Low Impact Development (LID)
As a Solution to the CSO Problem
In the NY-NJ Harbor Estuary
(A Policy Briefing Paper)

Contents

Executive Summary

Older cities in the Hudson-Raritan Harbor Estuary are saddled with an expensive pollution problem: combined sewer systems. These CSS's work in dry times, but in wet weather fail utterly when a surge of raw sewage and contaminated stormwater overwhelms treatment facilities, and floods our rivers and bays with raw sewage. Municipalities are required under the Clean Water Act to rectify this problem.

The currently proposed solution is to create vast underground storage capacity or cumbersome end of the pipe engineering solutions to hold or treat stormwater.~~stormwater until it can be treated~~ . Until recently, this end-of-pipe approach had been seen as the only available option. However, this "traditional engineered" approach is extremely expensive, with estimates running as high as $2.1 billion to clean up New York City's CSO's alone.

Thinking innovatively, several U.S. cities, including Chicago, Portland, and Seattle, have proven that there is a more economically efficient, and environmentally and socially beneficial alternative that most Northeastern US cities have yet to consider. This innovative solution is called Low Impact Development (LID). LID technologies – such as the use of rain barrels, cisterns, rain gardens, green roofs, and permeable pavements that stop stormwater from ever reaching the sewers during precipitation, prevent the combined sewage system from being overwhelmed. LID treats runoff as a valuable resource, rather than waste.

While end-of-pipe solutions offer no other benefits beside some combined sewer overflow abatement, LID technology offers myriad economic, environmental, and social benefits. LID "greens" cities, increases property values and enhances urban quality of life. It supplements cooling for buildings and neighborhoods, reducing some ~~the~~ need for air conditioning, and cutting greenhouse gas emissions. It creates habitat for wildlife and open space for people to enjoy. It also reduces urban flooding, protecting valuable properties.

NY-NJ Baykeeper and its many partners are working actively to make LID solutions to the CSS problem available in New York City, and northern New Jersey municipalities and authorities.

We feel certain that once municipal, state and federal officials understand the benefits of LID, they will include it in their solutions for CSO and stormwater controls. We do not maintain that LID is the only solution to our combined sewer overflow problem, but when used in conjunction with other options (including end-of-pipe solutions), we could, within a shorter time than previously estimated, see an end to the now widespread sewage pollution of our Estuary.

And that is the greatest benefit of LID technology: It could put us within reach of creating cleaner bays and rivers where wildlife and commercial fisheries thrive, in an Estuary where our citizens will again be able to safely boat, swim and fish, meeting the goals of the Clean Water Act.

Combined Sewer Systems dump millions of gallons of raw sewage into our Harbor Estuary. An economical and environmentally sound alternative is Low Impact Development such as this rain garden.

Section 1:
Public Health, Environmental and Recreational Impacts of CSOs in the New York-New Jersey Harbor Estuary

Many people would be stunned to learn that most of the older cities in the New York-New Jersey metropolitan area, along with sewage authorities, dump millions of gallons of raw sewage into the Hudson-Raritan (New York-New Jersey Harbor) Estuary every year.

Although average water quality in the Estuary has significantly improved over the last few decades, most areas are still un- swimmable. One major problem is the region's Combined Sewer Systems (CSS), primitive wastewater treatment operations that (like many in the nation's older cities) combine sewage from commercial and residential buildings with dirty stormwater runoff from city streets in the same pipes.

For example, when it rains even a little, the combined flow overwhelms New York City's 14 sewage treatment plants. Raw sewage and stormwater is then diverted into the harbor at more than 450 locations around New York ~~City~~, amounting to more than 27 billion gallons each year. The same problem occurs in many of New Jersey's communities surrounding the Hudson-Raritan Estuary (HRE).

