Off-Site Stormwater Crediting: Lessons from Wetland Mitigation

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Executive Summary

State and local governments have begun to develop off-site stormwater crediting programs as alternative mechanisms to implement on-site retention and treatment requirements in NPDES municipal stormwater (MS4) permits. This approach enables landowners and developers to receive credit for meeting permit requirements by implementing stormwater controls at off-site locations, particularly in cases where implementation at development project sites is infeasible or cost-prohibitive. Permittees have little experience with this type of implementation approach, and most permits provide little or no direction on how to structure a program that functions well, meeting not only its compliance requirements but also its community goals. To date, few municipalities have implemented successful off-site crediting programs.

Stormwater crediting resembles other Clean Water Act approaches, including the compensatory mitigation banking approach used to address impacts of wetland modification or destruction authorized under Section 404. Evaluations of the wetland mitigation banking program offer valuable lessons that can inform the design of off-site crediting programs authorized in MS4 permits. Water quality trading guidance may also inform the development of stormwater crediting programs. Based on a review of current literature, case studies, program rules, and guidance related to wetland mitigation, water quality trading, and off-site stormwater crediting, this paper identifies critical permitting and program design elements needed to appropriately authorize, design, and implement effective off-site stormwater crediting programs.

Like wetland compensatory mitigation approaches, regulators can implement off-site stormwater controls along three main pathways: privately-arranged off-site controls, purchase of credits through an approved crediting or banking program, or payment to an approved in-lieu fee program. These approaches can facilitate sustainable stormwater control projects, increasing capacity to capture, treat, and reuse stormwater; enhance flood control functions; or achieve other public objectives.

Lessons from compensatory wetland mitigation programs indicate that poor site selection, design, monitoring, and tracking resulted in regular failure of mitigation efforts. Projects were more likely to succeed in meeting their permit requirements and project goals when supported by thorough analysis, diligent agency oversight, careful consideration of regional or cumulative impacts, and thoughtful project design. Applying these and other lessons to off-site stormwater crediting programs similarly points to the necessity of providing a sound administrative, financial, and legal foundation. An off-site stormwater crediting program should be compatible with community resources and goals, supplemented by robust technical and administrative analysis, and supported by strong project design and program oversight. Crediting options authorized in MS4 permits should provide adequate accountability and water quality protection as required under the Clean Water Act and associated regulations. Permitting authorities and permittees should be willing to invest in active oversight of off-site projects, and adjust program design or execution in response to new information throughout the program's life. Decision-making transparency and local buy-in are also essential for successful implementation.

This paper identifies lessons from the history of wetland mitigation implementation, assesses the current state of off-site stormwater crediting, and provides key recommendations to develop robust stormwater crediting provisions in MS4 permits and effectively implement stormwater crediting programs at the local level.

Table of Contents

1. Introduction: Why Off-Site Stormwater Crediting?

Many municipal stormwater (MS4) permits issued under Clean Water Act (CWA) Section 402 NPDES regulations require landowners or developers to implement post-construction controls that retain, treat, or infiltrate stormwater on-site to reduce runoff of water and pollutants. In some locations, on-site retention and infiltration are technically infeasible or cost-prohibitive. In other cases, developing larger-scale, regional stormwater infiltration and treatment facilities may provide more cost-effective and naturally-sustainable water supply augmentation than distributed infiltration facilities. Sometimes a parcel nearby offers an opportunity for stormwater retention and water quality protection with enhanced environmental and community benefits. For these reasons, stormwater regulatory authorities, permittees, and land managers have recently expressed interest in developing options for off-site stormwater management as an alternative to on-site controls.

State and local governments are developing off-site stormwater crediting programs to help implement required runoff reductions, address technological constraints in dense urban environments, provide collateral community enhancements, and give developers and land managers greater regulatory flexibility without compromising water quality. While providing flood hazard and pollution reduction, stormwater crediting programs can facilitate other benefits, such as supplemental irrigation water, groundwater recharge, improved aesthetic and recreational opportunities, ecosystem enhancements, watershed education, and job creation.

Off-site stormwater crediting programs are one of the most promising alternative approaches to addressing these interests, but limited guidance exists concerning their design, structure, and implementation. Off-site stormwater crediting is still in the early stages of development and implementation, but similarly-structured wetlands mitigation approaches have been tested for more than a decade and can provide insights for developing stormwater crediting programs. Early off-site wetlands mitigation efforts resulted in many successes and some notable failures. Lessons learned from wetland mitigation banking will benefit stormwater crediting program development by highlighting significant technical, legal, financial and administrative characteristics critical to success. Features unique to existing stormwater crediting programs reflect the physical and political environments of the states and local governments that adopt them, with little consistency from one jurisdiction to the next. Stormwater crediting is not yet widespread, so this is an excellent time for regulators to address opportunities and potential pitfalls. Our objective is to encourage effective and appropriate implementation.

Study Scope

We evaluated experiences with wetlands compensatory mitigation approaches, program rules, mitigation and water quality trading guidance, and the current state of off-site stormwater crediting. We identified key factors needed to appropriately accommodate, direct, and facilitate effective off-site crediting options. We also reviewed documents related to existing stormwater programs, considering regulatory approaches, financing options, outreach methods, and tracking mechanisms. A selection of interviews with stormwater crediting managers provided valuable insights into early implementation experiences.

Organization

We first assess aspects of wetland compensatory mitigation, noting key lessons and critical structural elements that can apply to stormwater crediting. We then provide recommendations regarding the development of stormwater crediting programs. Examples from existing wetland mitigation and stormwater crediting programs are provided to illustrate why these elements are critical to success. Finally, we recommend NPDES permitting provisions to help ensure that authorized programs contain sufficient technical, administrative, legal, financial, and structural rigor.

2. Learning from Wetlands Mitigation

Early Issues with Wetland Mitigation Banking

In the decades before the Clean Water Act and in its early days, wetland losses in the U.S. were occurring at an alarming rate. In 1989, the U.S. Army Corps of Engineers (Corps) and U.S. EPA signed a Memorandum of Agreement expressing an overall goal of "no net loss" of wetlands (US Dept. of the Army and USEPA, 1990). It required actions to offset unavoidable adverse impacts to wetlands, streams, and other aquatic resources when Clean Water Act Section 404 permits authorized wetland impacts. Many studies of the compensatory mitigation program under Section 404 and associated guidance documents, including the National Research Council's Assessment of Wetlands Mitigation (NRC 2001), found that while the rate of wetlands loss had declined by nearly a quarter over the previous decade, net losses continued. Compliance with permit conditions was minimal, and the Corps, the lead federal agency, was not adequately tracking progress. The NRC (2001) recommended several measures to improve progress toward the "no net loss" goal, including the development of a tracking database, improving quality assurance, and use of a watershed approach to ensure the integrity of wetlands.

Constructed wetlands were failing to function as wetlands, so the report also recommended that mitigation wetlands be self-sustaining and designed to mimic natural conditions. Some mitigation projects were incorrectly installed, inadequately maintained, or not installed at all; accordingly, the report further recommended establishing more effective legal and financial assurances. The NRC (2001) called for permittees to complete compensatory mitigation concurrent with, and preferably prior to, the authorized activity and associated impacts. The NRC also urged the Corps to articulate performance standards, implement more effective compliance programs, and ensure long-term stewardship of mitigation sites. Because the NRC found that Section 404 permit writers were not adequately trained or supported, and there was little oversight or consistency from one Corps District to the next, the NRC (2001) called for the development of guidance manuals.

Ambrose et al. (2007) undertook a detailed file and field review of wetland mitigation projects in California, assessing compliance with permit requirements and identifying wetland conditions and functions from an ecosystem standpoint. Their objective was to determine whether the wetland mitigation program was accomplishing both the specific requirements as well as the overall purpose of the regulations (i.e., "no net loss"). They discovered widespread deficiencies in the implementation of the law and guidance. Their key

findings and recommendations highlighted poor project planning, minimal compliance with permit conditions, nonattainment of ecological goals, a net loss of wetlands and associated uplands, and improper wetlands accounting (non-wetland uplands and buffer areas incorrectly classified as wetlands). Overall, intended results were not achieved, in part due to "vague regulatory language and lack of clear accounting" (Ambrose et al. 2007).

Program oversight was also lacking. The U.S. Government Accountability Office (GAO) reviewed Corps guidance, oversight, and potential enforcement actions for compensatory mitigation projects, titling the report with its major conclusion: "Corps of Engineers does not have an effective oversight approach to ensure that compensatory mitigation is occurring" (US GAO 2005). GAO visited seven Corps Districts. Of 152 permit files where compensatory mitigation was required, only slightly more than half even required monitoring reports. Of those, only 21 permittees submitted at least one report. About the same number showed evidence that the Corps had completed an inspection. The Corps provided slightly more oversight for 85 mitigation bank permits and 12 in-lieu fee permits than for the permittee-responsible installed wetlands. Of the 85 mitigation banks, the Corps required monitoring reports for 60; only 42 submitted required reports. The Corps conducted inspections for just 31 permits. For the 12 in-lieu fee permits, the Corps required monitoring reports for all, and all but one submitted at least one report. The Corps conducted inspections on five of the in-lieu fee permits.

GAO found that the Corps has adequate enforcement authority, including the ability to issue compliance orders, assess administrative penalties, force permittees to forfeit bonds, suspend or revoke permits, and implement third-party agreement enforcement provisions—even if the permittee does not perform required mitigation. However, the Corps rarely undertakes enforcement actions, and District officials sometimes undermined their enforcement authority by not including clear and enforceable requirements in the permits (US GAO 2005).

