Repensando o manejo de águas pluviais no DF

Brasília, abril de 2014

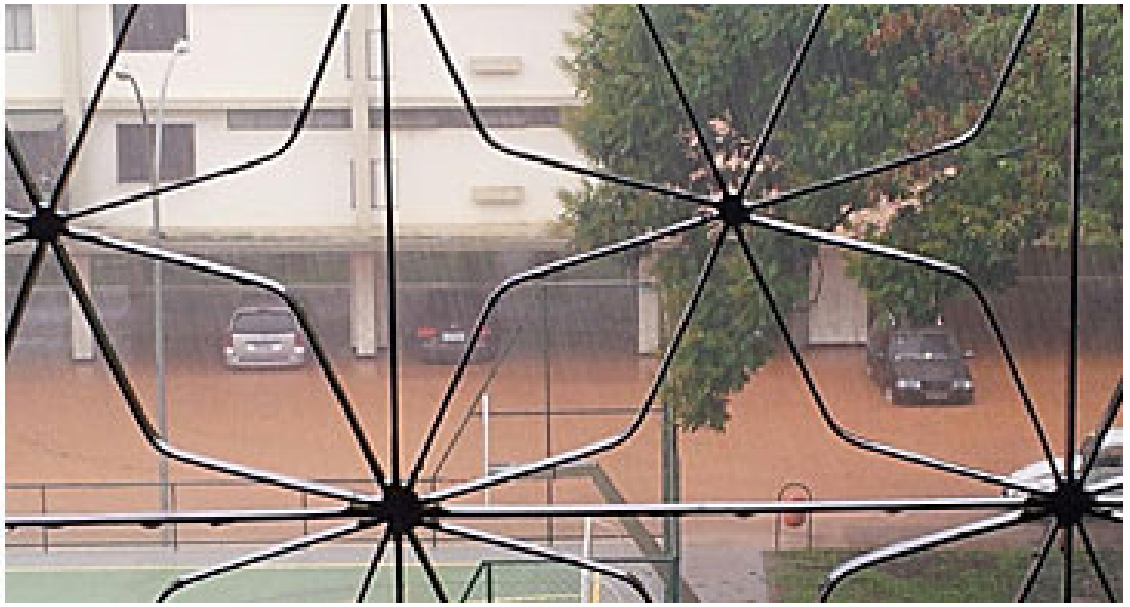
ABES ASSOCIAÇÃO BRASILEIRA DE ENGENHARIA SANITÁRIA E AMBIENTAL

Seção Distrito Federal

Tesourinha e ruas alagadas na Asa Norte na tarde desta segunda-feira (28/11/2011), em Brasília

Ônibus e van parados em área alagada na Asa Norte devido a temporal. (Foto: Raquel Morais/G1) 20 novembro de 2012

Internauta flagrou carros e ônibus submersos em alagamento na W3 Norte, na altura da 511. (Foto: Jackeline Morais) 20/11/2012



Alagamento no final da Asa Norte, entre o Extra e o Wallmart.
A estudante Júlia Herszenhut registrou os carros boiando na 408 Norte.

Internauta flagrou carros e ônibus submersos em alagamento na W3 Norte, na altura da 511. (Foto: Jackeline Morais) 20/11/2012

Bombeiros tiveram de resgatar passageiros de ônibus na W3 Norte

‘Estamos derrotados’, diz pai de criança que morreu afogada em ônibus no DF

O GLOBO 9/10/13

O motorista do ônibus escolar achou que era possível atravessar a área alagada, mas o veículo quebrou

Reprodução / Globonews

Os destroços causados pela chuva no C.E.F. 25 da Ceilândia (12/02/2011)

Joana D'arc é bibliotecária no Centro de Ensino Fundamental 25 há 12 anos. Nunca em todo esse tempo passou por tamanha angústia e pânico. Visualmente abatida, Joana relembra os momentos angustiosos que viveu na companhia de 12 estudantes menores que estavam com ela na biblioteca.

"Na hora que vi a água entrando na biblioteca pensei que a canaleta havia quebrado. Em pouco tempo a água já estava na altura da minha perna".

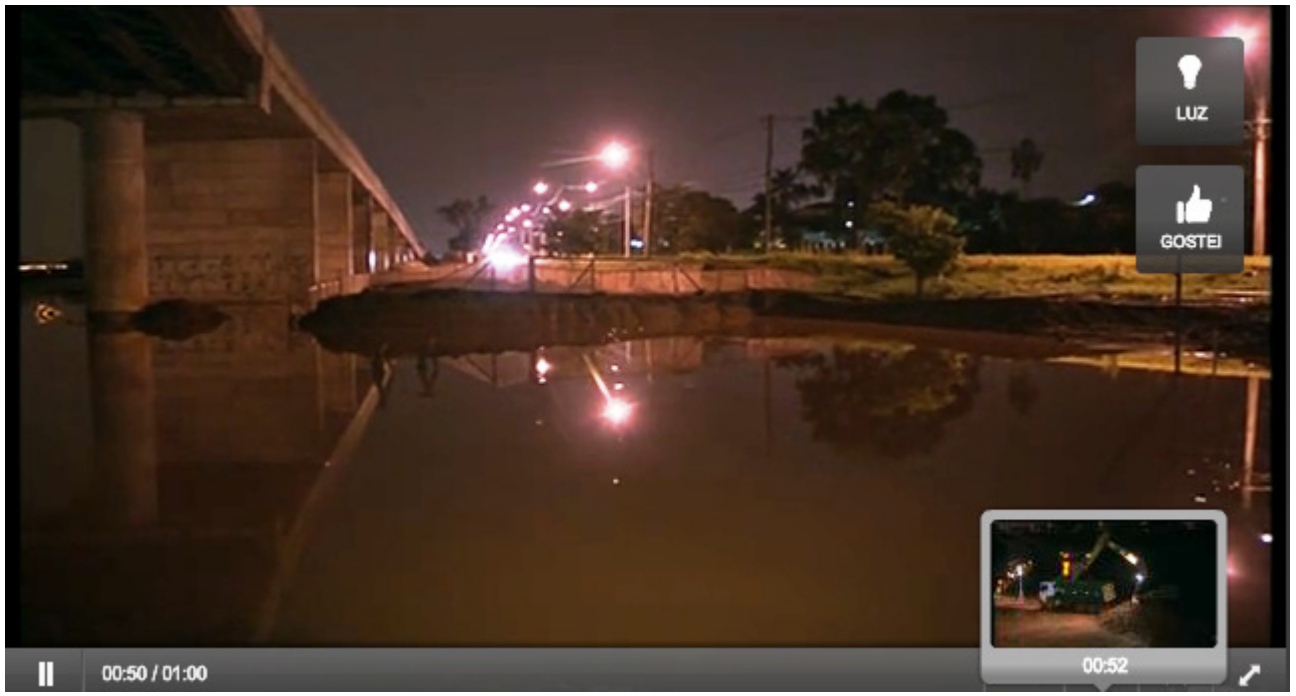
UnB para após alagamento nesse domingo

Enxurrada invade ICC e outros prédios da UnB na tarde do dia 10/4/2011

Hoje

Chuva alaga dois viadutos no DF

Em um dos viadutos, que dá acesso ao aeroporto, as pedras rolaram barranco abaixo e interditaram a passagem. Dois carros ficaram presos.