In rainy weather, the rivers, bays and straits of the HRE are filled with raw sewage as well as disease-carrying organisms, harming both people and wildlife. The U.S. Environmental Protection Agency agrees that the Estuary's major cities' combined sewer systems are to blame, and a major cause of water pollution in our region. According to EPA, "CSO discharges have widespread impacts causing beach closings, shellfishing restrictions and limiting fishing and other recreational activities. Exposure to viruses, bacteria, pathogens and other CSO-related pollutants or toxics is an obvious public health concern. Swimmers, kayakers, and others exposed to CSO contaminants are vulnerable to gastroenteritis, respiratory infections, eye or ear infections, skin rashes, hepatitis and other diseases. Children, the elderly, and people with suppressed immune systems are especially vulnerable. Wildlife and aquatic habitat are also adversely affected by CSO pollutants which lead to higher water temperatures, increased turbidity, toxins and reduced oxygen levels in the water."[1]

Designed over a century ago, CSSs move raw sewage and stormwater together through the same pipe. The system works in dry times but with as little as a quarter inch of rain, stormwater often overwhelms them and their treatment plants. Operators then 'bypass' the system, flushing wastewater mixed with stormwater straight into our waterways in a combined sewer overflow (CSO).

Despite requirements to correct CSO problems under the federal Clean Water Act, most cities have barely taken the first baby steps to solve this expensive and complex problem. Engineers claim the best solution is to spend billions building vast underground holding tanks or "end-of-pipe" engineering solutions for combined sewage and stormwater runoff. New York City's "end-of-pipe" solution will cost an estimated $2.1 billion, and not even solve the CSO problem. This prohibitive price tag did however recently cause New York to plead a decades-long delay for such a project because it was not "cost effective." Bayonne and Newark similarly found that the cost for an engineer-driven end-of-pipe solution would be in the hundreds of millions of dollars, not including annual operating and maintenance costs. None of these end-of-pipe solutions would solve the CSO problem, and in some cases would barely keep pace with future urban development. Fortunately there is a proven complementary and more economical solution to our stormwater and wastewater woes. Seattle, Portland, Chicago and Philadelphia, for example, have successfully implemented relatively inexpensive stormwater management systems. These Low Impact Development (LID) technologies include conservation easements, on-site source controls (e.g., green roofs, rain gardens, rain barrels, etc.), stream buffers, urban redevelopment technologies, decentralized wastewater treatment, water reuse and wetlands restoration.

In Portland, Oregon, 43,000 downspouts are now connected to rain gardens or rain barrels, keeping 1.1 billion gallons of runoff out of combined sewers each year. LID technologies would not only help alleviate CSOs relatively inexpensively; they would also provide open space, outdoor recreation opportunities and wildlife habitat, improving the quality of life for our region.

Since our governments won't stop the primitive practice of using our waterways as a toilet – citizens must compel them to do so. The next time one hears rain on the roof, one should not feel comforted. Instead one should hear those drumming raindrops as a call to end the flushing of millions of gallons of sewage into the Harbor Estuary – to end the polluting of swimming beaches and wildlife resources, from the Highlands to the Raritan River, from the Arthur Kill to the East River, Long Island Sound to Raritan and Jamaica Bays, the Great Falls to the New Jersey Meadowlands. We can no longer tolerate the unhealthy and uncivilized practice of combined sewer overflows.

Instead we can begin to solve the problem once and for all with the inclusion of LID, which curbs the amount of stormwater channeled into our combined sewer systems, and improves quality of life in our cities and in the waters around them.

Sprawling urban and suburban developments like the one pictured here can reduce their stormwater runoff dramatically by installing rain gardens, rain barrels and cisterns.

Section 2:
Federal and State CSO Law

Though enforcement has been slow, there is strong federal law mandating the immediate control of CSSs and the clean up of CSOs. In 1994, the U.S. Environmental Protection Agency finalized the National Combined Sewer Overflow Control Policy that requires National Pollutant Discharge Elimination System (NPDES) permittees with combined sewer systems to carry out a CSO Long-Term Control Plan to develop, evaluate, and implement control alternatives for attaining compliance with the Clean Water Act (CWA), including compliance with water quality standards and protection of designated uses.

The policy was created with the purpose of coordinating the planning, selection, design and implementation of CSO Best Management Practices and controls to meet the requirements of the CWA, and fully involve the public during the decision making process. The Act calls for the immediate meeting of the Nine Minimum Controls, and for the creation of municipal Long-Term Control Plans to meet the water quality requirements of the CWA, to require intensive CSO monitoring and modeling studies, and to require significant infrastructural improvement.

