Establishing a Stormwater Credit-Trading Program as an Off-Site Alternative for Compliance with Stormwater Management Requirements in Grand Rapids, Michigan

Prepared for the City of Grand Rapids Environmental Services Department

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Abbreviations and Acronyms

BMP: Best Management Practice

cfs: cubic feet per second

mg/L: milligrams per liter

D.C.: District of Columbia

DDOE: District of Columbia's Department of Energy and Environment

EGLE: Michigan Department of Environment, Great Lakes and Energy https://www.michigan.gov/egle/

ESD: Grand Rapids Environmental Services Department
https://www.grandrapidsmi.gov/Government/Departments/Environmental-Services

GI: Green Infrastructure

GIS: geographic information system

GSI: Green Stormwater Infrastructure

HUC: hydrologic unit code

ILF: In lieu fee

LGROW: Lower Grand River Organization of Watersheds https://www.lgrow.org/

LUDS: Land Use Development Strategy

MS4: Municipal Separate Storm Sewer System

NGO: Non-governmental organization

NPV: Net Present Value

PV: Present Value

ROI: Return on investment

SVC: Stormwater Volume Credits or retention credits

TSS: Total suspended solids; total amount of suspended materials

WMEAC: West Michigan Environmental Action Council https://wmeac.org/

Glossary

Certification period: length of time for which the constructed BMP is certified. The proposed inspection cycle for Grand Rapids is up to three years. BMPs can be re-certified at the end of the certification period.

Channel protection volume: The retention volume designated by regulation to protect stream channels from erosion. In Grand Rapids, this volume is the amount of rain associated with the 2-year, 24-hour storm event.

Compliance volume: the infiltration capacity required to meet stormwater management regulations. Compliance volume is calculated using the entire project site and each site drainage area.

Design volume: the maximum volume of storage that a BMP can accommodate for any one storm. The design volume should be calculated using the Grand Rapids stormwater manual according to BMP type.

Gentrification: the process of repairing and rebuilding homes and businesses, usually in an urban neighborhood, accompanied by an influx of middle-class or affluent people, that often results in the displacement of earlier, usually poorer residents

Grandfathered credits: credits from green infrastructure projects implemented prior to the market launch as early as 2015.

Hydrologic unit code (HUC): a hierarchical system of codes that geographically delineate U.S. watersheds

In lieu fee: an option for stormwater regulatory compliance, to pay a fee to the municipality 'in lieu of' paying directly to install green infrastructure. The fee is based on the cost for the municipality to install the green infrastructure. In a stormwater credit trading market, the in lieu fee can act as the price ceiling for the market; if the SVC price is higher than the in lieu fee price, then buyers should choose the in lieu fee option.

Net present value: the worth of a future stream of payments (or benefits) minus the worth of a future stream of costs, in today's dollars

Off-site compliance: option to manage stormwater volume at a location other than the project site.

Present value: the worth of a future stream of payments in today's dollars

Purchase guarantee program: a municipality or agency acts as a buyer of last resort for SVC credits unsold in the market, providing assurance for projects that voluntarily install GI in order to generate credits that they can recover their costs.

Qualified buyer: property owner that is required to meet Grand Rapids MS4 permit requirements, who also faces soil or other types of conditions at the project location that makes green infrastructure implementation infeasible

Qualified seller: a property owner that installs a GI BMP that meets criteria under Grand Rapids MS4 permit to voluntarily add retention capacity, or add additional capacity beyond the regulatory requirement. BMP's must be inspected and certified before a seller if qualified

Regulatory sites (or projects): a site that is subject to post-construction stormwater management requirements to provide stormwater retention capacity.

Sewershed: an area of land over which a storm sewer collection system drains to a single point.

Stormwater retention credit trading: a voluntary program that allows stormwater requirements to be met by purchasing volume-based credits generated through a green infrastructure (GI) project located off-site.

Stormwater volume credits (SVCs): stormwater volume retention capacity where 1 SVC is equivalent to 1 cubic foot of stormwater management capacity; stormwater "retention" credits.

Trading area: a defined geographical area in which volume-based retention credits can be bought and sold. The trading areas correspond with natural hydrologic conditions to minimize any potential adverse effect on downstream water quality.

Vital Streets Program: Grand Rapids program to install a network of accessible city streets and rights-of-way that are attractive, multimodal and safe, contributing to livability while protecting the river; includes a 'complete streets' design and green infrastructure.
https://www.grandrapidsmi.gov/Government/Programs-and-Initiatives/Vital-Streets-Program

Voluntary sites (or projects): green infrastructure implementations that are not constructed to meet a stormwater or water quality-related regulatory requirement, but are instead constructed voluntarily to generate credits for sale in the market.