2008 Compensatory Mitigation Rule and Standardized Mitigation Elements

The 2008 Compensatory Mitigation Rule (US Dept. of Defense and USEPA 2008, at 40 CFR § 332.4(c)) addressed mitigation inadequacies by standardizing and adding additional program requirements. The rule added a "sequencing" provision, requiring that compensatory mitigation not be considered until after all other steps have been taken first to avoid, then minimize adverse impacts. The rule now requires monitoring for at least five years following installation of compensatory mitigation. It sets a cap on the number of credits that a bank can sell before securing a compensatory mitigation site and implementing the required mitigation. The rule also favors in-kind mitigation (i.e., creating or restoring specific wetlands functions and services to replace those that were lost or damaged in the development). The previous preference for on-site mitigation was removed, in recognition that off-site locations can sometimes provide superior wetland mitigation opportunities.

Assessing the failures of some mitigation banks led the Corps and EPA to establish clearer and more consistent requirements, such as standard elements for mitigation plans, to facilitate effective planning and appropriate review of proposals in advance of permitted activities. The goal was to ensure that the mitigation wetlands adequately compensated for wetlands impacts (US Dept. of Defense and USEPA 2008, at 40 CFR § 332.4(c)). Plans for compensatory mitigation projects must now contain 12 minimum elements (below):

Table 1: Minimum Required Elements for Compensatory Mitigation Projects 40 CFR § 332.4(c)(2)-(14)
(1) Objectives: A description of the resource type(s) and amount(s) that will be provided, the method of compensation (i.e., restoration, establishment, enhancement, and/or preservation), and how the resource functions of the compensatory mitigation will address the needs of the watershed, ecoregion, physiographic province, or other geographic areas of interest.
(2) Site Selection Criteria: A description of the factors considered during the site selection process, including consideration of watershed needs, on-site alternatives, and the practicability of accomplishing ecologically self-sustaining aquatic resource restoration, establishment, enhancement, and/or preservation.
(3) Site Protection Instrument: A description of the legal arrangements and instrument, including site ownership, that will be used to ensure the long-term protection of the mitigation project site.
(4) Baseline Information: A description of the ecological characteristics of the proposed mitigation project and impact sites. May include historic and existing plant communities and hydrology; soil conditions; locations of the impact and mitigation site(s); and jurisdictional delineation of waters of the United States on the proposed mitigation site. A prospective permittee who plans to secure credits from an approved mitigation bank or in-lieu fee program does not need to provide baseline information about the mitigation bank or in-lieu project site.
(5) Credit Determination Methodology: A description of the number of credits to be provided, including a brief explanation of the rationale for this determination. An explanation of how the mitigation project will provide the required compensation for unavoidable impacts to aquatic resources for permittee-responsible mitigation, and/or the number and resource type of credits to be secured and how these were determined for permittees intending to secure credits from an approved mitigation bank or in-lieu fee program.
(6) Mitigation Work Plan: Detailed written specification and work descriptions for the mitigation project, including geographic boundaries, construction methods, timing, and sequencing; source(s) of water, including connections to existing waters and uplands; methods to establish the desired plant community and control invasive species; proposed grading plan; soil management and erosion control measures. For stream mitigation projects, planform geometry, channel form, watershed size, design discharge, and riparian area planting.
(7) Maintenance Plan: A description and schedule of maintenance requirements to ensure the continued viability of the resource once initial construction is completed.
(8) Ecological Performance Standards: Ecologically-based standards that will be used to determine whether the mitigation project is achieving its objectives.
(9) Monitoring Requirements: A description of parameters to be monitored to determine if the mitigation project is on track to meet performance standards and if adaptive management is needed. A schedule for monitoring and reporting on monitoring results to the district engineer must be included.
(10) Long-term Management Plan: A description of how the mitigation project will be managed after performance standards have been achieved to ensure the long-term sustainability of the resource, including long-term financing mechanisms and the party responsible for long-term management.
(11) Adaptive Management Plan: A strategy to address unforeseen changes in site conditions or other components of the mitigation project, including the party or parties responsible for implementing the adaptive management measures.
(12) Financial Assurances: A description of financial assurances that will be provided and how they are sufficient to ensure a high level of confidence that the compensatory mitigation project will be successfully completed, in accordance with its performance standards.

Source: US Dept. of Defense and USEPA 2008. Compensatory Mitigation for Losses of Aquatic Resources; Final Rule. 40 CFR § 332.4(c).

All compensatory mitigation proposals undergo a similar process and must include those 12 elements. The Corps District Engineer may require additional information as necessary to determine the appropriateness, feasibility, and practicability of the compensatory mitigation project. Some districts have developed additional guidance and templates. Permittees can provide compensatory mitigation using one of three main options:

- Permittee-responsible mitigation (permittee prepares a proposal for on-site or off-site mitigation specific to the permitted activities, obtains approval, and implements the approved mitigation project, either on the development site or off-site, as authorized in the permit);
- Use of an approved mitigation bank (purchase of mitigation credits from a pre-established mitigation site designed to "bank" mitigation credits for future use by the bank sponsor or for sale to other permittees); and

- Payment of an in-lieu fee, which is placed into a fund managed by the in-lieu fee sponsor, with funds to be expended on a compensatory mitigation project (either a single project or one that consolidates funds from more than one project) within three years.

Mitigation Banks

A wetland mitigation bank provides prospective permittees an option to purchase mitigation credits rather than install their own mitigation project on-site or off-site. Private individuals, corporations, public agencies, nongovernmental organizations, or any other entity willing to assume the risks and responsibilities (the "sponsor") may develop a wetland mitigation bank. The sponsor funds and installs the mitigation project before wetland impacts occur, or in anticipation of future impacts. The mitigation bank must meet schedule, installation, and performance benchmarks before any sales can happen, as specified in its permit authorization package. The sponsor is thus motivated to create a viable project to recoup their investment. Corporations anticipating a future need to provide compensatory mitigation may develop a mitigation bank for their own use, to expedite future development approvals. Public agencies and nongovernmental organizations sometimes create mitigation banks to meet policy objectives. Agencies can install mitigation bank projects on public lands or rights of way and can expedite their internal approval processes. In some markets, investors will create successful mitigation projects, motivated only by profit potential, which can be significant in some urban areas. From a regulatory perspective, a mitigation bank is preferable to permittee-responsible mitigation because a permittee installs it in advance, so its success can be assured before impacts occur (J. Siu, pers. comm., 2017). Because the ecological values and services are known in advance, replacement values of impacted wetlands can be more appropriately assigned.

A mitigation bank enabling instrument is attached to the permit, specifying the terms of project approval, including site descriptions, construction details, credit release schedule, and legal and financial assurances. The permit also includes performance standards, operating and maintenance requirements, and procedures for closing the bank when all the credits have been released and sold. Once the sponsor establishes the mitigation bank, credits can be purchased, sold, or saved for future use within a service area defined by the local Corps District (40 C.F.R. § 230). Typically, 20 percent of the credits are released as soon as implementation is complete, then roughly 10 percent each following year, as specified in the enabling instrument (M. Scianni, pers. comm., 2017).

Unfortunately, some changes contained in the 2008 rule *reversed* wetland protections. For example, the previous regulations required that mitigation banks "be protected in perpetuity with appropriate real estate arrangements" (33 C.F.R. § 332.7(a)). The 2008 regulations removed the requirement for sponsors to protect mitigation banks in perpetuity, and instead replaced it with a vaguely-worded requirement for "long-term protection" (Alagood 2016). "Long-term" is typically understood to be five to ten years, although this can vary (M. Scianni, pers. comm., 2016). Thus, an existing wetland and its associated values and ecological services, permanently destroyed by the permitted activity, is only required to be "self-sustaining over time" and "to the maximum extent practicable." The regulations acknowledge that "some active management and maintenance may be required to ensure their long-term viability and sustainability" (Alagood 2016, citing 33 C.F.R. § 332.7), but do not specify requirements to attain that goal. This ill-defined provision almost guarantees additional losses will occur. Furthermore, the 2008 rule does not adequately address permittee-responsible mitigation. Sometimes the Interagency Review Team (IRT), which reviews the applications, may be reluctant to deny an

authorization for a mitigation bank even if is unlikely to succeed, for fear that the applicant may instead choose permittee-responsible mitigation instead, with its weaker oversight and review options (J. Siu, pers. comm., 2017).

Once the bank sells all the credits and closes, the "long-term" monitoring phase begins. Regulatory agencies have little leverage to influence the outcomes at this point. The required endowment fund, which pays for long-term monitoring and maintenance, is estimated using detailed cost information. Permit writers estimate credit prices from current market values, which can fluctuate with the economy. For example, prices for credit sales fell precipitously in the economic downturn following the 2008 stock market crash. As a result, endowment funds were smaller than needed for monitoring, operations, and maintenance, because they were tied into higher sales price estimates (M. Scianni, pers. comm., 2016). In western states, the recent drought has also been a significant factor in the failures of some mitigation bank sites: invasive species become established with the reduced water supply, out-competing the wetland species. Maintaining the wetland requires more management interventions than initially anticipated, and more time, effort, and resources to meet performance standards. Permit writers do not usually account for unforeseen changes (including climate change). Accordingly, projects with artificial hydrology and extensive maintenance requirements are less likely to succeed. Approving officials, understandably, prefer projects with natural hydrological regimes (M. Scianni, pers. comm., 2016).

