MEASURING FROM THE HIGH WATERMARK: DEFINING BASELINES FOR WATER EFFICIENCY IN GREEN BUILDINGS

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"When the well's dry, we know the worth of water."
—Benjamin Franklin[1]

INTRODUCTION

Over the last decade, green building has caught the attention of builders around the world, engendering a nascent revolution in the way buildings are built.[2] In the United States, the U.S. Green Building Council's ("USGBC") Leadership in Energy and Environmental Design ("LEED") Green Building Rating System provides a voluntary

1. BENJAMIN FRANKLIN, POOR RICHARD'S ALMANAC (1746), *reprinted in* BENJAMIN FRANKLIN, AUTOBIOGRAPHY, POOR RICHARD, AND LATER WRITINGS 497 (J.A. Leo Lemay ed., Penguin Putnam Inc. 1997).

2. *See generally, e.g.*, NAT'L ASS'N OF HOME BUILDERS (NAHB) & NAHB RESEARCH CENTER, BUILDING GREENER, BUILDING BETTER: THE QUIET REVOLUTION (2002) (discussing the green "revolution" in building); DAVID M. ROODMAN & NICHOLAS LENSSEN, WORLDWATCH, PAPER 124, A BUILDING REVOLUTION: HOW ECOLOGY AND HEALTH CONCERNS ARE TRANSFORMING CONSTRUCTION (1995) (presenting an overview of the advantages of environmentally sustainable building designs).

checklist against which builders can measure their projects.[3] LEED measures the efforts of builders in five "areas of human and environmental health": sustainable site development, water savings, energy efficiency, materials selection, and indoor environmental quality.[4]

Although LEED and other green building programs advance a "whole-building approach,"[5] a significant portion of the literature and debate surrounding green building focuses on energy efficiency.[6] Recent spikes in the price of oil, the finite nature of many sources of energy, and the need for energy security have drawn attention to this area of green building.[7] Green building commentators, however, have dedicated relatively little attention to water savings, despite the urgent need for careful water management and conservation in many parts of the United States and throughout the world.[8]

Specifically, builders and commentators have closely analyzed the problem of defining baselines against which to measure increases in energy efficiency for purposes of achieving points under the LEED rating system,[9] while baselines for measuring water efficiency remain largely undefined. This Note attempts to explain and address this oversight. Part I outlines the economic, social, and environmental importance of water savings in the United States and presents the rationale for including water savings in green building programs such as

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3. *See* U.S. Green Building Council (USGBC), Leadership in Energy and Environmental Design, http://www.usgbc.org/DisplayPage.aspx?CategoryID=19 (last visited Oct. 30, 2007) [hereinafter LEED Web Site] (noting LEED is "the nationally accepted benchmark for the design, construction, and operation of high performance green buildings").

4. USGBC: LEED Rating Systems, http://www.usgbc.org/DisplayPage.aspx?CMSPageID=222 (last visited Nov. 13, 2007).

5. The "whole-building approach" includes attention to site development, water savings, energy efficiency, materials selection, and indoor environmental quality. *Id.*

6. *See, e.g.*, LOREN LUTZENHISER ET AL., MARKET STRUCTURE AND ENERGY EFFICIENCY: THE CASE OF NEW COMMERCIAL BUILDINGS 2 (2001); Nick Murray, *Green Starts with Energy*, BOMA-KINGSLEY QUARTERLY, Spring 2006, at 9, *available at* http://www.energystar.gov/ia/business/comm_real_estate/downloads/BOMAKingsleyNewsletter.pdf; Auden Schendler & Randy Udall, *LEED is Broken; Let's Fix It*, GRIST, Oct. 26, 2005, http://www.grist.org/comments/soapbox/2005/10/26/leed/index1.html (discussing the problems associated with LEED certification).

7. *See, e.g.*, Jad Mouawad, *Oil's Lesser Role in U.S. Economy Limits Damage from High Prices*, N.Y. TIMES, Apr. 23, 2005, at C1; *Leaders: The Real Trouble with Oil*, ECONOMIST, Apr. 30, 2005, at 12.

8. *See infra* Part I.

9. *See, e.g.*, Nadav Malin, *The Going Rate*, ARCHITECTURE MAG., Apr. 2, 2003, at 45; John H. Scofield, Critique of NREL's High Performance Building Report, http://www.oberlin.edu/physics/Scofield/ASHRAEcomment.htm (last visited Nov. 11, 2007) (noting that "[p]roper comparison involves source energy," rather than "site energy") (responding to Paul A. Torcellini, Ron Judkoff & Drury B. Crawley, *Lessons Learned: High-Performance Buildings*, ASHRAE J., Sept. 2004, at S4-11).

LEED. Part II provides a brief summary of green building, including its development and social and theoretical underpinnings. Part III explains why the green building movement has largely ignored the problem of defining baselines for water savings. Part IV analyzes the benefits and drawbacks of various approaches to this problem and makes a recommendation for defining baselines. Part V applies this approach to Phoenix, Arizona, a city that is experiencing rapid growth and faces considerable water constraints. As a result, it is an ideal site for exploring the problem of defining baselines for water efficiency in green buildings. Finally, this Note concludes by examining the role of water savings in green building in the larger context of water regulation and conservation.

I.
WHY WATER SAVINGS?

A. *Unsustainable Water Use Threatens the Freshwater Supply*

Water is a critical resource, absolutely essential to almost every human activity. We use water to drink, grow crops, cultivate wildlife, generate electricity, support industry, and sustain our culture. Though water covers a significant portion of the earth, much of the earth's water is unsuitable for human consumption.[10] Although water, unlike fossil fuels, is considered a renewable resource,[11] the over-consumption of water has resulted in significant food and water shortages, and threatens to cause even greater harm in the future.[12] In 1990, the

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10. According to the U.N., only 2.5% of the roughly 1.4 billion cubic kilometers of water on earth is freshwater, and approximately 68.9% of the freshwater is trapped in glacial ice or permanent snow in mountainous regions, the artic region, or Antarctica. *See* U.N. ENVTL. PROGRAMME, VITAL WATER GRAPHICS, A WORLD OF SALT: TOTAL GLOBAL SALTWATER AND FRESHWATER ESTIMATES (2002), *available at* http://www.unep.org/dewa/assessments/ecosystems/water/vitalwater/01.htm. Roughly 30.8% is groundwater, much of which is inaccessible to humans. *Id.* The remainder is surface water in lakes and rivers. *Id.*; *see also* ALLAN R. HOFFMAN, INST. FOR THE ANALYSIS OF GLOBAL SECURITY, THE CONNECTION: WATER AND ENERGY SECURITY (2004), http://www.iags.org/n0813043.htm (noting that of the 0.3% of the earth's water available for human consumption, "much is inaccessible due to unreachable locations and depths").

11. *See* SANDRA POSTEL, LAST OASIS: FACING WATER SCARCITY 27–28 (1992). Of course, "[a]lthough water is a renewable resource, it is also a finite one. The water cycle makes available only so much each year in a given location." *Id.* at 28.

12. *See, e.g.*, Union of Concerned Scientists, Scientist Statement: World Scientists' Warning to Humanity (1992), *available at* http://www.ucsusa.org/ucs/about/1992-world-scientists-warning-to-humanity.html ("Heedless exploitation of depletable ground water supplies endangers food production and other essential human systems. Heavy demands on the world's surface waters have resulted in serious shortages in some 80 countries, containing 40 percent of the world's population."); WORLD RES. INST., WORLD RESOURCES 2000-2001: PEOPLE AND ECOSYSTEMS: THE FRAYING WEB

United States used 1834 cubic meters of water per person.[13] While this number amounted to 25.6% of actual renewable water resources in the United States,[14] the availability of water is not spread evenly across the country. In 2002 the World Resources Institute showed approximately one-third of the continental United States—primarily the western half—experiencing severe water stress.[15] This pattern is common throughout the world. Water is also unevenly distributed between countries, as well as different regions within those countries.[16]

In addition, the inefficient and unsustainable use of potable water—water suitable for human consumption—threatens to exacerbate freshwater shortages in the United States and throughout the world.[17] These unsustainable and destructive practices include pollution of freshwater sources, poor irrigation management,[18] increased consumption of water domestically and by the industrial sector,[19] groundwater extraction that exceeds natural replenishment rates,[20]

OF LIFE: FRESHWATER SYSTEMS 107–12 (2000), *available at* http://www.wri.org/biodiv/pubs_content_text.cfm?ContentID=230 (reporting that "[c]urrently, more than 40 percent of the world's population lives in water scarce river basins. With growing populations, water scarcity is projected to increase significantly in the next decades" due to "[w]idespread depletion and pollution of groundwater sources.").

13. WORLD RES. INST., EARTHTRENDS: WATER RESOURCES AND FRESHWATER ECOSYSTEMS—UNITED STATES (2003), *available at* http://earthtrends.wri.org/pdf_library/country_profiles/wat_cou_840.pdf.

14. *Id.*

15. WORLD RES. INST., IDEAS INTO ACTION: WRI ANNUAL REVIEW 2002, at 22 (2003).

16. *See* CARMEN REVENGA, WORLD RES. INST., EARTH TRENDS: WILL THERE BE ENOUGH WATER? 2 (2000), *available at* http://earthtrends.wri.org/features/view_feature.php?fid=17&theme=2 (noting "[w]ater supplies are unevenly distributed around the globe, with some areas containing abundant water and others a much more limited supply. For example, arid and semiarid regions receive only 2 percent of the world's runoff, even though they occupy roughly 40 percent of the terrestrial area.").

17. *See, e.g.*, PETER H. GLEICK, PACIFIC INST. FOR STUDIES IN DEV., ENV'T, AND SEC., WATER: THE POTENTIAL CONSEQUENCES OF CLIMATE VARIABILITY AND CHANGE FOR THE WATER RESOURCES OF THE UNITED STATES 5–9 (2000), *available at* http://www.pacinst.org/reports/national_assessment/natl_assessment_water.pdf (discussing the major impacts of climate variability and change on U.S. water resources). The problem is not limited to the United States. *See e.g.*, Richard Black, *Climate Water Threat to Millions*, BBC NEWS, Oct. 20, 2006, http://news.bbc.co.uk/1/hi/sci/tech/6068348.stm ("Climate change threatens supplies of water for millions of people in poorer countries . . . .").

18. *See* REVENGA, *supra* note 16, at 3 (noting that "most irrigation systems are relatively inefficient and result in massive water waste.").

19. MARK W. ROSEGRANT ET AL., INT'L FOOD POLICY RES. INST., GLOBAL WATER OUTLOOK TO 2025: AVERTING AN IMPENDING CRISIS 2–3 (2002), *available at* http://www.ifpri.org/pubs/fpr/fprwater2025.pdf.

20. *See, e.g.*, Susanna Eden & Sharon B. Megdal, *Water and Growth*, *in* ARIZONA'S RAPID GROWTH AND DEVELOPMENT: NATURAL RESOURCES AND INFRASTRUCTURE: EIGHTY-EIGHTH ARIZONA TOWN HALL 81, 83 (2006), *available at* http://www.

evaporation and sedimentation in reservoirs,[21] and surface-water withdrawals that lead to the deterioration and salinization of rivers.[22] These threats coupled with the growing scarcity of water in some areas underscore the urgency of responsible water consumption and more expansive efforts at conservation. According to the USGBC, buildings in the United States use "one-eighth of our water,"[23] suggesting that any effort toward water conservation in the United States should include attention to consumption by buildings.

Thus, despite its relative abundance, most water is not available for human use,[24] and the available fraction is not evenly distributed or efficiently exploited. In other words, development in many parts of the country and the world will be considerably constrained by limited water sources.[25]

B. Climate Change Underscores the Urgency of Water Conservation Measures

Analysts predict that climate change will exacerbate the problem of water scarcity, if it has not already done so.[26] One recent report

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aztownhall.org/pdf/88th%20Complete%20Publication.pdf (documenting declines in water level by hundreds of feet in some areas of Arizona); PETER H. GLEICK ET AL., THE WORLD'S WATER 2004-2005: THE BIENNIAL REPORT ON FRESHWATER RESOURCES, at xvi (2004), *available at* http://www.worldwater.org/2004-2005.html (noting that groundwater is "inadequately monitored, insufficiently regulated, and often overpumped and overused").

21. *See generally* Herath M. Gunatilake & Chennat Gopalakrishnan, *The Economics of Reservoir Sedimentation: A Case Study of Mahaweli Reservoirs in Sri Lanka*, 15 INT'L J. WATER RES. DEV. 511 (1999) (analyzing the impact of reservoir sedimentation).

22. The Colorado River is a paradigmatic example of unsustainable exploitation of rivers. *See* Kevin Watkins, Opinion, *Save a Little Water for Tomorrow*, INT'L HERALD TRIB., Mar. 17, 2006, at 7 (describing "a Colorado River so depleted that it barely reaches the sea"); *see also* Int'l Boundary and Water Comm'n, *Permanent and Definitive Solution to the International Problem of the Salinity of the Colorado River*, Minute 242 (Aug. 30, 1973), *available at* http://www.usbr.gov/lc/region/g1000/pdfiles/min242.pdf (resolution requiring the U.S. to adopt measures to reduce the salinity of water being delivered to Mexico from the Colorado River).

