WE 1:
ENHANCE WATER EFFICIENCY STANDARDS

New York City Plumbing Code and Administrative Code
Proposal developed by the Water Efficiency & Building Stormwater Committee

Summary

Issue:
Although New York City receives substantial rainfall, the city is still vulnerable in dry years and has experienced seven droughts in the last 45 years. Fortunately, the need for water can be easily reduced with more-efficient plumbing fixtures.

Recommendation:
Enhance water efficiency standards for plumbing fixtures.

Proposed Legislation, Rule or Study

Amendments to the New York City Plumbing Code:

1. Add the following definitions to Section 202:

DUAL-FLUSH TOILET. A toilet that enables the user to select a high flush for solid waste or a reduced volume, low flush for liquid waste.

HIGH-EFFICIENCY TOILET (HET). A toilet that is authorized by the WaterSense Program of the United States Environmental Protection Agency to bear the WaterSense label.

NON-WATER URINAL. A urinal that discharges into the sanitary drainage system but is not supplied by a water distribution system.

WATERSENSE-LABELED FIXTURE. A plumbing fixture that has been tested by a third-party laboratory in accordance with the WaterSense Program of the United States Environmental Protection Agency, has been certified by such laboratory as meeting the performance and efficiency requirements of the program and has been authorized by the program to use its label.

2. Add a new Section 417.4.2 as follows:

417.4.2 Limitation on showerheads. The aggregate allowable flow rate from all shower head fixtures (including rain systems, waterfalls, bodysprays, and jets) that can operate simultaneously in a single shower compartment shall be limited to the flow rate in Table 604.4 for a single shower head.

Exception: Group showers, such as in athletic facilities, schools, or institutional occupancies, shall be permitted to have more than one showerhead.

3. Amend Section 419.1 as follows:

419.1 Approval. Urinals shall conform to ASME A112.19.2M, CSA B45.1 or CSA B45.5. Urinals shall conform to the water consumption requirements of Section 604.4. Urinals shall conform to the hydraulic performance requirements of ASME A112.19.6, CSA B45.1 or CSA B45.5. Non-water urinals shall conform to ANSI/ASME A112.19.19.

4. Amend Section 420.1 as follows:

420.1 Approval. Toilets shall conform to the water consumption requirements of Section 604.4 and shall conform to ANSI Z124.4, ASME A112.19.2M, CSA B45.1, CSA B45.4 or CSA B45.5. Toilets shall conform to the hydraulic performance requirements of ASME A112.19.6. Toilet tanks shall conform to ANSI Z124.4, ASME A112.19.2, ASME A112.19.9M, CSA B45.1, CSA B45.4 or CSA B45.5. Electro-hydraulic toilets shall comply with ASME A112.19.13. Dual-flush toilets shall comply with flush volume testing requirements in ASME A112.19.14.

5. Add new Sections 420.6, 420.7 and 420.8 as follows:

420.6 Requirement for high-efficiency toilets. All toilets installed after July 1, 2010, shall be high-efficiency Watersense-labeled fixtures.

420.7 Requirement for dual-flush toilets. All toilets installed after January 1, 2013, shall be dual-flush. The commissioner may promulgate rules establishing signage explaining proper usage and water conservation benefits of dual-flush toilets.

Exception: Toilets with a flushometer valve and a sensor control device for automatic flushing.

420.8 Requirement for WaterSense lavatory faucets & showerheads. All residential lavatory faucet fixtures and shower head fixtures installed after July 1, 2010 shall be WaterSense-labeled fixtures.

6. Amend Section 604.4 as follows:

604.4 Maximum flow and water consumption. The maximum water consumption flow rates and quantities for all plumbing fixtures and fixture fittings shall be in accordance with Table 604.4.

Exceptions:
1. Blowout design toilets [3.5 gallons (13 L) per flushing cycle].
2. Vegetable sprays.
3. Clinical sinks [4.5 gallons (17 L) per flushing cycle].
4. Service sinks.
5. Emergency showers.

7. Amend Table 604.4 as follows:

TABLE 604.4

MAXIMUM FLOW RATES AND CONSUMPTION FOR PLUMBING FIXTURES AND FIXTURE FITTINGS

PLUMBING FIXTURE OR FIXTURE FITTING	MAXIMUM FLOW RATE OR QUANTITY[b]
Lavatory, private	[2.2] 1.5 gpm at 60 psi
Lavatory, public, (metering)	0.25 gallon per metering cycle
Lavatory, public (other than metering)	0.5 gpm at 60 psi
Shower head[a]	[2.5] 2.0 gpm at 80 psi
Sink faucet	[2.2] 1.5 gpm at 60 psi
Service sink	2.5 gpm at 60 psi
Urinal	[1.0] 0.2 gallon per flushing cycle
Toilet[c]	[1.6] 1.28 gallons per flushing cycle

For SI: 1 gallon = 3.785 L, 1 gallon per minute = 3.785 L/m,
1 pound per square inch = 6.895 kPa.

a. A hand-held shower spray is a shower head.
b. Consumption tolerances shall be determined from referenced standards.
c. Dual-flush toilets installed between July 1, 2010 and July 1, 2013 shall have an effective flush volume that shall not exceed 1.28 gallons (4.8 liters). The effective flush volume is defined as the composite average flush volume of two reduced flushes and one full flush. Dual-flush toilets installed after July 1, 2013 shall comply with the maximum flush volume in Table 604.4, which shall not exceed a total of 1.28 gallons (4.8 liters) for any flush cycle.

8. Amend Chapter 13 as follows:

Add ASME standard A112.19.14 after standard A112.19.13 as follows:
A112.19.14-2006 Six-Liter Toilets Equipped with a Dual-flushing Device.....420.1

Add ASME standard A112.19.19 after standard A112.19.14 as follows:

A112.19.19-2006 Vitreous China Nonwater Urinals.....419.1

9. Delete Section C102 (Waterless Urinals) in its entirety.

Amendments to the Administrative Code of the City of New York:

1. Add a new subchapter to Chapter 4 of Title 20 that is similar in substance and structure to Subchapter 12 (Endangered or Threatened Species) but contains the following prohibition language:

> Water efficient fixtures. a. It shall be unlawful to buy or sell, offer, or attempt to buy or sell, or cause any person to buy or sell any water fixture that does not comply with the water consumption requirements of section 604.4 of the New York city plumbing code.

Supporting Information

Issue – Expanded
New York City has experienced seven droughts over the last 45 years, two of which lasted for over a year.[1] Although there have not been serious droughts in two decades, repair of major system components, such as the Delaware Aqueduct leak, means that the City must either reduce consumption further or invest in expensive supply projects that are not required outside of emergencies and will be far less environmentally acceptable than the existing supply system. Improving water efficiency is the least expensive and most sustainable means to ensure there will be a sufficient supply of water to meet all of the City's needs. New Yorkers have been enormously successful in decreasing water consumption citywide from an average high of over 208 gallons per person per day in 1988 to approximately 137 gallons of water per person per day in 2003 (or 78 gallons per person per day when limited to residential water consumption).[2] This proposal builds upon this record of improving water efficiency.

Environmental & Health Benefits
This proposal is estimated to reduce water consumption by 5-7 gallons of water per person per day, or 3-4% over the next ten years. Using less water reduces wastewater flows, thus easing the burden on the City's already taxed wastewater treatment plants, reducing the energy spent on water treatment and distribution and reducing the incidence of combined sewer overflows. In addition, by removing impediments to the use of non-water urinals, we facilitate the use of water-efficient technologies.

This proposal was determined to have a high, positive environmental impact per building and to impact a large number of buildings. It was thus given an environmental score of 3.

This proposal was determined to have no significant health impact.

Cost & Savings
As described in the Executive Summary, Bovis Lend Lease prepared cost estimates for each Task Force proposal in the context of well-defined construction projects in specific buildings. Where possible, members of the Technical Committees prepared savings estimates for some of these projects and buildings. These cost and savings estimates are presented in the February 1st draft version of Appendix A. The innate uncertainty in how construction and operation will vary from one building to another, the complexity of the Task Force proposals, and the wide range of applications in which the proposals may be realized mean these figures are truly estimates.

For some buildings this proposal will result in no increase of capital costs and for others an increase of up to 0.08%. It was thus categorized as incurring no to a medium capital cost increment. This proposal was also estimated to generate financial savings that will pay for the capital costs in three to ten years or more than ten years depending on the building type.

