Green Infrastructure for Los Angeles:

Addressing Urban Runoff and Water Supply Through **Low Impact Development**

In memory of Dorothy Green,

whose dedication to creating healthy, sustainable waters for
Los Angeles and the state of California was an inspiration to us all.

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[1] Executive Summary

The purpose of this report is to examine low impact development (LID) for the City of Los Angeles and potential steps for instituting city-wide low impact development programs or projects. It also gathers policy strategies and technical information that could be pertinent to the City's LID efforts.

Part I (Chapters 2–5) describes the importance of low impact development and green infrastructure and highlights existing LID programs throughout the nation and here in Southern California. Part II (Chapters 6–11) explores potential ways to implement LID in Los Angeles and some of the issues that should be considered. It also reviews current policies and regulations (such as stormwater management laws and the City's recent Green Building Ordinance) that intersect with local LID programs. Finally, the appendices contain additional information and resources that may be helpful for developing comprehensive green infrastructure programs and projects for the City of Los Angeles.

Rio Hondo Golf Course parking lot in Downey, CA

What is Low Impact Development?

Stormwater pollution, water shortages, flood control, climate change and the availability of natural green space have all become pressing environmental issues for cities around the nation, including the City of Los Angeles. Fortunately, new strategies for runoff management using low impact development and green infrastructure offer promising solutions to many of these concerns.

Low impact development (LID) is an approach to stormwater management that emphasizes the use of small-scale, natural drainage features integrated throughout the city to slow, clean, infiltrate and capture urban runoff and precipitation, thus reducing water pollution, replenishing local aquifers and increasing water reuse.[1]

Key Principles of Low Impact Development

- Decentralize & manage urban runoff to integrate water management throughout the watershed.
- Preserve or restore the ecosystem's natural hydrological functions and cycles.
- Account for a site's topographic features in its design.
- Reduce impervious ground cover and building footprint.
- Maximize infiltration on-site.
- If infiltration is not possible, then capture water for filtration and/or reuse.

While conventional stormwater controls aim to move water off-site and into the storm drains as quickly as possible, LID seeks to do just the opposite—to keep as much water on-site as possible for absorption and infiltration in order to clean it naturally. LID focuses on controlling urban runoff and pollution at the source of the problem, rather than at the end of the storm drain outlet. A comprehensive approach to LID should include city-wide land development strategies and planning along with the creation of infrastructure for stormwater management.

Green Infrastructure

Green infrastructure refers to an interconnected network of natural features (vegetation, parks, wetlands, etc.) that provide beneficial "ecosystem services" for human populations. The benefits can include functions such as pollution removal, carbon sequestration and groundwater recharge.[2] [3] Low impact development and green infrastructure are often used interchangeably because the terms overlap, but it should be noted that LID focuses specifically on water management issues, while green infrastructure's scope can be broader. Green infrastructure is often used to refer to networks of parks and open lands that preserve habitats and ecosystem functions (usually created or protected by managing land uses), but the term can also encompass small-scale natural features such as trees planted along a city sidewalk. While green infrastructure is often used for water management purposes, it can also be used to tackle other issues such as air pollution, urban heat island effects, wildlife conservation and recreational needs.

Common LID Best Management Practices

A **best management practice (BMP)**[4] is a device or technique used to remove or reduce pollutants found in stormwater runoff, preventing the contamination of receiving waters.[a] It is important to note that LID primarily employs *natural* structural best management practices (such as vegetated swales, retention ponds and green roofs), not mechanical best management practices (such as water treatment facilities and manufactured filtration units). Examples of some of the most common LID best management practices are depicted on the next page; a more extensive selection can be found in Chapter 3. The best management practices generally fall into four categories: landscape BMPs, building BMPs, street and alley BMPs, and site planning BMPs.

Seattle's SEA Street (Street Edge Alternatives) project includes bioswales and permeable pavement.

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[a] Receiving waters are lakes, rivers, oceans, and other types of waterways into which stormwater can flow.

Some Common LID Best Management Practices [5]

			
Vegetated Swales / Bioswales	Rain Gardens	Rain Cisterns	Green Roofs

			
Permeable Pavers	Porous Pavement	Curb Bump-Outs	Curb Cuts

The Benefits of LID for Los Angeles

Low impact development offers a wide range of community benefits. It improves flood control, relieves pressure on the sewage treatment system, prevents river and ocean pollution, reduces the demand for water use, augments groundwater aquifers, mitigates climate change, provides natural green space, increases the availability of green jobs, and saves money on the capital costs for stormwater management infrastructure.