23. U.S. GREEN BLDG. COUNCIL (USGBC), LEED FOR NEW CONSTRUCTION VERSION 2.2, at 3 (2005), *available at* https://www.usgbc.org/ShowFile.aspx?DocumentID=1095 [hereinafter LEED-NC]. *Cf.* ROODMAN & LENSSEN, *supra* note 2, at 5 (buildings consume one-sixth of global freshwater).

24. *See supra* note 10 and accompanying text.

25. *See* J. T. WINPENNY, FOOD & AGRIC. ORG. OF THE U.N., MANAGING WATER SCARCITY FOR WATER SECURITY 3 (2001), http://www.wca-infonet.org/servlet/BinaryDownloaderServlet?filename=documents/1354.Managing_water_scarcity_for_water_security.2001-11-13.pdf (describing water as "an unavoidable constraint on everything [people] do" in deserts and "drylands").

26. Black, *supra* note 17 (naming several "[a]reas where people are already on the move to avoid climate excesses" relating to water scarcity); *see also* SOUTHWEST

suggests that "[n]early a third of the world's land surface may be at risk of extreme drought by the end of the century" as a result of climate change, and that the "most striking impact is expected in parts of southern Europe, North Africa, western Eurasia and the US."[27] The same report suggested that the current upward trend in greenhouse gas emissions would have the effect of doubling the current pattern of droughts by the end of the century.[28] The resulting global drying and increased salt pollution will only exacerbate the growing demand for water.[29] One commentator acknowledged that "there will be transitional and frictional costs in regions that become drier" as a result of climate change and variability.[30]

C. Green Building Embraces Water Savings

The water efficiency measures in LEED programs are designed to reduce overall water consumption by buildings through reductions in irrigation and fixture usage and increases in wastewater reuse.[31] LEED's program overseeing new construction, for example, measures water savings measures in terms of reducing the burden on the municipal water supply and wastewater system,[32] implicitly recognizing the external concerns arising from unsustainable water consumption because it frames reduction in terms of *municipal* and not *individual* water supply. The statement in the LEED for New Construction ("LEED-NC") program that buildings use "one-eighth of our water," in combination with the goal of "mak[ing] a positive impact on public health and environment"[33] suggests that the water savings aspects of

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REG'L ASSESSMENT GROUP, U.S. GLOBAL CHANGE RES. PROGRAM, PREPARING FOR A CHANGING CLIMATE: THE POTENTIAL CONSEQUENCES OF CLIMATE VARIABILITY AND CHANGE 3 (2000), *available at* http://www.ispe.arizona.edu/research/swassess/report.html (predicting effects of climate change on water resources of the southwest United States) [hereinafter SOUTHWEST REG'L REPORT].

27. Ian Sample, *Extreme Droughts Will Spread, Warn Forecasters*, GUARDIAN (UK), Oct. 4, 2006, *available at* http://www.guardian.co.uk/environment/2006/oct/04/water.climatechange (reporting on 2006 study by researchers at the Hadley Centre for Climate Change and Research). *See* Eleanor J. Burke et al., *Modeling the Recent Evolution of Global Drought and Projections for the Twenty-First Century with the Hadley Centre Climate Model*, 7 J. HYDROMETEROLOGY 1113 (2006) (reprinting full report).

28. *Id.*

29. *See* George Monbiot, Comment, *The Freshwater Boom is Over. Our Rivers Are Starting to Run Dry*, GUARDIAN (UK), Oct. 10, 2006, *available at* http://environment.guardian.co.uk/water/story/0,,1891587,00.html.

30. Winpenny, *supra* note 25.

31. *See infra* notes 56–60.

32. *See, e.g.*, LEED-NC, *supra* note 23, at 29 (providing LEED points for technologies which "[r]educe generation of wastewater and potable water demand").

33. *Id.* at 3.

green building are motivated, at least in part, by an awareness of the need to carefully manage our limited water supply.

II.
Background on Green Building and Water Savings Under LEED

The term "green building" denotes a variety of practices.[34] One prominent definition, provided by the Office of the Federal Environmental Executive, defines green building as "the practice of (1) increasing the efficiency with which buildings and their sites use energy, water, and materials, and (2) reducing building impacts on human health and the environment, through better siting, design, construction, operation, maintenance, and removal—the complete building life cycle."[35] Green building is perhaps best understood as a convergence of two movements: (1) an architectural movement emphasizing environment-conscious, integrated, efficient, and innovative design; and (2) an environmental movement arising from the principle of sustainable development.

A. The Architectural Movement Toward Building "Green"

While the "green building" label is a recent invention, the idea of attending to environmental integration and opportunities for innovation in designing buildings is not new.[36] Ancient examples include indigenous structures such as igloos[37] and the design of a small Himalayan village.[38] David Gissen, curator of architecture and design at the National Building Museum in Washington, D.C., discusses a number of buildings from the nineteenth and early twentieth centuries that

34. *See* Bldg. Design & Constr., White Paper on Sustainability: A Report on the Green Building Movement 4–6 (2003), *available at* https://www.usgbc.org/Docs/Resources/BDCWhitePaperR2.pdf [hereinafter BDC White Paper 2003] (describing different green building technologies incorporated over the past century).

35. Office of the Fed. Envtl. Exec., The Federal Commitment to Green Building: Experiences and Expectations, at Part V (2003), *available at* http://www.ofee.gov/sb/fgb_report.pdf.

36. For a more thorough discussion of the history of innovative, environment-conscious building design, *see* BDC White Paper 2003, *supra* note 34, at 4–6.

37. *See* EcoLodgical, Environmental Design Element: Building Form and Orientation, http://www.yourhomeplanet.com/ecolodgical/index_design.php?theme_last=&issue_last=&content_number=36&content_num=36 (last visited Nov. 13, 2007) ("The igloo is a 'natural' example of the optimum building form" because it "minimizes exterior surface area and thus minimizes heat loss from the shell of the igloo. As it turns out the igloo is the perfect design choice by the Inuit of the Arctic.").

38. *See* Jonathan Rose Companies, Who We Are, Mission, http://www.rosenetwork.com/whoweare (last visited Nov. 13, 2007) (describing a Himalayan village as "entirely integrated into the ecosystem").

introduced "green" innovations such as passive ventilation systems and deep-set windows.[39] A few prominent examples of environmentally integrated architecture in an arid climate include Frank Lloyd Wright's Taliesin West in Scottsdale, Arizona,[40] and Paolo Soleri's Arcosanti in Phoenix, Arizona.[41] Only recently, however, has this aspect of architecture crystallized into a relatively coherent movement in the form of green building.

B. The Environmental Principle of "Sustainable Development"

The environmental component of green building arises from a concept that crystallized in the 1987 Report of the UN World Commission on Environment and Development (the Brundtland Commission), which defined the term "sustainable development" as "meeting the needs of the present without compromising the ability of future generations to meet their own needs."[42] This idea contains two critical concepts: (1) the needs of the present generation and (2) the "limitations imposed by the state of technology and social organisation on the environment's ability to meet present and future needs."[43] The

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39. David Gissen, *Introduction in* BIG AND GREEN: TOWARD SUSTAINABLE ARCHITECTURE IN THE 21ST CENTURY 10–11 (David Gissen ed., 2003); *see* BDC WHITE PAPER 2003, *supra* note 34, at 4.

40. *See* Great Buildings Online, Taliesin West, http://www.greatbuildings.com/buildings/Taliesin_West.html (last visited Nov. 13, 2007).

41. *See* Arcosanti: Project Background: History, http://www.arcosanti.org/project/background/history/main.html (last visited Nov. 13, 2007).

42. WORLD COMM'N ON ENV'T & DEV., OUR COMMON FUTURE 43 (1987); *Report of the World Commission on Environment and Development*, G.A. Res. 42/187, ¶ 2, U.N. GAOR, 42nd Sess., 96th plen. mtg., U.N. Doc. A/RES/42/187 (Dec. 11, 1987), *available at* http://www.un.org/documents/ga/res/42/ares42-187.htm. *See also* PHILIPPE SANDS, PRINCIPLES OF INTERNATIONAL ENVIRONMENTAL LAW 48–49 (2d ed. 2003).

43. SANDS, *supra* note 42, at 10–11. Some commentators believe the principle of sustainable development has become international customary law. *Id.* at 254 (sustainable development has "entered the corpus of international customary law"); *see* Conference on Environment and Development, June 3–14, 1992, *Rio Declaration on Environment and Development, Annex I*, ¶ 2, U.N. Doc. A/CONF.151/26 (Vol. I) (Aug. 12, 1992) (the "Rio Declaration"); Conference on the Environment and Development, June 3–14, 1992, *Agenda 21 Programme of Action for Sustainable Development*, ¶ 39.1, U.N. Doc. A/CONF.151/26 (1992), *available at* http://un.org/esa/sustdev/documents/agenda21/english/Agenda21.html. In this sense, sustainable development acts as a guiding principle for domestic and international development and environmental regulation throughout the world. The federal government in the United States, for example, has adopted the idea of "sustainable development." *See, e.g.*, Exec. Order No. 12,852, 58 Fed. Reg. 126 (July 2, 1993) (establishing the President's Council on Sustainable Development). For additional discussion of the principle of sustainable development, *see* SANDS, *supra* note 42, at 10–11, 252–66. While some have suggested that sustainable development has largely failed as an organizing principle and does little more than make us feel better about our existing practices, their

principle of sustainable development first appeared in the United States building design and construction industry in 1993.[44] Recognizing both the present need to continue building and the impact of that development on the environment today and in the future, architects and builders embraced the idea that "sustainable design can significantly reduce adverse human impacts on the natural environment while simultaneously improving quality of life and economic well being."[45] This idea has taken hold in the form of the green building movement in the intervening years; many use the terms "sustainable building" and "green building" interchangeably.[46]

C. The LEED Green Building System

The USGBC launched the LEED green building system in late 1998,[47] and it has since become "the most widely accepted program of its kind in the U.S."[48] LEED is a rating system that scores performance in five categories: (1) sustainable site development, (2) water savings, (3) energy efficiency, (4) materials selection, and (5) indoor environmental quality.[49] USGBC has tailored LEED ratings systems for a range of building types, including new commercial construction and major renovation, existing building operations and maintenance,

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critique is beyond the scope of this Note. *See, e.g.*, Daniel C. Esty, *A Term's Limits: Many Flocked to the Banner of Sustainable Development, but it Led Them Nowhere*, FOREIGN POL'Y, Sept.–Oct. 2001, at 74, 74; William Onzivu, *International Environmental Law, the Public's Health, and Domestic Environmental Governance in Developing Countries*, 21 AM. U. INT'L L. REV. 597, 614–15 (2006) (citing critics' observations that the U.N.'s approach to sustainable development is "anthropocentric and utilitarian" and has "created tensions with environmental advocates").

44. In 1993, a group of prominent builders, developers, architects, and representatives from industry and the federal government incorporated as the U.S. Green Building Council (USGBC). BDC WHITE PAPER 2003, *supra* note 34, at 6–7. That same year, the USGBC held a conference on sustainable design in partnership with the Union of International Architects and the American Institute of Architects (UIA/AIA). *Id. See also* UIA/AIA World Congress of Architects, Chicago, June 18–21, 1993, *Declaration of Independence for a Sustainable Future*, *available at* http://www.uia-architectes.org/texte/england/2aaf1.html [hereinafter UIA/AIA Declaration] (resolution of architects' themed congress focusing on sustainable design).

45. *Id.*

46. *See, e.g.*, U.S. Environmental Protection Agency, Green Buildings, http://www.epa.gov/greenbuilding (last visited Nov. 13, 2007) ("Green or sustainable building is . . . ."); California Integrated Waste Management Board, Sustainable (Green) Building: Green Building Basics, http://www.ciwmb.ca.gov/GreenBuilding/Basics.htm (last visited Nov. 13, 2007) (discussing what makes "[a] green building, also known as a sustainable building").

47. BDC WHITE PAPER 2003, *supra* note 34, at 7.

48. *Id.*

49. USBGC, LEED Rating Systems, *supra* note 4.

commercial interiors, and core and shell development.[50] USGBC is developing and refining LEED rating systems for schools, homes, new construction for retail uses, commercial interiors for retail uses, healthcare facilities, and neighborhood development.[51] LEED for New Construction, LEED for Existing Buildings, and LEED for Homes represent three different approaches to the water savings category of green building.