PDDU

GOVERNO DO DISTRITO FEDERAL – GDF
SECRETARIA DE ESTADO DE OBRAS

PROGRAMA DE SANEAMENTO BÁSICO NO DISTRITO FEDERAL

ACORDO DE EMPRÉSTIMO Nº 1366/OC-BR – BID

PLANO DIRETOR DE DRENAGEM URBANA DO DISTRITO FEDERAL

2009

PLANO DIRETOR DE DRENAGEM URBANA DO DISTRITO FEDERAL

Recursos Renováveis

CONCREMAT

Agosto/2009

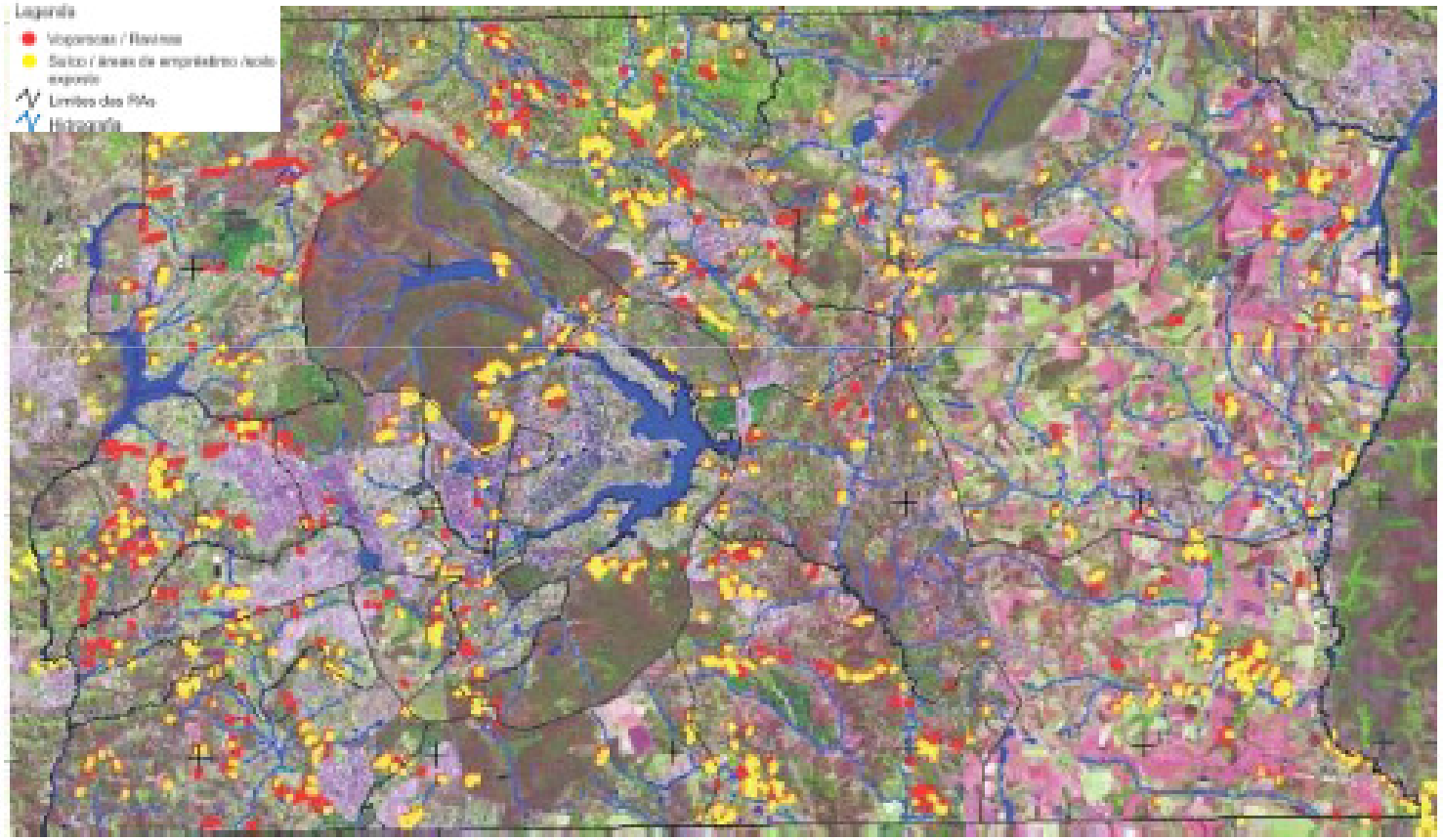


Figura 2.5. Feições erosivas do DF.

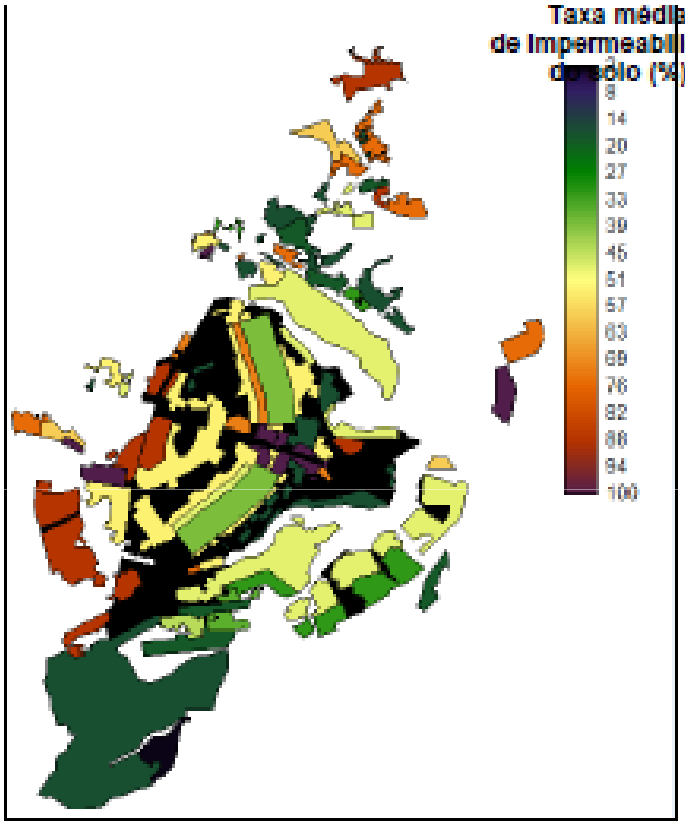
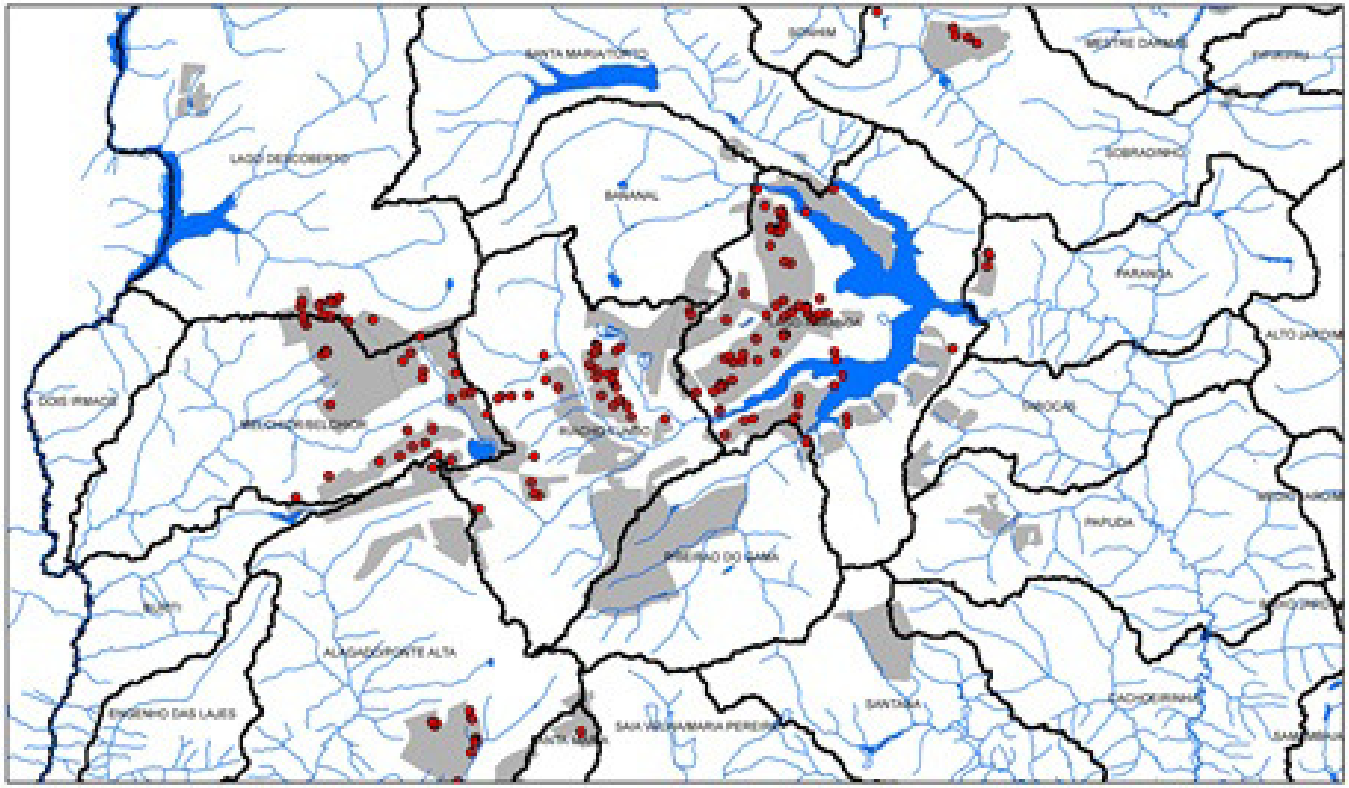


