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How to:
STORMWATER CREDIT TRADING PROGRAMS

When rain runs off impervious surfaces such as sidewalks, streets, and roofs, it collects a wide range of toxic pollutants, which are then dumped, usually untreated, into local waterways. With older "combined" sewer systems, the problem is exacerbated because stormwater pipes join with wastewater pipes, sending the polluted runoff and wastewater from sinks and toilets into our waterways. Many cities are taking steps to reduce stormwater runoff through large-scale "green infrastructure" (GI) solutions, compelled in part by the Clean Water Act and in part by a desire to make cities more resilient, livable, and equitable. GI includes street trees, rain gardens, vegetated swales, porous pavement, and green roofs. These practices keep polluted stormwater on or near the site where the rain falls—and out of waterways—until it can be treated, evaporate back to the atmosphere, be used onsite, or filter into the ground to benefit vegetation and replenish groundwater supplies.

Most cities' GI plans include modifications to existing paved space on public properties and in the public right-of-way such as streets and sidewalks. Private property, however, is also a substantial contributor to stormwater runoff, and satisfying water quality requirements will often necessitate controlling pollution from public and private property. In addition, stormwater management opportunities can be less expensive on private land than on public land.

The most common and straightforward way for cities to realize some of the GI potential of private land is by requiring on-site stormwater retention as a condition of construction permit approval for projects above a certain size. The concept of "stormwater credit trading" typically arises within this context. Credit trading programs enable property owners who are subject to an on-site retention requirement to meet a portion of their requirements by

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buying stormwater "credits" from other property owners rather than building all needed GI on their own property. Credit trading programs are becoming popular because they introduce flexibility into cities' on-site retention rules and, if designed correctly, credit trading programs can create equal or better water quality outcomes than a simple on-site retention requirement. The remainder of this paper will lay out some of the potential opportunities and risks presented by such programs.

ON-SITE RETENTION REQUIREMENTS

Stormwater credit trading programs originate with a city incorporating green infrastructure into the development process. Every time land is developed or re-developed for homes, businesses, or industry, sustainable stormwater management must be part of the plan. The "land disturbance" threshold for new or re-development that triggers on-site retention requirements will vary according to each city's rainfall, land use patterns, and water quality needs. For example, some cities may require on-site retention when developers plan to disturb more than 5,000 square feet of land, while other cities may place the threshold as high as 15,000 square feet or even one acre.[1] Strategically calibrated on-site retention requirements help to ensure that new development on private land will not add to a city's stormwater burden and redevelopment will help solve runoff problems. In the absence of an on-site retention standard, private buildings and other impermeable surfaces will generate increasing amounts of polluted runoff, which the city (through tax dollars or water charges) must manage.[2] On-site retention rules place the responsibility of reducing runoff on the party generating the runoff and augment the city's stormwater management capability without the need for additional municipal infrastructure. As such, on-site capture ensures that new buildings do not increase a city's stormwater burden and allows cities to take advantage of redevelopment opportunities. Cities with a substantial rate of development or redevelopment in particular can benefit from these rules instead of relying on private property owners to voluntarily undertake undertake stormwater retrofits.

Local stakeholders, including forward-thinking property developers, may even welcome on-site stormwater retention requirements. For example, widespread use of GI in some neighborhoods can help reduce localized flooding, or can improve property values through beautification, improved air quality, and temperature regulation. On an individual building scale, mature vegetation can reduce heating and cooling costs, improve rental income and property values, and increase worker productivity.[3]

STORMWATER CREDIT TRADING

In order to provide more flexibility in their on-site retention rules, cities may create "stormwater credit trading" programs, which allow developers to meet their stormwater retention requirements on their own sites or elect to purchase "credits" for stormwater retention from others who have voluntarily retrofitted their properties through a stormwater credit-trading program.

Optimal design of stormwater credit-trading programs will vary greatly based on local physical conditions, populations, economic drivers, and water quality needs.[4] "Demand" for credits will arise as construction projects trigger the on-site retention requirements and developers seek to comply in part through buying credits generated by stormwater management practices (SMPs) located on other properties. Credits would be "supplied" by property owners with relatively low-cost, on-site retention options who voluntarily implement SMPs on their property with the intention of selling retention credits.