The federal CSO Control Policy identifies the following nine essential elements be included in all NPDES permittee LTCPs:

1. Characterization, monitoring, and modeling of the CSS
2. Full public participation throughout the development of the LTCP
3. Consideration of sensitive areas
4. Evaluation of alternatives to meet Clean Water Act requirements
5. Cost/performance considerations
6. Operational plan

7. Maximizing treatment at existing Publicly Owned Treatment Works (POTW)
8. Implementation schedule
9. Post-construction compliance monitoring program[2]

On the state level, the New Jersey Sewerage Infrastructure Improvement Act of 1998 (SIIA) declared that New Jersey CSOs are a major source of ocean and other surface water pollution, and that they contribute to the degradation of the coastal waters of the state. All municipalities operating CSSs were directed by the Act to provide abatement measures as required by the state. The State is also to create a fund to provide grants to municipalities for the planning and design of required CSO abatement facilities.

In June 2004, the New Jersey Department of Environmental Protection (NJDEP) revoked and reissued all NJPDES permits to incorporate a requirement for all permittees to undertake and complete the development of a Combined Sewer Overflow (CSO) Long-term Control Plan (LTCP). Municipalities with CSOs submitted their most recent round of LTCP proposals to NJDEP in April of 2007, and are awaiting review.

Similarly, in January 2005, an Administrative Consent Order was entered into between the New York State Department of Environmental Conservation ("NYSDEC") and the New York City Department of Environmental Protection ("NYCDEP"), requiring a city-wide CSO Long Term Control Plan report. There will be 18 Watershed/Waterbody plans developed in all before a final LTCP for the city is adopted. The final citywide LTCP for all watersheds within the City of New York is scheduled for completion by 2017.

Section 3:
Low Impact Development

Low Impact Development (LID) is a relatively new practice that attempts to control stormwater runoff by uniting urban and suburban site planning, land development, and stormwater management with ecosystem protection. It was first developed in the 1990s in response to the costly economic and environmental impacts of conventional (end-of-pipe) stormwater management techniques.

Put briefly, LID is a comprehensive development and design technique that strives to preserve or restore predevelopment hydrology and water quality through a series of small-scale, decentralized natural and engineered controls at or near the point where the stormwater is generated. The objective is to disperse LID devices uniformly across a site to minimize runoff and to prevent CSSs from being overwhelmed by stormwater.

LID utilizes a wide variety of techniques, ranging from green roofs to permeable pavements, rain barrels to rain gardens, for slowing and diverting stormwater. Its basic premise is to not treat stormwater as waste, but as an invaluable natural resource that needs to be routed to where it can do the most good, rather than being channeled into CSOs where it does the most harm.

LID technologies reduce stormwater and thereby reduce untreated discharges into CSOs. LID reduces the risk of flooding, an important factor considering that global warming projections forecast increased 50- and 100-year storm events for our region.

LID technologies also provide recharge to on-site hydrology, offering water as a natural resource for natural plantings, for people to enjoy and for use by wildlife.

The Whole Building Design web site[3] offers detailed definitions of potential LID technologies:

Bio-retention Cell (rain garden) – A rain garden is an engineered natural stormwater treatment system consisting of a landscaped and planted area constructed with a special soil mixture, an aggregate base, an underdrain, and site-appropriate (preferably native) plantings. The bio-retention cell site is graded to intercept runoff from paved areas, grass swales, or roofs.

Cisterns – These manufactured tanks or underground holding areas store large amounts of non-potable stormwater, and can be used in residential, commercial or industrial buildings. The water can be treated and used for fountains, pools, gray water, air conditioning, and other purposes.

Downspout Disconnection – Downspouts normally direct stormwater toward streets and storm drains. They can be disconnected and re-directed to grass swales, rain gardens or rain barrels to reduce runoff, promote soil infiltration, and lengthen runoff timing (thus reducing stormwater-loads during precipitation events).

Grassed Swale – These engineered densely vegetated depressions retain and filter the first rush of runoff from impervious surfaces such as parking lots or streets. Swales, to be effective, must be constructed downhill from a runoff source.

Green Roof – Vegetated rooftops installed on residential, commercial, or government buildings utilize a special lightweight soil mixture and sedums (plants with thick fleshy leaves, not grass) to store, detain, and filter rainfall. They reduce runoff volume and improve runoff timing. They also offer energy conservation benefits and aesthetic improvements to buildings.

Infiltration trench – Well-suited to dense urban areas where there is little room for rain gardens or grass swales, these subsurface stormwater retention facilities are typically installed beneath permeable or impervious parking lots and can retain, filter, infiltrate, and alter runoff volume and timing.