Figura 2.7. Produto da classificação da imagem ALOS para a determinação da taxa média de impermeabilidade do solo nas zonas urbanas do Distrito Federal

PDDU

Áreas com obstrução à passagem d'água na rede de drenagem do DF



PDDU

Situação da rede de macrodrenagem

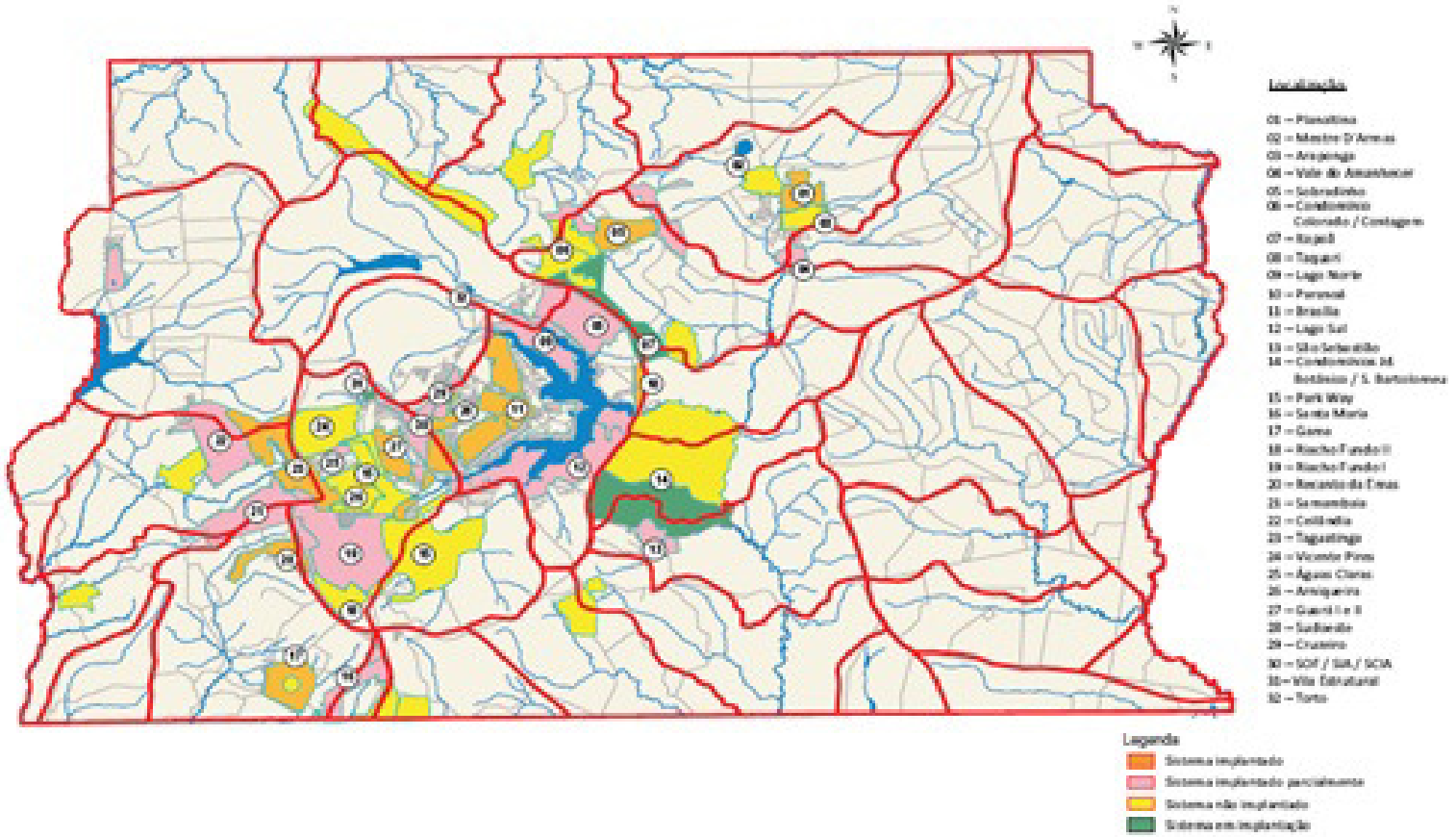
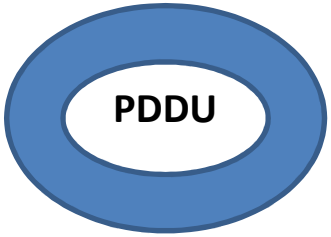


Figura 2.10. Exemplo de fotografias da rede analisadas.

Figura 2.18. Localização de possíveis reservatórios de detenção.



Plano de Gestão e Ações – PGA

Execução e colocação em prática do Plano Diretor de Drenagem Urbana e do Plano de Contingência.

Ações do PGA :

- Ações não-estruturais para o controle de inundações;
- Implementação das ações de gerenciamento;
- Desenvolvimento do marco regulatório da Drenagem Urbana;
- Ações estruturais emergenciais para o controle de inundações;
- Ações estruturais de médio prazo (2-3 anos) para o controle de inundações;
- Ações estruturais de longo prazo para o controle de inundações.

Pioneirismo

O DF é a única unidade da Federação que ao mesmo tempo detém a competência da outorga de águas pluviais e a titularidade dos serviços públicos de drenagem urbana e manejo de águas pluviais

Adasa
Agência Reguladora de Águas, Energia e Saneamento Básico do Distrito Federal

RESOLUÇÃO Nº. 09, DE 08 DE ABRIL DE 2011

Estabelece os procedimentos gerais para requerimento e obtenção de outorga de lançamento de águas pluviais em corpos hídricos de domínio do Distrito Federal e naqueles delegados pela União e Estados.