The potential benefits of low impact development to help water pollution, water supply and energy usage in Los Angeles County are compelling. A study done by Community Conservancy International in March 2008 found that **nearly 40% of L.A. County's needs for cleaning polluted runoff could be met by implementing low impact development projects on existing public lands.** A net average of 15,000 acres of existing public lands in the county are suitable for LID projects.[6]

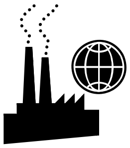
In addition, each ¼-acre of hardscape in Los Angeles has the potential to collect 100,000 gallons of rainwater per year.[7] A separate study by the Natural Resource Defense Council from January 2009[8] found that an increased use of LID practices throughout residential and commercial properties in L.A. County would promote groundwater recharge and water capture and reuse, reducing the county's dependence on distant sources of water. This increased use of LID would result in the **savings of 74,600–152,500 acre-feet of imported water** per year by 2030. Based on current per capita water usage in the City of Los Angeles, this is equivalent to the water consumption of 456,300–929,700 people.[9] Moreover, since L.A. County would be pumping less water from distant locations, **131,700–428,000 MWH of energy would be saved** per year by 2030, which is equivalent to the electricity used by 20,000–64,800 households.[10] Therefore, LID could also mitigate climate change by reducing greenhouse gases.

The following tables highlight some of the advantages that LID has to offer and provide interesting facts about the effectiveness of LID. Additional tables about flood control, wastewater management, water pollution, community improvements, and construction and building costs can be found in Chapter 4.

Bioswales at 1100 S. Hope Street in downtown L.A.

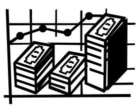
Water Supply & Demand

Issues	How LID Helps	Supporting Facts
• The L.A. area regularly faces water shortages and does not generate enough water to sustain itself. • Only 13% of L.A. City's water supply comes from local groundwater.[11] • 48% of L.A. City's water supply originates from the Mono Basin and Owens Valley aqueducts. • At least 30% of all the water used in the City of Los Angeles is used outdoors.[12]	• Decreases Los Angeles' dependence on outside sources of water. • Reduces the demand for irrigation water because rainwater is slowed and captured for infiltration into the ground. Some methods also capture water for reuse. • Increases the supply in the local water table. • Promotes or requires the use of drought-tolerant plants.	• Widespread use of water infiltration, capture and reuse in L.A. County would result in the savings of 74,600–152,500 acre-feet of imported water per year by 2030.[13] (Equivalent to the water consumption of 456,300–929,700 people.) • Each ¼-acre lot in L.A. has the potential to generate100,000 gallons of stormwater annually.[14] • By disconnecting 60,000 gutter downspouts, Portland diverted 1.5 billion gallons of stormwater per year. [15]



Climate Change

Issues	How LID Helps	Supporting Facts
• Fossil fuels are the #1 source of the greenhouse gases that cause climate change. • World temperatures could rise by between 2.0 and 11.5 °F during the 21st century.[16] • Blacktop surfaces can elevate surrounding city temperatures as much as 10°F.[17] • In the summer, central Los Angeles is typically 5°F warmer than surrounding suburban and rural areas due to the heat island effect.[18]	• Increasing the local water supply means that Los Angeles will use less energy pumping water from distant locations. • Trees and landscaping counteract climate change by absorbing excess carbon dioxide. • Shade from trees and evapotranspiration by plants reduce the heat island effect.	• Water systems account for 19% of the electricity used in the state of California.[19] • L.A. County could save 131,700–428,000 mWh of energy per year if less water was transported from Northern California.[20] (Equivalent to electricity use of 20,000–64,800 households.) • Each shade tree in L.A. prevents the combustion of 18kg of carbon annually and sequesters an additional 4.5–11kg of carbon per year.[21]



