[MPN/100 mL]	Infective dose
Bacteria		1 - 10^6
• Fecal coliform	10^6 - 10^8	
• Fecal streptococci	10^4 - 10^6	
• *Salmonella*	10^2 - 10^4	
Viruses		1 - 10
• Enteric viruses	10^3 - 10^4	
Protozoa		1 - 20
• *Cryptosporidium* oocysts	10^1 – 10^4	
• *Giardia* cysts	10^3 – 10^4	
Helminthes		1 - 10
• Ova	10^1 – 10^3	

Soil as a treatment medium –removal of viral pathogens and positively charged pollutants

Cation Exchange – attraction and retention due to electric charge



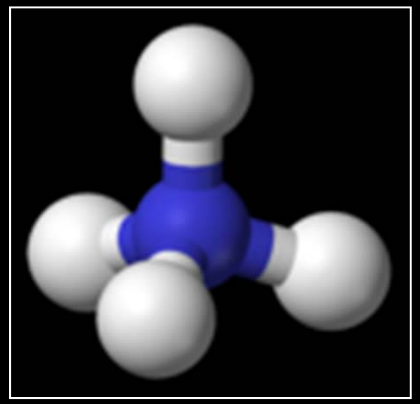
Sandy soils often lack the negative charge on clay & organics & don't retain positively charged (cation) pollutants.

Loamy soils containing clay and organics attract and retain positively charged cations (Virus particles, heavy metals, sodium, etc.)

Soil as a treatment medium

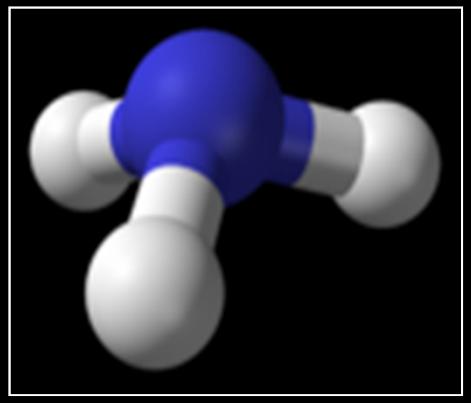
Cation Exchange – attraction and retention due to electric charge

Ammonium cation +
NH_4^+



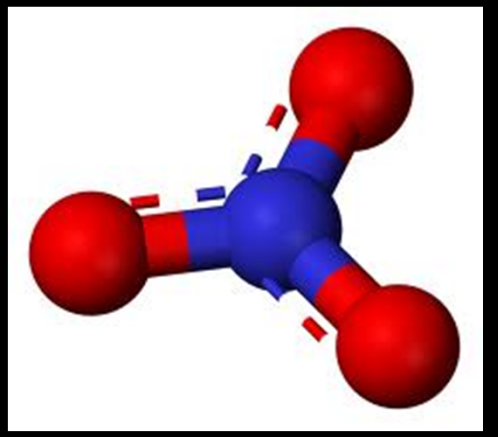
Ammonium is captured on clay and organics due to it's positive surface charge. (Also, viruses, heavy metals, sodium, etc.)

