Williamsburg Environmental Group, Inc.

Environmental Consultants

April 17th, 2013

ATTN: Rebecca Stack
District Department of the Environment
1200 First Street NE
Washington DC 20002

RE: Revised Stormwater Guidebook Comments

Dear Ms. Rebecca Stack,

The District Department of the Environment (DDOE) and the Center for Watershed Protection (CWP) should be commended on its work to roll out the proposed stormwater rulemaking, SWM Guidebook, Stormwater Retention Credit (SRC) protocol and associated material. While the Guidebook is long at 559 pages, it is organized in a manner that makes it user friendly and accessible, with consistent formatting for each of the dozen + BMPs. The Stormwater Retention Credit program, design tools, rainwater harvesting TRAM protocol, and crediting for tree planting and preservation are all truly innovative approaches, and seem especially well suited to an ultra-urban environment.

The following comments are offered for consideration. They are relatively minor. For easy reference, each comment cites the relevant Guidebook page number, section, and title. Red text within brackets indicates recommended language insertions and/or edits.

Specific Comments:

1.) Table of Contents

Under "Appendix K" of the TOC, the TRAM is listed as N.1 with "Error! Bookmark not defined".

2.) Table of Contents

It would be helpful to add titles to each of the leading Appendix sections. For instance, "Appendix N" could become "Appendix N TRAM". Minor comment, but it would provide for quicker referencing.

3.) Pg 43: Chapter 3.2 Rainwater Harvesting

"…decreased demand on municipal or groundwater supply,…" Note: does DC use groundwater as water supply, or does it primarily come from the Potomac River? Perhaps this statement is more in concept, but might consider changing the wording to "…decreased demand on municipal supplies and groundwater sources…".

4.) Pg 43: Chapter 3.2 Rainwater Harvesting

Last set of bullet points …"Storage tank (not number but depicted in figure 3.2) Note: remove 't'.

5.) Pg 45: Section 3.2.1; Water Use.

"This will outline the design assumptions, outline water quality risks, [treatment requirements], and provide water quality end use standards."

6.) Pg 45: Section 3.2.1; Site Topography

Recommend slight modification to wording to ensure sufficient slope of outlet pipe….
The final invert of the storage tank outlet pipe at the discharge point must be designed to match or meet the invert of the receiving mechanism (e.g. natural channel, storm drain system) and be of sufficient slope to adequately convey this overflow.

7.) Pg 45: Section 3.2.1; Site Topography

Second paragraph: "…Locating storage tanks in low elevation areas will make it easier to get water into the cisterns; however, it [may] increase the amount of pumping needed to distribute the harvested rainwater…" Very minor, but if irrigation or secondary practice are located further downhill, this wouldn't be the case, so add the word "may".

8.) Pg 45: Section 3.2.1; Available Hydraulic Head

"For residential landscaping uses, the cistern [may] be sited up-gradient of the landscaping areas or on a raised stand." Replace the word should with may. This should be more of an encouragement rather than a requirement. And, probably don't want to encourage (or require) the use of raised stands. While they may be appropriate and excellent for preserving potential energy, they also have their own set of safety risks, such as structural integrity over time and settling of soils, which carry in increased potential of future harm due to overturning/collapsing.

9.) Pg 46: Section 3.2.1; Soils

"A sufficient aggregate, or concrete foundation, may be appropriate depending on the soils, [dimension of cistern, and design]. Where the installation requires a foundation, the foundation must be designed to support the tank's weight when the cistern is full consistent [with good engineering practice] and the soils bearing [capacity]." Note: believe this sentence should read capacity and not capability. Should also take the extra precautions to ensure these systems are designed with good engineering practice, as they weight can be tremendous.

10.)Pg 46: Section 3.2.1 Contributing Drainage Area

"Rooftop surfaces are what typically make up the CDA, but paved areas and landscaped areas can be used with appropriate treatment…." Should the wording referencing landscaped areas be removed? The Cistern Design Spreadsheet (CDS) does not allow for inclusion of pervious areas and so would not accurately represent them. In addition, the Compliance calculator grays out the cells related to

CDA from pervious areas for rainwater harvesting. Finally, the CDA Surface section on age page 50 does not make reference to non-impervious surfaces. This section on page 46 appears to be the only language permitting the use of landscaped areas. Recommend removing it OR updating other sections and modifying the CDS to accurately represent these areas so that all is consistent.