In a functional credit market, property owners will buy credits when it is cheaper or easier than implementing their own SMPs. For example, a high-rise building in a dense urban center may occupy the entire footprint of the parcel on which it sits, leaving only two options for on-site retention: on top of the building or underground. However, the developer might want to use the roof for a deck or a pool, or the space under the building for extra parking or storage. Thus, rather than build all required SMPs onsite, the developer would plan to satisfy at least some of their on-site retention requirement through purchasing stormwater credits. The seller providing credits for the high-rise owner to buy would be a different property owner who is not bound to an on-site retention obligation (i.e., not developing or re-developing), but instead a person who built the SMPs with the intention of selling the credits at a profit.

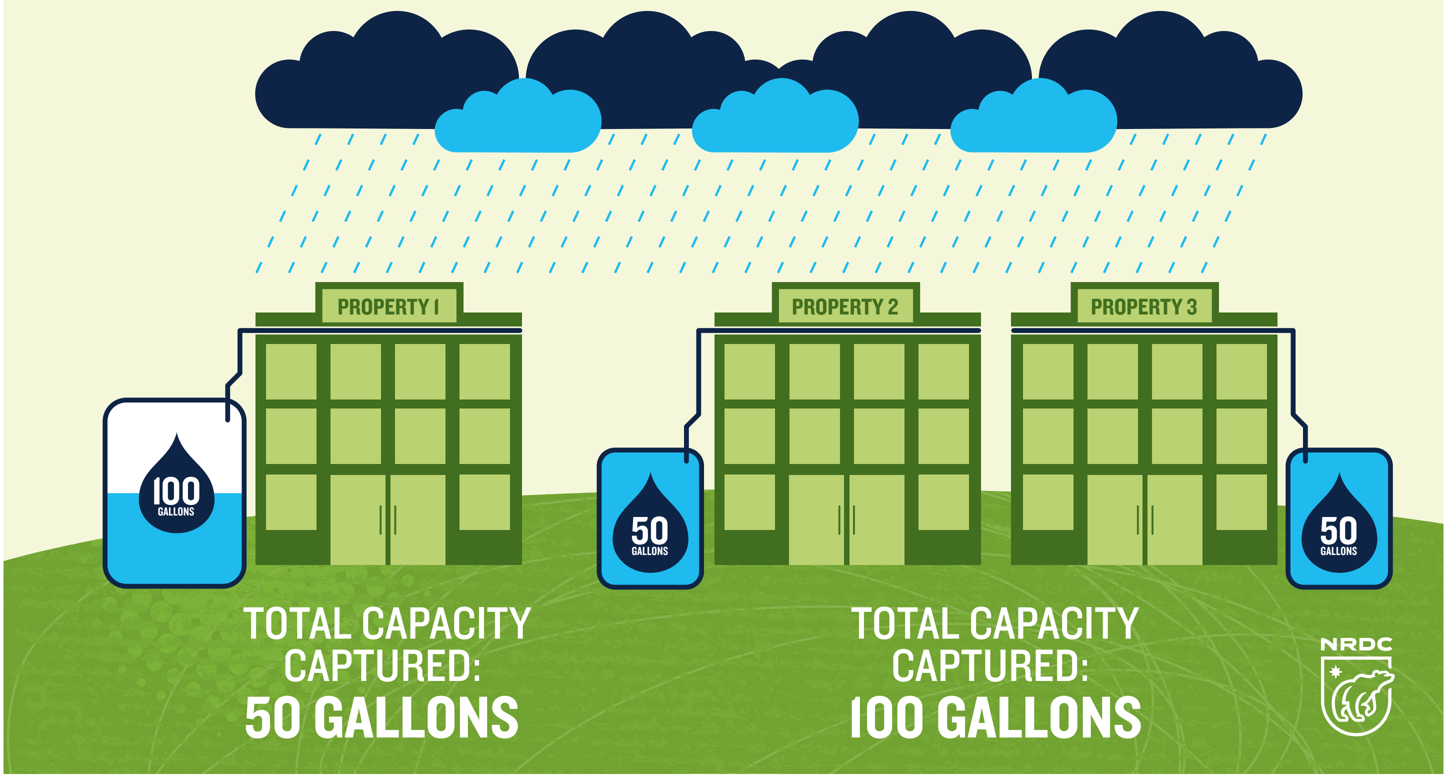
Stormwater credit trading programs present an attractive option for cities that want a flexible option to enlist the private sector in meeting water quality goals. Moreover, as described below, a regulatory system that allows a portion of the retention to be met off site can decrease pollution and flood risk just as well as or even better than a retention rule requiring 100 percent on-site retention. Allowing for some portion of retention to happen offsite generates a larger number of smaller SMPs which, in comparison to a smaller number of larger SMPs, help distribute the ecological, social, and human health co-benefits of GI throughout a watershed (an area that drains into a common waterbody or waterway) and capture more stormwater annually.

