

A Case Study of the Long Island Pine Barrens pertaining to
Groundwater, Groundwater Contamination and the Benefits of
Preservation in Suffolk County, New York

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Executive Summary

The Long Island Pine Barrens is a pristine natural forest that serves to provide the local and neighboring communities with both a taste of the natural world and as a necessary ecological entity. Located in Suffolk County, New York, it spans over 3 townships and is the largest preserve of its kind ever created. Through its organic covered forest floor to its conifer decorated landscape, it is what lies beneath that give this crown jewel its true importance.

Beneath the sandy soil composition lays three aquifers, the Upper Glacial, Magothy, and Lloyd. These aquifers provide all of Long Island with water to drink, use, and most commonly pollute. Many people do not understand the importance of these aquifers and do not take into consideration the consequences that may occur. Whether it be excessive fertilizing, dumping VOC's, or storm water pollution, we need to manage these contaminates through the best available technology. The creation of the Central Pine Barrens Preserve was made with two goals in mind; to preserve open space and protect drinking water. The passing of the Pine Barrens Protection Act strengthened the resolve of committing to protection of drinking water. These commitments helped to acquire more open space through TDR's (transfer of development rights) and in turn, preserving clean drinking water. The Pine Barrens is one of two deep recharge stations on Long Island that allow water to replenish the Magothy Aquifer.

The Pine Barrens also have created opportunities for recreational use and have preserved the quality of life of the local communities. Through examining information from local environmentalist groups and attending meetings about groundwater, we can truly see how the Long Island Pine Barrens serve Suffolk County with great distinction.

Geology and Geography

The Long Island Pine Barrens spans over 100,000 acres of Suffolk County and covers the Towns of Brookhaven, Riverhead, and Southampton. The Pine Barrens is the largest land preserve of its kind and is maintained through collaborate governance through the local municipalities. The Pine Barrens geologic purpose is what serves to be its crucial role for protection and preservation of natural land.

The Pine Barrens is mostly composed of pitch pine woodlands, pitch pine-oak forests, coastal plain ponds, swamps, marshes, grasslands and streams.¹ It is a diverse ecosystem that is home to many forms such as the Northern Harrier Hawk, Eastern Mud Turtle, and the Water-Dependent Tiger Salamander. All which are listed as threatened species under the Endangered Species Act. Many will notice the many kettle hole and glacial erratic's that were formed by the Continental glaciers of Wisconsinian age (20 to 86 thousand years ago) brought to Long Island the materials that now comprise nearly all of its surficial sediments.² This glacial material was deposited along two moraines: the Ronkonkoma Moraine which formed Suffolk' spine and the South Fork, and the Harbor Hill Moraine which runs along the North Shore and forms the North Fork. The elevations within the Central Pine Barrens area range from mean sea level where the study area borders Flanders Bay, to a high of 295 feet at Bald Hill, which is on the Ronkonkoma Moraine just southwest of the Eastern Campus of Suffolk County Community College (SCCC) south of Riverhead. Generally, elevations are lowest in the areas where recent geologic deposits are found and highest in the moraine areas. Through the formation of these glacial deposits, we see the creation of the aquifer system which contains the three aquifers that cover Long Island.

¹ "Central Pine Barrens | The Nature Conservancy." Central Pine Barrens | The Nature Conservancy. The Nature Conservancy, n.d. Web. 08 Dec.

² Chapter 2: Geologic Overview." Chapter 2: Geologic Overview. N.p., n.d. Web. 08 Dec. 2014.