Ammonia (no surface charge)
NH^3

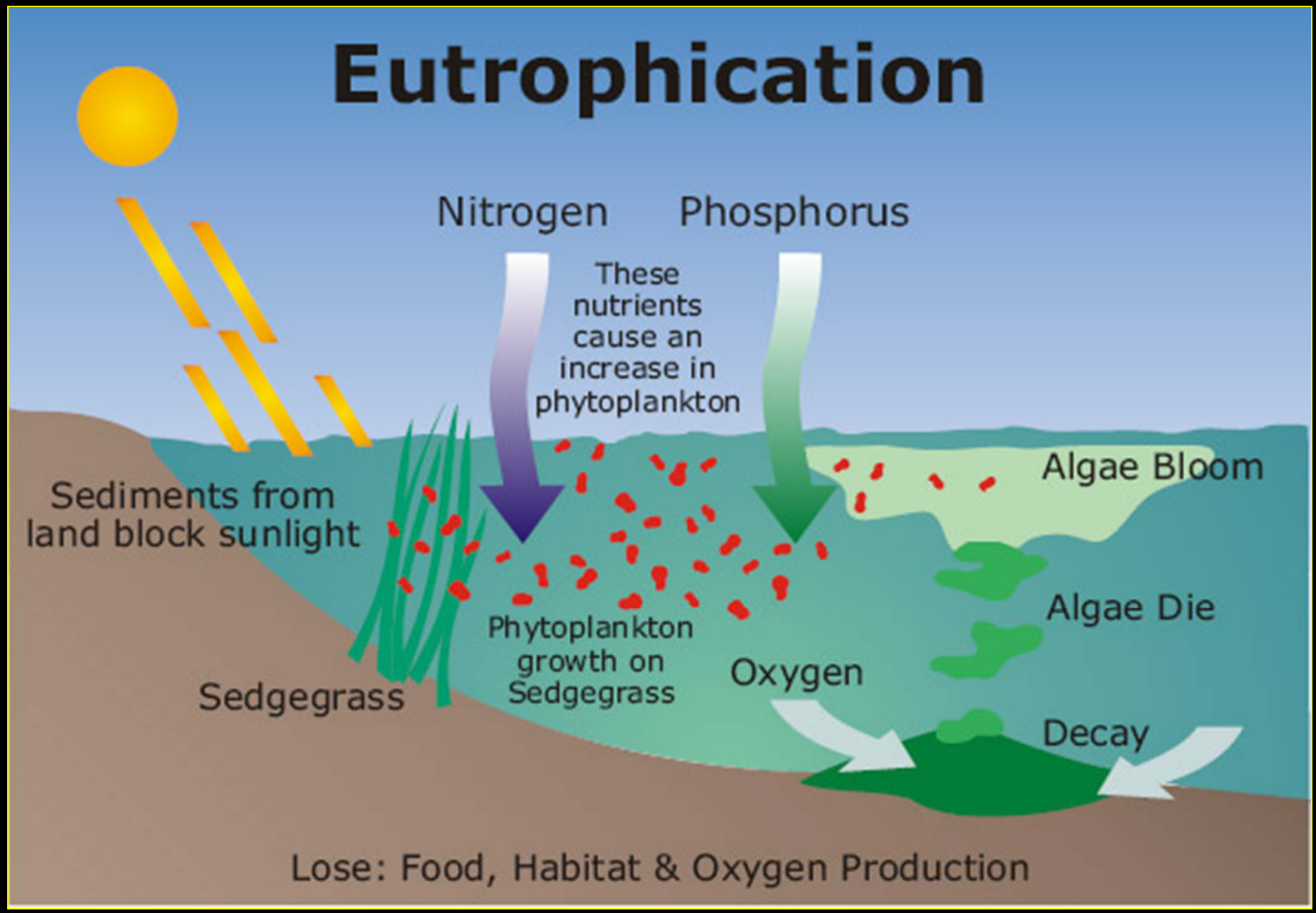


Ammonia can't be captured via cation exchange- due to its neutral charge.

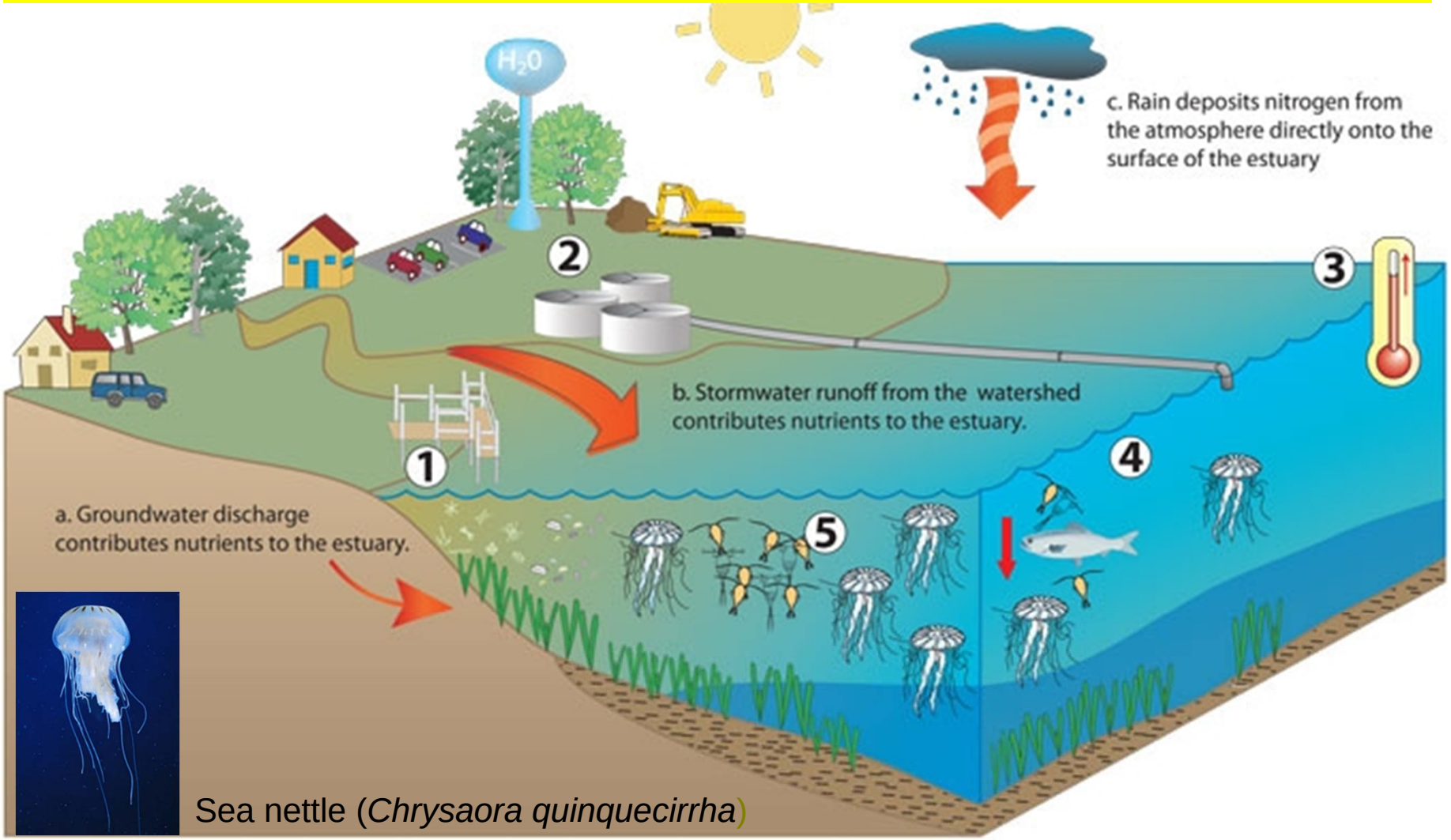
Nitrate anion -
NO_3^-



Nitrate and other neg. charged anions go un-captured because their neg. charges are repelled by clay and organics