However, credit-trading markets can be substantially more costly for local governments to establish and administer than simple on-site retention requirements. Due to lack of resources, many local governments may need to outsource credit-trading market design, administration, and enforcement to external firms. Thus, local governments must decide whether the potential benefits of a credit trading program are worth the added costs. Additionally, local governments must work with the local stakeholders likely to be impacted by these regulations to ensure that they are feasible, understandable, and fair.

After weighing the costs and benefits, if a local government

TWO TANKS ARE BETTER THAN ONE

When it comes to capturing stormwater runoff, communities can capture more volume over time by encouraging the use of multiple stormwater management practices with smaller capacity as opposed to one stormwater management practice with large capacity. This is because most storms only generate a small amount of runoff (pictured below), while big storms that fully utilize large capacity are rare.



decides that a credit-trading program is desirable, adhering to number of principles in program design will be critical to ensuring success in terms of both maximizing water quality and delivering the co-benefits of GI to residents.

I. STRUCTURING THE MARKET: THE 4 "W'S" OF STORMWATER CREDIT TRADING

What defines a credit will vary by city, and should depend on Clean Water Act compliance obligations and water quality goals.

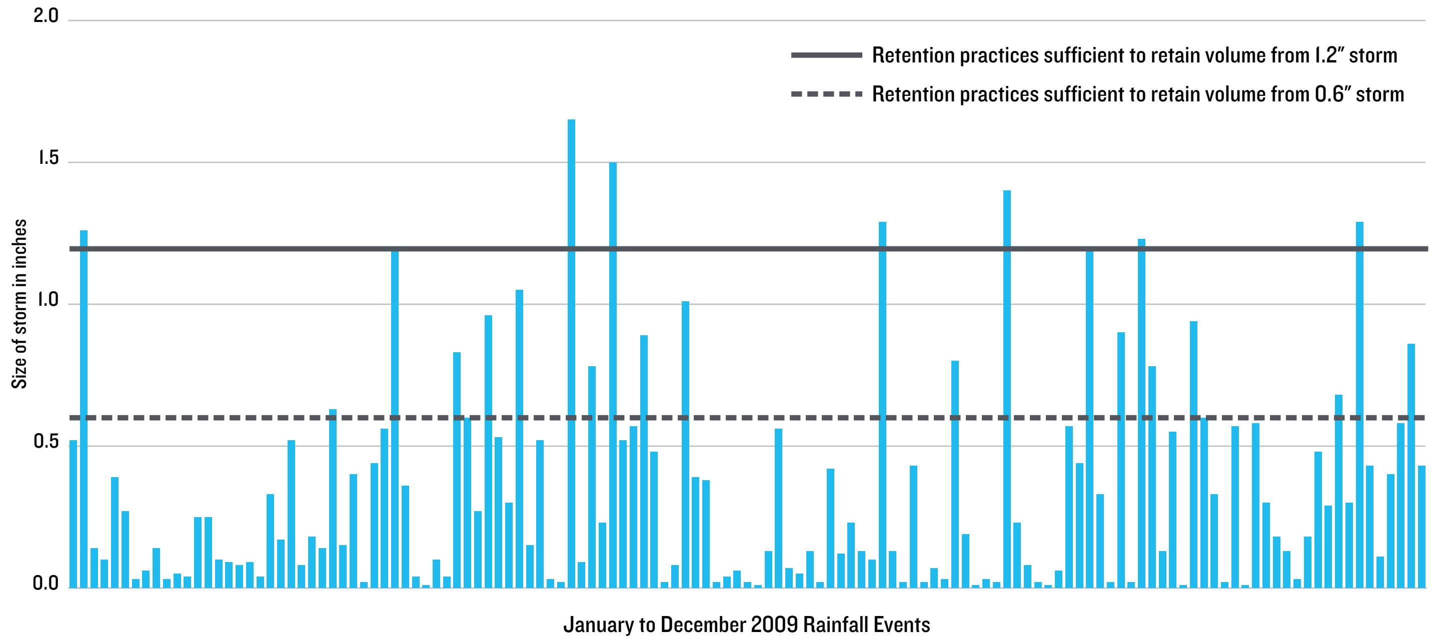
CREDITING RULES MUST BE TAILORED TO SPECIFIC LOCAL WEATHER CONDITIONS TO AVOID EXCESSIVE CREDIT FOR INFREQUENTLY USED CAPACITY