Narrow road design – A decrease in the width of roads results in a decrease of impermeable surfaces and stormwater runoff.

Permeable pavements – Most pavements today are impermeable, and quickly channel massive flows of stormwater into CSOs. Permeable pavements, though relatively expensive, are especially useful in areas that repeatedly experience heavy flooding. Permeable pavements not only reduce runoff, but also curb storm damage.

Rain Barrels – Placed beneath roof downspouts, rain barrels collect rooftop runoff for later reuse in lawn and garden watering. They change runoff timing, preventing stormwater from reaching CSO's all at once, and reduce overall runoff volume. Rain barrels have many advantages. They take up little space, are inexpensive, and are easy to install.

Riparian buffers – A riparian buffer is undeveloped and vegetated land adjacent to a stream or water body. They help to absorb stormwater runoff. They also maintain and improve water quality by protecting water resources from nonpoint pollutants such as sediment, nutrients and pesticides from both urban and agricultural activities. Riparian barriers have the added advantages of providing habitat for wildlife and are ideal locations for linear parks and greenways, improving urban quality of life for local neighborhood residents who might not have immediate access to open space.

Tree box filters – These 'boxed' bio-retention cells are placed at the curb adjacent to storm drain inlets. They receive the first rush of stormwater along the curb and filter it through layers of vegetation and soil before entering a catch basin. Tree box filters beautify streetscapes with trees, shrubs, or perennials, and provide habitat.

Tree planting – Trees significantly reduce stormwater runoff, increase cooling (to reduce the urban heat island effect), are beneficial to people and wildlife, and absorb carbon dioxide, curbing urban carbon emissions.

GLENN: FIND PICTURE OF SEA STREET. Green city streets not only reduce stormwater runoff, they also beautify and cool neighborhoods, improving quality of life. Portland Oregon's Sea Street, pictured here, includes impervious pavement that has significantly helped reduce flooding damage to local buildings.

Section 4:
End-of-Pipe Solutions Versus LID Technology

Many engineers specializing in wastewater infrastructure, as well as municipal and state environmental regulators, have an outdated view of stormwater runoff. They regard it as waste. For example, they see the roughly 320 billion gallons of rainwater that falls on the five boroughs of New York City each year as waste that has to be disposed of at the end of a sewer pipe, rather than as a valuable resource that could be put to beneficial use before it hits the streets and picks up oil, grease, salt, solvents and other contaminants.

A more sustainable solution is to capture much of the City's rainfall *before* it hits dirty city streets and divert it to other uses. This captured water could be directed towards a proliferation of new planted medians and sidewalk parks, street trees, permeable pavement, gardens, city parks, rain barrels, and green roofs, as well as stored in underground tanks for use in commercial, industrial and large residential buildings. This isn't new, untried science. Other CSO-burdened cities like Chicago, Washington, DC, and Portland, Oregon are way ahead of New York City and New Jersey communities in controlling stormwater at its source.

A city “greened” in this way would do more than just help restore its polluted waterways. More trees and vegetation means more shade, which subsequently means cooler streets and homes, and lower energy bills for residents and businesses. A greener city would help offset the predicted rise in average temperature from climate change. More trees, and less energy consumption, also means reduced greenhouse gas emissions. Cleaner air means a decline in our region’s epidemic of lung-related diseases and illnesses. Greener streets in presently treeless neighborhoods means an increase in home values and thus property tax revenues. Greened cities also provide invaluable wildlife habitat. Large stormwater storage tanks and bigger pipes confer none of these benefits.

LID Advantages:

LID is economical – LID technology costs less than conventional stormwater management systems to construct and maintain, in part, because of fewer pipes, fewer below ground infrastructure requirements, and less imperviousness. But the economic benefits do not stop there. According to an important Benefit-Cost analysis done by ECONorthwest[4] the economic benefits of LID technology include:

- **Reduced flooding costs –** One study estimated that adopting LID practices throughout a watershed would reduce downstream flooding, resulting in $54 - $343 in benefits per developed acre.

- **Reduced CSO control costs –** Portland’s downspout disconnection program eliminates an estimated 1.1 billion gallons of stormwater runoff each year from the city’s combined sewer system.