Precedents
This proposal is largely consistent with the Environmental Protection Agency's WaterSense program, establishes voluntary standards for toilet and bath fixture flow rates.[4] A number of municipalities have mandated lower flow rates in local codes, some of which also reference the WaterSense requirements.[5] The International Code Council, which is adopted in 37 states plus Washington DC, is a partner with EPA's WaterSense guidelines.[6] These standards also align with proposed flow rates in ASHRAE Standard 189.1P.[7]

California has reduced flow rate requirements for fixtures; the recommended flow rates in this proposal either equal or surpass California's recommendations.[8] In addition, several California cities– including San Diego, Los Angeles, and San Francisco – have retrofit-on-resale ordinances, in which either the buyer or seller of a property is required to replace inefficient plumbing fixtures upon sale.[9]

Dual-flush toilets are common and often mandatory in developed countries that make water a priority, including Australia, Israel, Japan, and throughout Europe. For example, dual-flush toilets are mandatory in most parts of Australia and, as of 2001, 63% of Australian households have dual-flush toilets.[10]

LEED
This proposal will assist in achieving all Water Use Reduction & Innovative Wastewater Technology prerequisites and credits in LEED Water Efficiency sections of the various rating systems.

LEED 2009 for New Construction will implement changes to the format of the WE section. The following revised credits are relevant to the measures outlined under this proposal:

- LEED NC-WE prerequisite 1, Water Use Reduction: 20% Reduction
- LEED NC-WE cr.2, Innovative Wastewater Technologies
- LEED NC-WE cr.3, Water Use Reduction

LEED requires compliance with the Energy Policy Act of 1992 fixture performance requirements. Since this proposal refers to another standard for performance criteria, the project team will need to evaluate potential LEED compliance for individual projects.

LEED Water Efficiency measures only apply to water closets, urinals, lavatory faucets, showers, and kitchen sinks. The reduction in water use calculates water savings for these fixture types, and factors in any greywater volume for additional reduction in potable water usage under this credit.

Implementation and Market Availability
The fixtures required by 2013 under this proposal are readily available.

Numerous manufacturers produce dual-flush toilets and some have dual-flush models that use a maximum of 1/28 gpf, including American Standard and Caroma,.

Notes
1. The committee had mixed views on limiting the flow rate of sink faucets to 1.5 gpm. To the extent kitchen faucets are used for filling basins, a lower flow rate will increase waiting time. On the other hand, kitchen sink faucets are often left running during dish washing, meaning a lower flow rate will save water. Understanding this issue completely would require a study on how humans behave with different flow kitchen faucets. The committee ultimately opted for the lower flow rate.

2. Some committee members expressed concern that the low flushing volume of .2 gpl urinals or non-water urinals could potentially lead to issues of drain line cleanliness. Nonetheless, there was consensus that this limited concern should not be a boundary to greater water efficiency. It was suggested that drain line cleanliness be taken into account when installing .2 gpf or non-water urinals by placing them first to the stack with water closets behind them.

3. The committee spent more time on the question of whether to require dual-flush toilets than any other issue in this proposal. Initially, the issue was considered as a choice between requiring 1.28 gpf toilets or dual-flush toilets. In that context, there was considerable debate whether, given the variances of use patterns, a dual-flush toilet would actually lead to lower consumption than a 1.28 gpf toilet. Ultimately, the committee recast the policy options to first require 1.28 gpf toilets in 2010, and then requiring that these toilets (with a maximum flush of 1.28 gpf) also be dual-flush by 2013.

This attention to toilets is apt since in a typical household, more water is used for toilet flushing than any other use. Studies have shown, with proper education, dual-flush toilets can lead to dramatic reductions in water use.

4. A comparison of five independent studies on dual-flush water usage found that dual-flush toilets result in 23%-32% less water usage than conventional fixtures and the average water savings from replacing existing plumbing fixtures with dual-flush fixtures was 10,600 gallons per year per home.[11] These reductions have held up with dual-flush toilets tested outside of homes. In a Canadian study, flush volumes were reduced by 68% in single-family homes, 56% in offices, and 52% in an average coffee shop.[12] This same study also showed dual-flush toilets to be consumer friendly – 66% of participants said they would definitely recommend dual-flush toilets to others.[13]

While dual-flush toilets dramatically reduce water usage and overall cost, the exact amount varies depending on the use of a building and whether or not urinals are also installed. Some commentators have noted that potential improvements from dual-flush toilets may not be realized without appropriate user education.[14]

5. Estimates of citywide savings are based on the calculations provided below:

How Enhanced Water Efficiency Standards for Plumbing Products Reduces Per Capita Residential Water Consumption (gcpd = Gallons per Capita per Day)		
End Use	Total Savings (Additional Savings)	Notes
Toilet Use at Home	13.2 gcpd (2.4 gcpd)	4.5 gpf – 1.2 gpf = 3.3 gpf * 4 flushes per day = 13.2 gcpd savings
Showerheads	14 gcpd (3.5 gcpd)	4 gpm – 2 gpm = 2 gpm * 7 minutes per shower = 14 gcpd
Faucets	6 gcpd (3 gcpd)	2 gpm reduction * 3 minutes per day = 6 gcpd
Toilets and Urinals at Work	5.8 gcpd (3.6 gcpd)	Males: (3.5 gpf – 0.5 gpf) * 2 uses = 6 gcpd Females: (4 gpf – 1.28 gpf) * 2 uses = 5.4 gcpd
Total at Home	33.2 gcpd (8.9 gcpd)	
Total at Work	5.8 gcpd (3.6 gcpd)	

Abbreviations and Acronyms:

gcpd = Gallons per capita per day

gpf = Gallons per flush

gpm = Gallons per minute

4.5 gpf = water use of pre-1980 toilets (some are 5 gpf or more)

1.2 gpf = water use of mix of single-flush High Efficiency Toilets and Dual-flush Toilets

4 gpm = Flow rate for pre-1990 showerheads (some are 5 gpm or more)

2 gpm = Proposed new showerhead flow rate (Current Code is 2.5 gpm)

Old faucets flow at anywhere from 3 gpm to 6 gpm

Existing fixture standards will already provide significant water savings over time. The proposed new standards will increase those savings significantly: About 27% increased saving in home water use and 62% savings in water use in the workplace compared to current standards alone.

Existing Residential Water Use: 78 gcpd average,

Fixture Replacement Rates: 20-30 years (toilets and faucets); 10 years (showerheads)

Toilets: 45% currently 1.6 gpf, 5% currently 3.5 gpf; 50% 5 gpf (oldest portion, mostly in 1-20 unit residential buildings)

After 10 years: All showerhead savings attained, 30% of toilet and faucet savings: Average (13.2 gcpd * 0.3) + 14 gcpd + (6 gcpd * 0.3) = 19.96 gcpd (25.5% reduction in residential use, 18.6% reduction in citywide use)

After 20 and 30 years: Additional (13.2 gcpd * 0.3) + (6gcpd * 0.3) = 5.96 gcpd

After 30 years: 19.96 + 5.96 + 5.96 = 31.88 gcpd

Conservatisms and other Notes:

4.5 gpf used for older toilets instead of nominal 5 gpf.

1.2 gpf reflects mix of HET single flush and dual-flush fixtures

4 gpm used for old showerheads based on field data rather than 5 gpm nominal

Additional savings in second and third decades may be less as the toilet being replaced is increasingly more likely to be 3.5 gpf or even 1.6 gpf.

ENDNOTES:

[1] New York City EPA, History of Drought and Water Consumption http://www.nyc.gov/html/dep/html/drinking_water/droughthist.shtml, (last visited Jan. 19, 2010).

[2] New York City EPA, History of New York City's Water Supply System, http://nyc.gov/html/dep/html/drinking_water/history.shtml (last visited Jan. 19, 2010).

[4] U.S. EPA, NATIONAL EFFICIENCY STANDARDS AND SPECIFICATIONS FOR RESIDENTIAL AND COMMERCIAL WATER, ENVIRONMENTAL PROTECTION AGENCY: USING FIXTURES AND APPLIANCES, http://www.epa.gov/WaterSense/docs/matrix508.pdf (last visited April 9, 2009).

[5] U.S. EPA, WaterSense: Meet our Partners, http://www.epa.gov/watersense/meet_our_partners.html (last visited Oct. 8, 2009).

[6] Ibid.

[7] AMERICAN SOCIETY OF HEATING, REFRIGERATORS, AND AIR-CONDITIONING ENGINEERS, PUBLIC REVIEW DRAFT: ASHRAE STANDARD, (2008) available at http://www.sanantonio.gov/Mayor/EnvironmentalPolicy/attachments/ASHRAE%20189%20Public%20Review.pdf.

[8] CAL. CODE, Tit. 24 § pt. 11 § 603, 42-43 (2008), available at http://www.documents.dgs.ca.gov/bsc/2009/part11_2008_calgreen_code.pdf.

[9] Alex Wilson, Water Policies: Encouraging Conservation, ENVIRONMENTAL BUILDING NEWS, Sept. 1, 2008, available at http://www.buildinggreen.com/auth/article.cfm/ID/4007.

[10] GEORGE WILKENFELD AND ASSOCIATES, A MANDATORY WATER EFFICIENCY LABELING SCHEME FOR AUSTRALIA, 29, 68 (2003), available at http://www.waterrating.gov.au/publications/pubs/strategic-study.pdf.