Eutrophication
Nitrogen
Phosphorus
These nutrients cause an increase in phytoplankton
Sediments from land block sunlight
Algae Bloom
Algae Die
Phytoplankton growth on Sedgegrass
Oxygen
Sedgegrass
Decay
Lose: Food, Habitat & Oxygen Production

The role of nutrient enrichment in Sea nettle proliferation in Barnegat Bay



Sea nettle (*Chrysaora quinquecirrha*)

Original Five Pilot Program Nitrogen Reducing Wastewater Systems

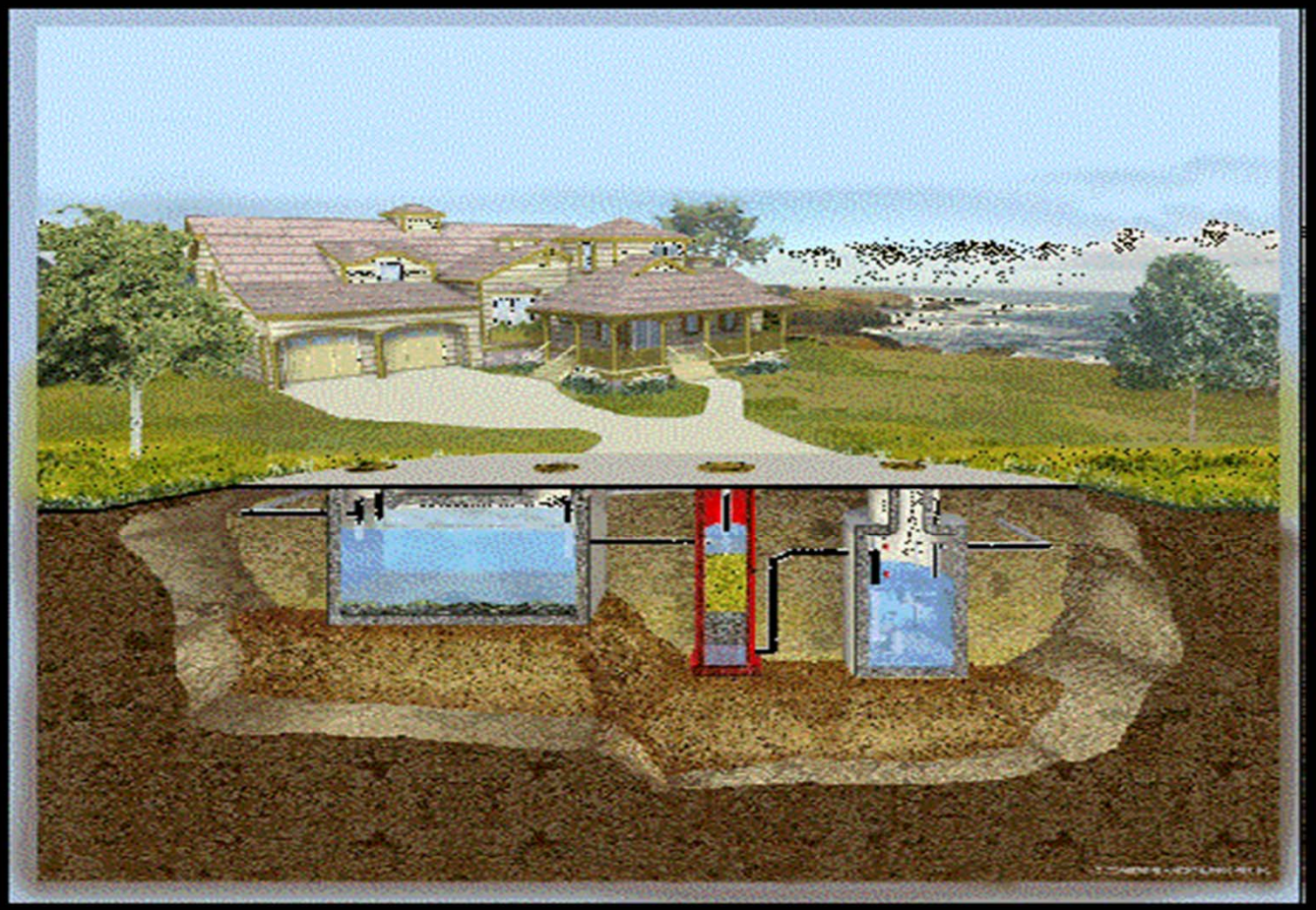
System Name	System Vendor	Treatment Process
Amphidrome	F.R. Mahony & Assoc.	Fixed Film SBR
Bioclere	Aqua point Inc.	Modified Trickling Filter
*Cromaglass	Cromaglass Corp.	Sequencing Batch Reactor
Fast	Bio-Microbics, Inc.	Fixed Film Activated Sludge
** Ashco RFS^{III} (Removed Dec. 2007)	Ashco-A-Corp.	Recirculating Sand Filter

- * Recommended for removal from the Pilot Program effective Aug. 5, 2013
- ** Removed from the pilot program effective Dec. 3, 2007

