

**COMMUNITY-BASED CLIMATE JUSTICE ASSESSMENT FOR THE
CITY OF BEACON
DUTCHESS COUNTY, NEW YORK***

SEPTEMBER 2012

**PREPARED BY
CITY OF BEACON CLIMATE JUSTICE COUNCIL
HUDSON RIVER SLOOP CLEARWATER, INC.**

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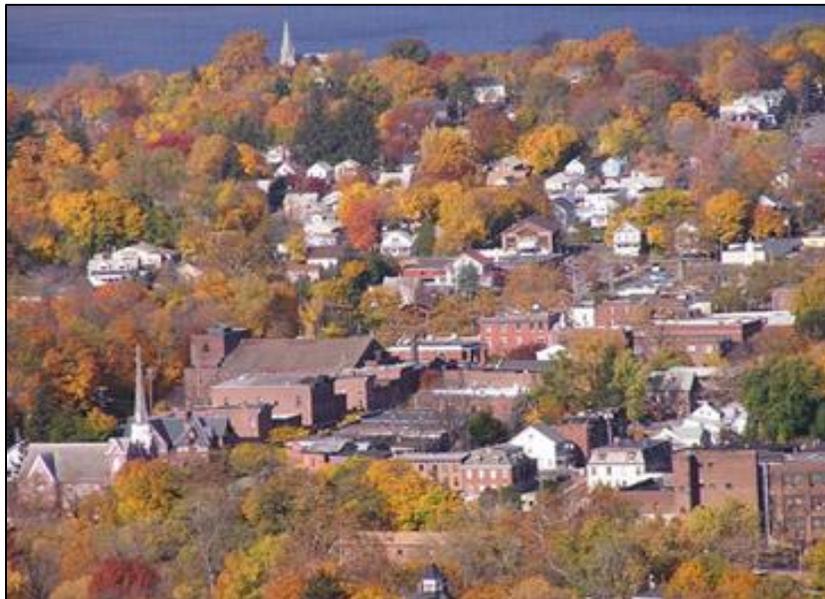
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A. INTRODUCTION

Low income communities and communities of color have historically been overburdened as a result of air pollution from energy-generating facilities, small stationary sources, dense traffic, and water pollution from the disproportionate siting of locally undesirable land use practices.¹ For instance, studies have found that New York City residents in high asthma hospitalization areas were almost twice as likely to be African-American or Hispanic/Latino.²

To minimize further burdening these populations it is important that decisions with the potential to affect environmental justice communities consider the environmental and health impacts various public and private actions will have on these communities. In an effort to develop more robust and effective environmental justice policies and programs it is imperative to identify areas with disproportionately high rates of poverty, unemployment, traffic, and areas with greater concentrations of polluting facilities.³

Recognizing the importance of advancing these principles, Hudson River Sloop Clearwater, Inc. (Clearwater) partnered with Citizens for Equal Environmental Protection of the Hudson Valley (CEEP) to submit an Environmental Justice Grant to NYS DEC to examine various environmental and health impacts in the Beacon area. NYS DEC Office of Environmental Justice funded Clearwater and CEEP \$21,000 to do this research and community outreach in Beacon, a community that has been designated as a Potential Environmental Justice Area (PEJA). (See Attachment 1: NYSDEC Office of Environmental Justice Map of Potential Environmental Justice Areas.)

The project goal was to objectively research multiple sources of pollution, review existing health data, and evaluate if there are any disproportionate impacts on communities of color, ethnicity, or low-income populations. To accomplish this, team members reached out to a wide-range of community stakeholders to collaboratively identify environmental issues and potential health impacts. This group, with the help of technical advisors and

¹ New York State, "Environmental Justice Issue Brief, New York State Energy Plan 2009." December 2009. www.nysenergyplan.com

² Schragger, Thomas F., Asthma and Air Pollution, Toxicology Source. 2009. www.toxicologysource.com/scitox/asthma.html; Miller, K.A., et al., Long Term-Exposure to Air Pollution and Incidence of Cardiovascular Events in Women. 365 New Eng J Med, (2007).

³ New York State, "Environmental Justice Issue Brief," op. cit.

using information obtained from New York State Department of Environmental Conservation, New York State Department of Health, the New York State Department of Education and other sources, identified a wide range of sources of pollution in the designated study area, including transportation impacts.

To complete the environmental justice profile of the City of Beacon the report attempts to assess whether there are any disparate health patterns in communities of color or low income, and identify possible environmental stressors. It was already known, for example, that asthma disproportionately affects low-income communities and communities of color. Between 2003 and 2005, the age-adjusted asthma death rate among non-Hispanic Black New Yorkers and Hispanic New Yorkers was more than 4.6 times higher and 3.8 time higher, respectively, than that among non-Hispanic White New Yorkers.⁴

As part of this project, and as an attempt to further evaluate environmental and health impacts in the community of Beacon, Clearwater and CEEP revised and administered an updated Angler Survey to fishermen and crabbers along the Beacon waterfront and in surrounding communities⁵ (see Section 10). The data gathered during this process explores whether people are eating the fish they catch and sharing their catch with their family or others, and if they are aware of health advisories for various contaminants in fish found in this area of the Hudson River, and of potential adverse effects associated with eating fish caught in the River. This process was aided by Professor Joanna Burger, PhD, MS, of the Environmental and Occupational Health Department of Rutgers University, a major advisor for this section of the project.

This report identifies multiple point and non-point sources of pollution, health data, and an evaluation of any disproportionate impacts on communities of color, ethnicity and low-income populations.

Most importantly, this report is the product of an iterative collaboration with an inclusive task force of community stakeholders that came to call itself the Beacon Environmental

⁴ Department of Health. "New York State Asthma Surveillance Summary Report." 2007. www.health.state.ny.us/statistics/ny_asthma/pdf/2007_asthmasurveillance_summary_report.pdf

⁵ The Angler Survey used during this project is an updated version of the first angler survey developed by Clearwater in 1993.

Justice Council and other interested community members and leaders. As such it depicts Beacon's environmental values and concerns, and recommendations for future actions, including protecting existing assets, mitigating harms, and identifying further research needed. The goal is that the report will provide valuable information that will help Beacon in future planning to protect impacted communities from further pollution burdens or environmental degradation.

B. ENVIRONMENTAL JUSTICE ASSESSMENT

1. ENVIRONMENTAL JUSTICE

The environmental justice movement arose to address the disproportionate injustices of environmental inequity being committed against communities of color and low income. Noticing the trend of toxic wastes, landfills, and other dangers to public health being concentrated in these communities soon led to an assertion that this was a case of environmental racism. The movement helped empower small communities around the world to stand up for their right to equal access to a clean, healthy, and fair environment, and helped these issues gain national attention.

History of the Environmental Justice Movement

The Environmental Justice movement has its values grounded in the struggles of the 1960's Civil Rights Movement ⁶, but was created into a distinct, notable movement only in recent decades. As Dr. Robert Bullard, the father of the movement, says, "(t)he struggle for environmental justice was not invented in the 1990s. People of color, individually and collectively, have waged a frontal assault against environmental injustices that predate the first Earth Day...many of these struggles, however, were not framed as 'environmental' problems- rather they were seen as addressing 'social' problems".⁷ Seen from this perspective, the environmental justice movement is a component of a much larger fight for social equality.

⁶ US Environmental Protection Agency. "Environmental Justice." Retrieved December 22, 2010 from www.epa.gov/environmentaljustice/basics/ejbackground.html.

⁷ Bullard, Robert D. *Confronting Environmental Racism: Voices from the Grassroots*. Boston, MA: South End, 1993. p.9.

One great example of a defining case for the movement is the 1982 community mobilization in Warren County, North Carolina against the state government's decision to dump 6,000 truckloads of toxic PCB-laced soil into their county.⁸ Legitimately worried about a large-scale contamination of their drinking water, many individuals physically stopped the trucks from entering the dumpsite. Though the community didn't succeed in the end, the demonstration of social action for a cause of environmental equity was the first of its kind.

As the Warren County protests gained more attention nationally, interest was stimulated in what demographics were most affected by the siting and construction of hazardous waste landfills. It was only a year later in 1983 that Congress's General Accounting Office published a study that declared that three-fourths of the hazardous waste disposal sites in eight states were localized in low income, African American and Latino communities.⁸

Further solidifying the notion of environmental racism, the United Church of Christ's Commission for Racial Justice, under the leadership of Dr. Ben Chavis, published *Toxic Wastes and Race in the United States* in 1987, the first report to demonstrate the strong correlation between race and the siting of hazardous wastes. As this "Toxic Movement" evolved, the year 1990 saw an even greater solidification of many environmental justice leaders, as they drafted and signed a widely publicized letter to the "Big 10" active environmental organizations, all of which were dominated by upper class whites, accusing them of racial bias in their agendas and representation. As a result, some mainstream environmental organizations adopted environmental justice into their activism and hired several people of color.⁹

The Environmental Justice Movement really spurred its growth with the 1991 First National People of Color Environmental Leadership Summit meeting in Washington D.C. This summit brought hundreds of leaders together from a variety of places to network and strategize. Out of this meeting came two keystone documents of the movement: the "Principles of Environmental Justice" (see Attachment 4) and the "Call to Action". The movement gained more power when President Clinton appointed Dr. Chavis and Dr.

⁸ Skelton, Renee, and Vernice Miller. "The Environmental Justice Movement." (2006). Natural Resources Defense Council. Retrieved December 22, 2010 from www.nrdc.org/ej/history/hej.asp.

⁹ *Ibid.*

Bullard to his Natural Resources transition team, where they were able to develop a strong voice and make environmental justice a top priority. Soon enough, this led to a change in federal policy. In 1994, Clinton signed an executive order that “directed federal agencies to identify and address disproportionately high adverse health or environmental effects of their policies or programs on low-income people and people of color. It also directed federal agencies to look for ways to prevent discrimination by race, color or national origin in any federally funded programs dealing with health or the environment.”¹⁰

Although many cite the Warren County incident as what ignited the movement, it is difficult to pinpoint a particular event as the sole cause. The movement grew organically out of hundreds of local struggles and events and emerged from a variety of other social movements.¹¹ The movement itself has evolved from issues seen primarily from a community perspective to issues that are of national, and even international, concern.

What is Environmental Justice?

The United States Environmental Protection Agency (EPA) and the New York State Department of Environmental Conservation (NYSDEC)¹² define environmental justice as the fair treatment and meaningful involvement of all people regardless of race, color, national origin, or income with respect to the development, implementation, and enforcement of environmental laws, regulations, and policies.¹³ Fair treatment means that no group of people should bear a disproportionate share of the negative environmental consequences resulting from industrial, governmental and commercial operations or policies. Meaningful involvement means that people have an opportunity to participate in decisions about activities that may affect their environment and/or health; the public’s contribution can influence the regulatory agency’s decision; their concerns

¹⁰ Skelton, Renee, and Vernice Miller. 2006, *op. cit.*

¹¹ Center for Community Action and Environmental Justice. "Environmental Justice History." Retrieved December 23, 2010 from www.ccae.org/environmental-justice/environmental-justice-history.html.

¹² The NYSDEC adopted EPA’s definition in 2003 under its Commissioner Policy on Environmental Justice Permitting. DEC. Commissioner Policy 29, “Environmental Justice and Permitting.” 2003. www.dec.ny.gov/docs/permits_ej_operations_pdf/ejpolicy.pdf.

¹³ New York State Department of Environmental Conservation. "Environmental Justice-" (2011). www.dec.ny.gov/public/333.html.

will be considered in the decision making process; and the decision makers seek out and facilitate the involvement of those potentially affected.¹⁴

More specifically, environmental justice includes the right to be free from ecological destruction, the assurance that environmental burdens will be distributed fairly and equally, and equal access to environmental goods, such as food, clean air and water, education, and recreation.¹⁵

1.2 Examples of Environmental Justice in New York

The need for environmental justice is widespread. As mentioned in Section 2.1, many leaders and small grassroots organizations were born out of the environmental justice movement when it started gaining national attention. These include many leaders in the New York area, who founded organizations that are now well established and contribute a valuable role in the environmental justice movement.

WE ACT

West Harlem Environmental Action (WE ACT for Environmental Justice), one of the first environmental organizations in New York State to be run by people of color, and the first environmental justice organization in New York City, was founded and incorporated by Peggy Shepard, its current executive director, in 1988 as the result of local community struggles around environmental threats and resulting health disparities created by institutionalized racism and the lack of social and political capital.¹⁶ WE ACT's goals are to improve environmental health and quality of life in communities of color by fighting against public health threats apparent in communities. This organization strives to work on the community level conducting public health research and stressing an educational approach. Through community organizing and outreach WE ACT was able to mobilize its members to file a lawsuit against the Metropolitan Transit Authority (MTA) for their plans to construct a sixth diesel bus depot in Northern Manhattan, when only one other one existed in Lower Manhattan. Working to reduce fleet emissions and improve practices and conditions in and around bus depots has been an ongoing and

¹⁴ U.S. EPA. Basic Information about Environmental Justice. www.epa.gov/compliance/basics/ejbackground.html

¹⁵ *Ibid.*

¹⁶ We Act For Environmental Justice. "History of WE ACT." (2010). www.weact.org/tabid/180/Default.aspx

increasingly successful effort of WE ACT. WE ACT also addressed the North River Sewage Treatment Plant detrimental emissions, winning a \$1.1 million settlement against the City of New York in 1993. With this victory WE ACT became a leading and important voice in ensuring political accountability and sound governmental regulations in the area.¹⁷

UPROSE

Another active participant in the regional environmental justice movement is UPROSE, the United Puerto Rican Organization of Sunset Park. Currently led by executive director Elizabeth Yeampierre, “UPROSE is dedicated to the development of Southwest Brooklyn and the empowerment of its residents primarily through broad and converging environmental, sustainable development, and youth justice campaigns.”¹⁸ It aims to foster community leadership by promoting activism around a host of environmental justice issues. Its two biggest accomplishments include securing \$1 million for community pollution reduction and organizing a coalition to halt the siting of a 520-megawatt fossil fuel power plant in Brooklyn.

Sustainable South Bronx (SSBx)

Majora Carter established Sustainable South Bronx in 2001 to advocate for the creation of new parks and green spaces and to oppose the construction of a new waste transfer station. The organization now serves to transform the South Bronx and surrounding underdeveloped areas into sustainable living spaces through policy change, community education, green job training, and community greening programs. Sustainable South Bronx was winner of the 2003 United States Department of Clean Energy’s Clean Cities Program and the 2008 winner of the National Conservation Achievement Award from the National Wildlife Federation.¹⁹ One of its notable programs is the Stewardship Training Program that provides urban green collar training and placement programs, which allows communities to step out of poverty and into the expanding field of environmental sustainability and public health. Another issue for the area is the Sheridan Expressway, according to the organization, a poorly planned 1.25-mile redundant highway link, which was built by Robert Moses and has contributed to the blight, disinvestment and public health problems plaguing the South Bronx. SSBx is hoping that this short stretch of

¹⁷ *Ibid.*

¹⁸ United Puerto Rican Organization of Sunset Park. “Welcome to UPROSE.” www.uprose.org.

¹⁹ Sustainable South Bronx. “History and Mission.” www.ssbx.org/index.php?link=2#history.

highway will be removed to reunite South Bronx neighborhoods and allow residents to access the newly restored Bronx River. The South Bronx also handles 25 percent of New York City's waste, with 15 waste transfer stations located within a one-mile radius in this community. SSBx is advocating for the redistribution of waste facilities and the elimination of long-haul diesel trucks by replacing them with more sustainable barge and rail export options.²⁰

New York City Environmental Justice Alliance (NYCEJA)

NYCEJA is an umbrella organization comprised of member groups based in low-income communities throughout New York City. Founded in 1991, NYCEJA became a 501(c)(3) corporation in 1995. It works as a citywide network that links grassroots' organizations, low-income neighborhoods and communities of color in their struggle for Environmental Justice. NYCEJA empowers its member organizations to fight against environmental injustice by coordinating citywide EJ campaigns and by encouraging them to coalesce around specific issues which threaten the ability of low income communities of color to thrive, by supporting the work that local community-based organizations are already doing, and by helping to replicate projects and activities that have proven successful in one or more communities. NYCEJA's board is comprised of executive directors of its member organizations, who set policy and guide program development.²¹

W. Haywood Burns and Arbor Hill Environmental Justice Corporation

In Albany and the surrounding Capital District, the Arbor Hill Environmental Justice Corporation (AHEJC) is the voice for Environmental Justice. AHEJC was established in 1998 through a \$1.6 million federal Resource Conservation and Recovery Act (RCRA) settlement with New York State regarding pollution from the state-owned regional waste incinerator, the ANSWERS Plant. Located in a heavily populated minority neighborhood, it was described by then NY State DEC Commissioner, Thomas Jorling, as "abysmal" -- emitting the highest levels of dioxin and furans in the state: 188 times the state-of-the-art standard on dioxin of 0.10 ng per dry normal cubic meter, as well as the highest lead emissions. When attempts to retrofit the plant failed, it was closed permanently.²² Aaron Mair, founder and president of AHEJC and long-time Sierra Club

²⁰ Loria, Keith. "Sustainable South Bronx: Reimagining a Neighborhood." *The Cooperator*. www.cooperator.com/articles/1916/1/Sustainable-South-Bronx/Page1.html

²¹ NYCEJA. "History and Mission." www.nyceja.org/aboutus.html.

²² Clarke, M. J. *Burning Garbage in the U.S.: Practice vs. State of the Art*. New York: INFORM, 1991.

Atlantic Chapter president, used the settlement to create two nonprofit community service organizations: AHEJC and the W. Haywood Burns Environmental Education Center, both of which are assets to the surrounding community. They actively advocate for environmental health, the rehabilitation of green spaces, and political accountability. Made up of mostly local community members, Arbor Hill EJ Corp. is a member of the White House Council on Environmental Quality.²³ Working closely with the W. Haywood Burns Environmental Education Center, much has been done to clean up the Tivoli Preserve and the Patroon Creek Watershed. Air pollution, exposure to lead, brownfields, toxic waste, pesticides, and water pollution are all areas of concern for the AHEJC, which works to educate the inner city community about pollution-related diseases and to establish links for care.

1.3 Environmental Justice and Human Rights

The Environmental Justice movement shares close ties with the fight for human rights. Many concepts in each movement parallel each other and possess the same core values. The Universal Declaration of Human Rights (Declaration), proclaimed in 1948 by the United Nations General Assembly, addresses the necessity to promote positive social progress and to hold all human beings to a higher standard in their obligation to show humane treatment and equitable regard for others.

In respect to environmental justice, the Declaration asserts the requirement of total equality of all people and the opportunity all should enjoy to equal access to an adequate standard of living. As such, Article 2 states that “(e)veryone is entitled to all the rights and freedoms set forth in this Declaration, without distinction of any kind, such as race, colour, sex, language, religion, political or other opinion, national or social origin, property, birth or other status(...)” and Article 25 declares, “(e)veryone has the right to a standard of living adequate for the health and well-being of himself and of his family(...)”²⁴ This fundamental Declaration set a new standard for conduct on an international, national, and community level. Many of its values are mirrored in subsequent declarations, including the 17 Principles of Environmental Justice.

²³ Wiser Earth- The Social Network for Sustainability. “Arbor Hill Environmental Justice Organization.” www.wiserearth.org/organization/view/9ad859b3be242f5be9a095426fb1b0a6.

²⁴ Welcome to the United Nations: It's Your World. "The Universal Declaration of Human Rights." Retrieved December 23, 2010 from www.un.org/en/documents/udhr/index.shtml.

The 17 Principles, developed during the First National People of Color Environmental Leadership Summit, have served as a defining document for the growing grassroots movement for environmental justice.²⁵ (See Attachment 4). The document takes the human rights argument and connects it wholeheartedly to a human debt to and reverence for Mother Earth. It stresses that not only should each person bear the burden of environmental wastes equally, but also that we should strive to altogether reduce the impact we have on the environment as a species. This includes the right to be free from ecological destruction and equal access to the environmental goods of clean air, land, water, and food. Most importantly, to further confirm the intimate link between environmental justice and human rights, Principle 10 states that “(e)nviro(n)mental (j)ustice considers governmental acts of environmental injustice a violation of international law, the Universal Declaration On Human Rights, and the United Nations Convention on Genocide.”²⁶

Both the definition of environmental justice, referenced in Section 2.2, and the 17 Principles emphasize the disproportionate negative environmental impacts on communities of color and low income. They call for a need to address this environmental racism by reducing and conserving our use of earth’s resources and by equally distributing the results of our uses, both beneficial and destructive, to all peoples collectively.

2. CITY OF BEACON: HISTORY, DEMOGRAPHICS, AND COMMUNITY CHARACTER

2.1 History

Beacon, New York is a small city located in the southwestern part of Dutchess County. The total area of Beacon is 4.9 square miles, with 4.8 square miles of it being land, and just 0.1 square miles being water. The city is located 138 ft. above sea level, and based on the 2010 census, the population of Beacon is 15,541. Beacon, NY is bordered by Fishkill to the south, Wappinger Falls to the North and is 20 minutes south of Poughkeepsie NY (Dutchess County capital). Many of the residents of Beacon consider it to be a very historical city with a rich history. In recent years, Beacon has experienced

²⁵ First National People of Color Environmental Leadership Summit held on October 24-27, 1991, Washington DC.

²⁶ First National People of Color Environmental Leadership Summit, 17 Principles of Environmental Justice, Principle 10. October 24-27, 1991, Washington DC.

an artistic and commercial rebirth with the opening of one of the world's largest contemporary art museum: Dia: Beacon, as well as providing one of the largest environmental institutions in NY: The Beacon Institute of Rivers and Estuaries. Beacon is also home to one of at least three operating "dummy-lights" in the US.

Beacon first became an incorporated city in 1913, when the two villages of Fishkill Landing and Matteawan, as well as the hamlet of Glenham from the town of Fishkill. The area which encompassed present-day City of Beacon was originally part of an 85,000 acre patent given to two individuals: Francis Rombout and Gulian Verplanck in 1683.²⁷ The two villages that formed in the area for called Fishkill Landing, a port and; Matteawan, a manufacturing center of Dutchess County in that time. When the two communities of Fishkill Landing and Matteawan merged, they formed a committee and adopted the Charter of Grand Junction, Colorado for the new city. Originally, the committee had decided on adopting "Melzingah", however after a second round of votes were taken, Beacon was chosen, in honor of the famous fires which had burned atop Fishkill Mountain. These fires warned General George Washington, who was stationed across the river in Newburgh, of British ship and troop movements during the Revolutionary War. During the Revolutionary War, the area which would become Beacon had played various important roles such as serving as a fort and signaling post as well as manufacturing war supplies for the Continental Army.

During the 1880s, a couple of workmen had discovered immense deposits of clay at Denning's Point. Ramsdell Enterprises then bought the site for its new brickyard. The new company was called Denning's Point Brick Works and last for 50 yrs. It was also during this time that the area become known as the "The Hat Making Capital of the US", with nearly 500 small factories built.

In the 1960s, with urban renewal and then in the 1970s with the economic downturn, many of the historical buildings were left to ruin, and many of the factories in Beacon shutdown. However in the 1990s, a new artistic and commercial rebirth occurred in the city with the opening of Dia: Beacon, as well as The Rivers and Estuaries Center on Dennings Point.

²⁷ Beacon, New York, "History of Beacon, NY" <http://www.howlandculturalcenter.org/beacon.php>

In addition to Beacon’s large list of historical sites, Beacon NY is home to Mount Beacon Incline Railway, which would take residents, and tourists from the base of Wolcott Avenue to the top of the mountain, where the riders would either enjoy the Beaconcrest Hotel and/or Casino, or enjoy the natural beauty of the surrounding environment. It was built as a joint venture by the Otis Elevator Company and Mohawk Construction. The Mount Beacon Incline Railway was opened on Memorial Day 1902 and would remain open until 1978 when it ceased operations due to financial problems. It was added to the National Register of Historic Places in 1982; however a massive fire had destroyed many of the buildings the following year. The Mount Beacon Incline Railway Restoration Society is working to rebuild the railroad and restore service by 2013, the centennial of the City of Beacon.²⁸



2.2 Demographics

Beacon, NY’s population as of 2010 census was estimated to about 15,541, compared to the 2000 census which placed the city’s population at 13,808. The artistic and commercial rebirth that has occurred in Beacon in the 1990s has made the city livelier, allowing for many family owned businesses such as bars, restaurants to take over vacant factory buildings for themselves.²⁹

The following tables show the population information for the City of Beacon as of 2010.

Table 1: *Population by Sex/Age*

Male	8,263
Female	7,278
Under 18	3,112
18 & over	12,429

²⁸ *History of Mount Beacon Incline Railway History*. (2011, October 16). Retrieved from Mount Beacon Incline Railway: [http://www.inclinerailway.org/history construction.htm](http://www.inclinerailway.org/history%20construction.htm)

²⁹ U.S. Census Bureau, Demographic Profile of Beacon City.

Male	8,263
20 - 24	936
25 - 34	2,260
35 - 49	3,874
50 - 64	3,147
65 & over	1,824

Source: U.S. Census Bureau

Table 2: Population by Ethnicity

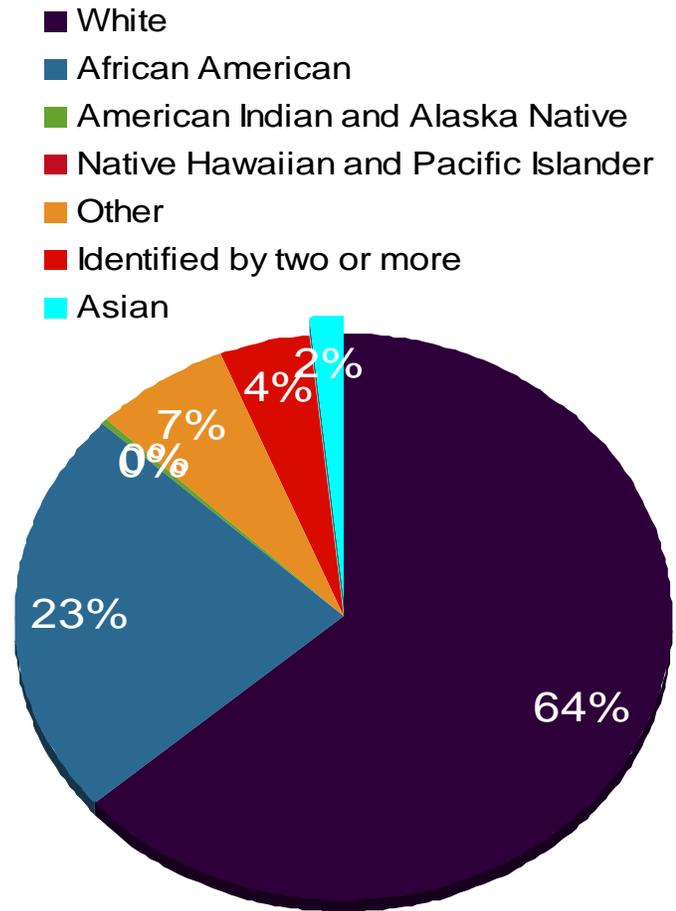
<i>Hispanic or Latino</i>	3,219
Non-Hispanic or Latino	12,322

Source: U.S. Census Bureau

Table 3: Population by Race

<i>White</i>	9,887
African American	3,612
Asian	253
American Indian and Alaska Native	54
Native Hawaiian and Pacific Islander	0
Other	1,039
Identified by two or more	696

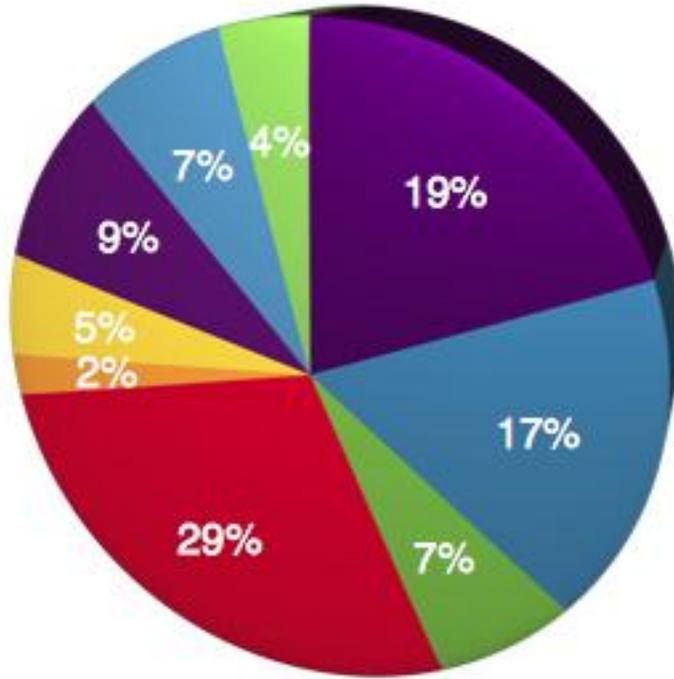
Table 4: Population Distribution by Race - 2010



Source: U.S. Census Bureau

Table 5: Population Distribution by Sex/Age

- Male ● Female ● Under 18 ● 18 & Over ● 20 - 24 ● 25 - 34
- 35 - 49 ● 50 - 64 ● 65 & over



2.3 Community Character

Beacon is a relative small city with a population of 15, 541. There are many well-known historical sites located around the area. In recent years, Beacon has seen large amount of artistic and commercial rebirth and as a result has seen a larger increase in non-white population.