- **Reduced filtration costs –** For example, instead of using sand filters and storm drain structures to treat stormwater along a seawall on the Anacostia River, a bio-retention filter strip was installed, saving $250,000.

- **Reduced cooling costs –** Reduced pavement area and natural vegetation in the Village Homes LID development in Davis, CA helped reduce home energy bills by 33-50% compared to surrounding neighborhoods.

- **Reduced costs to developers –** Replacing curbs, gutters, and storm sewers with roadside swales in one residential subdivision saved the developer $70,000 per mile, or $800 per residence.

- **Increased amenity values –** A preliminary analysis of properties on streets redeveloped by Seattle’s Natural Drainage Systems Program indicates these modifications can add 6% to the value of a property.

With LID, areas once dedicated to stormwater ponds can be used for additional development to increase lot yields or be conserved as open space. The greater use of on-site landscaping / vegetation also greens neighborhoods and contributes to livability, sense of place, and aesthetics. Other benefits include enhanced property values and re-development potential, greater marketability, improved wildlife habitat, thermal pollution reduction, energy savings, smog reduction, enhanced wetlands protection, and decreased flooding.

In a University of Southern California study it was estimated that collecting and treating stormwater flows would cost $44 billion for Los Angeles County. However, a USC-UCLA study estimated that alternative stormwater controls, including LID would be significantly cheaper: Costs were estimated at $2.8 to $7.4 billion, with economic benefits estimated at $5.6 billion to $18 billion.[5]

According to the Low Impact Development Center:[6]

LID is simple and effective – Instead of large investments in complex and costly end-of-pipe infrastructure, LID integrates stormwater treatment and management into urban landscape features. This involves strategic placement of engineered LID controls customized to mimic a watershed's original hydrology. The result is a hydrologically functional landscape that generates less surface runoff, less pollution, less erosion, and less overall damage to lakes, streams, and coastal waters.

LID is flexible – It offers a wide variety of simple techniques to provide runoff quality and quantity benefits. LID works in highly urbanized areas, suburbs, as well as environmentally sensitive sites. Opportunities to apply LID principles are practically infinite since any feature of the urban landscape can be modified to control runoff and/or reduce pollution. LID can be used to truly create a "customized" watershed management design.

LID is a balanced approached – LID is an advanced, ecologically-based land development technology that seeks to better integrate the built environment with the natural environment. LID's principles and practices allow the developed site to maintain its predevelopment watershed and ecological functions.

The reduction of pavement and the addition of native plantings helps cool this Portland urban development.

Section 5:
Case Studies — Chicago, Portland, Seattle

LID technology has met with success around the nation as a means of dealing with chronic CSO problems, with examples available in Chicago, Milwaukee, Pittsburgh, Portland, the Rouge River Watershed in Michigan, Seattle, Toronto, Vancouver, and Washington D.C.

Chicago Case Study

One of the best comparable examples to the NY/NJ metropolitan area is that of Chicago, a large old Northern cold-water city with similar CSO concerns.

The 2006 "Rooftops to Rivers" report by the Natural Resources Defense Council[7] notes that Chicago "manages one of the largest wastewater collection and treatment systems in the world and contends with flooding, surface water quality impairment, and CSOs." The greater Chicago area has a population that exceeds 8.0 million people, with over 4,400 miles of sewage infrastructure.

Chicago is implementing a dual program to solve its CSO woes. They are implementing an ambitious $3.4 billion end-of-pipe system to collect and store CSO stormwater and sewage. They are also however deeply committed to LID solutions that include green roofs, rain gardens, vegetated swales and landscape, permeable pavement, downspout disconnection and rainwater collection.

Chicago's green roof program is one of the most ambitious in the nation. It started with a 20,300 square foot demonstration project on the metropolis' own city hall. This green roof not only has the benefit of reducing stormwater runoff by 75 percent during a one inch storm, the building is also an average of ten to fifteen degrees Fahrenheit cooler than neighboring black tar roofs, and can be as much as 50 degrees cooler on the hottest days of summer. This has led to a $3,600 per year energy savings, which will only increase as global warming heats up Chicago in coming decades.

There are now more than 80 green roofs in Chicago, totaling more than one million square feet, producing less than half of the runoff from conventional roofs. The city encourages green roofs by sponsoring installations and demonstration sites and by offering incentives.