Pinelands Pilot Program

Amphidrome®

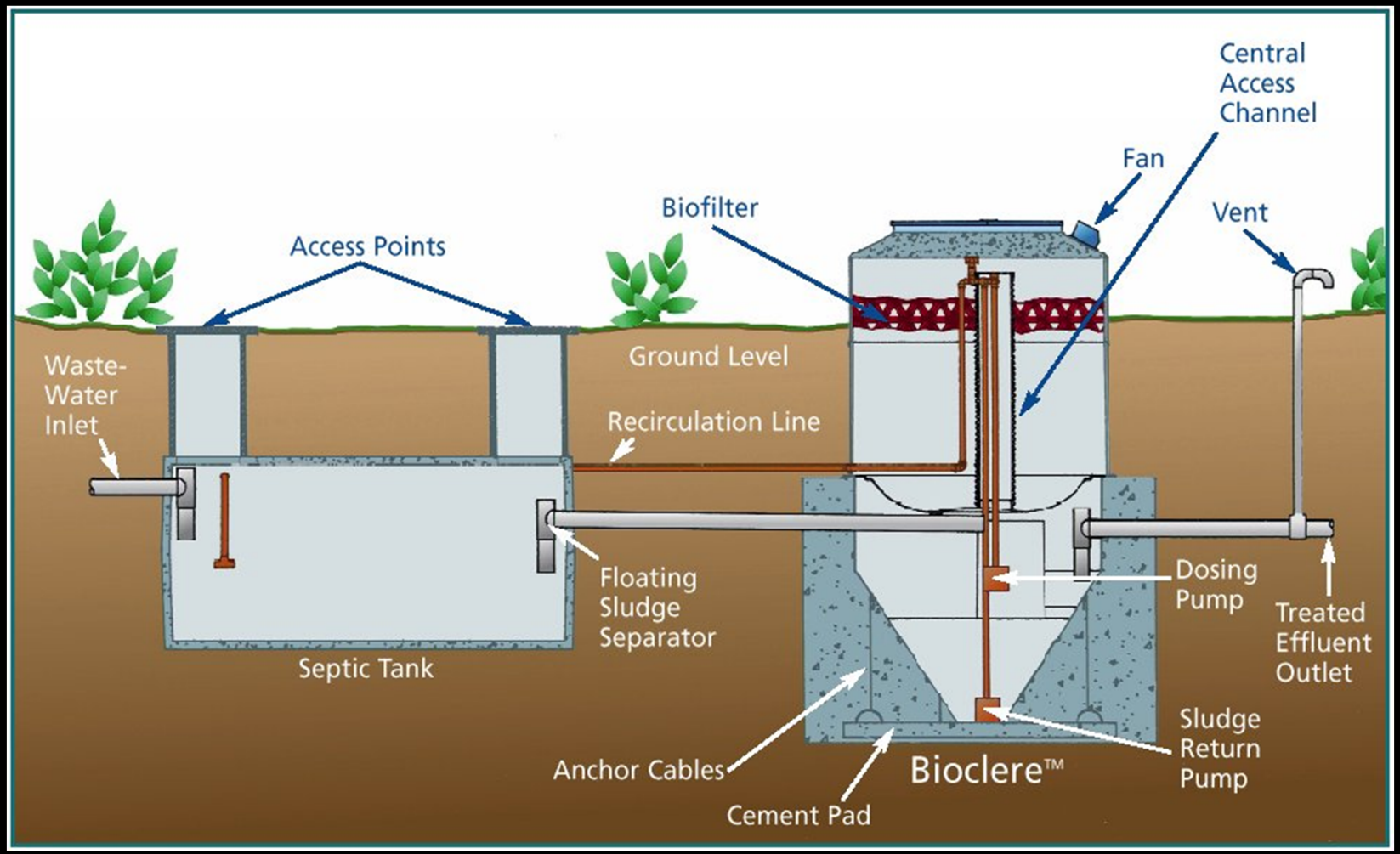
11.9 mg/l TN



Pinelands Pilot Program

Bioclere System

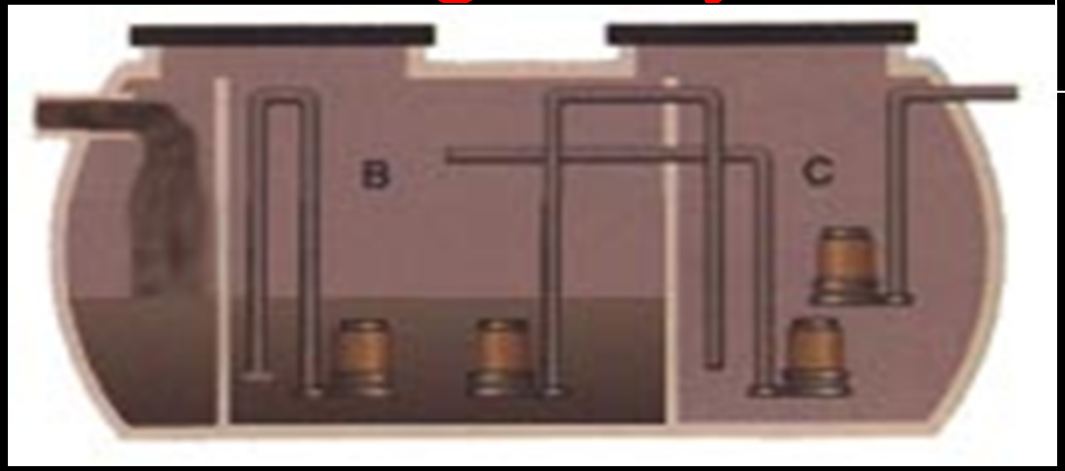
11.2 mg/l TN



Pinelands Pilot Program

Cromaglass System

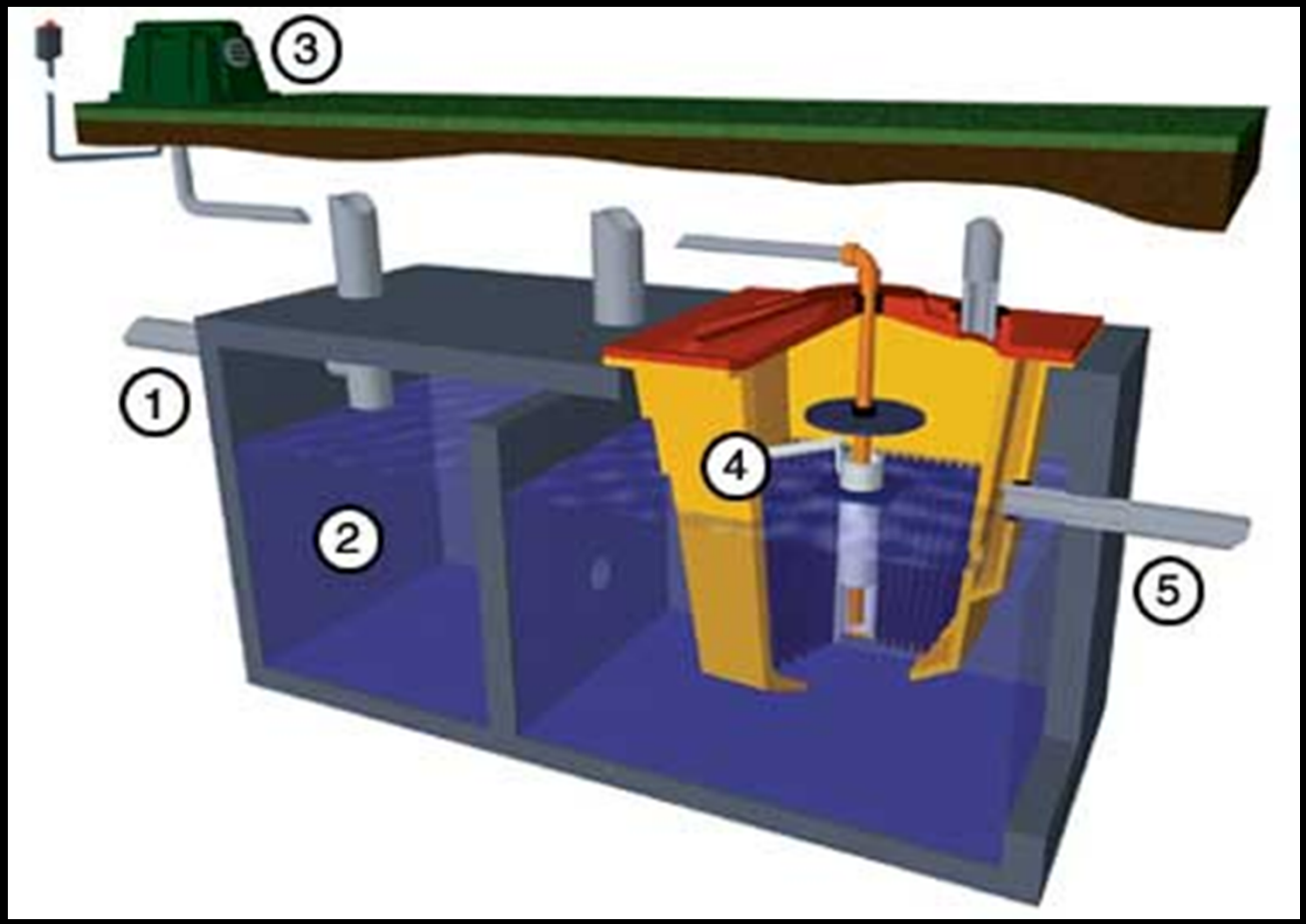
31.5 / 19.2 mg/l