Beacon was once known as the “Hat Making Capital of the US” and also was home to Denning’s Point Brick Works, which was of the largest brickwork companies in NY. Beacon was also home to many famous individuals such as Robert Montgomery who was a famous actor that served as the head of the Screen Actors Guild in 1935 and 1946. Another famous individual was James Forrestal who was the Secretary of the Navy from 1944-1947 and Secretary of Defense from 1947-1949. Beacon is also home

to many clubs and festivals such as: The Beacon Sloop Club, which promotes recreation, sound ecological practices, and environmental awareness of the Hudson River. It is also home to the Pumpkin Festival, Jazz Festival, Beacon Day, and local activities that are organized by the local schools.

3. ACTUAL AND POTENTIAL POLLUTION SOURCES

3.1 Air Pollution

Air pollution comes from many different sources such as factories, power plants, dry cleaners, auto repair shops, cars, buses, trucks and even windblown dust and wildfires threatening the health of human beings, trees, lakes, crops, and animals.³⁰ This section of the Community-Based Environmental Justice Report identifies some of the most prevalent sources of air pollution in the Beacon area. In an attempt to depict a clear picture of some of the effects associated with the emissions these facilities release into the ambient air, it also includes a section on the air pollutants commonly associated with the identified sources and their known consequences on human health and the environment.

Although air quality issues have been the subject of public and private nuisance actions since the nineteenth century, state legislation to safeguard air quality was, until recently, rudimentary. Public concern in the 1960s over industrial air pollution and urban smog from motor vehicle exhaust became serious enough to attract the attention of Congress.³¹

Today, air quality in most areas of New York meets standards that are much more rigorous than those of 1970. As new information on the health and environmental effects of air pollution has become available, new state and federal standards have been established and early limits tightened to protect health and environment. By requiring the use of effective pollution control technology and enforcing compliance with permit conditions, DEC's air permitting program has been a vital means of reducing emissions to meet ever more stringent standards.³²

³⁰ US Environmental Protection Agency. "Air." www.epa.gov/ebtpages/air.html.

³¹ Weinberg & Reilly. "Understanding Environmental Law". 2007. Second Ed, p 77.

³² New York State Department of Environmental Conservation. "Air-NYS DEC." www.dec.ny.gov/chemical/281.html

Although national air quality has improved over the last 20 years, many challenges remain in protecting public health and the environment from air pollutants.

Regulatory Framework

For nearly four decades, state and federal governments have controlled the emission of pollutants through permits with enforceable requirements, and have measured and monitored pollution levels in the air.³³ Under the Clean Air Act (CAA) of 1970, the EPA sets limits on how much of a pollutant is allowed to be released into the air anywhere in the United States.³⁴ At the state level NYS DEC is the agency that carries out both the state and federal air pollution control and monitoring programs.³⁵

New York's air permitting program identifies and controls sources of air pollution. These sources range in size from large industrial facilities and power plants to small commercial operations, such as dry cleaners and auto repair shops. While smaller sources of air pollution are covered by NYS DEC's air source registration program, most large sources require full air pollution permits.³⁶

The two most common types of permit for air contamination sources described in 6 NYCRR Part 201 are: Air State facility (ASF) permits and Title V facility (ATV) permits. The first type of permits, ASF, are issued to facilities that are not considered to be major (as defined in the department's regulations), but that meet the criteria of 6 NYCRR Subpart 201-5. These are generally large facilities with the following characteristics:

- (a) actual emissions exceed 50 percent of the level that would make them major, but their potential to emit as defined in 6NYCRR Part 200 does not place them in the major category;
- (b) they require the use of permit conditions to limit emissions below thresholds that would make them subject to certain state or federal requirements;
- (c) they have been granted variances under the department's air regulations, or

³³ *Ibid.*

³⁴ US Environmental Protection Agency, "Air," *op. cit.*

³⁵ New York State Department of Environmental Conservation, "Air-NYS DEC," *op. cit.*

³⁶ *Ibid.*

(d) they are new facilities that are subject to New Source Performance Standards (NSPS) or that emit hazardous air pollutants.³⁷

The second type of permit, Title V permits, are issued to facilities considered to be “major sources” under applicable law.³⁸ A “major source” has been construed to include any stationary source or group of stationary sources located within a contiguous area and under common control that emits or has the potential to emit considering controls, in the aggregate, 10 tons per year or more of any hazardous air pollutant or 25 tons per year or more of any combination of hazardous air pollutants.³⁹ As per applicable law, the Administrator of the EPA may establish a lesser quantity, or in the case of radionuclides different criteria, for a major source than that specified in the previous definition, on the basis of the potency of the air pollutant, persistence, potential for bioaccumulation, other characteristics of the air pollutant, or other relevant factors.⁴⁰

National Ambient Air Quality Standards (NAAQS) and Criteria Pollutants

The Clean Air Act (CAA) requires EPA to set National Ambient Air Quality Standards (NAAQS) for six common air pollutants. These commonly found air pollutants or criteria pollutants are found all over the United States. Of the six pollutants, particle pollution and ground-level ozone are the most widespread health threats.⁴¹ These pollutants are commonly called “criteria” air pollutants because EPA regulates them by developing human health-based and/or environmentally-based criteria, science-based guidelines, for setting permissible levels. The set of limits based on human health are called primary standards. Another set of limits intended to prevent environmental and property damage are called secondary standards.⁴²

The six criteria pollutants and some of the consequences of exposure to these pollutant identified by EPA are listed below.⁴³

³⁷ New York State Department of Environmental. “Air Facility Permits and Registrations.” www.dec.ny.gov/chemical/8569.html

³⁸ 42 U.S.C. 7412. 2010 and 6 NYCRR Subpart 201-6.

³⁹ New York State Department of Environmental, “Air Facility Permits and Registrations,” *op. cit.*.

⁴⁰ 6 NYCRR Subpart 201-6. 2010.

⁴¹ The United States of America Environmental Protection Agency. “Six Common Air Pollutants.” 17 Nov. 2009. www.epa.gov/air/urbanair/.

⁴² *Ibid.*

⁴³ *Ibid.*

- Carbon monoxide, exposure to which reduces central nervous system function and has cardiovascular impacts;⁴⁴
- Lead, which accumulates in bones, blood, and soft tissue, can have neurological, cardiovascular, autoimmune, and developmental impacts, especially in young children;⁴⁵
- Ground level ozone, which is smog caused from a combination of cars, industrial sites, and chemicals. Exposure to these pollutants can cause inflammation of the lungs, reduced lung function, and respiratory symptoms such as a cough, chest pain, and shortness of breath;⁴⁶
- Particulate matter, which is defined by the EPA as "a complex mixture of extremely small particles and liquid droplets,"⁴⁷ causes increased risk of mortality from heart and lung diseases, as well as extensive respiratory impacts and decreased lung function, particularly in children and adults with asthma;⁴⁸
- Nitrogen dioxide, which is associated with decreased lung function, increased respiratory symptoms or illness, and increased symptoms in children with asthma;⁴⁹ and
- Sulfur dioxide, which causes symptoms such as wheezing, chest tightness, or shortness of breath, and, similar to many of the previous pollutants, poses a particular threat to those with asthma.⁵⁰ These pollutants are known as "criteria pollutants," because the EPA uses health indicators to set their permissible atmospheric levels.⁵¹

Non-Attainment and Attainment Zones

Section 107(d)1 of the CAA governs the designation process by which the Governor of each State submit to the Administrator a list of all areas, or portions thereof, in the State,

⁴⁴ The United States of America Environmental Protection Agency. "Six Common Air Pollutants, Carbon Monoxide Health and Environmental Impacts of CO." 17 Nov. 2009. www.epa.gov/air/urbanair/co/hlth1.html.

⁴⁵ The United States of America Environmental Protection Agency. "Lead in Air, Health and Environment." 17 Nov. 2009. www.epa.gov/air/lead/health.html.

⁴⁶ The United States of America Environmental Protection Agency. "Ground-level Ozone, Health and Environment." 17 Nov. 2009. www.epa.gov/air/ozonepollution/health.html.

⁴⁷ The United States of America Environmental Protection Agency. "Particulate Matter." 28 Dec. 2009. www.epa.gov/oar/particlepollution/.

⁴⁸ The United States of America Environmental Protection Agency. "Particulate Matter, Health and Environment." 9 May 2008. www.epa.gov/air/particlepollution/health.html.

⁴⁹ The United States of America Environmental Protection Agency. "Nitrogen Dioxide, Health." 29 June 2009. www.epa.gov/air/nitrogenoxides/health.html.

⁵⁰ The United States of America Environmental Protection Agency. "Sulfur Dioxide, Health." 17 Nov. 2009. www.epa.gov/air/sulfurdioxide/health.html.

⁵¹ The United States of America Environmental Protection Agency. "Six Common Air Pollutants," *Op. cit.*

to designate as non-attainment, attainment or unclassifiable. For these purposes the CAA defines a non-attainment zone as any area that does not meet or that contributes to ambient air quality in a nearby area that does not meet the national primary or secondary ambient air quality standard for the pollutant. An attainment zone is any area, other than an area identified as a non-attainment area, that meets the national primary or secondary ambient air quality standard for the pollutant. Additionally, the CAA also defines an unclassifiable zone as any area that cannot be classified on the basis of available information as meeting or not meeting the national primary or secondary ambient air quality standard for the pollutant.⁵²

3.2 Industrial Facilities in Beacon and Adjacent Areas as Sources of Air Pollution

Drycleaners

Dry cleaning facilities release hazardous waste into the air in the form of perchloroethylene (perc). The 6NYCRR Part 232 Regulations of 1997 were enacted to reduce and contain solvent vapors by instituting standards for machinery, ventilation systems, record-keeping, hazardous waste and waste water management, compliance inspections, staff certification, and public access to information. To account for more recent developments in production practices, process, and control technologies the EPA enacted the national emission standards for hazardous air pollutants (NESHAP) in 2006 to control perc emissions.⁵³ Revisions to NESHAP have shifted regulatory efforts from a chemical-by-chemical approach to one that is based on the maximum achievable control technology (MACT). The MACT standards, established under Title III of the 1990 Clean Air Act Amendments, include both emission and operating standards that “achieve the maximum degree of reduction in emissions of the hazardous air pollutants taking into consideration the cost of achieving such emission reduction, and any non-air quality health and environmental impacts and energy requirements.”⁵⁴ The MACT standards limit the emissions of: dioxins and furans; mercury; semivolatile metals; low volatile metals; particulate matter; hydrogen chloride and chlorine gas; and organic hazardous

⁵² United States Environmental Protection Agency. “Attainment and Non-attainment areas.” www.epa.gov/OCEPAt/terms/terms.html

⁵³ New York State Department of Environmental Conservation. www.dec.ny.gov/chemical.

⁵⁴ NYS DEC <http://www.epa.gov/apti/course422/apc4e.html>

air pollutants. Perchloroethylene released in dry cleaning facilities is regulated under section 63 of the MACT standards.⁵⁵

There are several dry cleaning facilities in the city of Beacon.

AC Friendly Dry Cleaner

AC Friendly Dry Cleaner is a privately operated drycleaner and laundry service located on 285 Main Street since 2002. It is regulated under MACT Section 63 of NESHAPS and has a minor air polluter permit to emit hazardous air pollutants (HAPS) and tetrachloroethylene (perchloroethylene). In June of 2005, AC Friendly Dry Cleaner was found in violation of section 201.4 for lack of minor facility registrations. AC Friendly Dry Cleaner is no longer in business.

Main Clean

Main Clean is a privately operated drycleaner and laundry service located on 347 Main Street. It is regulated under MACT Section 63 of NESHAPS and has a minor air polluter permit to emit hazardous air pollutants (HAPS) and tetrachloroethylene (perchloroethylene)

Peoples Cleaners

Peoples Cleaners is located on 352 Main Street and is a privately owned and operated drycleaner.

Other Facilities

American Burnish Inc.

American Burnish Inc is an art restoring company located on 291 Main Street. Their work is geared toward an extensive clientele of architects, interior designers, and fine artists and focuses on custom gold and silver leafing on glass, wood, metal, and fabric. The facility has a RCRA permit for the emission of hazardous waste on site.

⁵⁵ <http://www.epa.gov/epawaste/hazard/tsd/td/combust/finalmact/faqs.htm>

Beacon City School District

The Beacon City School District has locations on 72 Fishkill Avenue, 60 South Avenue, Matteawan Road Rombout Perplank, and Liberty & Grove Street. The various location all hold RCRA permits.

Beacon Correctional Facility

The Beacon Correctional Facility is a minimum security female state prison located on Asylum Road. The Correctional Facility holds a Minor Air Polluter permit and a National Pollution Discharge Elimination System permit. According to the permit this facility is owned/operated by the state government.⁵⁶

Beacon Housing Authority

The City of Beacon Housing Authority (BHA) located on 1 Forrestal Heights was created in 1969 to provide affordable housing to eligible individuals and family within the community. The BHA operates 245 public housing apartments and provides Section 8 rental assistance to over 300 families in the Beacon area. The facility has a RCRA permit.

Beacon Self Storage

Beacon Self Storage is a storage facility located on 39 Front Street. The facility has a RCRA permit.

Beacon Terminal

Beacon Transportation Terminal is located on South & Tioranda Avenue Block 16 in Beacon. The facility has a RCRA permit.

Cervone Auto Body Inc.

⁵⁶ EPA Plant ID: 110019673646

Cervone Autobody Inc. is a full service autobody and auto repair facility on 207 Fishkill Avenue. The facility holds a RCRA permit and an FIS permit 3-1302-00030 for the production of hazardous air pollution.

Chemprene Inc.

Chemprene Inc., located on Fishkill Avenue, Beacon, is subject to a Title V operating air permit. The facility is in an attainment zone for all the criteria pollutants except for ozone, which is in a moderate non-attainment status.⁵⁷

The facility manufactures lightweight conveyor belts and rubber (polymer) coated fabrics. It is comprised of raw product mixing mills, five spreader/oven



Chemprene, Inc. located in Beacon. Photo provided by chemprene.com

coating lines and two 20.92 MMBTU/hr boilers capable of firing natural gas or #4 fuel oil.⁵⁸ According to the Permit Review Report, there are several additional emission points at the facility for activities including toluene storage, solvent and rubber mixing vessels and curing/vulcanizing ovens; in addition, a catalytic oxidizer is used for the control of VOCs from the solvent-related coating lines.

Chemprene Inc. is an existing major facility based on potential emissions for Sulfur Dioxide exceeding 100 tons per year.⁵⁹

Dia Center for the Arts

Dia Center for the Arts in Beacon, NY was started by the Dia Foundation in 2003 as a museum to house permanent collections of major works of art from the 1960s to the present. Located on the Hudson River in Beacon, New York, Dia:Beacon occupies a nearly 300,000-square-foot historic printing factory. Dia:Beacon occupies a former Nabisco (National Biscuit Company) box printing facility built in 1929 and designed by Nabisco's staff architect Louis N. Wirshing, Jr. In the building's most recent owner,

⁵⁷ New York Department of Environmental Conservation. Permit Review Report. Permit ID: 3-1302-00017/00017 Renewal Number: 2 12/07/2010

⁵⁸ *Ibid.*

⁵⁹ *Ibid.*

International Paper, donated the property to Dia in 1999.

The former factory is built of brick, steel, concrete, and glass, and is considered a model of early twentieth century industrial architecture. Design elements include broad spans between supporting columns, and more than 34,000-square-feet of skylights



which create an exceptional environment for viewing works of contemporary art in natural light. The facility holds a RCRA permit for the use of a small generator.

Dorel Hat Co Inc.

Dorel Hat Co Inc., located on 1 Main Street is a wholesale hat manufacturer and merchant. The facility has a RCRA permit.

Dutchess Publishing Co Inc.

Dutchess Publishing Co. Inc. is a commercial printing company located on 382 Main Street. The facility on Main Street has a RCRA permit.

Freedom Ford Inc.

Freedom Ford Inc is located on Fishkill Avenue and is a 3rd generation family owned business in Beacon, NY. It has been selling Ford cars, trucks and SUVs for the past 50yrs in the Hudson Valley. The facility holds a RCRA permit.

Healey Hyundai Inc.

Healey Hyundai Inc is part of the 11 dealerships owned under the Healey Brothers family. The dealership, located on 360 Fishkill Avenue holds a RCRA permit.

Healey Chev Geo Old Inc.

Healey Chev Geo Old Inc is part of the 11 dealerships owned under the Healey Brothers family. The dealership is located next door to the other Healey car dealerships on Fishkill Avenue and also holds a RCRA permit.

Jerrys Auto Body

Jerrys Auto Body is located on 14 Commerce Street. The facility specializes in auto body and collision repair. The facility has a RCRA permit.

Mechtronics Inc.

Mechtronics Inc. is a manufacturing facility on 511 Fishkill Avenue. The company specializes in manufacturing and assembling Gillette, Kodak, and HP, and Dr. Scholls. The facility has a RCRA permit.

New York State Dept. of Correction Fishkill Correctional Facility

The New York State Department of Correction-Fishkill Correctional Facility is located on Prospect Street. The facility holds a RCRA permit for the use of a small generator.

NYS Bridge Authority Newburgh Beacon

The NYS Bridge Authority is located on the Bridge Plaza on I-84. The facility holds a RCRA permit for the use of a small generator.

Palisi Auto Body Inc.

Palisi Auto Body Inc., located on 5 West Main Street is a full service auto body and collision repair facility. Palisi Auto Body has a RCRA permit as well as a minor air polluter permit regulated under MACT Section 63 of NESHAPS to emit paint strip and miscellaneous surface coating pollutants.

S S Premises C-O Shell Oil Co

S S Premises C-O Shell Oil Co is located on 385 Main Street in Beacon.

Sargent School Beacon City School District

Sargent School Beacon City School District is located on 445 Wolcott Avenue. The school facility has a RCRA permit.

Shell

Shell is a full service gas station located on Main Street and Fishkill Avenue. The facility holds a RCRA permit for minor pollutants.

St Francis Hospital

St Francis Hospital is located on 60 Delavan Avenue in Beacon. The hospital is a substituent of St Francis Hospital in Poughkeepsie and functions as a drug rehabilitation and detox center. The facility holds a RCRA permit for minor pollutants.

Sunoco Service Station

The two Sunoco Service Stations in Beacon are located on 357 Main Street and on the corner of Prospect Street and Wolcott Avenue. Both locations hold RCRA permits and function as minor auto body and car maintenance facilities.

Texaco EHS Division

The facility submitted information to TSCA reports but there is no information online about the chemicals reported.

Transportation Dept. Beacon City School Dist.

The Transportation Department of the Beacon City School District is located on Route 9D. The facility has a RCRA permit.

Wikoff Color Corp.

Wikoff Color Corporation, located on 125 Wolcott Avenue, specializes in supplying high quality inks, coatings and varnishes to the graphic arts industry. The facility holds a RCRA permit for the emission of minor pollutants.

3.4 Solid Waste Storage Facilities as Sources of Air Pollution

Three Star Anodizing

Three Star Anodizing is an inactive hazardous waste disposal site on 1 East Main Street in Beacon, NY. The site once facilitated metal electroplating, plating, polishing, anodizing and coloring. The facility held a RCRA permit as well as a FIS minor air polluter permit. In addition, Three Star Anodizing had a Toxic Release Inventory System (TRIS) permit for the emission of chemicals nitric acid, phosphoric acid, sodium hydroxide, and sulfuric acid into Fishkill Creek and to other publicly owned treatment works (POTW).

In 2009 The New York State Department of Environmental Conservation in consultation with the NY State Department of Health decided that the vacant facility was a significant threat to both human health and the environment due to years of soil, groundwater, and sediment contamination.⁶⁰

Tuck Industries Inc.

Tuck Industries is an inactive hazardous waste site located on Tioranda Avenue. The facility holds a RCRA permit as well as an FIS air polluter permit and ICIS permit for the use of adhesives and sealants. Furthermore Tuck Industries has a TRI permit for the emission of toluene, an organic solvent

3.5 Traffic

Cars, buses and trucks are a big source of air pollution. When their engines burn petroleum-based fuels (gasoline or diesel), they produce large amounts of chemicals that are emitted in engine exhaust. In addition, some of the gasoline used by engines

⁶⁰ http://www.dec.ny.gov/docs/remediation_hudson_pdf/314058r.pdf

vaporizes into the air without having burned, and this also creates pollution.⁶¹

Approximately 16% of U.S. housing units are located within 300 ft of a major highway, railroad, or airport (approximately 48 million people). This population likely includes a higher proportion of non-white and economically disadvantaged people.⁶²

The following are some of the main pollutants produced by road traffic: nitrogen oxides, carbon monoxide, volatile organic compounds (VOCs), fine PM and ground level ozone. Exposure to these contaminants may cause adverse impacts to humans and the environment (see Section 4.6).

One issue that has been identified by community members as a priority is vehicle idling. Diesel exhaust particulate matter (PM) is a toxic air contaminant. Diesel engines contribute to fine particulate matter (PM 2.5) air quality problems. Those most vulnerable are children whose lungs are still developing and the elderly who may have other serious health problems.⁶³ Residents of Beacon have also been critical of the aesthetic and safety issues caused by the volume of truck traffic passing through their neighborhoods.

3.6 Environmental and Health Effects Associated with Exposure to Air Pollutants Produced by Local Sources

This section of the report identifies some of the air pollutants released to the ambient air by the facilities identified above.. It also identifies some of the environmental and health effects commonly associated with the selected contaminants

Nitrogen Oxides (NOx)

These chemicals are produced by industrial processes and vehicle engines. When engines burn fuel, the nitrogen present in the air and nitrogen compounds found in fossil fuels produce NOx. Nitrogen oxides can irritate airways, especially lungs.

⁶¹ Health Canada. "The Health Effects of Traffic-Related Air Pollution." www.hc-sc.gc.ca/hl-vs/iyh-vsv/environ/traf-eng.php#th.

⁶² U.S. Environmental Protection Agency. "Nitrogen Dioxide: Health." (2010). www.epa.gov/air/nitrogenoxides/health.html.

⁶³ Air Quality Department. "Consequences of Diesel Idling" www.maricopa.gov/aq/divisions/compliance/air/Diesel_Idling/ConsequencesOfDieselIdling.aspx

NO_x react with ammonia, moisture, and other compounds to form small particles. These small particles penetrate deeply into sensitive parts of the lungs and can cause or worsen respiratory disease, such as emphysema and bronchitis, and can aggravate existing heart disease, leading to increased hospital admissions and premature death.⁶⁴ Nitrogen dioxide (NO₂), one of several highly reactive nitrogen oxides,⁶⁵ is a reddish-brown toxic gas that has a characteristic sharp, biting odor and is a prominent air pollutant.

While EPA's National Ambient Air Quality Standard (see Section 4.2) covers this entire group of NO_x, NO₂ is the component of greatest interest and the indicator for the larger group of nitrogen oxides. NO₂ forms quickly from emissions from cars, trucks and buses, power plants, and off-road equipment. In addition to contributing to the formation of ground-level ozone, and fine particle pollution, NO₂ is linked with a number of adverse effects on the respiratory system.⁶⁶

NO₂ concentrations in vehicles and near roadways are appreciably higher than those measured at monitors in the current network. In-vehicle concentrations can be 2-3 times higher than measured at nearby area-wide monitors.⁶⁷

Near-roadway (within about 50 meters) concentrations of NO₂ have been measured to be approximately 30 to 100% higher than concentrations away from roadways. Individuals who spend time on or near major roadways can experience short-term NO₂ exposures considerably higher than measured by the current network.⁶⁸

Current scientific evidence links short-term NO₂ exposures, ranging from 30 minutes to 24 hours, with adverse respiratory effects including airway inflammation in healthy people and increased respiratory symptoms in people with asthma. Also, studies show a connection between breathing elevated short-term NO₂ concentrations, and increased visits to emergency departments and hospital admissions for respiratory issues, especially asthma.⁶⁹

⁶⁴ *Ibid.*

⁶⁵ Other nitrogen oxides include nitrous acid and nitric acid.

⁶⁶ U.S. Environmental Protection Agency. "Nitrogen Dioxide." www.epa.gov/air/nitrogenoxides/.

⁶⁷ U.S. Environmental Protection Agency. "Nitrogen Dioxide: Health," *op. cit.*.

⁶⁸ *Ibid.*

⁶⁹ *Ibid.*

Emissions that lead to the formation of NO₂ generally also lead to the formation of other NO_x. Emissions control measures leading to reductions in NO₂ can generally be expected to reduce population exposures to all gaseous NO_x. This may have the important co-benefit of reducing the formation of ozone and fine particles both of which pose significant public health threats.⁷⁰ (See Ozone and PM environmental and health effects below)

Volatile Organic Compounds (VOCs)

VOCs are emitted as gases from certain solids or liquids. These are a large group of organic chemicals that include any volatile compound of carbon (excluding carbon monoxide, carbon dioxide, carbonic acid, metallic carbides or carbonates, and ammonium carbonate) and that participate in atmospheric photochemical reactions.⁷¹ VOCs are of particular interest to regulators in part because they contribute to ozone formation.

As shown in previous sections VOCs are produced by a myriad of sources, including motor vehicles, chemical manufacturing facilities, refineries, factories, consumer and commercial products, and natural (biogenic) sources (mainly trees). One of the most common VOCs released into the ambient air is benzene. Benzene is an air toxic emitted from gasoline service stations, motor vehicle exhaust and fuel evaporation, the burning of coal and oil, and various other sources.⁷² Urban areas generally have higher ambient air concentrations of benzene than other areas; it may also contaminate water.⁷³

Other anthropogenic sources of VOCs are:

- (1) "Fuel combustion," which includes emissions from coal-, gas-, and oil-fired power plants and industrial, commercial, and institutional sources, as well as residential heaters and boilers;

⁷⁰ *Ibid.*

⁷¹ U.S. Environmental Protection Agency. "Report on the Environment: Volatile Organic Compounds Emission."
<http://cfpub.epa.gov/eroe/index.cfm?fuseaction=detail.viewInd&lv=list.listByAlpha&r=209842&subtop=341>.

⁷² U.S. Environmental Protection Agency. "Report on the Environment: Ambient Concentrations of Benzene."
<http://cfpub.epa.gov/eroe/index.cfm?fuseaction=detail.viewInd&ch=46&subtop=341&lv=list.listByChapter&r=201745>.

⁷³ *Ibid.*

- (2) "Other industrial processes," which includes chemical production, petroleum refining, metals production, and processes other than fuel combustion;
- (3) "On-road vehicles," which includes cars, trucks, buses, and motorcycles; and "Nonroad vehicles and engines," such as farm and construction equipment,
- (4) lawnmowers, leaf blowers, chainsaws, boats, ships, snowmobiles, aircraft and others.⁷⁴

Some of the health effects associated with exposure to benzene at sufficient concentrations are cancer and damage to the immune system, as well as neurological, reproductive (e.g., reduced fertility), developmental, respiratory, and other health problems. Plants and animals may also be harmed by exposures to benzene (U.S. EPA, 2003).⁷⁵

Ozone (O₃): Ozone is a gas composed of three oxygen atoms. It is not usually emitted directly into the air, but at ground-level is created by a chemical reaction between oxides of nitrogen (NO_x) and volatile organic compounds (VOC) in the presence of sunlight.⁷⁶ Children, the elderly, people with lung diseases such as asthma, and people who work or exercise outside are at risk for adverse effects from ozone. These include reduction in lung function and increased respiratory symptoms as well as respiratory-related emergency department visits, hospital admissions, and possibly premature deaths.⁷⁷

Ozone has the same chemical structure whether it occurs miles above the earth or at ground-level and can be "good" or "bad," depending on its location in the atmosphere. In the earth's lower atmosphere, ground-level ozone is considered "bad."⁷⁸ As mentioned above motor vehicle exhaust and industrial emissions, gasoline vapors, and chemical solvents as well as natural sources emit NO_x and VOCs that help form ozone. Depending on the location of ozone in the atmosphere it is considered good or bad. At ground-level, ozone is the primary constituent of smog. Sunlight and hot weather cause

⁷⁴ U.S. Environmental Protection Agency. "Report on the Environment: Volatile Organic Compounds Emission," *op. cit.*

⁷⁵ U.S. Environmental Protection Agency. "Report on the Environment: Ambient Concentrations of Benzene," *op. cit.*

⁷⁶ U.S. Environmental Protection Agency. "Ground-level Ozone." www.epa.gov/air/ozonepollution/

⁷⁷ *Ibid.*

⁷⁸ *Ibid.*

ground-level ozone to form in harmful concentrations in the air more common in urban areas.⁷⁹

People with lung disease, children, older adults, and people who are active can be affected when ozone levels are unhealthy. Numerous scientific studies have linked ground-level ozone exposure to a variety of problems, including:

- airway irritation, coughing, and pain when taking a deep breath;
- wheezing and breathing difficulties during exercise or outdoor activities;
- inflammation, which is much like a sunburn on the skin;
- it can worsen bronchitis, emphysema, asthma and cause increased susceptibility to respiratory illnesses such as pneumonia and bronchitis, and reduce the immune system's ability to fight off bacterial infections in the respiratory system,⁸⁰ and,
- permanent lung damage with repeated exposures.

Ground-level ozone can also have detrimental effects on plants and ecosystems. Some of these adverse effects include:

- interfering with the ability of sensitive plants to produce and store food, making them more susceptible to certain diseases, insects, other pollutants, competition and harsh weather;
- damaging the leaves of trees and other plants, negatively impacting the appearance of urban vegetation, as well as vegetation in national parks and recreation areas; and
- reducing forest growth and crop yields, potentially impacting species diversity in ecosystems.⁸¹

Carbon Monoxide (CO)

Carbon monoxide is a colorless, tasteless, odorless, and non-irritating gas formed when carbon in fuel is not burned completely. All engine exhaust contains a certain amount of carbon monoxide, but the amount will increase if your vehicle engine is poorly maintained.