Although approving officials have more ability to influence mitigation banks than permittee-responsible projects (J. Siu, pers. comm., 2016), "advance credits" are sometimes sold once the mitigation bank is far enough along that regulators are confident it will be completed as designed (M. Scianni, pers. comm., 2016). Again, regulators have limited leverage to influence the outcome once the bank sponsor sells all the credits. Moreover, a mitigation bank may not necessarily yield the same functions and values that the impacted wetland would have. Regulators may require an applicant to replace lost acreage at a greater than 1:1 ratio to account for the loss of a high-value wetland, but that would not guarantee replacement of the specific functions and values from the original wetland.

In-Lieu Fees

Payment of an in-lieu fee to an approved in-lieu fee sponsor is an alternative to permittee-responsible mitigation or purchase from a mitigation bank. An in-lieu fee sponsor is usually either a public agency or a nonprofit organization approved by a public agency. Fees remain in the sponsor's fund until the sponsor identifies a mitigation project and collects sufficient funds to install it. This option enables a program sponsor to consolidate funds from several projects or contributors, and it can allow the sponsor to take advantage of economies of scale. In theory, the funds could be used for larger, more complex, or ecologically noteworthy wetland projects, potentially beginning to address the ongoing loss of extensive, regionally-significant wetlands. Regulators initially hypothesized that in-lieu fee projects could be more valuable than scattered, smaller-scale, permittee-responsible mitigation. Thus, in-lieu fee requirements in the pre-2008 regulations were more lenient. The disparity between in-lieu fee and the other options was sharply criticized over time. Not only did the projects fail to meet the ideal of re-creating regionally-valuable wetlands, they sometimes failed entirely to achieve the necessary acre-for-acre wetland replacement requirement. The regulations did not specify standards or procedures for the use of in-lieu fees; as a result, fees were sometimes expended inappropriately, on items unrelated to wetland mitigation (CWP 2012a, M. Scianni, US EPA, pers. comm., 2016). The 2008 rule

(40 C.F.R. § 230) strengthened standards and requirements for in-lieu fee programs equivalent to mitigation bank requirements.

Wetland impacts usually occur before the sponsor has expended in-lieu fees on a mitigation project. Ideally, the permittee would complete mitigation by the time the impacts occur. Temporary wetland losses occur immediately when the wetland is adversely affected, and the impacts are uncompensated until the permittee installs appropriate mitigation. Often, significant time lags can occur between impacts and mitigation—beyond the three-year limit specified in the regulations, especially if suitable mitigation sites are difficult to find and acquire (M. Scianni, pers. comm., 2016). Regulators have little ability to enforce the time limit or otherwise influence the outcome once permits have been issued, which typically occurs before a mitigation project for the in-lieu funds has even been determined.

The Corps Districts set in-lieu fee pricing. Payment of the fee absolves the permittee of further responsibility, which is then transferred to the sponsoring agency, so it is crucial that regulators set fees incorporating all direct and indirect costs from the present through the anticipated life of a compensatory project.

Geographic Service Area

The regulations defined the service area as "the geographic area within which impacts can be mitigated at a specific mitigation bank or an in-lieu fee program, as designated in its instrument" (40 C.F.R. § 230.92). It delineates the boundaries of the mitigation market; permittees can develop, purchase, and sell mitigation credits within those boundaries. Service areas should be small enough so that the affected wetlands are replaced within the area that they are needed, but large enough to allow for an adequate supply of appropriate land to develop mitigation wetlands (Kaplowitz et al. 2008; M. Scianni, pers. comm., 2017). The service area for wetlands projects should also consider the connectivity and biological integrity of various individual wetlands, which doesn't necessarily correspond to watershed boundaries (M. Scianni, pers. comm., 2016).

In urban areas, the Corps often delineates larger service areas when the availability of suitable properties for wetlands creation is insufficient, and the market would not otherwise function properly. For example, in the San Francisco Bay Area, one service area extends dozens of miles inland to the Central Valley, far from the urbanized areas where impacts will occur, but relatively close as the wetland bird flies. Thus, the connectivity is relevant, at least for avian wetland habitats. Extensive, high-value wetlands sites can be acquired or enhanced in these agricultural or sparsely developed areas (M. Scianni, pers. comm., 2016).

Only half the wetland mitigation bank projects surveyed by Kaplowitz et al. (2008) throughout the U.S. were in service areas defined by a watershed. In some smaller states, the Corps defines the entire state as a service area, which is unlikely to facilitate attaining the "no net loss" goal, considering the need for ecological connectivity. Wetland mitigation is supposed to address biotic function and ecosystem services. Appropriate placement of mitigation wetlands is dependent on landscape and relationships to other types of wetlands with similar functions and services (Ambrose et al. 2007; M. Scianni, pers. comm., 2016).

Mitigation Bankers' Perspectives

Kaplowitz et al. (2008) reviewed the status of the wetlands mitigation banking program from the perspective of the mitigation bankers. Private entrepreneurs operate about three-quarters of banks, while public agencies and nonprofit organizations sponsor the remainder. Approximately half of the banks were developed for regulatory compliance. A third of government-owned banks (e.g., banks owned by transportation agencies) were formed to meet permit requirements at the lowest price. Owners retained most of these banks for their future use. The mitigation bankers believe that shortening and simplifying the review and approval process (which averaged four years) would improve the compliance experience. Accomplishing this change would likely require providing adequate resources to the approval agencies and improving interagency coordination (Kaplowitz et al. 2008).

Additional Limitations on Mitigation Success

While consolidated mitigation projects may have some advantages, particularly if implemented by a responsible public agency, larger projects are not inherently better. Steinhoff (2008) notes that many implementing agencies incorrectly ascribe a higher value to larger wetland areas than to smaller wetlands, in his opinion without adequate evidence justifying that interpretation. Small, isolated wetlands can be more ecologically diverse, whereas large constructed wetlands often do not correctly mimic the hydric soils, fluctuating water levels, longevity, or biodiversity of natural wetlands (Steinhoff 2008). Moreover, greater economies of scale can potentially translate to larger-scale risks of failure. While larger wetlands can absorb impacts more successfully than their smaller, isolated counterparts, and they are less likely to fail, the failure of a single large, consolidated wetland can much more significant than the failure of a handful of smaller wetlands (Alagood 2016).

Even with the improvements implemented under the 2008 regulations, wetland losses continue. Mitigation installed in advance of impacts does add value based on the timing of the installation, but otherwise a mitigation bank may not be inherently more ecologically valuable than permittee-responsible mitigation (Alagood 2016), except that mitigation rules are more comprehensive for in-lieu fee projects and mitigation banks than they are for permittee-responsible mitigation (J. Siu, pers. comm., 2016). The Corps' history of limited oversight and broad discretion leads some Corps Districts to approve mitigation banks without much scrutiny (Alagood 2016).

Micacchion et al. (2010) reviewed a random sample of 26 wetland mitigation sites in Ohio. Nearly two-thirds were considered failures for site selection, protection of hydric soil profiles, fluctuating water levels reflecting natural wetland conditions, and proactive management oversight and intervention. Two did not even meet wetland criteria. Only six sites were considered ecologically successful, and four were considered "potential" successes (Micacchion et al. 2010). The ages of the projects were not a factor, suggesting that a mitigation project is probably as good as it will be shortly after installation.

Key Lessons: Wetland Mitigation Program

- *Project tracking, compliance assurances, rule clarity, interagency and intra-agency coordination, and development of guidance manuals are critical components of successful programs.*
- *Project monitoring, reporting, inspections, and enforcement are necessary to ensure mitigation projects are implemented as permitted. Specifying compliance requirements in permits and using enforcement authority helps improve performance.*
- *Standardized application procedures and review procedures facilitate effective and efficient review and improve mitigation/credit success.*
- *Once a mitigation/off-site credit project is installed, it is important to ensure its functionality for a length of time commensurate with its impact and permit certification, whether that is a one-year period or "in perpetuity." Projects that function in accordance with natural regimes, requiring minimal maintenance, have a better chance of success than artificially-enhanced environments.*
- *Approving advance credits creates significant gaps between authorization of wetland impacts and implementation of effective mitigation. Applying credit ratios may help achieve adequate compensation for loss of higher-value wetlands.*
- *As many in-lieu fee programs experienced significant delays in creating wetlands, setting in-lieu fee prices high enough to favor on-site or wetland mitigation bank projects may result in more rapid implementation of mitigation projects.*
- *Service area boundaries should be small enough that off-site mitigation areas are relevant to impact areas, and large enough to enable a functioning market appropriate for the implementing jurisdiction(s).*
- *Fostering effective partnerships and coordination with public agencies and nonprofit organizations smooths implementation of mitigation projects. Lengthy agency review times impede timely implementation of mitigation.*
- *Mitigation programs are more effective when they articulate program goals and provide for regular review and adjustments. Public scrutiny and adequate agency oversight are necessary. Large scale mitigation projects are valuable, but smaller, more widely distributed mitigation may provide insurance against large-scale failures.*

3. Building on Water Quality Trading Principles

"Water quality trading" is often used either specifically to refer to programs that fall within EPA's Water Quality Trading Policy (USEPA 2003), or more generally to refer to any system of credits being exchanged for payment or other commodities for water quality purposes. Municipalities developed many of the existing stormwater crediting programs based on trading guidance, even if they don't strictly conform to trading guidelines. Programs in Lake Tahoe, the San Diego region, and Santa Rosa, California originated from trading policy. D.C.'s program incorporates many elements of trading policy, although it also closely resembles a wetlands mitigation program in structure. Water quality trading guidance and implementation examples can be instructive to developers of stormwater crediting options.