TN



Pinelands Pilot Program

FAST

21.4 / 14.1 mg/l TN

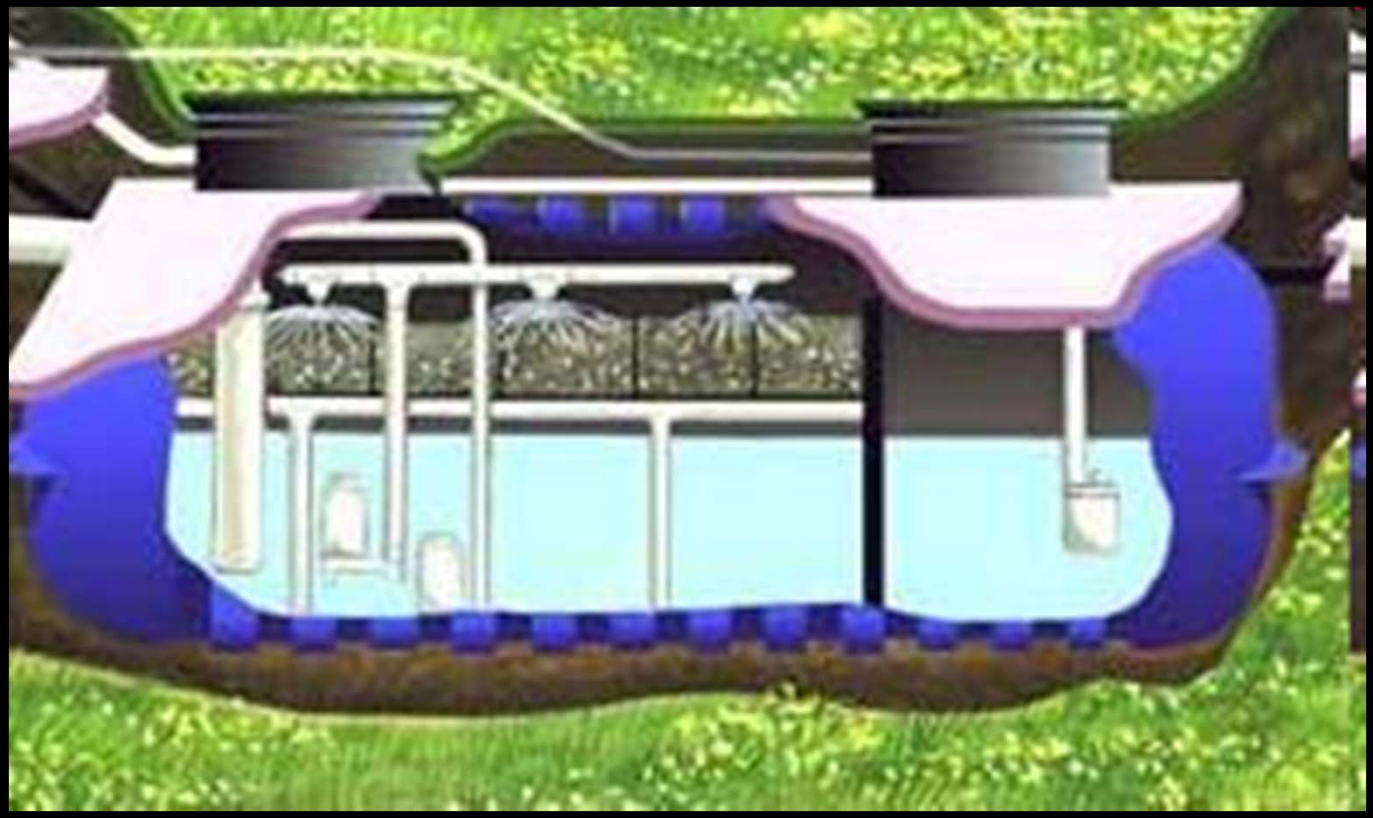


Four New NSF 245 Nitrogen Reducing Wastewater Systems

System Name	System Vendor	Treatment Process
Bio Barrier	Bio-Microbics, Inc.	Membrane * Bioreactor
Busse GT	Busse Green Technologies, Inc.	Membrane * Bioreactor