The Upper Glacial, Magothy, and the Lloyd are the aquifers that lie beneath the Pine Barrens and all of Long Island (Figure 1). The Upper Glacial aquifer is an unconfined aquifer that is directly under the ground surface. An unconfined aquifer is when there is no aquitard of silt or clay that encompasses its entire surface area making it vulnerable to pollution. This is the most polluted aquifer on Long Island because it is right below that ground surface and because there is no aquitard (protective layer) guarding it from pollution. The Magothy aquifer is the

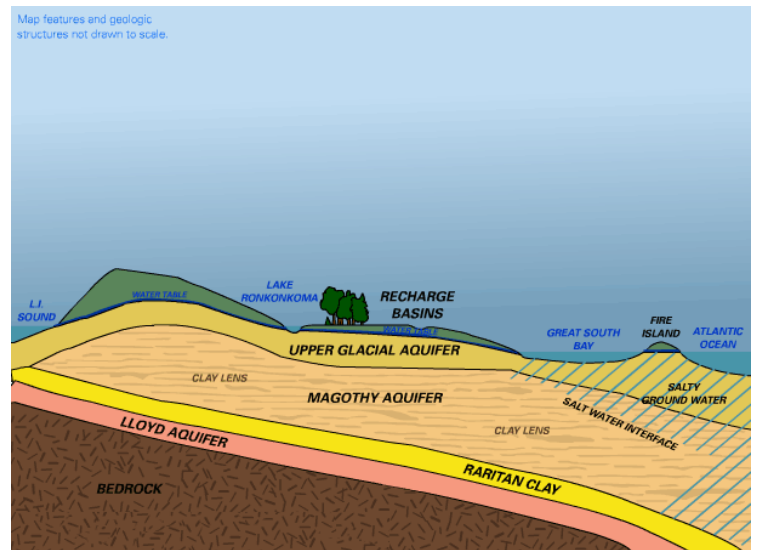


Figure 1

largest of Long Island aquifers. Consisting of sand deposits alternating with clay, it attains a maximum thickness of approximately 1,100 feet and is the source of water for most of Nassau County and about half of Suffolk County. The formation can be seen in the coastal bluffs of the north shore and plunges under the land surface to the south. The Long Island Pine Barrens serves as a deep recharge zone for this aquifer and because the development in the Pine Barrens is heavily restricted, the water in this aquifer is pure. The Lloyd Aquifer is the deepest and oldest of Long Island's aquifers. It is a sand and gravel formation ranging in thickness from zero to five hundred feet. At its deepest, it is 1,800 feet below the surface. The water contained in the Lloyd aquifer is about six thousand years old. Not many wells tap this formation and New York Environmental Conservation Law §15-1528³ establishes a moratorium on the use of water from this formation in order to maintain it for future generations. In effect, these aquifers serve as a

³ "Disclaimer." Long Island Aquifers. New York State Department of Environmental Conservation, n.d. Web. 08 Dec. 2014.

water resource to most of Nassau and Suffolk County. These aquifers are crucial to Long Islanders because it is our water source. The sandy soil profile provides as a natural filter that cleans the water as it moves down into the underground aquifers. This process allows for a natural recharge station that is untainted by human ailments such as oil, gasoline, and other toxic chemicals. Because this area is sealed off, it provides for a natural unharmed area that is protected by our local government and a clean water source for Long Island.

History of Preservation

The Long Island Pine Barrens was not protected by New York State until 1993 with the signing of the Pine Barrens Protection Act. However, it was not just some piece of legislation introduced to the state; it was created by a suit that was filed by the Long Island Pine Barrens Society suing local municipalities for not following SEQRA (State Environmental Quality and Review Act). SEQRA was used as a defense to protecting the Pine Barrens. Although they lost at the Court of Appeals, citizens continued to press for action. Ultimately, this led to an unprecedented convergence of environmentalists, business leaders and government representatives to produce the Long Island Pine Barrens Protection Act⁴. In 1993, New York State's Long Island Pine Barrens Protection Act defined this region at the junction of the Towns of Brookhaven, Riverhead, and Southampton. The 1993 Act created a five member Central Pine Barrens Joint Planning and Policy Commission, an Advisory Committee, and mandated the production and implementation of the Central Pine Barrens Comprehensive Land Use Plan, adopted in June 1995. However, there was a lot of push from the local communities and municipalities for the preservation of the Pine Barrens. In an interview with Richard Amper, the Executive Director of the Long Island Pine Barrens Society, it was dubbed “the war of the