⁷⁹ *Ibid.*

⁸⁰ Ozone and Your Health. EPA-452/F-99-003. USEPA, Air and Radiation. Washington, DC 20460.

⁸¹ U.S. Environmental Protection Agency. "Ground-level Ozone: Health and Environment." www.epa.gov/air/ozonepollution/health.html.

Carbon monoxide enters the bloodstream through the lungs and attaches to hemoglobin (Hb), the body's oxygen carrier, forming carboxyhemoglobin (COHb) and thereby reducing oxygen (O₂) delivery to the body's organs and tissues. High COHb concentrations are poisonous. Central nervous system (CNS) effects in individuals suffering acute CO poisoning cover a wide range, depending on severity of exposure: headache, dizziness, weakness, nausea, vomiting, disorientation, confusion, collapse, and coma.⁸² It is a common cause of death in enclosed spaces.

At lower concentrations, CNS effects include reduction in visual perception, manual dexterity, learning, driving performance, and attention level. 5% would be sufficient to produce visual sensitivity reduction and various neurobehavioral performance deficits.⁸³

Particulate Matter (PM)

PM is a complex mixture of extremely small particles and liquid droplets. These tiny particles contain many substances, including metals, acids and related chemicals (such as nitrates and sulfates), carbon, and polycyclic aromatic hydrocarbons and organic chemicals.⁸⁴

The size of particles is directly linked to their potential for causing health problems. EPA is concerned about particles that are 10 micrometers in diameter or smaller because those are the particles that generally pass through the throat and nose and enter the lungs. Once inhaled, these particles can affect the heart and lungs and cause serious health effects. EPA groups particle pollution into two categories:

- "Inhalable coarse particles," such as those found near roadways and dusty industries, are larger than 2.5 micrometers and smaller than 10 micrometers in diameter.
- "Fine particles," such as those found in smoke and haze, are 2.5 micrometers in diameter and smaller. These particles can be directly emitted from sources such

⁸² Carbon Monoxide and the Nervous System. Raub, J. A., and V. A. Benignus. Carbon Monoxide and the Nervous System. NEUROSCIENCE AND BIOBEHAVIORAL REVIEWS 26(8):925-940, (2002).

⁸³ *Ibid.*

⁸⁴ U.S. EPA. "Air Quality Criteria for Particulate Matter." (Final Report, Oct 2004). U.S. Environmental Protection Agency, Washington, DC, EPA 600/P-99/002aF-bF, 2004.

as forest fires, or they can form when gases emitted from power plants, industries and automobiles react in the air.⁸⁵ Particles less than 2.5 micrometers in diameter are so small that they can easily get into the lungs, potentially causing serious health problems

Vehicle engine exhaust may include all the substances described above. Ultrafine particles are observed in the emissions from spark, diesel, and jet engines.⁸⁶ In these cases, it seems likely that organic compounds, ammonia and sulfuric acid from sulfur in the fuel, as well as metal additives in the fuel or fuel oil, may contribute to the formation of ultrafine particles.⁸⁷ While some of these particles are emitted in vehicle exhaust, others are formed in the atmosphere through chemical reactions between the various pollutants found in exhaust. Particulates are known to aggravate symptoms in individuals who already suffer from respiratory or cardiovascular diseases. Particle pollution, especially fine particles, contains microscopic solids or liquid droplets that are so small that they can get deep into the lungs and cause serious health problems.

Numerous scientific studies have linked particle pollution exposure to a variety of problems, including:

- increased respiratory symptoms, such as irritation of the airways, coughing, or difficulty breathing, for example;
- decreased lung function;
- aggravated asthma;
- development of chronic bronchitis;
- irregular heartbeat;
- nonfatal heart attacks; and
- premature death in people with heart or lung disease.⁸⁸

People with heart or lung diseases, children and older adults are the most vulnerable and likely to be affected by particle pollution exposure. However, even if you are healthy, you may experience temporary symptoms from exposure to elevated levels of particle pollution.

⁸⁵ U.S. EPA. "Particulate Matter." www.epa.gov/pm/.

⁸⁶ U.S. EPA. "Air Quality Criteria for Particulate Matter," *op. cit.*.

⁸⁷ *Ibid.*

⁸⁸ U.S. EPA. "Particulate Matter," *op. cit.*.

Fine particles (PM_{2.5}) are the major cause of reduced visibility (haze) in parts of the United States, including many of our treasured national parks and wilderness areas.⁸⁹ Particles can be carried over long distances by wind and then settle on ground or water making lakes and streams acidic; changing the nutrient balance in coastal waters and large river basins; depleting the nutrients in soil; and damaging sensitive forests.⁹⁰

Landfill Gas and Methane

Landfill gas has an unpleasant odor that can cause headaches or nausea. The odor, however, is more irritating than a hazard to health. Although some compounds that make up landfill gas could be hazardous if present in large amounts, they should not cause adverse health effects if present in very small amounts.⁹¹

Methane is the main chemical in landfill gas and it is highly flammable. If a spark is present and enough methane is mixed into the air, a fire may occur. Breathing methane, however, is only hazardous if it is present at levels high enough to decrease the amount of oxygen in the air. The adverse health effects are due to a lack of oxygen, not by breathing the methane gas itself. In a building, methane would be a fire hazard at levels much lower than those that could cause breathing problems.⁹²

Methane burns very easily and often is used as natural gas for cooking and heating. It is lighter than air and collects at the top of enclosed spaces. When it rises through the soil and enters buildings, it gets trapped in the lower parts of a building, such as the basement. As more methane enters the building, the level in the air increases.⁹³

In addition to methane, hydrogen sulfide (H₂S) contributes to the odor of landfill gas, with a smell similar to that of rotten eggs.

⁸⁹ Haze is caused when sunlight encounters tiny pollution particles in the air, which reduces the clarity and color of what is seen, particularly during humid conditions.

⁹⁰ U.S. EPA. "Particulate Matter: Health and Environment." www.epa.gov/air/particlepollution/health.html

⁹¹ Illinois Department of Public Health: Environmental Health Fact Sheet. "Landfill Gas."
www.idph.state.il.us/envhealth/factsheets/landfillgas.htm.

⁹² *ibid.*

⁹³ *ibid.*

Transfer Stations. Waste transfer stations are facilities where municipal solid waste is unloaded from collection vehicles and briefly held while it is reloaded onto larger long-distance transport vehicles for shipment to landfills or other treatment or disposal facilities. By combining the loads of several individual waste collection trucks into a single shipment, communities can save money on the labor and operating costs of transporting the waste to a distant disposal site. They can also reduce the total number of vehicular trips traveling to and from the disposal site. Although waste transfer stations help reduce the impacts of trucks traveling to and from the disposal site, they can cause an increase in traffic in the immediate area where they are located. If not properly sited, designed and operated they can cause problems for residents living near them.⁹⁴

The City of Beacon Transfer Station located in 95 Dennings Avenue. The Transfer Station provides residents with a drop-off facility for garbage, recyclables and yard waste. Grass clippings may be dumped at no charge. Furniture, appliances, construction/demolition debris, tires, car batteries, and metal may be dumped for a minimal fee.

Items accepted at the Transfer Station include:

- Household furnishings
- Appliances (Freon and non-freon)
- Construction and demolition debris
- Newsprint, office paper, junk mail, magazines, catalogs
- Corrugated cardboard; paperboard (e.g. cereal boxes)
- Tires
- Car Batteries
- Yard waste
- Scrap metal
- Wood waste
- Recyclables

Items NOT accepted at the Transfer Station:

- Pesticides
- Explosives
- Household hazardous waste

⁹⁴ U.S. EPA Municipal Solid Waste. www.epa.gov.

- New or used motor oil

The City of Beacon now has an electronic waste collection container available at the transfer station at no charge for City residents and accepts computers, servers, monitors, printers, keyboards, VCRs, cell phones, wires, power supplies, fax machines, radios, modems, telephones, TVs, copiers, scanners, DVD players, stereo equipment, among other items.

4. WATER POLLUTION

4.1 Clean Water Act (CWA)

The Clean Water Act (CWA) establishes the basic structure for regulating discharges of pollutants into the waters of the United States and regulating quality standards for surface waters. The basis of the CWA was enacted in 1948 and was called the Federal Water Pollution Control Act, but the Act was significantly reorganized and expanded in 1972. "Clean Water Act" became the Act's common name with amendments in 1977.⁹⁵ It is the cornerstone of surface water quality protection in the United States.⁹⁶

The statute employs a variety of regulatory and non-regulatory tools to sharply reduce direct pollutant discharges into waterways, finance municipal wastewater treatment facilities, and manage polluted runoff. These tools are employed to achieve the broader goal of restoring and maintaining the chemical, physical, and biological integrity of the nation's waters so that they can support "the protection and propagation of fish, shellfish, and wildlife and recreation in and on the water."⁹⁷

Evolution of CWA programs over the last decade has also included a shift from a program-by-program, source-by-source, pollutant-by-pollutant approach to more holistic watershed-based strategies. Under the watershed approach equal emphasis is placed on protecting healthy waters and restoring impaired ones.⁹⁸ A full array of issues are addressed, not just those subject to CWA regulatory authority. Involvement of stakeholder groups in the development and implementation of strategies for achieving

⁹⁵ U.S. EPA. "Laws and Regulations: Summary of the Clean Water Act." www.epa.gov/regulations/laws/cwa.html.

⁹⁶ The Act does not deal directly with ground water nor with water quantity issues.

⁹⁷ U.S. EPA. "Watershed Academy Web: Introduction to the Clean Water Act."

www.epa.gov/owow/watershed/wacademy/acad2000/cwa/.

⁹⁸ *Ibid.*

and maintaining state water quality and other environmental goals is another hallmark of this approach.⁹⁹

The CWA made it unlawful to discharge any pollutant from a point source into navigable waters, unless a permit was obtained. EPA's National Pollutant Discharge Elimination System (NPDES) permit program controls discharges.

Phase I of the National Pollution Discharge Elimination System (NPDES) Stormwater program began in 1990 and required medium and large municipal separate storm sewer systems (MS4s) to obtain NPDES coverage. Municipalities that are designated as "MS4 Communities" through the NYSDEC Phase II Stormwater Permit Program must develop, implement, and enforce a "Stormwater Management Program" (SWMP) to reduce pollution to the "maximum extent practicable" (MEP) to protect water quality. An area is automatically designated if the population is at least 50,000 and has an overall population density of at least 1,000 people per square mile based on the 2000 Census.

4.2 National Pollutant Discharge Elimination System (NPDES)

Title IV, Permits and Licenses, of the FWPCA Act created the system for permitting wastewater discharges (Section 402), known as the National Pollutant Discharge Elimination System (NPDES). Under the NPDES program, all facilities which discharge *pollutants from any point source into waters of the United States* are required to obtain an NPDES permit.¹⁰⁰ Understanding how each of the key terms ("pollutant," "point source," and "waters of the United States") have been defined and interpreted by the regulations is the key to defining the scope of the NPDES Program.

Pollutants

The term *pollutant* is defined very broadly by the NPDES regulations and litigation and includes any type of industrial, municipal, and agricultural waste discharged into water. For regulatory purposes, pollutants have been grouped into three general categories under the NPDES Program: *conventional*, *toxic*, and *non-conventional*. There are five *conventional pollutants*, (see Section 4.1) and defined in Section 304(a)(4) of the CWA).

⁹⁹ *Ibid.*

¹⁰⁰ Kovalic, J. M. The Clean Water Act of 1987, 2nd edition; The Water Pollution Control Federation (W.P.C.F); Alexandria, VA, 1987.

Toxic pollutants, or priority pollutants, are those defined in Section 307(a)(1) of the CWA and include metals and man-made organic compounds. *Non-conventional pollutants* are those which do not fall under either of the above categories, and include such chemicals as ammonia, nitrogen, phosphorus, and parameters such as chemical oxygen demand (COD), and whole effluent toxicity (WET).

Point Source

Pollutants can enter waters of the United States from a variety of pathways including agricultural, domestic, and industrial sources. For regulatory purposes these sources are generally categorized as either *point sources* or *non-point sources*. Typical *point source* discharges include discharges from publicly owned treatment works (POTWs), discharges from industrial facilities, and discharges associated with urban runoff. These are discrete conveyances such as pipes or man-made ditches. While provisions of the NPDES Program do address certain specific types of agricultural activities (i.e., concentrated animal feeding operations), the majority of agricultural facilities is defined as *non-point sources* and is exempt from NPDES regulation.¹⁰¹

Pollutant contributions to waters of the United States may come from both *direct* and *indirect* sources. *Direct* sources discharge wastewater directly into the receiving water body, whereas *indirect* sources discharge wastewater to a POTW, which in turn discharges into the receiving water body.¹⁰² Under the national program, NPDES permits are issued only to direct point source discharges. The National Pretreatment Program addresses industrial and commercial indirect dischargers. As indicated above, the primary focus of the NPDES permitting program is municipal and non-municipal (industrial) direct dischargers. Within these major categories of dischargers, however, there are a number of more specific types of discharges that are regulated under the NPDES Program.

The Hudson River itself has been designated as a 200-mile Superfund site under CERCLA, due to contamination from discharges of 1.3 million pounds of polychlorinated biphenyls (PCBs) from two General Electric manufacturing sites in Hudson Falls and Fort Edward from 1947-1977. PCB-containing sediments, which have washed

¹⁰¹ U.S. EPA NPDES Permit Writers' Manual; U.S. Environmental Protection Agency, Office of Water, December, 1996; EPA-833-B-96-003, pp 1-28.

¹⁰² *Ibid.*

downstream to NY/NJ Harbor and beyond, are known to bioaccumulate in the food chain and may be one of several contaminants in Hudson River fin and shellfish, which are caught along the shores of Beacon and Verplanck as a source of protein for subsistence, or for cultural or recreational reasons. The remediation of 40 miles of highly contaminated 'hotspots' of the Upper Hudson between Fort Edward and Troy began in May 2009 and after a year-long peer review process will resume in May 2011, with the intention of restoring the Hudson closer to its natural state before it received this massive contamination, allowing PCB levels in fish to drop to a safer level for human consumption.

Municipal Sources

Municipal sources are POTWs that receive primarily domestic sewage from residential and commercial customers. Larger POTWs will also typically receive and treat wastewater from industrial facilities (indirect dischargers) connected to the POTW sewerage system. The types of pollutants treated by a POTW will always include conventional pollutants, and may include non-conventional pollutants and toxic pollutants depending on the unique characteristics of the commercial and industrial sources discharging to the POTW. The treatment provided by POTWs typically includes physical separation and settling (e.g., screening, grit removal, primary settling), biological treatment (e.g., trickling filters, activated sludge), and disinfection (e.g., chlorination, UV, ozone).¹⁰³

These processes produce the treated effluent (wastewater) and a biosolids (sludge) residual, which is managed under the Municipal Sewage Sludge Program. Some older POTWs have an additional concern of combined sewer overflow (CSO) systems that can release untreated effluent during storm events. CSOs were an economic way for municipalities to collect both sanitary sewage and storm water and are controlled under the NPDES program.¹⁰⁴

A number of municipalities have MS4s that are also subject to NPDES requirements. Specific NPDES program areas applicable to municipal sources are: the National

¹⁰³ Environmental Protection Agency, Office of Wastewater Management. Water Permitting 101, available here: http://cfpub.epa.gov/npdes/home.cfm?program_id=45.

¹⁰⁴ *Ibid.*

Pretreatment Program, the Municipal Sewage Sludge Program, Combined Sewer Overflows (CSOs), and the Municipal Storm Water Program.¹⁰⁵

Non-Municipal Sources

Non-municipal sources, which include industrial and commercial facilities, are unique with respect to the products and processes present at the facility. Unlike municipal sources, at industrial facilities the types of raw materials, production processes, treatment technologies utilized, and pollutants discharged vary widely and are dependent on the type of industry and specific facility characteristics.¹⁰⁶

The operations at industrial facilities are generally carried out within a clearly defined plant area; thus, the collection systems are typically less complex than those for POTWs. Industrial facilities may have storm water discharges contaminated by manufacturing activities, contact with raw materials or product storage activities, and may have non-process wastewater discharges such as non-contact cooling water.¹⁰⁷ The NPDES Program addresses these potential wastewater sources for industrial facilities. Residuals (sludge) generated by industrial facilities are not currently regulated by the NPDES Program. Specific NPDES program areas applicable to industrial sources are: Process Wastewater Discharges, Non-process Wastewater Discharges, and the Industrial Storm Water Program.

Types of Permits

A permit is typically a license for a facility to discharge a specified amount of a pollutant into receiving water under certain conditions; however, permits may also authorize facilities to process, incinerate, landfill, or beneficially use sewage sludge.¹⁰⁸ The two basic types of NPDES permits issued are individual and general permits.

An *individual permit* is a permit specifically tailored to an individual facility. Once a facility submits the appropriate application(s), the permitting authority develops a permit for that particular facility based on the information contained in the permit application (e.g., type of activity, nature of discharge, receiving water quality). The authority issues the permit

¹⁰⁵ *Ibid.*

¹⁰⁶ U.S. EPA NPDES Permit Writers' Manual; U.S. Environmental Protection Agency, Office of Water, December, 1996; EPA-833-B-96-003, pp 1-28

¹⁰⁷ *Ibid.*

¹⁰⁸ *Ibid.*

to the facility for a specific time period (not to exceed five years) with a requirement that the facility reapply prior to the expiration date.¹⁰⁹

A *general permit* covers multiple facilities within a specific category. General permits may offer a cost-effective option for permitting agencies because of the large number of facilities that can be covered under a single permit.¹¹⁰ General permits may only be issued to dischargers within a specific geographical area such as city, county, or state political boundaries; designated planning areas; sewer districts or sewer authorities; state highway systems; standard metropolitan statistical areas; or urbanized areas. These permits allow the permitting authority to allocate resources in a more efficient manner to provide more timely permit coverage.¹¹¹

4.3 State Pollutant Discharge Elimination System (SPDES)

EPA is authorized under the CWA to directly implement the NPDES Program. EPA, however, may authorize States, Territories, or Tribes to implement all or parts of the national program. States, Territories, or Tribes applying for authorization may seek the authority to implement the base program and additional parts of the national program including: permitting of federal facilities; administering the National Pretreatment Program; and/or administering the Municipal Sewage Sludge Program.¹¹²

New York State has a state program, which has been approved by the EPA for the control of wastewater and storm-water discharges in accordance with the Clean Water Act. Under New York State law the program is known as the State Pollutant Discharge Elimination System (SPDES) and is broader in scope than that required by the Clean Water Act in that it controls point source discharges to groundwaters as well as surface waters.¹¹³ The program is designed to eliminate the pollution of New York waters and to maintain the highest quality of water possible -- consistent with public health, public

¹⁰⁹ *Ibid.*

¹¹⁰ U.S. EPA. "Office of Wastewater Management. Water Permitting 101" http://cfpub.epa.gov/npdes/home.cfm?program_id=45.

¹¹¹ *Ibid.*

¹¹² *Ibid.*

¹¹³ NYS Department of Environmental Conservation. "State Pollutant Discharge Elimination System." www.dec.ny.gov/permits/6054.html.

enjoyment of the resource, protection and propagation of fish and wildlife and industrial development in the state through a permit system.¹¹⁴

The City of Beacon has been designated as an Urbanized Area as defined by the US Census. Furthermore, the city operates a Municipal Separate Storm Sewer System (MS4), which collects stormwater runoff and conveys that runoff through a system of catch basins, pipes and ditches, ultimately discharging into waters of the United States.

As of March 2003, the federal Phase II stormwater program has required operators of MS4s in urbanized areas to obtain State Pollution Discharge Elimination System (SPDES) permit coverage for the stormwater discharges under their jurisdiction and control.

In order to maintain conformance with the Phase II program and the SPDES General Permit for Stormwater Discharges from MS4s, the city must comply with six minimum control measures that serve as the basis for this permit. These six minimum measures are:

- Public Education and Outreach
- Public Involvement/Participation
- Illicit Discharge Detection and Elimination (IDDE)
- Construction Site Stormwater Runoff Control
- Post-Construction Stormwater Management
- Pollution Prevention/Good Housekeeping for Municipal Operations

This compliance required the city to adopt two local laws to prohibit illicit discharges, activities and connections to the storm sewer system, and to regulate land development activities by stipulating the implementation of stormwater management standards in site design. The city is obliged to submit an Annual Report to the NYS DEC to demonstrate compliance with these minimum measures.

A Stormwater Pollution Prevention Plan (SWPPP) is the central document of a development plan's stormwater management design. The city's local law amended the

¹¹⁴ NYS Department of Environmental Conservation. "P/C/I State Pollutant Discharge Elimination System Permit Program: Introduction." www.dec.ny.gov/permits/6308.html.

site plan and subdivision regulations to require a SWPPP and the law includes sections that outline the requirements and components of a SWPPP. The General Permit also requires the City of Beacon to develop a Stormwater Management Program Plan (SWMP plan) that addresses how the regulated MS4 will comply with all six minimum control measures.¹¹⁵

In September 2011, sewage discharge was discovered flowing from a pipe on the northeastern corner of the Beacon Harbor. Water samples collected by Riverkeeper from the discharge pipe indicated high levels of contamination at >24,196 Enterococcus per 100/ml, which is more than 397 times greater than the EPA guideline for acceptable water quality – 61 Enterococcus per 100/ml. Two months later in November 2011, the DEC reported that the discharged had subsided, however the actual cause of the sewage release has not been disclosed by Beacon officials to the DEC or Riverkeeper.¹¹⁶

4.4 Wastewater Facilities

Wastewater is mostly collected in sewers and directed towards wastewater treatment facilities for purification. The water is then discharged back into the environment or made ready for reuse. Since nature has its own capabilities to purify wastewater, the basic goals of wastewater treatment facilities is to facilitate the purification of the increased amount of wastewater generated by our growing population, for its safe discharge into waterways or groundwater, or, increasingly, for reuse. In fact, there are billions of gallons of wastewater produced every day.

Wastewater is used water, containing things such as feces, food scraps, oils, chemicals, and pollutants. It also includes storm runoff, which is the water that runs over paved surfaces and roofs before entering the sewer system.

Sewage disposal is of great concern to urban communities. Sewage may drain directly into major watersheds with minimal or no treatment. When untreated, sewage can have serious impacts on the quality of an environment and on the health of people. Pathogens

¹¹⁵ City of Beacon .www.cityofbeacon.org

¹¹⁶ <http://www.riverkeeper.org/water-quality/udson/accidents/beacon-9-2011/>

can cause a variety of illnesses. Some chemicals pose risks even at very low concentrations and can remain a threat for long periods of time because of bioaccumulation in animal or human tissue.

City of Beacon Wastewater Treatment Facility

The City of Beacon Wastewater Treatment Facility is located on Dennings Avenue and treats wastewater for the City of Beacon. While it is a source of air pollution, the facility also emits various sources of water pollution. The facility has permits to discharge the following chemicals/substances: Cyanide, Toluene, Bis(2-ethylhexyl) phthalate, 1,2,4-Trichlorobenzene, Silver, Arsenic, Copper, Zinc, Ammonia, Nitrogen, and Chlorine.

Wastewater Treatment Plants (WWTP)

Pathogens

High levels of pathogens may result from inadequately treated sewage discharges. Sewage pathogens have been linked to many illnesses, ranging from mild flu-like symptoms to serious disease, organ failure, and sometimes even death.¹¹⁷

Viruses are believed to be the major cause of disease contracted through direct contact with sewage, and are responsible for gastroenteritis, hepatitis, respiratory illness, and other health problems. One of the most common, the Norwalk Virus, is representative of a heterogenous group of viruses, also called small round structured viruses (SRSVs) or the Norwalk-like family of agents. Common names of the illness caused by the Norwalk and Norwalk-like viruses are viral gastroenteritis, acute nonbacterial gastroenteritis, food poisoning, and food infection.

The protozoan *Cryptosporidium parvum* causes cryptosporidiosis, a gastrointestinal disease that affects people and animals. Upon infection, this protozoan resides principally in the gastrointestinal tract and goes through its life stages as an intracellular parasite. In the intestines, it forms oocysts (similar to parasite eggs) that are shed in feces and which are the source of infection for new susceptible people.¹¹⁸

¹¹⁷ U.S. EPA. "Diseases Associated with Sewage." www.epa.gov/npdes/ssso/control/diseases.htm.

¹¹⁸ *Ibid.*

Bacteria in sewage, such as *Escherichia coli* (*E. coli*) and enterococci, can cause many diseases and illnesses. Enterococci are bacteria that normally live in the bowel, intestines and digestive tracts of humans. The bacteria help to break down wastes in the body, but can cause urinary tract infections, wound infections and blood infections if they get out of their normal environment. Today, new strains of the bacteria, called VRE (Vancomycin Resistant Enterococcus), have developed a resistance gene to most antibiotics.¹¹⁹ Since enterococci are found normally in the intestines, every time an antibiotic is taken, the bacteria are exposed. This resistance gene makes it very difficult for doctors to treat a VRE patient. Those most at risk from VRE are people who are already seriously ill.¹²⁰

Phosphorus

The effluent, the discharge from a WWTP, may contain higher levels of pollutants than the waterbody it is flowing into.¹²¹

Because phosphorus stimulates algal growth, when this growth is excessive, other aquatic forms of life are endangered. Algae blooms limit recreational use by reducing water clarity and aesthetic qualities. Factors that limit algal growth include available forms of nitrogen and phosphorus, sunlight, and temperature. Algae and other microorganisms in the water greatly affect dissolved oxygen. Under algae bloom conditions, the algae have a negative effect on reservoir fisheries because of periodic oxygen depletion associated with algae respiration and decomposition.¹²²

Chlorine

Chlorination remains the most common form of waste water disinfection in North America due to its low cost and long-term history of effectiveness. One disadvantage is that chlorination of residual organic material can generate chlorinated-organic

¹¹⁹ *Ibid.*

¹²⁰ *Ibid.*

¹²¹ Westchester County Department of Planning. "Westchester County Croton Watershed Water Quality Conditions Report For Development of the Comprehensive Croton System Water Quality Protection Plan in Westchester County." March 2002.

www.westchestergov.com/planningdocs/CrotonPlan/Appendix%20B%20Water%20Quality%20Conditions.pdf

¹²² Shock and Pratt. "Phosphorus Effects on Surface Water Quality and Phosphorus TMDL Development." http://cropandsoil.oregonstate.edu/sites/default/files/WERA103/2003_proceedings/p211_Shock_Phosphorus_TMDL1.pdf

compounds that may be carcinogenic or harmful to the environment. Residual chlorine or chloramines may also be capable of chlorinating organic material in the natural aquatic environment. Further, because residual chlorine is toxic to aquatic species, the treated effluent must also be chemically dechlorinated, adding to the complexity and cost of treatment.¹²³

Effects of chlorine on human health and the environment depend on how much chlorine is present and the length and frequency of exposure. Effects also depend on the health of a person or condition of the environment when exposure occurs. Chlorine irritates the skin, the eyes, and the respiratory system. These effects are not likely to occur at levels of chlorine that are normally found in the environment.

Human health effects associated with breathing or otherwise consuming small amounts of chlorine over long periods of time are not known. Some studies show that workers develop adverse effects from repeat inhalation exposure to chlorine, but others do not.¹²⁴ Laboratory studies show that repeat exposure to chlorine in air can adversely affect the immune system, the blood, the heart, and the respiratory system of animals.¹²⁵ Chlorine can also cause low level environmental harm but is especially harmful to organisms living in water and in soil.¹²⁶

5. TOXIC RELEASE FACILITIES

5.1 Emergency Planning and Community Right-to-Know Act (EPCRA) and the Toxic Release Inventory (TRI) Program

In 1984, a deadly cloud of methyl isocyanate killed thousands of people in Bhopal, India. Shortly after this incident, a serious chemical release took place at a plant in West Virginia. These events accelerated demands by industrial workers, communities, and public interest and environmental organizations for information on toxic chemicals being released outside of the facility.¹²⁷

¹²³ U.S. EPA. "Office of Pollution, Prevention, and Toxics: Chemicals in the Environment- Chlorine." (1994). www.epa.gov/chemfact/f_chlori.txt.

¹²⁴ *Ibid.*

¹²⁵ *Ibid.*

¹²⁶ *Ibid.*

¹²⁷ U.S. EPA. "What is the Toxics Release Inventory Program." www.epa.gov/tri/triprogram/whatis.htm

Against this background Congress enacted the Emergency Planning and Community Right-to-Know Act (EPCRA) in 1986. The Act's primary purpose is to inform communities and citizens of chemical hazards in their areas, it requires facilities in certain industries, which manufacture, process, or use significant amounts of toxic chemicals, to report annually on their releases of these chemicals. These reports contain information about the types and amounts of toxic chemicals that are released each year to the air, water, and land as well as information on the quantities of toxic chemicals sent to other facilities for further waste management. Section 313 of the Act requires EPA and the States to collect data annually on releases and transfers of certain toxic chemicals from industrial facilities and make the data available to the public in the Toxics Release Inventory (TRI).¹²⁸ Moreover, in 1990 Congress passed the Pollution Prevention Act which requires facilities to report additional data on waste management and source reduction activities to EPA under the TRI.¹²⁹

The current TRI toxic chemical list contains 593 individually listed chemicals and 30 chemical categories, including three delimited categories containing 62 chemicals.¹³⁰ Releases of approximately 650 chemicals and chemical categories covering about 23,000 industrial and federal facilities are required by law to be report annually to the EPA through the TRI program.¹³¹ If the members of the three delimited categories are counted as separate chemicals then the total number of chemicals and chemical categories is 682.¹³²

On November 26, 2010, EPA finalized a rule, which was effective on November 26, 2010, to provide communities with additional information about toxic chemicals being released to the environment. This rule was the first expansion of the TRI program in decades, it added 16 chemicals to the TRI list of reportable chemicals. This action is part of EPA's ongoing efforts to examine the scope of TRI chemical coverage and provide more complete information on toxic chemical releases.¹³³

¹²⁸ Reports must be submitted on or before July 1st each year and must cover activities that occurred at the facility during the previous calendar year.