A handful of states have established trading programs. Many other unofficial trading schemes are so removed from the constraints of official guidance that they are more accurately described as simply "inspired by" the trading policy. For example, the Lake Tahoe Clarity Crediting Program (LRWQCB and NDEP 2015) exhibits

characteristics of innovative stormwater crediting principles as well as traditional water quality trading programs. The Tahoe program implements a phased total maximum daily load (TMDL) through three MS4 Permits (LRWQCB 2011a, LRWQCB 2011b), with interim load reduction targets set for five years and 15 years from the date of adoption, to restore lake clarity by reducing fine sediment and nutrient concentrations. Fine sediment discharge "credits" (which are discharge limits corresponding to TMDL allocations) are distributed to MS4-permitted communities around the lake. The communities demonstrate compliance by ensuring adoption of Best Management Practices (BMPs) to reduce fine sediment runoff according to their credit allowances, which reflect reductions required by the TMDL allocations.

Credits can be transferred between jurisdictions once they achieve the phased TMDL reduction requirements. Few credit transfers occurred during the initial implementation phase (2011-2017), as the 10 percent reductions required for the five-year target were met and exceeded through the implementation of readily available BMPs. Trades are expected to be heavily utilized by the end of the next phase, when sediment discharges must be reduced by 21 percent. Program administrators anticipate that dischargers will then venture higher up in the watershed, to either install additional sediment reductions with BMPs or restoration projects, or to trade with landowners who install measures that reduce discharges beyond baseline requirements. BMP guidance provides a menu of options with estimated reductions; a monitoring program provides data to update and calibrate a discharge model on which the guidance is based (LRWQCB and NDEP 2015; J. Landy, pers. comm., 2016).

EPA's Water Quality Trading Policy (USEPA 2003, cited in Willamette Partnership et al. 2015) identifies six guiding principles to incorporate into a trading program. These principles are also applicable to stormwater crediting:

- Accomplishes regulatory and environmental goals.
- Based on sound science.
- Provides sufficient accountability, transparency, accessibility, and public participation to ensure promised water quality improvements.
- Does not produce localized water quality impacts.
- Consistent with the Clean Water Act regulatory framework.
- Includes appropriate compliance and enforcement provisions to ensure long-term success.

The Willamette Partnership et al. (2015) identified the following elements of a successful trading program:

- Identifies and establishes regulatory instruments to support trading.
- Defines who is eligible to trade, where trading can occur, and what can be traded.
- Determines eligibility for participants in the trading program.
- Quantifies water quality benefits.
- Manages risk and uncertainty in the trading program.
- Defines credit characteristics.
- Establishes project implementation and assurance guidelines.
- Establishes procedures for project review, certification, and tracking.
- Ensures compliance and enforcement.
- Establishes adaptive management guidelines for ongoing program improvement and performance tracking.
- Defines roles, responsibilities, transaction models, and stakeholder engagement processes.

The Water Quality Trading Toolkit (ACWA and Willamette Partnership 2016) was recently revised to include updated templates to assist in building a trading program. Although every item is not necessary to fully implement every program, the templates are helpful in establishing the authorities needed for stormwater crediting:

- The State Rule template provides an example of legislative authority to establish a trading program, which could also be used for other regulatory authorities. (Note: several states have trading programs even without a state rule, while others have a state rule but no active trading programs).
- State Guidance is designed to provide policy-level direction. Guidance can also be readily updated if needed.
- Watershed Trading Framework provides policies relevant to a specific watershed.
- The NPDES Permit template provides ideas for incorporating trading into permits, although it is not specific to stormwater crediting. Regulators can include provisions that are unlikely to change in a five-year NPDES permit, while guidance can include additional detail or provisions that may be updated more frequently and revised informally.
- The Annual Report template provides a format for permittees to report on progress under their permit or crediting program.

4. Developing an Effective Stormwater Crediting Program

Many municipal stormwater permits require specified storm volumes to be retained, infiltrated, and sometimes treated on-site. Allowing those measures to be undertaken at a different site but "credited" to the development site arises in part due to constraints in densely developed urban areas, on steep hillslopes, or in some soil types. Other factors also play a role, such as physical and financing limitations on expanding traditional "gray" infrastructure capacity, or a desire to increase green infrastructure. The D.C. Department of Energy and Environment (DOEE) developed an off-site crediting option when developers objected to significantly increased stormwater retention volume requirements, even though a crediting option was not originally proposed. DOEE added trading and in-lieu fee options to demonstrate that other options existed to meet the requirements, including fee payment, if on-site retention seemed too costly or infeasible (M. Espie, pers. comm., 2018). In some built-out environments, allowing off-site crediting can meet the primary objectives of retaining and treating stormwater while also enhancing community aesthetics and, potentially, improving ecosystem benefits.

This section identifies design and process elements critical to successful stormwater crediting programs, drawing upon lessons learned from wetland mitigation, water quality trading, and examples of stormwater crediting programs developed to date.[1] Widely-used approaches to off-site stormwater management are often similar to wetland mitigation options:

[1] Other useful guidance documents include the Georgia Stormwater Management Manual (AECOM et al. 2016) and Coastal Stormwater Supplement (CWP 2009), which are excellent examples of comprehensive statewide guidance. North Carolina's four Nutrient Management Strategies, for Jordan Lake (http://portal.ncdenr.org/web/jordanlake), Falls Lake (http://fallslake.org/web/fallslake), Neuse River (https://deq.nc.gov/about/divisions/water-resources/planning/nonpoint-source-management/nutrient-strategies/neuse), and Tar-Pamlico (https://deq.nc.gov/about/divisions/water-resources/planning/nonpoint-source-management/nutrient-strategies/tar-pamlico) demonstrate nutrient management strategies that incorporate comprehensive crediting/offsets/mitigation options, traditional water

- Retain or treat stormwater at an alternate site within a prescribed service area (like off-site permittee-responsible wetland mitigation);
- Purchase retention/treatment credits from an approved, certified retention/treatment project (akin to third-party wetland mitigation banks); or
- Pay an in-lieu fee, which the municipality or an authorized sponsor will use to install retention/treatment, sometimes for larger projects or on public lands (as with third-party wetland mitigation through in-lieu fees).

Required On-site Retention Volumes and Sequencing

Some jurisdictions allow off-site retention after following a mandatory "sequencing" process. For example, the Minneapolis/Capitol Region program states a preference first for on-site infiltration; off-site mitigation is allowed when on-site options are proven to be infeasible. If off-site mitigation cannot be satisfactorily secured, payment of an in-lieu fee is a final option (CRWD 2015). West Virginia's sequencing provisions similarly favor on-site retention first, then "developer-driven" off-site retention, and finally, "MS4-facilitated" off-site" retention (CWP 2012a, WVDEP 2014). Philadelphia's "off-site" retention is only allowed within a portion of the development parcel not directly involved with the current project (City of Philadelphia 2015), or, in rare cases, on a nearby parcel under the same ownership. The applicant must demonstrate that each step of the sequencing process is infeasible before proceeding to the next step. It is so restrictive that, in practice, only landowners holding the largest parcels (university campuses, for example) can utilize the option.

In contrast, Washington, D.C.'s crediting program allows up to half of the required volume to be retained off-site without a feasibility review or additional restrictions. Most stormwater-borne pollution is generated in "first-flush" rainfalls. Smaller storms are more frequent than larger storms, so greater capacity does not necessarily guarantee more effective retention of pollutant-generating stormwater runoff. Relaxing on-site retention requirements to allow retention of smaller quantities of rainfall distributed in more locations may capture more stormwater and more pollutants over time than could fewer, larger-volume retention systems that are less-frequently fully utilized (Day 2016, DOEE no date).

DOEE modeled the required retention volume over a 1,000-square foot "parcel," then ran the model for every storm throughout the year to determine what volume was retained. They concluded that greater retention volume over the course of the year could be realized if only half the volume were retained on-site and half at an off-site location. Thus, by allowing off-site retention, 50% more stormwater volume would be retained, covering twice as much area (M. Espie, pers. comm., 2018). Higher on-site capacity would be unused in all but the largest storms, so the excess capacity would be wasted, and it would not have the same ability to protect water quality. The total required retention may be higher than what may be needed for stormwater and water quality protection—previous regulations called for 0.3-0.5 inches, while current regulations require 1.2 inches to be retained, with at least half of that retained on-site—but it encourages developers and landowners to install more green infrastructure projects in outlying areas where land values are lower and water quality benefits are greater (M. Espie, pers. comm., 2018; B. Van White, pers. comm., 2017). Automatically allowing half the retention volume to be satisfied off-site provides flexibility to developers while accomplishing DOEE's water quality goals. Reduced costs and time for both the municipality and the applicant is an added benefit of not

quality trading, wetlands mitigation, and NPDES WWTP and MS4 approaches. These and many other programs also include guidance identifying pre-approved BMPs. Check whether guidance is current; programs are regularly updated.

requiring applicants to demonstrate on-site infeasibility. The D.C. regulations also have a provision allowing the full retention volume to be met off-site if the landowner demonstrates that on-site retention is infeasible (M. Espie, pers. comm., 2018).