Chicago has implemented other LID solutions to curb stormwater runoff. These include the replacement of a 630-foot long alley that regularly flooded with permeable paving, solving the flooding problem. As of June, 2004, the city embarked on a major green building effort. This included the conversion of a 17-acre brownfield to a model Chicago Center for Green Technology. This center boasts huge cisterns to capture stormwater which is then used for watering the center's landscaping. As a result, the site releases just 85,000 gallons of stormwater to CSO's in a three-inch storm, instead of the expected 175,000 gallons. Other city buildings – libraries, police stations, and firehouses – have also employed LID solutions.

An integral part of Chicago's LID effort is its public outreach programs, encouraging residents to install rain barrels and rain gardens. For example, in autumn 2004, the city sold residents 400 55-gallon rain barrels for $15 each, costing the city $40,000. It is estimated that this pilot project has the potential to divert 760,000 gallons of runoff annually from CSOs. By targeting the rain barrel program to areas that have seen heavy flooding, the city handles another of its infrastructure problems. The city has also begun planting rain gardens along city streets.

The city continues to study the stormwater problem, and plans to convert what was once seen as waste to a resource.

Portland, Oregon Case Study

Portland has promoted funding and education for innovative LID stormwater management since 1998. LID projects included all types of green infrastructure technologies, such as vegetated swales, green roofs, infiltration planters, and porous street design.

Incentives are an important impetus to LID in Portland. The city, for example, provides a zoning bonus, allowing for additional square footage for buildings featuring a green roof. It also offers a stormwater fee discount of up to 35 percent for properties with on-site stormwater management.

The downspout disconnect program in Portland is probably one of the strongest LID case studies available. Homeowners receive $53 per downspout disconnected from the CSS. The effort has achieved more than 45,000 disconnects and resulted in the reduction of CSO flow by more than 1.1 billion gallons per year. Rain barrels are one of the easiest most cost effective LID technologies to implement.

Seattle "Sea Street" Case Study

The city of Seattle is among the leaders in LID technology implementation, with use of green roofs, rain gardens, vegetated swales, downspout disconnection and rainwater collection. One of the best-known green infrastructure projects in the country is Seattle's SEA Street project (the 2nd Ave. Street Edge Alternative) An entire block of 2nd Avenue was redesigned to include green LID infrastructure, with the intention of reducing runoff and creating a more livable community environment. The original 24-foot wide straight street was narrowed to 14-feet and curved to reduce and slow stormwater runoff. Green swales were placed within right-of-ways to improve stormwater infiltration. Street imperviousness was also reduced by 18 percent, and numerous tree plantings were added at curbside. The project cost $850,000, and showed a 99 percent reduction in total potential surface runoff, according (TO WHOM?).[8]

Chicago city hall's 20,300 square foot green roof reduces stormwater runoff while reducing the building's cooling costs in summer.

Section 6:
Pilot LID Studies and Projects in the NY/NJ Harbor Estuary

NY/NJ Baykeeper, in collaboration with its partners, is well situated to establish working LID pilots in the Estuary. LID pilot projects provide hard data for use in developing the systems elsewhere. They demonstrate the economic and practical feasibility of Low Impact Development, and are vital to the ongoing process of implementing and improving LID solutions.

Current pilots either underway or in the planning stage include:

• **Bayonne –** Bayonne has 27 combined sewer outfalls that discharge to Newark Bay, the Kill Van Kull, and Upper New York Harbor. The Bayonne Municipal Utilities Authority (BMUA) is mandated by federal policy to develop a Combined Sewer Overflow (CSO) Long-term Control Plan (LTCP). Three different LID technologies, rain barrels, rain gardens, and green recharge areas using the right of way of the light rail line, have been suggested for testing in a portion of the Bayonne CSO-shed. During such testing measurements of impervious surfaces before and after the test, and measurements of stormwater being discharged during storm events before and after the test would be made. The results should clearly quantify how much the LID technology is actually reducing the CSO load.

• **Newark –** Baykeeper is working with the city of Newark to establish green building requirements, which include LID components for any new development or redevelopment contracted for by the city. Baykeeper will also be working with the city, seeking input from colleagues, to develop a CSO-shed pilot project. The purpose of the Newark pilot is to assess the water quality impacts of LID in a highly urban setting.