1. LEED for New Construction

LEED for New Construction ("LEED-NC") was the first rating system released by USGBC[52] and is the archetype for the various LEED rating systems. The system awards "Certified," "Silver," "Gold," and "Platinum" ratings to buildings based on the number of points they achieve in the six categories mentioned above.[53] In some categories, points cannot be earned unless certain prerequisites are met.[54] Of the total sixty-nine points available, the water savings category comprises a maximum of five points.[55] These five points can be earned by: a 50% reduction in potable water used for irrigation (one point),[56] a 100% reduction in the same (one additional point),[57] a 50% reduction in potable water used for building sewage conveyance (one point),[58] a 20% reduction in aggregate water use from a baseline calculated for the building (not including irrigation) after meeting the Energy Policy Act of 1992 fixture performance requirements (one point),[59] and a 30% reduction in the same (one additional point).[60]

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50. *Id.*

51. *Id.*

52. USGBC, NEW CONSTRUCTION, VERSION 2.2, REFERENCE GUIDE 12 (2d. ed. 2006), *available at* https://www.usgbc.org/ShowFile.aspx?DocumentID=3179; BDC WHITE PAPER 2003, *supra* note 34, at 7.

53. *See supra* note 49 and accompanying text for six categories. A total of 26–32 points earns a "Certified" rating, 33–38 earns "Silver," 39–51 earns "Gold," and 52–69 earns "Platinum." LEED-NC, *supra* note 23, at 10.

54. BDC WHITE PAPER 2003, *supra* note 34, at 9 (listing prerequisites for an earlier version of LEED-NC, Version 2.1).

55. USGBC, LEED-NC INFO. SHEET (2005), *available at* https://www.usgbc.org/ShowFile.aspx?DocumentID=1317. The remaining points can be achieved in the categories of Sustainable Sites (14 points), Energy & Atmosphere (17 points, including up to 10 points for optimizing energy performance), Materials & Resources (13 points), Indoor Environmental Quality (15 points), and Innovation in Design (up to 5 points). *Id.*

56. LEED-NC, *supra* note 23, at 27.

57. *Id.* at 28.

58. *Id.* at 29.

59. *Id.* at 30.

60. *Id.* at 31.

2. *LEED for Existing Buildings*

The LEED for Existing Buildings rating system ("LEED-EB") includes a total of eighty-five points and offers the same four levels of certification as LEED-NC.[61] The LEED-EB system includes two mandatory water efficiency measures: (1) reduction of "fixture potable water usage to a level equal to or below water use baseline, calculated as 120% of the water usage that would result if 100% of the total building fixture count were outfitted with plumbing fixtures that meet the Energy Policy Act of 1992 fixture performance requirements";[62] and (2) demonstration of compliance with pollution discharge requirements under the Clean Water Act, if the building is regulated under the EPA's pollution discharge elimination program.[63] Once those prerequisites are satisfied, an existing building renovation can achieve water efficiency points by achieving a 50% (one point) or 95% (one additional point) reduction in potable water use for irrigation "over conventional means of irrigation."[64] Another point can be achieved by reducing use of potable water for building sewage conveyance by 50% or treating 100% of wastewater on site to tertiary standards.[65] Achieving 10% or 20% reductions in fixture water use from the baseline earns one or two additional points, respectively.[66] This allocation of points essentially mirrors the allocation in LEED-NC, except that the required reductions are slightly smaller. Also, LEED-EB defines the minimum efficiency for fixture water use more explicitly; the minimum is derived from a calculation of hypothetical water usage in the pre-existing building if it had the water efficient fixtures required by the Energy Policy Act of 1992. Nonetheless, it raises the same ques-

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61. A "Certified" rating requires 32–39 points, "Silver" requires 40–47, "Gold" requires 48–63, and "Platinum" requires 64–85 points. USGBC, LEED FOR EXISTING BUILDINGS, VERSION 2, at 13 (2005), *available at* https://www.usgbc.org/ShowFile.aspx?DocumentID=913 [hereinafter LEED-EB].

62. *Id.* at 39.

63. *Id.* at 41.

64. *Id.* at 43. The term "conventional" is undefined; it is unclear if this term accounts for regional or geographic considerations.

65. *Id.* at 45. "Tertiary standards" refers to the third level of treatment of wastewater. The first level removes all heavy and light solids from wastewater by letting them settle to the bottom or float to the top; the second level involves mixing microorganisms and oxygen with the wastewater to eliminate smaller solids and chemicals from the wastewater; and the third level is a process in which the remaining solids and microorganisms settle to the bottom, often into sand or gravel, and are separated from the wastewater. *See* Sonoma County Water Agency, Sanitation: How a Wastewater Treatment Plant Cleans Water, http://www.scwa.ca.gov/about_your_water/sanitation.php (last visited Nov. 14, 2007).

66. LEED-EB, *supra* note 61, at 47.

tions regarding the definition of baselines against which to measure water efficiency.

3. LEED for Homes

LEED for Homes, which is currently in a pilot phase, includes a total of 108 points.[67] The water efficiency measures in this system are much more prescriptive. A builder achieves points by installing a rainwater harvesting system (one point) or graywater re-use system (one point),[68] designing and installing high efficiency irrigation systems (up to five points, depending on the climate region),[69] and installing high efficiency lavatory faucets, shower heads, and toilets (up to three points).[70] Because this rating system requires the use of specific water-saving technologies rather than percentage increases in water efficiency, it avoids the problem of defining a baseline.

III.
UNDER-PRICED WATER AND THE LACK OF INCENTIVES FOR WATER SAVINGS

The absence of a clear definition of baselines for measuring water efficiency in green buildings—in the LEED rating systems or any commentary about green building rating systems—can be explained by the nearly universal under-pricing of water.[71] Because the construction industry is profit-driven, advocates and practitioners of green building attend closely to its financial implications.[72] Upfront

67. USGBC, RATING SYSTEM FOR PILOT DEMONSTRATION OF LEED FOR HOMES PROGRAM 4 (2005), *available at* https://www.usgbc.org/ShowFile.aspx?DocumentID=855 [hereinafter LEED FOR HOMES PILOT]. A score of 30 achieves a "Certified" rating, 50 achieves "Silver," 70 achieves "Gold," and 90 achieves "Platinum." *Id.*

68. *Id.* at 47. A graywater re-use system catches wastewater effluent and uses it to satisfy the building's other water demands. *See* Joe Gelt, Water Res. Research Ctr., Univ. of Ariz., *Home Use of Graywater, Rainwater Conserves Water—and May Save Money*, http://cals.arizona.edu/AZWATER/arroyo/071rain.html (last visited Nov. 18, 2007).

69. LEED FOR HOMES PILOT, *supra* note 67, at 49–50.

70. *Id.* at 51.

71. *See infra* notes 75–90 and accompanying text. The price of water might not affect builders or developers who do not continue to own or occupy their buildings after construction, because the subsequent tenant or owner will have to pay the water bill. On the other hand, the price of water does affect builders or developers who continue to own or occupy their buildings (including, for example, public buildings constructed for and used by the government). Also, builders or developers might enjoy benefits such as higher sale and rental prices or faster sales and rentals from advertising potential savings on water bills to prospective purchasers or tenants.

72. *See* Nancy J. King & Brian J. King, *Creating Incentives for Sustainable Buildings: A Comparative Law Approach Featuring the United States and the European Union*, 23 VA. ENVTL. L.J. 397, 399 (2005) ("An important barrier to adopting sus-

costs, payback periods,[73] and returns on investment drive many decisions in green building.[74] As long as water is under-priced, the payback period for water-efficient technologies is artificially long, if it exists at all. Thus, water savings measures, usually amounting to sunk costs, are often incorporated primarily to achieve LEED points (rather than for a return on the investment), and, as a result, have not received the same attention as energy efficiency measures.

A. Water Prices Usually Fail to Reflect the Full Costs of Consumption

One fact acknowledged by virtually all commentators is that the full cost of providing water recovery and distribution services is not accounted for in water pricing.[75] A report on water pricing in the European Union observed that "[t]he level of the water price in EU

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tainable business practices for commercial buildings is the perceived negative impact that sustainability will have on businesses' bottom line.").

73. A payback period is equal to the amount of time it takes a builder, owner, or developer to recuperate the costs of construction.

74. *See, e.g.*, Lisa Fay Matthiessen & Peter Morris, Davis Langdon, Costing Green: A Comprehensive Cost Database and Budgeting Methodology 3 (2004), *available at* http://www.davislangdon.com/pdf/USA/2004CostingGreen.pdf (providing analysis of construction costs in green building); Greg Kats et al., The Costs and Financial Benefits of Green Buildings: A Report to California's Sustainable Building Task Force, at i, vii (2003), *available at* https://www.usgbc.org/Docs/Resources/CA_report_GBbenefits.pdf (providing an analysis of costs and benefits, including "lifecycle" savings, of sustainable buildings).

75. *See* Tom Jones, Organization for Economic Cooperation and Development (OECD) Environment Directorate, *Pricing Water*, OECD Observer, Mar. 2003, *available at* http://www.oecdobserver.org/news/fullstory.php/aid/939/Pricing_water.html (describing recent measures taken to "intern[alize] the full marginal costs (including environmental costs) into decisions that affect water use and water quality."); Kristin Komives et al., *The Distributional Incidence of Residential Water and Electricity Subsidies* 4 (World Bank, Policy Research Working Paper, No. WPS 3878, 2006) ("[A]ll surveyed water utilities in South Asia and Eastern Europe and Central Asia, and more than half in East Asia, the Middle East, and North Africa, charged average tariffs below what would normally be required to even cover ongoing operation and maintenance costs."); *see also* Leon Spencer, Presbyterian Church (USA), *Water Privatization: Providing Water Cannot Be Left to Market Forces*, http://www.pcusa.org/washington/issuenet/africa-040311.htm (discussing the negative consequences of a move to "full cost recovery" fees for water); Albert Garrido, OECD, Transition to Full-Cost Pricing of Irrigation Water for Agriculture in OECD Countries 7–8 (2002) (discussing the need to implement "full cost recovery prices" in OECD countries for irrigation uses); James E.T. Moncur & Richard L. Pollock, *Scarcity Rents for Water: A Valuation and Pricing Model: Reply*, 65 Land Econ. 425, 425 (1989) ("[U]rban water is frequently under-priced, in realistic economic terms, because it is undercosted by the enterprises, usually government owned, that supply it.").

countries is generally lower than the cost recovery level."[76] This same report notes that different pricing structures sometimes ignore environmental costs or capital costs.[77] In the United States, "water prices today frequently don't even capture the actual financial cost of providing clean and safe water—let alone the human health and environmental values."[78] Consumers in the United States pay the lowest percentage of income for water and wastewater services of any developed country.[79] According to a 2002 study by the Congressional Budget Office, "total household bills for drinking water and wastewater services combined represented 0.5% of household income nationwide."[80]

The precise scope of costs to be included in an accounting of the "full costs" of water is not clearly defined. Definitions of the "full costs" frequently include infrastructure construction, management, operation, maintenance, and delivery costs,[81] as well as *resource* costs, or "opportunity costs, which amount to the economic value of the opportunities forgone for allocating the resource to a given user."[82] In addition to these service costs, the consumption of water entails considerable *social* costs.[83] The significant environmental consequences

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76. EVA ROTH, EUROPEAN ENVT. BUREAU, PUBL'N NO. 2001/002, WATER PRICING IN THE EU: A REVIEW 5 (2001), *available at* http://www.eeb.org/publication/2001/Review%20Water%20Pricing%202001.pdf.

77. *Id.* at 2.

78. G. Tracy Mehan, III, *Everyone Undervalues the True Worth of Water*, DETROIT NEWS, June 19, 2003, *reprinted in* 1 INTERSTATE WATER REP. 7 (2003).

79. U.S. EPA, EPA 832-F-03-027, WATER AND WASTEWATER PRICING: AN INFORMATIONAL OVERVIEW 6, *available at* http://www.epa.gov/water/infrastructure/pricing/PDF/waterpricing_final2.pdf [hereinafter EPA WATER PRICING].

80. CONGRESSIONAL BUDGET OFFICE, FUTURE INVESTMENT IN DRINKING WATER AND WASTEWATER INFRASTRUCTURE, at xvi (2002), *available at* http://www.cbo.gov/ftpdocs/39xx/doc3983/11-18-WaterSystems.pdf. This percentage is projected to increase to between 0.6% and 0.9% by 2019. *Id.*

81. GARRIDO, *supra* note 75, at 10 (discussing "the costs of erecting and running the hydraulic works"); U.S. EPA, About Water & Wastewater Pricing, http://www.epa.gov/water/infrastructure/pricing/About.htm (last visited Nov. 20, 2006) ("Full cost pricing is usually interpreted to mean factoring all costs—past and future, operations, maintenance and capital costs—into prices.").