Green Jobs & Economy

Issues	How LID Helps	Supporting Facts
• The City of Los Angeles would like to encourage the development of “green-collar” jobs.[22] • The current economic recession has resulted in city budget cuts. More revenues are needed to fill the gaps.	• Encourages the growth of the green building industry. • Encourages the landscaping and gardening industry to shift to eco-friendly practices that emphasize native, drought-tolerant plants and rainwater harvesting. • Property drainage evaluations could increase the demand for “green industry” jobs in environmental assessment. • Trees and landscaping and reduced neighborhood flooding can enhance neighborhood property values, thus increasing tax revenues.	• L.A.’s Green Building Ordinance will create an anticipated 500 green-collar, union jobs.[23] • L.A.’s growing green building industry presents workforce development opportunities for auditors and landscapers and gardeners.[24] • Trees in Portland, OR generate approx. $13 million per year in property tax revenues by increasing real estate values.[25]

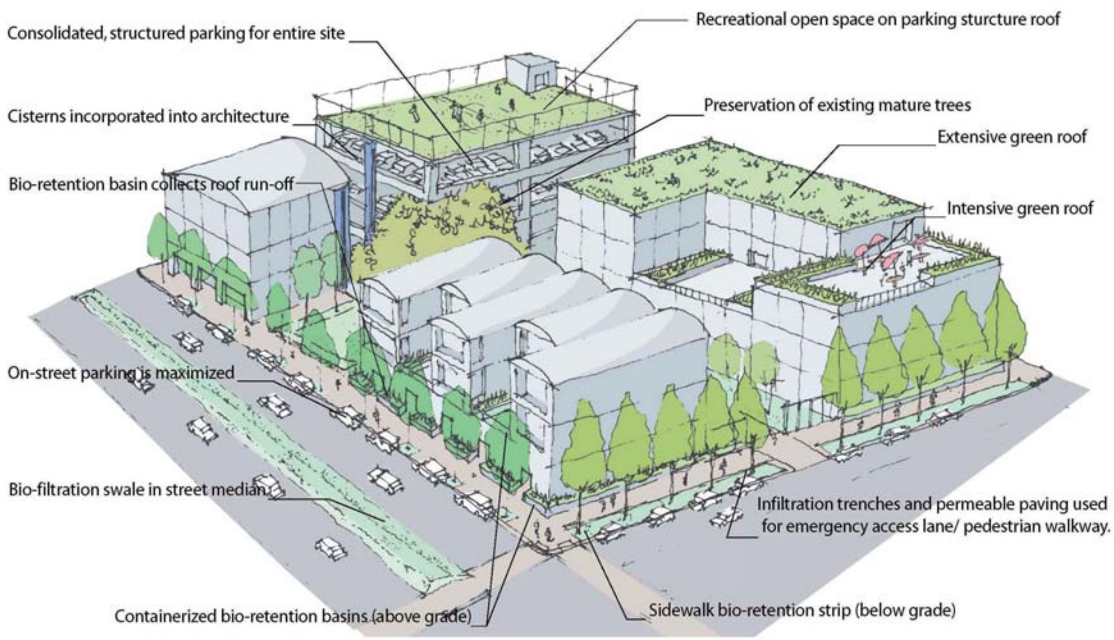


Illustration from the City of Emeryville's *"Stormwater Guidelines for Green, Dense Redevelopment"* manual depicting what LID might look like for a commercial development. *Credit: City of Emeryville / Community, Design + Architecture*

Examples of LID Programs, Projects and Regulations [26]

Many cities and counties across the country already have low impact development regulations, programs and projects underway, often pursued as an extension of a greater stormwater management, landscaping or sustainability program. Some particularly notable examples include the nation's first official LID program in Prince George's County (MD), Seattle's "Street Edge Alternatives" retrofit projects and their Green Factor building code (which requires properties to attain a certain level of permeability), numerous Green Streets projects in Portland (OR), Chicago's Green Alleys program, and Emeryville's program that promotes green, dense redevelopment.

The County of Los Angeles passed its Low Impact Development Ordinance in October 2008, which could offer a template for future LID efforts in the City of Los Angeles. The City of Los Angeles does not yet have a LID ordinance of its own, but it does have a number of pilot programs in place such as the Oros Street stormwater retrofit, Bimini Slough Ecology Park, the Green Streets LA program, and the Downspout Disconnect program. Other examples of LID in Southern California include the City of Ventura's Green Street policy, the City of San Diego's low impact development program, and Santa Monica's green building program.