O DIRETOR PRESIDENTE DA AGÊNCIA REGULADORA DE ÁGUAS, ENERGIA E SANEAMENTO BÁSICO DO DISTRITO FEDERAL – ADASA, no uso de suas atribuições regimentais, de acordo com a deliberação da Diretoria Colegiada, tendo em vista o disposto nos incisos III e IV do art. 7º e incisos I, II e III do art. 8º da Lei 4.285, de 26 de dezembro de 2008, art. 11 e inciso III do art. 12 da Lei nº 2.725, de 13 de junho de 2001 e art. 16 da Resolução ADASA nº 350, e considerando:

a competência da ADASA para outorgar lançamento de águas pluviais, visando ao controle quantitativo e qualitativo dos recursos hídricos no Distrito Federal;

as contribuições recebidas dos diversos usuários e setores da sociedade, por meio da Audiência Pública nº 002/2011 no período de 1º a 16 de fevereiro de 2011, que permitiram o aperfeiçoamento deste ato regulamentar, Resolve:

TÍTULO I
DOS OBJETIVOS E DAS DEFINIÇÕES

Art. 1º A Resolução tem o objetivo de estabelecer as diretrizes e critérios gerais para requerimento e obtenção de outorga de lançamento de águas pluviais em corpos hídricos superficiais do Distrito Federal e naqueles delegados pela União e estados.

Art. 2º Para fins desta Resolução, consideram-se as seguintes definições:

I – chuva de projeto: evento meteorológico capaz de gerar o maior valor de vazão a ser considerado (maximização de pico de cheia) no dimensionamento das estruturas de drenagem e das obras de retenção;

II – dispositivos de infiltração: sistemas que contribuem para a redução do escoamento das águas pluviais por meio da infiltração das águas;

LOW IMPACT DEVELOPMENT (LID)

LID inclui uma variedade de práticas que mimetizam ou preserva os processos de drenagem natural no manejo de águas pluviais.

Tais práticas tipicamente retém as água de chuva e incentivam a infiltração no solo ao invés de permitir seu escoamento para condutos do sistema de drenagem de águas pluviais nos quais contribuem para enchentes e para a poluição das águas superficiais.

(ver www.epa.gov/npa/lid)

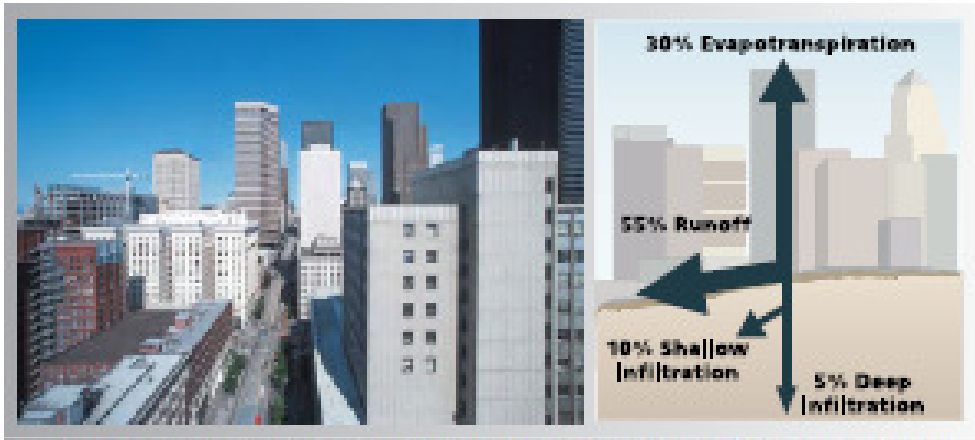


Figure 1. When roads, rooftops and parking lots cover much of the land, more than half of the rainfall runs off and flows directly into surface waters. In highly developed areas, such as in Seattle, Washington (above left), only 15 percent of rain water has the opportunity to soak into the ground.

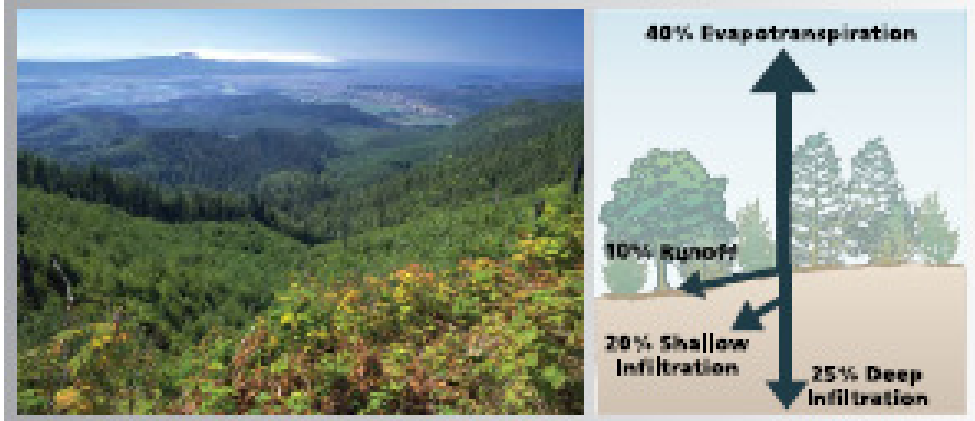
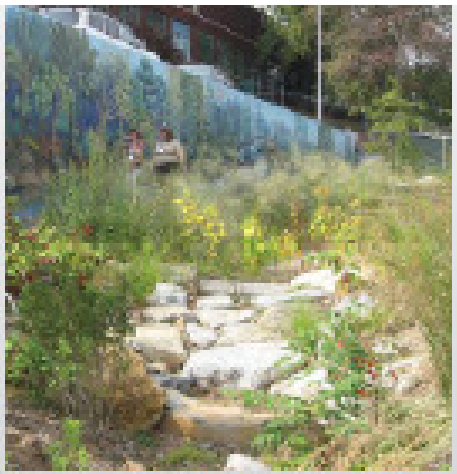


Figure 2. When vegetation and natural areas cover most of the land, such as in Oregon's Upper Tillamook Bay watershed (above left), very little water (only 10 percent) runs off into surface waters. Nearly half of the rainfall soaks into the soil. The remaining water evaporates or is released into the air by vegetation.

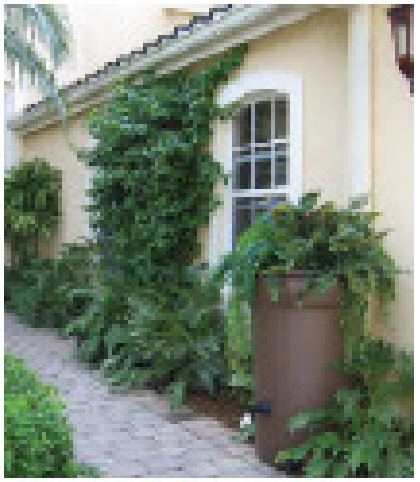
LID: Uma das estratégias

- Infraestrutura verde
- Infraestrutura de águas pluviais verde
- “Conservation Design”
- Novo urbanismo
- Projeto “Light Imprint”
- Crescimento inteligente
- Manejo sustentável das águas pluviais

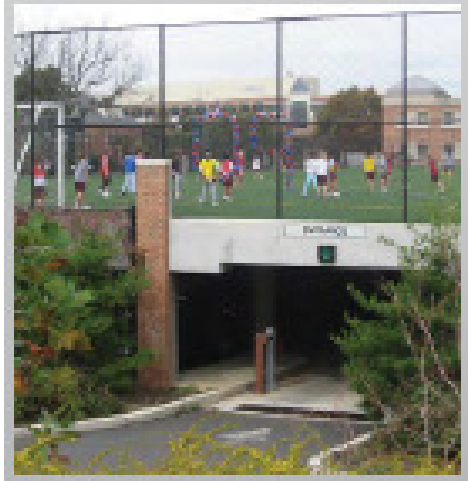


An open space next to a school in Philadelphia was transformed into an outdoor learning lab, recreation area and stormwater management system (rain garden) that captures and filters parking lot runoff.