• **Gowanus Canal** – Franco Montalto, PhD and President of eDesign Dynamics, LLC, conducted a study of the second largest CSO-shed in the Gowanus Canal, called OH007. The study, begun in 2004, modeled side-by-side the cost effectiveness of reducing the frequency of CSOs using a centralized end-of-pipe approach, compared to a program that would subsidize LID technologies on private property including green roofs, porous pavements, and constructed wetlands. In a life cycle study of end-of-pipe solutions vs. LID solutions, it would always make economic sense to invest in LID technologies. A public survey has also been conducted with 300 randomly selected homeowners in the OH007 Drainage Area through Columbia University, soliciting their opinions on rain barrels, porous pavements, green roofs, etc.

• **The Bronx** – Franco Montalto, PhD and President of eDesign Dynamics, LLC, along with students from Columbia University, has recently been funded by the National Fish and Wildlife Foundation for a two year study to measure the performance of a variety of LID systems across the Bronx, to develop a better, more detailed model that would scale up those performance studies to estimate what the city-wide cost savings might be.

Urban green roofs provide enjoyment for people who lack easy access to city parks and open space.

Section 7: Implementation of LID in the Harbor Estuary

Successful implementation of LID technology throughout the Estuary will require state and municipal leadership, proper land use and planning, as well as new funding strategies.

• **Federal Involvement –** On April 19, 2007, the Environmental Protection Agency and four national groups signed an agreement to promote green infrastructure as an environmentally preferable approach to stormwater management. The agreement was accompanied by an additional statement of support for green infrastructure signed by over 30 national groups. The primary goal of the new partnership is to reduce runoff volumes and sewer overflow events through the widespread use of green infrastructure management practices. Corporations, organizations, municipalities, and government entities are invited to join the partnership.

• **State weigh-in-** The first major step is for New York and New Jersey to accept and recommend LID technologies as a means of long-term source control. Municipalities must be educated that LID options can be effectively used separately from, or in combination with, end-of-pipe CSO solutions.

• **Municipal participation -** Willing municipal involvement in the process of source control is essential and is best prompted by active public participation in public hearings, CSO Citizen Advisory Committee meetings, submission of comments, and meetings with relevant officials to discuss concerns. It falls upon municipalities to create a viable source control plan through intra and interagency coordination, conducting public outreach on a regular basis, reviewing and utilizing public comments, and discussing solutions and concerns with all relevant stakeholders at every stage of the planning process.

Municipalities must ensure that new development and redevelopment does not contribute to the pollution problem. Ordinances can be adopted, as well as incentives created for both public and private involvement.

• **Pilot projects –** Local LID projects need to be designed and implemented to demonstrate that LID technologies actually work in our region, and are cost effective as part of an overall CSO abatement plan. Likewise, state and municipal officials need to become well informed about the LID successes achieved in other cities such as Portland or Chicago.

• **Creative funding –** Federal and state grants and loans must be made available to implement LID technology as a means of CSO abatement. The private sector should be involved in urban and suburban development that implements source control measures into site designs.

• **Allocation of funds –** Municipalities need to embrace the concept that if funds must be allocated for abatement measures to comply with state and federal laws, then finding solutions that are cost effective, that provide long-term control (so as not to have to repeat this process regularly), and that are environmentally beneficial is advantageous.

Low impact development invites community participation in the planting of green roofs and rain gardens, and the placement of rain barrels.

Conclusion:
View to Tomorrow — A Greener, Cleaner Estuary, at Less Cost

The NY-NJ Harbor Estuary Program says that "Currently, CSOs are the largest source of pathogenic contamination to the [NY/NJ] Harbor [Estuary], contributing nearly 90 percent of the loading of coliform indicators. Collectively, rainfall-induced discharges, including CSOs, stormwater, and non-point source runoff, account for about 99 percent of the bacterial loading to the Harbor."[9] If we can ameliorate the effects of CSOs, we will have gone a long way to cleaning up and restoring water quality. Besides cleaner water, LID technologies gain us greener cities, plus a greater appreciation of the capability of the natural landscape in controlling and enhancing urban environmental quality.

The greening of cities that would occur as a result of LID technologies has huge additional environmental benefits. We will see more cooling, and a reduction of the urban heat island effect, an especially important benefit in view of increased global warming in our region over coming decades. The greening provided by LID will also provide more carbon sequestration, helping the Estuary's cities to do their part to curb climate change.