⁴ “The Long Island Pine Barrens Protection Act : Pine Barrens Society.” The Long Island Pine Barrens Protection Act : Pine Barrens Society. Long Island Pine Barrens Society, n.d. Web. 08 Dec. 2014.

woods.” Long Island generally and Suffolk County governments have saved 60,000 acres at a cost of \$1.2 billion to protect drinking water, preserve critical habitats, and save farms. Because the Pine Barrens was so crucial to clean drinking water and preservation of open space, a comprehensive land use plan was created to limit and regulate land use in the Central Pine Barrens Region via the Central Pine Barrens Joint Planning & Policy Commission.

The PBPA (Pine Barrens Protection Act) established a five member Central Pine Barrens Joint Planning & Policy Commission to oversee the development and implementations of a

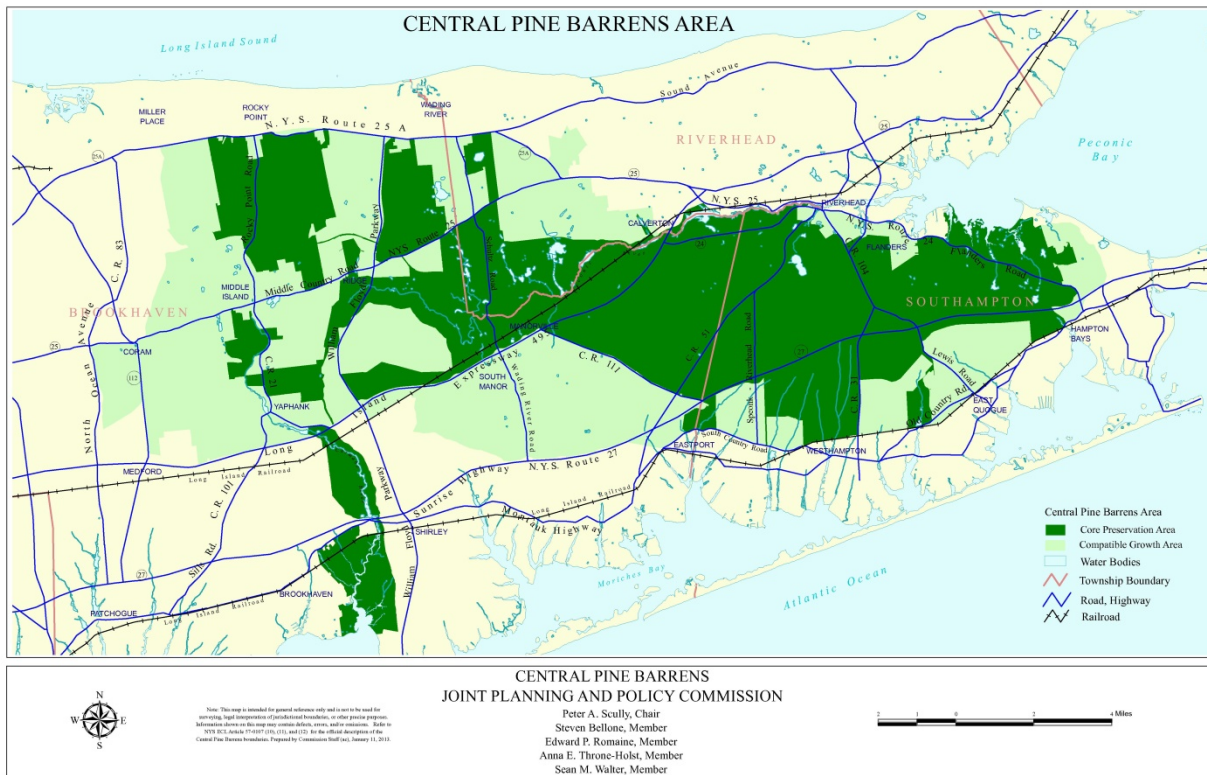


Figure 2

Comprehensive Management Plan (CMP); it also delineated two major regions within the 100,000 acre area - a 53,000 acre Core Preservation Area where no new development is permitted (55,000 with the addition of the Wertheim National Wildlife Refuge in 1998) and a 47,000 acre Compatible Growth Area where limited, environmentally compatible development is