11.)Pg 47: Section 3.2.1; Setbacks from Buildings

Recommend following language addition: ""…within 10 feet of building foundations. [While most systems are generally sited underground, and more than ten feet laterally from the building foundation wall, some cisterns are incorporated into the basement of a building or underground parking areas. In any case,] tanks must be designed to be watertight to prevent water damage when placed near building foundations. Should allow for incorporation into lower level areas of buildings as these may make for the best siting in ultra-urban environments, in some cases.

12.)Pg 47: Section 3.2.1; Vehicle Loading

Recommend following revised and added language: "**Vehicle [and Other Heavy] Loading**. Whenever possible, [it is highly recommended that] underground rainwater harvesting systems be placed [under surfaces] without vehicle traffic [or other heavy loading. If site constraints dictate otherwise, systems should] be designed [with good engineering practice] to [adequately] support live loads from heavy trucks [and other heavy loads that it will be subjected to], a requirement that may significantly increase construction costs. [Designers should be especially cautious when specifying modular systems in heavy load areas, including under traffic and deep earth fill (i.e. >15 -20 ft). DDOE may use discretion to disallow siting the practice in these areas on a site by site basis.]

Note: Several plastic modular systems failures have been reported in Virginia recently. At least a couple localities enacted moratoriums on the systems as an interim control as a result during ongoing investigations. Special precautions are advised and the ability for DDOE to exert increased discretion for this special situation is advised.

13.)Pg 47: Section 3.2.2; 2nd paragraph under Rainwater Harvesting Conveyance Criteria.

Note: Requiring the gutters, downspouts, and roof drains to convey 2 year and larger design storm intensities is a good idea, as the system will not function properly if the rainwater is not conveyed to the cistern. Recommend following language addition: "In some cases, a steeper slope and larger sizes may be recommended and/or necessary to [adequately] convey the required runoff, depending on the design objective and design storm intensity. [Computations for gutters, downspouts, and roof drains should be performed to ensure adequate capacity and conveyance to minimize the likelihood of failure and localized flooding surrounding and in the building.]"

14.)***Pg 47: Section 3.2.2; Overflow***

Recommend adding "…All overflow from the system must be directed to an acceptable flow path that will not cause erosion [, including] during a 2-year event." Smaller events should also not cause

erosion. For instance, this could be very plausible for an above ground cistern that releases water from an overflow pipe 5 feet above the ground surface to a grassed area, even during a small storm. Recommend keeping this description broad by using the word "including", which will be encompassing of smaller storm events and all conditions. In this light, may want to include language to recommend the inclusion of downspouts with elbows from above ground cistern overflows in order to dissipate hydraulic energy exerted on ground surfaces.

15.) ***Pg 50: Section 3.2.4; Storage Tanks***

"Cistern capacities…can be as large as 100,000 gallons [or more] for larger projects." I would think that it very possible for large development projects to easily exceed 100,000 gallons of storage volume. Very large scale dense projects, with high intensity water use could exceed 1 million gallons of storage.

16.) ***Pg 50: Section 3.2.4; Storage Tanks***

"…storage tanks must have a standard size manhole or equivalent opening to allow access for cleaning, inspection, and maintenance purposes" Following this statement, consider adding a bullet with the following: "Confined space safety precautions/requirements shall be observed during any inspection, maintenance or other activities."

17.) Pg 52: Section 3.2.4; Water quality treatment

"…a water quality treatment device may be required by the TRAM." See Appendix N.

18.) Pg 53: Section 3.2.4; Design Objectives and System Configuration

"…the system design configurations presented in this specification are targeted for use of rainwater through (1) internal use and (2) seasonal irrigation." Note: Also have cooling towers, additional use (street sweepers, bus and fire truck washing, etc.).

19.) Pg 54: Section 3.2.4; Tank Design 3

"…designed secondary practice (e.g., rain garden, urban bioretention)…" These BMPs are different than what is specified in the Guidebook. Recommend replacing with bioretention, section 3.5 and Stormwater infiltration, section 3.7.