Similarly, an ordinance currently under development for the City of San Diego does not require applicants to prove infeasibility (E. Mosolgo, pers. comm., 2018). Chattanooga's program is structured like D.C.'s, but it includes a mandatory sequencing process and higher retention ratios for off-site projects. Creating a strong preference for on-site controls in this way limits the use and effectiveness of off-site programs, particularly if generous fee reduction provisions or other incentives are more enticing to builders, as they are in Chattanooga and Philadelphia. Not coincidentally, both cities are under consent decrees requiring them to address combined sewer overflows during wet weather. The stormwater market in D.C. is vigorous and active, and has resulted in many aesthetically-pleasing and environmentally desirable green infrastructure projects, while Chattanooga's seemingly similar program has not certified a single credit sale to date. A portion of downtown D.C. is also served by a combined sewer system, which is similarly under a consent decree. However, D.C. plans to address overflows largely through a traditional "gray water" infrastructure approach of increased tunnel capacity to convey the stormwater. Thus, projects in the densely-developed downtown area served by the combined system tend to fulfill their retention obligations in the MS4 area, where it is more needed.

Most MS4 permits that provide for off-site implementation of retention and treatment controls only allow off-site installations if on-site controls are demonstrated to be infeasible. In some cases, requiring a sequencing process that heavily favors on-site retention may be the best course of action if localized water quality impacts are a significant concern that cannot be addressed off-site. In other cases, providing more flexibility may better accomplish water quality and community goals. As with wetland mitigation provisions, broader distribution of stormwater retention capacity through off-site compliance may have more significant environmental benefits. Program developers should conduct a thorough analysis to address uncertainties and provide support for the proposal. Cautious decision-makers may be reassured if they understand that enhanced community and environmental benefits can be realized while ensuring effective compliance. Limiting options to on-site retention and treatment may increase compliance costs without yielding equal water quality and community value. It may also reduce a jurisdiction's ability to realize the full suite of benefits (e.g. aquifer recharge or enhanced public spaces).

The issue of how, or whether, to require developers to demonstrate that on-site controls are infeasible as a precondition of allowing off-site compliance should be a topic of local discussion and analysis. The correct answer may depend upon the physical and political environment, water quality or compliance issues, community goals, and other factors. For example, D.C.'s environment comprises three subwatersheds, predominantly flat topography, a clearly-defined downtown with limited building sites, and a humid environment. Demand for retention credits is high in the dense downtown area. The supply will be generated primarily from an outlying subwatershed, but these inter-watershed exchanges will not adversely affect water quality in the downtown area subwatershed. The retention credits generated in those outlying areas will improve water quality where it is crucially needed. D.C.'s MS4 area is also compact, corresponding to District boundaries. In contrast, the San Diego region's MS4 area covers 33 cities and unincorporated areas in two counties. With its steep slopes, dry, Mediterranean climate, and poorly drained soils with limited on-site infiltration capacity (L. Walsh, pers. comm., 2017), unrestricted credit exchanges among its multiple, narrow subwatersheds may adversely affect local water quality in some demand areas.

A rule that heavily favors on-site compliance or heavily restricts off-site crediting may be less attractive to developers for off-site stormwater control installations, and may not accomplish its goals if full participation is needed for a functional program. Clearly-articulated goals and rigorous analysis can help establish an appropriate balance between the principles of local, on-site controls and the desire to encourage off-site stormwater retention or provide flexibility to developers. A builder will choose an action that appears profitable or cost-effective, or has other clear benefits consistent with their project goals, even if they may be more difficult to quantify: for example, points counting toward LEED certification, or positive public and community relations potentially leading to increased rents or sales prices. Such increased returns have been documented for some credit-generating D.C. sites (Day 2016).

Requiring at least a portion of the total volume to be retained on-site is advisable to address local impacts. In any case, ensuring a regulatory and water-quality nexus between the regulated site and the off-site compliance is prudent (M. O'Malley, pers. comm., 2018). If a municipality requires builders to demonstrate on-site infeasibility, the criteria should be explicitly defined, transparently developed, and evenly applied. To ensure that off-site projects are both highly functional (in terms of capacity) and attractive in terms of community and environmental benefit, a municipality could require or encourage off-site mitigation projects or credit banking projects to be drawn from a proven, pre-identified, and aesthetically pleasing selection of green infrastructure practices.

Analysis of sequencing options should address all the likely factors that could go into a builders' decisions, including the relationship between off-site incentives and potential fee reductions. In some municipalities (D.C., for instance), fee reduction programs are not a major influence on an applicant's decision (M. Espie, pers. comm., 2018). In others, generous incentives for ongoing fee reductions (as in Chattanooga) out-compete very restrictive off-site stormwater crediting rules. (J. Rogers., pers. comm., 2017).

Utilizing Credit Ratios to Manage Uncertainty and Facilitate Green Infrastructure

As with wetlands regulations, stormwater crediting programs sometimes apply ratios to account for uncertainty or other factors for off-site controls, or to facilitate development in designated target areas. The crediting programs developed for Philadelphia, West Virginia, Chattanooga, and Santa Rosa require more retention off-site retention than for equivalent on-site compliance (City of Philadelphia 2015, CWP 2012, City of Chattanooga 2014a, 2014b, Kieser & Associates 2015). However, offset ratio requirements may be too high if additional factors make off-site crediting less attractive, as in Chattanooga's case. Chattanooga's program was based in part on guidance developed for West Virginia, which built upon provisions in the State's MS4 permit. After several years requiring higher ratios for off-site retention, the state dropped the ratio requirement for its 2014 MS4 permit revision, in favor of a standard 1:1 replacement ratio, although the guidance has not yet been updated (CWP 2012, A. Parsons, pers. comm., 2017).

In Chattanooga, the lack of credit transactions is probably due to additional restrictions that were added to the program by the City Council, in opposition to staff recommendations. Intended to address the city's combined sewer system needs, or to appease those who were nervous about the program (J. Rogers, pers. comm., 2017), the restrictions discourage use of off-site compliance options. Off-site credits can be purchased or used at a 1.5:1 ratio, meaning that off-site implementation requires an additional 50 percent of what the builder would

install on-site, so costs could be higher off-site. The bar to document "infeasibility" is also high, so pursuing off-site crediting in this jurisdiction is burdened with barriers.

Credit ratios favoring specific locations may better distribute the environmental and community benefits of green infrastructure. Ratios apply in limited circumstances to D.C.'s Anacostia Waterfront Development Zone (AWDZ), a zone within the Anacostia subwatershed that was created by the District Council independent of the stormwater regulations, although stormwater requirements in the AWDZ are incorporated into D.C.'s stormwater regulations. Water quality is severely degraded in the Anacostia River, and the Council wanted to encourage economic development in the area, so projects in the AWDZ that are funded by the District must prove that on-site retention is infeasible if they want to comply off-site. For these projects, stormwater retention credits acquired outside of the Anacostia subwatershed must be provided at a 1.25:1 ratio over what would normally be required (M. Espie, pers. comm., 2018). Thus, for two identical development proposals funded by the District in the AWDZ that require 100 gallons of stormwater retention, 100 gallons are required in the Anacostia subwatershed, whereas 125 gallons required if the credits are generated in other subwatersheds, to encourage green infrastructure projects in the Anacostia subwatershed. Credit ratios favoring projects installed in those economically-disadvantaged areas resulted in much-needed community improvements, increased property values, and job creation (B. Van Wye, pers. comm., 2017, M. Espie, pers. comm., 2018).

Credit Market Structure

A crucial aspect of any stormwater crediting program is the strength of its market, which is closely linked to the adequacy of its market tracking system. The market needs a clear, legally-defensible structure for defining credits to be exchanged; a legally-recognized, enforceable title document or contract to record the exchange; and a formal system for documenting and tracking the transfer of credits from one party to another. In D.C., the tracking system accomplishes many goals beyond merely listing transactions (M. Espie, pers. comm., 2018). DOEE approves all transactions so they know who owns and is responsible for each credit. DOEE classifies credit certifications, trades, and credit sales as separate transactions. The database is tied into its inspection and enforcement activities and a TMDL modeling tool that can also evaluate the effects of the program on attainment of water quality goals (M. Espie, pers., comm., 2018). D.C.'s database functions well in this active development market with a high volume of trades. In communities where the number of trades is small, the information can be tracked by hand in a simple spreadsheet, at least initially. Municipalities would be well-advised to consider the potential for program expansion, and to anticipate future needs for a more powerful database.

Program designers may choose from an array of structural options for the exchange market. Transactions can take place in a decentralized, open market, directly through a municipality, or via a broker acting under the legal authority of the public agency. The prices of recent sales should be available to the public so that buyers and sellers can set prices appropriately. Typically, when a program allows independent sales of stormwater credits, the credits are traded on an open market, with the transactions being approved or certified by the regulatory authority. The certification process provides a checkpoint to ensure that conditions have been met. The market can function on its own, with little involvement by the regulatory authority beyond recording, tracking, and oversight activities, or the authority can be more directly involved. With greater involvement, the municipality will have greater control, but this will be accompanied by higher administrative costs.

The credit market structure should be robust and transparent to ensure that the involved parties, the regulatory agencies, and the public can understand and support the program's operations, and it should be designed to maintain accountability and ensure crediting arrangements function as expected. The municipality may want to attach the credit transfer to the property, such that the requirements or credit conditions (including maintenance) will remain with the property if ownership changes. This approach helps ensure that a new owner will adequately maintain credited practices. Municipalities should anticipate revising the system in the future in response to new information.

