**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 burst 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>
<thead>
<tr>
<th>PLUMBING FIXTURE OR FIXTURE FITTING</th>
<th>MAXIMUM FLOW RATE OR QUANTITY</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lavatory, private</td>
<td>[2.2] 1.5 gpm at 60 psi</td>
</tr>
<tr>
<td>Lavatory, public, (metering)</td>
<td>0.25 gallon per metering cycle</td>
</tr>
<tr>
<td>Lavatory, public (other than metering)</td>
<td>0.5 gpm at 60 psi</td>
</tr>
<tr>
<td>Shower head¹</td>
<td>[2.5] 2.0 gpm at 80 psi</td>
</tr>
<tr>
<td>Sink faucet</td>
<td>[2.2] 1.5 gpm at 60 psi</td>
</tr>
<tr>
<td>Service sink</td>
<td>2.5 gpm at 60 psi</td>
</tr>
<tr>
<td>Urinal</td>
<td>[1.0] 0.2 gallon per flushing cycle</td>
</tr>
<tr>
<td>Toilet²</td>
<td>[1.6] 1.28 gallons per flushing cycle</td>
</tr>
</tbody>
</table>

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. 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). 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. A number of municipalities have mandated lower flow rates in local codes, some of which also reference the WaterSense requirements. The International Code Council, which is adopted in 37 states plus Washington DC, is a partner with EPA's WaterSense guidelines. These standards also align with proposed flow rates in ASHRAE Standard 189.1P.

California has reduced flow rate requirements for fixtures; the recommended flow rates in this proposal either equal or surpass California's recommendations. 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.
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.¹

**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:

<table>
<thead>
<tr>
<th>End Use</th>
<th>Total Savings (Additional Savings)</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Toilet Use at Home</td>
<td>13.2 gcpd (2.4 gcpd)</td>
<td>4.5 gpf - 1.2 gpf = 3.3 gpf * 4 flushes per day = 13.2 gcpd savings</td>
</tr>
<tr>
<td>Showerheads</td>
<td>14 gcpd (3.5 gcpd)</td>
<td>4 gpm - 2 gpm = 2 gpm * 7 minutes per shower = 14 gcpd</td>
</tr>
<tr>
<td>Faucets</td>
<td>6 gcpd (3 gcpd)</td>
<td>2 gpm reduction * 3 minutes per day = 6 gcpd</td>
</tr>
<tr>
<td>Toilets and Urinals at Work</td>
<td>5.8 gcpd (3.6 gcpd)</td>
<td>Males: (3.5 gpf - 0.5 gpf) * 2 uses = 6 gcpd</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Females: (4 gpf - 1.28 gpf) * 2 uses = 5.4 gcpd</td>
</tr>
<tr>
<td>Total at Home</td>
<td>33.2 gcpd (8.9 gcpd)</td>
<td></td>
</tr>
<tr>
<td>Total at Work</td>
<td>5.8 gcpd (3.6 gcpd)</td>
<td></td>
</tr>
</tbody>
</table>

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,
Fixure 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 \( (13.2 \text{ gcpd} \times 0.3) + 14 \text{ gcpd}\) + \( (6 \text{ gcpd} \times 0.3) = 19.96 \text{ gcpd} \) (25.5% reduction in residential use, 18.6% reduction in citywide use)

After 20 and 30 years: Additional \( (13.2 \text{ gcpd} \times 0.3) + (6\text{gcpd} \times 0.3) = 5.96 \text{ gcpd} \)

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:

5 Ibid.
12 Ibid.