¹²⁹ *Ibid.*

¹³⁰ Methyl mercaptan, hydrogen sulfide, and 2,2-dibromo-3-nitropropionamide are under administrative stays and are not currently reportable.

¹³¹ U.S. EPA. "TRI Chemical List." www.epa.gov/tri/trichemicals/index.htm.

¹³² *Ibid.*

¹³³ U.S. EPA. "Addition of National Toxicology Program Carcinogens -- Final Rule." www.epa.gov/tri/lawsandregs/ntp_chemicals/final.html.

The chemical added by this rule have been classified as “reasonably anticipated to be a human carcinogen” by the National Toxicology Program (NTP) in their Report on Carcinogens (RoC) document.¹³⁴ Based on a review of available studies, EPA concluded that these 16 chemicals could cause cancer in humans and therefore meet the EPCRA section 313(d)(2)(B) statutory listing criteria. Four of the chemicals are being added to TRI under the polycyclic aromatic compounds (PACs) category. The PACs are of special concern because they are persistent, bioaccumulative, toxic (PBT) chemicals and as such, are likely to remain in the environment for a very long time, are not readily destroyed, and may build up or accumulate in body.¹³⁵

The TRI program empowers citizens, through information, to hold companies and local governments accountable in terms of how toxic chemicals are managed. The data often spurs companies to focus on their chemical management practices since they are being measured and made public.¹³⁶

5.2 Toxic Release Inventory Facilities in the Beacon Area

Chemprene Inc: Bis (2-ethylhexyl) adipate, Di (2-ethylhexyl) phthalate, Methyl Ethyl Ketone, Toluene, Zinc and Zinc compounds.

Tallix Inc: Copper

Three Star Anodizing: Nitric acid, Phosphoric Acid, Sodium Hydroxide, Sulfuric Acid

Tuck Industries: Toluene

5.3 Environmental and Health Effects Associated with Exposure to Toxic Release

Lead

Exposure to lead occurs when lead dust or fumes are inhaled or ingested via contaminated hands, food, water, cigarettes or clothing. There is no known safe level of

¹³⁴ *Ibid.*

¹³⁵ *Ibid.*

¹³⁶ U.S. EPA. “TRI for Communities.” (2010). www.epa.gov/tri/stakeholders/communities/index.htm

exposure to lead—that is, there is no known amount of lead that is too small to cause the body harm.¹³⁷

Lead entering the respiratory and digestive systems is released to the blood and, therefore, distributed throughout the body. More than 90% of the total body burden is accumulated in the bones, where it is stored. Lead in bones may be released into the blood, re-exposing organ systems long after the original exposure.¹³⁸

- Neurological Effects
- Peripheral neuropathy
- Fatigue / Irritability
- Impaired concentration
- Hearing loss
- Wrist / Foot drop
- Seizures
- Encephalopathy
- Gastrointestinal Effects
- Nausea
- Dyspepsia
- Constipation
- Colic
- Lead line on gingival tissue
- Reproductive Effects
- Miscarriages/Stillbirths
- Reduced sperm count & motility
- Abnormal sperm
- Heme Synthesis
- Anemia
- Erythrocyte protoporphyrin elevation
- Renal Effects
- Chronic nephropathy with proximal tubular damage
- Hypertension
- Arthralgia
- Myalgia

Lead's toxic nature is well documented. It affects all organs and functions of the body to varying degrees. The frequency and severity of symptoms among exposed individuals depends upon the amount of exposure and the subject being affected. The list below includes some of the key lead-induced health effects.¹³⁹

Take home lead (lead brought into the home and family vehicle on work clothes and equipment) can harm anyone who is exposed. Due to the fact that blood-borne lead crosses the placenta, a pregnant woman with an elevated blood lead level may expose her fetus to the toxic effects of lead. Children's exposure to lead is especially dangerous because it can cause learning problems and serious illness.¹⁴⁰

Hydrochloric Acid

Hydrochloric acid is used in the production of chlorides, fertilizers, and dyes, in electroplating, and in the photographic, textile, and rubber industries. It is also for

¹³⁷ http://en.wikipedia.org/wiki/Lead_poisoning

¹³⁸ New York State: Department of Health. "Lead Exposure in Adults- A Guide for Health Care Providers." www.health.state.ny.us/publications/2584/.

¹³⁹ *Ibid.*

¹⁴⁰ *Ibid.*

refining ore in the production of tin and tantalum, for pickling and cleaning of metal products, in removing scale from boilers, for the neutralization of basic systems, as a laboratory reagent, as a catalyst and solvent in organic syntheses, and for hydrolyzing starch and proteins in the preparation of various food products.¹⁴¹

It is corrosive to the eyes, skin, and mucous membranes. Short-term inhalation and exposure may cause eye, nose, and respiratory tract irritation and inflammation, and pulmonary edema and irritation, lesions of the upper respiratory tract, and laryngeal, and have been reported in rodents acutely exposed by inhalation. Acute oral exposure may cause corrosion of the mucous membranes, esophagus, and stomach and dermal contact may produce severe burns, ulceration, and scarring in humans.

Long-term occupational exposure has been reported to cause gastritis, chronic bronchitis, dermatitis, and photosensitization in workers. Prolonged exposure to low concentrations may also cause dental discoloration and erosion. Chronic inhalation exposure has also been reported to cause hyperplasia of the nasal mucosa, larynx, and trachea. EPA has not classified hydrochloric acid for carcinogenicity.¹⁴²

Polycyclic Aromatic Compounds

Also known as Polycyclic Aromatic Hydrocarbons (PAHs), these compounds represent a combination of over 100 organic compounds that are grouped together because it is rare that just one found alone, but rather in a mixture of two or more. PAHs generally enter the body through breathing polluted air. These substances are products of combustion that occur when organic substances, such as coal or garbage, are incompletely burned. PAHs are reproductive toxins, meaning any “defects in the progeny and injury to male and female reproductive function” are possible.¹⁴³ The EPA also lists these compounds as probable human carcinogens.¹⁴⁴ Animal studies have also shown that PAHs can affect the ability of an individual to fight off disease after both short and long term exposure.¹⁴⁵

¹⁴¹ *Ibid.*

¹⁴² U.S. EPA. “Hydrochloric Acid (Hydrogen Chloride).” www.epa.gov/ttnatw01/hlthef/hydrochl.html.

¹⁴³ <http://hazmap.nlm.nih.gov/>

¹⁴⁴ <http://www.mass.gov/dep/toxics/pahs.htm>

¹⁴⁵ <http://www.atsdr.cdc.gov/toxfaqs/tf.asp?id=121&tid=25#bookmark05>

Benzo(g,h,i)perylene

Benzo(g,h,i)perylene is a specific type of PAH. It has the same risks associated with the other PAHs including being a carcinogen and causing reproductive problems.¹⁴⁶

Mercury

Mercury is a naturally occurring element that is found in air, water and soil. It exists in several forms: elemental or metallic mercury, inorganic mercury compounds, and organic mercury compounds. Pure mercury is a liquid metal, sometimes referred to as quicksilver that volatilizes readily. It has traditionally been used to make products like thermometers, switches, and some light bulbs.¹⁴⁷

In the United States, people are mainly exposed to methylmercury, an organic compound, when they eat fish and shellfish that contain methylmercury. Whether an exposure to the various forms of mercury will harm a person's health depends on a number of factors. People may be exposed to mercury in any of its forms under different circumstances. As stated by EPA, the factors that determine how severe the health effects are from mercury exposure include these:

- the chemical form of mercury;
- the dose;
- the age of the person exposed (the fetus is the most susceptible);
- the duration of exposure;
- the route of exposure -- inhalation, ingestion, dermal contact, etc.; and
- the health of the person exposed.¹⁴⁸

No human data indicate that exposure to any form of mercury causes cancer, but the human data currently available are very limited. Mercuric chloride has caused increases in several types of tumors in rats and mice, and methylmercury has caused kidney tumors in male mice. Scientists only observed these health effects at extremely high doses, above levels that produced other effects. When EPA revised its Cancer

¹⁴⁶ <http://www.epa.gov/osw/hazard/wastemin/minimize/factshts/benzoper.pdf>

¹⁴⁷ U.S. EPA. "Mercury: Health Effects." www.epa.gov/hg/effects.htm.

¹⁴⁸ *Ibid.*

Guidelines in 2005, the Agency concluded that neither inorganic mercury nor methylmercury from environmental exposures are likely to cause cancer in humans.¹⁴⁹

High exposures to inorganic mercury have been found to cause damage to the gastrointestinal tract, lungs, the brain and the nervous system, and the kidneys. Both inorganic and organic mercury compounds are absorbed through the gastrointestinal tract and affect other systems via this route. However, organic mercury compounds are more readily absorbed via ingestion than inorganic mercury compounds. Symptoms of high exposures to inorganic mercury include: skin rashes and dermatitis, hair loss, mood swings, memory loss, mental disturbances, and muscle weakness.¹⁵⁰

6. LAND USE IMPACTS

6.1 Non Point Sources: Stormwater Runoff

Non-point source pollution generally results from land runoff, precipitation, atmospheric deposition, drainage, seepage or hydrologic modification. The term "non-point source" is defined to mean any source of water pollution that does not meet the legal definition of "point source" in Section 502(14) of the Clean Water Act.¹⁵¹

The term "point source" means any discernible, confined and discrete conveyance, including but not limited to any pipe, ditch, channel, tunnel, conduit, well, discrete fissure, container, rolling stock, concentrated animal feeding operation, or vessel or other floating craft, from which pollutants are or may be discharged.¹⁵² This term does not include agricultural storm water discharges and return flows from irrigated agriculture.

Unlike pollution from industrial and sewage treatment plants, nonpoint source (NPS) pollution comes from many diffuse sources. NPS pollution is caused by stormwater runoff (rainfall or snowmelt) moving over and through the ground. As the runoff moves, it picks up and carries away natural and human-made pollutants from the land or

¹⁴⁹ More technical information is available in volume V of the 1997 Mercury Study Report to Congress. Available here: U.S. EPA. "Mercury: Health Effects." www.epa.gov/hg/effects.htm.

¹⁵⁰ U.S. EPA. "Mercury: Health Effects." *Op. cit.*

¹⁵¹ U.S. EPA. "Polluted Runoff (Nonpoint Source Pollution): NPS Categories." www.epa.gov/owow_keep/NPS/categories.html.

¹⁵² U.S. EPA. "Polluted Runoff (Nonpoint Source Pollution): Basic Information." www.epa.gov/owow_keep/NPS/whatis.html.

impervious surfaces (paved streets, parking lots, building rooftops, compact soil), finally depositing them into lakes, rivers, wetlands, coastal waters and ground waters.¹⁵³

Non-point source pollution can include:

- Excess fertilizers, herbicides and insecticides from agricultural lands and residential areas
- Oil, grease and toxic chemicals from urban runoff and energy production
- Sediment from improperly managed construction sites, crop and forest lands, and eroding streambanks
- Salt from road salting, irrigation practices and acid drainage from abandoned mines
- Bacteria and nutrients from livestock, pet wastes and faulty septic systems
- Atmospheric deposition and hydromodification

States report that non-point source pollution is the leading remaining cause of water quality problems.¹⁵⁴ The effects of non-point source pollutants on specific waters vary and may not always be fully assessed. However, EPA has pointed out that these pollutants have harmful effects on drinking water supplies, recreation, fisheries and wildlife.¹⁵⁵

Stormwater pollution from point sources and non-point sources is a challenging water quality problem. As mentioned by EPA, unlike pollution from industry or sewage treatment facilities, which is caused by a discrete number of sources, stormwater pollution is caused by the daily activities of people everywhere.¹⁵⁶ Stormwater runoff is one of the most common causes of water pollution.

The City of Beacon manages its stormwater runoff through a Municipal Separate Storm Sewer System (MS4), which collects the runoff and sends it through a system of catch basins, pipes, and ditches, and finally into our nation's waters. "Urbanized Areas" (which Beacon is defined as by the US Census), that operate an MS4 are required by the

¹⁵³ U.S. EPA. "NPDES: Stormwater Program." cfpub.epa.gov/npdes/home.cfm?program_id=6

¹⁵⁴ U.S. EPA. "Polluted Runoff (Nonpoint Source Pollution): NPS Categories," *Op. cit.*

¹⁵⁵ *Ibid.*

¹⁵⁶ U.S. EPA. "NPDES: Stormwater Outreach Materials and Reference Documents." <http://cfpub.epa.gov/npdes/stormwatermonth.cfm>.

federal Phase II stormwater program to obtain National Pollution Discharge Elimination System (NPDES) permit coverage for stormwater discharges under their jurisdiction.¹⁵⁷ To maintain this permit coverage, Beacon must comply with six minimum control measures, and submit an annual report to the NY State Department of Environmental Conservation (NYS DEC) demonstrating this compliance. These six measures are:

- Public Education and Outreach
- Public Involvement/Participation
- Illicit Discharge Detection and Elimination (IDDE)
- Construction Site Stormwater Runoff Control
- Post-Construction Stormwater Management
- Pollution Prevention/Good Housekeeping for Municipal Operations

As a result of the compliance to these measures, the City of Beacon has since adopted two laws to prohibit illicit discharges, activities and connections to the storm sewer system, and to more closely regulate land development projects through improved stormwater management standards. Finally, the city is required to develop a Stormwater Pollution Prevention Plan (SWPPP) and a Stormwater Management Program Plan (SWMP plan) that address how the MS4 system will comply with these six measures.¹⁵⁸

In September 2011, reports of sewage flowing into Beacon's Waterfront harbor from a pipe in the harbor's northeast corner were confirmed by Riverkeeper, an environmental non-profit organization dedicated to the protection of the Hudson River and its tributaries. Though considered a point-source pollution problem, the sewage leak may have been caused by stormwater runoff. First noticed and reported by a member of the public on Sept. 17, Riverkeeper began collecting water samples a day later and notified the NYS DEC about the incident. Riverkeeper captain John Lipscomb returned to Beacon Harbor five days later to collect additional water samples, and found via the boat's onboard lab system, an Enterococcus count greater than 24,196 per 100/ml, which is at least 397 times greater than what is legally acceptable by the EPA guideline for acceptable water quality (the legal limit being 61 Enterococcus per 100/ml for freshwater). This finding was reported back to the DEC the next day, who then notified

¹⁵⁷ U.S. EPA. "Stormwater Discharges From Municipal Separate Storm Sewer Systems (MS4s)." <http://cfpub.epa.gov/npdes/stormwater/munic.cfm>

¹⁵⁸ City of Beacon, "Stormwater Management." <http://cityofbeacon.org/factsheets/stormwater>

the Beacon Water and Sewer Superintendent. A second sample was collected by Riverkeeper on Sept. 30, finding the same elevated Enterococcus level, and the Mayor of Beacon called for the Dutchess County Department of Health to perform a water quality test. This test also confirmed sewage contamination, but the microbial levels were not released to the public. After periodic water sampling by Riverkeeper, the sewage discharged stopped in November (from a Nov. 17 water sample), and was tested once again in February 2012 after a heavy rain and no sewage discharge was found.¹⁵⁹

Dutchess County and New York State as a whole have no laws requiring the public to be notified of a sewage discharge into public waterways, such as Beacon Harbor, even in areas where the public comes into direct contact with water contaminated by the discharge. Aside from an announcement made by Beacon's mayor on the City of Beacon website, and recommendations to the public to avoid contact with the water by Riverkeeper itself, no further public awareness was made in regards to the contamination. Currently, Riverkeeper is working with Senator Adriano Espaillat to pass a Sewage Right to Know Law for the state of New York, which would require notification of the public of any sewage discharge into the state's waterways.¹⁶⁰

Other sewage contamination problems have also occurred in the City of Beacon over the past years, namely sewage contamination into Fishkill Creek in 2004 and again in 2010. Riverkeeper filed a Clean Water Act Notice of Intent to Sue against the City of Beacon for both incidences. Finally, twenty percent of all water quality samples taken by Riverkeeper in Beacon Harbor have failed the EPA guideline for safe swimming, and a connection can be seen between rainfall and water quality at the testing site, inferring possible non-point source causes of the pollution.¹⁶¹

¹⁵⁹ Riverkeeper, "Beacon, Sept. – Nov. 2011." <http://www.riverkeeper.org/water-quality/udson/accidents/beacon-9-2011/>

¹⁶⁰ Riverkeeper, "Ongoing Sewage Discharge at Beacon Harbor Poses Public Health Risk." <http://www.riverkeeper.org/news-events/news/water-quality/ongoing-sewage-discharge-at-beacon-harbor-poses-public-health-risk/>

¹⁶¹ Riverkeeper, "Ongoing Sewage Discharge at Beacon Harbor Poses Public Health Risk." <http://www.riverkeeper.org/news-events/news/water-quality/ongoing-sewage-discharge-at-beacon-harbor-poses-public-health-risk/>

6.2 Marinas and Boating

Marinas and recreational boating are very popular uses of coastal waters. The growth of recreational boating, along with the growth of coastal development in general, has led to an increased awareness of the need to protect the environmental quality of our waterways. Because marinas are located right at the water's edge, there is a strong potential for marina waters to become contaminated with pollutants generated from the various activities that occur at marinas—such as boat cleaning, fueling operations and marine head discharge—or from stormwater runoff from parking lots and hull maintenance and repair areas into marina basins.

The Coastal Zone Act Reauthorization Amendments of 1990, known as CZARA, require that EPA describe sets of management measures to be used for the control of pollution from various nonpoint sources, including marinas and recreational boating. States will incorporate these measures into their own non-point source pollution control programs to help achieve water quality standards.

6.4 Roads, Highways, and Traffic

Runoff controls are essential to preventing polluted runoff from roads, highways and bridges from reaching surface waters. Erosion during and after construction of roads, highways and bridges can contribute large amounts of sediment and silt to runoff waters, which can deteriorate water quality and lead to fish kills and other ecological problems.¹⁶²

Heavy metals, oils, other toxic substances and debris from construction traffic and spillage can be absorbed by soil at construction sites and carried with runoff water to lakes, rivers and bays.¹⁶³

Runoff control measures can be installed at the time of road, highway and bridge construction to reduce runoff pollution both during and after construction. Such measures can effectively limit the entry of pollutants into surface and ground waters and protect their quality, fish habitats and public health. Pesticides and fertilizers used along roadway rights-of-way and adjoining land can pollute surface waters and ground water when they infiltrate into soil or are blown by wind from the area where they are applied.

¹⁶² U.S. EPA. "Polluted Runoff (Nonpoint Source Pollution): Roads, Highways, and Bridges." www.epa.gov/owow_keep/NPS/roadshwys.html.

¹⁶³ *Ibid.*

Typical pollutants found in runoff from roads and highways

	Pollutant	Source
Sedimentation	PM	Pavement wear, vehicles, atmosphere, maintenance activities
Nutrients	Nitrogen & Phosphorus	Atmosphere and fertilizer application
Heavy Metals	Lead	Residues from leaded gasoline from auto exhausts and tire wear
	Zinc	Tire wear, motor oil and grease
	Iron	Auto body rust, steel highway structures such as bridges and guardrails and moving engine parts
	Copper	Metal plating, bearing and brushing wear, moving engine parts, brake lining wear, fungicides and insecticides
	Cadmium	Tire wear and insecticides application
	Chromium	Metal plating, moving engine parts and brake lining wear
	Nickel	Diesel fuel and gasoline, lubricating oil, metal plating, brushing wear, brake lining wear and asphalt paving
	Manganese	Moving engine parts
	Cyanide	Anti-caking compounds used to keep deicing salt granular
	Sodium, calcium & chloride	Deicing salts
	Sulphates	Roadway beds, fuel and deicing salts
Hydrocarbons	Petroleum	Spills, leaks, antifreeze and hydraulic fluids and asphalt surface leachate

The City of Beacon was considering, in late 2011 it was announced that the project was going to be put on hold, a possible large-scale development project, referred to as a Transit-Oriented Development project, or TOD project. The TOD involves the

development of a 22-acre site in the proximity of the Beacon train station, the Hudson River waterfront, and Beacon's Main Street. The purpose of the development project would be to create a more transit-oriented community by creating an area of streets, shops, apartments, commercial offices, and a river-view promenade built on top of a double-deck parking garage for the train station. The project would focus around a pedestrian- and bike-friendly design, would be within half a mile of the city's main street, would maximize aesthetics by improving river views and creating more greenspaces, and would improve access to the Metro-North rail services and convert the current "park-and-ride" lots at the train station into a more attractive "walk-and-ride" neighborhood.¹⁶⁴

6.5 Brownfields

A brownfield is a property, the expansion, redevelopment, or reuse of which may be complicated by the presence or potential presence of a hazardous substance, pollutant, or contaminant.¹⁶⁵ It is estimated that there are more than 450,000 brownfields in the United States. Cleaning up and reinvesting in these properties increases local tax bases, facilitates job growth, utilizes existing infrastructure, takes development pressures off of undeveloped, open land, and both improves, reduces blight, and takes development pressures off greenspaces and working lands, protects the environment and health of the communities.¹⁶⁶

Nearly every community in New York State is affected by contaminated and abandoned properties, or brownfield sites. Left untouched, brownfields pose environmental, legal and financial burdens on a community and its taxpayers. However, after cleanup, these sites can again become the powerful engines for economic vitality, jobs and community pride that they once were.¹⁶⁷

Long Dock Beacon in the City of Beacon is a brownfield in an 8.85 acre peninsula of land forming the southern half of Beacon Harbor. The land parcel is a former industrial area, with prior commercial uses being a salvage yard which operated from 1962 to 1983, and a Major Oil Storage Facility (MOSF) known as "Garret Storm" which operated

¹⁶⁴ City of Beacon. "Proposed TOD Zoning District." <http://www.cityofbeacon.org/factsheets/proposed-transit-oriented-development-tod-district>

¹⁶⁵ U.S. EPA. "Brownfields and Land Revitalization." www.epa.gov/brownfields/mission.htm

¹⁶⁶ *Ibid.*

¹⁶⁷ NYS Department of Environmental Conservation. "Environmental Cleanup and Brownfields." www.dec.ny.gov/chemical/brownfields.html.

from 1936 to 1994. Both sites have gone through Interim Remedial Measures (IRMs); Garret Storm in 1999-2000, and Beacon Salvage in 2002, removing petroleum-contaminated soil and PCB-contaminated soil from the sites, respectively. In 2006 and 2007, Remedial Investigations (RIs) were conducted at the Long Dock site, and many contaminants were still found, including volatile organic compounds (VOCs), semi-volatile organic compounds (SVOCs), arsenic, lead, mercury, and PCBs. The next steps for the remediation project include a remedial design program to decide the best steps for safe remediation of the site, excavation and off-site disposal of the contaminated soil (estimated to be 8,000 to 11,500 cubic yards), in-situ chemical oxidation (ISCO) treatment to reduce petroleum contamination, the addition of uncontaminated soil to replace what was excavated and paved surfaces to decreased direct contact with the possible still-existing contamination in the soil, and a site management plan (SMP) to monitor the site in the future.¹⁶⁸

7. BEACON HEALTH PROFILE

7.1 Introduction

Any environmental justice assessment must consider the health status of the environmental justice community and the potential human health effects of current and increased environmental burdens. A population with a lower health status, whether the lower health status is caused by environmental or other factors, may be more vulnerable to the effects of increased environmental exposures. (Hudson River Sloop Clearwater, Inc, 2010)

7.2 Respiratory Diseases 2009¹⁶⁹

Table 7.2.1

	Beacon Admissions
Acute Respiratory Infections	3
Other Diseases of Upper Respiratory Tract	0
Pneumonia and Influenza	27
Chronic Obstructive Pulmonary Disease & Allied Cond	22
Pneumoconioses & Other Lung	7

¹⁶⁸ NYS DEC. "Brownfields Cleanup Program Draft Decision Document – Long Dock Beacon Site." http://www.dec.ny.gov/docs/remediation_hudson_pdf/C314112dd.pdf

¹⁶⁹ Respiratory Diseases (ICD 460-466) (Infoshare online)

Disease from Ext Agents	
Other Disease of Respiratory System	31

7.3 Cardiovascular Diseases Admissions 2009¹⁷⁰

Table 7.3.1

	Chronic Rheumatic Pericarditis	Diseases of Mitral Valve	Aortic Valve Disease	Diseases of Endocardial Structure	Rheumatic Heart Disease	Disorders of Circulatory System	Heart Transplant
Dutchess County	0	8	0	0	3	18	93
City of Beacon	0	0	0	0	0	0	2

	Cerebrovascular Disease	Heart Failure	Diseases of Pericardium
Dutchess County	61	868	15
City of Beacon	2	28	0

Table 7.3.2 Deaths due to all Cardiovascular Disease by Age Category for 2001¹⁷¹

Death due to all cardiovascular disease by Age Category for 2011
Data Source: Infoshare.org

	Dutchess County	City of Beacon
< 1yr	0	0
1-14yr	3	0
15-24yr	0	0
25-34yr	3	0
35-44yr	10	0
45-54yr	29	1
55-64yr	66	3
65-74yr	135	3
75-84yr	239	7
>84 yrs.	348	9

¹⁷⁰ Cardiovascular Diseases (ICD 390-456) (Infoshare online)

¹⁷¹ Deaths due to all Cardiovascular Disease (Infoshare online)

7.4 Cancer

Table 7.4.1 Deaths due to Malignant Cancers in Breast by Age Category For 2001¹⁷²

Data Source: Infoshare.Org

Age Range ↓	Dutchess County	City of Beacon
< 1yr	0	0
1-14yr	0	0
15-24yr	0	0
25-34yr	0	0
35-44yr	3	0
45-54yr	3	0
55-64yr	12	0
65-74yr	3	0
75-84yr	7	0
>84 yrs.	3	0

* As can be seen in the above table, in the year 2001, the City of Beacon didn't have any deaths cause by Malignant Breast Cancer, compared to the deaths in Dutchess County.

Table 7.4.2 Deaths due to Respiratory Cancer by Age Category For 2001¹⁷³

Data Source: Infoshare.Org

Age Range ↓	Dutchess County	City of Beacon
< 1yr	0	0
1-14yr	0	0
15-24yr	0	0
25-34yr	0	0
35-44yr	3	0
45-54yr	16	0
55-64yr	21	0
65-74yr	34	1
75-84yr	39	3
>84 yrs.	12	0

* As can be seen in the above table, in the year 2001, the City of Beacon didn't have any deaths caused by Respiratory Cancer until the age of 65 and above. For Dutchess County, Respiratory Cancer was seen from the age of 35 and above. The numbers in bold are the high values.

Table 7.4.3 Deaths due to Gastrointestinal Cancer by Age Category For 2001¹⁷⁴

¹⁷² Deaths due to Breast Cancer (Infoshare online)

¹⁷³ Deaths due to Respiratory Cancer (Infoshare online)

Data Source: Infoshare.Org

Age Range ↓	Dutchess County	City of Beacon
< 1yr	0	0
1-14yr	0	0
15-24yr	0	0
25-34yr	0	0
35-44yr	3	0
45-54yr	7	0
55-64yr	14	0
65-74yr	24	1
75-84yr	32	1
>84 yrs.	18	0

* As can be seen in the above table, in the year 2001, the City of Beacon only had Gastrointestinal Cancer between the ages of 65-84. For Dutchess County, Gastrointestinal Cancer was seen from the age of 35 and above. The numbers in bold are the high values

Table 7.4.4 Deaths due to Malignant Cancer by Age Category For 2001¹⁷⁵

Data Source: Infoshare.Org

Age Range ↓	Dutchess County	City of Beacon
< 1yr	0	0
1-14yr	3	0
15-24yr	0	0
25-34yr	3	0
35-44yr	16	1
45-54yr	37	3
55-64yr	72	1
65-74yr	116	3
75-84yr	133	3
>84 yrs.	66	1

* As can be seen in the above table, in the year 2001, the City of Beacon had Malignant Cancer deaths from the age of 35 and above. For Dutchess County, Respiratory Cancer was seen from the ages of 1-14yrs, and 25yrs and above. The numbers in bold are the high values

7.5 Perinatal Health

Death due to Perinatal situations

Age Range ↓	Dutchess County	City of Beacon
< 1yr	7	1

¹⁷⁴ Deaths due to Gastrointestinal Cancer (Infoshare online)

¹⁷⁵ Deaths due to Malignant Cancer (Infoshare online)

1-14yr	0	0
15-24yr	0	0
25-34yr	0	0
35-44yr	0	0
45-54yr	0	0
55-64yr	0	0
65-74yr	0	0
75-84yr	0	0
>84 yrs.	0	0

* The only time in both Dutchess County and the City of Beacon where there was a death due to Perinatal situations was before the first year.

Birth Weight for 2004¹⁷⁶

	Birth weight >1000g	Birth weight 1000-1499g	Birth weight 1500-1999g	Birth weight 2000-2499g	Birth weight 2500-2999g	Birth weight < 3000g	Birth weight not known
Dutchess County	0	20	37	108	470	2389	3
City of Beacon	0	0	3	3	14	48	0

- The greatest number of birth rates were over 3000g as indicated in bold.