allowed (Figure 2). The Plan also recommends that 75% of the core preservation area be preserved through public acquisition. The CMP was adopted by the Pine Barrens Commission in 1995 and updated in 2005 (Long Island Pine Barrens Society). To make the plan a reality the Core Preservation Area must be acquired. Funds approved by voters for the preservation of drinking water were, and continue to be, used to purchase Core acreage. An interesting feature of this plan, and one needed to make this plan a reality, is the concept of transfer of development rights (TDR). This provision makes it possible for landowner/developers who own land in the Core Preservation Area to acquire the rights to build in another location by transferring ownership of the Core lands to a government entity for perpetual preservation (Long Island Pine Barrens Society).⁵ The Central Pine Barrens Comprehensive Land Use Plan was signed by Governor George Pataki in 1995 and became the manifest for future development and preservation in the Pine Barrens Region. The CLUP is currently being amended with new amendments that will address further restrictions on development, new species being threatened, invasive species, and clean drinking water preservation.

Groundwater Issues

Toxic chemicals and contaminants are responsible for the pollution of the drinking water on Long Island. Because the Long Island Pine Barrens are preserved open space, there is no pollution and contamination of groundwater. The water directly under the Pine Barrens is considered to be the most pristine water in all of New York State. The PBPA and the CLUP regulate what can be developed in the Pine Barrens Region and dictates that the quality of the drinking water and preservation of open space comes first. Nitrogen is the number one pollutant that contaminates the drinking water on Long Island. Most of this gets into our water source

⁵ "The Long Island Pine Barrens Protection Act : Pine Barrens Society." The Long Island Pine Barrens Protection Act : Pine Barrens Society. Long Island Pine Barrens Society, n.d. Web. 08 Dec. 2014.

because of fertilizing lawns and agriculture. Nitrogen trickles down into the groundwater system and eventually works its way to the rivers and streams and eventually, the bay and ocean.

According to the New York Department of Environmental Conservation, “Nitrogen pollution continues to threaten vulnerable marshlands that serve as natural buffers, causing losses of critical areas along the South Shore of Long Island and diminishing their ability to protect coastal communities.” The excess nitrogen levels are causing marsh lands to die out leading to the buffers that protect us from storm surge to diminish. Nitrogen pollution has also led to red, brown, and rust tides that kill marine life in the bays and oceans that boarder Long Island.

Nitrogen does not just come from fertilizing lawns or crops, but is discharged as effluent from sewage treatment plants and storm runoff. Newsday says that nitrogen is, “a pollutant that can threaten public health and the environment.” When nitrogen is ingested at high levels, it can deprive the body of oxygen in blood. For infants, excess nitrogen in water used to make formula can cause “blue-baby syndrome” which turns the skin blue and in severe cases, lead to brain damage. Nancy Stoner, the EPA’s acting Assistant Administrator says that, “addressing nutrient pollution is a top priority for EPA.” However, in addressing nutrient pollution we also not only have to access health and environmental hazards, but address policies and laws that help us to protect the public. Under the Clean Water Act, agricultural storm water discharges and return flows from irrigated agriculture are not considered point-source pollution. This makes it hard to regulate one of the major polluting industries on Long Island. Most of Eastern Long Island is covered with vineyards, sod, dairy, cattle, and other farms that are major polluters of nitrogen. We would need to address in some form how to regulate it as a non-point pollution source. However, nitrogen is one of many issues with the groundwater debate.