Oros Street after its "green street" reconstruction (Los Angeles)

Existing Stormwater Regulations & Programs in Los Angeles

There are a number of stormwater regulations and green infrastructure programs originating from the federal, state, county and city levels of government that apply to the City of Los Angeles, providing a solid foundation for future LID efforts. Four key regulations and programs in the City of Los Angeles are the Standard Urban Stormwater Mitigation Plan, the Green Building Ordinance, the Landscape Ordinance and the Green Streets LA program.

The **Standard Urban Stormwater Mitigation Plan (SUSMP)** is part of L.A. County's Municipal Stormwater Permit, which applies to the City and addresses federal water pollution regulations by setting stormwater management requirements. In general, SUSMP applies to new developments and redevelopments of a certain minimum size.[27] It therefore does not apply to a large amount of existing development in Los Angeles. SUSMP best management practices must be able to infiltrate, capture and reuse, or treat all of the runoff from a site during an 85th percentile storm, which is equivalent to a ¾" storm. Although many of Los Angeles' existing low impact development BMPs were installed due to SUSMP requirements, SUSMP's primary goal is to reduce pollution levels; it only incidentally diverts stormwater to groundwater recharge areas. Additionally, the L.A. County Stormwater Permit must be reissued every five years, and its requirements can vary from permit to permit.

A vegetated swale with curb cuts in the parking lot of a shopping center at 8500 Firestone Blvd., Downey, CA.

The City of Los Angeles' **Green Building Ordinance** and **Landscape Ordinance** both have some LID features, but at this time neither addresses low impact development principles.[28] [29] Like SUSMP, they do not deal with existing development, and they do not specifically require significant use of green infrastructure BMPs.

The **Green Streets LA** program was initiated by the City Board of Public Works with the idea that Los Angeles' extensive street network offers an important opportunity to absorb, capture and filter urban runoff, which addresses pollution and groundwater recharge issues.[30] The Green Streets LA program has expanded the City's focus to include a broader array of LID practices. A preliminary set of Green Streets design guidelines were developed in 2008 and other measures are being planned to institutionalize low impact development.

How Much Does Low Impact Development Cost?

Pilot projects have shown that using low impact development techniques instead of conventional stormwater controls can result in considerable capital cost savings. **An analysis of LID projects from across the nation conducted by the U.S. Environmental Protection Agency (EPA) in 2007 found that with just a few exceptions, the capital costs of LID projects were less than conventional water management controls.** As shown in the table below, savings ranged from 15–80%.[31] (Please see Appendix III for a fact sheet about the report.) It is important to note that the EPA's analysis did not account for the value of the environmental, social and community benefits created by the projects.

Project [a]	Estimated Conventional Development Cost	Actual LID Cost	Cost Savings[b]	Percent Savings[b]
2nd Avenue SEA Street (Washington)	$868,803	$651,548	$217,255	25%
Auburn Hills (Wisconsin)	$2,360,385	$1,598,989	$761,396	32%
Bellingham City Hall (Washington)	$27,600	$5,600	$22,000	80%
Bellingham Park (Washington)	$52,800	$12,800	$40,000	76%
Gap Creek (Arkansas)	$4,620,600	$3,942,100	$678,500	15%
Garden Valley (Washington)	$324,400	$260,700	$63,700	20%
Kensington Estates (Washington)	$765,700	$1,502,900	–$737,200	–96%
Laurel Springs (Wisconsin)	$1,654,021	$1,149,552	$504,469	30%
Mill Creek[c] (Illinois)	$12,510	$9,099	$3,411	27%
Prairie Glen (Wisconsin)	$1,004,848	$599,536	$405,312	40%
Somerset (Maryland)	$2,456,843	$1,671,461	$785,382	32%
Tellabs Corporate Campus (Illinois)	$3,162,160	$2,700,650	$461,510	15%

EPA Report:

Cost Comparisons Between Conventional and LID Approaches

Notes:

[a] Some of the case study results do not lend themselves to display in the format of this table (Central Park Commercial Redesigns, Crown St., Poplar Street Apartments, Prairie Crossing, Portland Downspout Disconnection, and Toronto Green Roofs).
[b] Negative values denote increased cost for the LID design over conventional development costs.
[c] Mill Creek costs are reported on a per-lot basis.

Source: "Reducing Stormwater Costs through Low Impact Development (LID) Strategies and Practices." USEPA, 2007.