7.6 Lead Poisoning:¹⁷⁷

Contaminant	Date of Sample	Level Detected mg/l	Source of Contamination
Barium	11/9/10	0.0172	Discharge of drilling wastes, discharge from metal refineries, erosion of natural deposits
Nickel	11/9/10	0.0007	Erosion of natural deposits. Discharge from fertilizer factories
Chloride	9/7/10	21.8	Road Salt, natural occurrence
Nitrate	11/09/10	0.05	Runoff from fertilizer use, leaching from septic tanks
Sodium	9/7/10	8.7	Road Salt, natural occurrence, water

¹⁷⁶ Hospital Admissions for babies with indicated birth weight ranges (Infoshare online)

¹⁷⁷ Annual Drinking Water Quality Report for 2010, City of Beacon Water Supply (City of Beacon, 2010)

			softeners
Copper	7/16/08	0.29	Corrosion of household plumbing, Erosion of natural deposits
Lead	7/30/08	2.3	Corrosion of household plumbing, Erosion of natural deposits
Asbestos	1/14/04	0.20	Decay of asbestos-cement pipe. Erosion of natural deposits

7.7 Emerging Issues Requiring Further Research

Manufactured Chemicals found in the Environment (Pharmaceuticals, Industrial)

The new concern in the area has been chemical contaminant being detected in the waters surrounding the City of Beacon. In order to comply with State and Federal regulations, the City of Beacon Water supply annually checks the level of contaminants in the water to see if the drinking quality is within acceptable ranges. The water source for the City of Beacon comes from the Cargill, Mt. Beacon and Melzingah reservoirs as well as three ground water sources- City of Beacon Wells 1 and 2 and the Village of Fishkill Well 8.¹⁷⁸ The City of Beacon Water Supply serves approximately 19,000 people and the total water produced in 2010 was 837,629,00 gallons of water, with the daily average production being 2,294,874 gallons. The water is regularly checked for numerous contaminants such as microbial contaminants, inorganic contaminants, pesticides and herbicides, organic chemical contaminants, and radioactive contaminants. (City of Beacon, 2010)

Diabetes

Diabetes has been on the rise in the United States for many years, mainly due to unhealthy eating habits, lack of extracurricular activities as well as environmental factors. Exposure to environmental contaminants, whether it is radioactive, chemical has been shown by research to be one of the causes to the rise of diabetes and obesity in the United States.

¹⁷⁸ Annual Drinking Water Quality Report for 2010, City of Beacon Water Supply (City of Beacon, 2010)

Body burdens on newborns

There is current medical research initiatives occurring to determine the reason as to why there are more than 200 chemical contaminants found in the umbilical cord blood of 10 babies. Of the more than 200 chemical contaminants, 180 of them can cause cancer in humans. These contaminants have the strong potential to cause neurological damage and/or cause birth defects to the baby.¹⁷⁹

7.8 Conclusion

Comparing the health data of the City of Beacon with that of Dutchess County, the deaths due to the different cancers ranged from none to barely minimum. As such the population of the City of Beacon has been steady mostly due to the stagnant birth rates. The different environmental effects that are surrounding the City of Beacon, these effects still to-date affect the everyday life of the citizens of Beacon, as well as the children and newborns in the area. The level of contaminants in the water reservoirs surrounding City of Beacon was relatively low because of the extensive detection equipment that was placed in the reservoirs. The birth rates in the City of Beacon was fairly equally distributed among the different races that occupy Beacon.

8. FINDINGS AND RECOMMENDATIONS

8.1 Findings

The City of Beacon and its surrounding area has a number of unique physical and demographic characteristics that make it highly vulnerable to the risks of climate change.

Although the city does not face any single, significant, industrial polluter, residents still face a number of threats to human health, such as air pollution, drinking water contamination, exposure to toxins at brownfields and vacant lots, and lead and asbestos exposure in their own homes. Any one of these sources alone may cause a burden to the community, but collectively the impact is likely to be more significant due to cumulative and potentially synergist effects.

¹⁷⁹ Body Burden – The Pollution in Newborns (Environmental Working Group , 2005)

8.2 Recommendations

The following recommendations were the results of an interactive process between Clearwater and the members of the Beacon CJC. The group focused much of their attention to preserving Beacon's assets and resources and creating a more sustainable future and green economy. Some of the ideas may have seemed very idealist or unattainable, but with focused research it is likely that most are achievable – especially if funding and other resources can be found. Next steps will include prioritizing and looking for funding.

Preserving Environmental Assets and Resources

- Protect clean water and clean air, or restore where degraded
- Protect trees and forests (especially useful for water quality and carbon sequestration)
- Assure riverfront access, including Denning's Point, and Long Dock.
- Work with the Fishkill Watershed Committee and CAC to promote watershed awareness and protection.
- Map the wetlands, beyond existing federal and state maps, which need to be field verified.
- Continue to monitor outfalls and illicit discharges to the Hudson River as part of MS4 compliance.
- Utilize Green Infrastructure to reduce stormwater flow and improve water quality; identify potential projects and funding.
- "Green" municipal building, vehicles, and heavy equipment but upgrading to energy efficient alternatives and renewable energy.

Food Justice and Health

- More frequent and better advertising of local farmers' markets.
- Support local farms.
- Have a year-round Farmers Market (indoors monthly in winter).

- Create community gardens in accessible locations, especially in the urban areas to provide green space and nutritious food. Promote groups like Sargent Downing and Nursery.

Preventing or Mitigating Pollution Impacts and Other Environmental Burdens

Traffic

- Establish bike lanes to promote sustainable transportation and recreational uses of roadways
- Support and find funding for a solar-powered trolley to reduce traffic in downtown and explore pedi cabs.

Health

- Continue to problem-solve ways to reduce exposures and to promote health through good nutrition, exercise, and education.
- Support and work with existing agencies that are providing care and education.

Other

- Establish programs to test indoor air quality, lead, and radon.
- Prevent or mitigate the spread of invasive species such as plants and insects
- Flooding problems: can be severe during and after torrential downpours; storm sewer covers can actually become dislodged with water rushing out. This may become worse as climate change worsens.

9. CONCLUSION

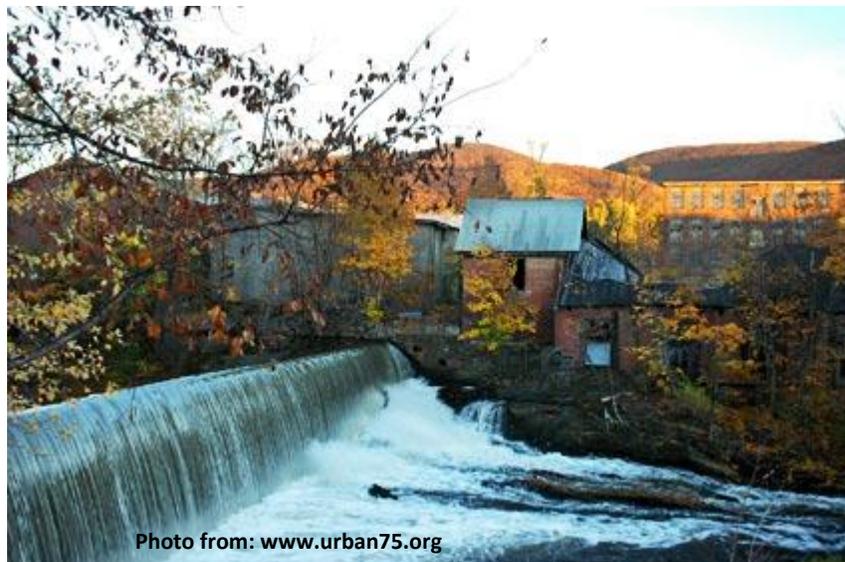
“Environmental justice is not an issue we can afford to relegate to the margins. It has to be part of our thinking in every decision we make.” ~ Lisa Jackson, Administrator, United States Environmental Protection Agency, 2009.

Environmental justice can be furthered by adopting policies to encourage and facilitate public participation in decisions, clean energy programs to improve efficiency and clean energy deployment, and targeted programs that ensure environmental justice communities are included in the transition to a clean energy economy.

Increasing opportunities for public participation in the decision making process would allow for greater transparency in agency decision making, and would reduce the likelihood that communities will be excluded from the decision making process. Fair and meaningful public involvement would include, among other things, availability of information, continual transparency, and early consultation and collaboration.

Encouraging and facilitating community involvement improves communication and embraces problem solving techniques that foster strong and trustworthy relationships between the community, regulatory agencies, and industries in the energy sector. Greater involvement in the decision making process increases community confidence in agency decisions and ensures that potential problems and possible solutions are addressed early in the process. Increased community involvement provides greater potential for addressing community concerns in siting decisions before disputes arise, improves agency relations with communities throughout the state, and helps communities move towards environmental equity.

When siting new facilities, assessing disproportionate health risks and environmental impacts could help identify overburdened communities and help develop measures to avoid or mitigate potential impacts in these communities.



C. CLIMATE JUSTICE ASSESSMENT

1. CLIMATE JUSTICE

According to the Mobilization for Climate Justice, “Climate justice is a vision to dissolve and alleviate the unequal burdens created by climate change. As a form of environmental justice, climate justice is the fair treatment of all people. It is the freedom from discrimination with the creation of policies and projects that address climate change, as well as the systems that create climate change and perpetuate discrimination.”¹⁸⁰ The unequal burden refers to people of color and low-income located in urban communities across the United States. These communities are the first to experience the negative impacts of climate change such as heat-related illness and death, respiratory illness, infectious diseases, and unaffordable rises in energy costs, among others.

1.1 Climate Justice in the Hudson Valley

Hudson River Sloop Clearwater, Inc. Hosts Climate Justice Conference in the Hudson Valley

On May 21, 2012 Hudson River Sloop Clearwater introduce the concept of Climate Justice to participating communities with an intermunicipal workshop on climate justice called "Finding Opportunity in the Climate Crisis." This well-attended and enthusiastic workshop brought together municipal leaders, community members, youth, and environmental/conservation committee members. Participants learned about environmental justice, how climate change will affect the Hudson Valley, and what current initiatives are taking place. After the speakers presented, the group split into breakout sessions to brainstorm on topics such as energy, food and water, transportation, disaster prevention, response and recovery, and economic opportunities/green jobs. At the end of the day, participants left with knowledge, ideas, and tools to bring back to their own cities.¹⁸¹

¹⁸⁰ Mobilization for Climate Justice. “What is Climate Justice?” (2009). Retrieved October 7, 2011 from <http://www.actforclimatejustice.org/about/what-is-climate-justice/>

¹⁸¹ New York House. http://www.upstatehouse.com/view/full_story/14345709/article-Climate-Justice-Initiatives-Set-for-Hudson-Valley-Cities-July-6--7--12--14. Upstate House.

2. CLIMATE CHANGE

Climate change is one of the most controversial science issues of the 21st century and is a real and urgent challenge that is already affecting people and the environment worldwide. It is undeniable that the Earth's climate is changing. In this section we will present some key scientific facts that explain the causes and effects of climate change (see section C.3) in an attempt to demystify this sometimes misunderstood phenomenon.

2.1 What is Climate Change?

Climate change may result from:

- natural factors, such as changes in the sun's intensity or slow changes in the Earth's orbit around the sun;
- natural processes within the climate system (e.g. changes in ocean circulation);
- human activities that change the atmosphere's composition (e.g. fossil fuel combustion) and the land surface (e.g. deforestation, reforestation, urbanization, desertification, etc.)

Although the Earth's climate has changed many times throughout its history, natural processes alone cannot explain the rapid warming seen today. Evidence of human influences on climate change has become increasingly clear and compelling.

Science

Climate or Weather

Weather is the way the atmosphere is behaving, mainly with respect to its effects upon life and human activities.

The difference between weather and climate is that weather consists of the short-term (minutes to months) changes in the atmosphere.

NASA. www.nasa.gov

Climate Change and Global Warming

Climate change refers to any significant change in measures of climate (such as temperature, precipitation, or wind) lasting for an extended period (decades or longer). Climate change might result from natural factors and processes or from human activities.

The term "climate change" is often used interchangeably with the term global warming. **Global warming** refers to an average increase in the temperature of the atmosphere near the Earth's surface, which can contribute to changes in global climate patterns. However, rising temperatures are just one aspect of climate change.

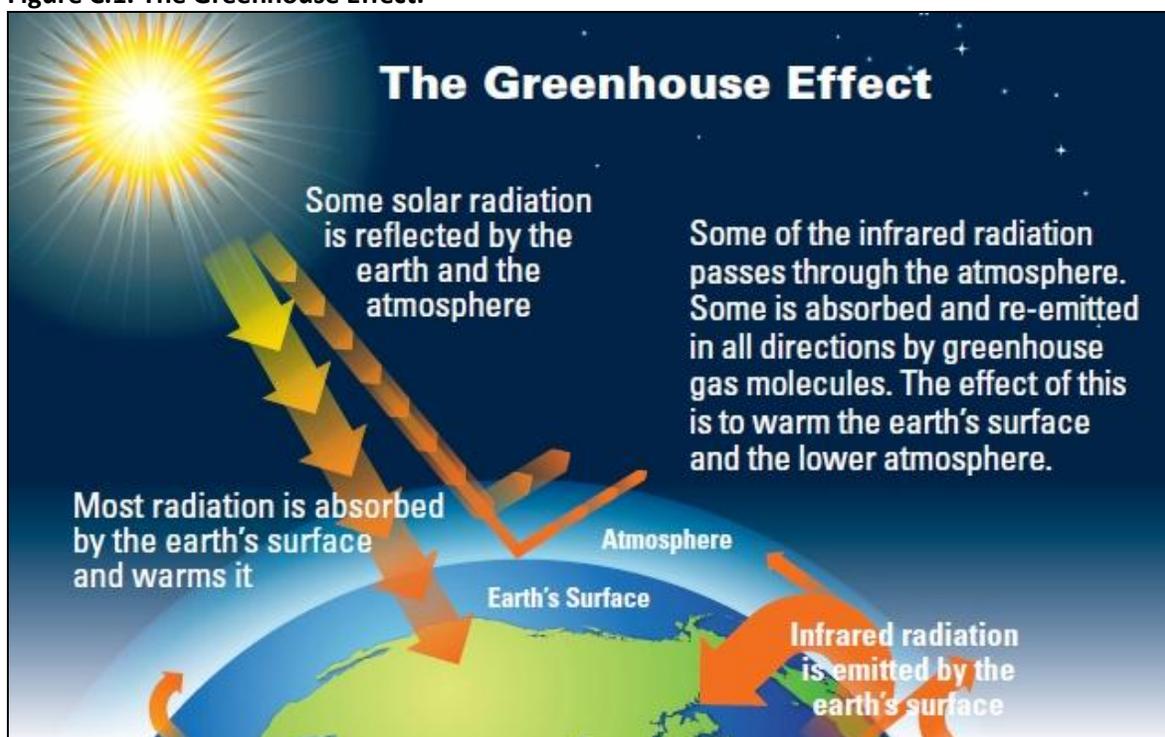
According to the National Academy of Sciences, "the phrase 'climate change' is growing in preferred use to 'global warming' because it helps convey that there are [other] changes in addition to rising temperatures."

(US EPA. Climate Change Indicators in the United States. www.epa.gov/climatechange/indicators.html)

Energy from the sun drives the Earth's weather and climate. The Earth absorbs some of the energy it receives from the sun and radiates the rest back toward space. However, certain gases in the atmosphere, called greenhouse gases, absorb some of the energy radiated from the Earth and trap it in the atmosphere. (See Figure C.1 for an Image Illustrating the Greenhouse Effect). These gases essentially act as a blanket, making the Earth's surface warmer than it would be otherwise. (US EPA)

Since the Industrial Revolution (around 1750), human activities have substantially added to the amount of heat-trapping greenhouse gases in the atmosphere. The burning of fossil fuels, such as coal and oil, and biomass (living matter such as vegetation) has also resulted in emissions of aerosols that absorb and emit heat, and reflect light.¹⁸⁴ Some amount of greenhouse gases is necessary for making it possible for life as we know it to exist on Earth because they trap heat in the atmosphere keeping the planet warm and maintaining a healthy equilibrium. Therefore, an increase in the amount of greenhouse gases in the atmosphere changes its composition and influences climate. The natural greenhouse effect is being strengthened as human activities add more of these gases to the atmosphere.

Figure C.1. The Greenhouse Effect.



Source: US Environmental Protection Agency (EPA), "Frequently Asked Questions About Global Warming and Climate Change: Back to Basics," www.epa.gov (Feb. 5, 2012)

Greenhouse Gases

As mentioned before the Earth's climate is changing. Right now it is getting warmer, very likely¹⁸⁵ the result of human activities.¹⁸⁶ Although some greenhouse gases are almost entirely

¹⁸⁴ EPA. "Causes of Climate Change." <http://www.epa.gov/climatechange/science/causes.html>

¹⁸⁵ EPA using language from: IPCC, 2007: Climate Change 2007: The Physical Science Basis. Contribution of Working Group I to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change [Solomon, S., D. Qin, M. Manning (eds.)]. (Use of "very likely" conveys a 90-99% chance the result is true. Other terms used to communicate confidence include "extremely likely" (greater than 95% chance the result is true); "likely" (greater than

man-made and others come from a combination of natural sources and human activities (See Carbon Dioxide below) their concentration in the atmosphere is changing the amount of radiation coming into and leaving the atmosphere, likely contributing to changes in climate.¹⁸⁷

The major greenhouse gases emitted into the atmosphere through human activities are carbon dioxide, methane, nitrous oxide, and fluorinated gases.¹⁸⁸

- **Carbon dioxide (CO₂)** is emitted primarily through the burning of fossil fuels (oil, natural gas, and coal), solid waste, and trees and wood products. Changes in land use, such as growing new forests or disturbing soils, can lead to the addition or removal of carbon dioxide to/from the atmosphere. Carbon dioxide occurs naturally because of volcanoes, forest fires, and biological processes (such as breathing), but is also produced by burning fossil fuels in power plants and automobiles.

CO₂ concentrations in the atmosphere increased from approximately 280 parts per million (ppm) in pre-industrial times to 382 ppm in 2006, according to the National Oceanic and Atmospheric Administration's (NOAA) Earth Systems Research Laboratory; a 36 percent increase.¹⁸⁹ According to the 2007 IPCC, almost all of the increase is due to human activities.¹⁹⁰ The current rate of increase in CO₂ concentrations is about 1.9 ppm/year. Present CO₂ concentrations are higher than any time in at least the last 650,000 years.¹⁹¹ (See Figure 1 for a record of CO₂ concentrations from about 420,000 years ago to present).

- **Methane (CH₄)** is emitted during the production and transport of coal, natural gas, and oil. Methane emissions also result from livestock and agricultural practices and from the decay of organic waste in municipal solid waste landfills. In the United States, the largest methane emissions come from the decomposition of wastes in

66% chance the result is true) and “extremely unlikely” (less than 5%). The term “virtually certain” conveys that there is a greater than 99% chance that a result is true.)

¹⁸⁶ Id.

¹⁸⁷ Atmosphere Changes. <http://www.epa.gov/climatechange/science/recentac.html>

¹⁸⁸ US EPA. Climate Change Indicators in the United States. Greenhouse Gases. at 9.

¹⁸⁹ <http://www.esrl.noaa.gov/gmd/ccgg/trends/index.html#global>

¹⁹⁰ IPCC, 2007: Climate Change 2007: The Physical Science Basis. Contribution of Working Group I to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change [Solomon, S., D. Qin, M. Manning (eds.)]

¹⁹¹ Id.

landfills, ruminant digestion and manure management associated with domestic livestock, natural gas and oil systems, and coal mining.¹⁹²

Methane is more abundant in the Earth's atmosphere now than at any time in at least the past 650,000 years.¹⁹³ Methane concentrations increased sharply during most of the 20th century and are now 148% above pre-industrial levels. In recent decades, the rate of increase has slowed considerably.¹⁹⁴

- **Nitrous oxide (N₂O)** is emitted during agricultural and industrial activities, as well as during combustion of fossil fuels and solid waste.

N₂O has increased approximately 18 percent in the past 200 years and continues to increase. For about 11,500 years before the industrial period, the concentration of N₂O varied only slightly. It increased relatively rapidly toward the end of the 20th century.¹⁹⁵

- **Fluorinated gases**, such as hydrofluorocarbons, perfluorocarbons, and sulfur hexafluoride, are emitted from a variety of industrial processes and commercial and household uses. Fluorinated gases are sometimes used as substitutes for ozone-depleting substances such as chlorofluorocarbons (CFCs).

Many of these gases can remain in the atmosphere for tens to hundreds of years after being released.¹⁹⁶ Thus, to get a more complete picture of the amount of greenhouse gases in the atmosphere, both emissions (how much of a given greenhouse gas is produced and emitted into the air) and concentrations (the amount of a greenhouse gas present in a certain volume of air) are measured. Long-lived greenhouse gases become globally mixed in the atmosphere, reflecting both past and recent contributions from emission sources worldwide.¹⁹⁷ Some short-lived greenhouse gases, such as tropospheric ozone and aerosols, as well as particulates in the atmosphere, such as

¹⁹² US EPA. Sources and Emissions: Where Does Methane Come From?

<http://www.epa.gov/methane/sources.html>

¹⁹³ EPA, Causes of Climate Change. <http://www.epa.gov/climatechange/science/causes.html#ref3>

¹⁹⁴ EPA. Greenhouse Gases: Methane. <http://www.epa.gov/climatechange/science/recentac.html>

¹⁹⁵ Ibid

¹⁹⁶ Id.

¹⁹⁷ Id.

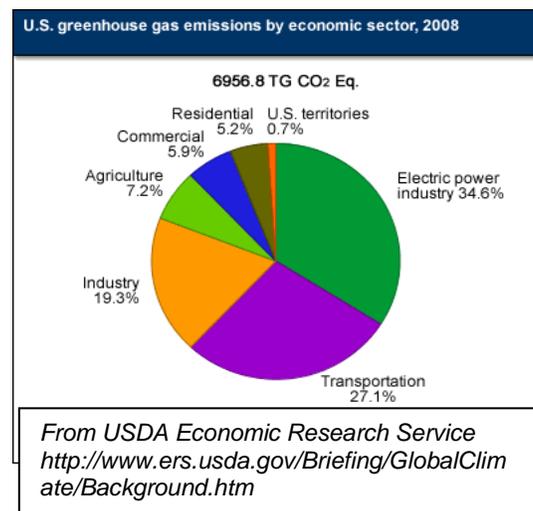
black carbon and sulfates, are relevant to climate change.¹⁹⁸ Other major sources of greenhouse gases include industrial and agricultural processes, waste management, and land use changes.

2.2 Climate Change Indicators

As reported by the IPCC, the buildup of greenhouse gases in the atmosphere is likely the cause of most of the recent observed increase in average temperatures, and contributes to other factors of climate change.¹⁹⁹

Collecting and interpreting environmental indicators has played a critical role in our increased understanding of climate change and its causes.²⁰⁰ An indicator represents the state of certain environmental conditions over a given area and a specified period of time.²⁰¹ Scientists, analysts, decision-makers, and others use environmental indicators, including those related to climate, to help track trends over time in the state of the environment, key factors that influence the environment, and effects on ecosystems and society.²⁰²

The EPA selected the 24 indicators presented in this report from a broader set of 110 indicators, many of which were identified at an expert workshop (November 30 to December 1, 2004) on climate change indicators convened by the National Academy of Sciences and funded by the EPA. The indicators in this report were chosen using a set of screening criteria that considered usefulness, objectivity, data quality, transparency, ability to show a meaningful trend, and relevance to climate change.



¹⁹⁸ Id.

¹⁹⁹ IPCC (Intergovernmental Panel on Climate Change). 2007. Summary for Policymakers. In: Climate change 2007: The physical science basis (Fourth Assessment Report). Cambridge, United Kingdom: Cambridge University Press.

²⁰⁰ US EPA, Climate Change Indicators Report. Available here www.epa.gov/climatechange/indicators.html. Feb 20, 2012.

²⁰¹ Id.

²⁰² Id.

U.S. Greenhouse Gas Emissions

Greenhouse Gas Emissions in the United States have risen 14 percent from 1990 to 2008.²⁰³ These greenhouse gases include carbon dioxide, methane, nitrous oxide, and several fluorinated compounds, and are released into the atmosphere by human-related commercial, industrial and household activities.²⁰⁴ Electricity generation accounts for 32% of U.S. emissions since 1990, followed by transportation (27%).²⁰⁵

Global Greenhouse Gas Emissions and Atmospheric Concentrations

From 1990 to 2005, global greenhouse gas emissions have risen by 26 percent.²⁰⁶ These emissions are increasing faster in some parts of the world that are highly industrialized and have high amounts of pollution. Before the industrial era around 1780, carbon dioxide concentrations measured about 270-290 parts per million (ppm) as compared to 387 ppm in 2009 - a 38 percent increase.²⁰⁷

Climate Forcing

Climate or 'radiative' forcing is a measurement of how substances like greenhouse gases affect the amount of energy naturally absorbed by the atmosphere. An increase in this forcing leads to climate warming and from 1990 to 2008 the cumulative greenhouse gases in the Earth's atmosphere caused climate forcing to increase by 26 percent.²⁰⁸ Most of this increase is due to an increase in carbon dioxide emissions and in this eighteen year period, radiative forcing due to carbon dioxide increased by 35 percent.²⁰⁹

U.S. and Global Temperature

By looking at average monthly and yearly temperatures in the past century, we can see how increases in average temperatures coincide with patterns of climate change. Since 1901, global average surface temperatures have risen at an average rate of 0.13 °F per decade.²¹⁰ Prior to 1970, the U.S. rate of temperature increase was in line with the global trend but since then the

²⁰³ Id.
²⁰⁴ Id.
²⁰⁵ Id.
²⁰⁶ Id.
²⁰⁷ Id.
²⁰⁸ Id.
²⁰⁹ Id.
²¹⁰ Id.

United States has warmed at almost twice the global rate. Trends show that 2000-2009 was the warmest decade on record worldwide.²¹¹

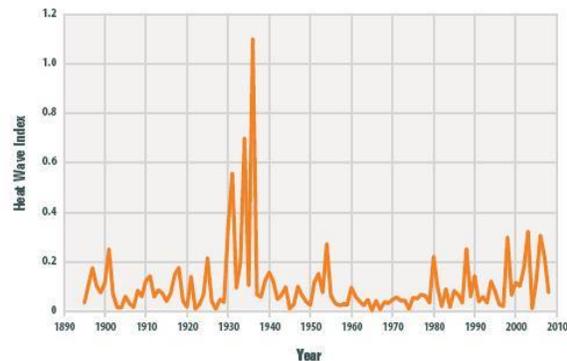
Heat Waves

Heat waves in the United States have increased since the 1960s and 1970s, but the highest frequency of heat waves occurred during the 1930s 'Dust Bowl'.²¹²

Heat waves are typically in conjunction with periods of intense drought when little soil moisture cannot regulate the evaporation process. Heat waves are known to kill or injure crops and livestock and can lead to power outages when high demand for air conditioning can short-circuit the power grid.²¹³

Figure 1. U.S. Annual Heat Wave Index, 1895–2008

This figure shows the annual values of the U.S. Heat Wave Index from 1895 to 2008. These data cover the lower 48 states.



Data source: CCSP, 2009*

From US EPA, Climate Change Indicators Report

Drought

As average surface temperatures rise, the Earth's water cycle speeds up and increases evaporation. An increase in evaporation usually results in a decrease of precipitation, causing drought. From 2000 to 2009, roughly 30 to 60 percent of U.S. land areas experienced drought conditions.²¹⁴ Data regarding patterns of drought have not been recorded long enough to determine any long-term trend, yet average increases in surface temperature suggest that drought has increased with climate change.²¹⁵

U.S. and Global Precipitation

Total rainfall and precipitation have significant effects on human and ecosystem life. Since 1901 global precipitation has increased at an average of 1.9 percent per century, while precipitation has increase by 6.4 percent per century in the United States.²¹⁶ While the increase in

²¹¹ Ibid

²¹² Ibid

²¹³ Id

²¹⁴ Id

²¹⁵ Id

²¹⁶ Id

precipitation rates are in direct reflection of the climate change, shifting weather patterns have decreased the total precipitation in some areas, including Hawaii and parts of the south-west.²¹⁷

Heavy Precipitation

Climate change can influence the intensity as well as the incidence of precipitation. Warmer oceans increase the amount of water evaporated into the air and this warmer air can hold more moisture that is released in the form of heavy rain and snowstorms.²¹⁸ Not only have precipitation rates per century increased, but incidences of heavy short-term precipitation have also increased since 1990. Eight of the top ten years for extreme one-day precipitation have occurred in the past two decades.²¹⁹

Tropical Cyclone Intensity

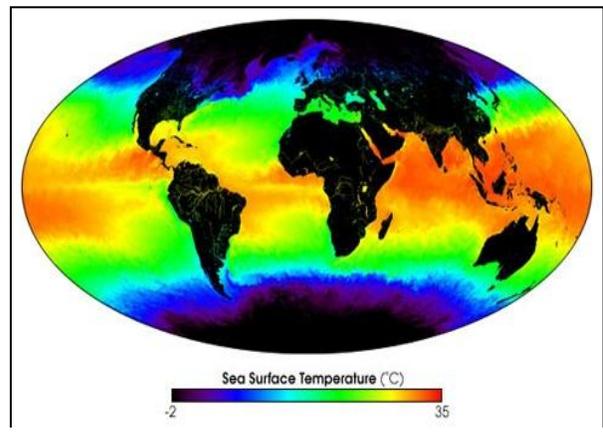
Tropical cyclones are cyclones that garner their energy from warm tropical oceans. A cyclone's intense rains and winds can cause property damage, soil erosion, and flooding.²²⁰ Increased sea surface temperatures that result from climate change are the primary cause of cyclone formation and behavior. While there is no clear trend of cyclone intensity in the past half century, levels of intensity have risen in the past 20 years or so, and six of the ten most intense years have occurred since the mid-1990s.²²¹

Ocean Heat

When sunlight hits the ocean's surface, some of the energy is captured and stored as heat and affects both the deep ocean's temperature as well as the surface temperatures. Ocean heat has substantially increased since 1950 and has affected not only surface temperatures, but also sea levels and currents.²²²

Sea Surface Temperature

Sea surface temperatures have significantly



Sea Surface Temperature: www.nasa.gov

²¹⁷ Id
²¹⁸ Id
²¹⁹ Id
²²⁰ Id
²²¹ Id
²²² Id

increased in the past century, and from 1901 to 2009 the average temperature rose at a rate of 0.12 degrees per decade. In the past 30 years, sea surface temperatures have been shown to rise more quickly at 0.21 degrees per decade.²²³

Sea Level

Changes in sea surface temperature affect sea levels. From 1870 to 2008, absolute sea level increased at an average rate of 0.06 inches per year but in the past decade or so, from 1993 to 2008, average sea level rose at a rate of 0.11 to 0.13 inches per year - almost twice as fast as the long-term pattern.²²⁴ Regional trends in sea level vary and have actually decreased in some places because the sea level is relative to the height of the land, which itself has shifted in the past few decades.