[11] John Koeller et. al., Dual-Flush Toilet Fixtures- Field Studies and Water Savings, KOELLER AND COMPANY (2003), http://www.allianceforwaterefficiency.org/WorkArea/linkit.aspx?LinkIdentifier=id&ItemID=836.

[12] CANADA MORTGAGE AND HOUSING CORPORATION, RESEARCH REPORT: HOUSING TECHNOLOGY SERIES: DUAL-FLUSH TOILET PROJECT (2002), http://www.cmhc-schl.gc.ca/odpub/pdf/63042.pdf.

[13] Ibid.

[14] U.S. EPA, WATER DEMAND BULLETIN, 91 (2008).

WE 2:
UPGRADE INEFFICIENT TOILETS, SHOWERHEADS & FAUCETS DURING RENOVATIONS

New York City Building Code
Proposal developed by the Water Efficiency & Building Stormwater Committee

Summary

Issue:
Older toilets and fixtures use three to five times as much water as today's standard fixtures.

Recommendation:
Require the replacement of any outdated plumbing fixtures when bathrooms are renovated.

Proposed Legislation, Rule or Study

Amendments to the New York City Building Code:

1. Add a new Section 2903 as follows:

SECTION BC 2903
UPGRADE UPON MAJOR RENOVATION

2903.1 Definitions. Definitions used in the New York City Plumbing Code shall apply in this section.

2903.2 Bathroom fixture replacement upon major renovation requiring a permit. Upon any alteration to any bathroom or restroom requiring a permit, any toilet, or showerhead that does not comply with the water consumption requirements of section 604.4 of the New York City Plumbing Code shall be replaced with a compliant model. Any sink or lavatory faucet that does not comply with the water consumption requirements of section 604.4 of the New York City Plumbing Code shall either be fitted with an aerator to bring such faucet into compliance or be replaced with a compliant faucet.

Exception: Any toilet that does not consume more than 1.6 gallons of water per flush.

Supporting Information

Issue – Expanded
Pre-1980 toilets can use as much as 7 gallons per flush (the equivalent of nearly 1½ water-cooler bottles), and other old plumbing fixtures use correspondingly large amounts of water. Although New York City has instituted incentive-based toilet replacement programs in the past and new toilets must comply with federal water efficiency requirements, there are still many wasteful plumbing fixtures in the city.

This proposal will only be triggered when plumbing fixtures are moved or added, not during simple replacements of fixtures or other standard bathroom renovation work.

Environmental & Health Benefits
Requiring more efficient fixtures will reduce water consumption, resulting in less wastewater treatment and reduced frequency of combined sewer overflows. This proposal will also generate business for plumbers and plumbing supply companies.

This proposal was found to have a low, positive environmental impact per building and to impact a small number of buildings. It was thus given an environmental score of 1.

This proposal was found to have no significant health impact.

Cost & Savings

As described in the Executive Summary, Bovis Lend Lease prepared cost estimates for each Task Force proposal in the context of well-defined construction projects in specific buildings. Where possible, members of the Technical Committees prepared savings estimates for some of these projects and buildings. These cost and savings estimates are presented in the February 1st draft version of Appendix A. The innate uncertainty in how construction and operation will vary from one building to another, the complexity of the Task Force proposals, and the wide range of applications in which the proposals may be realized mean these figures are truly estimates.

This proposal is not expected to have any significant impact on capital costs. This proposal was also estimated to generate financial savings that will pay for any capital costs in less than three years.

Precedents

New York City would not be the first major city to pass a law requiring the replacement of water-wasting fixtures during renovations.[i] A similar ordinance, for example, was proposed in San Francisco in February by Mayor Gavin Newsom and Supervisor Sophie Maxwell.[ii] Furthermore, a parallel San Francisco ordinance would require the replacement of outdated fixtures in all commercial buildings.[iii] Both ordinances have the support of the Building Owners and Managers Association and San Francisco Apartments Association.[iv]

Additionally, smaller municipalities have passed more extensive ordinances for outdated fixture replacement. The Marina Coast Water District (encompassing the City of Marina and Fort Ord in California), for example, requires upgrading to low-flow fixtures during new construction, any renovation that involves district review, any renovation that involves replacement of fixtures, and changes of ownership.[v] Also, all hotels and apartment buildings were required to install at least low-flow showerheads within a specified period of time following the enactment of the ordinance.[vi]

LEED

This proposal would help buildings to meet the LEED-EB 2009 Water Efficiency prerequisite WE1, Minimum Indoor Plumbing Fixture and Fitting Efficiency and WE Credit 2, Additional Indoor Plumbing Fixture and Fitting Efficiency.

Implementation & Market Availability

All plumbing fixtures required under this proposal are off-the-shelf products that are produced by all major manufacturers.

Notes

1. The proposal will only apply to a gut renovation of a bathroom in which fixtures are moved or added, since the requirement is tied to the issuance of a plumbing permit. A permit is not required for the vast majority of renovation work to bathroom, including the replacement of fixtures and retiling. A building permit is only required for work in a bathroom involving changes to the roughing (pipes leading to or from the drainage or supply plumbing).
2. Toilets that do not consume more than 1.6 gpf are exempted from the replacement requirement in this proposal because the committee's primary intent was to replace the truly water-guzzling toilets permitted prior to 1994. The committee felt that the water savings from replacing a 1.6 gpf toilet with a 1.28 gpf toilet would not justify the financial cost of doing so. Future studies of savings from dual-flush toilets may justify the repeal of this exception beginning 2013 when dual flush would be required in New York City under the *Enhance Water Efficiency Standards* proposal.

ENDNOTES:

[i] Joshua Sabatini, City Wants to Curb Flow of Water, SAN FRANCISCO EXAMINER, Feb. 25, 2009, available at http://www.sfexaminer.com/local/40268922.html; and San Francisco, CA., Residential Water Conservation Ordinance Amendments, File No. 090225 (2009), available at http://www.sfgov.org/site/uploadedfiles/bdsupvrs/committees/materials/090225tdr.pdf.

[ii] Joshua Sabatini, City Wants to Curb Flow of Water, SAN FRANCISCO EXAMINER, Feb. 25, 2009, available at http://www.sfexaminer.com/local/40268922.html;

[iii] San Francisco, CA., Residential Water Conservation Ordinance Amendments, File No. 090225 (2009), available at http://www.sfgov.org/site/uploadedfiles/bdsupvrs/committees/materials/090225tdr.pdf.

[iv] Ibid.

[v] MARINA COAST, CA., WATER DISTRICT CODE, Tit. 3 § 3.36.030 (2001), available at http://www.mcwd.org/code_3_water_svc_system.html#336020.

[vi] Ibid.

WE 3:
CATCH LEAKS BY MEASURING WATER USE

New York City Plumbing Code
Proposal developed by the Water Efficiency & Building Stormwater Committee

Summary

Issue:
Leaks and equipment malfunctions waste a tremendous amount of water in New York City buildings and they can persist undetected for years. Sub-meters attached to major water-using equipment can help detect these leaks.

Recommendation:
Require sub-meters for all major water-using equipment. These sub-meters will help building managers quickly detect leaks and malfunctions.

Proposed Legislation, Rule or Study

Amendments to the New York City Plumbing Code:

1. Amend Section 608.16.2 as follows:

608.16.2 Connections to boilers. The potable supply to the boiler shall be equipped with a backflow preventer with an intermediate atmospheric vent complying with ASSE 1012 or CAN/CSA B64.3. Where conditioning chemicals are introduced into the system, the potable water connection shall be protected by an air gap or a reduced pressure principle backflow preventer, complying with ASSE 1013, CAN/CSA B64.4 or AWWA C511. Makeup water supplies to boilers serving buildings with more than five stories shall be equipped with a water meter from a list promulgated by the department of environmental protection along with inlet and outlet isolation valves.

2. Amend Section 606.5.4.1 as follows:

606.5.4.1 Water piping control and location. Water inlets to gravity house tanks shall be controlled by a ball cock or other automatic supply valve or emergency electrical cut-off so installed as to prevent the overflow of the tank in the event that the pumps filling the tanks do not shut off at the predetermined level or the street pressure rises to a point where it can fill the tank. The water inlet to a suction tank shall be controlled by a ball cock or other automatic supply valve. The inlet shall be terminated so as to provide an accepted air gap but in no case shall it be less than 4 inches (102 mm) above the top of the overflow. The outlet from a gravity tank to the distribution system shall be equipped with a strainer located at least 2 inches (51 mm) above the tank bottom to prevent solids from entering the piping system. All down-feed supplies from a tank cross-connected in any manner with distribution supply piping in a building supplied by direct street or pump pressure, shall be equipped with a check valve on the main cold water down supply to prevent backflow of water into the roof tank. All roof tanks shall be provided with a high water level alarm at or slightly below the overflow.