82. GARRIDO, *supra* note 75, at 10; *see also* ROTH, *supra* note 76, at 2.

83. *See* GARRIDO, *supra* note 75, at 16–18. One commentator outlined the costs included in any definition of full cost recovery ("FCR") as follows: "everyday operation of water utilities (transport, distribution, collection, treatment)"; "the need to raise loans for investment in infrastructure"; "direct costs for interests as well as opportunity costs"; "taking into consideration the difference of return of capital investment between the investment in water affairs and the average of the economy"; "costs arising if water is economically scarce"; "the fact that a certain use may impose costs on other users (such as social costs)"; "the fact that environmental damage costs arise if water is used"; and "a forward-looking element is included in the water price as far as

of water use include over-exploitation,[84] the destruction of natural habitats and decimation of wildlife species,[85] salinization and contamination of water sources, and other forms of pollution.[86] Marc Reisner captured the absurdity of this policy of under-pricing water in his groundbreaking book, *Cadillac Desert*:

> Only a government that disposes of a billion dollars every few hours would still be selling water in deserts for less than a penny a ton. And only an agency as antediluvian as the Bureau of Reclamation, hiding in a government as elephantine as ours, could successfully camouflage the enormous losses the taxpayer has to bear for its generosity.[87]

The social costs of water use also include non-environmental impacts, such as current and future water shortages,[88] as well as the dramatic political consequences of conflicts arising from water scarcity and the exploitation of shared water sources.[89] The U.S. Environmen-

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investment cost and environmental damage costs are concerned." ROTH, *supra* note 76, at 2.

84. *See* GARRIDO, *supra* note 75, at 17.

85. *See, e.g.*, Eden & Megdal, *supra* note 20, at 109–10 (discussing damage to riparian habitat resulting from water development activities in Arizona); SOUTHWEST REG'L REPORT, *supra* note 26, at 32 ("[B]ecause such a large proportion of the region's biota is dependent on riparian habitat, the region's riparian systems will inevitably be the location of the most intense conflicts, as human pressures on those systems become more intense (grazing, recreation, direct human consumption).").

86. *See* GARRIDO, *supra* note 75, at 16–17.

87. MARC REISNER, CADILLAC DESERT: THE AMERICAN WEST AND ITS DISAPPEARING WATER 500 (1st ed., 1986).

88. *See, e.g.*, COMM. ON VALUING GROUND WATER, NAT'L RES. COUNCIL, VALUING GROUND WATER: ECONOMIC CONCEPTS AND APPROACHES 105 (1997) [hereinafter CVGW REPORT] (observing that "states rarely consider future ground water uses in establishing ground water allocation policies dealing with ground water depletion"). *Cf.* KATS ET AL., *supra* note 74, at 42 (emphasizing need to consider future costs of water in valuing water conservation measures); ROTH, *supra* note 76, at 2 (discussing "long run marginal costs" of water).

89. *See, e.g.*, Michael Specter, *The Last Drop*, NEW YORKER, Oct. 23, 2006, at 60, 62 (observing that "[t]he word 'rivals' even has it [sic] roots in fights over water, coming from the Latin *rivalis*, for 'one taking from the same stream as another.'"); SANDS, *supra* note 42, at 461–77 (discussing a number of significant international environmental legal battles over shared freshwater bodies, including the *Lac Lanoux* arbitration and the *Case Concerning the Gabcikovo-Nagymaros Project*); Wil Burns et al., *International Environmental Law*, 40 INT'L LAWYER 197, 206 (2006); *Israel Warns of War over Water*, BBC NEWS, Sept. 10, 2002, http://news.bbc.co.uk/1/hi/world/middle_east/2249599.stm (reporting on an "alleged Lebanese scheme to divert water from a river feeding Israel's largest reservoir" that the former Israeli prime minister warned could prompt a war). The Global Policy Forum provides an extensive database of articles and analysis of "international water disputes, civil disturbances caused by water shortages, and potential regulatory solutions to diffuse water conflict." Global Policy Forum, Water in Conflict, http://www.globalpolicy.org/security/natres/waterindex.htm (last visited Nov. 17, 2007). As Mark Twain (apocry-

tal Protection Agency (EPA) observed that current water pricing "often obscures the larger, but less quantifiable, societal interests in preserving our water resources."[90]

B. The Under-Pricing of Water Prevents Accurate Measurement of the Benefits of Water Efficiency in Green Building

The fact that water remains under-priced prevents finance-attentive green builders from accurately measuring the benefits of incorporating water-efficient design and technology into their buildings. In

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phally) observed, "Whiskey is for drinking, water is for fighting over." *See* Don Fowler, Book Review, 43 ETHNOHISTORY 345, 345–46 (1996) (attributing quote to Twain, without authentication).

90. EPA WATER PRICING, *supra* note 79, at 4. Any discussion of water pricing evokes the tension between encouraging conservation through full cost recovery and protecting the affordability of and access to water as a fundamental human right. *See* Press Release, Public Citizen, Public Citizen to World Bank: Practice What You Preach (Apr. 13, 2005), *available at* http://www.citizen.org/pressroom/release.cfm?ID=1919 (urging the World Bank to recognize a human right to water access); Spencer, *supra* note 75 (arguing that privatizing water distribution would hurt those who lack the resources to pay for it). Water prices that reflect the full costs of water would encourage more environmental conservation and more efficient use of water. Jones, *supra* note 75 (discussing the use of increasing-block volumetric charging to encourage conservation); U.S. EPA, CASE STUDIES OF SUSTAINABLE WATER AND WASTEWATER PRICING 1, *available at* http://www.epa.gov/safewater/smallsys/pdfs/guide_smallsystems_fullcost_pricing_case_studies.pdf ("Sensible pricing can also have the added benefit of encouraging efficient water use."); ROTH, *supra* note 76, at 11 ("[I]ncentives for water conservation are given by metering, volumetric charges, increasing block-tariffs and a move towards Full Cost Recovery as these instruments lead to a better reflection of marginal costs in water prices."). However, simply increasing the price of water disproportionately impacts the poor. ROTH, *supra* note 76, at 13 (observing that "the increase of water prices above a certain level can mean severe hardship for the less well-off"); Spencer, *supra* note 75 ("'Price increases hit people in poverty harder, for their relatively smaller incomes mean they pay a higher proportion of their income for water. . . . [W]ater rates are regressive.'") (internal citations omitted). The debate about water pricing often takes the form of privatization versus public management, in part because the World Bank has advocated privatization. *See, e.g.*, Public Citizen, Alternatives to Water Privatization, http://www.citizen.org/cmep/Water/alts/ (last visited Nov. 17, 2007); Maude Barlow & Tony Clarke, Polaris Institute, *Water Privatization: The World Bank's Latest Market Fantasy* (Jan. 2004), *available at* http://www.globalpolicy.org/socecon/bwi-wto/wbank/2004/01waterpriv.htm; JAMES WINPENNY, WORLD WATER COUNCIL & GLOBAL WATER P'SHIP, FINANCING WATER FOR ALL: REPORT OF THE WORLD PANEL ON FINANCING WATER INFRASTRUCTURE 7 (2003), *available at* http://www.gwpforum.org/gwp/library/FinPanRep_MainRep.pdf. The World Bank website provides a valuable collection of links to papers, web sites, and case studies on the privatization of water and sanitation services. *See* World Bank, Papers and Links: Privatizing Water and Sanitation Services, http://rru.worldbank.org/PapersLinks/Privatizing-Water-Sanitation-Services (last visited Nov. 17, 2007). This debate is beyond the scope of this Note, however, which only requires recognition of the fact that water prices do not accurately reflect the full economic, social, and environmental costs of water consumption. Water is simply under-priced.

Greg Kats' analysis of the benefits of green building in a study of government buildings in California he attempts to incorporate the "full costs" of water usage, but this exemplifies the hypothetical nature of such a measurement.[91] This study is unique inasmuch as it at least attempts to calculate the full costs of water. Kats' determination of a twenty-year present value ("PV") of water includes an "assum[ption] that actual [water] costs are two times higher than indicated" by data that calculated the marginal value of avoided costs, including environmental and wastewater treatment costs, among others.[92] Based on this hypothetical assessment of the full costs of water, he announced "a 20-year PV of $0.51/ft^2 for water savings from green buildings" in California.[93] In other words, *assuming* that Kats accurately accounted for the "full costs" of water, a builder saves $0.51 for each square foot of water conserved by a building. In the end, because these numbers are derived from a highly theoretical accounting of the full costs of water to the state government, Kats acknowledged that additional work would be needed to determine more realistic numbers.[94]

Furthermore, because Kats' analysis was aimed at government buildings, the avoided costs from water conservation could fairly be seen to accrue to the government's benefit. This is because many of the costs of water consumption[95] are actually borne by the government. Private builders, on the other hand, who pay less for water than it actually costs[96] do not enjoy the financial benefit of those same avoided costs and positive externalities when incorporating water saving measures.[97] To a certain extent, the state can shift these benefits to private builders through incentives and subsidies.[98] However, such

91. KATS ET AL., *supra* note 74, at 46.

92. *Id.* at 42–46.

93. *Id.* at 46.

94. *Id.*

95. *See supra* notes 81–90 and accompanying text.

96. *See supra* note 75 and accompanying text.

97. *See* K.R. GROSSKOPF & C.J. KIBERT, POWELL CTR. FOR CONSTR. & ENV'T., UNIV. OF FLA., MARKET-BASED INCENTIVES FOR GREEN BUILDING ALTERNATIVES 2 (2003), *available at* http://www.cce.ufl.edu/Market-Based%20Incentives%20for%20Green%20Building%20Alternatives.pdf ("[T]he commodity cost for water in Florida and throughout much of the world fails to internalize the 'true' cost of water resources beyond the capital and operational cost of the supplier. As a result, the benefits from water savings rarely justify the added investment into best management practices (BMPs), or those water policies, systems and structures that reduce water consumption and wastewater discharge beyond minimum standards required by law.").

98. *See id.* (discussing the creation by water suppliers of "market-based incentives for consumer investment in water saving measures" and of methods that "credit the benefits of water-related externalities"); *see also supra* note 71 (hypothesizing circumstances under which builders might incorporate water savings technologies).

incentives and subsidies would have to be tied specifically to water conservation measures and would have to approximate the true costs of water before they could correct the cost-benefit calculation for the water efficiency aspects of green building.

The result of the under-pricing of water is a perception that incorporating water efficiency measures into green buildings amounts to a sunk cost (or at least a cost that is difficult to recover) and, thus, water efficiency is effected primarily to achieve LEED points. Take, for example, the Hearst Tower[99] in New York City, one of the most innovative green buildings constructed to date. Designed to achieve "Gold" certification for core and shell and interiors,[100] the Hearst Tower includes impressive water saving technologies such as a green roof that reduces runoff and harvests rainwater for use in the building's air-conditioning system, a water irrigation system, and a three-story waterfall to cool the lobby.[101] While innovations such as these certainly score critical LEED points for the building, it is unlikely that they will pay for themselves anytime soon as long as municipal water is available for a negligible price.[102] Consider green roofs more generally: two of their most significant benefits are reduced stormwater runoff and reduced combined sewer overflows ("CSO").[103] While the builder absorbs the costs of building the green roof, presumably to achieve a LEED point, it does not enjoy the financial benefits of either the reduced runoff or the reduced CSO. Those benefits instead accrue to the municipality.

This phenomenon has two important consequences for defining baselines for water efficiency in green buildings. First, the lack of financial incentives for water conservation has arguably generated less-than-rigorous scrutiny of the water efficiency standards in LEED and other green building programs. Because there is relatively little payoff from making water savings improvements, the second consequence is that builders have an extra incentive to set minimal baselines

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99. *See* Robin Pogrebin, *How Green is My Tower?*, N.Y. Times, Apr. 16, 2006, at 2.1; Hearst Corp.—Hearst Tower Project, http://www.hearstcorp.com/tower/ (last visited Nov. 17, 2007).

100. *See* Pogrebin, *supra* note 99.

101. Hearst Corp.—Hearst Tower: Building Facts, http://www.hearstcorp.com/tower/facts/ (last visited Nov. 17, 2007).

102. *See, e.g.*, CVGW Report, *supra* note 88, at 13 (referring to "our practice of judging the value of ground water to be negligible").

103. *See, e.g.*, Nancy Stoner et al., Nat'l Res. Def. Council, Rooftops to Rivers: Green Strategies for Controlling Stormwater and Combined Sewer Overflows, at v (2006), *available at* http://www.nrdc.org/water/pollution/rooftops/rooftops.pdf.

for water use, so as to reduce the cost of achieving water efficiency points within the LEED rating system.

IV.
Defining Baselines for Water Efficiency in Green Buildings

A failure to internalize the true costs of water use, as well as increasing tension between encouraging water conservation and encouraging economic development and accommodating population growth, highlight the competing policy concerns at the heart of the problem of defining baselines for water efficiency in green buildings. Essentially, the problem pits the public interest in maximizing water conservation against the public interest in encouraging broad participation in green building programs such as LEED (and the builder's interest in minimizing costs while doing so), which is arguably facilitated by setting baselines lower[104] and making water efficiency points more readily accessible. Drawing on various approaches to defining baselines for energy efficiency and considering the policy concerns at stake, this Note proposes that baselines for water efficiency in green buildings should be determined by comparison to similar buildings in the same climate and region. By comparing a building's water usage to the water usage of similarly situated buildings that have responded to any existing water conservation pressures that are external to the green building program itself, rather than allowing water efficiency gains to be cumulative of those external gains, water efficiency efforts by green builders will be maximized.