In some cases, there can be substantial economies of scale at play in SMP construction, such that building a SMP that manages twice the amount of stormwater as another SMP may cost less than twice as much. However overconstruction of SMPs should not be rewarded because the extra retention is used only during enormous and statistically unlikely storms, as seen in Two Tanks are Better Than One above.

More generally, as illustrated in Figure above, a large single SMP sized to capture 100 gallons will capture less volume, over the course of a year, than two smaller SMPs, each sized to capture 50 gallons. Because small storms are more common than large storms, the single larger SMP's extra capacity won't be used very often. On the other hand, the two smaller SMP's would be more fully utilized during smaller storms, thus capturing more stormwater.

To apply the "two SMPs are better than one" concept in an example city, figure 2 provides an example of the relative frequency of small and large storms in Washington, D.C. in 2009. The District's retention standard for new and redevelopment is 1.2 inches over the project's area, half of which must be met on-site. If developers chose to retain all their stormwater onsite, the likely result is one large SMP. If, however, developers chose to buy credits for the remaining half of their retention requirement, two smaller SMPs will be built—one on the developer's site and one on

FIGURE 2: 2009 RAINFALL EVENTS IN THE DISTRICT OF COLUMBIA



Source: Weather Underground

the credit seller's property. These two smaller practices will have captured more rainwater in the District's frequent (approximately 120 events in 2009) small storms when compared to the amount of rainwater captured by one larger practice, which would only utilize its full capacity during large storms (approximately 20 events in 2009).

Once the SMP capacity exceeds a necessary minimum, a sliding scale in which credit value diminishes as the SMP gets larger can discourage developers from overbuilding SMPs and help the city keep a realistic picture of how much stormwater is being captured annually.

CREDIT DENOMINATION

Every credit-trading program aims to reduce pollution. A credit corresponds to a certain amount of stormwater retention capacity supplied by an SMP over a certain period of time. Depending on how existing water quality goals are framed, it may make sense to denominate a credit in terms of volume of capture in gallons (e.g., 1 credit = 3,000 gallons of retention capacity) or on a spatial basis, where a credit corresponds to the number of square feet over which a certain measure of stormwater is captured (e.g., 1 credit = 1 inch of stormwater retention capacity over 500 square feet of impervious area).

IMPORTANCE OF DESIGN GUIDELINES, MAINTENANCE OBLIGATIONS, AND CREDIT CERTIFICATION

Guidelines should be created to ensure that SMP construction, post-construction certification, and ongoing maintenance meet the city's design standards. These provisions will ensure that the voluntary SMPs built on private property conform to the city's regulatory requirements.[5] Design and construction guidelines may take the form of a manual explaining which SMPs are eligible for accreditation, as well as how those SMPs should be built and maintained. [6]

During the lifetime of a credit, owners must commit to maintaining the SMP and allowing site inspections to confirm SMP functionality.