3. Add a new subsection 606.7 to Section 606 as follows:

606.7. Equipment and area submeters. Water submeters from a list promulgated by the department of environmental protection shall be installed on the makeup water lines for each of the following: evaporative cooling towers, boilers serving buildings with more than five stories, and commercial tenants in food and laundry related businesses, gyms, spas, and swimming pools.

Supporting Information

Issue – Expanded
Sub-meters provide building owners and managers with the necessary information to make informed decisions regarding their water consumption. With sub-meters, an owner or manager can identify changes in water consumption that may be attributed to leaks or faulty equipment, directly bill tenants for water consumption, and identify areas of excessive water use. In addition, sub-meters enable building owners to provide the City with more detailed water consumption information, which may be assist in making infrastructure decisions. It is particularly important to monitor

cooling towers, rooftop water supply tanks, and boilers given the quantity of water used and/or the potential for leaks or other waste.

In many office buildings, evaporative cooling towers use more water than domestic uses. Cooling towers work by rejecting heat from building air conditioning systems using a water spray that dissipates heat as the water evaporates into the atmosphere. The water level in a cooling tower basin is controlled by a simple float valve that turns off the supply of make up water when the basin is full. However, the float valve can fail, causing the water level to increase until it overflows into the sewer, wasting hundreds or thousands of gallons an hour.

The refill of a rooftop water supply tank operates in much the same way with the same potential for large-scale water loss. Without alarms to inform the building owner of possible leak conditions, large-scale waste may remain undetected for days or even months. Likewise, water flows into boilers to make up for evaporative or blow down losses as well as condensate leaks. Without a makeup water meter these losses will not be detected at all.

The alarms being recommended in this proposal would either make a sound or send a signal to a building management computer if the level of water in a cooling tower basin or roof tank rises above the overflow point.

Environmental & Health Benefits
Environmental benefits of efficient water use are directly related to the amount of freshwater available for human consumption. Less than 2.5% of the earth's water is freshwater, and most of this is locked up in ice caps and glaciers.[1]

This proposal was determined to have a low, positive environmental impact per building and to impact a small number of buildings. It was thus given an environmental score of 1.

This proposal was determined to have no significant health impact.

Cost & Savings

As described in the Executive Summary, Bovis Lend Lease prepared cost estimates for each Task Force proposal in the context of well-defined construction projects in specific buildings. Where possible, members of the Technical Committees prepared savings estimates for some of these projects and buildings. These cost and savings estimates are presented in the February 1st draft version of Appendix A. The innate uncertainty in how construction and operation will vary from one building to another, the complexity of the Task Force proposals, and the wide range of applications in which the proposals may be realized mean these figures are truly estimates.

For some buildings this proposal will result in no increase of capital costs and for others an increase of up to 0.03%. It was thus categorized as incurring no to a low capital cost increment. This proposal was also estimated to generate financial savings that will pay for the capital costs in three to ten years or more than ten years depending on the building type.

Precedents
Water submetering is required under the 2008 California Green Building Standards Code for both indoor and outdoor potable water outlets.[2] In addition, Texas requires submetering of water use for all new construction begun after January 1, 2003.[3] The New York State Energy Code already requires submetering of electricity in new or renovated construction; the addition of water submetering as a means of allowing tenants to monitor their own water consumption would be consistent with this requirement.

There are no known precedents for requiring overflow alarms on roof tanks.

LEED
For existing buildings, water metering is addressed by LEED EB-EA cr.5.1-5.3, Performance Measurement, Enhanced Metering.

For other rating systems, LEED EA credits for Measurement & Verification require the implementation of a M&V Plan consistent with the International Performance Measurement & Verification Protocol (IPMVP) Volume III, April, 2003, which concerns energy conversation measures. However, the LEED credit expands upon typical IPMVP M&V objectives, and M&V activities should not necessarily be confined to energy systems. In fact, the case study presented in the LEED NC reference manual highlights the Frito-Lay Jim Rich Service Center in Rochester, NY, which monitored water through metering, along with other systems. Therefore, this proposal could also potentially contribute to earning the following credits:

- LEED NC-EA cr.5 Measurement & Verification
- LEED CI-EA cr.3 Energy Use, Measurement & Payment Accountability
- LEED for Schools EA cr.5 Measurement & Verification

Additionally, LEED 2009 encourages building owners to include water-using systems in their Commissioning plans, as

appropriate. While ongoing metering is not a component of Commissioning, LEED cites a synergy with this process as it also verifies performance of systems.

Implementation & Market Availability
There are no known implementation issues for this proposal. Water meters and overflow alarms are readily available.

Notes
1. A Submeter is a water meter owned, maintained and operated by the building owner for the purpose of monitoring water use by a specific end use, tenant or physical portion of a building. In this case, submeters are recommended for the makeup water lines of evaporative cooling towers to monitor for efficient operation of the tower, for makeup water lines for boilers, to help detect steam condensate system losses or excess boiler blow-down, for food- and laundry-related tenants because they are usually typically high water users and for large functional or physical portions of a building as well as gyms and spas containing water using equipment such as swimming pools, hydro-therapy pools, showers and toilet facilities, etc.
2. While not a requirement, it is strongly recommended that the requisite submeter be provided with a centrally located totalizing display or connected to a Building Automation System to allow building operators to more easily view water use profiles. Further, the committee strongly recommends that the DEP make available on line or via email water meter readings for total building water use.
3. The committee intended to include a provision in subsection 606.7 that would require a meter "for any tenant with a separate tap off the base building water system serving a single or multiple floors totaling 50,000 square feet or more." Servicing tenants for water with a dedicated tap is nonconventional practice but does occur in NYC. The committee was unable to finalize this language and appropriate costing assumptions for a nonconventional practice in time for the publication of this report. One potential source of appropriate code language for this provision is section 409 of the IAPMO Uniform Plumbing Code.
4. Mechanical Code section 908.5 requires that the Plumbing Code be followed with respect to water supply.

ENDNOTES:

[1] Blue Egg, Potable Water: Our Global Drinking Problem, http://www.blueegg.com/article/Potable-Water-Our-Global-Drinking-Problem.html (last visited Apr. 8, 2009).

[2] CAL. CODE, Tit. 24 § pt. 11 § 603, 29 (2008), available at http://www.documents.dgs.ca.gov/bsc/2009/part11_2008_calgreen_code.pdf.

[3] TEXAS WATER CODE ANN. § 13.501 (2003), available at http://www.tceq.state.tx.us/assets/public/permitting/watersupply/ud/forms/subchapm.pdf.

WE 4:
FACILITATE USE OF RECYCLED WATER

New York City Plumbing Code
Proposal developed by the Water Efficiency & Building Stormwater Committee

Summary

Issue:
Using rainwater and recycled water can reduce stress on the city's water supply while simultaneously reducing the volume of combined sewer overflow. But the Plumbing Code currently discourages reuse by limiting applications and requiring all recycled water to follow the same stringent protocols, regardless of end use or incoming water quality.

Recommendation:
Facilitate the use of rainwater and recycled water by tailoring protocols according to incoming water quality and end use, and expand the permitted uses of such water.

Proposed Legislation, Rule or Study

Amendments to the New York City Plumbing Code:
1. Amend Section C101.1 as follows:

C101.1 General. This section provides standards for the recycling of greywater, blackwater and rainwater piped within a building. [Water recycling systems shall receive storm water captured from roofs and balconies, condensate reclamation systems, gray water discharge only of lavatories from public restrooms in commercial office buildings, and the treated effluent from an approved black water treatment system as regulated by Department of Health and Mental Hygiene.] Recycled water shall be utilized only for flushing water closets and urinals, cooling tower makeup, washing of sidewalks, streets or buildings, vehicle washing, laundry, irrigation systems that are located in the same lot as the water recycling system and any other uses permitted by the department. Recycled water shall be considered non-potable. Such systems shall comply with sections C101.2 through C101.1[2]4.

Exceptions.
1. Rainwater where all piping is exterior to the building and that is used solely for subsurface irrigation, drip irrigation or washing of sidewalks, streets, buildings or vehicles.
2. Commercial car washing facilities.

2. Amend Section C102.1 as follows:

BLACKWATER. Wastewater discharged from water closets, urinals, clothes washers and any other fixtures discharging animal or vegetable matter in suspension or solution.

GREYWATER. Wastewater discharged from lavatories, bathtubs, showers, [clothes washers] steam condensate and laundry sinks.

RAINWATER. Precipitation collected from roofs, roof setbacks or balconies.

3. Amend Section C101.6 as follows:

C101.6 Disinfection. Recycled water shall be disinfected by an approved method that employs ultraviolet or one or more disinfectants such as chlorine, iodine or ozone.

Exception. The following sources of water may be used for the following purposes without additional disinfection:
1. Steam condensate used for any purpose authorized in section C101.1; or
2. Rainwater used solely for subsurface irrigation, drip irrigation, or washing of sidewalks, streets, buildings or vehicles.