Ocean Acidity

Changes in ocean waters develop over a period of time. Over the past decades studies show that the acidity level in oceans has increased substantially due to the abundant level of carbon dioxide. As levels of carbon dioxide increase in the atmosphere the ocean waters absorb more carbon dioxide in order to keep a balance.²²⁵ Although carbon dioxide can be stored in oceans to help lessen climate change caused by human activity the significant increase has caused a chemical imbalance, which can change the biodiversity and productivity of the ocean's ecosystem.²²⁶ Sensitive organisms such as plankton and corals can be greatly affected due to the reduced level of calcium carbonate to harden their skeletons and shells. This balance between the atmosphere and the ocean can take up to hundreds of years to correct itself.

Arctic Sea Ice

During the cold winter months sea ice covers nearly all of the Arctic Ocean, but in the summer months with warm temperatures the sea ice begins to melt. The extent of the sea ice has, even in winter months, begun to decrease over the past century. Since sea ice is reflective, this region usually helps regulate the global climate keeping the polar region cold.²²⁷ However, due to the decrease in sea ice caused by the increase in temperatures, the balance of the Earth's

²²³ Id

²²⁴ Id

²²⁵ Id

²²⁶ Id

²²⁷ Id

climate is reduced.²²⁸ The decreased amount of sea ice can be harmful to Arctic mammals such as polar bears and walruses. These animals strongly rely on the existence of sea ice to hunt, breed, and migrate.²²⁹ In 2007, the lowest extent of sea ice was recorded as 490,000 square miles, which is an area larger than Texas and California combined.²³⁰

Glaciers

A glacier is a large body of ice that has accumulated over a period of time and is present year round.²³¹ Glaciers naturally flow like a river, but much slower. Higher elevations build up snow which is compressed into ice over time, and water flows at lower elevations until volume is eventually lost.²³² A balance between higher and lower elevations with the presence of fresh snow is always met resulting in glaciers neither growing nor shrinking.²³³ Therefore, the appearance of glaciers changing or melting and breaking off relates to the change in climate. Observations over a period time are calculated to indicate the mass balance of glaciers around the world. A negative mass balance will determine that glaciers are losing ice and snow.²³⁴ Therefore, a cumulative negative mass balance signifies that glaciers are melting faster than they can be recharged by snow precipitation.²³⁵ Since 1960, glaciers worldwide have lost more than 2,000 cubic miles of water, which correlates with the increase in sea levels.²³⁶

Lake Ice

The disappearance of winter ice in the spring relates to climate factors such as temperature, wind, and cloud cover.²³⁷ A shorter lifespan of lake ice in the spring months may be a sign that the climate is warming.²³⁸ Changes in lake ice can affect the life cycles of the plant and animal species present there. A decrease in ice cover can cause higher water temperatures, lower water levels, higher light penetration, and increased evaporation.²³⁹ These conditions all correlate with the thaw dates trending toward earlier ice break up in the spring.

Snow Cover

²²⁸ Id
²²⁹ Id
²³⁰ Id
²³¹ Id
²³² Id
²³³ Id
²³⁴ Id
²³⁵ Id
²³⁶ Id
²³⁷ Id
²³⁸ Id
²³⁹ Id

Snow cover is influenced by many climate factors, most importantly the changes in global temperature and precipitation over time. The amount of snow cover can affect heating and cooling trends globally. Snow has a higher albedo because it is light and reflective causing cooler temperatures in these areas, whereas darker surfaces such as asphalt or open waters have a lower albedo retaining more heat causing warmer temperatures. Snow cover is also important in replenishing local streams and rivers, and plants and animals rely on the snow for insulation and protection. Over a climate period trends have indicated that snow cover has decreased throughout North America.²⁴⁰

Snow Pack

Snow pack is the amount of snow that is accumulated on the ground over a period of time.²⁴¹ As temperature increases, precipitation levels also change, resulting in more rainfall than snowfall, and causing the snow pack to decrease and melt earlier in the spring. Snow pack is vital for mountainous areas because during the winter months the snowfall stores water that melts in the spring and is used for drinking supplies, irrigation, and power.²⁴² If these trends occur earlier, agriculture, tourism, and wildlife will be greatly affected.²⁴³ Certain species of plants and animals that rely on the snow pack for insulation from the freezing temperatures may be negatively affected by its decrease.

Heat-Related Deaths

Heat-related deaths in the United States are the leading cause of weather-related fatalities. This can be prevented through outreach interventions, education, air quality management, and health care. Extreme temperatures can cause serious illnesses such as heat stroke, hyperthermia, heat cramps, and heat exhaustion.²⁴⁴ Recently, with increased temperatures, heat wave events are becoming more prevalent. The number of people over the age of 65 has increased at a steady rate due to the baby boomers, and this age group is at the highest risk of heat-related deaths.²⁴⁵ Elderly people are more sensitive to excessive heat conditions, and people who have serious cardiovascular and respiratory diseases are more susceptible to be affected as well.

²⁴⁰ Id
²⁴¹ Id
²⁴² Id
²⁴³ Id
²⁴⁴ Id
²⁴⁵ Id

Length of Growing Season

The length of growing season is defined by the number of days when plant growth takes place, ranging usually from the last frost of the spring to the first frost of the fall.²⁴⁶ Many climate factors are taken into consideration when defining this term due to the maturity of plants, daylight hours, temperature, rainfall, and frost days.²⁴⁷ Warming climates can have a positive or negative effect on crop yield depending on location and type of crop. Also, invasive species or weed growth can alter the length of growth season. Throughout North America, over the last climate period, there has been a steady increase in the growing season, more so in the western US than the east.²⁴⁸

Plant Hardiness Zones

Plant hardiness zones are regional designations that help farmers and gardeners determine which plant species are expected to survive a typical winter.²⁴⁹ This designation is determined based on the average low temperatures recorded each winter due to the fact that low temperatures affect plants more so than do higher temperatures. Therefore, as temperatures increase globally plant species are able to thrive in areas that were previously too cold. This can have many effects on growing patterns and agriculture production. Animal species may migrate or emigrate depending on climate change and new invasive plant species can harm native plants.²⁵⁰ Plant hardiness zones have shifted northward over time from 1990 to 2006 due to warmer winter temperatures.²⁵¹

Leaf and Bloom Dates

The natural events of leaf and bloom dates (when plants begin letting out their leaves and flowers in spring) are affected by climate change. Some factors that can affect these events are temperature, light, rainfall, and humidity.²⁵² Warming trends have been correlated with the earlier arrival of spring and this has many impacts on ecosystems and human society.²⁵³ The earlier spring arrives, the longer the growing season is, which means a longer allergy season, more invasive species and pests. The early occurrence of lilacs and honeysuckles is a great indicator of climate change because they have such a large geographical range that over the

²⁴⁶ Id

²⁴⁷ Id

²⁴⁸ Id

²⁴⁹ Id

²⁵⁰ Id

²⁵¹ Id

²⁵² Id

²⁵³ Id

years blooming has occurred a few days earlier. Plants in New York are blooming as much as eight days earlier than they did in 1970.²⁵⁴

Bird Wintering Ranges

Animal behavior is a strong indicator of climate change, especially among birds. Birds' life cycles can be altered by climate change events particularly during reproduction and migration.²⁵⁵ Birds have been observed over a long period of time because they are easy to count and identify. Most birds migrate north to breed and feed for the summer and during the winter months migrate south to warmer temperatures. Changes in habitat choice of certain bird species can be an indicator of climate change due to the fact that conditions in these habitats have changed, causing them to become more or less favorable for the species. Precipitation and temperature fluctuations have caused many bird species to move further north for the summer and less south for the winter. Birds that traditionally breed in New York have migrated as much as forty miles further north in the past two decades.²⁵⁶ Also, climate change can alter the timing of life cycle changes, and birds that do not adapt to the change can suffer a decline in population.²⁵⁷

3. ACTUAL AND POTENTIAL CLIMATE CHANGE IMPACTS

If global warming emissions continue to grow unabated, New York state can expect dramatic changes in climate during the course of this century, with substantial impacts on the state's economy and character.²⁵⁸

3.1 Temperature

Average temperatures across the Northeast have risen more than 1.5 degrees Fahrenheit (°F) since 1970, with winters warming most rapidly. Due to emissions in the recent past, average temperatures across the Northeast are projected to rise another 2.5 to 4 degrees Fahrenheit (°F) in winter and 1.5°F to 3.5°F in summer above historic levels over the next several decades.

²⁵⁴ NYS DEC, "Climate Change Basics." <http://www.dec.ny.gov/energy/63848.html>.

²⁵⁵ EPA, Climate Change Indicators Report. www.epa.gov/climatechange/indicators.html.

²⁵⁶ Id

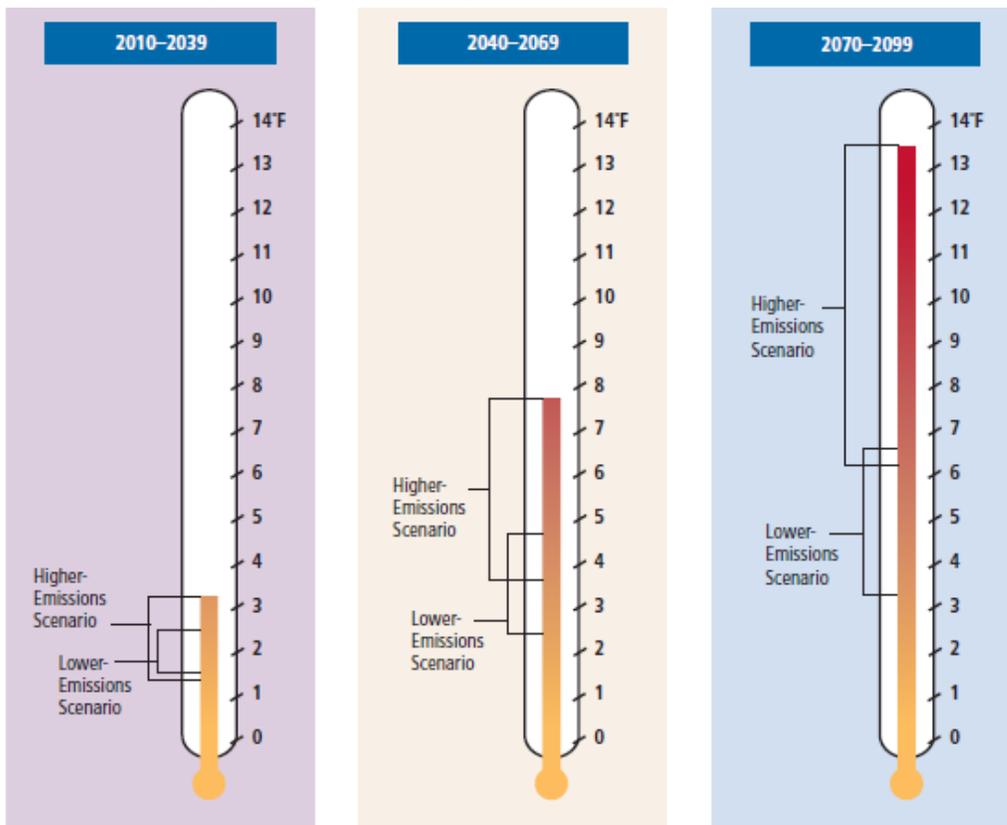
²⁵⁷ Id

²⁵⁸ Frumhoff, P.C., J.J. McCarthy, et. al. July 2007. *Confronting Climate Change in the U.S. Northeast: Science, Impacts, and Solutions*. Synthesis report of the Northeast Climate Impacts Assessment (NECIA). Cambridge, MA: Union of Concerned Scientists (UCS).

The extent and severity of climate change beyond the mid-21st century, however, will be determined by emissions choices we make now—in the Northeast and around the world.²⁵⁹

If heavy reliance on fossil fuels and heat-trapping emissions continue, New York cities can expect a dramatic increase in the number of days over both 90°F and 100°F. Cities across the Northeast are projected to average 20 days per summer over 100°F and some (such as Philadelphia and Hartford, CT) could average nearly 30 such days. The length of the winter snow season could be cut in half across Maine, New Hampshire, northern New York, and Vermont.²⁶⁰

Figure C.2. Changes in Regional Average Summer Temperature



Projected increases in regional average temperatures for three time periods.
www.climatechoices.org.

²⁵⁹ Id.

²⁶⁰ Id.

3.2 Health Impacts

Climate change affects human beings in many different ways; directly through changing weather patterns, and indirectly through its impact on the quality and quantity of the food and water we consume, the air we breathe, and the natural environment in which we live.²⁶¹

One large impact of climate change is the actual changing of temperature on the planet. Since 1901, global average surface temperatures have risen at an average rate of 0.13°F per decade, but since 1970 this warming has occurred at nearly twice this rate.²⁶² An increase in temperature could lead to direct and adverse effects on human health, ranging from increased heat waves and incidents related to them, to climate-sensitive vector-borne diseases.

Heat waves are a serious effect of climate change, especially in urban areas. The IPCC predicts that extreme heat events will increase in frequency and duration due to global warming and that these events will have greater effects on humans due to factors such as continued urbanization and heat island effects, a larger proportion of the population being over 65 years old, and the number of people living alone.²⁶³

Another serious health-related impact of climate change is the increase in climate-sensitive diseases. The term “climate-sensitive disease” refers to food-borne, water-borne, or animal-borne diseases caused by the transmission of pathogens through these three vectors, which can all be affected by change in climate.²⁶⁴ Climate-sensitive diseases are very prevalent in warm areas around the planet, particularly those that are carried by mosquitoes and other relevant insects. A few examples of climate-sensitive diseases are malaria, yellow fever, encephalitis, and dengue fever. Also, in these warmer climates where the temperatures are much higher, there are usually much higher rainfall patterns which cause the disease to be more prolonged and frequent. Flooding and runoff caused by stormwater can cause contamination of drinking water and crops by pathogen-containing sewage. Lyme disease and

²⁶¹ IPCC: Intergovernmental Panel on Climate Change document (IPCC, 2007)

²⁶² EPA, “U.S. and Global Temperature”. <http://www.epa.gov/climatechange/science/indicators/weather-climate/temperature.html>

²⁶³ EPA, “Aging Initiative – Extreme Heat Events”.

<http://www.epa.gov/aging/resources/climatechange/extremeheatevents.htm>

²⁶⁴ EPA, “Human Health Impacts & Adaptation”. <http://www.epa.gov/climatechange/impacts-adaptation/health.html#impactsdiseases>

West Nile virus are two other examples of animal-borne diseases, both of whose vectors (ticks and mosquitoes, respectively) are positively affected by increased temperatures.²⁶⁵

3.3 Sea Level Rise

One of the most dramatic effects of climate change is its impact on sea level rise.

Over the past century, sea level rose by an average rate of 1.7 millimeters a year, or 0.7 inches a decade, and based on recent observations, it is believed that this rate is accelerating²⁶⁶.

Conservative projections estimate a rise of 7 to 23 inches by the year 2100, while more recent studies, which take a closer look at the rapid melting of land-based ice sheets (namely Antarctica and Greenland), suggest that the sea level could rise as much as 55 inches by the same year.²⁶⁷

Increasing sea level has a number of impacts on human beings, directly and indirectly, as well as numerous impacts on the natural environment. Human-related impacts of sea level rise in the United States include increased flooding of populated coastal cities and towns and the infrastructure damage that results, potential contamination of salt water into freshwater and drinking water sources, as well as an increased risk of waterborne illnesses due to sewage overflows and pollutants entering the water supply. There are several other non-human related impacts of sea level rise as well, which are also important to consider, namely coastal erosion, and the destruction of important coastal ecosystems such as beaches, tidal marshes, swamps, bogs, mangroves, and other coastal wetland habitats.²⁶⁸

New York State, having a large amount of its population living in coastal areas, would therefore be greatly affected by this drastic increase in sea level. According to the NYS Sea Level Rise Task Force, 62% of the state's population lives in coastal areas, or areas that would be directly affected by sea level rise, including, geographically, the Capital Region/Upper Hudson Valley, the Mid-Hudson Valley (including Beacon), the Lower Hudson Valley, New York City, and Long Island.²⁶⁹ The Task Force also projects the sea level in New York Harbor to rise by as much as fifteen inches in the next 150 years, which would in turn affect the entire Hudson River estuary

²⁶⁵ Ibid

²⁶⁶ NYS DEC, "Sea Level Rise", <http://www.dec.ny.gov/energy/45202.html>

²⁶⁷ Ibid

²⁶⁸ EPA "Climate Change – Northeast Impacts and Adaptation", <http://www.epa.gov/climatechange/impacts-adaptation/northeast.html#ImpactsPrecipitation>

²⁶⁹ NYS Sea Level Rise Task Force – Report to the Legislature Dec. 2010. http://www.dec.ny.gov/docs/administration_pdf/slrffinalrep.pdf

area.²⁷⁰ Based on the ClimAID Integrated Assessment 2010, this could cause a potential water-level rise of 5-10 inches for the majority of the Hudson Valley as soon as the year 2020.²⁷¹

The City of Beacon, being located right on the Hudson River and part of the tidal estuary area, is therefore clearly at risk of being affected by sea level rise. The city's main industrial buildings, both current and old, are mostly located near the riverfront and as a result, much of the physical land of the waterfront has started to erode. In recent years, a new initiative was taken up to revitalize the waterfront. Heavy stones were placed in strategic areas to help stabilize them in order to prevent further erosion. Many of the city's public recreation areas, including Riverfront Park, Beacon Point Park, Denning's Point, and the Beacon Shoreline Trail are also located in proximity to the waterfront, and could be damaged or lost with an increase in the river level.²⁷² As seen by the dramatic flooding of Hurricane Irene in 2011, which caused large-scale flooding of the city's train station and waterfront area, the rising water level of the Hudson, in this case due to storm surge, can have a large impact on the city. The effects of this temporary storm surge can be used to help understand how Beacon would thus be affected by the sea level rise that is projected, and hopefully help the city prepare for such an issue in the future.

3.4 Environmental Effects

Water Quality and Climate Change

Freshwater resources are highly sensitive to variations in weather and climate. The changes in global climate that are occurring as a result of global warming will affect patterns of freshwater availability and will alter the frequencies of floods and droughts.²⁷³ Climate model simulations suggest that "total flows, probabilities of extreme high or low flow conditions, seasonal runoff regimes, groundwater-surface water interactions, and water quality characteristics could all be significantly affected by climate change over the course of the coming decades."²⁷⁴

Although changes in the climate are certain to occur, there are significant uncertainties regarding the specific nature of the local and regional impacts of climate change on hydrologic

²⁷⁰ Ibid

²⁷¹ NYSERDA, "Responding to Climate Change in New York State – Technical Report", <http://www.nysERDA.ny.gov/Publications/Research-and-Development/Environmental/EMEP-Publications/~media/Files/Publications/Research/Environmental/EMEP/climaid/11-18-response-to-climate-change-in-nys-introduction.ashx>

²⁷² City of Beacon – Beacon Waterfront. <http://www.cityofbeacon.org/features/waterfront>

²⁷³ Dr. Kathleen Miller. Climate Change Impacts on Water. http://www.isse.ucar.edu/water_climate/impacts.html

²⁷⁴ Id.

regimes. Nevertheless, some types of changes can be foreseen with relatively high confidence. For example, it is currently projected that in watersheds where stream-flow currently depends on snowmelt, warmer temperatures will increase the percentage of precipitation falling as rain rather than as snow, causing the annual spring peak in runoff to occur earlier.²⁷⁵ Depending on changes in the amount and seasonal distribution of precipitation, these watersheds may experience an increased likelihood of winter flooding and reduced late summer flows. Also, saltwater intrusion into coastal aquifers is likely to become an increasing problem as a result of sea-level rise, and for many watersheds, there will be an increased likelihood of warmer summer water temperatures with associated impacts on aquatic ecosystems and water quality.

The City of Beacon sits in the Fishkill Creek Watershed. This watershed drains approximately 193 square miles in eleven Dutchess County (including Beacon) and three Putnam County municipalities. Its main stem is approximately 38 miles long and begins in the center of Union Vale, flowing southwest, and enters the Hudson River in Beacon.²⁷⁶ Located less than 90 miles from New York City, the watershed has experienced intense growth over the past thirty years. Pre-colonial Dutchess County was predominantly forested, but by the mid-1800s much of the county had been converted to farmland and by 2004 much of the farmland had been converted to residential, commercial, and forested landscapes.²⁷⁷

The Fishkill Creek Watershed contains cold (headwater) and warm (closer to Hudson) water habitats that may be adversely impacted by projected increased temperatures. Although the main stem of the Fishkill Creek is mainly non-impacted in its upstream reaches, it is slightly impacted in its confluence with the Hudson River. Also vulnerable to climate change is the Beacon Reservoir, a 20.2-acre reservoir adjacent to Mount Beacon Monument Road in the town of Fishkill, which provides drinking water for the City of Beacon.²⁷⁸

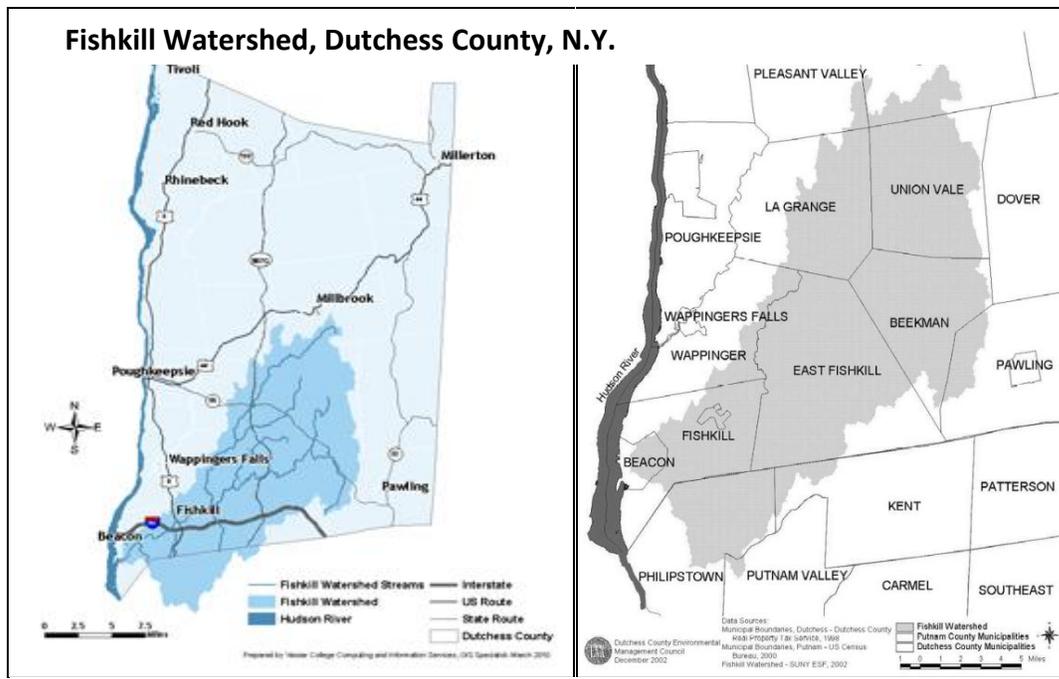
Land use in the Fishkill Creek Watershed is diverse - consisting of agriculture, urban/commercial, extractive, forest, industrial, outdoor recreation, public, residential, transportation, inactive, and water resources as defined using the New York State Land Use and Natural Resources Inventory.

²⁷⁵ Water Cycle Study Group (K. Miller member), A Plan for a New Science Initiative on the Global Water Cycle, U.S. Global Change Research Program, Washington, D.C., 2001.

²⁷⁶ General Information. <http://www.dutchesswatersheds.org/fishkill-creek-information>

²⁷⁷ <http://www.dutchesswatersheds.org>

²⁷⁸ Natural Resources Management Plan For The Fishkill Creek Watershed. A Project of the Fishkill Creek Watershed Committee, May, 2005 At 19



www.dutchesswatershed.org

Air Quality and Climate Change

In the Environmental Section of this report we have discussed the effect air quality has on the Earth's climate. This section explores climate impacts from air pollution.

As previously discussed, ozone and particle pollution are strongly influenced by shifts in the weather (e.g., heat waves or droughts). Based on projected future climate scenarios, and in the absence of additional emissions reductions, the IPCC projected “declining air quality in cities” in the future as a result of climate change. Furthermore, the EPA concluded in 2009 that greenhouse gas emissions “may reasonably be anticipated both to endanger public health and to endanger public welfare.” This finding was based, in part, on the potential for climate change to worsen air quality in the U.S., and the accompanying public health impacts that would result.²⁷⁹

Climate change could have the following impacts on national air quality levels:

- “produce 2-8 ppb increases in summertime average ground-level ozone concentrations in many regions of the country.

²⁷⁹ United States Environmental Protection Agency. *Climate Change and Air Quality*. www.epa.gov.airtrends.

- further exacerbate ozone concentrations on days when weather is already conducive to high ozone concentrations
- lengthen the ozone season
- produce both increases and decreases in particle pollution over different regions of the U.S.²⁸⁰

Given these potential impacts of climate change on air quality, regional and local governments should consider implementing mitigation and adaptation measures. Hudson River Sloop Clearwater, Inc. is currently implementing one such measure in the City of Beacon. Funded by New York State Department of Environmental Conservation, an urban forestry project will be implemented in the years 2012 and 2013. This project will include tree planting projects, community training, an Arbor Day celebration with a tree planting component, and revitalization of Hiddenbrooke Park.

Agriculture and Climate Change

Agriculture is highly sensitive to climate variability and weather extremes. Increases in temperature and carbon dioxide (CO₂) can be beneficial for some crops in some places, but to realize these benefits, nutrient levels, soil moisture, water availability, and other conditions must also be met. Climate change could make it more difficult to grow crops, raise animals, and catch fish in the same ways and same places humans have done in the past.²⁸¹ Projected temperature increase could directly threaten livestock. A number of states have each reported losses of more than 5,000 animals from just one heat wave.²⁸² Over time, heat stress can increase vulnerability to disease, reduce fertility, and reduce milk production, and drought may threaten pasture and feed supplies.²⁸³

New York is a leading agricultural state, worth \$4.42 billion in 2008. This income is then added to the economy in a variety of ways, including: \$427 million in employee compensation, \$343 million in energy cost, \$236 million in property taxes, \$188 million in maintenance & repairs, and \$133 million in marketing & transportation.²⁸⁴

²⁸⁰ Id.

²⁸¹ United States Environmental Protection Agency. *Agriculture*. www.epa.gov.

²⁸² United States Environmental Protection Agency. *Climate Change Impacts and Adapting to Change*. www.epa.gov.

²⁸³ Id.

²⁸⁴ Farm Bureau of New York. About New York Farm Bureau. <http://www.nyfb.org>. This information is provided by USDA's National Agricultural Statistics Service and the NYS Department of Agriculture and Markets.

Farms in Dutchess County have a very diverse array of agricultural commodities including: tree fruits, berries, grapes, field crops, maple syrup, dairy products, meat, poultry, eggs, vegetables, bedding and garden plants, Christmas trees, biofuel crops, horses, and other horticultural products. Small and large farms in Dutchess County contribute to the local economy, food security, locally-grown food availability, healthy communities, and the environment.²⁸⁵

Energy and Climate Change

Changes in temperature, precipitation, sea level, and the frequency and severity of extreme events will likely affect how much energy is produced, delivered, and consumed in the United States.

The U.S. Department of Energy led the development of a report published by the U.S. Global Change Research Program that investigates the impact of climate change on energy production and use in the United States.²⁸⁶ The report summarizes the ways climate change will affect how Americans produce and use energy by answering the three questions found below, included here with a brief summary of the answers provided in the report:

“How might climate change affect energy consumption in the United States?”