A. *Energy Efficiency Baselines*

Because buildings consume a substantial amount of energy, the opportunity for a return on the initial investment in energy efficient measures has attracted considerable attention.[105] Also, many people believe energy efficiency is "arguably the most critical aspect of green

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104. I use "lower" here not to refer to the amount of water usage (technically a lower baseline water usage would make increased efficiency more difficult to achieve), but rather the opposite: that is, the least amount of water efficiency incorporated into the baseline building calculation.

105. *See, e.g.*, Kats et al., *supra* note 74, at 19–27 (concluding that "on the basis of energy savings alone, investing in green buildings appears to be cost-effective"); Matthew Boyle, *Wall Street's Green Machines*, CNNMoney.com, Oct. 25, 2006, http://money.cnn.com/2006/10/25/magazines/fortune/pluggedin_boyle_greeninvestments.fortune/index.htm; City of Seattle, Sustainable Building: Case Study 03, Market Value and R.O.I., http://www.seattle.gov/light/conserve/sustainability/studies/cv5_sv.htm (last visited Nov. 17, 2007).

building."[106] These opportunities for financial return and the central role of energy savings in green building have encouraged careful scrutiny of the baselines for achieving energy efficiency credits in green building. As a result, energy efficiency baselines have been clearly defined and can provide valuable guidance in defining baselines for measuring water efficiency.

1. Energy Efficiency in LEED

In LEED-NC, the baseline for measuring energy efficiency is derived from the energy code of the American Society of Heating, Refrigeration, and Air-Conditioning Engineers ("ASHRAE").[107] Specifically, any new construction must comply with the mandatory provisions and the prescriptive or performance requirements of ASHRAE Standard 90.1-2004.[108]

The baselines for energy efficiency derive from the same ASHRAE standard.[109] The point thresholds range from one LEED point for a 10.5% energy cost savings (or 3.5% for existing building renovations) to ten points for a 42% savings (or 35% for existing building renovations), with points awarded for incremental savings within this range.[110] These savings are compared to a baseline building performance rating as defined by Appendix G of the ASHRAE Standard 90.1.[111] The requirements of Appendix G differ slightly from the mandatory minimum requirements: for purposes of measuring energy efficiency, buildings must be compared against a comparable system.[112] This means that the baseline building against which energy costs in the new building are to be measured must be a building that includes the same kind of heating and cooling systems, among

106. Schendler & Udall, *supra* note 6. *See also* Murray, *supra* note 6, at 9 (reporting on EPA official's view that "[r]educing energy consumption and greenhouse gas emissions is the most significant green challenge in commercial real estate").

107. LEED-NC, *supra* note 23, at 34; *see* ASHRAE, http://www.ashrae.org/ (last visited Nov. 17, 2007).

108. LEED-NC, *supra* note 23, at 34.

109. *Id.* at 36.

110. *Id.*

111. *Id.*; ASHRAE STANDARD 90.1-2004: ENERGY STANDARD FOR BUILDINGS EXCEPT LOW-RISE RESIDENTIAL BUILDINGS 169–79 (2004), *available at* http://www.realread.com/prst/pageview/browse.cgi?book=1931862664 [hereinafter APPENDIX G]; *see also* John Hogan, Chair, Envelope Subcomm., Press Breakfast Remarks at the 2006 Winter ASHRAE Meeting: The Role of ASHRAE Standard 90.1-2004 in LEED, (Jan. 23, 2006), *available at* http://www.ashrae.org/publications/detail/15521.

112. *See* APPENDIX G, *supra* note 111, at 169–75 (describing a performance rating system for heating and cooling systems that requires comparison against similar systems); *see also* Schendler & Udall, *supra* note 6 (describing the Appendix G performance rating method as a "like system" requirement).

other required similarities.[113] In other words, "claiming credit for improvements in energy efficiency above a baseline is a different matter than tradeoffs for minimum compliance."[114]

The "like system" baseline requirement for energy efficiency has its critics, primarily among builders who resent the increased burden it imposes. In a critique of the LEED program, Auden Schendler and Randy Udall provided the following anecdote about a building on which they worked:

> When we first modeled the geothermal system we compared its energy consumption to that of a code-compliant building we could otherwise build. We soon learned, however, that [ASHRAE] required us to model our innovative heating system against a "like system." In other words, although our proposed geothermal solution was far superior to a gas-fired boiler, ASHRAE forced us to compare it to *another geothermal system*. Confused? So were we. Here's an automotive analogy: Shopping for a new car, you might consider a Toyota Prius rather than a SUV. If you bought the Prius, however, LEED would evaluate its performance against a Honda hybrid, not the guzzler alternative.[115]

This requirement, however, is not as absurd as Schendler and Udall suggest. The theory behind this "like system" requirement is that builders should be discouraged from achieving energy efficiency points by simply switching to a different energy system. Rather, to earn energy efficiency credits, builders should be required to incorporate innovative design and efficiency systems into their buildings. If the baseline were simply the minimum required by ASHRAE for a code-compliant building, the energy efficiency points would be too easily achieved and the impact of green buildings on total energy savings would be diminished.

The "like system" requirement does not analogize directly to water efficiency in green buildings in that there is less variability in water systems and uses[116] than in energy systems and uses.[117] However, this policy of favoring higher baselines to encourage increased

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113. *See* APPENDIX G, *supra* note 111, at 171–75 (delineating and describing categories of heating and cooling systems).

114. Hogan, *supra* note 111 (emphasis omitted).

115. Schendler & Udall, *supra* note 6.

116. For example, the fact that LEED-NC only allows five points for water efficiency, and those points are available for only three categories of use (plumbing fixtures, irrigation, and sewage/sewage conveyance) suggests a more limited range of options for water efficiency measures. *See* LEED-NC, *supra* note 23, at 27–31.

117. For a sampling of different heating and cooling systems available to builders, see generally ENERGY STAR, BUILDING UPGRADE MANUAL 116 (2004), *available at* http://www.energystar.gov/ia/business/BUM.pdf.

innovation and energy savings over lower baselines that would reduce the cost of achieving credits applies equally to water efficiency baselines.

2. *Baselines in Energy Star*

Another prominent player in the energy efficiency (and green building) movement is the Energy Star program,[118] which implemented a rating system that scores buildings from 1 to 100.[119] A rating of seventy-five or greater may qualify the building for an Energy Star label.[120] The system compares the target energy usage of a new building against a building of similar size, taking into consideration the climate conditions and "the energy fuel mix typical in the region specified by the zip code."[121] Energy Star then assesses the percent improvement "in weather-normalized source energy," rather than in site energy.[122] Source energy "includes the energy consumed at the building itself—or the *site energy*—plus the energy used to generate, transmit, and distribute the site energy."[123] This approach allows builders to change their energy fuel mix, as long as electricity is selected as one of the choices. It also eliminates the requirement of comparing against a like system by comparing total source energy for buildings.[124]

As with the LEED approach, this approach is inapplicable to water efficiency in one important respect: the conversion of source energy into site energy (i.e., electricity) does not analogize to water usage perfectly, because the water drawn from its source is essentially the same water used at the building site. In other words, water is

118. Energy Star is a joint program of the U.S. EPA and the U.S. Dep't of Energy aimed at encouraging the development and use of energy efficient appliances and increased overall energy performance for businesses and buildings throughout the United States. Energy Star, About Energy Star, http://www.energystar.gov/index.cfm?c=about.ab_index (last visited Nov. 17, 2007).

119. Energy Star, Green Buildings and Energy Efficiency, http://www.energystar.gov/index.cfm?c=green_buildings.green_buildings_index (last visited Nov. 30, 2007).

120. *Id.* Presumably, the Energy Star label reduces the burden on consumers of obtaining information necessary to choose energy efficient buildings.

121. Energy Star, Target Finder, http://www.energystar.gov/index.cfm?c=new_bldg_design.bus_target_finder (last visited Nov. 17, 2007).

122. Energy Star, Portfolio Manager Overview, http://www.energystar.gov/index.cfm?c=evaluate_performance.bus_portfoliomanager (last visited Nov. 30, 2007) (accounting for the impact of weather variations in rating a building's energy performance).

123. Energy Star, Understanding Source and Site Energy, http://www.energystar.gov/index.cfm?c=evaluate_performance.bus_benchmark_comm_bldgs (last visited Nov. 30, 2007).

124. Energy Star, Target Finder, *supra* note 121.

changed very little from source to site, whereas the energy taken from the source must be converted into the electricity used at the building site. However, the Energy Star system serves as a valuable model insofar as it accounts for regional and climate differences in establishing the baseline for energy efficiency.[125]

B. Implementing a Policy for Defining Water Efficiency Baselines

While green building programs such as LEED have clearly established baselines for energy efficiency, their steps toward defining baselines for water efficiency can be more accurately understood as establishing national minimum requirements. In this sense, a minimum requirement functions as a prerequisite which must be satisfied by any building before it can achieve LEED certification. Instead, baselines against which relative water efficiency in green buildings are measured, like baselines for energy efficiency under LEED, should be defined on a local or regional basis. The definition of a baseline should factor in relevant local or regional regulation, climate, and other external pressures. Defining baselines on a national basis, on the other hand, ignores the uneven distribution of water sources and water impacts throughout the country and the world.

1. Existing Minimum Requirements for Water Efficiency

It is worth reiterating that prescriptive water efficiency requirements, such as those mandating specific plumbing fixtures, avoid the problem of defining a baseline. This approach is embodied in programs such as LEED for Homes,[126] in legislation such as the Energy Policy Act of 1992,[127] and in Arizona's Efficient Plumbing Fixtures Act.[128] Supporting this technology-based approach to increasing water efficiency, the EPA launched its WaterSense program in 2006.[129] The WaterSense program essentially adapts the Energy Star

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125. *See* Energy Star, Weather Normalization Description, http://www.energystar.gov/index.cfm?c=business.bus_weather_normalization (last visited Nov. 17, 2007).

126. *See supra* notes 67–70 and accompanying text.

127. 42 U.S.C. § 6295(j)–(k) (2000 & Supp. IV 2004) (mandating a maximum of 1.6 gallons per flush for toilets, 1.0 gallons per flush for urinals, 2.5 gallons per minute for lavatory faucets, and various low-flow requirements for showerheads and other fixtures).

128. 1992 Ariz. Legis. Serv. Ch. 352 (West) (similar to the plumbing fixture requirements of the Energy Policy Act of 1992, with slight variations in lavatory faucet flows and requirements stated in terms of average, as opposed to maximum, flows).

129. U.S. EPA, WaterSense: Major Milestones, http://www.epa.gov/watersense/basic/milestones.htm (last visited Nov. 17, 2007).

labeling program to plumbing fixtures and irrigation/landscaping products and serves to "differentiate products in the marketplace."[130]

The LEED programs that award points for increased water efficiency, including both LEED-NC and LEED-EB, define the minimum requirement for water efficiency as compliance with the plumbing fixture requirements of the Energy Policy Act of 1992.[131] These requirements serve to establish minimum water efficiency levels for green buildings across the country, like the mandatory provisions of the ASHRAE Standard 90.1-2004 do for energy efficiency.[132] These minimum water efficiency levels might provide a minimum baseline for measuring water efficiency increases, but the urgent need to conserve water in some climates and regions suggest that such minimum national requirements ought not to function as the baseline for measuring water efficiency increases.

2. *Water Efficiency Baselines Should Incorporate Local Regulatory, Climate, and Other Market Pressures*

At the heart of the problem of defining baselines for water efficiency is a tension between the economic bottom line and the environmental bottom line.[133] One option for defining baselines is to use the LEED minimum requirement of compliance with the Energy Policy Act of 1992. The advantages of this approach go primarily to the financial consequences (or the *economic* bottom line) of building green. Water usage modeling would be made less complex because the baseline would be a uniform technological standard, thereby reducing the costs of modeling and demonstrating efficiency gains.[134] Also, using minimum requirements such as a baseline would potentially reduce the marginal cost of achieving water efficiency credits.

130. U.S. EPA, WaterSense: General Questions, http://www.epa.gov/watersense/fq/general.htm (last visited Nov. 17, 2007).

131. LEED-NC, *supra* note 23, at 30–31; LEED-EB, *supra* note 61, at 39 (defining the required minimum "as 120% of the water usage that would result if 100% of the total building fixture count were outfitted with plumbing fixtures that meet the Energy Policy Act of 1992 fixture performance requirements").

132. *See supra* notes 109–11 and accompanying text.

133. *See, e.g.*, BDC WHITE PAPER 2006, *supra* note 34, at 17 (discussing attempts to reconcile the economic bottom line with environmental and social bottom lines—the three of which together make up the so-called "triple bottom line"); *see also* JOHN ELKINGTON, CANNIBALS WITH FORKS: THE TRIPLE BOTTOM LINE OF 21ST CENTURY BUSINESS 2 (1998) (introducing the triple bottom line concept and defining it to include economic, environmental and social considerations).

134. *Cf.* Wolf Fichtner et al., *Baseline Setting Using Optimising Energy Models*, 12 ENERGY & ENV'T. 463, 463–65 (2001) (discussing the large complexity and cost of determining baselines on a project-by-project basis for the clean development mechanism under the Kyoto Protocol).