4. Amend C101.7 to add an exception as follows:

Exception: Rainwater used for subsurface irrigation, drip irrigation, and washing of sidewalks, streets, buildings or vehicles.

5. Section C101.11 is amended as follows:

C101.11 [Coloring. The recycled water shall be dyed blue or green with a food grade vegetable dye before such water is supplied to the fixtures.] Reserved.

6. Section C101.12 is amended as follows:

C101.12 Identification. All recycled water distribution piping and reservoirs shall be painted purple and identified in writing as containing nonpotable water. Piping identification shall be in accordance with Section 608.8. Any hose bibb supplied with recycled water shall be colored purple in accordance with the Uniform Plumbing Code (2009 edition) and identified with a sign stating, "Do Not Drink." Any hose attached to such a hose bibb shall be colored purple.

7. Add new sections C101.13 and C101.14 as follows:

C101.13 Water closet-sink combinations. Notwithstanding any other provision of this appendix, a fixture that enables waste water from a lavatory sink to discharge directly into the flushing tank of a water closet may be utilized.

C101.14 First-flush diverters. All recycling systems for stormwater exempted from Section C101.6 shall include a first-flush diverter, which shall divert the first flow of water from the catchment service. First-flush diverters shall be sized so that the minimum volume of water diverted is equal to at least one (1) gallon (3.8 L) per each hundred (100) square foot (9.3 m2) of catchment area served.

Supporting Information

Environmental & Health Benefits
By facilitating water recycling, this proposal will decrease the use of potable water for non-drinking purposes and reduce the volume of stormwater entering New York's sewer system, thus helping to reduce combined sewer overflows.

This proposal was found to have a high, positive environmental impact per building and to impact a small number of buildings. It was thus given an environmental score of 2.

This proposal was found to have no significant health impact.

Cost & Savings
As described in the Executive Summary, Bovis Lend Lease prepared cost estimates for each Task Force proposal in the context of well-defined construction projects in specific buildings. Where possible, members of the Technical Committees prepared savings estimates for some of these projects and buildings. These cost and savings estimates are presented in the February 1st draft version of Appendix A. The innate uncertainty in how construction and operation will vary from one building to another, the complexity of the Task Force proposals, and the wide range of applications in which the proposals may be realized mean these figures are truly estimates.

This proposal is not expected to have any significant impact on capital costs.

Precedents
Rainwater

Few U.S. jurisdictions regulate rainwater, in part due to an assumption of relatively high quality and part because rainwater collection and reuse is generally decentralized and used mainly for subsurface irrigation. That particular use may have limited utility in New York City. Neither the International Plumbing Code (IPC) nor the Universal Plumbing Code directly addresses using captured rainwater for flushing water closets and urinals. Although the NYC-PC is largely based on the IPC, it specifically mentions rainwater from certain sources as approved for certain end uses, if it is filtered and disinfected.

Some U.S. jurisdictions allow for limited, untreated uses. Massachusetts allows the use of runoff from non-metal roofs for toilet flushing, and also allows the re-use of stormwater runoff for irrigation without a permit if it is not exposed to land uses with higher potential for pollution than the runoff source.

Other U.S. jurisdictions that allow such uses have not done so through formal rules or statues based upon scientific studies of water quality or public health. For example, in October 2008, San Francisco Mayor Gavin Newsom began a city initiative that promoted rainwater harvesting for "non-drinking purposes like outdoor irrigation and indoor toilet use."[1] Mayor Newsom, the San Francisco Public Utilities Commission, the Department of Public Health, and the Department of Building Inspection signed a Memorandum of Understanding that allows for rainwater usage in toilets

without "requiring treatment to potable standards."[2] San Francisco requires only a basic filtration of the rain water and a backflow prevention device.[3]

In January 2007, Seattle and King County Department of Public Health issued a "Policies and Procedures" memo that formally established rainwater harvesting guidelines in Seattle.[4] The memo allows "harvested rainwater to supply certain types of plumbing fixtures in structures while maintaining the standards for adequate public health protection."[5] The allowable applications include "water closets, urinals, hose bibs, industrial applications, domestic clothes washing, irrigation and water features."[6] Seattle and King County require pre-storage treatment to "divert debris and/or 'first flows' prior to entering the storage system;" the CAM recommends using "leaf screens" and "self cleaning bug screens" for the Pacific Northwest.[7] [8] For final water quality treatment, "[s]creen systems and/or basic mechanical filtration are typically adequate for . . . toilet flushing."[9] All other installation and connection matters are governed by the Uniform Plumbing Code.[10]

In many international jurisdictions, rainwater is not required to be treated before being used for toilet flushing.[11] Generally, these jurisdictions require clearly marked pipes, a system to prevent cross-contamination (such as an airgap), and usually a roofwasher or some type of preliminary filter.[12] Rainwater is permitted (or in some cases required) for toilet flushing in France (pipes must be labeled),[13] Beligum (rainwater harvesting required in new construction),[14] Germany,[15] and the UK.[16] Furthermore, according to a UK report, in depth studies have been conducted in Germany, which have found that "if rainwater is collected properly, it can be used in toilets and washing machines without being disinfected."[17]

Greywater

In the U.S., the arid states have pioneered reuse standards. California has had health, design, and operational requirements for reuse projects since 1978. California has a new statute (11/12/2008) that requires standard-setting for greywater systems for the first time. Arizona has a well-regarded code that has been copied in other states. New Mexico, Colorado, Texas, Florida, Massachusetts, Connecticut, Oregon, Utah, Vermont, Washington and other states have some variation of reuse standards.

In almost all of the state regulations, untreated greywater is limited to irrigation, and in many cases only subsurface irrigation, for non-food crops. Greywater regulation is almost exclusively aimed at small residential properties with sufficient unbuilt land area to absorb on-site flows. For example, Arizona's code contains a general permit for such uses. California allows only subsurface irrigation onto zones of specific sizes and soils, but still requires a permit and operation and maintenance plan. The UPC, followed in many jurisdictions but not New York City, only allows greywater to be used in residential subsurface landscape irrigation. The use of untreated greywater in densely-populated urban areas without such areas, and for uses other than irrigation, is a largely untested proposition. For example, the IPC, followed in many jurisdictions including New York City, allows reuse only after disinfection and dyeing for subsurface irrigation and toilet flushing. (301.3, App. C 101). The Greywater Code of Queensland, Australia, generally considered to be one of the most progressive in the world, requires the treatment and disinfection of greywater before re-use in toilet flushing. New York State's 2007 plumbing code specifies filtration, disinfection, and dyeing of greywater, and explicitly allows it only for toilet flushing. Other uses presumably require a variance. There are unconfirmed reports of untreated uses for toilet flushing in Germany, but the presence of sophisticated systems in that country for that application (e.g., Pontos Aquacycle[18]) suggests that some treatment is required there. (A similar system in the Netherlands is the Muiden Ecoplay.[19]) International reviews (Lazarova, 2003; Alkhatib, 2006) found that toilet flushing universally requires pre-treatment units of varying complexity.

Rather than mandating treatment, another approach is to regulate greywater along with reclaimed water or other sources through the application of source-neutral water quality standards that depend on end-uses, which presupposes a regulatory apparatus to permit, monitor, and enforce the limits. For example, the recently-adopted Massachusetts Reclaimed Water Code[20], requires a state permit, engineering report, and reuse management plan, unless greywater is used only for subsurface irrigation and disposal. The permit system provides for the following classes and uses of reclaimed water:

Class A water

- Uses: irrigation where contact likely; cooling where mist may make contact if chlorine or other biocide used to treat recirculating water; toilet and urinal flushing; food crop irrigation; industrial process water, commercial laundries and carwashes; snowmaking, fire protection
- Standards: pH of 6.5-8.5; BOD<10 mg/l; TSS<5 mg/l; Turbidity < 2 NTU; Total Nitrogen < 10 mg/l (exceptions allowed); median of no detectable fecal coliform / 100 ml over continuous 7 day samples, not to exceed 14/100 ml in any one sample

Class B water

- Uses: irrigation where contact unlikely; cooling water where mists and aerosols not created; irrigation for pasture and unprocessed food crops where there is no contact with edible portion of the crops; wetlands and recreational impoundments; dust control; soil compaction; mixing and washing concrete and aggregate; street cleaning

- Standards: pH of 6.5-8.5; BOD<30 mg/l; TSS<10 mg/l; Turbidity < 5 NTU; Total Nitrogen < 10 mg/l (exceptions allowed); median of 14 detectable fecal coliform / 100 ml over continuous 7 day samples, not to exceed 100/100 ml in any one sample

Class C water

- Uses: orchard and vineyard irrigation if no contact with edible portions; closed systems for industrial process water; industrial boiler feed; silviculture
- Standards: pH of 6.5-8.5; BOD<30 mg/l; TSS<30 mg/l; Turbidity < 10 NTU; Total Nitrogen < 10 mg/l (exceptions allowed); median of 200 detectable fecal coliform / 100 ml over continuous 7 day samples, not to exceed 800/100 ml in any one sample

The World Health Organization, Israel, Jordan and South Africa, among others, have developed specific regulatory requirements including maximum permissible levels of various contaminants. However, many of these guidance documents are directed towards irrigation of food and non-food crops. Exceptions are European Union countries and Australia, which has a federal system that is similar to ours, but with more developed national guidelines and binding state standards. Australia is in the midst of promulgating national guidelines to address health concerns in a comprehensive way.