DOEE has committed to serving as "buyer of last resort" through its Price Lock program, a provision that was not originally part of the program. It was added later to hasten the process of providing a supply of credits while the program was in the initial stages. If credits offered on the exchange do not sell, DOEE will buy them at a pre-established, advertised price, as long as it was not created to satisfy a compliance requirement. The price is lower than on the open market prices, but it is an absolute floor price for generated credits. It is funded by an escrow account and is administered by a nonprofit organization under contract to the agency. DOEE will not purchase credits generated in excess of a regulated site's total on-site requirement (i.e., greater than 1.2 inches), because the additional capacity is used infrequently and provides less environmental benefit than a new project in an otherwise unmanaged area (M. Espie., pers. comm., 2018).

D.C.'s in-lieu fee is priced to cover all direct and indirect costs of installing off-site retention, and it serves as a credit price ceiling. The range between the lowest credit value (the credit buy-back price for generated credits) and the highest value (the in-lieu fee price) is periodically adjusted based on inflation and direct costs. These options reduce investment risk in uncertain or fluctuating markets. Outside investors are attracted to the D.C. market (Day 2016), possibly due to its vibrancy, stability, and defined risk based on known floor and ceiling prices for credits (B. Van Wye, pers. comm., 2017; M. Espie, pers. comm., 2018).

Ensuring that a crediting program market does not inadvertently compete with itself is another important consideration. For example, Chattanooga's program provides multiple methods for obtaining generous stormwater fee reductions, providing greater simplicity, certainty, and appeal to a developer than the added burden and cost uncertainties of going through the approval process for off-site stormwater retention. Chattanooga's fee reduction rules are clear, and participating can provide considerable monthly savings on its relatively high stormwater fees (J. Rogers, pers. comm., 2017, City of Chattanooga 2014b). Similarly, Philadelphia's combined sewer program consent decree requires a considerable increase in the number of "Greened Acres," for which the city provides generous grants, fee reductions, loans and other incentives to retrofit outdated stormwater infrastructure and build green stormwater systems. Its off-site crediting option is also so restrictive that it is largely unnecessary and almost entirely unused. Because its Greened Acres program is functioning adequately to demonstrate progress toward its consent decree, the city has no interest in changing its off-site options to make it more attractive (E. Williams, pers. comm., 2017). Savannah's incentives to reduce impervious surface area allows builders to add an additional floor to a proposed structure over what is typically allowed in the downtown area. This is probably more appealing from an investment perspective than the city's only other option, to pay the city's fee to install permeable pavers. These factors may explain the limited participation in that program.

A municipality's stated or implied reluctance to fully endorse the program may also contribute to uncertainty and lack of participation. For example, the ordinances in Chattanooga and Savannah, and the San Diego region's

MS4 permit specifically state that approval is discretionary, meaning that the regulator can choose whether to approve a project (City of Chattanooga 2014a, 2014b; SDRWQB 2013; City of Savannah 2015). While retaining this authority may be helpful in the case of misguided proposals, it could also have the effect of turning potential participants away, even if the program director is unlikely to disapprove a project. Greater clarity in program rules may address this concern.

Service Area

The service area is similar to a shopping mall in which to buy, sell, or barter for credits. As with wetlands mitigation banking, the service area should be small enough to address local stormwater impacts, but large enough to ensure an adequate supply of sites that can generate stormwater credits sufficiently balanced with demand. The market will usually function effectively when large-enough price differentials are found among landowners (Thurston 2012). In other words, when the cost of constructing on-site retention is high enough relative to the cost of providing off-site retention, and the supply of both is adequate, the market should function. If the price of an off-site credit is sufficiently lower than the cost to install on-site compliance measures or to pay equivalent in-lieu fees, transactions are likely. An excessively small service area may not generate an adequate supply of credits for sale, while an overly large service area may result in an oversupply of credits, potentially depressing credit prices and decreasing participation or program effectiveness. A service area that is too large can also leave local impacts unaddressed. Analyzing the potential supply and demand is advisable to build a viable marketplace (e.g., Kieser & Associates 2013).

Stormwater service areas are usually defined as subsets of the MS4 permit jurisdictional boundary, up to the entire extent of the MS4 area. For example, in D.C., the service area is effectively the District boundary, which is the limit of its permit area, and encompasses the city's combined sewer system area as well. Philadelphia defines sewersheds within its seven subwatersheds for its combined system (City of Philadelphia 2015). Service areas for North Carolina's four Nutrient Management Strategy areas include several counties (K. Williams, pers. comm., 2017), but the watersheds contributing to excess nutrients in lakes are large. The State has determined that some service areas are still too small to provide an adequate supply off-site mitigation projects (K. Williams, pers. comm., 2017).

In general, trades and sales should occur within clearly defined watersheds, subwatersheds, and sewersheds, unless water quality can be better protected with a broader distribution of off-site retention. An off-site crediting program can provide more effective and appealing ways to address stormwater runoff, but the obligation to meet water quality standards and receiving water limits remains. In this sense, a stormwater crediting program is the opposite of the wetlands mitigation program, in which the Corps authorizes impacts to wetlands in one location that can be mitigated elsewhere. The Clean Water Act does not allow actions that forego water quality protection in one location in favor of another location, even if water quality standards are difficult to attain. It also does not authorize improved water quality as a substitute for water quality standards attainment. Such misinterpretations form the basis for the most vigorous objections to water quality trading.

Program authorizations allowing cross-watershed or cross-pollutant trades are usually problematic and leave a jurisdiction vulnerable to legal challenges. The current San Diego Regional MS4 permit authorizes trades between adjacent but unrelated watersheds, and between pollutants, potentially overlooking localized water quality impacts (O'Malley 2014a, 2014b, 2015; SDRWQCB 2013a; M. O'Malley, pers. comm., 2017). However,

the City of San Diego MS4 permit under development in 2018 may not allow trades across watershed management areas (E. Mosolgo, pers. comm., 2018). In Minneapolis, while proposals outside of the watershed are unlikely to be approved in practice, the rules technically allow for retention to occur in another drainage basin (CRWD 2015, M. Doneux, pers. comm., 2017).

Credit Market Participants

Most stormwater crediting programs have attracted the attention of private investors with profit or philanthropic motives, or both (B. Van Wye, pers. comm., 2017). Businesses may install retention credits to facilitate future development approvals (Kaplowitz et al. 2008) or invest in credit development projects as a credit aggregator and seller. State and local transportation departments often have large parcels to develop, and can readily create attractive stormwater retention projects within the public rights of way. The Minneapolis-St. Paul stormwater program works closely with local and county road departments, with the mutual benefits of adding stormwater retention ahead of planned projects and expediting future approvals. Because transportation projects are usually planned far in advance, they can sometimes install greater stormwater retention than required for the current project, banking the credits for a specific future project with greater site constraints (M. Doneaux, pers. comm., 2017). Park departments often have suitable land that can be utilized for stormwater detention as well.

In-Lieu Fee Options

As with wetlands mitigation, an in-lieu fee option can provide compliance flexibility, and it allows a municipality or other authorized program sponsor to aggregate funds for larger projects or to install green infrastructure projects on public land or in public rights of way. The municipality should be willing to serve as a construction manager if they install projects in a public right of way or other public property. Projects funded by in-lieu fees do not always need to be large or complex. For example, Savannah offers an off-site stormwater program based entirely on its plan to install permeable pavers in the historic downtown area. It is accomplished through a voluntary in-lieu fee option (R. Raines, pers. comm., 2017). Correctly-priced in-lieu fees can have a stabilizing effect on the market by serving as a maximum price. As discussed above, D.C.'s in-lieu fee establishes a maximum cost for credits, which provides assurances to builders.

Hodge and Cutter (2012) discuss setting the in-lieu fee to reflect the municipality's incremental cost of adding additional stormwater retention capacity. DOEE's annual process of adjusting the in-lieu fee considers actual project costs as well as expected project life, administrative costs, and maintenance costs (B. Van Wye, pers. comm., 2017). A survey of in-lieu fees for stormwater crediting (Hodge and Cutter 2012) found that in most cases, cities offered an in-lieu fee option because they considered regional stormwater management to be more effective and beneficial than numerous small, scattered BMP installations. However, some municipalities instituted in-lieu fee programs either in response to requests from the development community or as a tool to help pave the way toward public acceptance for stormwater fees or stricter standards (Hodge and Cutter 2012).

Most of the existing in-lieu fee programs have a defined, transparent process for setting the fees. DOEE posts the analysis to set the fees on their stormwater crediting program webpages (B. Van Wye, pers. comm., 2017). North Carolina can adjust fees within a range of 10 percent on a quarterly basis, and recalculates them annually in a similarly comprehensive and transparent process (K. Merritt., pers. comm., 2017).

Enforcement Authority and Compliance Time Lags

As with wetland mitigation projects, avoiding compliance time lags is important to ensure adequate water quality protection and to avoid legal vulnerability for potential stormwater permit violations. Approval of an off-site stormwater control plan should occur in conjunction with approval of a development plan. Pre-project consultations are usually helpful, particularly for complex projects, to provide planning assurances to both the applicant and the regulator that proposals are approvable (D. Kuzsmar, pers. comm., 2017).

Programs typically require stormwater retention projects to be installed and certified before construction authorization, final inspections, and issuance of occupancy permits. The regulators thus retain compliance assurance and leverage to compel permittees to meet permit conditions (e.g., DOEE 2013b, Philadelphia 2015). Stormwater program review and sign-off is explicitly part of D.C.'s development approval process (DOEE 2013b). Chattanooga recommends retention be installed before development approval or occupancy, but the ordinance also allows up to a three-year lag between site development and installation of off-site mitigation (Chattanooga 2014a, 2014b), eliminating the city's leverage to ensure permit conditions are met.