A green roof, such as this one at Sidwell Friends School in Washington, D.C., absorbs rain water, reduces energy costs, and provides green space and wildlife benefits in an urban area.

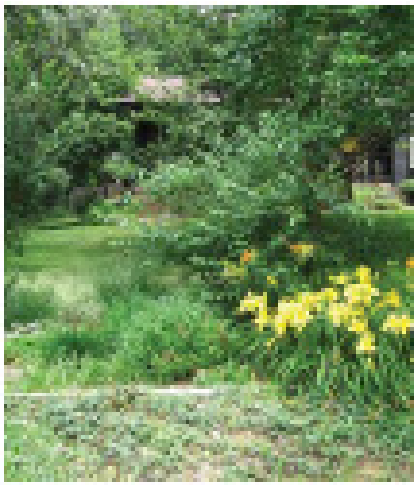


A rain barrel captures and stores roof runoff for later use. A planter incorporated as the top of the rain barrel provides camouflage.



The roof of this Washington, D.C. parking garage doubles as a school athletic field, reducing runoff and offering usable open space.

A roadside swale built in a public right-of-way provides aesthetic benefits and collects and filters road runoff in Olympia, Washington.



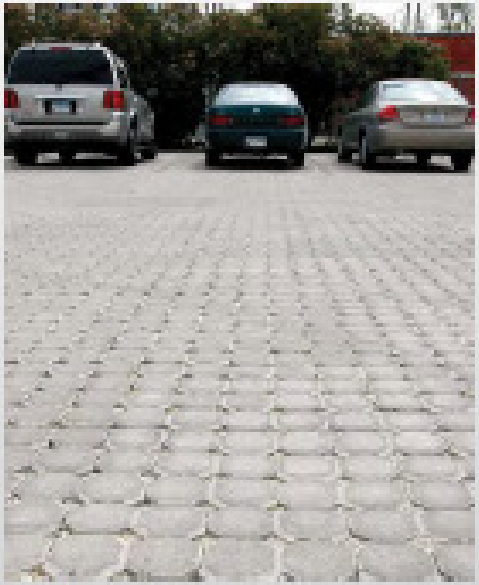
A rain garden collects and treats runoff from a residential lot in Stafford County, Virginia.

LID: Principais benefícios ambientais e econômicos (EPA)

- reduz o número de eventos de enchentes e alagamentos seus prejuízos
- restaura o habitat aquático
- Melhora a recarga dos aquíferos
- Embeleza a paisagem urbana

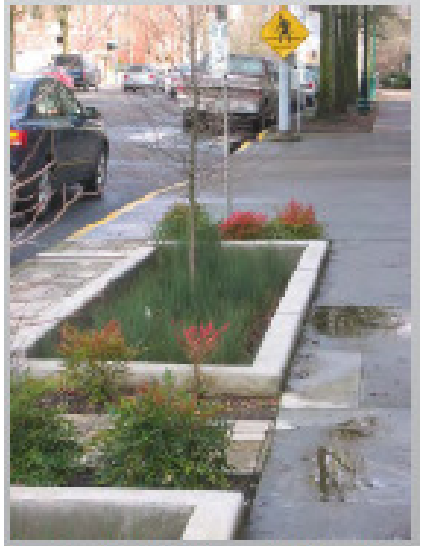
De acordo com a EPA, as práticas de LID podem ser adotadas tanto em novas urbanizações quanto em áreas a serem urbanizadas.

A landscaped curb extension calms traffic and captures and infiltrates street runoff in Portland, Oregon.



Rainfall soaks through permeable pavement and into the ground below in this parking area in west Des Moines, Iowa.

A green roof absorbs rainwater, reduces energy costs and offers wildlife habitat in urban Portland, Oregon.



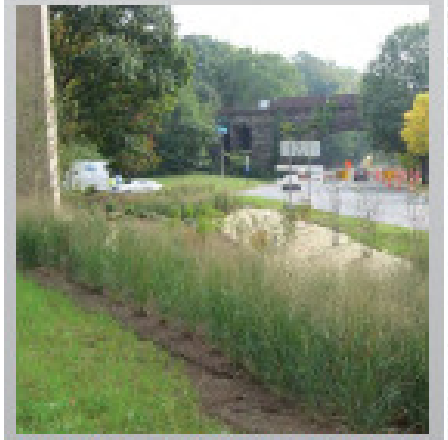
Street runoff collects in stormwater planters in Portland, Oregon.

EPA

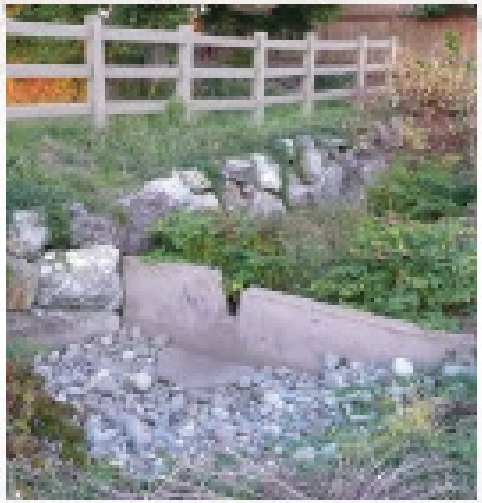
LID: custo x benefício

Are Low Impact Development (LID) Practices More Economical Than Conventional Practices?

In many cases, the answer is yes. LID typically includes a variety of low-cost elements such as bioswales that retain rain water and encourage it to soak into the ground rather than allowing it to run off into storm drains where it would otherwise contribute to flooding and pollution problems. LID projects typically include smaller overall development footprints, reduce the amount of runoff generated and increase the amount of natural areas on a site, thereby reducing costs when compared to traditional stormwater management and flood control.

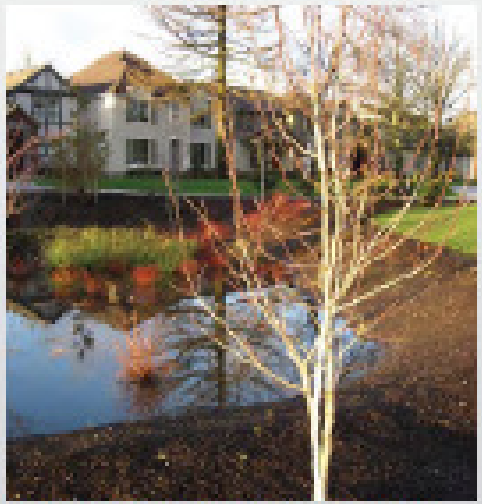


Philadelphia has been expanding its use of LID by implementing new policies and demonstration projects, such as this roadside bioswale that treats runoff from an adjacent parking lot. The city's use of LID has reduced stormwater runoff volume, saving approximately $170 million in combined sewer overflow costs since 2006.