Salt-Water Intrusion is shrinking the aquifers by allowing the freshwater from the aquifers to mix with the salt water from the bays and oceans. According to the USGS, saltwater intrusion occurs, “under natural conditions, the seaward movement of freshwater prevents

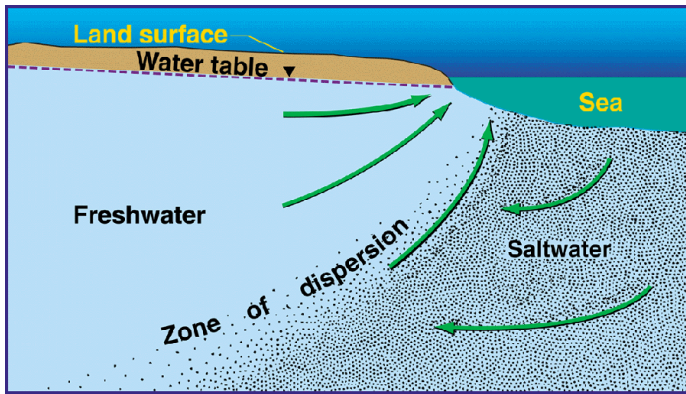


Figure 3

saltwater from encroaching coastal aquifers, and the interface between freshwater and saltwater is maintained near the coast or far below land surface (Figure 3).” This is where freshwater and saltwater mix and is referred to as the zone of dispersion. When

groundwater is pumped excessively out of the ground, the saltwater is advanced further into the aquifer towards the freshwater zone and decreases freshwater storage in the aquifer. In severe cases, the well is abandoned because the saltwater concentration is too great. Because of the excess pumping of freshwater from the aquifers, we are seeing the depletion of our source of drinking water and a necessary natural resource.

Ecological Services

The Long Island Pine Barrens Region provides a plethora of benefits to human beings that arise from this healthy functioning ecosystem. However, the Pine Barrens have more to offer us as far as ecological services, it is protected by state law and is preserved open space, it serves as a carbon sequestration and climate regulator that reduces CO₂ in the atmosphere. This helps to reduce the carbon footprint made by residents of Suffolk County and local communities within the Pine Barrens.

Other than providing clean water and decreasing CO₂ emissions, the Pine Barrens have a lot to offer for recreational purposes. Most prominent of its recreational services are its hiking trails that go through the most pristine natural landscape on all of Long Island. Glacial kettle ponds and erratic's, rolling hills with panoramic vistas, parabolic dunes, coastal plain ponds, white Atlantic cedar swamps, dwarf pines, pitcher plants, and painted turtles describe the Pine Barrens, an area of natural beauty and diversity that welcomes great opportunities for hiking or strolling through the plentiful hiking trails and natural areas.⁶ One of these trails called the Paumanok Path runs from Rocky Point in Brookhaven to Montauk Point. It spans 125 miles and goes through the most secluded parts of the Pine Barrens. Another important landmark that the Pine Barrens trail system goes to is Bald Hill, which stands at 295 feet the highest point on Long Island. These trails allow us to commune with nature where we can observe the importance of this ecosystem.

The quality of life of many of the communities is facing a tough decision. We are now at the tipping point where we are expected to build out the rest of Long Island by 2025. The issue here is that we need to begin to make a decision if we are to protect and preserve the last remnants of open space via the Pine Barrens Protection Act. The adverse environmental and quality of life implications, failure to preserve this important land would undercut Long Island's number one industry, tourism, worth \$4.3 billion.⁷ The quality of life of the locals on Long Island would suffer because of the suburbanization of open space. Without tourism, many family small businesses would fall under bankruptcy and many towns would become relics to

⁶ "Parks: Pine Barrens Society." Parks: Pine Barrens Society. N.p., n.d. Web. 09 Dec. 2014. <<http://pinebarrens.org/hiking.asp>>.

⁷ "Preservation Now or Never: Pine Barrens Society." Preservation Now or Never: Pine Barrens Society. N.p., n.d. Web. 09 Dec. 2014. <<http://www.pinebarrens.org/preserve.asp>>.

civilization. The Pine Barrens preservation helps to maintain a stable economy and makes quality of life healthy, comfortable, and happy.