Research conducted by the City of Ventura may be helpful in determining the potential costs of implementing low impact development in Los Angeles, as Ventura is also located in Southern California and has a similar climate. A copy of Ventura's "Green Streets Matrix" is included in Appendix II. It contains an analysis of the costs, benefits, challenges and drawbacks for 17 different kinds of LID best management practices. The City of Los Angeles' Green Streets LA program is also in the process of developing its own cost estimates.

Low Impact Development for Los Angeles

Funding and Maintaining a LID Program

In a time of government budget cuts, searching for steady funding to support new public works projects and regular maintenance services has never been more important. Consistent maintenance of low impact development best management practices will ensure that they continuously perform at a high standard. Chapter 6 highlights more than a dozen strategies that could help secure a steady revenue stream for city projects and services. Ideas include municipal bonds, LID in-lieu fees, individualized parcel drainage fees with a rebate program, parking increment financing, using Quimby Fees for LID parks, public-private partnerships, and sales of L.A. City carbon offsets.

Strategies to Codify Low Impact Development

While a number of existing regulations and programs in Los Angeles touch on low impact development principles, the City could benefit from a comprehensive, enforceable ordinance that makes LID a common practice. **The two greatest advantages to enacting a LID ordinance—as opposed to relying exclusively on LID policies—are (1) enforcement, and (2) long-term reliability.** Nonetheless, a few alternative methods for implementing low impact development on a smaller scale include meeting SUSMP requirements using low impact development standards, revising the Landscape Ordinance to include LID standards, or enacting a LID ordinance after a voluntary pilot phase. These alternatives are further described in Chapter 8.

Defining the Scope of a LID Strategy for Los Angeles

Chapter 9 discusses issues that must be considered in order to define the appropriate scope and standards for a low impact development strategy in Los Angeles:

- Determining to whom LID should apply—government buildings, public infrastructure, private residences, commercial properties, industrial land, etc.
- Encompassing new and existing development to ensure that LID is implemented throughout the watershed for maximum results, possibly using a rebate program to encourage existing properties to install LID best management practices.
- Deciding how to safely include brownfields in a LID program.
- Setting new performance standards—should LID vary with soil type and the character of the local water table? Would it benefit L.A. to exceed current SUSMP standards?
- Suggestions for the potential contents of a comprehensive LID ordinance, program and standards manual.

A curb cut that directs water from the street into a bioswale. 1100 S. Hope Street in downtown Los Angeles.

Considerations for LID Implementation

Low impact development offers promising strategies for the City of Los Angeles to significantly improve stormwater management and increase water supply and green space while simultaneously reducing its impact on climate change and the environment in general. However, the city should consider a number of challenges before developing and implementing a comprehensive LID program. Chapter 10 explores the following issues:

- Defining LID goals and standards that are appropriate for Los Angeles.
- Balancing the City's smart growth and infiltration goals.
- Administrative challenges—which departments will administer LID? Are there any existing regulations that conflict with LID?
- LID readiness and education—do city employees, architects, landscape designers and professional gardeners have the knowledge to properly implement LID techniques?
- LID knowledge, data and evaluation—need to gather more information about the costs and effectiveness of using LID in dry climates.
- Equity issues—how can we ensure that implementing low impact development will not unfairly burden low income communities with a financial obligation that might be difficult to bear without a subsidy?

Recommended Next Steps

Chapter 11 recommends a number of steps that the City of Los Angeles can pursue to implement a more comprehensive low impact development (LID) and green infrastructure program. These recommendations can be summarized as:

1. Internal Review: review low impact development strategy with the City's Green Team, Green Streets Committee and City Council committees.
2. Survey and analyze current policies, ordinances and standards to identify potential conflicts with LID and green infrastructure. Make recommendations for necessary changes. (See Chapters 7 & 10.) Engineering and building & safety standard plans, practices, and ordinances should be a top priority. Also check fire and flood ordinances and insurance maps for conflicts with LID.
3. Integrate LID principles into the Conservation Element of the General Plan.
4. Integrate LID principles into a revised Landscape Ordinance, which the state requires every city to adopt by 2010. (See Chapter 7.)
5. Determine which groups need to be involved with LID brainstorming, review and feedback: environmental groups, developers, architects, landscape architects, planners, civil engineers, community organizations, gardening industry, etc.
6. Develop a working group to draft a LID ordinance.