Document Purpose and Organization

The purpose of this document is to provide the City of Grand Rapids with background information, analyses, and recommendations to support the design and implementation of a stormwater retention credit trading program. The proposed trading program is intended to accompany the release of the City's renewed Municipal Separate Storm Sewer System (MS4) permit and associated post-construction channel protection requirements. The document covers the following topics:

- Background information about stormwater credit trading;
- Feasibility of a stormwater credit trading program in Grand Rapids;
- Fundamental aspects of the program;
- Trading program design and administration; and,
- Suggested actions to prepare for implementation of the program.

Additionally, this document contains three appendices that include a detailed methodology for establishing the payment in lieu fee and analyses of the expected market prices for stormwater credits, and two case studies illustrating compliance scenarios and costs of real estate developments participating in the credit trading market.

Stormwater Credit Trading in Grand Rapids: Background

General nature and origins of stormwater credit trading

Stormwater credit trading allows developers and property owners subject to post construction stormwater management requirements to meet a portion of those requirements by purchasing volume-based stormwater credits generated by green infrastructure (GI) projects located off-site. In this context, credits can be generated by:

1. Property owners (or third-parties) not subject to post construction stormwater management requirements who voluntarily implement GI retrofit projects on their property;

2. Developers and property owners subject to post construction stormwater management requirements who build GI projects that provide storage capacity that exceeds their regulatory requirements. These developers and property owners can either bank the extra storage capacity they create for use at future development sites or sell them on the market.

Stormwater credit trading has been pioneered by the District of Columbia's Department of Energy and Environment (DOEE). In D.C., development and redevelopment sites with a disturbed area of 5,000 square feet or more are subject to post-construction retention requirements. DOEE's Stormwater Retention Credit Trading program allows property developers to meet up to 50% of their stormwater retention requirements by purchasing an equivalent volume of stormwater best management practice (BMP) capacity from credit sellers who build stormwater retention projects located elsewhere in the District. This provides economically valuable flexibility to developers, particularly in the dense urban core where buildable area is relatively scarce. In addition, because credits can be generated by installing GI on sites that are not subject to new retention requirements, the Program has the effect of incentivizing GI retrofits to manage stormwater runoff from existing impervious areas across the District. The distribution of these credit generating GI projects results in improvements in neighborhoods that are not otherwise seeing

direct investments from real estate development projects, providing benefits to residents outside of the urban core.

General Characteristics of a Stormwater Credit Trading Program in Grand Rapids

Interest in a trading program for Grand Rapids arose as a way of providing real estate developers with alternative, and more flexible, ways to comply with forthcoming post-construction stormwater regulations that feature more stringent retention requirements (discussed more fully below). As an alternative to either full on-site compliance or payment of an in lieu fee to the CIty, developers could choose to achieve compliance by purchasing GI-based stormwater retention capacity from projects built in other locations.

Participation in the credit trading program is entirely optional and voluntary. The credit trading program is a market-based alternative compliance option in which site developers purchase retention-based credits from providers of GI in amounts equal to or greater than their off-site compliance obligation. Under the program, developers also have the option to utilize credits generated at one of their other development sites where they built GI-based retention capacity beyond their required amount.

In Grand Rapids, one credit is equal to one cubic foot of stormwater management capacity. Throughout this document, we refer to these credits as "credits," "retention credits," or Stormwater Volume Credits (SVCs). The City's draft MS4 permit specifies that developers opting for off-site compliance must purchase at least 1.5 times the amount of retention that would be required onsite (a 1.5:1 trading ratio.) This ratio applies if a developer is able to manage a portion of their requirements onsite. If retention onsite is completely infeasible (according to infeasibility criteria outlined in the permit), then a 2:1 trading ratio applies.

Developers that add 1,000 square feet or more of impervious area at a project site have an obligation to comply with the City's stormwater regulations for the duration of the project's lifespan. If stormwater is managed fully on-site, this obligation is met by ensuring that on-site BMPs are maintained and continue to operate as designed. Costs for this ongoing compliance are based on regular inspection and maintenance. GI projects that generate SVCs will be subject to periodic inspection by ESD staff, as with on-site GI installations.

