WE 4: FACILITATE USE OF RECYCLED WATER

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.” 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.
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. The memo allows “harvested rainwater to supply certain types of plumbing fixtures in structures while maintaining the standards for adequate public health protection.” The allowable applications include “water closets, urinals, hose bibs, industrial applications, domestic clothes washing, irrigation and water features.” 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. For final water quality treatment, “[s]creen systems and/or basic mechanical filtration are typically adequate for . . . toilet flushing.” All other installation and connection matters are governed by the Uniform Plumbing Code.

In many international jurisdictions, rainwater is not required to be treated before being used for toilet flushing. 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. Rainwater is permitted (or in some cases required) for toilet flushing in France (pipes must be labeled), Belgium (rainwater harvesting required in new construction), Germany, and the UK. 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.”

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. 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) suggests that some treatment is required there. (A similar system in the Netherlands is the Muiden Ecoplay.) International reviews (Lazarova, 2003; Alkhathib, 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, 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. 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:


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.


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.


10. Ibid.


12. Ibid.

13. Ibid.

14. Ibid.

15. Ibid.


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.