The NY/NJ Baykeeper is in complete agreement with its colleagues at Hudson Riverkeeper, who in their 2007 LID report, "Sustainable Raindrops" said, "[s]ource control regards stormwater as a resource to be utilized for much broader sustainability purposes, rather than a waste that must be disposed. By giving life to vegetation, stormwater can help prepare the [region] for the effects of climate change, decrease summer temperatures, promote energy efficiency, improve air quality, and make communities more livable."[11]

If the centralized end-of-pipe solutions proposed by city engineers are coupled with local decentralized LID solutions we will see the added benefit of increased citizen cooperation and participation in our stormwater runoff problem. Cities and their citizens will begin to recognize that stormwater is not a bothersome waste product, but a valuable resource worth protecting. They will see that LID technologies enhance quality of life and improve neighborhoods in a marked and noticeable way, and citizens can get involved as easily as planting a tree in one's yard rather than paving it over, or by installing rain barrels.

Ultimately, LID solutions, to be truly effective in handling the CSO debacle, will need to be widely implemented throughout the region, and integrated into old and new construction. The federal government, states, municipalities and engineering firms will need to embrace LID as a viable solution. The result will be a dramatic change in the environmental conditions, the look, and livability of cities for the better.

NY/NJ Baykeeper, Hackensack Riverkeeper, and Raritan Riverkeeper have all worked together in advocating the advantages of LID in contributing to CSO abatement in New Jersey. Also, Baykeeper is working with Hudson Riverkeeper and Long Island Soundkeeper, along with other partners in New York City on CSO abatement. ~~, to incorporate LID technology as Best Management Practices ("BMPs") throughout the various waterbodies/watersheds.~~

The Waterkeepers have collectively and individually met with municipalities, commented on Long Term Control Plans, and attended hearings to discuss the benefits and need for this technology. Based on the extensive benefits, including economic, environmental and quality of life to name a few, the states and municipalities cannot ignore the necessity of incorporating LID into their source control measures.

The waters of the NY/NJ Hudson Raritan Harbor Estuary will become cleaner and more healthful with the implementation of LID technology.

NEW PULL QUOTE TO BE INCORPORATED INTO THE DESIGN LAYOUT:

Green infrastructure [LID technology] can be both cost effective and an environmentally preferable approach to reduce stormwater and other excess flows entering combined or separate sewer systems in combination with, or in lieu of, centralized hard infrastructure solutions.

Benjamin Grumbles
US EPA Assistant Administrator
March 5, 2007 Memo to EPA Regional Administrators

Notes

[1] http://www.epa.gov/region1/eco/cso/index.html#impacts
[2] http://cfpub.epa.gov/npdes/cso/ltplan.cfm
[3] http://www.wbdg.org/design/lidtech.php
[4] www.econw.com/reports/Low-Impact-Development_Benefit-Cost.pdf
[5] Ibid
[6] http://www.lid-stormwater.net/intro/background.htm
[7] http://www.nrdc.org/water/pollution/rooftops/contents.asp
[8] ibid
[9] http://library.marist.edu/diglib/EnvSci/archives/hudsmgmt/ny-njharborestuaryprogram/theplan.html

[10]http://riverkeeper.org/campaign.php/pollution/the_facts/986
[11]http://www.bronxriver.org/SWIM/files/EPA_UsingGreenInfrastructure.pdf

Photo credits

Front cover: (L.) Andy Willner, (R.) GAIA Institute
Page 1: (L.) Andy Willner, (R.) Franco Montalto EDesign
Page 3: (T.) Montgomery County.org, (B.) Jupiter Images.com
Page 5: LID Center
Page 6: Franco Montalto, EDesign
Page 8: Franco Montalto, EDesign
Page 10: http://www.greenroofs.com/projects/pview.php?id=21
Page 11: GAIA Institute
Page 12: (T.) GAIA Institute, (B.) Inhabit.com
Back cover: Andy Willner

Prepared By:
NY/NJ BAYKEEPER
52 West Front Street
Keyport, NJ 07735
732-888-9870
http://www.nynjbaykeeper.org

Written By:
Glenn Scherer

With Contributions from:
Betsy McDonald
Andrew Willner