For off-site, compliance, developers have the same obligation to ensure sufficient stormwater retention for as long as they own or retain control over the development. However, the implementation of GI and ongoing inspection and maintenance costs are transferred to the provider of SVCs. The credit seller provides retention capacity to the site developer through an enforceable contract. That contract will stipulate payment from the buyer to the seller to cover the capital costs of the credit- generating BMP installed by the seller, plus a reasonable return on investment (payment can be made to the seller as a one-time lump sum or over a period of multiple years, as stipulated in buyer-seller agreement). The contract will also ensure that the credit-generating BMPs are maintained for full functionality over the entire period of the contract, which may be for the expected useful life of the BMP, or for at least 20 years. The credit seller will also enter into a Maintenance Agreement with the City, committing to ensuring maintenance for the expected useful lifetime of the credit-generating BMPs and is subject to inspection by City staff. The credit purchaser must verify to ESD that it has continual maintenance agreements covering all SVCs during the lifetime of the credits purchased. This obligation can be met by providing ESD with evidence of the service agreement with the credit seller.

It should be noted that the credit buyer has an obligation to meet stormwater requirements for as long as the buyer owns the property. So, if the buyer owns the property for longer than the expected useful life of the BMP that they contract with for SVCs, as built into the maintenance contract between buyer and seller, then the buyer must pay to meet their obligation for another 20-year minimum - whether that is through paying for recapitalization of the same BMP for another 20-year minimum, or buying SVCs from a different seller with a different BMP for a 20-year minimum, or entering into an in lieu fee agreement with the City.

Credit sellers will fall into two broad categories. Some site developers will opt to install more retention capacity than required by the City's stormwater regulations at a given development site. By treating additional impervious area onsite, they can accrue credits to either sell on the market or to dedicate to future projects. The other category of providers are property owners, non-profit, or for-profit entities that install stand-alone GI projects as retrofits to manage runoff from existing impervious area. Both categories are subject to minimum capacity thresholds and maximum volume caps, as detailed below.

Updated Grand Rapids Post-construction stormwater standards for new development and redevelopment sites

The City of Grand Rapids will be revising its existing post-construction stormwater management requirements to meet regulations outlined in its new (pending) MS4 permit. The new requirements will go into effect within a year of when the City receives its final, updated permit from the Michigan Department of Environment, Great Lakes and Energy (EGLE)). Changes from existing requirements include an increase in the water quality treatment standard from 0.5 inches to approximately 1 inch, and the introduction of retention standards for channel protection purposes. New development and redevelopment projects that increase on-site impervious area by 1,000 square feet or more (relative to pre-project conditions) will be subject to these requirements. The City will require property developers to meet the new retention requirements by installing GI practices, such as rain gardens, bio-infiltration cells, pervious pavement and other approaches detailed in the City's stormwater technical design manual, when feasible.

The City also requires new development and redevelopment sites that increase impervious area by 1,000 square feet or more to limit discharge rates and provide storage for flood protection. Allowable discharge rates and storage volumes vary based on whether the project is located in a sensitive watershed.

Table 1 outlines the City's new (forthcoming) post-construction stormwater management requirements, as described in the City's draft stormwater manual.

Table 1. Minimum Required Post Construction Stormwater Requirements

Standard	
Water quality	Treat the runoff generated from 1 inch of rain over the project site (i.e. the 90% annual non-exceedance storm) through BMPs designed to reduce post-development TSS loadings by 80%, or achieve a discharge concentration not to exceed 80 mg/L.

	Treatment may be provided through settling (permanent pool or extended detention), filtration or infiltration, absorption, or chemical/mechanical treatment.
Channel protection	Retain on-site the increase between the pre-development and post-development runoff volume and rate for all storms up to and including the 2-year, 24-hour rainfall event. Retention can be provided through infiltration, or interception and evapotranspiration or reuse. Pre-development is defined as the last land use prior to the planned new development or redevelopment.
Flood control	*Collection and Conveyance:* Design storm sewers, open channels, and swales for the 10-year storm. *Detention and Retention:* Store runoff from the 25-year storm with a maximum release rate of 0.13 cfs/acre (minimum rate of 0.26 cfs for sites less than 2 acres), unless the site is in a sensitive sewershed. Sites in sewersheds sensitive to flooding shall store runoff for the 100-year storm. Sites in sewersheds sensitive to downstream soil erosion shall have its discharge limited to a rate of 0.05 cfs/acre up to the two- year rain event. If the post-development runoff volume is equal to or less than the existing runoff volume, the maximum release rate may be increased to the pre-development 25-year or 100-year peak runoff rate, as applicable per sewershed.