20.) Pg 54: Section 3.2.4; Tank Design 3

The third tank design includes a constant drawdown mechanism. It states "the release must not be discharged to a receiving channel or storm drain without treatment, and maximum specified drawdown rates from this constant drawdown should be adhered to, since its primary function of the system is not intended to be detention." This is true, but no guidance is given for what an appropriate maximum drawdown rate might look like. While this may be less important for small storm water quality treatment, it becomes increasingly important for the larger channel protection and flood volume controls. For instance, a volumetric rate of 890 gallons per day (or 120 CF/day)

could be pumped from the cistern to a secondary practice for treatment. This is a relatively substantial volume, that has the potential to significantly increase the retention credit calculated for the practice in the spreadsheet. Pumping this volume over a 15 minute period however, only equates to a 0.13 cfs flow rate. This is a very minimal release and well below what may be expected from most sites during a 2 year or greater 24-hour storm. Often, up to 1 cfs can be released with little or no erosion issues.

Recommend adding a quantitative upper bound or more structured process for establishing an upper bound to limit the maximum permissible flow from this constant drawdown to reduce ambiguity. Without this, it will open the practice up to potential abuse (using it as a detention orifice) and degrade the integrity of the practice.

21.) Pg 55: Section 3.2.4; Sizing of Rainwater Harvesting Systems

"…long term rainfall data, and CDA capture area data (Forasté and Lawson, 2009). " This citation is a reference to the Virginia CDS. The DC spreadsheet uses a different approach and methodology and should be cited as (Forasté 2011). Full citation immediately below.

22.) Pg 64: Section 3.2.9; References

"Forasté, J. Alex and Lawson, Sarah. 2009. Cistern Design Spreadsheet, McKee Carson, Rainwater Management Systems, Inc. and Center for Watershed Protection"

The above reference is appropriate for the Virginia CDS model. The DC model uses a different methodology and approach (i.e. single storm retention vs. average annual volume reduction) and was developed in collaboration only with CWP and DDOE. It should read as follows:

"Forasté, J. Alex. 2011. District of Columbia Cistern Design Spreadsheet. Center for Watershed Protection, Inc."

23.) Pg 56: Section 3.2.4; Incremental Design Volumes within Cistern

"The 'Storage Associated with Retention Value'" is the storage within the tank [from the orifice invert to the cistern bottom, and is the volume] modeled [in the spreadsheet.] Note: Language in this sentence carries old 'Design Storm' terminology; graphic was updated to describe this value as that associated with the "Retention Value" and so the paragraph should be changed to be consistent.

24.) Pg 57: Section 3.2.4; Cistern Design Spreadsheet

"If the tank runs dry….then the volume in the tank is fixed at the low level, and a dry-frequency day is recorded." Note: The Guidebook does note that municipal backup is not accounted for. If a municipal backup is to be included in the installed system, but not accounted for the in the design computations, then the CDS has the potential to significantly over-estimate the actual retention,

depending on the design. It is recommended that a municipal backup option be provided in the CDS to more accurately represent conditions, as it is likely that many users will include this feature into their designs.

25.) Pg 64: Section 3.2.9; References

The U.S. EPA recently released a document in January of 2013 that designers may find useful. It is called: *Rainwater Harvesting: Conservation, Credit, Codes, and Cost Literature Review and Case Studies* (Jan 2013). It can be accessed by copying and pasting the following link into a web browser: water.**epa**.gov/polwaste/nps/upload/rain**harvesting**.pdf

General Comments:

26.) ***Provide Guidance on Water Use Estimates for Rainwater Harvesting***: This would serve several functions including the following. It would:

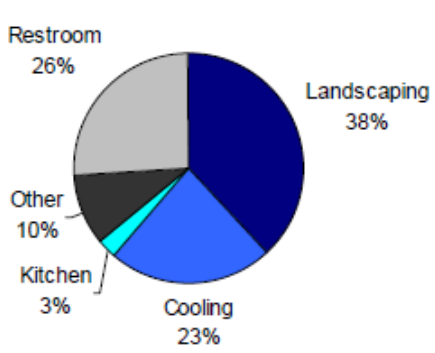
a. Make sure that designers do not use peak demand estimates for SWM purposes and CDS model results. While MEP designers may use peak demands for the design of internal plumbing systems, it would not be appropriate for SWM purposes and would artificially inflate demands and stormwater retention calculations. Instead, 'best estimates of actual use' should be used to more accurately portray anticipated actual conditions.

b. Provide designers with a solid and easily accessible reference that outlines acceptable and appropriate water use estimates for various development demand types (e.g. gallons/day/employee for restrooms in an office development type). Because estimating water use is often not traditionally part of the civil engineers or landscape architects toolbox, this would be especially useful.