LEED

This proposal will assist in achieving all prerequisites and credits in LEED Water Efficiency sections of the various rating systems.

LEED 2009 for New Construction will implement changes to the format of the WE section. The following revised credits are relevant to the measures outlined under this proposal:

- LEED NC-WE prerequisite 1, Water Use Reduction: 20% Reduction
- LEED NC-WE cr. 1.1 & 1.2, Water Efficient Landscaping
- LEED NC-WE cr.2, Innovative Wastewater Technologies
- LEED NC-WE cr.3, Water Use Reduction

LEED also addresses the use of treated stormwater as one method of reducing the amount of wastewater going into the sewer system. For these purposes, this proposal will assist in achieving all stormwater design credits in LEED Sustainable Sites sections of the various rating systems

Implementation & Market Availability

There are no known implementation issues for this proposal.

Notes

To Wait or Not to Wait?

The New York State Legislature has mandated that New York State Department of Health publish a report on water reuse by February 2008 and adopt water quality and operational standards by February 2009.[21] Little progress has been made on the report, let alone regulations, despite the publication of a second working draft report in February 2008.

A central discussion of the committee was whether to recommend that NYC convene a blue ribbon commission to develop water reuse standards in the absence of action by NYS DOH. One perspective is that regardless of delays at NYS DOH ultimately there will be statewide standards that will supersede any NYC standards. Even if NYC convened a commission immediately after publication of the task force report, it would probably take at least a year before the city promulgated standards. That time could be better spent encouraging NYS to enact standards. In addition, there are public policy advantages to having a single statewide standard, such as economies of scale in terms of expertise and equipment and ease of enforcement. The NYC DOH felt strongly that water reuse standards are better left to NYS.

Another perspective is that NYC cannot control NYS DOH, which thus far has not even complied with a state law that would lead to statewide standards. According to this perspective, it is better to have interim NYC standards than continue indefinitely without water reuse standards. One potential source for these interim standards is those used by The Solaire since 2004 and some other buildings in NYC under prior authorization from NYC DOH.

Ultimately, the committee was swayed by NYC DOH's views and decided against recommending the formation of an NYC blue ribbon commission on water reuse.

How Safe is Safe Enough?

The committee spent months discussing the degree to which variations in system design could be applied to different water sources or for different end uses.

One approach is, in the absence of comprehensive standards, to design systems so that recycled water is safe for all

potential uses other than drinking water.

Another perspective is that applying the same standard regardless of water source or end use is needlessly stringent and will impede water reuse. This perspective is informed by a desire to reduce potable water consumption and stormwater, recognizing that additional requirements will likely lead to greater costs and reduce water recycling. Smaller buildings are likely to be particularly price sensitive, whereas larger buildings will have greater capacity to absorb higher costs.

The committee attempted to strike a balance between these two approaches. Most water sources and end uses will be subject to the same standards with the following exceptions:

- Steam condensate, which comes from water heated to over 212 degrees Fahrenheit and is thus sterile, will be exempt from disinfection requirements.
- Rainwater also provides a reasonably clean source of water and is exempted from some requirements of Appendix C when used for limited purposes. Rainwater piped external to a building, such as rain barrels and cisterns, is entirely exempt from Appendix C. Rainwater piped inside a building must comply with most requirements of Appendix C, but not requirements for treatment and make-up water.
- Single unit sink-toilet combinations are also exempted from the requirements of Appendix C.

Clean Toilet Water?

The committee spent considerable time discussing whether to allow untreated but filtered rainwater for flushing toilets and urinals. In a typical building, toilet flushing is the largest water end use and also is a particularly unclean end use, meaning it offers significant potential for water reuse.

The potential for objective decision-making was limited by the absence of testing data on pathogens that may exist in rainwater (carried from a roof) and may pre-exist in toilets and urinals. One approach is water quality must be high because people can drop objects in toilets and, if untreated, pathogens may grow when water sits in storage or toilet tanks.

Another approach is that toilets and urinals are so inherently unclean and pathogen-laden that rainwater could not cause any appreciable increase in health risk. We should also avoid the unnecessary addition of chemicals to water that is eventually released into waterways. Moreover, the city does not require a large number of practices that would likely have a much more significant impact on the cleanliness of toilets, such as cleaning toilets and limiting the use of harsh chemicals or chlorine pucks inside toilets.

This issue proved to be more contentious than any other discussed by the committee. The final proposal would continue to subject flushing water to the same standards as other end uses. At the same time, the city is instructed to study the issue and determine whether an alternative standard is appropriate for toilet and urinal flushing water.

Blue Dye

The proposal eliminates the requirement that blue dye be added to recycled water. Dying diminishes the ability to reuse water for certain applications such as laundry, irrigation and, in some instances, cooling. Instead, all pipes handling recycling water must be colored purple, a practice that is common in other U.S. jurisdictions and required under the Uniform Plumbing Code (2009).

Steam Condensate

At the suggestion of representatives from the Department of Health, the proposal would add “steam condensate” to the list of sources of “greywater” in C102.1. Steam condensate comes from water heated to over 212 degrees Fahrenheit and is thus sterile. While it would not require disinfection, the condensate can include metals from piping and is not fit for drinking.

Clothes Washers

At the suggestion of representatives from the Department of Health, the proposal would move “clothes washers” from the definition of “greywater” in C102.1 to the definition of “blackwater” given the potential contamination from washing diapers or soiled clothing.

Commercial Car Washing Facilities

These facilities are currently regulated by the Department of Environmental Protection so have been exempted from Appendix C.

ENDNOTES:

[1] Press Release, Mayor's Office of Communications, Mayor Gavin Newsom Launches Rainwater Harvesting Initiative to Green the City, Conserve Water & Protect the Bay & Ocean (Oct. 9, 2008), available at http://www.californiachronicle.com/articles/view/77115.

[2] Memorandum from the San Francisco Public Utilities Commission to the Department of Public Health & Department of Building Inspection, Rainwater Harvesting Systems. 3 (June 11, 2008) (on file with author).

[3] Ibid. at 5.

[4] King County Department of Policies and Procedures, Rainwater Harvesting and Connection to Plumbing Fixtures, Product/Method #07-001 (2007), available at http://www.kingcounty.gov/healthServices/health/.../Rainwater_Harvesting.ashx.

[5] Ibid. at §1.1.

[6] Ibid. at § 6.6.

[7] Memo from the San Francisco Public Utilities Commission to the Department of Public Health, 2.

[8] Department of Planning and Development of Seattle, Client Assistance Memorandum 701: Rainwater Harvesting for Beneficial Use, 2 (Apr. 28, 2008), available at http://www.seattle.gov/DPD/Publications/CAM/CAM701.pdf.

[9] Memo from the San Francisco Public Utilities Commission to the Department of Public Health, 4.

[10] Ibid.

[11] CANADA MORTGAGE AND HOUSING CORPORATION, RAINWATER HARVESTING AND GREY WATER REUSE FACT SHEET, TECHNICAL SERIES 03-100, http://www.cmhc-schl.gc.ca/publications/en/rh-pr/tech/03-100-e.htm (last visited Jan. 21, 2010).

[12] Ibid.

[13] Ibid.

[14] Ibid.

[15] Ibid.

[16] ENVIRONMENT AGENCY, CH. 7: REUSING GREYWATER AND HARVESTING RAINWATER, CONSERVING WATER IN BUILDINGS (2003), http://www.environment-agency.gov.uk/static/documents/Leisure/cwb_ch7_grey_rain_889316.pdf.

[17] Canada Mortgage and Housing Corp., Rainwater Harvesting and Grey Water Reuse, Technical Series 03-100

http://www.cmhc-schl.gc.ca/publications/en/rh-pr/tech/03-100-e.htm (last visited Jan. 26, 2010).

[18] Hansgrohe International, Pontos GMBH, http://www.pontos-aquacycle.com (last visited Jan. 21, 2010).

[19] Ecoplay, Home, http://www.ecoplay-systems.com (last visited Jan. 21, 2010).

[20] 314 MASS. CODE REGS. 20 (2009) available at http://www.mass.gov/dep/service/regulations/314cmr20.pdf.