A roadside swale captures and retains runoff in Seattle, Washington. The city saves money with LID by avoiding costly stormwater infrastructure and reducing paving costs.

This 4-acre grassed overflow parking lot at a mall in West Hartford, CT cost $500,000—half the cost of a traditional parking lot.



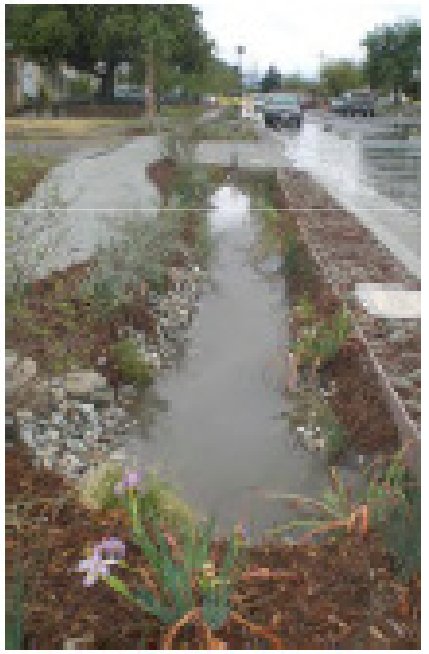
This bioretention pond in Wilsonville, Oregon collects runoff from the rooftops, sidewalks and yards. The pond offers valuable aesthetic and wildlife habitat benefits while also reducing stormwater control costs.

Street drainage flows into this roadside bioswale in Lenexa, Kansas. The city found that on-site detention with LID practices cost 25 percent less than traditional stormwater management retrofits.

LID: Embelezamento urbano

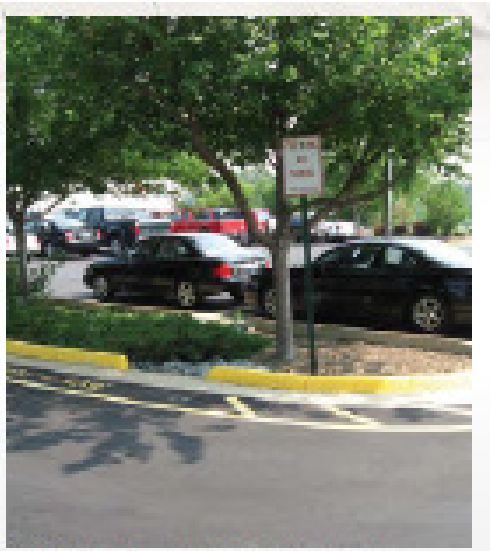
Southern California's Elmer Street (at right) was retrofitted to include roadside bioswales that capture and infiltrate stormwater. Before the project, neighborhood homes had grass lawns and minimal landscaping (below). Adding LID practices increased the visual beauty of the neighborhood (below right), provided sidewalks and reduced problems with flooding and standing water.

Elmer Street photos provided by the Los Angeles and San Gabriel Rivers Watershed Council.

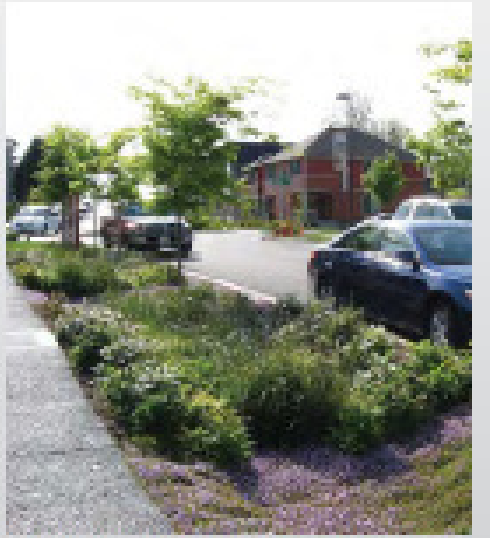


Stormwater flows through a curb inlet into a bioswale on Elmer Street. The water infiltrates into the soil within a day, preventing breeding mosquitoes.

LID: Embelezamento urbano

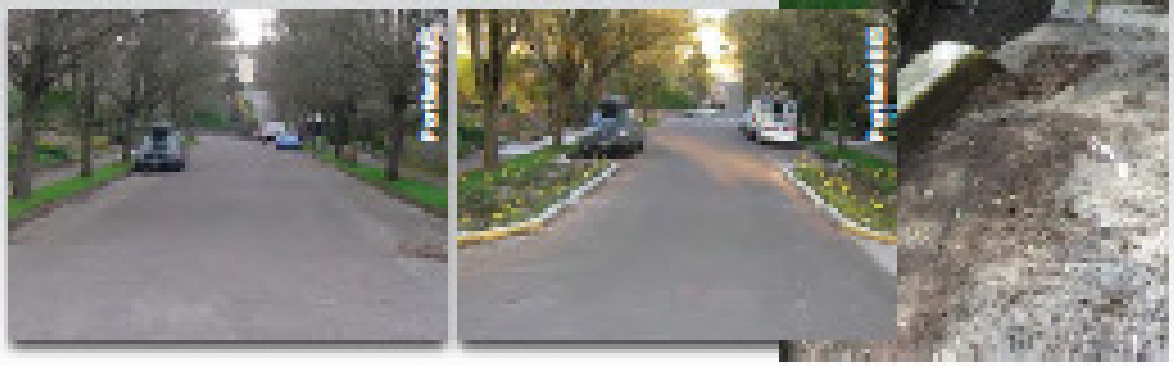


In this Virginia parking lot, traffic islands are designed with curb-cuts and a porous drainage medium to allow runoff to collect and infiltrate.



In Seattle's High Point neighborhood, roadside bioswales collect and filter stormwater, create a park-like feel and improve pedestrian safety.

Landscaped curb extensions (detail, right) on Northeast Siskiyou Street in Portland, Oregon, are designed to intercept stormwater runoff flowing down the street just before it would have entered the storm drain. The stormwater is redirected through a vegetated area, where it has a chance to infiltrate into the soil. Although a minor change, the curb extensions greatly improve the street's appearance and slow the traffic moving through the neighborhood.



LID: Resultados

Seattle, Washington
Projeto demonstrativo.
Redução da vazão de escoamento superficial em 99%.

Seattle's SEA Street project (top of photo) uses numerous LID practices including rain gardens, vegetated swales and a narrow, winding street. A typical Seattle street (bottom of photo), by comparison, has a broad, wide street and flat yards with few natural depressions to capture and store stormwater runoff.