Using compliance with the Energy Policy Act of 1992 as the baseline would allow builders to get credit for measures they might have incorporated notwithstanding the green building requirements, possibly making green building more accessible to those who might otherwise not have built green and reducing the upfront costs.

The problem with this approach is that it potentially allows free-riding[135] and minimizes the cumulative environmental benefit of water efficiency in green buildings. This is where the environmental bottom line comes into play. An approach that mirrors the logic of the "like system" requirement for energy efficiency in LEED[136] would considerably advance the goal of water stewardship and conservation, even if it might increase the builder's costs. In regions and climates in which pressures external to the green building system have already encouraged efforts to conserve water, comparing buildings to "like systems" for purposes of measuring water efficiency would require extra innovation and further reductions in water consumption. An Energy Star approach that applies regional or state-wide standards would achieve the same result by incorporating the regulatory, climate, and other relevant local characteristics into a baseline calculation. Both approaches would more accurately reflect the fact that water is not evenly distributed throughout the world, by accounting for local and regional differences rather than relying on a national standard.

The under-pricing of water underscores the importance of the environmental bottom line, particularly in regions experiencing water stress and facing future water shortages.[137] In those regions where efforts have been made to require some water conservation in buildings, lower baselines would allow builders to "greenwash"[138] their buildings by awarding them credit for water conservation efforts they would already have made as a result of local regulation, regional climate pressures, or local water market pressures. Increasing the stringency of water efficiency requirements by heightening the baselines, on the other hand, would reinforce the affirmative nature of the efforts of green builders to *actually* improve the water efficiency of their

135. In the sense that builders who already comply with the minimum requirements, either voluntarily or because of local regulation, get the double-benefit of receiving green building credit for the efforts they had taken independent of the green building incentives.

136. *See supra* Part IV(A)(i).

137. *See supra* Part III.

138. "Greenwash" is a term used to describe deceptive marketing of a practice as environmentally aware when it is actually no different from the status quo or even environmentally destructive. *See, e.g.*, David Beers & Catherine Capello, *Greenwash!*, MOTHER JONES, Mar.–Apr. 1991, at 38.

buildings, thereby eliminating the "greenwashing" problem. Also, it would help to constrain the artificial demand engendered by the under-pricing of water, moving the price of water for green buildings closer to full cost recovery.[139]

V.
Phoenix, Arizona: A Paradigm for Green Building and Water Savings

It is helpful to consider the policy for defining water efficiency baselines discussed in this Note in the context of an actual city. Phoenix, Arizona is a paradigmatic site for exploring the consequences of water efficiency in green building because of the city's complicated water supply regime, arid environment, and rapid development. This section provides a brief background on Phoenix and its water infrastructure, discusses examples of green building in the greater Phoenix metropolitan area, and then applies the water efficiency baseline policy proposed in this Note to Phoenix.

A. Background and History of Phoenix: Aridity and Population Explosion

Phoenix was founded in 1867 by a man named Jack Swilling, who reportedly saw land that was suitable for farming but lacking water (because it was not near any rivers).[140] He subsequently built canals in the ruins of an ancient Hohokam irrigation system connecting Phoenix to the Salt River.[141] Recently, Phoenix and its greater metropolitan area[142] have experienced tremendous population growth,

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139. *See supra* Part III.

140. *See* City of Phoenix, Out of the Ashes: The History of the City of Phoenix, http://phoenix.gov/CITYGOV/history.html (last visited Nov. 17, 2007). Not only does Phoenix lack local water, it is one of the hottest and driest cities in the world. It experiences a temperature of 100 degrees Fahrenheit on an average of 89 days per year. ROBERT J. SCHMIDLI, CLIMATE OF PHOENIX, ARIZONA: PART II (1996), *available at* http://geography.asu.edu/cerveny/wxpart2.htm.

141. City of Phoenix, Out of the Ashes: The History of the City of Phoenix, *supra* note 140.

142. The greater metropolitan area, comprising towns and cities in Maricopa County, includes Phoenix, Mesa, Chandler, Gilbert, Glendale, Scottsdale, Tempe, Surprise, Avondale, Peoria, and Fountain Hills, among others. *See* Greater Phoenix Economic Council, Demographics and Labor Force, http://www.gpec.org/greater_phoenix_demo_labor.asp (last visited Jan. 15, 2008) (listing job and labor force demographic information for cities in the greater Phoenix area); ARIZ. DEP'T OF COMMERCE, PROFILE: MARICOPA COUNTY, ARIZONA 2 (2007), http://www.azcommerce.com/doclib/COMMUNE/Maricopa%20County.pdf (listing the cities and towns of Maricopa County).

increasing from nearly 1 million people in 1970[143] to approximately 3.1 million in 2000.[144] Between 1990 and 2000, the population of greater Phoenix increased by 45.3%, second only to Las Vegas in the growth rate of the thirty-five largest cities in the country.[145] The city's growth has been primarily horizontal[146]—though the population of greater Phoenix is only twice that of Manhattan, it covers more than 200 times as much land.[147]

As "one of the most rapidly urbanizing regions in the country,"[148] Phoenix has made development a top priority; one prominent Phoenix attorney said, "Phoenix is a place, like much of the West, that has been built on population growth as the goal. All of our tax structures, all of our infrastructure, everything . . . our identity is wrapped up in being first, second or third."[149] Despite some indications of a slowdown in the housing boom in Phoenix,[150] the recent history of Phoenix has been defined by stunning economic growth and an explosion of new, primarily suburban residential development.[151]

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143. U.S. Census Bureau, Arizona, Population of Counties by Decennial Census: 1900 to 1990 (1995), http://www.census.gov/population/cencounts/az190090.txt (last visited Jan. 2, 2008) (documenting Maricopa County's population as 967,522 in 1970).

144. U.S. Census Bureau, Maricopa County, Phoenix QuickFacts, http://quickfacts.census.gov/qfd/states/04/04013.html (last visited Jan. 2, 2008). From 2000 to 2002, Gilbert (2nd), Chandler (12th), and Peoria (13th) were among the 100 fastest growing U.S. cities with a population greater than 50,000. City-Data.com, Top 100 Fastest Growing Cities from 2000 to 2002, http://www.city-data.com/top32.html (last visited Nov. 18, 2007).

145. U.S. Census Bureau, Census 2000, Ranking Tables for Metropolitan Areas: 1990 and 2000 tbl. 3 (2001), *available at* http://www.census.gov/population/cen2000/phc-t3/tab03.pdf (ranking metropolitan areas by population based on 2000 census).

146. The legal system in Phoenix has historically promoted outward expansion. *See, e.g.*, Spur Industries, Inc. v. Del E. Webb Development Co., 494 P.2d 700, 708 (Ariz. 1972) (a property law decision in which the court issued a compensated injunction to the owner of a feedlot whose land had been encroached upon by a development in Sun City, reflecting the powerful public interest in encouraging growth).

147. David Owens, *Green Manhattan: Why New York is the Greenest City in the U.S.*, New Yorker, Oct. 18, 2004, at 111, 115.

148. Charles L. Redman, *The Urban Ecology of Metropolitan Phoenix: A Laboratory for Interdisciplinary Study*, *in* Population, Land Use, and Environment: Research Directions 163, 165 (Barbara Entwisle & Paul C. Stern eds., 2005).

149. Matt Jenkins, *Arizona Returns to the Desert*, High Country News, Mar. 21, 2005, at 8.

150. *See, e.g.*, Vikas Bajaj, *After Arizona's Housing Boom, 'For Sale' Is a Sign of the Times*, N.Y. Times, Nov. 7, 2006, at A1.

151. *See* Paul Kaihla, *The Next Real Estate Boom*, CNNMoney.com, Nov. 1, 2005, http://money.cnn.com/magazines/business2/business2_archive/2005/11/01/8362829/index.htm; *see also supra* notes 142–46 and accompanying text (documenting dramatic population growth in the Phoenix-area). Much of the residential development has been remarkably uniform, as a result of the limited water supply. Redman, *supra*

B. Water Regulation in Phoenix

From its ancient origins as a Hohokam site through the present, Phoenix has required water to be brought in from sources outside of the city.[152] What has emerged in recent years is a complex water management regime that attempts to balance the city's dramatic growth and the relative scarcity of available water.

1. Arizona Water Usage Patterns and History

Arizona draws on three sources of water: surface water, groundwater, and reclaimed water.[153] Surface water accounts for approximately 58% of the state's water.[154] An average of 39% (2.8 million acre-feet) is drawn from the Colorado River, 13.8% (1 million acre-feet) from the Salt River, and 5.2% (0.4 million acre-feet) from the Gila and other rivers.[155] Of the water taken from the Colorado River, slightly more than half is allocated to the Central Arizona Project ("CAP"), which delivers the water to central Arizona, including Phoenix.[156] Groundwater supplies 40% (2.9 million acre-feet) of Arizona's water.[157] Although groundwater is plentiful in Arizona, it has been over-exploited. In the state's most populous areas "water is pumped from groundwater sources faster than it is replenished naturally . . . [which] has led to declines in water level by hundreds of feet in some

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note 148, at 166 ("The costs of extending the water infrastructure and other social factors have resulted in a remarkable uniformity of residential lot size across the metropolitan region that defies national patterns.").

152. *See* WaterHistory.org, Hohokam Irrigation: Travel Information, http://www.waterhistory.org/histories/hohokam/hohokam.pdf (describing contemporary remains of Hohokam irrigation canals); Pamela Sands Showalter, *A Thematic Mapper Analysis of the Prehistoric Hohokam Canal System, Phoenix, Arizona*, 20 J. FIELD ARCHAEOLOGY 77, 77 (1993) (describing the Hohokam environment and irrigation system).

153. Sharon B. Megdal, Dir., Water Res. Research Ctr., Presentation at the Universities' Council on Water Resources (USOWR) Convention: The Economics of Water Regulation in Arizona 3 (July 20, 2004), *available at* http://ag.arizona.edu/AZWATER/presentations [click on hyperlink for "The Economics of Water Regulation in Arizona"] [hereinafter Megdal Presentation]; WENDI WEINMAN, ARIZONA'S WATER INFRASTRUCTURE 1–4 (2002), *available at* http://www.commerce.state.az.us/pdf/prop/sesreports/water.pdf. "Surface water" is defined by Arizona law as "waters of all sources, flowing in streams, canyons, ravines or other natural channels, or in definite underground channels, whether perennial or intermittent, floodwater, wastewater or surplus water, and of lakes, ponds and springs on the surface." ARIZ. REV. STAT. ANN. § 45-101 (2003). "Groundwater" is the water in aquifers under the earth's surface. *See id.*; Eden & Megdal, *supra* note 20, at 83. "Reclaimed water" is treated wastewater. WEINMAN, *supra* note 153, at 4.

154. Megdal Presentation, *supra* note 153, at 3.

155. *Id.*

156. Eden & Megdal, *supra* note 20, at 83.

157. Megdal Presentation, *supra* note 153, at 3.

areas."[158] The remaining 2% of water in Arizona is reclaimed water, or effluent (treated wastewater), which is used primarily for irrigating non-food crops and turf and for industrial cooling.[159]

Despite steady, even dramatic, population growth in Maricopa County, where Phoenix is located,[160] overall annual freshwater withdrawals have declined from approximately 2.79 million acre-feet of water in 1985 to approximately 2.41 million acre-feet in 2000.[161] However, this decline in water usage can be explained by the conversion of agricultural lands into urban and suburban development.[162] While the short-term consequence of this change in land use is less overall water usage, commentators predict that the decline in agricultural uses will level out eventually and new development will occur more frequently on desert land rather than irrigated farmland.[163] Municipal water demand in the greater metropolitan Phoenix area will "increase[] proportionally with population growth."[164] This increase will occur as long as per capita water use in urban and suburban settings in Phoenix remains steady.[165]

2. *Surface Water, Groundwater, and Effluent*

Arizona's access to surface water from the Colorado River is governed by a complex legal arrangement known as the Law of the River.[166] The Arizona Department of Water Resources ("ADWR")

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158. Eden & Megdal, *supra* note 20, at 85. There have been reports of significant subsidence and earth fissures in central Arizona as a result of this excessive groundwater withdrawal. *See* JOE GELT ET AL., WATER IN THE TUCSON AREA: SEEKING SUSTAINABILITY 19–21 (1999), *available at* http://cals.arizona.edu/AZWATER/publications/sustainability/pdf/Chapter_3.pdf.

159. Eden & Megdal, *supra* note 20, at 85.

160. *See supra* notes 142–45 and accompanying text.

161. Eden & Megdal, *supra* note 20, at 82 tbl. 4.1.

162. *Id.* at 83 (noting that "total water usage declined between 1990 and 2000, when a 56 percent increase in public supply was more than offset by a 30 percent decrease in agricultural irrigation").

163. *See id.*; Jenkins, *supra* note 149.