Certification will typically include some methodology to process SMP credit applications to ensure that the projects meet design, construction, and maintenance standards before the credits can be sold.

Credit-generating projects should be subject to the same review/approval process as when the city certifies on-site SMP compliance with new development/redevelopment requirements

Who is eligible to generate credits and which are the watersheds where a credit can be sold?

Credits should only be sold within the watershed where the credit-generating SMP is located. As such, cities should prohibit trading across watersheds. If trading allows developers in one watershed to buy credits that correspond to SMPs in another, the benefit of the SMP for one waterbody does not mitigate the negative impact of the development on the other. For this reason, the U.S. Environmental Protection Agency (EPA) strongly discourages trading between watersheds.[7]

In a combined sewer area, similar concerns arise if a new impervious area is developed in a dense urban core, but the developer wants to buy credits that correspond to SMPs in a less developed area. In such a case, the offsite SMP might not ameliorate the polluted runoff and increased likelihood of sewer overflows caused by the newly developed site, nor will the offsite SMP produce an appropriate pollution reduction.

The term “watershed” should be defined based on each area’s water quality goals. In the case of a Total Maximum Daily Load (TMDL), the scale of the watershed boundaries should match the geographical area under a pollution limit.[8]

It is worth noting that, in some cities with several receiving water bodies or several drainage areas, a stormwater credit-trading system may not be feasible. There may not be enough supply and demand to support a liquid credit market within a small watershed.[9]

Cities may consider ways to prioritize neighborhoods for SMP construction and may consider delineating the preferred source neighborhoods for SMP credits, so that more SMP’s get built in the neighborhoods the city targets for both social and environmental reasons.

When should credits be used? Accounting for stormwater retention and problems with credit banking

When a property owner “uses” credits to meet their on-site retention obligations, those credits must be immediately retired from the market so that they cannot be subsequently bought or sold.

Credit banking occurs when credits are not used immediately after they are generated, but rather are stored for later use (either by the credit generator, credit purchaser, or a third party).

Banking credits can be problematic because it generates a risk of creating disparate “real world” and “on paper” compliance pictures at the moment of credit retirement. If a property owner buys many credits over a period of years and then uses them all at once, in the real world, incremental retention has occurred over a longer period of time. On paper, however, because that owner then retired or “used” a large number of credits at once, it appears that a large amount of retention has occurred in a short time. This problem also comes into play when a large SMP quickly generates a lot of credits, but those credits are used gradually over a long time period. In that case, according to the city’s credit trading records, it looks as if a smaller amount of retention occurred over many years when in reality a large amount of retention occurred over a short period.

Disparate “on paper” and “real world” pictures caused by credit banking will make it hard for a city know exactly how much retention is getting accomplished in the watershed at any given time and therefore inhibits a jurisdiction’s ability to plan for meeting water quality goals or pollution reduction limits. This can cause the municipality to potentially fall short of their water quality goals and violate legal retention requirements (e.g., in a Municipal Separate Storm Sewer permit).

To ensure that a given SMP is, in fact, reducing the load on the stormwater system and receiving water bodies at the time that the credit is used, the life span of a credit (from certification until use or “retirement”) should not extend beyond the duration of the SMP maintenance obligations. To avoid problems with credit banking, cities should require that credits be used as soon as possible after—and at least within a year—certification. Prohibiting credit banking and limiting the lifetime of a credit can increase the certainty of water quality outcomes and ensure uniformity in how much stormwater capture is represented by any given “credit” at any time and place in the market.

It is important to note, however, that prohibiting credit banking can also reduce liquidity in the credit trading market (discussed in more detail below) and possibly depress credit prices. To counter these challenges, a municipality can deploy a number of strategies:

- Build SMPs on public land and sell them as credits to increase the number of available credits in the market
- Buy credits to ensure a “floor price” below which credits do not fall
- Enable multi-year credits (see example in box below).