Collaborative Governance

The Pine Barrens Protection Act would have never been able to succeed if it were not for the cooperation of government entities. Through the creation of the PBPA, the Central Pine Barrens Joint Policy and Planning Commission was established. The Planning Commission is the largest section of the Pine Barrens Act and is responsible for creating and upholding the Comprehensive Land Use Plan for the Central Pine Barrens, hold monthly meetings that will limit development projects, and is responsible for stewardship of protected lands. Because of the geographic location and spread of the Pine Barrens region, the Town Supervisors of each town sits on the board. Suffolk County's Executive also sits on the board along with local environmentalists and member of the Long Island Pine Barren Society. The ability for these governments to work together to limit and restrict land use development is proof that there is a greater good. However, it is through conflict resolution that new amendments are made for the CLUP and how issues like high nitrogen levels, saltwater intrusion, and eutrophication can be resolved. According to Dr. Rosemary O'Leary, " Collaborative problem solving is the process of facilitating and operating in multi-organizational arrangements to solve problems that cannot be solved, or solved easily, by single organizations."⁸ Through the efforts of having members of the towns and county come together, we can see how these different government entities work together with local environmentalist to preserve not only the Pine Barrens, but open space. It has also led to a piece of legislation brought before the New York State Assembly and Senate that would preserve the integrity of clean water on Long Island. However, even though it was not

⁸ Lichtenstein, Mark. "Skill Development: Leadership." Community Planning and Sustainability. State University of New York College of Environmental Science and Forestry, Syracuse. 26 Sept. 2014. Lecture.

passed in the Senate, it is proof that collaborative governance is used for the preservation of the Long Island Pine Barrens and preservation of natural open space.

In these meetings, conflict tends to arise between Towns and the County. For many of these politicians, they are looking out for their constituents and are blind to seeing the “wicked problem.”⁹ Whether it is the preservation of more open space or clean drinking water, conflict will come out of every meeting for the Joint Policy and Planning and Policy Commission. In order to deal with these conflicts, we must balance representation, maintain transparency, accept responsibility, admit mistakes, and share the power. There must be joint fact-finding if this commission is to be successful. Because this commission has representatives from the towns and the county, power has to be evenly distributed so that they can make an unbiased decision that would favor one government entity over the other. Many of these members will try to prove their point even when it is wrong. They must admit their mistakes so that they can be trustworthy and not act falsely. This will help to make the meetings go much smoother and allow for policies and regulation of land use to remain balanced among the towns and keeps the door open for future cooperation. Remember, the Long Island Pine Barrens span over three towns in Suffolk County, the collaboration between these towns will maintain the integrity of the JPPC (Joint Policy and Planning Commission).

Recommendations and Arguments

The Long Island Pine Barrens is a microcosm for what can be done to not only preserve open space but, preserve clean drinking water across Long Island. One of the biggest issues with Long Island is the idea that we must keep building to keep the economy strong. This is a red

⁹ Lichtenstein, Mark. "Sustainable Materials Management (SMM) – A Proxy for Sustainability." Community Planning and Sustainability. State University of New York College of Environmental Science and Forestry, Syracuse. 3 Sept. 2014. Lecture.

herring and is an outlandish attack by major construction and building firms. Building is not a sustainable practice because the island cannot sustain excessive infrastructure. The ability of building companies to influence local land use is a failure of local governments to solve the “wicked problem.” If the problem itself is excessive building, than we could see an extinction of

ecosystems and more importantly, the ecological services they provide. We cannot develop land indefinitely on an island; it is a finite resource where the ecosystem has immeasurable carrying capacity. Long Island can only sustain 3 million people but we are currently building out to 10 million. In an interview with Dick Amper, the