Conclusion

Southern California was designed and built mostly in the 20th Century, and the prevailing idea at the time was to move water quickly and directly to the ocean. In the 21st Century, we have learned how to design our streets, sidewalks, and landscaping to soak up runoff through a more natural process, weaving the textures of nature into the fabric of the city. Low impact development is an emerging and important international stormwater management trend. We have begun to capitalize on the valuable services that nature can offer us: capturing, cleaning, and storing stormwater.

Nationwide research has proven that low impact development can be a cost effective solution to pressing problems pertaining to water quality and water supply, as well the other benefits noted in this paper, such as flood control, mitigation of climate change, and creation of more natural spaces. For instance, research conducted in Los Angeles has found that the City can significantly increase its water supply, ameliorate climate change issues, and address of much of the pollution found in urban runoff by converting its paved areas from gray to green. Moreover, implementing low impact development will create new, local "green-collar" jobs through the development of a workforce trained to install and maintain green infrastructure features.

The LID principles become particularly crucial as climate change impacts to our environment produce changing weather patterns that are currently predicted to result in longer term drought conditions throughout California. Harvesting all available rainwater by the various methods shown in this paper is an important means of addressing this looming problem.

The City of Los Angeles is well underway toward implementing the principles of low impact development into its designs for streets, sidewalks and alleys, through its Green Streets and Green Alleys program. With over 6,500 miles of streets and 900 miles of alleys, much could be accomplished by incorporating LID principles into new construction and by phasing in LID conversions for existing infrastructure. However, these paved areas only account for a portion of the hardscape found in Los Angeles, and thus only a portion of the stormwater burden. Implementation of low impact development on a wider and more intensive scale throughout the city is worth consideration, both on public and private property.

Endnotes

[1] Puget Sound Action Team, Washington State University Pierce County Extension. "Low Impact Development: Technical Guidance Manual for Puget Sound," p.1. January 2005. Accessed on 8/5/08, www.psp.wa.gov/downloads/LID/LID_manual2005.pdf

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[3] U.S. Environmental Protection Agency. *Managing Wet Weather with Green Infrastructure.* Accessed on 8/10/08, http://cfpub.epa.gov/npdes/home.cfm?program_id=298

[4] U.S. Environmental Protection Agency. "Urban Stormwater BMP Performance Monitoring: A Guidance Manual for Meeting the National Stormwater BMP Database Requirements," p.10. April 25, 2002. Accessed on 8/10/08, http://www.epa.gov/guide/stormwater/files/montch1and2.pdf

[5] *Photo credits for Common LID BMPs:* Vegetated swales = Capital Region District, British Columbia. Rain garden = Iowa Natural Resources Conservation Service. Rain cistern = EPA / Abby Hall. Green roof = City of Los Angeles Bureau of Sanitation. Permeable pavers = EPA / Abby Hall. Porous pavement = City of Los Angeles Watershed Protection Division, Planning and Engineering Section. Curb bump-out = EPA / Abby Hall. Curb cuts = Haan-Fawn Chau.

[6] Community Conservancy International. "The Green Solutions Project" report, March 2008. Executive Summary, p.ES-3. The report can be viewed at http://www.ccint.org/greensolution.html

[7] Estimates of potential stormwater runoff assuming an average yearly rainfall in Los Angeles of 15-inches on impervious surfaces. {Potential stormwater from a ¼-acre lot} = (0.25 x 43,560 sq.ft. per acre) x (15" rain per year) / (12" per ft.) x (7.481 gal. per cu.ft.) = 101,835 gallons. An ordinary, 2-lane street is 30 feet wide. {Potential stormwater from a city street, not including sidewalks} = (500 ft. long) x (30 ft. wide) x (15" rain per year) / (12" per ft.) x (7.481 gal. per cu.ft.) = 140,269 gallons. Calculation by the City of Los Angeles Bureau of Sanitation, November 2008.

[8] *First source of information:* Beckman, David S. and Noah Garrison. "NRDC Comment on AB32 Scoping Plan Appendices—Water Sector," August 11, 2008. Natural Resources Defense Council comments sent to the California Air Resources Board. *Second source of information:* Email message from Noah Garrison, Project Attorney at NRDC, on January 21, 2009. "LID Numbers for L.A. County."