164. Eden & Megdal, *supra* note 20, at 83.

165. *Id.*

166. U.S. Bureau of Reclamation, The Law of the River, http://www.usbr.gov/lc/region/g1000/lawofrvr.html (last visited Nov. 18, 2007). The Law of the River is "a collection of interstate compacts and international treaties, Congressional acts and Supreme Court Decrees resulting from lawsuits between the states sharing the river." Eden & Megdal, *supra* note 20, at 86. This includes the landmark 1963 decision in Arizona v. California, 373 U.S. 546 (1963), in which the Supreme Court ruled that Arizona has a right to appropriate and use tributary flows before the tributaries comingle with the Colorado River and enforcing Arizona's right to use its full Colorado River apportionment. *Id.* at 590–91. The Supreme Court has issued a number of supplemental decisions and decrees in this matter. *See, e.g.*, Arizona v. California (Decree), 376 U.S. 340 (1963); Arizona v. California, 383 U.S. 268 (1966); Arizona

manages and allocates Arizona's portion of the Colorado River.[167] ADWR has already made essentially all of the allocations,[168] including 1.5 million acre-feet to CAP each year.[169] Because Arizona currently does not use its full portion of water from the Colorado River, it created the Arizona Water Banking Authority ("AWBA") in 1996 to store the unused water,[170] thereby reducing evaporative losses and ensuring availability upon demand.[171] Other than the Salt River,[172] all remaining surface water sources in Arizona are governed by the law of prior appropriation, wherein

> [t]he right to use a certain amount of surface water for a specified purpose is acquired through the process of obtaining a permit to take the water, constructing the means for taking the water and conveying it to its point of use, and then using the water. The first person to acquire a right to water from any water body has the highest right to water, while the newest water right holder has the lowest right. In times of shortage, the holders of the older rights receive all of their water before newer rights holders receive theirs.[173]

Together, these surface water systems account for approximately 79% of the total freshwater withdrawals in Maricopa County.[174]

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v. California, 439 U.S. 419 (1979); Arizona v. California, 460 U.S. 605 (1983); Arizona v. California, 466 U.S. 144 (1984); Arizona v. California, 530 U.S. 392 (2000); Arizona v. California, 531 U.S. 1 (2000).

167. *See* Eden & Megdal, *supra* note 20, at 86.

168. *Id.*

169. About 2.8 million acre-feet of Arizona's water comes from the Colorado River each year. Eden & Megdal, *supra* note 20, at 83. Though the CAP canals are designed to transfer up to 1.8 million acre-feet each year, only 1.5 million acre-feet are allocated to CAP. *Id.* at 86.

170. Arizona Water Banking Authority (AWBA), Background, http://www.awba.state.az.us/backgrnd/exec_sum.html (last visited Nov. 18, 2007); *see also* ARIZ. REV. STAT. ANN. §§ 45-2401, -2421 (2003) (establishing the AWBA). Between 1996 and 2003, the AWBA banked 952,912 acre-feet of water in the Phoenix Active Management Area ("AMA"). Megdal Presentation, *supra* note 153, at 17.

171. It is unclear if water banking is a reasonable solution for future needs or encourages more efficient use of water, but water banking does help reduce evaporative losses and ensures availability on demand, among other benefits. *See, e.g.*, Connected Water, Australian Gov't, Water Banking, http://www.connectedwater.gov.au/framework/water_banking.html (last visited Nov. 18, 2007).

172. The Salt River is the largest non-Colorado River surface water sources on which the Phoenix draws on. Megdal Presentation, *supra* note 153, at 3. Its waters are managed by the Salt River Project ("SRP"), which allocates water to landowners in the SRP. Eden & Megdal, *supra* note 20, at 86.

173. *Id.*

174. City-Data.com, Maricopa County, Arizona (AZ), http://www.city-data.com/county/Maricopa_County-AZ.html (last visited Nov. 18, 2007).

Groundwater in Arizona is regulated by ADWR under the Groundwater Code.[175] The Groundwater Code established a number of Active Management Areas ("AMAs"),[176] including the Phoenix AMA,[177] to allow for comprehensive groundwater management.[178] The management goal of the Phoenix AMA is "[t]o achieve safe-yield by the year 2025 through the increased use of renewable water supplies and decreased groundwater withdrawals in conjunction with efficient water use."[179] Within the Phoenix AMA, groundwater withdrawals are limited and closely regulated through the Assured Water Supply ("AWS") program.[180] Under the AWS program, new subdivision developments within the Phoenix AMA must be certified, which requires compliance with strict criteria regarding water availability, water quality, and financial stability.[181] This includes a requirement of proof that that water is physically, continuously, and legally available for 100 years.[182] Subdivisions must also conform to the AMA's management goal, such that a significant portion of the water used by new developments must come from renewable sources, usually CAP.[183]

175. The Groundwater Code is codified at ARIZ. REV. STAT. ANN. §§ 45-401–898.01 (2003). ADWR is the body responsible for the regulation of groundwater to the extent provided for in the Code. *Id.* § 45-103; Eden & Megdal, *supra* note 20, at 87.

176. An AMA is defined as "a geographical area which has been designated . . . as requiring active management of groundwater." ARIZ. REV. STAT. ANN. § 45-402.

177. *Id.* § 45-411; Ariz. Dep't of Water Resources, Phoenix AMA, http://www.azwater.gov/WaterManagement_2005/Content/AMAs/PhoenixAMA/default.htm (last visited Nov. 17, 2007) [hereinafter Phoenix AMA].

178. Eden & Megdal, *supra* note 20, at 87.

179. Phoenix AMA, *supra* note 177. "Safe-yield" is defined in the Groundwater Code as "a long-term balance between the annual amount of groundwater withdrawn in the AMA and the annual amount of natural and artificial recharge." ARIZ. REV. STAT. ANN. § 45-561.

180. Eden & Megdal, *supra* note 20, at 90.

181. A developer either must obtain a certificate of AWS from ADWR or must be served by a water provider approved by ADWR. ARIZ. REV. STAT. ANN. § 11-806.01(B); Eden & Megdal, *supra* note 20, at 90. To do so, the developer or water provider must meet the following five criteria: (1) that show that water is physically, continuously and legally available for 100 years; (2) that it meets water quality standards; (3) that the proposed water use is consistent with the management goal of the AMA; (4) that the proposed water use is consistent with the current management plan of the AMA; and (5) that the water supplier must demonstrate the financial capability to develop any needed water infrastructure. ARIZ. ADMIN. CODE §§ R12-15-704F, -716 to -722 (2007); *see also* Ariz. Dep't of Water Res., Assured/Adequate Water, http://www.azwater.gov/watermanagement/Content/OAAWS/default.htm (last visited Nov. 18, 2007) (summarizing requirements of AWS program).

182. ARIZ. ADMIN. CODE §§ R12-15-704.F.2, -717.

183. *See* Eden & Megdal, *supra* note 20, at 90.

The Central Arizona Groundwater Replenishment District ("CAGRD") allows developers to offset their groundwater use by recharging groundwater sources with renewable water.[184] The CAGRD is designed to reduce the barriers to development geographically distant from CAP and other renewable water sources.[185] While the AWS rules for new developments have the potential for limiting growth to that which is consistent with the available water supply within the Phoenix AMA, the "CAGRD has buffered developers from the growth management potential of those rules."[186] This "buffering" allows developers to maximize growth (and encourages economic development and population growth in the Phoenix area) at the cost of reducing incentives for developers to conserve water.

Effluent, the third source of Arizona's water, is treated wastewater that can be reclaimed for subsequent human use, often for irrigation.[187] Although effluent is an important potential renewable water source for Phoenix, either to be used instead of groundwater or to be pumped back into the groundwater sources in the Phoenix AMA via the CAGRD, "it currently provides an insignificant proportion of water saving."[188] It has been suggested by some commentators that the low profile of effluent reuse in Arizona is a product of low municipal water prices and an "ambiguous" regulatory regime that might prohibit effluent use for any user with a connection to a public sewer system.[189]

3. *Creating a Market for Water in Phoenix*

Theoretically, the complex water management and supply regime described above should create a market for water. The finite allocation of surface water and limited access to groundwater operate as a

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184. *Id.* at 92. CAGRD members may replenish "excess groundwater" with other renewable sources (excluding groundwater withdrawn from elsewhere in the AMA). *Id.* Membership in the CAGRD is open to anyone; it costs $5,000 for water providers and $20 per unit for developers, plus annual assessment fees based on the volume of excess groundwater drawn. *See* JUSTIN FERRIS ET AL., WATER RESOURCES RES. CTR., UNIV. OF ARIZ., AN INTRODUCTION TO THE CENTRAL ARIZONA GROUNDWATER REPLENISHMENT DISTRICT 3 (2006), *available at* http://ag.arizona.edu/azwater/files/cagrd.pdf; *see also* Central Arizona Groundwater Replenishment District (CAGRD), CARGRD Membership Introduction, http://www.cagrd.com/static/index.cfm?action=group&contentID=145 (last visited Dec. 19, 2007).

185. FERRIS ET AL., *supra* note 184, at 3.

186. Eden & Megdal, *supra* note 20, at 97.

187. *Id.* at 85. Because wastewater is a product of human use, "[t]he larger the population, the more effluent is generated." *Id.* As a result, effluent is the only water source that is steadily increasing. *Id.* at 97.

188. *Id.*

189. *See, e.g.*, Gelt, *supra* note 68.

cap on supply, with limited trading options through the CAGRD built in to the system, such that water efficiency should be encouraged. Effluent and treated wastewater is included in the water source mix, which should further encourage efficiency. This should go some way to countering any artificial demand created by under-priced water. Also, the AWS requirements that apply to new subdivisions within the Phoenix AMA create pressures to reduce water use, because lower water demand should make it easier to get AWS certification.[190] However, the 100-year availability requirement for AWS certification likely cannot accurately account for climate-change induced shortfalls,[191] including projections that the demand "for CAP water will exceed the available supply by almost 90 percent" by 2050[192] or that Arizona might have to declare a water shortage sometime between 2007 and 2011.[193] Another failure in the Phoenix AMA is the grandfathering in of a number of inefficient groundwater rights.[194] Ultimately, commentators have observed that water regulation in Arizona fails to attend to basic economic considerations, including price signals and principles of supply and demand.[195]

C. *Green Building in Phoenix*[196]

In 1992, the Arizona legislature enacted an Efficient Plumbing Fixtures Act, which imposes technology-based water efficiency measures on both public buildings and private commercial and residential buildings.[197] These laws prohibit the distribution, sale, offering for sale, importation, or installation of inefficient plumbing fixtures for use in new or renovated residential buildings,[198] and in commercial,

190. *See supra* notes 181–83 and accompanying text for details of the AWS certification requirement process.

191. *See* Eden & Megdal, *supra* note 20, at 105 (explaining the unpredictability of climate conditions in Arizona over the long term).

192. *Id.* at 102.

193. Jenkins, *supra* note 149.

194. *Id.* *See also* ARIZ. REV. STAT. ANN. §§ 45-411.01.A., -461 to -483 (grandfathering provisions relating to water rights).

195. *See, e.g.*, Jenkins, *supra* note 149.

196. Development in Phoenix presents a number of ecological challenges that fall within the scope of most green building programs, including the serious siting and transportation concerns that arise from the city's dominant patterns of urban sprawl. Much of the new development in the greater Phoenix area is far from downtown Phoenix, often in previously undeveloped desert on the outskirts of existing municipalities. *See generally* Redman, *supra* note 148 (discussing the problems related to urban sprawl in Phoenix). Those subjects, as well as important energy efficiency issues in Phoenix, are beyond the scope of this Note.

197. *See* 1992 Ariz. Legis. Serv. Ch. 352 (H.B. 2440) (West).

198. ARIZ. REV. STAT. ANN. § 45-312 (2003).

industrial, and public construction.[199] Mandated levels of efficiency[200] roughly parallel the plumbing fixture requirements of the Energy Policy Act of 1992.[201] Violation of these laws can result in a $100 fine for the first citation and a $250 fine for subsequent citations.[202]

In addition to these explicit regulations targeting efficient plumbing fixtures, a number of executive orders issued by Governor Janet Napolitano have endorsed green building in Arizona. For instance, Executive Order 2005-05 broadly embraces green building in new state buildings but focuses primarily on setting energy efficiency standards.[203] Another, Executive Order 2005-02, established the Climate Change Action Group,[204] which released an action plan recommending that state and local governments adopt substantial water efficiency measures, among other efforts toward sustainability.[205]

Finally, the ADWR manages the Municipal Conservation Program, which assesses water conservation efforts made by municipalities and the various AMAs throughout the state.[206] The program is designed "to gradually increase the efficiency of water use by municipal water providers through reasonable reductions in per capita use, in addition to developing conservation measures appropriate for individ-

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199. *Id.* § 45-313.

200. The levels of efficiency are as follows: an average of 1.6 gallons per flush for toilets, 1.0 gallons per flush for urinals, 3.0 gallons per minute for lavatory faucets, and various low-flow requirements for showerheads and other fixtures. *Id.* §§ 45-312, -313. "'Plumbing fixture' means a lavatory faucet, lavatory faucet replacement aerator, kitchen faucet, kitchen faucet replacement aerator, shower head, urinal, water closet, evaporative cooler or decorative fountain. Plumbing fixture does not include parts necessary for routine maintenance." *Id.* § 45-311.