[21] N.Y. ENVTL. CONSERV. ART. 15, TIT. 6 § 5-0601 to 15-0607. NYSDOH was also directed to create a registry of recycled water systems. The U.S. Environmental Protection Agency (EPA) published water reuse guidelines in 2004, but these were focused on reclaimed water from utilities. In any event these are not binding on states, which have the primary responsibility in our federal system for setting water quality standards.

WE 5:
REDUCE USE OF DRINKING WATER TO CLEAN SIDEWALKS

Administrative Code of the City of New York
Proposal developed by the Water Efficiency & Building Stormwater Committee

Summary

Issue:
Clean drinking water is frequently used in New York City to wash sidewalks, parking lots, and streets.

Recommendation:
Require the use of either water-conserving equipment, such as water brooms, or recycled water for cleaning sidewalks, parking lots, and streets.

Proposed Legislation, Rule or Study

Amendments to the Administrative Code of the City of New York:

1. Amend Section 24-332 as follows:

§ 24–332 Use of water through hose. It shall be unlawful for any person to wash any street, parking area, sidewalk, areaway, steps, building or other place in the city by means of a hose or piping, or to use water through a hose or sprinkler for watering lawns or gardens, or to operate any outside shower where the water runs upon a street, sidewalk, or other public place between the first day of November and the last day of March following. Any person washing, by means of a hose or piping, any street, parking area, sidewalk, areaway, steps, or building, shall utilize one of the following:

a. Water conserving equipment, as such term is defined by the department; or
b. Recycled water for any such washing.

Supporting Information

Issue – Expanded
Sidewalk cleaning is necessary to maintain a clean and healthy urban space. Sidewalk cleaning removes animal feces, garbage, liquid residue, and other residue from the sidewalk. Buildings typically undertake this cleaning by spraying drinking water on the sidewalk through a hose with no control nozzle.

A primary strategy for resource conservation is to use all resources for their maximum benefit. For water, this implies matching water quality to the appropriate use. It is not necessary to use drinking-quality water to clean sidewalks given this water does not come in contact with humans and immediately flows into the storm sewer.

This proposal would require buildings to minimize the use of drinking water for sidewalk cleaning by requiring the use of water efficient pavement cleaning equipment, such as a “water broom” or other products. This type of equipment is already used by some buildings in the city, but is not a common practice. Alternatively, building could use recycled water, such as rainwater collected on a roof, for sidewalk cleaning.

Utilizing water efficient pavement cleaning strategies is important due to the public nature of the act. The sight of building staff washing down the sidewalk with drinking water sends a message to the public that water conservation is unimportant; water brooms would send the opposite message. Signage noting that a hose bib is for non-potable uses further communicates to the public the conservation measures of its citizens.

During periods of drought, these strategies will allow buildings to maintain clean streets and a healthy environment by removing unpleasant refuse from the sidewalk, without negatively impacting the available water resources.

Environmental & Health Benefits
This proposal would reduce the consumption of drinking water in New York City. If the proposal leads some buildings

to add on-site capacity for rainwater storage, it will shift the discharge of some water to post-storm event periods, reducing combined sewer overflows (CSOs). Reduction of CSOs reduces the risk of exposure to disease-causing viruses and bacteria. (See Stormwater proposals for more information on CSOs.)

This proposal was found to have a low, positive environmental impact per building and to impact a small number of buildings. It was thus given an environmental score of 1.

This proposal was found to have no significant health impact.

Cost & Savings

As described in the Executive Summary, Bovis Lend Lease prepared cost estimates for each Task Force proposal in the context of well-defined construction projects in specific buildings. Where possible, members of the Technical Committees prepared savings estimates for some of these projects and buildings. These cost and savings estimates are presented in the February 1st draft version of Appendix A. The innate uncertainty in how construction and operation will vary from one building to another, the complexity of the Task Force proposals, and the wide range of applications in which the proposals may be realized mean these figures are truly estimates.

This proposal is not expected to have any significant impact on capital costs. This proposal was also estimated to generate financial savings that will pay for any capital costs in less than three years.

Precedents

Many municipalities in California forbid wash-water from entering the sewer system in order to prevent water contamination with hazardous materials. A few municipalities restrict surface cleaning as a means of water conservation. For example, under the City of Los Angeles' Water Conservation Plan - Phase I, all residents are prohibited from using a "water hose to wash any hard or paved surfaces including, but not limited to, sidewalks, walkways, driveways, and parking areas," unless using a "Department-approved water conserving spray cleaning devices." (Chapter XII: The Water Conservation Plan of the City of Los Angeles, § 121.08(A)(1).) Waterbrooms are currently the only approved sidewalk cleaning device.[1]

LEED

Utilizing non-potable water for sidewalk cleaning is a strategy to reduce water consumption for all buildings and, in conjunction with other conservation strategies such as HET plumbing fixtures, drip irrigation, and/or water-efficient mechanical systems, meeting both water conservation points is possible.

Also, when utilizing stormwater for sidewalk cleaning, additional credits may be achieved as well. The development of a stormwater management plan includes mitigating runoff from the site. This can be accomplished by the capture of rainwater for reuse or other measures. LEED also addresses the use of treated stormwater. Therefore, this proposal will facilitate achieving LEED points under the following credits:

- NC SS 6.1 Stormwater Design: Quantity Control Option 1B
- LEED for Schools SS cr.6.1 Stormwater Design: Quantity Control
- LEED ND-GCT cr.9 Stormwater Management
- LEED CI-SS cr.1B, Stormwater Management: Rate & Quantity
- LEED for Homes SS cr. 4 Surface Water Management.
- LEED EB-SS cr. 5 Stormwater Management

Additionally, LEED for New Development (pilot program) will address diverting wastewater generated by the project in: LEED ND-GCT cr.16, Wastewater Management.

Implementation & Market Availability

Water efficient pavement cleaning equipment is readily available.

ENDNOTES:

[1] Press Release, Los Angeles Department of Water and Power, Drought Busters, The City's Mobile Water Conservation Team, Take To The Street To 'Stop and Spot' Water Waste (Nov. 13, 2007), http://www.ladwpnews.com/go/doc/1475/182533.

WE 6:
STOP WASTING DRINKING WATER FOR COOLING

New York City Plumbing Code
Proposal developed by the Water Efficiency & Building Stormwater Committee

Summary

Issue:
"Once-through" cooling systems emit heat into potable water, which is then drained into the sewer. No other cooling systems waste water in this manner.

Recommendation:
Prohibit new installations from using “once through” cooling systems.

Proposed Legislation, Rule or Study

Amendments to the New York City Plumbing Code:

1. Amend Section 202 to include the following definitions:

SUBSTANTIAL REPAIR OR REPLACEMENT. Repair or replacement of an item of equipment or system costing 50% or more of the cost of replacing the entire existing item of equipment or system.

ONCE-THROUGH COOLING. The practice of using potable water to cool a condenser or other item of process or building equipment and then discarding the water to a sanitation drain. Once-through cooling also includes the use of potable water to temper hot water or steam before sending it to a sanitation drain.

2. Add a new Section 428 as follows:

SECTION PC 428
PROHIBITED WATER USES

428.1 Potable water prohibited for once-through cooling. Potable water shall not be used for in once-through cooling equipment or substantial repair or replacement of existing cooling equipment. Equipment such as ice-making machines, walk-in coolers, refrigerated walk-in boxes, or environmental air conditioning equipment shall be provided with air cooled condensers or recirculating condenser water systems, or supplied with non-potable water as permitted by Appendix C of this code.

PC 428.2 Approvals. If a proposed design includes the use of non-potable water for cooling, calculations shall be provided and approved by the department demonstrating that sufficient non-potable water is available at all times for the proposed cooling load. Potable water may be used as an emergency backup providing sufficient backflow equipment is provided and the emergency feature can be used no more than 24 hours consecutively and no more than 24 hours in any year.

Exception: The department may waive the requirements of this section in connection with the substantial repair and replacement of existing cooling equipment upon the submission of a cost and savings analysis prepared by a licensed professional that demonstrates that the elimination of once-through water-cooled equipment in accordance with this section has a payback longer than five years assuming a water/sewer cost escalation of 7% per year. In no case shall such equipment be used in sizes that exceed maximum sizes specified in RCNY Title 15 Chapter 20-08.