[9] This calculation is based on the average daily per capita water use of Los Angeles residents from 2006-2007, which was 146 gallons per person per day. (According to the City of Los Angeles Department of Environmental Affairs website, http://www.lacity.org/EAD/2007environmental%20facts.htm, accessed on 2/22/09.) 146 gallons per day x 365 days per year = 53,290 gallons per person per year = .1635 AF/person/year. Conversion factor: 1 acre foot = 325,851 gallons. 74,600 AF per year saved / .1635 AF per person per year = the water used by 456,269 people. 152,000 AF per year saved / .1635 AF per person per year = the water used by 929,664 people.

[10] This calculation is based on the average monthly electricity use per household in the City of Los Angeles, which is 550 kWh. (According to the C40 Cities website, http://www.c40cities.org/bestpractices/renewables/la_renewable.jsp, accessed on 2/22/09.) 550 kWh per household per month x 12 months = 6,600 kWh = 6.6 mWh per household per year. 131,700 mWh saved per year / 6.6 mWh per household per year = 19,955 households per year. 428,000 mWh saved per year / 6.6 mWh per household per year = 64,848 households per year.

[11] *See Endnote #8.*

[12] Los Angeles Department of Water & Power. "City of Los Angeles Water Supply Action Plan," p.4. May 2008.

[13] *See Endnote #8.*

[14] Estimates of potential stormwater runoff assuming an average yearly rainfall in Los Angeles of 15-inches on impervious surfaces. {Potential stormwater from a ¼-acre lot} = (0.25 x 43,560 sq.ft. per acre) x (15" rain per year) / (12" per ft.) x (7.481 gal. per cu.ft.) = 101,835 gallons. An ordinary, 2-lane street is 30 feet wide. {Potential stormwater from a city street, not including sidewalks} = (500 ft. long) x (30 ft. wide) x (15" rain per year) / (12" per ft.) x (7.481 gal. per cu.ft.) = 140,269 gallons. Calculation by the City of Los Angeles Bureau of Sanitation, November 2008.

[15] Wise, Steve. "Green Infrastructure Rising: Best Practices in Stormwater Management." *Planning*, the magazine of the American Planning Association. August/September 2008. Pages 14-19.

[16] Intergovernmental Panel on Climate Change. "Climate Change 2007: Synthesis Report. Summary for Policy Makers." IPCC Fourth Assesment Report (AR4); Summary for Policy Makers. Accessed on 1/2/09, http://www.ipcc.ch/pdf/assessment-report/ar4/syr/ar4_syr_spm.pdf

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[19] *See Endnote #8*

[20] *See Endnote #8*

[21] Akbari, H. "Shade Trees Reduce Building Energy Use and CO_2 Emissions From Power Plants." *Environmental Pollution* 116 (2002) S119–S126. Accessed on 1/4/09, http://www.fs.fed.us/psw/programs/cufr/products/12/psw_cufr703_Akbari_Reduce_Energy_Use.pdf

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[25] USDA Forest Service, Pacific Northwest Research Station. *Study shows that street trees increase the value of Portland homes by more than $1 billion*, March 10, 2008. Accessed on 1/3/09, http://www.fs.fed.us/pnw/news/2008/03/trees.shtml

[26] Please see the source citations in Chapter 5 for more information about this section.

[27] State of California, California Regional Water Quality Control Board, Los Angeles Region. "Waste Discharge Requirements for Municipal Storm Water and Urban Runoff Discharges Within the County of Los Angeles, and the Incorporated Cities Therein, Except the City of Long Beach." Order No. 01-182, NPDES Permit No. CAS004001. December 13, 2001.

[28] City of Los Angeles, Department of City Planning. "Building a Green Los Angeles: Framework for the City's Green Building Program," May 2008. Accessed on 8/13/08, http://cityplanning.lacity.org/code_studies/GreenLa/Brochure.pdf

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The City of Los Angeles is grateful for the generous funding provided by the **Annenberg Foundation** which made this research project possible, and for the operational support of the **Los Angeles & San Gabriel Rivers Watershed Council.**

Thank you to **Abby Hall** of the U.S. Environmental Protection Agency for permission to use her photographs of green infrastructure projects, which can be viewed at http://picasaweb.google.com/buildgreeninfrastructure.

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