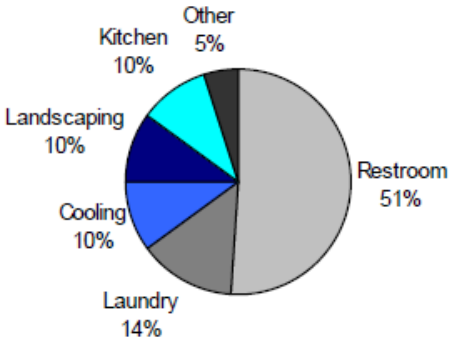
c. Encourage increased coordination between the Architect and Engineer (or other designer) to accurately understand interior design specifications (e.g. number and type of toilets). Along these same lines, understanding roof divides, slopes, location of downspouts and gutters will be necessary to delineate accurate drainage areas and to complete the computations section. Some engineers only consider the roof in its entirety and do not drill down to gain this additional detail, which is really necessary for a rainwater harvesting system to be designed and built as intended.

d. Enable designers to better envision which development types may have greater water uses and hence be most amenable to rainwater harvesting for SWM purposes. For example, the Pacific Institute provided the following estimates in the graphic below.

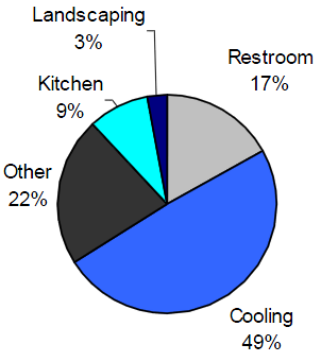
Water Use by Development Type



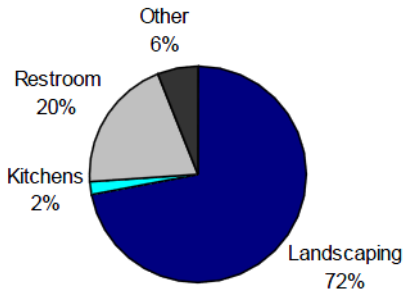
Office Buildings



Hotels



Grocery Stores

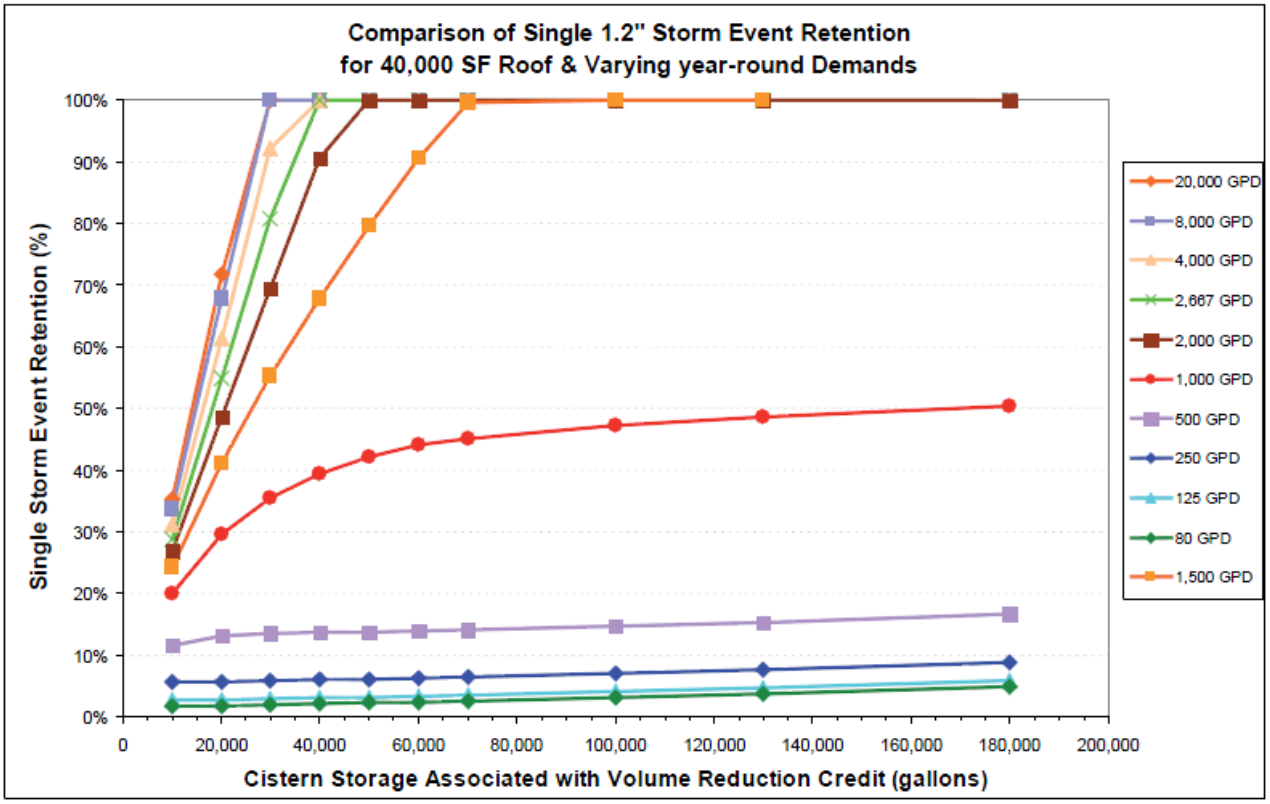


K-12 Schools

Source: Pacific Institute

Water use estimates by category for different development types enable designers to identify projects that may have the greatest potential to use rainwater harvesting for stormwater management. For instance, these graphics indicate that K-12 schools provide a fantastic opportunity to use rainwater harvesting as approximately 72% of the total water demand is for landscaping alone. Office buildings also represent an opportunity as 61% of the total demand is for outdoor non-potable supplies: landscaping and cooling .

27.) ***Sensitivity Analysis – Water Use and SWM Retention Credit***: Stormwater management retention credit is closely linked and dependent upon water demands. The chart below plots stormwater retention versus cistern size, using the Cistern Design Spreadsheet (CDS). Each line on the plot represents a different water demand from a site ranging from 80 gallons per day (gpd) to 20,000 gpd year-round, capturing rainwater from a 40,000 SF rooftop. As expected, the retention is great for large water demands for small to large cisterns, while the retention is small for small water demands regardless of the cistern size. The significance of this graphic is that retention credit is largely driven by demand; without it, the maximum retention is limited no matter how much the cistern size is increased. This comment is provided is the same context as the one above on the utility of providing water use estimates.