Supporting Information

Issue – Expanded
Most large building air conditioning and refrigeration systems operate with a recirculating system of cooling water. Throughout the city, however, there are small-to-medium size systems that pass potable water once through a piece of equipment to provide cooling and then dump the potable water into the sewer system. Examples include ice-making

machines in hotels, restaurants, taverns and similar occupancies, walk-in coolers in food business facilities, older medical x-ray and laser equipment and local cooling particularly for "back office" portions of an office building where people and computer heat loads exceed what was originally anticipated for the air conditioning system. The Department of Environmental Protection's (DEP) water use rules currently limit the size of such equipment to no more than six tons of refrigeration capacity (1 ton = 12,000 BTUH) or two tons of air conditioning capacity.[1]

Each "ton" of cooling uses about 250,000 gallons of single-pass cooling water each year, amounting to more than $200 per year in water/sewer costs. This is 40 times more water than would be used in a recirculating system using an evaporative cooling tower operating at five cycles of concentration and 100% more than an air-cooled system.[2] [3]

Once-through water-cooled equipment is particularly susceptible to "silent leaks" that can waste an enormous amount of water and cost the customer a great deal of money. A small solenoid valve is meant to turn the cooling water supply "on" or "off" depending on whether the compressor needs cooling at that moment. To avoid damage to the expensive compressor from overheating, the solenoid valve is designed to fail in an open position, meaning water flowing full time. Under that circumstance, normal operation, which might mean 0.5 – 2.0 gpm water flow for 15-20 minutes each hour, escalates to continuously flow, 24 hours a day. The valve and equipment do not provide any indication of valve failure without a physically difficult inspection. According to Department of Environmental Protection water conservation officials, virtually every high water bill complaint from a food or medical business turns out to have to water-cooled equipment as the primary problem.

Environmental & Health Benefits
By conserving potable water, we are also reducing the amount of energy and resources spent on water treatment and distribution. Using less water also reduces the amount of sewage in our sewer systems and reduces the frequency of combined sewer overflows (CSOs).

This proposal was determined to have a low, positive environmental impact per building and to impact a small number of buildings. It was thus given an environmental score of 1.

This proposal was determined to have no significant health impact.

Cost & Savings

As described in the Executive Summary, Bovis Lend Lease prepared cost estimates for each Task Force proposal in the context of well-defined construction projects in specific buildings. Where possible, members of the Technical Committees prepared savings estimates for some of these projects and buildings. These cost and savings estimates are presented in the February 1st draft version of Appendix A. The innate uncertainty in how construction and operation will vary from one building to another, the complexity of the Task Force proposals, and the wide range of applications in which the proposals may be realized mean these figures are truly estimates.

This proposal is not expected to have any significant impact on capital costs.

Precedents
Austin, Seattle, Phoenix, San Antonio, Denver, and Hawaii are among the jurisdictions that prohibit once-through equipment. The draft of Portland, OR's new water conservation standards requires potable water used in once-through cooling systems to be reused.[4]

LEED
LEED addresses the use of condensate water as a water conservation strategy for irrigation and building sewage conveyance systems. For these purposes, this proposal will assist in achieving all prerequisites and credits in LEED Water Efficiency sections of the various rating systems.

LEED also addresses the use of treated stormwater as condensate water as one method of reducing the amount of wastewater going into the sewer system. For these purposes, this proposal will assist in achieving all Stormwater Design credits in LEED Sustainable Sites sections of the various rating systems.

Implementation & Market Availability
There are no known implementation issues for this proposal. All replacement and substitute systems, such as high-efficiency (EnergyStar rated) air-cooled condensers for heat rejection or a connection to a recirculating cooling water system, are readily available.

Notes
RS 16 P107.16 of the 1968 building code and DEP regulations allow once through cooling systems. The 2008 building code no longer expressly allows once through cooling but instead references DEP or has removed references to these cooling systems.

ENDNOTES:

[1] R.C.N.Y., TIT. 15 § 20-06 (A)(2) AND (A)(3) (1991).

[2] U.S. Dep't. of Energy, Best Management Practice: Single-Pass Cooling Equipment, http://www1.eere.energy.gov/femp/program/waterefficiency_bmp9.html (last visited July 14, 2009).

[3] California Urban Water Conservation Council, Resource Center: Commercial Food Services, http://www.cuwcc.org/products/commercial-ice-makers.aspx (last visited Oct. 20, 2009).

[4] City of Portland, Water Conservation and Stormwater Management Requirements, available at http://www.portlandonline.com/BDS/INDEX.CFM?c=48074&a=222101 (last visited Oct. 20, 2009).

WE 7:
REUSE WATER FROM CONED STEAM

New York City Plumbing Code; New York City Mechanical Code
Proposal developed by the Water Efficiency & Building Stormwater Committee

Summary

Issue: The water used by Con Edison to make steam is dumped into the sewers after it has been used by buildings. This wastes 5 million to 10 million gallons of clean water a day and stresses wastewater treatment plants.

Recommendation:
Require buildings that use utility steam for space heating and/or cooling to reuse at least 50% of the steam condensate produced, unless shown to be unfeasible.

Proposed Legislation, Rule or Study

Amendments to the New York City Plumbing Code:

1. Add a new Section 614.1 as follows:

SECTION PC 614
UTILIZATION OF STEAM CONDESATE

614.1 Applicability. Buildings that use utility steam for space heating and/or cooling shall reuse at least 50% of the steam condensate produced, averaged over one year, using one any means permitted in Appendix C of this code.

Exception. Any water remaining after use for the purposes permitted in Appendix C may be discarded; provided, however, that any such building shall report to the department the percentage of steam condensate discarded.

614.2 Restrictions. The systems for utilization of steam condensate shall be designed to ensure that:

1. Water utilized for toilet/urinal flushing shall not exceed 100ºF at any time, unless combined with other sources of water to lower such temperature below 100º F; and

2. Water supplied to any outlet accessible by humans, including hose bibs and laundries, shall not exceed 140ºF, unless combined with other sources of water to lower such temperature below 140º F.

Amendments to the New York City Mechanical Code:

1. Add a new Section 307.4 as follows:

307.4 Utility Steam Condensate. In buildings where utility steam condensate is used to provide space heating or cooling, provision shall be made to recover the condensate as required by Section 614 of the New York City Plumbing Code.

Supporting Information

Issue – Expanded
Approximately 2,000 large Manhattan buildings use Con Edison's steam system as a source of energy. When this steam cools into liquid water (steam condensate), it is still far hotter than permissible by the Department of

Environmental Protection for release into the sewers. Typically, this water is then cooled with potable water and disposed. Because of this, between five and ten million gallons of almost potable water (condensate mixed with potable water) is wasted annually.

Five and seven million gallons per day of steam condensate flow into the sewer system, ending up at the Newtown Creek, Wards Island and North River wastewater treatment plants. To the extent that steam condensate can substitute for potable water for certain non-potable uses, such as toilet/urinal flushing, cooling tower makeup water, and sidewalk washing, both potable water and wastewater flows can be reduced.

Some condensate reuse already occurs without any incentive or regulatory requirement due to cost effectiveness. The 100 largest steam consumers (who produce 40% of the system's total condensate) recovered 30% of their condensate in 2005, compared to about 20% recovery systemwide. A Con Edison-sponsored analysis that assumed far lower water/sewer costs than currently exist found that all but 10% of condensate could be recovered economically.

The intent of this recommendation is that it would only apply to new construction and gut rehabilitations.

Environmental & Health Benefits

This proposal will reduce wastewater flows to Newtown Creek and Wards Island plants. It will also reduce water use as condensate replaces potable water for these end uses.

This proposal was found to have a low, positive environmental impact per building and to impact a large number of buildings. It was thus given an environmental score of 2.

This proposal was found to have no significant health impact.

Cost & Savings

As described in the Executive Summary, Bovis Lend Lease prepared cost estimates for each Task Force proposal in the context of well-defined construction projects in specific buildings. Where possible, members of the Technical Committees prepared savings estimates for some of these projects and buildings. These cost and savings estimates are presented in the February 1st draft version of Appendix A. The innate uncertainty in how construction and operation will vary from one building to another, the complexity of the Task Force proposals, and the wide range of applications in which the proposals may be realized mean these figures are truly estimates.

For some buildings this proposal will result in no increase of capital costs and for others an increase of up to 0.03%. It was thus categorized as incurring no to a low capital cost increment. This proposal was also estimated to generate financial savings that will pay for the capital costs in less than three years or in three to ten years depending on the building type.

Precedents

There are no known precedents for this proposal.

LEED

LEED addresses the use of condensate water as a water conservation strategy for irrigation and building sewage conveyance systems. For these purposes, this proposal will assist in achieving all prerequisites and credits in LEED Water Efficiency sections of the various rating systems.

Implementation & Market Availability

The technology is readily available. There are no known implementation issues for this proposal.

Notes

A separate Task Force proposal, Use Waste Heat from ConEd Steam, requires that the thermal energy in condensate be used to the extent practical. (Added material in Section 6.8 of ASHRAE 90.1 2007.) When there is a use for this energy (e.g., during heating season), the condensate will be available at 100-130ºF. However, in the summer, if steam cooling is operating, the condensate will be used only for service hot water heating and may be considerably hotter (180ºF or more) when released for these applications. A water-to-air cooling coil (with freeze protection) will therefore be a necessary part of the installations called for in this measure in most cases.

The Committee had originally suggested adding this language to MC 1210.2.3, but that section refers to high pressure steam and is concerned with assuring reliability and safety. PC 614 seems a more natural fit. A reference has been included in the Mechanical Code.