Hoot ANR	Hoot Systems, LLC.	Extended Aeration/Activated Sludge
SeptiTech	SeptiTech, LLC	Fixed Film Trickling Filter

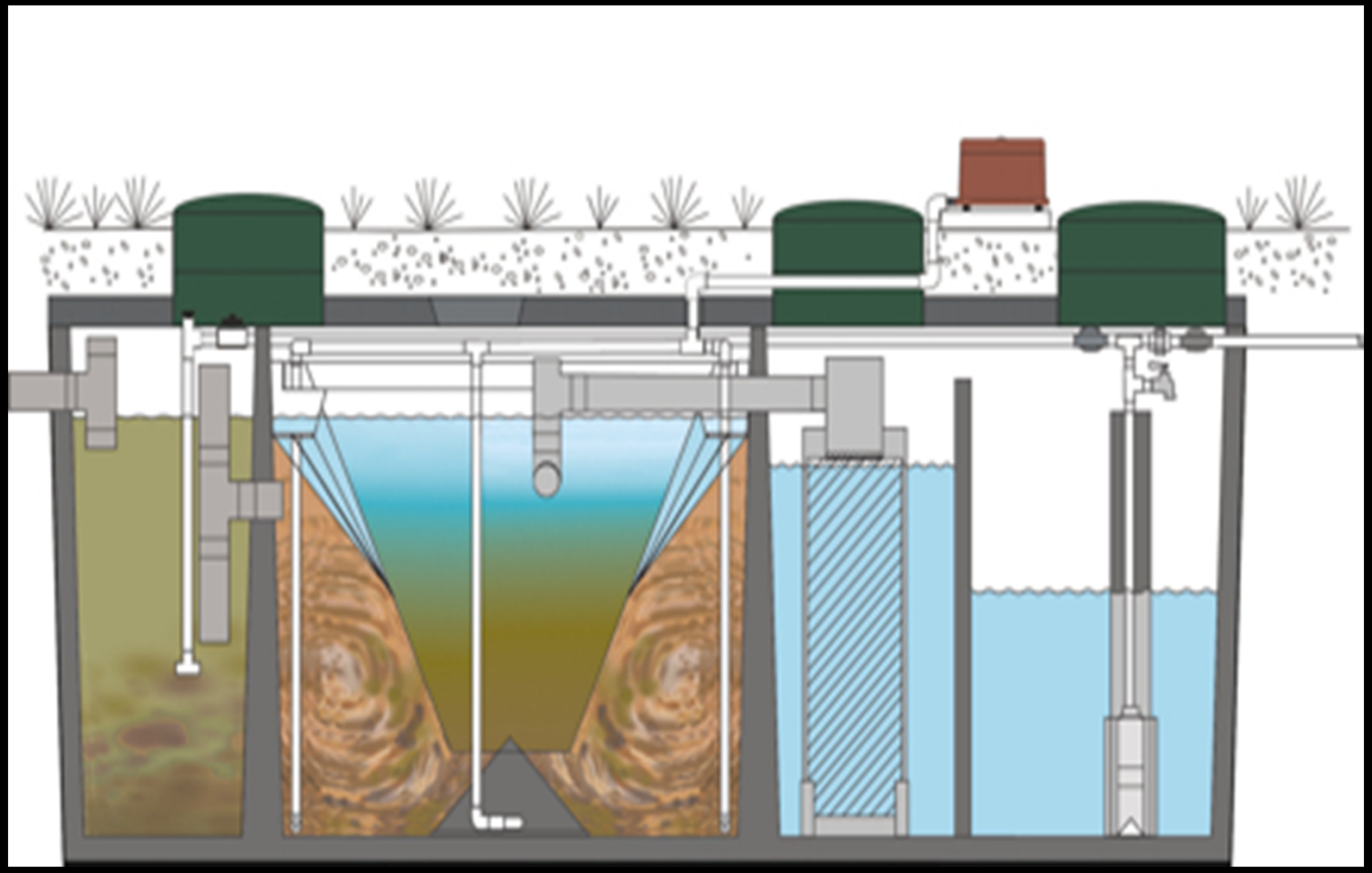
* May remove many large organic molecules including Personal Care Products – (pharmaceuticals, etc.)