Source: City of Grand Rapids, 2017. Draft Stormwater Standards: Procedures and Design Criteria for Stormwater Management. Prepared by Fishbeck, Thompson, Carr &Huber, Inc., draft January 2017

Of these three requirements, the channel protection standard is the primary driver for the stormwater credit trading program. This is because compliance with this provision requires stormwater to be retained through GI-based infiltration practices, if feasible. This is likely to be the most technically challenging and costly for real estate developers, compared to the standards for water quality and flood protection requirements, which can be met through more standard detention practices.

While channel protection volume will serve as the primary program driver, the retention volume contributed by off-site credits will also be applied towards the managed-volume required to meet the site's water quality and flood control standards. Working through the Lower Grand River Organization of Watersheds (LGROW) or other stormwater design calculators, a site developer will be able to deduct the compliance volume provided by off-site credits from the portion of the design volume needed to meet flood control and water quality requirements. Note that, as used in this document, 'compliance volume' refers to the portion of the design volume required to meet the stormwater management regulations. As explained below, because of the operation of offset ratios governing the purchase of retention credits, this volume will be lower than the actual volume of retention provided by purchased credit.

Alternative compliance for channel protection requirements

Infeasibility criteria

The proposed MS4 permit allows for alternative compliance in cases where retention onsite is infeasible. The site conditions that the City uses to define infeasibility will determine the level of participation in the credit trading program, at least initially before any adjustments might be made to the permit. There are two sets of criteria for infeasibility that should be considered when defining feasibility in practice. The first set of criteria are listed in the City's proposed stormwater ordinance, intended to effectuate the updated MS4 permit. Specifically, this document states that infeasibility will be based on multiple criteria and not solely on the difficulty or cost of implementing BMPs on site. Further, the ordinance lists several conditions under which the option to move off site would become available, including:

- Limited size of the lot outside of the building footprint to create the necessary infiltration capacity even with amended soils.
- Soil instability as documented by a thorough geotechnical analysis.
- A site use that is inconsistent with capture and reuse of stormwater.
- Too much shade or other physical conditions that preclude adequate use of plants.
- The potential water quality impacts associated with the original project site compared to the benefits realized at the offsite location.

A second set of infeasibility criteria are also listed in the City's draft stormwater manual (2017); they include:

- Poorly draining soils <0.24 inches per hour; typically hydrologic soil groups C or D)
- Bedrock
- High groundwater, or the potential of mounded groundwater to impair other uses
- Wellhead protection areas
- Stormwater hot spots (includes Part 201 and Part 213 sites, and areas of soil or groundwater contamination)

The above conditions are currently listed in the manual as enabling extended detention when onsite retention is not feasible. However, based on our conversations with the City, extended detention is intended to be the last option available to developers for meeting channel protection standards, only to be utilized when off site compliance is not available (this is key to having a functioning market). In addition, these conditions are more limiting, in terms of allowing for alternative compliance, compared to those outlined for inclusion in the City's stormwater ordinance. We recommend that the City develop one, consistent set of criteria for determining whether offsite compliance is allowed (e.g., by taking elements from both lists), as well as a process for determining infeasibility and when in the development process this should occur. The infeasibility criteria should not be so overly restrictive that they severely constrain market demand. In addition, the City should update its draft manual to clarify that extended detention is the last resort option for meeting channel protection standards.

Offsite compliance options

When off-site compliance is warranted, property developers would have three offsite compliance options under the proposed trading program:

- Payment of an in lieu fee to the City. This fee is linked to the construction of GI-based stormwater management projects by the City and will be tied to the actual implementation cost of public stormwater enhancements.
- Constructing equivalent GI-based stormwater retention at an off-site location controlled by the developer within the same watershed or sewershed (referred to as offsite mitigation).
- Purchasing SVCs that reflect an appropriate amount of retention provided at an off-site location.

When site conditions enable a developer to retain at least the volume of stormwater associated with a 0.4 inch rain event, remaining off-site compliance must be provided at a 1:1.5 ratio. When this minimum cannot be met onsite, a 1:2 ratio applies. These ratios apply to all offsite compliance options (i.e., in lieu fee, offsite mitigation, purchasing credits).

As noted above, Installation of on-site extended detention basins may be allowed when compliance with channel protection requirements cannot be met through retention and off-site options are not available.