MAKING MULTI-YEAR CREDITS AVAILABLE

Without the ability to “bank” credits, property developers who comply in part with their retention requirements through offsite credits are in particular need of multi-year credits. Indeed, potential property buyers may hesitate if, owing to the future need to buy offsite credits, the ownership costs of the building are uncertain. To help address this concern, if an SMP were certifiable for a multi-year period, say three years, a single three-year credit can be sold with the building, rather than the owner needing to buy new one-year credits each year. This would stabilize the stormwater compliance costs for the first three years of ownership without the need to bank credits.

2. GETTING THE MARKET STARTED: THE NEED TO STIMULATE DEMAND FOR CREDITS AT PROGRAM INCEPTION

AVOIDING PERCEPTION OF LIQUIDITY RISK

At the start of a new credit trading market, very few credits will be bought or sold, in part because there is a perception of strong liquidity risk—the hazard that a credit cannot be sold without a significant price concession due to the small size of the market. If buyers and sellers are unsure about their ability to buy or sell a credit at a relatively stable price, some may avoid the market completely, leading to inefficiency.

There are several ways that cities can effectively create a "purchase guarantee" to reduce liquidity risk by ensuring that there is a demand for credits from program inception. For example, the city may offer to buy stormwater credits directly, or work with local environmental organizations, private entities, or philanthropies to commit to buying those early credits.

If the city buys credit directly, it allows the city to establish a price floor, which can help set the credit price at a level that will encourage property owners to install credit-generating SMPs. Moreover, it may make sense for cities to continue buying stormwater credits on an ongoing basis. If the cost of SMPs on private land is less than the cost of equal retention on public land, a city can save money by buying stormwater retention credits to achieve a portion of its water quality goals.[10]

Even outside of the initial liquidity context, a city can always offer to buy credits when the credits come from SMPs built in priority areas for the city. By taking steps to ensure early credit demand, a city can also help direct the location of initial GI projects to neighborhoods prioritized for environmental, economic, or social reasons.

AVOIDING "GRANDFATHERING" OF CREDITS

Cities should avoid awarding "credit" for existing SMPs in an attempt to increase liquidity early in the credit market. This practice does supply credits early on, but it defeats the purpose of the market because new SMPs are not built, since existing SMPs will fulfill demand for credits. In addition, the credits for grandfathered SMPs may be offered at prices that no longer correspond to true project costs in the current market, depressing prices and discouraging potential credit sellers from new SMP construction.

Finally, grandfathering SMPs will not advance a city's pollution reduction goals. If credit is given to preexisting projects, the SMP that generated the credit would not reduce pollution further since it predated the market. Instead, it would maintain the status quo.

ENSURE CREDIT-TRADING PROGRAMS WORK TOWARD WATER QUALITY GOALS AND ARE WELL UNDERSTOOD BY MARKET PLAYERS

Cities should conduct robust cost-effectiveness analysis in determining whether a credit trading program makes sense locally. Wherever possible, the results from those analyses should be shared with local stakeholders, especially the real estate community, to invite feedback and establish an ongoing dialogue with local stakeholders around the market rules. For example, cities can learn how real estate developers plan to integrate stormwater credit trading into building pricing and sales. This can help a city better anticipate important issues with credit trading rules, such as credit banking and ongoing maintenance requirements. However, accounting for the needs of market participants must always take place within the context of crafting a trading scheme that ensures pollution control equal to or greater than 100 percent on-site compliance.

During credit trading program setup, stakeholder participation and transparency should be emphasized through a public process. This can help disseminate information about the program and ensure that it is understood by market participants and draws participation from the targeted property owners. Stormwater authorities creating a trading program may find stakeholder partners in local real estate affinity groups such as U.S. Green Building Council (USBGC), Urban Land Institute, or local chambers of commerce.

Once a locality decides that a credit trading program should be established, an online platform should be created to facilitate transactions by helping connect credit buyers and sellers, the quantity and cost of retention credits that are available, and the location and type of the stormwater retrofit that generated the credit. Online platforms might also include near-term credit demand forecasting (perhaps updated regularly to show locations of approved construction permit applications). The online platform can be created and maintained by the city or by a third party.