SeptiTech



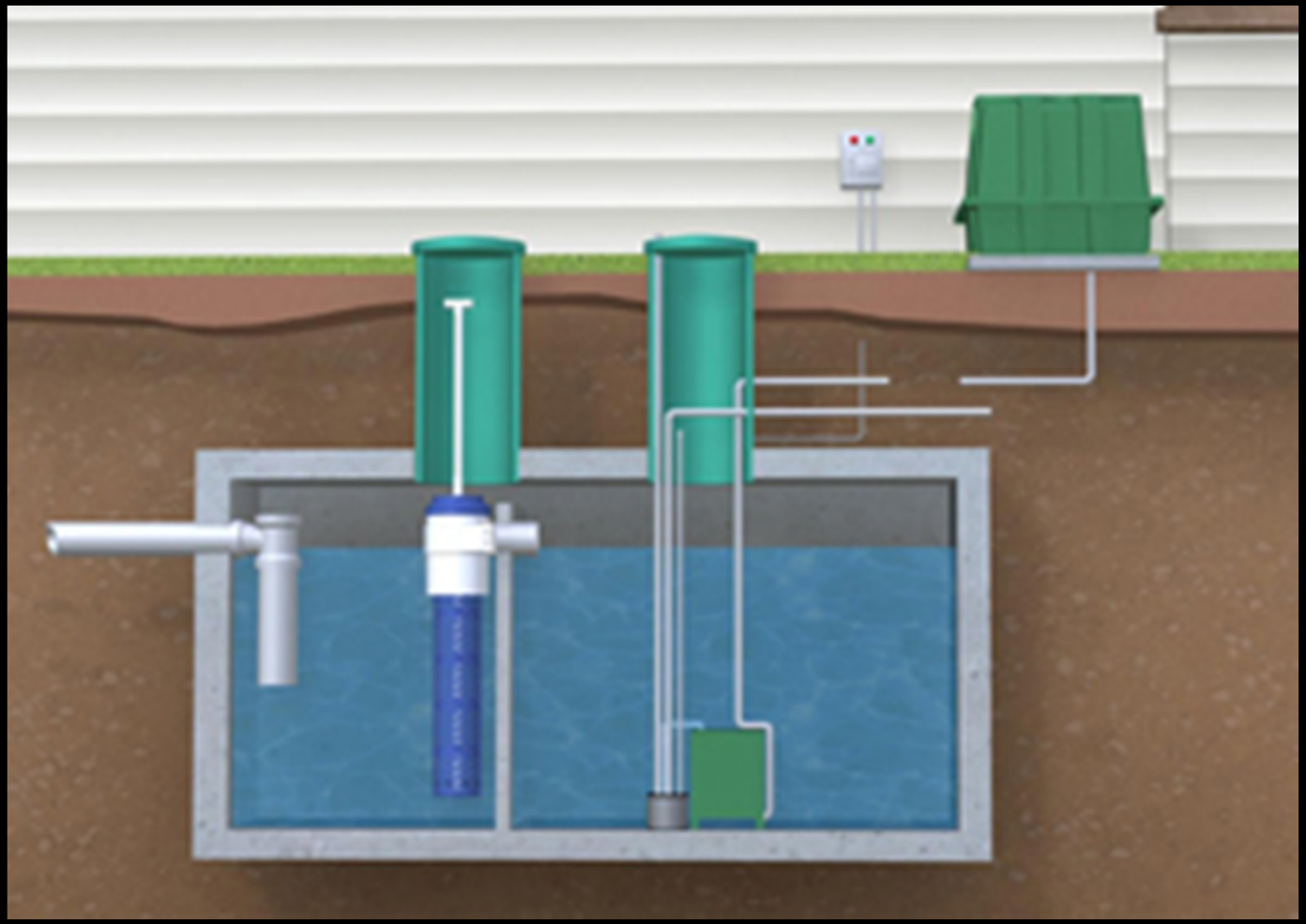
Fixed Film Trickling Filter

Hoot ANR



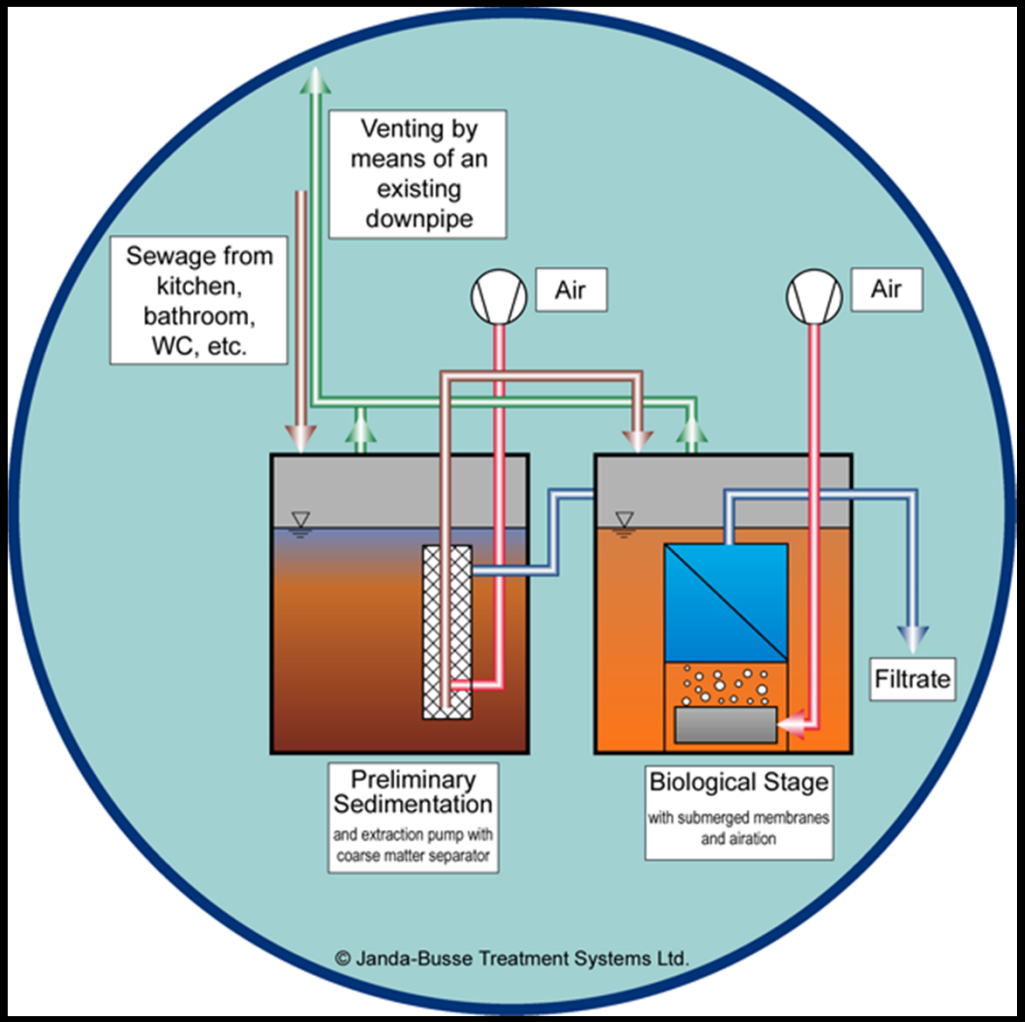
Extended Aeration/Activated Sludge

BioBarrier



Membrane Bioreactor

Busse GT



Membrane Bioreactor

Pilot Program Technology Costs

Technology	Average Treatment System & Five Year Service Cost	Ave. Total Reported Cost
Amphidrome	$ 19,196	$31,492
Bioclere	$ 17,654	$ 31,866
Cromaglass	$22,345	$ 35,265
FAST	$ 17, 819	$29,633
Bio Barrier	$ 15,000	N/A
Busse GT	$ 24,000	N/A
SeptiTech	$ 16,700	N/A
Hoot ANR	$ 14,500	N/A

Installed Pilot Program Technologies

Technology	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	Total
Amphidrome	7	10	11	29	13	7	5	8	4	6	100
Bioclere	-	2	11	9	7	9	6	5	3	5	57
Cromaglass	-	19	26	3	7	4	2	0	0	0	61
FAST	-	-	-	-	2	5	3	5	3	5	23
Total	7	31	48	41	29	25	16	18	10	16	241

Cromaglass System Replacements

Number of Systems	Equipment Cost Subsidy *	Total Cost
61	100% (61 x $17,800)	$1,085,800
61	50% (61 x $8,900)	$542,900
61	25% (61 x $4,450)	$271,450

- Assumes average equipment cost of $17,800 for an alternative pilot program system.

Onsite Treatment Systems Summary

- Disease transmission from sewage borne pathogens is minimized due to NJDEP's regulations that ensure septic systems are installed in suitable soils.

- Nutrient enrichment of wetlands and surface waters is addressed through the Pinelands Commission's septic density standards and through the use of Pinelands advanced (denitrifying) pilot program systems

- The potential ecological and human health implications from emerging contaminants (sewage borne pharmaceuticals, endocrine disrupting compounds, etc. may be addressed through the use of MBR technologies.

Pinelands Alternate Design Wastewater Treatment System Pilot Program

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www.nj.gov/pinelands