Feasibility of a Credit Market for Grand Rapids

The project team undertook an analysis of the economic, geographic, and other factors that determine whether a stormwater credit trading market would be technically feasible for Grand Rapids. To assess the demand for the market, we examined data from recent development activity relative to the factors that would make on-site retention infeasible. As detailed in previously submitted report detailing the feasibility of a credit trading program in Grand Rapids,[1] we also evaluated conditions under which it would make economic sense for developers to participate in the market. To assess potential market supply, we examined property availability in regions of the city where site conditions would likely make GI-based retention more feasible. In general, there was a roughly equal distribution of potential demand and potentially available credit supply across the sewersheds.

However, the technical feasibility analysis was instructive about the importance of ESD efforts to promote GI projects to generate credits. As detailed below, the findings from the feasibility assessment indicate that in some of the proposed trading areas of the City, there may be a sufficient amount of SVCs available from existing projects built by the City in excess of regulatory requirements to serve as an initial source of supply to help generate market activity. However, this is not the case in all areas where significant investment in the generation of credits will be needed to meet potential demand. Efforts to publicize the stormwater credit trading program with business groups, affordable housing developers, and non-profit groups including faith-based institutions will likely be important to providing supply commensurate with expected demand. Financial incentives for credit sellers and/or project aggregators could also help to ensure a continuous supply of SVCs.

In addition to technical feasibility, we examined the economic drivers and feasibility for developers to purchase credits/participate in the market. Developers and property owners subject to stormwater management standards will purchase SVCs from an offsite provider when it is cheaper or easier than managing all stormwater onsite. In some cases, buying SVCs can allow developers to take advantage of additional buildable area onsite, including rooftop or underground area. To assess economic feasibility,

[1] American Rivers, Corona Environmental Consulting, WEF, An Analysis of Stormwater Credit Trading Program Potential in the City of Grand Rapids, Michigan, prepared May 31, 2018.

we estimated the cost of onsite compliance compared to the cost of participating in the credit market for several recent development sites (if they had been subject to the standards). Our analysis found that it would be economically feasible in many cases to purchase credits. This is in part because of onsite feasibility constraints, which drive up costs for onsite compliance. Appendix 3 provides examples of our cost estimates for two recent development sites in the city.

Core Components of a Stormwater Credit Trading Program in Grand Rapids

To establish an effective stormwater credit trading program, the City must create a set of fundamental program components. These include:

- Setting an in lieu fee payment option that functions as a price "ceiling" for retention credits;
- Calculating the volume equivalent or currency of a retention credit;
- Establishing trading areas or boundaries within which trades can occur;
- Creating an initial supply of SVCs and helping to ensure adequate supply over time.
- Establishing requirements and guidelines for credit generating projects
- Establishing administrative processes necessary for the market to function

Payment in Lieu Option for Off-site Compliance

In many ways, the ability to purchase stormwater retention credits is an alternative to paying the in lieu fee when on-site retention is infeasible. While simply paying an in lieu fee may be a simple and initially attractive option for a developer, a properly set in lieu fee fully recaptures the City of Grand Rapids' costs for providing the equivalent retention capacity required by the developer. Given public sector labor and overhead costs, as well as increased costs often associated with implementing projects in the public right-of-way (e.g., utility conflicts, permitting), the fee is highly unlikely to be less than the comparable market rate for retention credits created by the private or NGO (non-governmental organization) sector. Thus, the in lieu fee alternative likely reflects the highest price for complying with the City's new stormwater retention requirements, effectively functioning as a ceiling price for the market. It plays important roles, both signaling the economic benefit of participating in the credit market and providing a backstop that will ensure stormwater permit compliance for developers and the City.

The project team has set the initial in lieu fee by calculating a price based on the following factors:

- Capital cost for ESD to build an equivalent amount of GI-based retention based on the City's current mix of GI BMPs and associated costs, as well as national BMP cost data (see Appendix 1);
- Costs of Grand Rapids ESD construction and program management costs for one BMP lifecycle;
- Value of land required for the installation of equivalent retention BMPs; and
- Annual or cumulative maintenance costs, assumed to amount to 5% of construction costs.

Appendix 1 provides additional detail on our methodology for setting in lieu fee, as well as our estimate for the initial in lieu fee. We recommend that the City follow this methodology as it adjust the in lieu fee over time to incorporate updated information. At a minimum, the in lieu fee should be adjusted for inflation every year.