Source: (Forasté 2011) LID Symposium; ORISE/US EPA

28.) ***Consider providing Plan Checklist for R.H.:*** DDOE may consider providing a checklist that would enable reviewers and CEI inspectors to more accurately verify design and construction. VDCR has developed a checklist for the practice and included it in the Appendix: (http://vwrrc.vt.edu/swc/NonProprietaryBMPs.html)

29.) ***Differentiate between concept and construction drawings:*** It is recommended that the difference between concept drawings (acceptable at preliminary phase) and more detailed construction documentation (which should probably be provided prior to final approval) be outlined. Plan reviewers in other localities have accepted very cursory concept drawings in the past that are very general and include little site specific detail (e.g. overflow and orifice inverts, actual shape and dimensions of cistern, connections to municipal supply, etc.). These may lead to construction of systems that plan reviewers did not anticipate because of the general nature of the drawings. Provide example of each?

30.) ***Rainwater Harvesting General Terminology***: The spreadsheet is referred to as the Cistern Design Spreadsheet throughout the Guidebook, while the spreadsheet title and file name are DC Rainwater Harvesting Design Spreadsheet. Consider making the two consistent, perhaps changing the spreadsheet name to CDS.

31.) ***Consider providing incentives for Installed Water Meters and Data Logging :*** Consider providing some form of incentive for applicants that commit to installing water meters that will log data for the purposes of tracking actual performance over a multi-year period. This would inevitably lead to valuable lessons and enable for validation of the current methods and/or necessary improvements based on findings. Incentives might include a bump in the retention value, banked SRC, expedited review, or other mechanism.

32.) ***Tree Planting and Preservation:*** Note: This is great to see tree planting and preservation accounted for. It is nice to see preservation given greater retention values over new plantings and that a minimum mature canopy cover has been specified.

I hope that DDOE finds these comments constructive and useful. Please feel free to contact me with any questions or requests for clarification.

Sincerely,

Alex Forasté, P.E.
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