Harmful algal blooms across Long Island

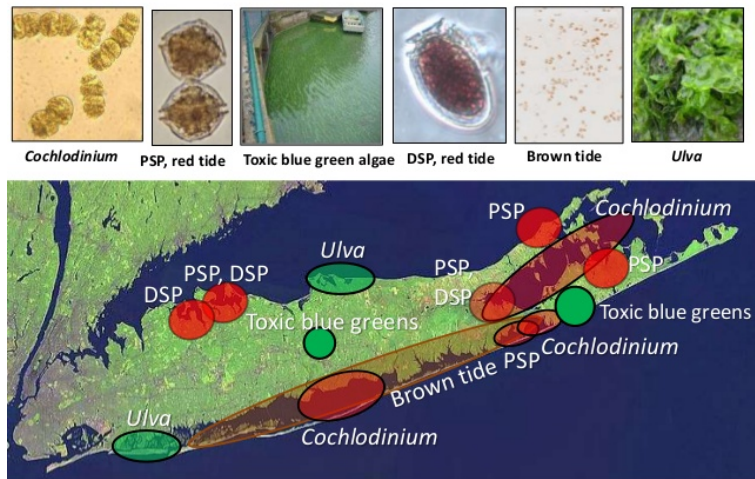


Figure 4

Executive Director of the Long Island Pine Barrens Society, he says that, “we cannot put 10 pounds of shit, in a 3 pound bag.”¹⁰ It is clear that we are exceeding the carrying capacity of Long Island and the ecosystem is suffering. As a result of excessive building, we see an increase of nitrogen pollution which causes algae blooms across Long Island’s marine ecosystems as seen in Figure 4. The excessive building is created by the abuse of the planning process at the town and local level which is known as Home Rule. Because of this building crisis, I would recommend that we require for every 1 acre of developed land, we must preserve 2 acres of open space. So while they continue to build, the amount of open space is doubled in affect shrinking the amount of available land to develop and increasing the preservation of open space and ecosystems on Long Island.

¹⁰ Amper, Richard. "Long Island Pine Barrens." Personal interview. 26 Nov. 2014.

Another major issue we have on Long Island is the excessive pollution of contaminants put into our water. Most of Suffolk County is still using septic systems that allow effluent to go into the groundwater system. These include nitrogen, VOC's, and pesticides. Nitrogen is the most dominant pollutant in our waterways and leads to both environmental and health effects. However, there are ways we can manage this pollutant through either nitrogen removal technology or implementing ways we can reuse the nitrogen so it does not make its way into groundwater aquifers and marine habitats. Scott Horsley is a consultant to the Cape Cod Commission where they have developed ways to limit and prevent contaminants from getting into groundwater. One is to use a Permeable Reactive Barrier which would intercept contaminants in groundwater. He said that there is, "a 90% removal rate of nitrogen in hundreds of remediation projects in Cape Cod."¹¹ This is a recommendation I would also make because of its high efficiency to capture groundwater contaminants. Another one of Mr. Horsley's recommendations was to use fertigation wells that would collect the nitrogen contaminated water and reuse it to water golf courses and other areas that use excess amounts of nitrogen. However, all this would be monitored through adaptive management to reduce uncertainty overtime. Reed Super, an environmental lawyer made the suggestion that we should start shallow well monitoring to monitor what contaminants are being put into groundwater and change discharge standards to limit that effluent being put into the ground.¹² However, this suggestion must meet the process as summarized by the EPA. The water must be monitored, identify and quantify the pollution sources, determine what controls are achievable, allocate pollution reduction

¹¹ Horsley, Scott. "Cape Cod Area Wide Water Quality Management Plan Update." EPA--Long Island Groundwater/Water Quality Meeting. The Nature Conservancy, Cold Spring Harbor. 9 Dec. 2014. Lecture.

¹² Super, Reed. "Wastewater." EPA--Long Island Groundwater/Water Quality Meeting. The Nature Conservancy, Cold Spring Harbor. 9 Dec. 2014. Lecture.

obligations, and continue to monitor.¹³ A recommendation would be to monitor sites where WQS (water quality standards) are exceeded and implement the BAT (best available technology) to monitor and limit pollution.