Credit Market Option for Off-site Compliance: Credit "currency" or unit of exchange

The City's stormwater manual, and associated LGROW design tool, guides site developers through the calculations required to determine water quality, channel protection, and flood prevention control volumes. The results of these calculations are consistently expressed in term of "cubic feet." To enable consistency with local practice, we suggest that SVCs be created, traded and consumed in "cubic feet." In other words, one SVC shall be worth one cubic foot of design retention capacity for one year.

We have paid additional attention to the application of retention credits to the flood control and water quality requirement in the MS4 permit and local ordinance. In general, credits purchased to meet channel protection standards will have the effect of reducing the volumes necessary for meeting water quality and flood protection standards. The channel protection volume, whether met on-site, through off-site credits, or some combination, will be deducted from the total volume required to meet water quality and flood control standards. However, when credits are purchased to satisfy the channel protection volume, only the calculated channel protection volume may be used to satisfy the other requirements. Site developers may not apply the additional volume associated with the "extra" credits that were purchased because of the credit offset ratios. For example, a development that meets 1,000 cubic feet of channel protection by purchasing 1,500 SVCs (at 1.5:1 ratio) may reduce its water quality and flood control volume by 1,000 cubic feet, not by 1,500 cubic feet.

Trading Areas

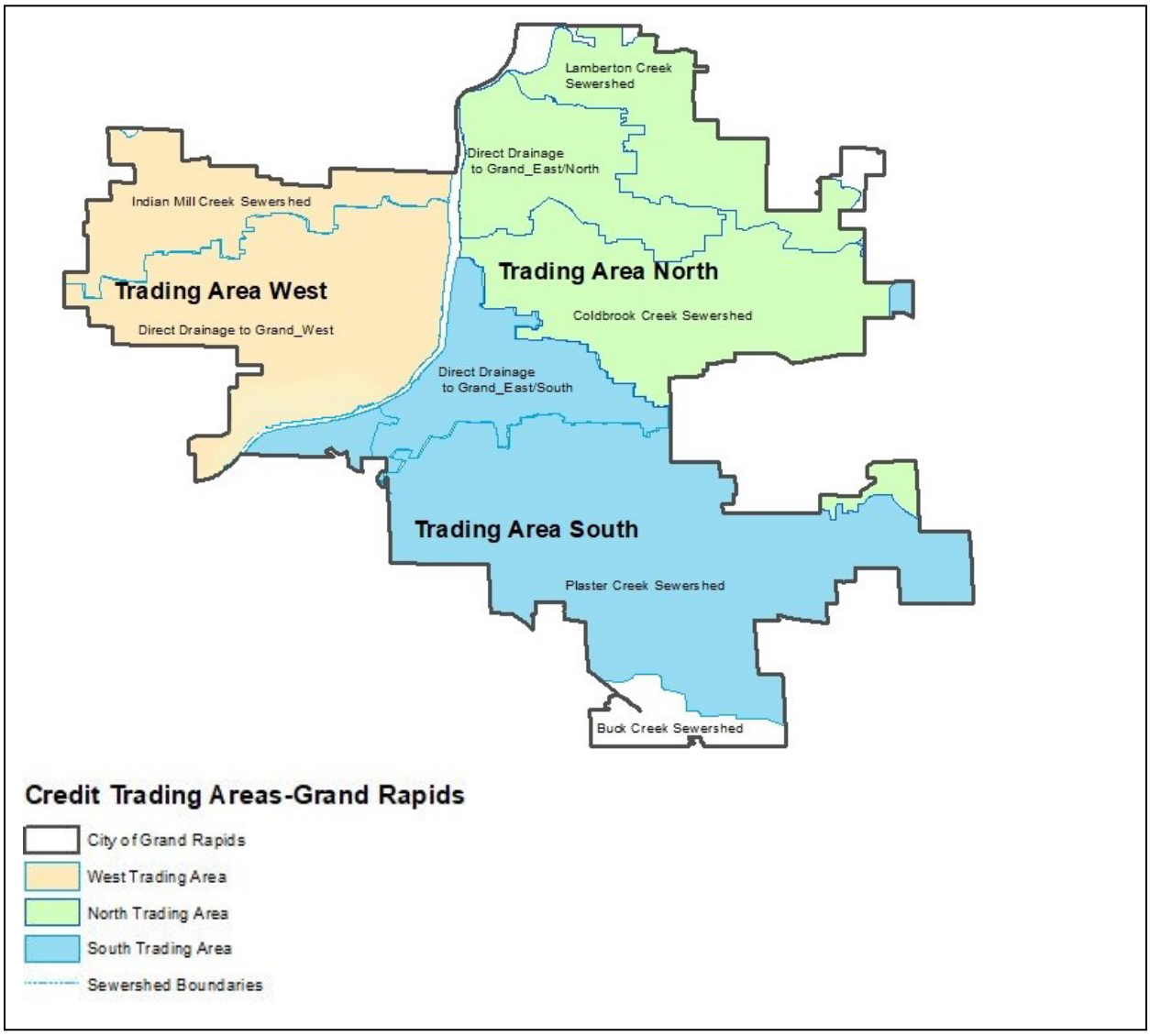
Grand Rapids' draft MS4 permit requires that the location of off-site compliance stormwater management be within the same HUC-10 watershed and sewershed as the original project. Storm sewersheds in Grand Rapids generally follow the contours of seven pre-existing creeksheds or drainages. While it would be possible to set up a market that restricts credit trades to providers and purchasers within the same sewershed, the resulting markets would be too small to sustain an active trading program. After review of development patterns in Grand Rapids, and the general geographic distribution of GI feasibility/infeasibility, ESD and the project team have determined that these sewersheds and drainages can be grouped into three composite trading areas without resulting in adverse water quality impacts: North, South, and West (Figure 1).