Requiring prior certification for off-site installation may also stimulate the creation of private credit banks. An added advantage of credit banking is that additional stormwater retention and green infrastructure projects will exist in advance of development impacts. The municipality or a nonprofit partner can identify retention projects ahead of time to be ready to take advantage of grants or other incentives that may be time-sensitive. Most programs also use performance or surety bonds. Financial incentives and potential penalties to motivate compliance are necessary, but not sufficient, to ensure compliance; having to call in a bond is similar to collecting a delayed in-lieu fee, with similar potential lag times and little leverage to compel action.

Time lags are also a significant concern with in-lieu fee collection, as with wetland in-lieu fee options. To address this issue, DOEE built its first in-lieu fee project using stormwater fees, prior to receiving in-lieu fee payments. Now, when DOEE receives an in-lieu fee payment, it reimburses the stormwater fund (M. Espie, pers. comm., 2018). The San Diego Regional Water Board does not explicitly define an in-lieu fee option, but it requires municipalities to develop a watershed plan and maintain a list of eligible priority projects (SDRWQCB 2013a and 2013b) that an applicant can help finance. The provision is intended to facilitate high-value off-site projects. Applicants can choose to install or fund identified projects or implement their own off-site projects, subject to approval (SDRWQB 2013a). Maintaining a list of "shovel-ready" projects can also reduce delays between fee collection and project installation. In general, a comprehensive watershed-wide analysis of potential projects expedites off-site or in-lieu installations. Builders looking for off-site stormwater retention options may also choose a previously-identified project, which could provide expedited approval.

The municipality should retain authority for compliance and enforcement, reporting, and regular inspections. Lack of compliance should bring penalties such as fines, credit decertification, and permit revocation. Many of the programs wisely require an Operations and Maintenance Agreement be included in approval documents, to apply to off-site credit-generating projects as well. Some municipalities include provisions to undertake needed maintenance themselves and to seek reimbursement from the owner if the owner fails to maintain the installation according to the agreement. DOEE's credit certification process requires the credit generator to have a maintenance contract in place for the entire period of certification. If the owners plan to conduct the

maintenance themselves, DOEE requires a maintenance plan. The contract or maintenance plan must be consistent with DOEE's Stormwater Management Guidebook (DOEE 2013b). The credit provider is responsible for maintenance. If it is not adequately maintained, or if the property is sold and the new owner decides not to maintain the credits, the credits will be decertified. The credit generator then needs to secure credits from another source, with the in-lieu fee option as a last resort (M. Espie, pers. comm., 2018).

Tracking Stormwater Credits

Programs that function well maintain rigorous credit tracking programs. A unique identifier (e.g., a serial number) should be assigned to each generated retention credit to avoid double use. The state or the local jurisdiction can track certification and use of credits in online databases. Such databases may vary in sophistication, from the comprehensive system developed by D.C. to the less complex list maintained by North Carolina. The Capitol Region Watershed District (CRWD) in the Minneapolis area maintains a ledger of all credits and trades for each bank and relates runoff pollution reduction progress toward TMDL allocations (M. Troyan, pers. comm., 2017), similarly to most other programs. Trading programs in Ohio and Pennsylvania make use of a commercial trading registry called IHS Markit (http://www.markit.com/product/registry). Programs that are just starting or are limited in scope (Savannah or Santa Rosa, California) manually maintain simple databases or lists of projects and credits; Santa Rosa intends to expand its database when the program grows (D. Kuszmar, pers. comm., 2017). The City of Chattanooga will record installed retention credits on a paper certificate issued to the owner. The seller or user will surrender the certificate, and if it is lost, stolen, or destroyed, the credit no longer has market value, and it cannot be replaced (J. Rogers, pers. comm., 2017). Although this system reduces the administrative burden on the city, it may be another disincentive for builders to participate.

The D.C. program certifies stormwater retention credits and credit transfers, and maintains a web-based tracking database containing all permit and credit information for TMDL purposes, from application through approval stages and beyond, including compliance and enforcement information. The database also functions as the exchange market where participants can seek or offer credits to be purchased or sold. Participants can register credits that are currently in the installation phase, effectively advertising the future availability of a credit commodity. The registry can assist those in various project development planning or review stages to secure required credits in a timely fashion. DOEE certifies credits for one, two, or three years at a time, consistent with its inspection cycle, and incorporates pricing information into the database (DOEE 2013b, B. Van Wye, pers. comm., 2017). Recertification is straightforward if the installation remains functional, providing clarity on the investment and long-term compliance assurances.

Community Engagement

The process of designing and developing a stormwater program that the public supports is crucial to its success. Municipalities should invite local businesses, trade groups, advisory groups, residents, community and environmental organizations to participate throughout the process of developing and implementing any stormwater program (Throwe 2013). Credibility and trust are crucial in developing an off-site crediting program (B. Van Wye, pers. comm., 2017). Community acceptance can be cultivated with a comprehensive outreach and marketing plan to increase the likelihood of success, develop and leverage partnerships, and ensure a smooth transition to the program (Throwe 2013, B. Van Wye, pers. comm., 2017). D.C learned the importance of full stakeholder outreach, engagement, and involvement in program development when an earlier iteration of its

stormwater retention rule failed due to strong public opposition (B. Van Wye, pers. comm., 2017; M. Espie, pers. comm., 2018). Effective outreach includes presentations at community and business events, website resources, and written or digital information and training materials such as handbooks, webinars, BMP guidance, application process information, and templates (B. Van Wye 2017, pers. comm., 2017; Throwe 2013). An active and continuing training and outreach effort can help reduce public concern and resistance to new rules by acquainting potential users and the public. Projects already in the approval pipeline during program adoption should be considered in a transition plan. For example, D.C. established an 18-month transitional period in which applicants could choose to be evaluated under the old or new regulations (DOEE 2013a, 2013b).

Testing the program with one or more pilot projects can help reveal program flaws before finalizing regulatory and financial commitments. D.C. ran a pilot project to demonstrate that BMPs could accomplished their increased retention requirements (M. Espie, pers. comm., 2018). Santa Rosa also ran a pilot before proposing a formal program. In San Diego, a local environmental group requested pilot projects be implemented to alleviate water quality concerns (M. O'Malley, pers. comm., 2017). Pilot projects can help the jurisdiction identify and address technical, administrative, and legal issues.

Administrative Structure

Developing a crediting program and ensuring ongoing administrative success requires administrative stability, integrity, and transparency, clear program requirements, legal and regulatory assurances, and investment risk minimization. While off-site mitigation programs operate within the context of an overall stormwater management program, additional staff and resources may be needed, at least initially for associated tasks (Valderrama et al. 2013):

- Work with stakeholder groups to set up and operate the program.
- Establish legal authorities and check compatibility with local, state and federal laws.
- Coordinate with other local departments and agencies.
- Ensure that the MS4 permit provides authority.[2]
- Establish or revise a stormwater review process to dovetail with the development approval process.
- Draft or revise local ordinances, if needed.
- Develop and update guidance manuals and template documents.
- Set up and operate a tracking system.
- Set up and maintain a website and resources.
- Conduct a market analysis.
- Train program staff and stakeholders.
- Run at least one pilot project, to test and market the program.
- Develop procedures to transition smoothly from the existing stormwater regulations to the new system.
- Review and approve project proposals.
- Undertake inspections and enforcement.
- Revise the program as needed.

[2] While some programs currently operate without explicit MS4 permit authority, regulators should ensure that necessary authorization is included when the permit is reissued if not already included.

Program Ordinances, Guidance, and Fees

Municipal permittees will need to enact ordinances that establish appropriate legal and financial structures and rules. Most MS4s already have a stormwater ordinance that they can revise to create crediting program authority and processes. Municipal authorities should provide accompanying guidance specifying technical and procedural details. Any MS4 permit provision or local ordinance should be as clear and detailed as necessary to provide program authority and ensure compliance, but as flexible as possible to avoid unnecessary barriers to participation. Establishing a new ordinance or revising an existing ordinance may require City Council approval or a city-wide vote. Guidance, which should include information about preferred BMPs, BMP retention effectiveness, incentives, and priorities, should be removed from regulatory processes to facilitate timely staff updates. Any changes should be available for public review, including periodic fee adjustments. Updated guidance can also be published online. North Carolina, D.C., and Lake Tahoe programs all include an online credit calculator. Minnesota's program developed Wiki pages, which can be readily updated (although, at least in its initial iteration, some items may be difficult for users to find). Guidance and resources can include technical recommendations, templates for contracts or credit instruments, and a clear explanation of application, approval/certification, and tracking processes.

Establishing the authority to collect, manage, and expend funds is another crucial step, if it does not yet exist (Valderrama et al. 2013). Otherwise, the municipality can add the stormwater or crediting fee structure to an existing revenue ordinance. The revenue ordinance can also include the in-lieu fee rate, if revising the rate within the ordinance is simple. In Savannah's case, a few lines in the city's revenue ordinance specify in-lieu fees to pay for permeable street pavers in the historic downtown area, and it is revised annually (City of Savannah 2015, R. Raines, pers. comm., 2017). If the city specifies the fee structure in a separate ordinance, it can also adjust the rates without re-opening the ordinance that implements the MS4 permit (R. Raines, pers. comm., 2017).