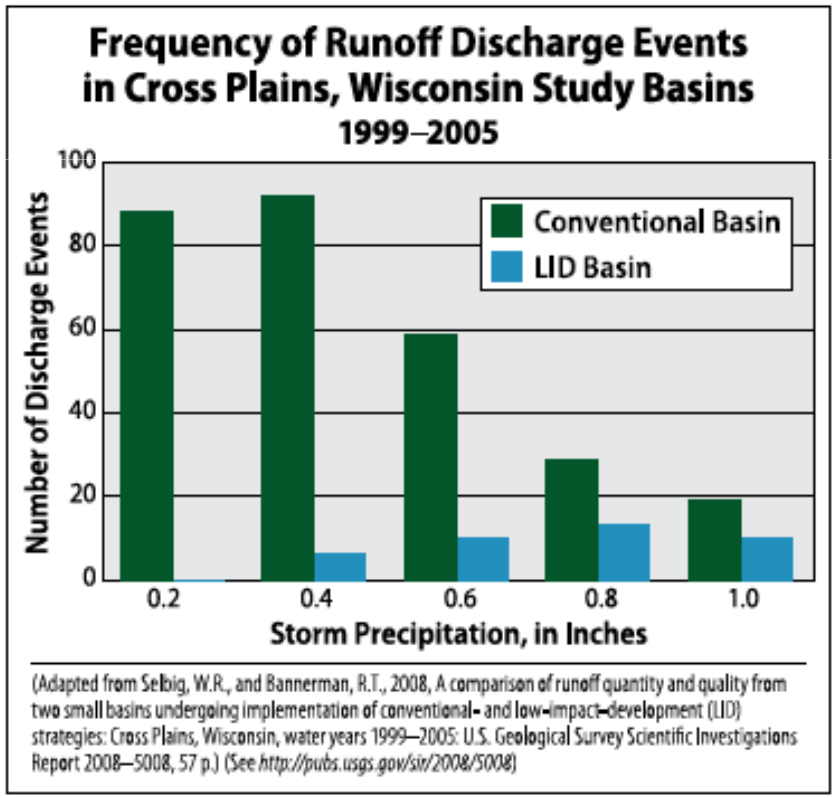
Seattle, Washington

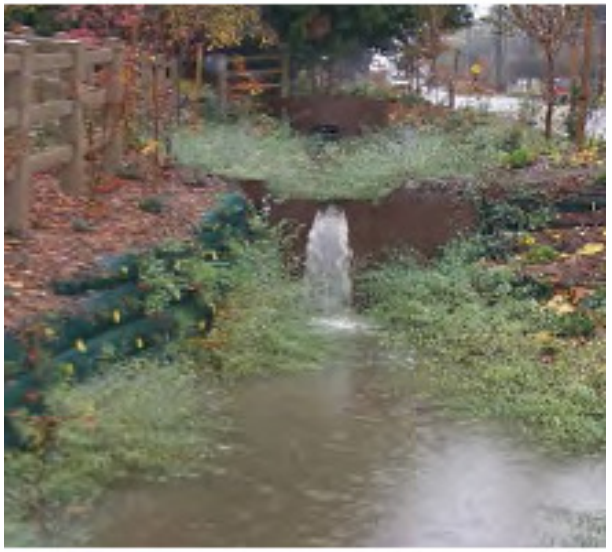
Seattle launched its Street Edge Alternatives (SEA Street) neighborhood demonstration project in 2000. The city incorporated LID practices to improve stormwater management on 600 linear feet of street (comprising a drainage area of 2.3 acres). The project reduced impervious surfaces by 11 percent when compared to a traditional street, provided surface detention in roadside swales, and added more than 1,200 new trees and shrubs.

Results? The volume of stormwater leaving the street declined by 99 percent. LID practices absorbed all dry season flow and 98 percent of wet season flow.

LID: Resultados

Redução da poluição





A stair-stepped pool slows runoff in Seattle's NW 110th Cascade project.

Table 1. NW 110th Cascade Project: Pollutant Removal (2004–2006)

Pollutant	Pollutant Mass Loading Reductions[1]
Total suspended solids	84%
Total nitrogen	63%
Total phosphorus	63%
Total copper	83%
Dissolved copper	67%
Total zinc	76%
Dissolved zinc	55%
Total lead	90%
Motor oil	92%

[1] As compared to traditional street drainage

Figure 1. A worker removes sediment and debris from a curb-cut in a stormwater bump-out along a street in Portland, Oregon.

Figure 2. Soldiers with the U.S. Army in Hawaii help maintain a bio-retention area by trimming bushes and removing weeds.

Figure 3. This stormwater planter is one of a suite of dispersed stormwater management practices that Portland, Oregon, city employees help to manage.

Figure 4. Volunteers with Portland's Green Street Stewards program care for a LID feature in their neighborhood by removing debris and weeding.

EPA

LID: custos de manutenção

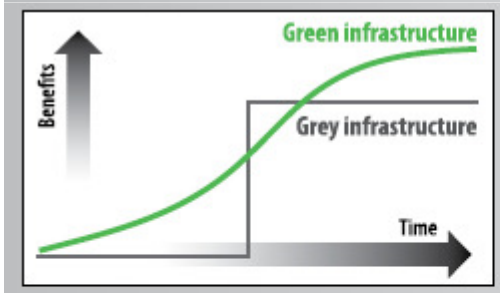
Os custos de manutenção a longo prazo são normalmente menores.

LID: Vale para Nova Iorque.
E para Brasília?

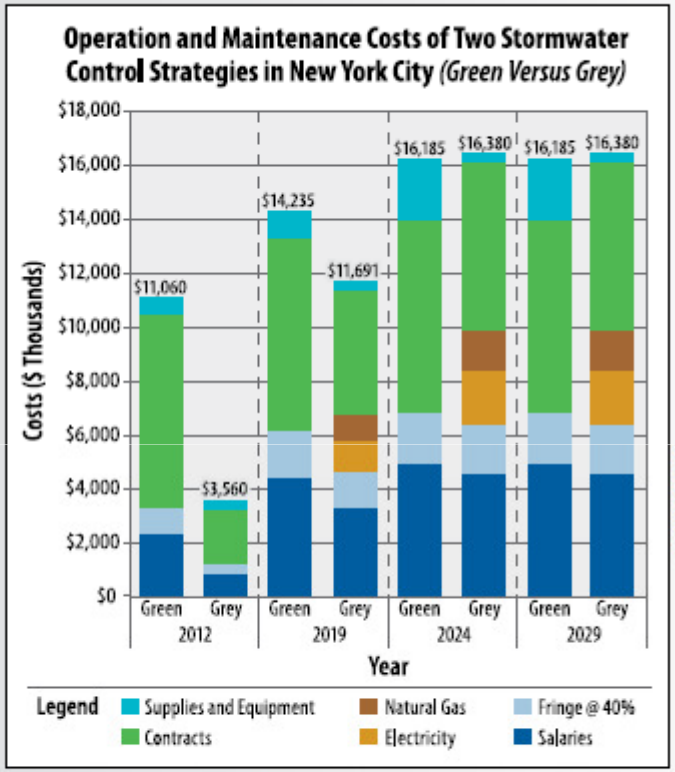
New York City's Green Strategy Will Pay Off Over Time

In 2010 New York City released a green infrastructure plan that outlines options for adding LID practices such as swales and green roofs to help reduce combined sewer overflows (CSO) and protect water quality. Modeling and data analyses conducted during plan development showed that operating and maintaining the green infrastructure elements of the plan (the "Green Strategy") is higher in the initial years as these controls are built quickly, while operating and maintaining the grey infrastructure (the "Grey Strategy") will be higher in the long run as large tanks, tunnels and expansion costs come online over time.

By 2024, New York City would pay about $200,000 less annually to operate and maintain the Green Strategy as compared to the Grey Strategy. Over a 20-year period, the New York Department of Environmental Protection estimates that the Green Strategy will reduce CSO volumes by nearly 2 billion gallons more than could be achieved by the Grey Strategy. In total, the Green Strategy would cost approximately $5.3 billion, about $1.5 billion less than the $6.8 billion required for the Grey Strategy. Plus, the Green Strategy provides additional valuable benefits not provided by the Grey Strategy, including improved neighborhood aesthetics, lower summer temperatures, reduced energy use, cleaner air and water, and increased property values.



The water quality and sustainability benefits provided by green infrastructure would begin to accrue immediately, unlike the benefits of the grey infrastructure, which would be realized at the end of a decades-long design and construction period.