The North market is comprised of properties located in the Lamberton Creek and Coldbrook Creek sewersheds, and the north portion of the Direct Drainage to Grand River East sewershed. The South Market is comprised of properties located in the Plaster Creek sewershed and the south portion of the Direct Drainage to Grand River East sewershed. A third market will be allocated to properties in the Indian Mill Creek sewershed and the Direct Drainage to the Grand River West sewershed. For the time being, projects located within the Buck Creek sewershed will be considered on a case-by-case basis. The Buck Creek sewershed is mostly located outside of the City of Grand Rapids and is not hydrologically connected to the other sewersheds in the city (such as the adjacent Plaster Creek sewershed). Projects in the Buck Creek watershed will need to trade with other projects in the Buck Creek watershed in order to provide the intended benefits of the program.

Developers will be required to purchase credits from within the same trading area as their originating project. To ease this process, we anticipate that the City of Grand Rapids staff will maintain a registry of available SVCs based on location within the three trading markets, and to direct project developers to SVCs generated in the appropriate geography. More detail on the registry/trading platform is provided below.

The MS4 permit expresses a preference that off-site mitigation projects be located downstream of the originating site development. In Grand Rapids, this is not always possible (many downtown developments discharge to the adjacent Grand River) nor desirable from a channel protection or water quality perspective. There are, however, concerns about adding discharges from new developments to already over-burdened or size-limited storm sewers. To address this problem, ESD has indicated that it will continue to evaluate proposals for off-site mitigation on a case-by-case basis during normal permitting review and retains the right to attach conditions affecting credit purchase when needed.

FIGURE 1: Trading Areas and component sewersheds



Ensuring a Supply of Credits

Initial Supply of Credits

At the launch of the trading program, there will most likely be a gap between the amount of credits that developers will seek to purchase and credits available from GI coming into the market. As such, it will be important to ensure that there is a sufficient amount of credits available to meet initial demand from developers. We recommend that an initial supply of credits be made available from relatively recent projects that the City has constructed, as well as from projects constructed by third-parties (e.g., Plaster Creek Stewards or private property owners). In either case, projects that constitute an initial supply of credits must be voluntary, meaning they cannot have been constructed to meet a stormwater or water quality-related regulatory requirement. We also recommend allowing only projects constructed over the past 5 years (i.e., since 2015) to become certified credit-generating projects.

The project team forecasted the initial supply of SVCs that could be made available from projects constructed by the City within each trading area (North, West and South) since 2015. We found that the North trading area will have the greatest initial supply of SVCs because of the investment that the City has made in stormwater retention in the Mary Waters Park project in the Coldwater Creek sewershed (96,257 cu. ft. of available retention capacity). Therefore, there will likely be sufficient SVCs available initially in the North trading area to meet demand.

The other trading areas (West and South) do not benefit from an initial investment in retention that can be used to supply credits. However, these areas can rely on credits generated through projects conducted as part of the Vital Streets program to have some initial credits available. A relatively superficial analysis of these projects, using data found in the City's GIS data and annual reports for sewer program and the Vital Streets program, shows how Vital Streets projects are distributed across the market's trading areas. From 2015 to 2017, credits generated through Vital Streets projects were greatest in the South trading area, followed by the North and West areas. Credits generated by City projects should be set at market price and will essentially serve as the de facto in lieu fee for the program in its early years.