CONCLUSION

Stormwater credit trading programs can be a valuable addition to a city's water quality compliance strategy. They provide a measure of flexibility in on-site retention rules, and can actually provide equal or better water quality outcomes compared to a simple on-site retention rule. Cities should carefully consider the opportunities and limitations in the local geography and study whether the rate of development is projected to create enough of a market to merit the costs of program startup and ongoing administration. Ultimately, however, the details of the credit trading program such as prohibiting trading across watersheds, credit banking, and limiting the lifetime of a credit, will determine whether the program helps or hinders local water quality goals.

ENDNOTES

1 For some municipalities regulated as small Municipal Separate Storm Sewer Systems (MS4s) under the federal Clean Water Act, federal rules require a threshold of no greater than one acre for regulation of runoff from new development and redevelopment. 40 C.F.R. § 122.34(b)(5)(i). Federal law requires MS4s to reduce polluted runoff from new development and redevelopment “to the maximum extent practicable.” 33 U.S.C. § 1342(p)(3)(B)(iii). In some states and regions this has been interpreted to require thresholds lower than one acre, and to require on-site retention of specified volumes of runoff. *See*, e.g., EPA, *Post-Construction Performance Standards & Water Quality-Based Requirements* (June 2014), available at http://www3.epa.gov/npdes/pubs/sw_ms4_compendium.pdf

2 Because they are usually triggered by new property development or re-development, on-site retention requirements may not always provide a reliable stream of green infrastructure. In an economic downturn, for example, there may not be much new or re-development in a given city.

3 Clements, J. and St. Juliana, A., “The Green Edge: How Commercial Property Investment in Green Infrastructure Creates Value,” NRDC, December 2013, www.nrdc.org/water/commercial-value-green-infrastructure.asp; Chen, J. and Hobbs, K., “Rivers to Rooftops II: Green Strategies for Controlling Stormwater and Combined Sewer Overflows,” NRDC, October 2013, www.nrdc.org/water/pollution/rooftopsii/files/RooftopstoRivers_chapter2.pdf; U.S. Environmental Protection Agency, “Why Green Infrastructure,” U.S. Environmental Protection Agency, July 22, 2014, http://water.epa.gov/infrastructure/greeninfrastructure/gi_why.cfm.

4 Valderrama, A., et al., “Creating Clean Water Cash Flows: Developing Private Markets for Green Stormwater Infrastructure in Philadelphia,” NRDC, January 2013, pp. 35-53, www.nrdc.org/water/stormwater/files/green-infrastructure-pa-report.pdf.

5 Ibid. pp. 47.

6 The Philadelphia Water Department has created a good example of SMP design standards in its online resource page for private property owners seeking to build SMPs in order to mitigate their stormwater fees. Philadelphia, Water, “Green Stormwater Infrastructure Design Resources,” Philadelphia Water, 2015, www.phillywatersheds.org/what_were_doing/gsi_design_resources.

7 U.S. EPA Office of Water, “Final Water Quality Trading Policy,” U.S. Environmental Protection Agency, January 13, 2003, http://water.epa.gov/type/watersheds/trading/finalpolicy2003.cfm.

8 Under the federal Clean Water Act, the EPA and states establish total maximum daily loads (TMDLs) for impaired water bodies. TMDLs calculate the maximum amount of a pollutant that a water body can receive and still safely meet water quality standards. 33 U.S.C. § 1313(d); 40 C.F.R. § 130.7.

9 For example, Philadelphia has 7 watersheds in its 134 square miles. This small size of each watershed could make trading challenging with too little supply and/or too little demand to make a market in each watershed. See http://www.phillywatersheds.org/what_were_doing/waterways_assessment/comprehensive_assessment. By comparison, Los Angeles has 4 watersheds and is 468 square miles, so on average each watershed is much larger, making trading more feasible. *See* http://www.lastormwater.org/about-us/about-watersheds/

10 Valderrama, A., et al., *Creating Clean Water Cash Flows*, Chapter 1.