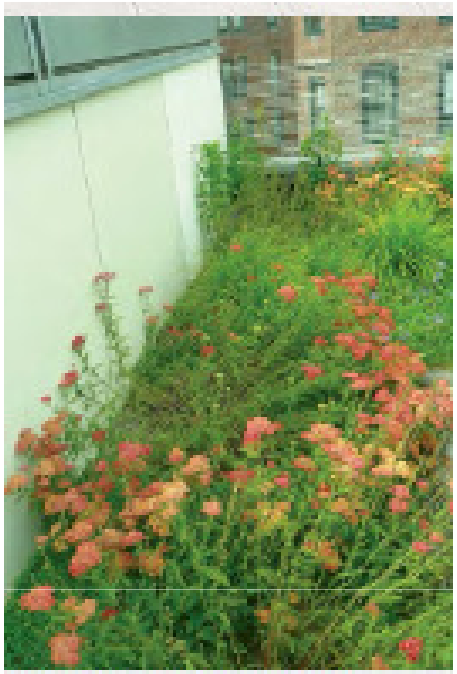
An analysis of the life cycle costs showed that the Green Strategy would cost less to maintain over time because of high fuel costs (required by pumps, etc.) associated with maintaining grey infrastructure.

Images adapted from NYC Green Infrastructure Plan, 2010 (nyc.gov)

Reducing Stormwater Costs through Low Impact Development (LID) Strategies and Practices

LID: Incentivos

Cisterns operate as part of a rainwater harvesting system in Philadelphia that collects roof runoff for uses such as landscape irrigation or water reuse.



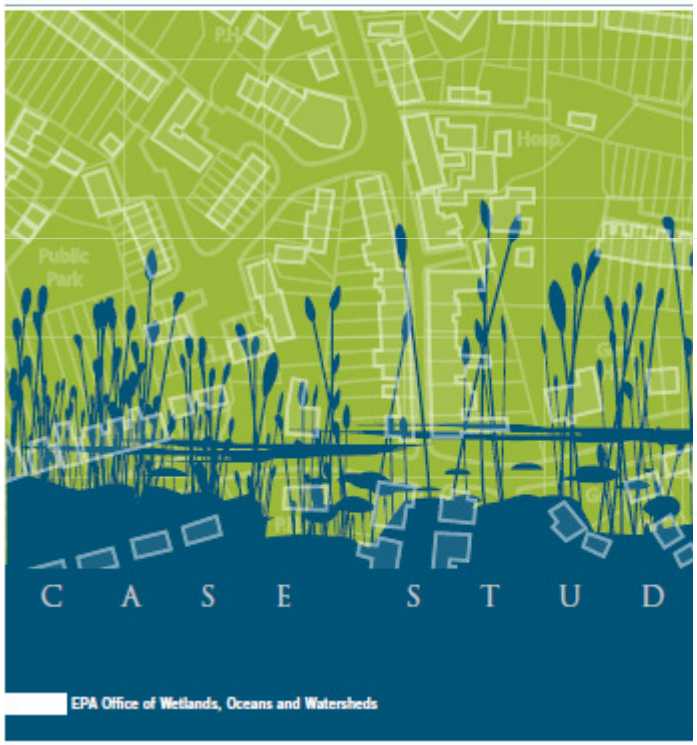
Developers of Philadelphia's Thin Flats condominiums added green roofs that capture rain water and provide private green space, complete with rooftop patios, for each unit.

Philadelphia uses multiple incentive tools to encourage developers to install rain gardens like this one at Wissahickon Charter School.

The City of Santa Monica, California, offers rebates to property owners who redirect downspouts away from paved areas, install cisterns and rain barrels, and use native landscaping.

Portland, Oregon's Ecoroof Incentive Program will fund up to $5 per square foot of green roof installed by a property owner or developer.

A necessidade de políticas públicas integradas



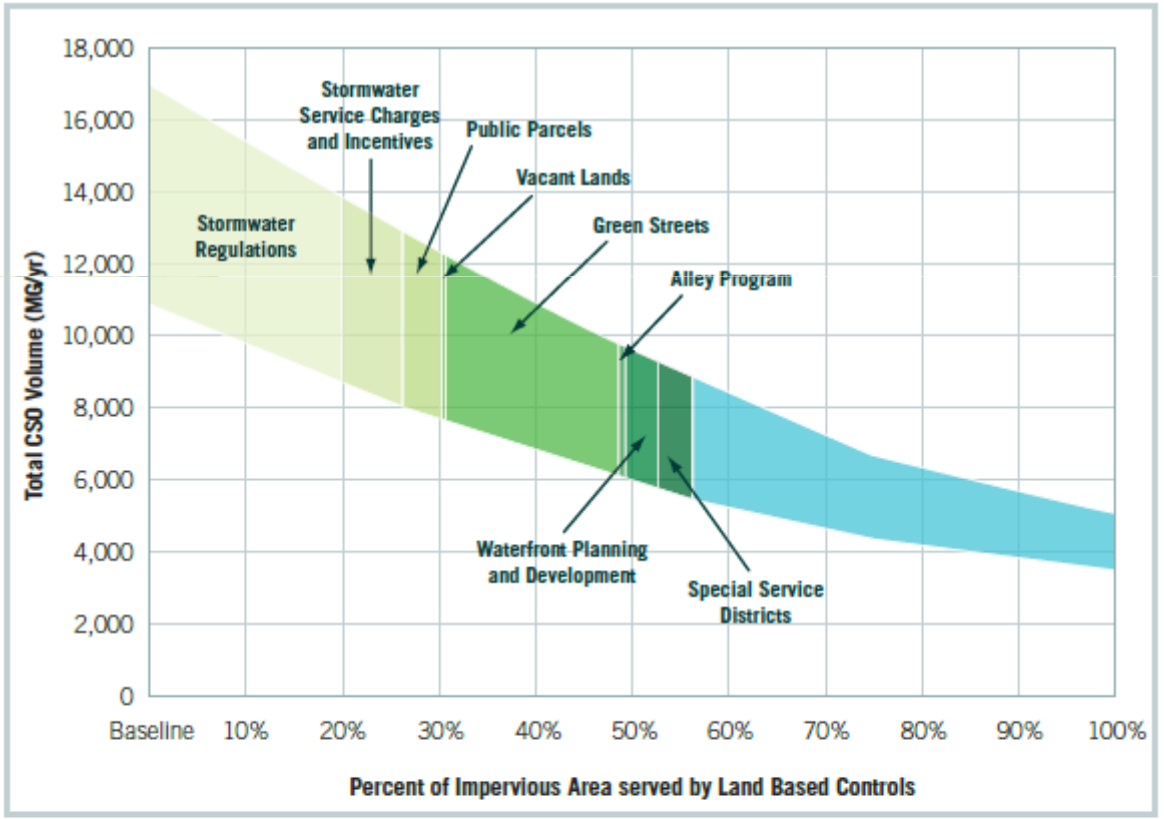


Figure 7: *Philadelphia found that stormwater regulations alone would only reach 20 percent of the impervious surfaces in the City. The City uses a range of policy types, including public land projects and incentives.*

O desafio de inovar no manejo das águas pluviais

Quais são os desafios no DF?

...umas pistas:

- Enfoque holístico e integração das políticas urbanas com vistas ao manejo sustentável das águas pluviais
- Aproveitar as características positivas da cidade
- Institucionalizar a prestação do serviço e a regulação
- Instituir incentivos
- Ampliar a participação e o controle social

Alagamento na 711 Norte

Como podemos fazer avançar o manejo das águas pluviais no DF?

Eng. Marcos Helano Montenegro
Presidente da ABES DF
Abril de 2014