Studies indicate that climate warming will mean reductions in total U.S. heating requirements and increases in cooling requirements for buildings varying by region and season, but they will affect household and business energy costs and their demands on energy supply institutions. Generally, changes will imply increased demands for electricity, which supplies virtually all cooling energy services but only some heating services.²⁸⁷

“How might climate change affect energy production and supply in the United States?”

Climate change could affect energy production and supply (a) if extreme weather events become more intense, (b) where regions dependent on water supplies for hydropower and/or thermal power plant cooling face reductions in water supplies, (c) where temperature increases

²⁸⁵ Cornell Cooperative Extension. Dutchess County. *Agriculture*. www.ccedutchess.org

²⁸⁶ United States Environmental Protection Agency. *Energy Impacts and Adaptation*. www.epa.gov.

²⁸⁷ Wilbanks, Bhatt et.al. *Effects of Climate Change on Energy Production and Use in the United States*. A Report by the U.S. Climate Change Science Program and the subcommittee on Global change Research. Department of Energy, Office of Biological & Environmental Research, Washington, DC., USA, 160 pp (2007).

decrease overall thermoelectric power generation efficiencies, and (d) where changed conditions affect facility siting decisions. Most effects are likely to be modest except for possible regional effects of extreme weather events and water shortages.”²⁸⁸

Might climate change have other effects that indirectly shape energy production and consumption in the United States?

It appears that climate change is likely to affect risk management in the investment behavior of some energy institutions, and it is very likely to have some effects on energy technology investments and energy resource and technology choices. In addition, climate change can be expected to affect other countries that in turn affect U.S. energy conditions through their participation in global and hemispheric energy markets. U.S. energy policy can be expected to suffer some changes too.

Other Potential Impacts.

- Climate change could affect the amount of water available to produce electricity or extract fuel. In areas where water is already scarce, competition for water between energy production and other uses could increase.
- Sea level rise and more frequent intense storms could disrupt energy production and delivery by damaging electricity infrastructure, fuel delivery infrastructure and equipment, power plants, or storage facilities.²⁸⁹

3.5 Public Services

Emergency Response and Preparedness

The City of Beacon has a fire and rescue service that includes about 60 volunteer firefighters and 13 full-time paid firefighters, as well as 3 paid support personnel, and operates out of three firehouses with a total of six fire-fighting apparatuses. It also known for having the fastest response time of all emergency response services in Dutchess county, and responds to over 1,700 emergency calls yearly.²⁹⁰ Beacon also boasts its own police department, as well as a volunteer ambulance corps, which has three NYS-certified ambulances, an Advanced Life

²⁸⁸ Id. at 1.

²⁸⁹ *Supra*, note 14.

²⁹⁰ City of Beacon – Fire Department. <http://cityofbeacon.org/departments/fire-department>

Support first response vehicle, and a mass casualty incident trailer, and receives roughly 2,400 calls yearly.²⁹¹

3.6 Public Lands and Recreation

The City of Beacon has a number of recreational areas, including ten public parks, as well as four popular hikes.

The parks are:

- *Hiddenbrooke*: Beacon's newest park; nearly 100 acres at the foot of Mount Beacon for hiking and walking
- *Riverfront Park*: Located just north of the Beacon train station, and has the River Pool, a playground, and volleyball, tennis, and basketball courts, as well as barbeque pits and picnic tables
- *Memorial Park*: Located in the northeast of the city, and has a playground, pavilions, wooded picnic areas, and softball fields
- *South Avenue Park*: Located at the corner of 9D and South Avenue, and has tennis and basketball courts
- *Green Street Park*: Also at the foot of Mount Beacon, this park has a pavilion with picnic tables, a basketball court, and a playground for kids
- *University Settlement Park*: At the foot of Mount Beacon, and has the town swimming pool, as well as a theater building with a stone fireplace
- *Beacon Point Park*: Located on Beacon's Long Dock, this park reopened in July 2011 with a kayak pavilion, a beach for launching kayaks and canoes, rehabilitated wetlands, the restored historic Red Barn (now a center for arts and environmental education), and an art installation by artist George Trakkas²⁹²
- *Denning's Point*: A 64-acre peninsula south of Beacon Harbor with a 1.2 mile woods road loop trail for hiking, as well as areas to fish. Closed in the winter to protect the habitat of the bald eagle
- *Madame Brett Park*: A 12-acre park along the Fishkill Creek with a mile of trails leading to tidal marsh overlooks and Tioronda Falls, as well as good fishing

²⁹¹ City of Beacon – Beacon Volunteer Ambulance Corps. <http://www.cityofbeacon.org/departments/beacon-volunteer-ambulance-corps>

²⁹² Scenic Hudson. "Scenic Hudson's Long Dock Park." <http://www.scenichudson.org/parks/longdockpark>

- *Mount Beacon Park*: Created on Scenic Hudson land, with several trails, including the trail to the summit of Mount Beacon ²⁹³

The hikes are:

- *Incline Rail Trail up to Mount Beacon*: Moderately difficult hike taking about 1.5 hours following red trail markers up to the summit gearhouse of the historic Mount Beacon Incline Railway. Panoramic views of the Hudson Valley from the top
- *The Hemlock Gorge: Up to Mount Beacon or the Reservoir*: Part of the Fishkill Ridge Trail, moderately easy hike taking 1-3 hours. Starts near City of Beacon water tank, follows Dry Brook and eventually on up to the reservoir, and on further to the summit of Mount Beacon and the firetower
- *Beacon Shoreline Trail*: (2 miles); Easy 45 minute out and back hike along the river from the train station parking lot. Trail connects the train station and Long Dock to Denning's Point and, in the future, Madame Brett Park
- *Denning's Point Trail*: (1.2 miles) Easy 45 loop hike around Denning's point along the Hudson River, with views south to Bannerman Island and its castle

4. Conclusions and Recommendations

The potential effects and impacts of climate change are clearly widespread and encompass a great variety of issues that affect both human beings and their natural environment. Whether it be the physical effects on humans, such as the threat of increasing sea levels and its impact on coastal cities and their infrastructures, the health effects that come along with climate-sensitive diseases, changes in agriculture and nutrition, and food-borne diseases, or the effects climate change has on the world's natural ecosystems, it is clear that this is an issue that cannot be overlooked.

Community education is one of the most important measures that needs to be taken in dealing with climate change. The fact that climate change is occurring is more or less unanimously agreed upon by the scientific community, and it is important now, more than ever, to continue to further educate the public and increase understanding of these issues, and help local communities prepare for the impacts of climate change.

²⁹³ City of Beacon. "Beacon Parks." <http://cityofbeacon.org/albums/20>

In terms of local communities, such the City of Beacon, it is vital to realize that dealing with climate change on the city level is not only possible, but extremely important. This could entail developing new projects and/or refining old projects directed at local scale climate change adaptation and mitigation (see section D.3). These projects could be implemented by cities throughout the world on a regional scale to help communities focus on and realize their true potential in helping deal with the effects of climate change. In Beacon for example, this may entail directing new development within the city away from the waterfront area, and developing projects to elevate, relocate, or physically protect important city structures close to the waterfront, as well as devising maps to show areas that are affected by flooding caused by stormwater runoff and storm surges from the Hudson River.²⁹⁴

Another important step in helping the public to realize the issues related to climate change and the impacts it has on their daily lives and futures is to make the information more easily accessible. This means not only providing the documents and data containing the information, but helping to make it more easily understandable, and helping to convey the information in a way that the public can more easily relate to.

Finally, it is vital to educate and expand on the knowledge of local decision makers and politicians of the impacts of climate change on both the global and local levels. It is key to get the support of these people in local communities who have the actual ability to implement these ideas and projects in their cities.

Climate change, though a global issue, has definite solutions on a regional, even local, scale. Dealing with climate change through mitigation and adaptation projects at the local level is beneficial due to the fact that each city or local community feels and handles the repercussions of climate change in different ways. This allows the community to address its own specific needs in terms of climate resilience and deal with them on an individual basis. Through these mitigation/adaptation projects, increased community and public education and awareness on the impacts of climate change, and providing city officials and decision makers with the ways and means to implement the changes in their community, climate change can continue to be combated throughout the United States, and the world as a whole.

²⁹⁴ NYS Sea Level Rise Task Force – Report to the Legislature Dec. 2010.
http://www.dec.ny.gov/docs/administration_pdf/slrffinalrep.pdf

D. CITY OF BEACON CLIMATE CHANGE MITIGATION AND ADAPTATION PROJECTS

1. INTRODUCTION

“Climate change is no longer a thing of the future.”²⁹⁵ The character and economy of the Northeast are defined in no small part by its dramatically changeable climate: the pronounced seasonal cycle that produces snowy winters, verdant springs, pleasant summers, and colorful autumns; the year-to-year and day-to-day variability that includes extreme events such as nor’easters, ice storms, and heat waves; and the moderating influence of offshore currents such as the Gulf Stream. As mentioned in a report prepared by the Northeast Climate Impacts Assessment Synthesis Team of the Union of Concerned Scientists, “[i]f emissions of heat-trapping gases continue to grow unabated, the Northeast can expect dramatic temperature increases over the course of the century.”²⁹⁶

Since it is clear that some additional warming is inevitable, it is now essential to prepare to adapt to the changes that cannot be avoided. However, at the same time, science supports that deep reductions in emissions in the Northeast and across the world can reduce the extent and severity of global warming.²⁹⁷ This scientific consensus supports that national, regional, and local governments create adaptation and mitigation plans to create climate resilience, assuming the long term effects of global warming could have a dramatic impact on the planet which society cannot afford.

To advance climate resiliency and awareness in the City of Beacon, the Climate Justice Council (BCJC), formed for the purposes of this project and developed two project proposals to advance the City’s climate adaptation and mitigation. In the course of year 2011 the BCJC met as a whole to identify priorities for Beacon. After careful examination of the potential climate change impacts and vulnerabilities, the group engaged in a prioritization process that led to the selection of the city’s two projects. (See Section C.3 for Beacon’s Potential Climate Change Vulnerabilities)

²⁹⁵ Breakthrough Strategies and Solutions, LLC. *Climate Solutions for a stronger America: A Guide for Engaging and Winning on Climate Change and Clean Energy*. Maryland 2012.

²⁹⁶ Frumhoff, McCarthy, et.al. 2007. *Confronting Climate Change in the US Northeast: Science Impacts, and Solutions*. Synthesis Report of the Northeast Climate Impacts Assessment (NECIA). Cambridge, MA: Union of Concerned Scientists. 1: 2.

²⁹⁷ *Supra*, at 13.

In selecting the two projects, the BCJC took into consideration, among other things, the City's formal adoption of the "Climate Smart Communities Pledge", and the commitment Beacon has demonstrated to initiate in a path that would lead to GHGs emissions reduction and climate adaptation. (See attachments 1 and 2 in Section E for the City of Beacon Climate Smart Community Pledge and Map of NYS Climate Smart Communities, respectively). The goal of the BCJC is to develop projects that feed the process of developing a local climate action plan. During the implementation of this grant the local government of the City of Beacon changed. Under the previous administration, members of the City Council were going to be involved in a city-condoned program to promote implementation of the proposed projects, especially Beacon's Adaptation Project. (See Section D.3.)

The BCJC's goals focused on developing projects that would both reduce greenhouse gas emissions (specifically CO₂) as a mitigation measure and improve stormwater management as an adaptation measure. To further research and develop projects to advance these two goals the BCJC divided into two subgroups: the Mitigation Council and the Adaptation Council. This methodology does not, however, assume a complete separation between the working groups as the BCJC recognizes the interrelation between these two concepts. Moreover, the BCJC mitigation efforts can foster the Beacon's adaptive capacity.

The BCJC holds that a core value and guiding principle of Hudson Valley cities should be the integration of mitigation and adaptation measures in the development of such cities to promote a sustainable development.

1.1 Climate Change Mitigation and Adaptation

In dealing with climate change, there are two main approaches: mitigation and adaptation. These two concepts, though different, are interrelated and can often be applied together to best combat climate change. As defined by the Intergovernmental Panel on Climate Change Third Assessment Report (IPCC TAR), mitigation refers to "an anthropogenic intervention to reduce the sources or enhance the sinks of greenhouse gases."²⁹⁸ This refers to society's attempt to reduce its "carbon footprint" at its sources as a preventative measure to lessen or slow down climate change. Adaptation, on the other hand, is defined (by the IPCC TAR) as "adjustment in

²⁹⁸ IPCC TAR WG3 (2001), Metz, B.; Davidson, O.; Swart, R.; and Pan, J., ed., *Climate Change 2001: Mitigation*, Contribution of Working Group III to the Third Assessment Report of the Intergovernmental Panel on Climate Change, Cambridge University Press, http://www.grida.no/publications/other/ipcc%5Ftar/?src=/climate/ipcc_tar/wg3/index.htm

natural or human systems in response to actual or expected climatic stimuli or their effects, which moderates harm or exploits beneficial opportunities.”²⁹⁹ Adaptation then, refers to society’s actions in coping and adapting to the damage that has already been brought on, or could potentially be brought on in the near future, by climate change.

The two concepts are clearly related, as improving mitigation (lessening the effects, both positive and negative, of climate change) could potentially reduce the need for adaptation. However, adaptation and mitigation can be implemented together on a regional level, such as in the Hudson Valley, to create climate resilience. Although mitigation more often has global effects, i.e. reducing a nation’s carbon emissions and its effect on CO₂ levels on a global scale, it can still have a great impact on regional and state-wide communities. Adaptation, on the other hand, is much more regional in scale, as it is most often implemented by local communities based on their decisions of how to best deal with climate change in relation to their own specific set of issues.

The benefits of a mitigation approach over an adaptation approach are much more easily seen, as the results can be physically reported through data such as actual levels of atmospheric greenhouse gases, whereas adaptation has no comparable source of data, because it is often implemented on a more regional or local scale where communities often have different social, economic, and political values. However, adaptation may have greater time-sensitive benefits, as its effects are often immediately effective and yield benefits in helping to reduce a community’s vulnerability to constantly changing climate, whereas the benefits of mitigation are often not even evident for decades after.³⁰⁰

Based on an assessment made by Working Group III of the Fourth Assessment Report the current rate of global climate change mitigation is not sufficient to lead to the stabilization in concentration of atmospheric greenhouse gases.³⁰¹ Furthermore, Working Group I of the AR4 has also claimed that no mitigation effort whatsoever could help prevent climate change from

²⁹⁹ IPCC TAR WG2 (2001), McCarthy, J. J.; Canziani, O. F.; Leary, N. A.; Dokken, D. J.; and White, K. S., ed., *Climate Change 2001: Impacts, Adaptation and Vulnerability*, Contribution of Working Group II to the Third Assessment Report of the Intergovernmental Panel on Climate Change, Cambridge University Press, http://www.grida.no/publications/other/ipcc%5Ftar/?src=/climate/ipcc_tar/wg2/index.htm.

³⁰⁰ Chapter 17, IPCC AR4 WG2 (2007), Adger, W.N., S. Agrawala, M.M.Q. Mirza, C. Conde, K. O’Brien, J. Pulhin, R. Pulwarty, B. Smit and K. Takahashi, 2007: Assessment of adaptation practices, options, constraints and capacity. *Climate Change 2007: Impacts, Adaptation and Vulnerability*. Contribution of Working Group II to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change, M.L. Parry, O.F. Canziani, J.P. Palutikof, P.J. van der Linden and C.E. Hanson, Eds., Cambridge University Press, Cambridge, UK, 717-743.

³⁰¹ IPCC AR4 WG3 (2007), B. Metz, O.R. Davidson, P.R. Bosch, R. Dave, L.A. Meyer, ed., *Mitigation of Climate Change*, Contribution of Working Group III to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change, Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA.

occurring in the upcoming decades.³⁰² These scientific conclusions, together with the data that reflects that climate change is still occurring even through the implementation of mitigation-based tactics, are promoting a shift in how an adaptation-based approach to climate change is being perceived. Perhaps, adaptation measures are now being perceived as more practical and beneficial by the public.

2. CLIMATE CHANGE MITIGATION PROJECT: TOWARD A BIKEABLE BEACON

2.1 Methodology

The goal of the Beacon Mitigation Climate Justice Council or Mitigation Council (BMCJC or MC) was to identify and design a project that would reduce the amount of CO₂ produced locally while promoting environmental justice awareness within city limits. After participating in brainstorming sessions, the group decided to focus on transportation justice as a way to achieve the goal of lowering Beacon's carbon footprint and, perhaps, facilitate a healthier mode of transportation to those who do not own private motor vehicles.

The BMCJC considered several options before deciding what type of transportation justice project would best serve the particular needs of City of Beacon residents, existing infrastructure, and existing efforts. The MC decided that this systematic approach to the project development process would help the group prepare a stronger proposal that could be easily defended in unofficial and official forums alike. Therefore, after identifying and studying several alternatives by which to promote bicycle use in the City of Beacon, the Council tailored a project proposal that effectively addresses the important group's mission of reducing local CO₂ emissions without compromising important environmental, social, and economic resources.

2.2 Overview

The transportation sector plays a crucial and constantly growing role in world energy use and emissions of greenhouse gases (GHGs). In 2004, transportation energy use amounted to 26% of total world energy use and the transportation sector was responsible for about 23% of world

³⁰² IPCC AR4 WG1 (2007), Solomon, S., D. Qin, M. Manning, Z. Chen, M. Marquis, K.B. Averyt, M. Tignor and H.L. Miller, ed., *The Physical Science Basis*, Contribution of Working Group I to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change, Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA.

energy-related GHG emissions. The 1990–2002 growth rate of energy consumption in the transport sector was highest among all the end-use sectors.³⁰³

There seems to be little doubt that transport activity will continue to grow at a rapid pace for the foreseeable future. The shape of that demand and the means by which it will be satisfied depend on several important factors that the council considered in deciding that promoting an alternative method of transportation is a project that respond to current environmental concerns. Some of these important considerations are:³⁰⁴

- *It is not clear whether oil can continue to be the dominant feedstock of transport.*

Transport can be fuelled by multiple alternative sources, beginning with liquid fuels from unconventional oil (very heavy oil, oil sands and oil shale), natural gas or coal, or biomass. However, all of these alternatives are costly, and several – especially liquids from fossil resources – can increase GHG emissions significantly without carbon sequestration.

- *The growth rate and shape of economic development, the primary driver of transport demand, is uncertain.*

But even in the most conservative economic scenarios, considerable growth in travel is likely.

- *Transport technology has been evolving rapidly.*

The energy efficiency of the different modes, vehicle technologies, and fuels, as well as their cost and desirability, will be affected by technology developments in the future.

- *Current trends point towards growing dependence on private cars.*

Future choices made by both governments and travelers will have huge implications for future transport energy demand and CO₂ emissions.

Many technologies and strategies are at hand to reduce the growth or even, eventually, reverse transportation related GHG emissions. Only with sharp changes in economic growth, major behavioral shifts, and/or major policy intervention would transport GHG emissions decrease substantially.

³⁰³ IPCC: Intergovernmental Panel on Climate Change document (IPCC, 2007)

³⁰⁴ Ibid

Like much of the United States, Beacon is over-reliant on the use of private automobiles. While suburban sprawl has created an environment that often makes cycling and walking impractical and expensive to retrofit, Beacon has an advantage in that it was developed during a time when communities relied heavily on walking, horse and carriage, and street trolley to move from place to place. The result of such development is that Beacon center or downtown area is compact enough to make other non-motorized mobility options feasible and desirable.

2.3 Project Proposal

Key Project Components

- Installation of Shared Lane Markings (SLM) on Main Street, Beacon, between Herbert Street and Route 9D, and from Main St. onto 9D and down on Beekman to the Metro North train Station. (See Attachment 3 for a Map of the Proposed Bikeable Areas and Routes)
- Reduction of the current speed limit to 20MPH
- Developing a “Master Bike Plan” that promotes cycling and considers impacts on potential cycling opportunities.
- Consider developing a local Bike Share System
- Creating Bicycle friendly infrastructure to accommodate potential traffic
- Create educational programming to inform the public about bicycling safety and include, among other things, “Safe Route to School” component.

Project Benefits

There are many benefits associated with bicycling. It is in the best interest of the City of Beacon to accommodate and encourage cycling as a transportation mode not only as a practical necessity but also in order to enjoy the important economic, environmental, and social benefits that come from its increased use.

Health Benefits. The positive effects of bicycling are well known and have been extensively documented, especially in the public health sector. Some of the health benefits include: lower cholesterol levels, weight loss, lower blood pressure, and increased mobility and strength. Some pro-cycling groups have conducted studies to quantify the health benefits of cycling. If you cycle 6 miles to and from work instead of driving, taking about 30 minutes each way, you could burn 15 to 20 lbs. each year.

On average, the estimated health benefits of cycling were substantially larger than the risks relative to car driving for individuals shifting their mode of transport.³⁰⁵ For example, the benefits of increased physical activity from shifting from driving to bicycling (3 to 14 months gained) outweigh the effects of increased inhaled air pollution (0.8 to 40 days lost) and increased traffic accidents (5 to 9 days lost).³⁰⁶ Other studies, like a New England Foundation (NEF) report entitled; *Measuring our progress, The Power of well-being*, states that “[a] wealth of literature from researchers studying stress and related effects reveals ‘persistent and significant costs associated with a long commute through heavy traffic’.”³⁰⁷

Economic Benefits. In “Economic Benefits of Bicycling in Urban Environments”, the Marin Bicycle Network states that “research on economic benefits, by Rutgers University, University of California Davis (...), University of Minnesota (...), University of Colorado (...), University of Michigan (...), the National Bicycle Tour Directors Association (...), Local Government Commission (...) and numerous state Departments of Transportation (...), all echo these basic findings: bicyclists riding through a town will stop and spend money.”³⁰⁸ This behavioral pattern can be explained by what has been cited in studies as the ‘human scale’ of bicycling, the article continues.³⁰⁹ This means that bicycling occurs at a speed that allows cyclists to take in their surroundings and interact with their environment. In an urban setting, like the City of Beacon, this implies that cyclists stop to shop, investigate, and/or discover the area that they are in. The conclusion is that this behavior leads to more money being spent within a community.³¹⁰

Also relevant to this analysis is that, according to Consumer Expenditures in 2006, the average vehicle costs \$8,003 per year to own and operate.³¹¹ According to *Investopedia*, “the breakdown of the figure comes to \$3,421 for purchasing the vehicle \$2,227 in gasoline and motor oil expenses, and \$2,355 in other vehicle-related costs.”³¹² This consumes about 15 percent of the income of a family in Beacon. For those families falling below the city \$45,000 median household income, this percentage is higher. In a recent article this data was updated. The new

³⁰⁵ Hartog, et.al. *Do the Health Benefits Outweigh the Risks?* Environ Health Perspect. 2012 Aug. 118(8):1109-16.

³⁰⁶ Id.

³⁰⁷ New Economic Foundation. 2010. *Measuring our Progress –The Power of Well-Being*.

<http://www.scribd.com/doc/89869750/NEF-Measuring-Our-Progress-The-Power-of-Well-Being-2010>

³⁰⁸ “Economic Benefits of Bicycling in Urban Environments” marinebike.org.

³⁰⁹ Id.

³¹⁰ Id.

³¹¹ This report was released in February of 2008 by the U.S. Department of Labor's U.S. Bureau of Labor Statistics,

³¹² The True Cost of Owning a Car. 2008. <http://www.investopedia.com/articles/pf/08/cost-car-ownership.asp#ixzz26rAZ3s8i>

average is up 1.9 percent due to an increase in fuel and tire costs, and moderate increases in other areas.³¹³ By contrast, a good quality new bicycle can be purchased for significantly less than \$700.00 at one of Beacon's two local bicycle shops.

Environmental Benefits. The U.S. is a leader in petroleum consumption. These high levels of consumption are leading to many negative effects on the environment, such as increased emissions of harmful greenhouse gases, volatile organic compounds, and sulfur hexafluoride, among others.³¹⁴

In the U.S., motor vehicle transportation accounts for 31 percent of the nation's total carbon dioxide emissions,³¹⁵ 81 percent of its carbon monoxide emissions, and 49 percent of its nitrogen oxide (NO_x) emissions released into the atmosphere.³¹⁶ Based on a survey done in 2001 (National Household Travel Survey), 25 percent of all Americans' trips made by any mode of transportation is within one mile of their home, 40 percent within two miles, and 50 percent within five miles. Also found by the survey, 82 percent of these trips fewer than five miles in distance are made by motor vehicle.³¹⁷

Improving bicycle routes in a small city like Beacon can have many other benefits that affect the environment on a local or regional scale as well. These benefits focus less on fuel savings and emissions reduction and more on the improvement of the local environment of specific towns and communities, like Beacon. Decreased motorized traffic due to increased bicycle routes and bike safety within a city can help to improve road space and decrease congestion, decrease accidents and health-related incidences caused by motor vehicles, help prevent further suburban sprawl that is often caused by the ease of motorized transportation, decrease noise pollution, and decrease the need for salts and other de-icing chemicals in the winter laid down to aid motorized transportation, which are in turn carried away by stormwater runoff.³¹⁸

³¹³ "Cost of Owning and Operating Vehicle in U.S. Increased 1.9 Percent According to AAA's 2012 'Your Driving Costs' Study" April 27, 2012. www.newsroom.aaa.com

³¹⁴ <http://www.mercedrides.com/bike/benefits.htm>

³¹⁵ EPA, "Climate Change – Carbon Dioxide Emissions", <http://www.epa.gov/climatechange/ghgemissions/gases/co2.html>

³¹⁶ <http://www.bikeleague.org/resources/why/environment.php>

³¹⁷ National Household Travel Survey 2001, <http://nhts.ornl.gov/2001/usersguide/UsersGuide.pdf>

³¹⁸ Federal Highway Administration, "Case Study No. 15 – The Environmental Benefits of Bicycling and Walking", http://safety.fhwa.dot.gov/ped_bike/docs/case15.pdf

Project Components

Although the main goal of this project is to promote bicycle use within the City of Beacon to reduce local GHG emissions and other environmental hazards, the project requires that several components be implemented to execute an effective program:

Educational Campaign

Any successful change in social behavior requires a strong educational campaign. The Mitigation Council examined several ways in which to inform the public about bicycle safety as well as the benefits it can offer individuals and the community. The educational campaign would be implemented during all phases of project development and implementation. Starting with the introduction of basic concepts, such as sharing a code for cyclists, in the initial planning phases and culminating with community route tours and map distribution.

Safe Routes to School

This is a national program implemented and run at a local, school by school level. In addition to teaching traffic safety to our children, it can be an invaluable tool in helping to “normalize” cycling as transport for the next generation, which will see greater impacts from both resource depletion and climate change. This program provides communities with an opportunity to make walking and bicycling to school safer and more accessible for children, including those with disabilities, and to increase the number of children who choose to walk and bicycle.³¹⁹

Public Service Announcements

While educating children is important, the Mitigation Council believes that it is critical to reach the adult population, both to inform them of existing laws regarding cars and bicycles, as well as educating about the potential economic and quality of life benefits that can be achieved in a bicycle-friendly environment. This might be accomplished through short spots on the local cable channel promoting various aspects of bicycling as well as reminders of current motor vehicle laws.

Maps

³¹⁹ *Safe Routes: National Center for Safe Routes to School*. <http://www.saferoutesinfo.org/program-tools/build-and-sustain-program>. Last visited May 2011.

The Council looked at developing a map of Beacon that would be useful for cyclists. It would include any current bicycle infrastructure such as bike lanes and bicycle parking, as well as suggested bicycle routes through the city to various commercial, educational, and cultural destinations.

Community Training Sessions

The Mitigation Council, in conjunction with the City and other local stakeholders, would conduct fun training sessions for the community where cycling safety tips and best practices would be offered, among other things.

Events

An increasing number of municipalities around the world are holding “Ciclovias”, events where the city closes one or more streets to automobiles for the day, allowing bicycles and pedestrians to take over. This could be run during national Bike Month in May, and also be used to promote using a bicycle to shop or get to the train station. Also, conducting bicycle tours of the city’s historic, cultural, and social heritage would help foster bicycling while at the same time educating the community about how to safely navigate through Beacon.

Other Educational Opportunities

The Council recommends utilizing social media (Beaconcitizen.com, thehudsonvalleygreen, cityofbeacon.org) and press releases and letters to local print media to announce various bicycle-related initiatives and projects.

Infrastructure

In order to have an efficient bicycle transportation system in the City of Beacon it is necessary that appropriate infrastructure be developed and built to accommodate the needs of new and existing cyclists would be needed.

Bicycle Parking.

Just like automobiles, bicycles need a place to park. The expenditure to build parking for bicycles does not compare with what would be needed to build parking space for automobiles. Also, it would not take as much space.



Estimates for the cost of a parking space for a car vary, but as an example, the recent addition of 95 spaces at the Metro-North train station is estimated to have cost as much as \$1,000,000. Bikeable Beacon has designed a rack to accommodate two bicycles that costs approximately \$250, plus installation costs, which the city is currently covering. The cost of the racks themselves is currently being absorbed by local businesses adjacent to where the racks are going to be installed. As the center of commercial and social activity for the city, Main Street, must provide adequate parking for bicycles. Other key locations include the Metro-North train station, municipal buildings, and schools. In each case, parking facilities should be in a prominent location and allow ample space to park, depending on each site's need. To preserve the aesthetics values of Main Street, "low volume" parking should be strategically placed in commercial, cultural, and social attractions along the Street. In addition to bike racks some of the parking at the train station should include bicycle lockers for those who need more secure, all-weather parking.