Septic systems are another issue that increase the amount of contaminants being put into our groundwater aquifer systems. A suggestion made by Walter Dawydiak, Director of the Environmental Quality Division is to introduce and establish a sewer system in Suffolk County. This would not only create jobs, but would allow the proper treatment of nitrogen through a process of anaerobic and aerobic bacteria at sewer treatment facilities. The sewage treatment facilities would help maintain the EPA's discharge standard of nitrogen at or below 10ppm and marine discharge at 3ppm. However, meeting the standard for marine discharge is hard and there is an alternative solution to meeting that standard.

The Harbor Brook CSO O18 Constructed Wetlands Pilot Treatment System is located in Onondaga County and is used to treat overflows from CSO O18 and discharge into Harbor Brook. This is a system where we use vegetation to consume the nitrogen and other contaminants in a way where we can drop the level of these pollutants drastically. This treatment system along Harbor Brook has increased water quality, natural habitat, recreational uses, and educational benefits.¹⁴ We can take what they have used in Onondaga County and apply it to areas that are sensitive to building infrastructure and accommodate a delicate ecosystem. By using native plants and species to consume these contaminants while partnering with sewage treatment facilities, we will create a triage system and see a drastic decline in groundwater contamination and pollution.

¹³ Driesen, David M., Robert W. Adler, and Kirsten H. Engel. *Environmental Law: A Conceptual and Pragmatic Approach*. 2nd ed. New York City, NY: Aspen, 2011. Print.

¹⁴ "Harbor Brook CSO O18 Constructed Wetlands Pilot Treatment System." NYWEA CSO Tour. Onondaga County, Syracuse. 9 Nov. 2014. Address.

The commitment to have clean drinking water and preserve open space has been made by the local communities, local governments, and environmental groups. However, we need a stronger commitment from the EPA in order to solve the issue of groundwater pollution. Holding meetings about addressing Long Island's groundwater quality is a good start, but I would argue for more involvement. Dereth Glance made the statement for a call to "water governance."¹⁵ We have to not address water as some commodity but address its value of sustaining life. Water is the elixir for life and we have to regulate the pollution of this resource. Dereth Glance also said that, "whiskey is for drinking, water is for fighting." We have to fight for our most precious resource. The EPA has imposed minimum standards for addressing these criteria pollutants and if the State is having issues with addressing these minimum standards, we must make them more stringent. These can be made more stringent through developing harsher fines and penalties for excessive pollution and contamination of groundwater. Through creating stronger SIP's (state implementation plans), we can regulate more contaminants and pollutants. The EPA should also step in to assist the preservation of open space like the Pine Barrens to reduce pollution and increase the ecological services provided by nature.

In most cases, the EPA has failed to address the pollution from fertilizers and pesticides coming from agricultural waste. Even though the Clean Water Act does not consider agricultural waste a point source pollution source, there are still ways to contain these contaminants. We could provide an incentive program for using fertigation systems so farms reuse their fertilizers. We could also offer subsidies to farms that use biodegradable and organic ways to grow their crops either without fertilizers or maintain a low-level of pollution. These are recommendations I would make to limit pollution of groundwater aquifers on Long Island.

¹⁵ Glance, Dereth. "International Joint Commission." Community Planning and Sustainability. State University of New York College of Environmental Science and Forestry, Syracuse. 4 Nov. 2014. Lecture.

The Long Island Pine Barrens is a microcosm for the rest of Long Island. It is proof that government entities can work together and come up with well throughout decisions that will preserve open space and protect our groundwater aquifers. The Pine Barrens have offered us the opportunity to make change, and change the behavior of the local communities. Although there is not much open space left to preserve, we can still act and preserve the future. As Benjamin Franklin once said, "When the well's dry, we know the worth of water." The well is still full, so through collaborative governance and perseverance, we can keep the well full.

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