201. 42 U.S.C. § 6295(j)–(k) (2000 & Supp. IV 2004).

202. ARIZ. REV. STAT. ANN. § 45-316.A. These laws do not apply to a residential dwelling owner or occupant who installs an inefficient plumbing fixture in her own residential dwelling. *Id.* § 45-316.C. These laws, however, have not entirely curbed the use of inefficient toilets. A "black market" in old, high-flow toilets (often imported from Canada) has arisen in response because some of the new, low-flow toilets are not sufficiently powerful. *See, e.g.*, Jon Delano, *Americans Lack Freedom to Flush Toilets of Own Choice*, PITTSBURGH BUS. TIMES, Aug. 23, 1999, *available at* http://pittsburgh.bizjournals.com/pittsburgh/stories/1999/08/23/editorial4.html.

203. Ariz. Exec. Order 2005-05 (2005), *available at* http://www.governor.state.az.us/eo/2005_05.pdf.

204. Ariz. Exec. Order 2005-02 (2005), *available at* http://www.governor.state.az.us/eo/2005_02.pdf.

205. ARIZ. DEP'T OF ENVTL. QUALITY, CLIMATE CHANGE ACTION PLAN 11 (2006), http://www.azclimatechange.us/ewebeditpro/items/O40F9347.pdf (recommending that Arizona make efforts to encourage water efficiency).

206. *See* Ariz. Dep't of Water Res., Municipal Conservation Program—Third Management Plan Review, http://www.azwater.gov/dwr/Content/Hot_Topics/Municipal_Conservation_Program--TMP_Review/default.htm (last visited Nov. 17, 2007).

ual users."[207] This program facilitates communication between municipalities and AMAs and compiles laws, codes, ordinances, incentives and services, educational programs, and outreach programs dedicated to water conservation.[208]

According to the Municipal Conservation Program summary, Phoenix has retrofitted plumbing fixtures and improved irrigation systems for homeowners in targeted neighborhoods.[209] Phoenix also offers on-site water usage audits for homeowners, prohibits discharge of water onto streets and sidewalks, requires low-water use plants for landscaping, and conducts an array of educational and outreach programs.[210] Other cities in the greater Phoenix metropolitan area employ a range of similar conservation measures.[211]

Apart from other legal and social efforts aimed at water efficiency, Phoenix has conducted what amounts to a fairly limited experiment in green building. Beginning in 2002, the city initiated a pilot program to determine the costs and benefits of building green.[212] After determining that green building only increases costs by two to three percent,[213] the city council passed green building guidelines for new buildings in the city.[214] To date, a number of buildings in Phoenix have been LEED certified or registered with USGBC;[215] several other green buildings are in the process of obtaining LEED certification.[216] Tempe, home to Arizona State University and part of the

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207. Mark Frank, Dir., Ariz. Dep't of Water Res., Effects of Urbanization Symposium: Municipal Water Use in the Phoenix Active Management Area (1997), *available at* http://ag.arizona.edu/OALS/urbanization/water.html.

208. *See* ARIZ. DEP'T OF WATER RES., A SUMMARY OF WATER CONSERVATION PROGRAMS IN ACTIVE MANAGEMENT AREAS 1 (2007), *available at* http://www.azwater.gov/WaterManagement_2005/Content/AMAs/files/2007Conserv.Summary.pdf.

209. *Id.* at 32.

210. *Id.* at 32–34.

211. *See id.*; Frank, *supra* note 207, at tbl. 4.

212. *See* City of Phoenix, Phoenix Environmental Sustainability Program, http://phoenix.gov/sustainability/blueprint.html (last visited Nov. 19, 2007).

213. *See* News Release, City of Phoenix, Phoenix Adopts "Green Building" Guidelines for New Facilities (June 21, 2005), http://phoenix.gov//NEWSREL/ARCHIVE/2005/JUNE/21green.html. It is unclear what definition of green building the city council used and what method it employed to determine the relative cost increases of green building.

214. *Id.*

215. *See* USGBC, *LEED Registered Projects* (Apr. 12, 2007), https://www.usgbc.org/ShowFile.aspx?DocumentID=2314 [hereinafter LEED Registered Project List]. This list includes at least ten government buildings and several private commercial buildings. *Id.*

216. *See e.g.*, Hunt Corporation, *Assuming the LEED On 'Green' Building*, 6 LANDMARKS 5 (2006) (noting that the Phoenix Convention Center Expansion project has applied for certification through LEED), *available at* http://www.thehuntcorp.com/news/pdf/Landmarks_0604.pdf; Phoenix Public Library, Desert Broom Branch,

greater Phoenix metropolitan area, boasts at least twenty green buildings, several of which have been developed by the University.[217]

Scottsdale,[218] a suburb of Phoenix, has been a national leader in the green building movement.[219] It is the first city in the United States to require all occupied city buildings to achieve LEED "Gold" certification.[220] However, the resolution exempts buildings for which the return on investment will take more than five years.[221] Scottsdale developed its own voluntary residential green building checklist[222] and incorporated the checklist into provisions of the city's building code.[223] The residential green building system awards points for high-

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supra note 217 (reporting Phoenix's Desert Broom library branch project is applying for LEED certification).

217. *See* LEED Registered Project List, *supra* note 215.

218. Scottsdale is the second most affluent municipality in the greater Phoenix area. The median household income in Scottsdale in 2005 was $60,057, higher than all municipalities in the greater Phoenix area other than Paradise Valley, which is much smaller than Scottsdale. City-Data.com, Scottsdale, Arizona, http://www.city-data.com/city/Scottsdale-Arizona.html (last visited Nov. 17, 2007) (also reporting estimated population of 231,127); *see* City-Data.com, Phoenix, Arizona, http://www.city-data.com/city/Phoenix-Arizona.html (last visited Nov. 17, 2007) (reporting median household income of $42,353); City-Data.com, Mesa, Arizona, http://www.city-data.com/city/Mesa-Arizona.html (last visited Nov. 17, 2007) (reporting median household income of $44,861); City-Data.com, Tempe, Arizona, http://www.city-data.com/city/Tempe-Arizona.html (last visited Nov. 17, 2007) (reporting median household income of $45,644); City-Data.com, Paradise Valley, Arizona, http://www.city-data.com/city/Paradise-Valley-Arizona.html (last visited Nov. 17, 2007) (reporting median household income of $161,300 and population of 14,479).

219. *See* City of Scottsdale, Green Building Program, http://www.scottsdaleaz.gov/greenbuilding (last visited Nov. 20, 2007).

220. *See* SCOTTSDALE, ARIZ., RES. NO. 6644 (2005), *available at* http://www.ci.scottsdale.az.us/greenbuilding/LEED/LEED_ResNo6644.pdf; News Release, City of Scottsdale, Scottsdale Becomes First City in the Nation to Adopt Gold Standard for Energy and Environmental Design (Mar. 23, 2005), http://www.scottsdaleaz.gov/greenbuilding/LEED/default.asp.

221. SCOTTSDALE, ARIZ., RES. NO. 6644, *supra* note 220 (the resolution "require[s] a pay back period of no more than five (5) years for projects designed to the LEED Gold Standard. Where the payback is anticipated to be more than five (5) years, City staff is directed to recommend to the City Council which level of LEED certification is appropriate for that particular project. If no level of LEED certification is feasible, then the project under consideration shall include as many principles of both the LEED program and the City's Green Building Program as are feasible."). Also, "[t]he City Council may grant exceptions to this Policy when it deems appropriate." *Id.*

222. *See* City of Scottsdale, Green Home Rating Checklist (Sept. 2006), *available at* http://www.scottsdaleaz.gov/AssetFactory.aspx?did=7372; *see generally* City of Scottsdale, *supra* note 219.

223. The Scottsdale Building Code incorporates the International Building Code (IBC), 2006 Edition, and the City of Scottsdale amendments thereto. SCOTTSDALE, ARIZ., CODE §§ 31-31, 31-32 (2007), *available at* http://www.municode.com/resources/gateway.asp?pid=10075&sid=3. The City's amendments to the IBC incorporate provisions related to Scottsdale's Green Building Program and Green Building

efficiency toilets, faucets, showerheads, and other plumbing fixtures, but does not include an overall water efficiency increase requirement;[224] it takes the same prescriptive approach as LEED for Homes.[225] This program has been tremendously successful—in 2003, 4.5% of all new residential buildings were built green, in 2004 it jumped to 21%, and in 2005 an estimated 33% of all new residential buildings were built green.[226]

As the Scottsdale Green Building Program observes, in addition to efforts by ADWR to manage critical groundwater depletion and other water scarcity issues in Phoenix, "[o]ne way to conserve water is to incorporate water management strategies into building and site design."[227]

D. *Applying the Water Efficiency Baselines Policy to Phoenix: A Test Case*

Now consider the policy for defining baselines for water efficiency in green buildings discussed in Part IV, *supra*, when applied to our test case, Phoenix. To reiterate, baselines should be defined on a local or regional basis, in light of relevant local or regional regulation, climate, and other external pressures. In Arizona, the Efficient Plumbing Fixtures Act established minimums for plumbing fixtures roughly parallel to those in the Energy Policy Act of 1992.[228] Beyond these minimum requirements, however, a number of pressures exist that theoretically encourage water conservation. These include the AWS requirement that a developer must demonstrate a 100-year supply of potable water, the AMA's groundwater management goals, and the ability to buy and sell water credits within the CAGRD (which essentially operates like a cap-and-trade system).[229] Also, various ordinances and efforts within the Municipal Conservation Program, such as the use of low-water plants for landscaping or the prohibition of

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Rating Checklist. *See* Scottsdale, Ariz., Ordinance 3735 §§ 101.4.1, 106.1.1.2 (July 10, 2007), *available at* http://www.scottsdaleaz.gov/Assets/documents/codes/2006_IBC_Final_Amendments.pdf.

224. *See* City of Scottsdale, Green Home Rating Checklist, *supra* note 222.

225. *See supra* notes 68–70 and accompanying text.

226. Green Building Expo, The Growth of Green: Green Building Continues from Trend to Tradition in Scottsdale, http://www.greenbuildingexpo.com/green.html (last visited Nov. 17, 2007).

227. CITY OF SCOTTSDALE, GREEN BUILDING PROGRAM OVERVIEW (2004), *available at* http://www.scottsdaleaz.gov/AssetFactory.aspx?did=7397.

228. *See supra* notes 197–202 and accompanying text.

229. *See supra* notes 182–86 and accompanying text.

irrigation that spills water onto sidewalks, all reflect a regulatory response to over-exploitation of water in Phoenix.[230]

A baseline defined only to include minimum plumbing fixture requirements would not accurately reflect the water conservation efforts in effect in Phoenix and would allow builders to receive "double" credit for compliance with those efforts. Because any developer in Phoenix must incorporate some water conservation measures into a new development—for example, to comply with the 100-year AWS requirement or to meet local plumbing codes—the builder should not also receive credit toward LEED certification for those measures. Thus, for example, water conservation measures implemented solely to comply with the 100-year AWS requirement ought not to be included in any measure of a building's relative water efficiency for purposes of LEED certification. A "like system" baseline can be achieved by comparing any prospective green building against similar buildings built since the AWS system was enacted and in light of other local water conservation measures. Thus, applying either a general "like system" requirement or the use of a regional green building program, a proper baseline for water efficiency in green buildings in Phoenix should incorporate the full spectrum of conservation pressures present in Phoenix.

Conclusion: Green Building in the Context of Water Regulation

One question that arises when considering resource efficiency in green buildings is whether or not this is ultimately a second-best approach. Is it not more effective to encourage energy or water conservation by regulating the supply side or by attempting to change the supply system such that the prices of those resources more accurately reflect their costs? In other words, should the burdens of addressing an impending global water crisis or climate change fall on developers and building owners, who can only effect limited change, rather than on governments and power and water companies?

Ultimately, water scarcity, droughts, and climate change will have to be addressed at all levels. Because buildings consume somewhere between one-eighth and one-sixth of the world's freshwater,[231] the building industry has an important part to play, even if encouraging water efficiency in green buildings is not the single, perfect solu-

230. *See supra* notes 206–11 and accompanying text.

231. *See* LEED-NC, *supra* note 23, at 3 (buildings in the U.S. use one-eighth of the country's water); *see also* Roodman & Lenssen, *supra* note 2, at 5 (buildings consume one-sixth of global freshwater).

tion. As Dr. Peter H. Gleick stated in his Congressional testimony, "Water conservation and efficiency are the greatest untapped sources of water in this nation—cheaper, cleaner, and more politically acceptable than any other alternative."[232] As long as green building represents an affirmative step toward a more conscientious interaction between development and the environment, green builders should push hard to increase their water efficiency. Heightened baselines that take into account regional water demands are an excellent place to start.

232. *Water: Is it the 'Oil' of the 21st Century?: Hearing before the Subcomm. on Water Resources and Environment of the House Comm. on Transportation and Infrastructure*, 108th Cong. 90 (2003) (statement of Dr. Peter H. Gleick, Director, Pacific Institute for Studies in Development).