Bike Lanes

Main Street, Beacon, poses a challenge to bicyclists. It is narrow, with parallel parking on both sides of the street. If a cyclist stays to the right-hand side, he or she is in the dangerous "door zone." Many cyclists and motorists are not aware that cyclists have the right to take to the center of a travel lane to avoid this "door zone." The narrow nature of Main Street, and other principal roadways like Verplanck Avenue, coupled with a very low number of rendered creating bike lanes not viable for the City of Beacon.

In order to exhaust any alternative that would make bike lanes viable, the Council considered confining car parking to one side of Main Street to potentially create a bike lane at the opposite

side. However, this option would still leave the bike lane on one side subject to the “door zone”. It would also be politically very difficult, with opposition likely from Main Street merchants who would be upset over loss of automobile parking, as well as cost issues - bike lane costs can run as high as \$60,000 per mile.

Shared Lane Markings

The Mitigation Council then looked at SLMs, one of the newer tools available to urban bike planners, included in the Manual on Uniform Traffic Control Devices (MUTCD).³²⁰ SLMs or sharrows, are not considered infrastructure, but rather signage. They consist of two chevrons above an outline of a cyclist that are applied to the roadbed using thermoplastic paint.

Bicycle signage has a number of positive attributes:

- it is not infrastructure, so it can be implemented relatively quickly and at a lower cost than creating bike lanes
- it involves the entire community, and engages all road users -pedestrians, cyclists, and motorists functioning as an educational tool, a way finding device, and a safety mechanism

Some of the same factors that make a bike lane difficult on Beacon's Main Street represent ideal conditions for SLMs: narrow roadway with parallel parking on both sides. The speed of traffic (currently set at 30MPH) is also slow enough for cyclists to take the lane and share the road with motorists.



Sharrows help bicyclists position themselves safely in lanes too narrow for a motor vehicle and a bicycle to comfortably travel side by side within the same traffic lane. The markings on the

³²⁰ U.S Department of Transportation, Federal Highway Department. *Manual on Uniform Traffic Control Devices*. 2009. Edition.

roadway serve as a constant reminder to motor vehicle drivers of the potential presence of bicyclists and alert road users of the lateral position bicyclists are likely to occupy within the street. In addition to providing a wayfinding element along bike routes, SLMs also increase the distance between bicyclists and parked cars, keeping bicyclists out of the dangerous “door zone.”

Additional benefits of Sharrows include:

- Encourages safe passing by motorists.
- Requires no additional street space.
- Reduces the incidence of sidewalk riding.
- Reduces the incidence of wrong-way bicycling.
- Can be used with, or in place of, other signage.
- Range in cost from about \$300 to \$500 per marking, including labor.

Social Bicycle System

The Council has considered this alternative, which involves a bike share system. Bike sharing is becoming much more popular in some of the major cities around the world today. New York City, for example, plans on implementing a bike share system this fall, which would potentially have 10,000 bikes located at up to 600 docking stations around the city. This system would work using a GPS-enabled bike, which can be located and unlocked by the user’s mobile phone. Though this system might work for large-scale urban areas like New York City, the City of Beacon does not have the critical mass necessary to sustain a bike share system like this. There are, however, smaller-scale “social bike” concepts and ideas that are being developed that would be more suitable to lower population areas, like Beacon. For example, existing infrastructure, like bike racks at the train station, or just simple signposts along Main Street could be used to start a small-scale bike share system in Beacon. The system could then be expanded and improved as demand for a bike share system increases.

Developing a Master Plan

The City of Beacon currently has no bicycle infrastructure, or bicycle-related policies in its zoning ordinances. To create a more bikeable community, it is important to have in place a master plan that will guide future engineering of the city as it relates to the use of bicycles as an

important and growing part of the transportation mix. The plan would suggest standards for any future development, road, or infrastructure projects that might impact cycling in some way. It would also envision specific bicycle-promoting infrastructure plans, such as bike lanes and cycle paths that could be phased in over time.

2.4 Conclusion

While all of the above elements are key components to addressing the issue of promoting cycling as transportation within the City of Beacon, the Council has determined that installing Shared Lane Markings on Main Street would have the most immediate impact on helping to mitigate climate change by fostering a more bicycle-friendly environment within the city. The use of sharrows takes advantage of the potentially negative traffic features on Main Street and turns them into positives. For example, while the speed limit on Main Street is currently 30mph, traffic rarely travels at that speed, with the narrowness of the street and the parallel parking on both sides acting as traffic calming devices. (The Council still recommends an official reduction of the speed limit to 20mph, to reflect actual usage. This measure has support within the 2011 Beacon City Council.)

According to the MUTCD, the sharrow assists cyclists with lateral positioning in a shared lane with on-street parallel parking in order to reduce the chance of a bicyclist impacting the open door of a parked vehicle; and assists bicyclists with lateral positioning in lanes that are too narrow for a motor vehicle and a bicycle to travel side by side within the same traffic lane. The Shared Lane Marking alerts other road users of the lateral location bicyclists are likely to occupy within the traveled way, encourages safe passing of bicyclists by motorists, and reduces wrong-way bicycling and bicycling on the sidewalks. SLMs would also be beneficial in Beacon due to the fact that they require no additional street space, and can take advantage of already-existing traffic signage.

Installing these shared lane markings on Beacon's main roadway will have an impact on making bicycles a more viable alternative mode of transportation for local shopping and commuting residents and visitors. Welcoming bicyclists could potentially have a positive economic impact on Main Street business, and could plant the seed for bicycle tourism to become an economic driver for the community.

The Mitigation Council favors the installation of SLMs on Main Street between Herbert and Route 9D, and from Main Street onto 9D and down Beekman Street to the Metro-North train station at the waterfront (See Attachment 3 for a Map of Proposed Bikeable Area and Routes).

2.5 Next Steps

Funding Opportunities and Relationships Built to Achieve Implementation

As an initial step towards achieving implementation of “Toward a Bikeable Beacon”, a concerted Hudson Valley effort was discussed at a meeting with City of Peekskill officials from the Department of Economic Development. The City of Peekskill, as well as the City of Beacon, is looking into reinvigorating its economy by redeveloping waterfront infrastructure and its relationship with the city’s commercial center, downtown Peekskill. This project, “Toward a Bikeable Beacon” presented them with an interesting and sustainable paradigm that could, in the future, connect Hudson River towns making the area an attractive destination for bicyclists in New York State.

The Mitigation Council has been actively working in the community to promote implementation of this project. Council members have participated in City Council Workshops to promote implementation, and Bikeable Beacon, together with other local groups and interested residents, is working towards securing several bike racks location on Main Street. But in order to implement this project as a whole, specialized funding opportunities should be identified and pursued.

As a first step of pursuing implementation several funding opportunities have been identified:

- **Bikes Belong Grant Program.** The Bikes Belong Grant Program strives to put more people on bicycles more often by funding important and influential projects that leverage federal funding and build momentum for bicycling in communities across the U.S. These projects include bike paths and rail trails, as well as mountain bike trails, bike parks, BMX facilities, and large-scale bicycle advocacy initiatives. Since 1999, this grant program has awarded 245 grants to municipalities and grassroots groups in 48 states and the District of Columbia,

investing \$1.9 million in community bicycling projects and leveraging more than \$659 million in federal, state, and private funding.³²¹

- **NYSDOT Safe Route to School Grant Program:** Safe Routes to School (SRTS) is a federal, state and local effort to enable and encourage children, including those with disabilities, to walk and bicycle to school and to make walking and bicycling to school safe and appealing. The goal of this program is to assist New York communities in developing and implementing projects and programs that encourage walking and bicycling to school while enhancing the safety of these trips.
- **Consolidated Local Street and Highway Improvement Program (CHIPS):** A New York State funded program available to provide for bicycle, pedestrian, and traffic calming measures.
- **The Transportation Enhancements Program (TEP):** administered by the NYS Dept. of Transportation is a federal reimbursement program under the Safe, Accountable, Flexible, Efficient Transportation Equity Act: A Legacy for Users (SAFETEA-LU), administered by the New York Department of Transportation (NYSDOT) which enables funding for transportation projects of cultural, aesthetic, historic and environmental significance.
- **NYS Scenic Byways Program:** Both technical and financial assistance may be available through this program administered by the NYS Dept of Transportation for communities who wish to develop a scenic byway. Development of scenic byways has the potential of bringing tourism dollars into communities along the corridor.
- **A Grant Program of the Preservation League of New York State and the New York State Council on the Arts:** The Preserve New York Grant Program provides support for three types of projects: cultural resource surveys, historic structure reports, and historic landscape reports. An applicant must be a not-for-profit group with tax-exempt status or a unit of local government. State agencies and religious institutions are not eligible to apply.

³²¹ Bikes Belong Foundation. <http://bikesbelong.org/grants>

The program generally provides only partial support on a competitive basis. Grants are likely to range between \$3,000 and \$10,000.³²²

Existing Resources for Future Implementation

Throughout the process of developing this project existing relationships were strengthened and new ones were built based on the shared interest of creating a healthier urban environment for Beacon residents by promoting cycling. Local stakeholders include: Bikeable Beacon³²³, School of Jellyfish³²⁴, Zero-to-Go, People's Bicycle³²⁵, and Beacon CAC. City officials, George Mansfield and former Mayor Steve Gold, actively participated and supported the process. Future implementation of the project would require additional outreach to the new local administration.

3. CLIMATE CHANGE ADAPTATION PROJECT: STORMWATER MANAGEMENT FOR THE CITY OF BEACON

3.1 Methodology

The Beacon Climate Justice Adaptation Council (BCJAM or AC) began the project development process with an assessment of existing stormwater management initiatives in the City of Beacon. After concluding that existing tools were not adequate the AC decided to design a project that would address this deficiency. As a first step, AC members had to engage in an assessment of the City's vulnerabilities to identify areas prone to flooding events. The proposed project would help protect important community assets, such as private and public property, parks and other public spaces located in these climate-sensitive areas.

³²² <http://www.preservenys.org/>

³²³ Bikeable Beacon is a grassroots organization seeking to promote bicycling within the City of Beacon for its economic and environmental benefits to the community. It is focused on developing a master plan for bicycling and implementing specific bicycle-related projects.

³²⁴ School of Jellyfish is a design house for the advancement of sustainable living and renewable energy. It is located at 183 Main Street, Beacon, NY.

³²⁵ Peoples' Bicycle is a vintage, used and recycled bicycle shop located in Chestnut Street in Beacon, NY.

3.2 Overview

Stormwater runoff occurs when precipitation from rain or snowmelt flows over the ground. Impervious surfaces like driveways, sidewalks, and streets prevent stormwater runoff from naturally soaking into the ground.³²⁶ (See Section B.6.1 for more information about stormwater runoff). As mentioned in Section B.6.1, as it flows, stormwater can pick up debris, chemicals, dirt, and other pollutants and run off into a storm sewer system or directly to a waterbody. Moreover, stormwater runoff can deposit sediment, bacteria and other pathogens, hazardous household products, and debris, creating a health hazard for people that ingest the contaminated water, making it difficult or impossible for aquatic plants to grow, or destroying entire aquatic habitats.

The City of Beacon as an urban center inherently has a considerable area of impermeable surfaces within its jurisdiction. Beacon stormwater issues include flooding streets and basements that affect homes, businesses, and roads. As a riverfront community, Beacon is directly affected by sea level rise.

Over the years, Beacon has endured many water related issues. One of the most recent heavy rain storms, Hurricane Irene in 2011, brought approximately 9.8 inches of water, caused serious flooding all around town and thousands of dollars in damages. Flooding overwhelmed a number of local sewage treatment plants, since many of them collect and process storm runoff as well as wastewater. After the passing of Hurricane Irene, President Obama declared Dutchess County, and many others, a Disaster Zone.³²⁷ Some of the following photos taken on August 29, 2012, from Michael Koch's Blog, illustrate the devastation Hurricane Irene caused in the City of Beacon.³²⁸

³²⁶ U.S. Environmental Protection Agency. <http://water.epa.gov/action/weatherchannel/stormwater.cfm>

³²⁷ City of Poughkeepsie - <http://www.cityofpoughkeepsie.com/archives/1040>

³²⁸ <http://michaelkoch.wordpress.com/2011/08/29/pictures-from-the-aftermath-of-hurricane-irene-in-beacon-ny/#>



All images from: michaelhkoch.wordpress.com

Another recent heavy rainfall event, Tropical Storm Lee, almost two weeks after Hurricane Irene, brought to an already suffering Beacon about 7 inches of new rain on already saturated ground and river still swollen. Tropical Storm Lee caused roads to closed, including exits on the New York State Thruway in the Mohawk Valley and, south of Interstate 84 exit at Newburgh, the entire road. New York State Department of Environmental Conservation (NYS DEC) reported on September 6, 2011 that at least 52 municipalities in the Hudson Valley had reported raw-sewage spills into local waters. "The collection plants were just overwhelmed" said one DEC engineer. "This was raw sewage but mixed with millions and millions of gallons of stormwater — raw sewage that was very diluted."³²⁹ Many others reported large spills of what they called "gray water," a murky liquid that can include bath water, laundry water, industrial waste and toilet water. Most of that water leaked into tributaries that eventually feed the Hudson River.³³⁰

Hurricane Irene and Tropical Storm Lee, underscore the importance of utilizing methods that help cities adapt to heavy rain events and stormwater runoff and abate the issue of having old infrastructure that has not kept pace with current development.

³²⁹ Record Online. Sewage plants no match for Irene, authorities say Adam Bosch. Times-Herald Record.

<http://www.recordonline.com/apps/pbcs.dll/article?AID=/20110908/NEWS/109080314/-1/NEWS>. September 8, 2011.

³³⁰ Id.

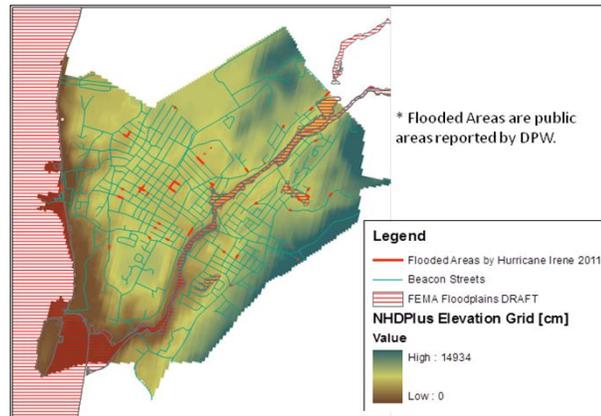
3.3 Project Proposal

The goal of this project proposal is to create a pool of data that helps the local government and emergency response team develop systems and processes that can be used to promote rapid and efficient stormwater runoff adaptation measures. Ultimately, it aims to create a climate resilient community.

Data Gathering Stage: Stormwater Management Profile of the City of Beacon.

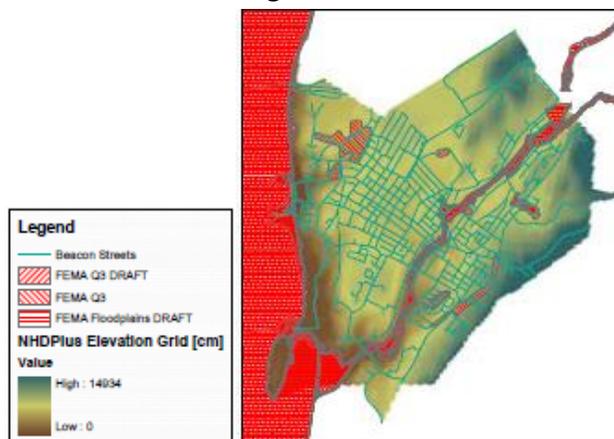
To begin the creation of this data collection system, the AC recommends that actual data be obtain from existing mapping tools. For example, areas flooded during Hurricane Irene were mapped to assess critical assets at risk and identify vulnerable communities. (See Figure 1.)

Figure 1. FEMA Floodplain Data & Hurricane Irene 2011



Gathering this historic data will help Beacon city officials assess areas most vulnerable to rain events and device emergency response procedures and preventative emergency alerts specially addressing these areas. Historically, it will help city official, or any other interested person, compare past and present data to project future potential impacts within Beacon.

Figure 2. FEMA Data



In Figure 2., above, the AC used the digital FEMA Q3 Flood Data. According to this agency, this tool is designed to serve FEMA's needs for disaster response activities, National Flood Insurance Program activities, risk assessment, and floodplain management and the can be used for a variety of planning applications including broad-based review for floodplain management, land-use planning, natural resource/environmental analyses, and real estate development and targeting.³³¹ Q3 Flood Data, provides the user with: 1% (100 year) and 0.2% (500 year) annual chance floodplain boundaries, flood insurance zone designations, floodway boundaries (when available), political boundaries, and map quadrangle neatlines, among other valuable information.³³²

Because of the relationship between impervious cover and stormwater runoff, stormwater management initiatives need to consider the target area's impervious cover. Impervious surfaces increase the amount of runoff, and as little as 10 percent impervious cover in a given watershed can result in stream degradation.³³³ Therefore, an important consideration in the development of the Stormwater Management Profile of the City of Beacon is the amount of impervious cover in this urban center. (See Figure 4).

³³¹ FEMA. <https://msc.fema.gov/webapp/wcs/stores/servlet/info?storeId=10001&catalogId=10001&langId=-1&content=productQ3FAQ&title=Q3%2520FAQ&parent=productInfo&parentTitle=Product%2520Information#whatis>

³³² Id.

³³³ US Environmental Protection Agency. Urban Fact Sheet: Polluted Runoff. http://water.epa.gov/polwaste/nps/urban_facts.cfm. May 2012.

Figure 3. Relationship between Impervious cover and Stormwater Runoff

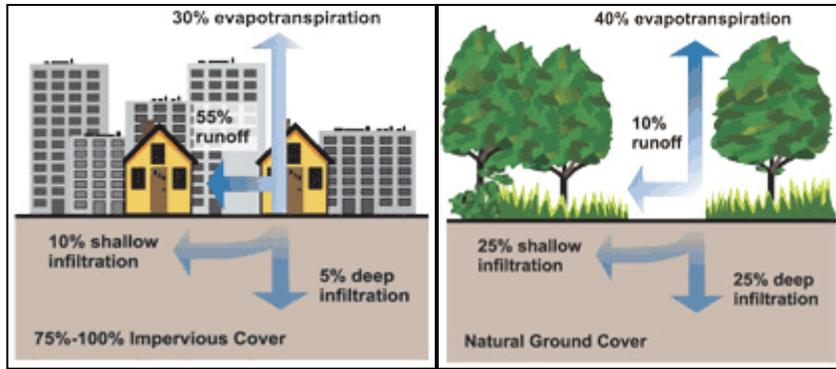
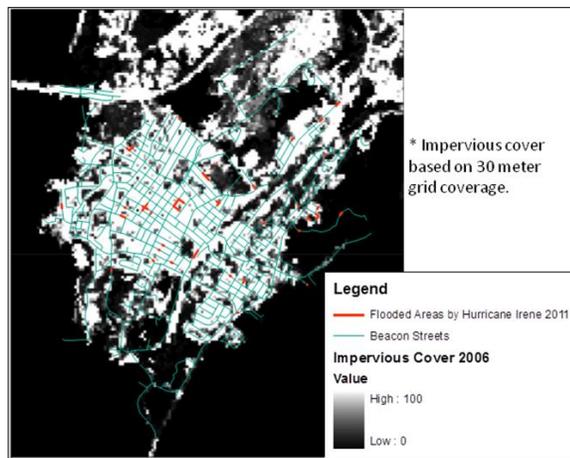


Image from: www.water.epa.gov.

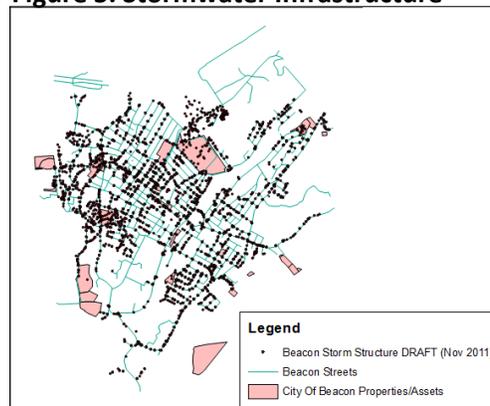
Figure 4. City of Beacon Impervious Cover



This important information can be used to develop plans to reduce impervious surfaces in the City of Beacon and promote permeable surfaces to increase infiltration.

Of equal importance for the AC is to determine the location of existing stormwater and sewer infrastructure in the City of Beacon. An integral part of this project proposal is that this layer of data be compared against data of previous flooding events to identify infrastructure susceptible to heavy rain events or that may be failing during these periods.

Figure 5. Stormwater Infrastructure



The Project also requires further description of the Mapping of the City’s assets. Categories in the Assets’ Map should include parks, public utilities, open spaces, cultural and historic landmarks, streams and any other waterbodies, and important economic areas.

New York State Sea-Level Rise Task Force (Sea-Level Rise Task Force)

An important component of the Project is that the Sea Level Rise Task Force analysis be applied to the Hudson River and Fishkill Creek.

The State Sea Level Rise Task Force created in 2007 by the New York State Legislature, to assess impacts to the state's coastlines from rising seas and recommend protective and adaptive measures, adopted the sea level rise projections in the table below for two regions of New York State. DEC considers these projections the best available projections for planning purposes.³³⁴

Figure 6. Projected Sea Level Rise in Two Regions of New York (ClimAid Integrated Assessment, 2010)

Lower Hudson Valley & Long Island	2020s	2050s	2080s	
Sea Level Rise	2 to 5 in	7 to 12 in	12 to 23 in	
Sea Level Rise with Rapid Ice-Melt Scenario	5 to 10 in	19 to 23 in	41 to 55 in	

Mid-Hudson Valley & Capital Region	2020s	2050s	2080s
Sea Level Rise	1 to 4 in	5 to 9 in	8 to 18 in
Sea Level Rise with Rapid Ice Melt Scenario	4 to 9 in	17 to 26 in	37 to 50 in

www.dec.ny.gov

From the Sea Level Rise Task Force³³⁵ report it is particularly significant for the City of Beacon to implement measures recommended to provide more protective standards/enforcement for coastal development; shoreline armoring; and post-storm recovery as well as identify and monitor early effects of climate change and integrate climate change adaptation strategies into the city’s decision making processes, with an emphasis in climate related events. This project is an attempt to achieve the latter.

³³⁴ New York State Department of Environmental Conservation. NYS Sea Level Rise Task Force. <http://www.dec.ny.gov/energy/45202.html#Projections>.

³³⁵ The Task Force report was delivered to the Legislature on December 31, 2010.

Additional tools that can be used to continue building the City of Beacon Stormwater Management Profile include:

- LIDRA, developed for comparing the cost effectiveness of reducing runoff with different green infrastructure / low impact development technologies.³³⁶
- System for Urban Stormwater Treatment and Analysis Integration Model (SUSTAIN), which is a decision support system to facilitate selection and placement of Best Management Practices (BMPs) and Low Impact Development (LID) techniques at strategic locations in urban watersheds. It was developed to assist stormwater management professionals in developing implementation plans for flow and pollution control to protect source waters and meet water quality goals.³³⁷
- Stormwater Management Model (SWMM), first developed in 1971 and used for planning, analysis and design related to stormwater runoff, combined sewers, sanitary sewers, and other drainage systems in urban areas. This dynamic rainfall-runoff simulation model used for single event or long-term (continuous) simulation of runoff quantity and quality from primarily urban areas.³³⁸

Stormwater Runoff and Sewer Systems

The profile and data gathering should encompass stormwater that infiltrates sewer lines and causes sewage backups into homes and basements. (See Section 6.1 for more information about Beacon's Combined Sewer System Overflows).

Project Benefits

This project would produce an inventory of roadways, and buildings, or any type of structure that floods during rain events, including homes, businesses, and roads and areas where Infiltration of sewer lines and causes of sewage backups into homes and basements.

Adapting to stormwater runoff problems intersect other planning exercises, requirements, and initiatives in the City of Beacon, such as:

- MS4 Stormwater Mitigation - As indicated in Section 6.1 of the Climate Justice Report of the City of Beacon, Beacon has been designated as an Urbanized Area as defined by the US Census and operates a Municipal Separate Storm Sewer System (MS4), which collects

³³⁶ Users can run LIDRA simulations for free through this website: <http://lidratool.org/>

³³⁷ United States Environmental Protection Agency. SUSTAIN. <http://www.epa.gov/nrmrl/wswrd/wq/models/sustain/>

³³⁸ United States Environmental Protection Agency. SWMM. <http://www.epa.gov/nrmrl/wswrd/wq/models/swmm/>

stormwater runoff and conveys that runoff through a system of catch basins, pipes and ditches, ultimately discharging into waters of the United States. As of March 2003, the federal Phase II stormwater program has required operators of MS4s in urbanized areas to obtain State Pollution Discharge Elimination System (SPDES) permit coverage for the stormwater discharges under their jurisdiction and control. In order to maintain conformance with the Phase II program and the SPDES General Permit for Stormwater Discharges from MS4s, the city must comply with several minimum control measures that serve as the basis for this permit and complete a Stormwater Management Program Plan (SWMP). This compliance required the city to adopt two local laws to prohibit illicit discharges, activities and connections to the storm sewer system, and to regulate land development activities by stipulating the implementation of stormwater management standards in site design.³³⁹

- All-Hazards Emergency Operations Planning. A goal of FEMA is to develop, in partnership with state and local governments, a national emergency management system that is comprehensive, risk based, and all-hazard in approach. In an effort to develop and maintain a viable all-hazard emergency operations plan each community's emergency operations plans (EOP) must reflect what *that community* will do to protect itself from *its* hazards with the resources *it* has or can obtain.³⁴⁰ This project is an invaluable tool to feed Beacon's EOP by providing up to date and climate sensitive data.
- Sustainable Site Design, Low Impact Development (LID), Smart Growth, and other sustainable land use practices. These principles promote a more sustainable land development approach. Sustainable Site Designs can be achieved through implementing LID techniques. LID begins with a site planning process that first identifies critical natural resource areas for preservation and looks at maintaining natural drainage flow paths, minimizing land clearance, clustering buildings, and reducing impervious surfaces are incorporated in the design. Smart Growth is an environmentally sensible planned growth that integrates economic development and job creation with community quality-of-life by preserving the built and natural environments. Smart Growth, which also comprises LID,

³³⁹ City of Beacon. Stormwater Management. www.cityofbeacon.org

³⁴⁰ Federal Management Management Agency. Guide for All-Hazard Emergency Operations Planning. September 1996.

seeks to discourage development on open space and farmland and encourage growth in developed areas with existing infrastructure.³⁴¹

Protection of Life, Property, and the Environment

Managing stormwater runoff can reduce flooding, improve water quality by allowing vegetated areas to trap sediment, debris and particulates that would otherwise enter the waterway; avoid and prevent flood damage to homes, roadways, and businesses; reduce land area of traditional stormwater management techniques; and increase property values through natural landscaping, open space, wetlands and waterways.

Economic Impact of Severe Weather Adaptation

Irene reached flood-level records in New York City and in much of the Northeast, raising casualty loss estimates to \$20 billion, causing two days of lost economic activity, over a period of a week. “Add to those the loss of about two days economic activity, spread over a week, across 25 percent of the economy, and an estimated of the losses imposed by Irene is about \$40 to 45 billion.”³⁴² Devising adaptive measures to be implemented in these events would help protect local economies from potentially excessive loss in damages.

Local Stakeholders involved in the development of the Beacon Adaptation Project:

- Beacon Conservation Advisory Committee
- City of Beacon
- Beacon Volunteer Ambulance Corps
- Cornell Cooperative Extension Dutchess County

3.4 Next Steps

- *Funding and Support.* The success of this project depends greatly on the City of Beacon receptiveness and collaboration. The administration of the City has changed. Therefore, in order to move this project forward and pursue potential implementation of the project an assessment of the priorities of the new administration need to be explored.

³⁴¹ New York State Department of Environmental Conservation. Smart Growth. <http://www.dec.ny.gov/lands/45970.html>.

³⁴² Prof. Peter Morici. *Economic Impact of Hurricane Irene*. Global Politician. <http://www.globalpolitician.com/27062-hurricane-irene-economy-usa-east-coast->. August 30, 2011.

- *Create a Stormwater Task Force.*³⁴³ One of the task force's responsibilities should be to Regularly Update the Stormwater Management Profile of Beacon to keep an accurate record of the status of stormwater issues in the City.
- *Update relevant plans (i.e. EOS, Waterfront Development) to reflect data gathered in the Stormwater Management Profile of Beacon.* This is a critical step in project implementation that could be absorbed by the Stormwater Task Force to respond and plan for current risks and vulnerabilities. If implemented this tool could inform the work currently conducted by the City pursuant to the MS4 program.
- Continue to map out infrastructure and conduct further research that contains an additional level of specificity regarding water sensitive areas. The AC has committed to conducting training sessions to the extent needed to facilitate implementation.
- Compare areas of repeated/expected flooding to infrastructure. This analysis will yield infrastructure that need to be replaced or substituted by sustainable stormwater management infrastructure, like green infrastructure.
- Measure high water marks after each major storm. Record heavy rainfall episodes and its frequency.
- Reach out to local and regional stakeholders to possibly co-lead one of these processes, such as NOAA Coastal Services Center.

³⁴³ Creation of a City Stormwater Task Force was a priority under the City's previous administration. Current priorities have not been assessed regarding this particular.

E. ATTACHMENTS

List of Attachments to Beacon's Mitigation and Adaptation Projects

Climate Change Mitigation Project: Towards a Bikeable Beacon

Attachment 1 – Climate Smart Community Pledge

Attachment 2 – Map of NYS Climate Smart Communities

Attachment 3 – Map of Proposed Bikeable Areas and Routes