5. Summary List of Key Lessons and Program Recommendations

Key Lessons and Recommendations: Off-Site Stormwater Crediting

- *Off-site stormwater crediting programs incorporating crediting options structured like wetland mitigation programs, including the ability to create credits for sale or later use, can provide multiple environmental and community benefits.*

Crediting Program Development and Implementation

- *Ensure appropriate legal authorities are in place and the program is compatible and coordinated with other local, state, and federal regulations. Financing and fee systems should be adequate, cost-effective, legally and economically defensible, equitable, and transparent.*

- *Adopt or revise ordinances to include provisions authorizing crediting, fee collection, and expenditures. Provide program guidance separately from ordinances, so that it can be revised and updated independently of the local political process.*

- *Engage all stakeholder groups early in the development process. Seek feedback from community members, environmental organizations, business and trade groups, and others.*

- *Plan for necessary local approvals, rollout procedures, transition plans, outreach/marketing plans, and training for staff, builders, and potential credit generators.*

- *Account for potential credit market participants in program design: businesses, private investors, nonprofit organizations, transportation agencies, and parks departments.*

- *Implement pilot projects prior to full program implementation to test program design, and establish ongoing monitoring to ensure projects function as intended.*

- *Maintain a tracking registry appropriate to the program. Assign a unique serial number to certified credits. Track all transactions and coordinate with inspections, enforcement, building approval processes, and TMDL implementation requirements, if possible.*

- *Use of off-site controls cannot result in local water quality degradation near a development site. A nexus between the regulated site and the off-site compliance site should exist to ensure water quality protection. Assess the likely water quality effects of allowing off-site compliance options.*

- *Requiring an applicant to demonstrate on-site compliance infeasibility adds administrative burdens and may limit the use and success of an off-site crediting program. Allow at least a portion of the retention volume to be met off-site in the defined service area unless local conditions preclude it. If appropriate, consider increasing retention requirements to allow off-site options on a portion of the volume.*

- *Minimize or, preferably, avoid delays between project development and installation of appropriate stormwater retention, by requiring credits to be purchased or installed and certified prior to concurrent with allowing development project construction to begin. Consider making occupancy certificate issuance contingent on satisfactory credit generation inspection. Include stormwater retention provisions in project approval processes.*

- *Encourage green infrastructure projects that provide multiple benefits in addition to stormwater retention and water quality treatment.*

- *Be prepared to adjust program components if needed to meet goals and account for new information.*

<u>Crediting Market Considerations</u>

- *Assess credit supply and demand; markets will function where supply and demand are roughly equal and price differentials are sufficient. Consider the effects of other stormwater control incentives (e.g., fee reductions) to avoid undercutting the market. Provide appropriate level of flexibility and certainty in the market, to stimulate program participation without sacrificing water quality.*

- *Establish an appropriate cap on credit generation to ensure market stability and appropriate water quality protection.*

- *Price negotiations can be left in the hands of buyers and sellers, with program approval, certification, and tracking. The municipality can facilitate market exchange with a website listing credits, buyers, sellers, and sales prices. The contract or exchange instrument should be recorded with the municipality.*

- *If possible, enable the municipality to purchase certified credits at a buy-back floor price, to provide initial demand while regulated demand is growing, and a ceiling price set by in-lieu fees.*

In-lieu Fee Program Considerations

- *The municipality should consider creating an inventory of approvable projects for the use of builders who would like to expedite approvals, and to facilitate timely in-lieu fee retention projects. Consider a fund to construct in-lieu fee projects prior to collecting fee payments, if possible.*

- *In-lieu fee prices should be set as a ceiling price, high enough so that mitigation projects are favored over payments. In-lieu fee prices should reflect actual costs, including administrative expenses and uncertainty. The criteria for determining prices should be available for public review.*

Oversight and Compliance Considerations

- *The 5-year NPDES renewal cycle provides greater opportunities for effective, long-term compliance assurances than wetlands mitigation permitting. Program administrators should recertify credits if they continue to function as approved, subject to inspection and maintenance commitments. Regulators should decertify credits that fail in their performance goals and maintenance.*

- *Specify inspection and enforcement provisions for credit certification in an Operations and Maintenance Agreement. Require surety bonds and specify that permits can be revoked or credits decertified if conditions are not met.*

6. Specifying Stormwater Crediting Authority and Requirements in NPDES Permits

If the NPDES permitting authority wishes to enable permittees to satisfy new or redevelopment requirements through off-site controls, MS4 permits should provide this authority to municipalities, and articulate required elements of a crediting program. In cases where a crediting program is operating but the permit does not specifically authorize its use (such as Savannah or Chattanooga), off-site crediting authorization and program details should be incorporated when the permit is renewed. Similarly, where permit authority exists but is inconsistent with existing guidance or local ordinances, outdated guidance and regulations should be updated. This section suggests approaches for authorizing stormwater crediting programs in MS4 permits.

We reviewed off-site crediting provisions in a selection of MS4 permits, including Washington, D.C., Chattanooga, Minneapolis/St. Paul, Minnesota Small MS4s General Permit, Long Beach, Ventura County, and Los Angeles County. The permits typically provide very brief authorization (1-2 sentences) to pursue off-site crediting options. Some are silent on whether and how off-site implementation approaches are permissible. Most permits create a sequencing hierarchy of retention/control requirements, allowing off-site controls only if on-site controls are demonstrated to be "technically infeasible," which is often poorly defined. Most permits provide little or no specificity regarding required technical, administrative, legal-regulatory, financial, and oversight requirements and expectations to inform program design and implementation.

Our reviews of existing stormwater crediting programs, wetland mitigation banks, and in-lieu fee programs demonstrate that clarity in permits and corresponding local regulations is crucial to ensuring effective implementation. Local ordinances and detailed program guidance can include detailed provisions. Stormwater

controls should be implemented in conjunction with the local development and redevelopment processes, to enable effective implementation and compliance oversight. Lack of clarity and public support in some initial stormwater crediting programs resulted in little or no participation. MS4 permits should incorporate specific language authorizing the use of offsite crediting arrangements, and describe required structural and process elements. The permit should at least articulate a list of necessary program elements and require the permittee to codify program details through local ordinances, rules, and guidance that the permitting authority can review. The MS4 permit should address the following elements:

Recommendations for MS4 Permits

Authorization. *Provide clear authorization of off-site crediting as a compliance method. The permit should specify what types of crediting are authorized and whether credit banking and in-lieu fee approaches are permitted. Program requirements should be codified through local ordinances or similar legal mechanisms.*

Control Requirements and Credit Units. *Specify how off-site control requirements and credits will be measured (e.g., retention of a specified design storm volume). Identify credit units and processes for creating, certifying, and exchanging credits. Specify the conditions and timing for off-site compliance installation to authorize credit release for use or exchange, and the relationships between development approvals and off-site credit certification. Determine credit characteristics, including appropriate longevity of certification. Articulate the process for determining in-lieu fees, floor prices, ratios and credit generation caps, if applicable.*

Credit Instruments. *Specify creation and use of enforceable credit instruments that establish crediting agreements, performance assurances, maintenance agreements, and inspection and reporting requirements. Establish clear procedures for evaluating, approving, and recording credit instruments.*

Tracking and Accounting. *Specify the need for a tracking and accounting system sufficient to track credits, evaluate compliance with permit requirements, and ensure appropriate certification and use of credits. Establish an expectation that permittees will establish policies and mechanisms to verify that required stormwater practices remain in place, are adequately maintained, and are not double-counted. Allow controls to be removed if not required for compliance (e.g., if credits are developed on another site).*

Service Areas. *Identify authorized service area boundaries in which credits can be exchanged, and the criteria on which they are based. Prohibit creation of localized pollutant impacts.*

Sequencing Hierarchy. *If a preference is created for on-site controls over off-site controls, define sequencing requirements, keeping in mind that sequencing may adversely affect the viability of and participation in the off-site crediting program. If the permitting authority wishes to include a provision requiring an applicant to demonstrate on-site compliance infeasibility, specify infeasibility criteria or require local criteria development.*

Oversight and Revision Processes. *Establish clear procedures for program oversight, evaluation, reporting to permitting authority, and program adjustment. Direct the municipality to develop or revise local ordinances as needed to authorize program implementation, funding, and spending, and to develop local guidance, outreach, and training.*

7. Conclusion

State and local governments have been examining and, in a few cases, have developed off-site stormwater crediting programs as alternatives to standard on-site retention requirements. Motivating forces include aging infrastructure, combined sewer overflows, pollution control challenges, desire for greater development flexibility, potential investment returns, and community aspirations for increased green infrastructure. Municipalities also appreciate the potential to realize multiple benefits, including flood hazard reduction, water supply augmentation, aesthetic or ecosystem enhancement, recreational opportunities, and job creation.

While the wetlands and stormwater programs are very different, lessons learned from implementing wetland compensatory mitigation can inform the development of effective off-site stormwater crediting programs. Stormwater crediting programs can also utilize water quality trading principles. Crediting program specifics will vary according to local conditions, but clear and specific definitions of program structure and procedures are critical to success. Local governments and stakeholders are principally responsible for shaping details of crediting programs; developing programs that effectively meet local needs can be challenging. To effectively guide program development and ensure water quality protection, MS4 permits should, at a minimum, explicitly authorize off-site stormwater compliance options and specify critical structural requirements for the program that local governments need to address. An MS4 permit directing the permittee to develop off-site options can also provide the permittee necessary support for a program they may be in the process of introducing to the public. MS4 permitting authorities will also help ensure that the program contains the components necessary to function appropriately and within the boundaries of legal mandates through ongoing review of local program development, revising the specifics as needed in response to new information gleaned from program operations or other sources. The lessons and program components discussed in this paper should help municipalities and MS4 permitting authorities plan for and initiate effective crediting programs appropriate to their local conditions and community goals.

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