Another source of initial credits may be voluntary GI projects, installed by other parties such as private businesses and institutions after 2015 (or other established timeline). A common concern with these 'grandfathered' credits is that, because costs to install them have already been recouped or are not at issue, they can be sold for far cheaper than credits from new GI projects. An excess of cheap credits flooding the market could have a significant undesirable effect by creating a disincentive for the private sector to incur the cost of investing in more expensive projects generating less attractive credits. Therefore, we recommend that the City cap the number of years that pre-existing project SVCs can be sold to a maximum of three years. If market conditions warrant as this date approaches, the cap could be extended for another period of time.

Continuous Supply of Credits

The City will most likely need to take an active role in ensuring that an adequate supply of credits exists to meet the demand from new development and redevelopment over the lifetime of the trading program. One of the strengths of a credit trading program is that it creates an incentive for private property owners and developers to fund and construct GI projects. The City can make participation in the market more attractive by offering incentives in the form of funding or non-financial steps that ease real estate development projects (i.e., to incentivize developers to go beyond their regulatory requirements). These

incentives may be especially useful in creating future supply in watersheds where insufficient credits currently exist.

Options that the team has considered include:

- Ensuring compatibility between stormwater retention requirements and other provisions of the City's development and planning code. For example, properly designed street tree installations (and trees installed as part of a retention facility) should be able to count toward both the stormwater requirements and Grand Rapids' Urban Forest requirements. ESD and the City may want to consider measures to harmonize these closely related policy goals in a way that creates an incentive for additional trees in shade deprived portions of the city;
- Coordinating with local watershed and community organizations who are able to obtain grant funding (from private philanthropic and other sources) to create GI projects. Coordination may make it easier for these projects to qualify as credit-generating projects, and may enable the City to guide projects to priority locations within the sewersheds or urban landscape;
- Working closely with Grand Rapids' affordable housing community to assist in the design and implementation of GI that reduces costs or provides economic returns for these projects;
- Hosting workshops or otherwise connecting property owners and GI developers to private 'impact' investors who may be interested in providing funding for credit generating GI projects.
- Providing limited funding to third-party project aggregators (i.e., third-parties or property owners who develop multiple credit-generating projects across multiple properties) to help cover costs associated with project identification, property owner recruitment, and design.
- Providing upfront financing (in the form of a low-interest or no-cost loan) to credit sellers for design and construction of GI projects, with payment due upon sale of SVCs.

The most prominent incentive concept is to adopt a "purchase guarantee" program that would assure SVC sellers that the City would be a buyer of last resort for unsold SVCs. The District of Columbia has instituted such a program. DOEE staff report that the commitment by the District to purchase (at a below market rate) unsold retention credits has created some degree of certainty in the market and reduced risk for credit sellers; it has also encouraged several project aggregators to enter the market. One concern that the City may have in considering this approach is the source of funding needed to purchase credits. Potential sources include:

- Revenues collected from sale of the credits generated by City projects, including the bank of retention capacity created after 2015 and ongoing Vital Streets projects;
- State or federal funding that may be available to initiate a low-interest loan that could be repaid with in lieu fee revenues and/or a surcharge on development and stormwater permit fees;
- Philanthropic funding from organizations interested in the many benefits that GI projects can provide.
- A potential fee on single use plastic bags and disposable food and beverage containers. The fee would provide consistent revenue while also reducing litter and trash stormwater runoff.

Credit Generating Projects – categories, caps, and minimum threshold

SVCs can be generated by the installation of GI practices that are not required to meet any stormwater or water quality-related regulatory requirements. There are two categories of projects that can foreseeably supply SVCs: 1) development and redevelopment projects that treat more stormwater than the new post

construction regulations require and 2) voluntary projects installed as retrofits on properties where no other construction is ongoing or at new or redevelopment sites that do not trigger the new post-construction standards. As described below, while the action that creates the credits are somewhat different across these categories, they are functionally indistinct.

It is important that SVCs not be associated with retention volume that is unlikely to ever be used. When credits are sought by developers who intend to exceed their on-site regulatory requirements, the City has expressed an intention to only certify SVCs for retention projects that capture stormwater runoff from more impervious area than is required by the City's stormwater regulations. Currently, development and redevelopment projects must treat runoff associated with added impervious area (the increase between pre- and post-development runoff). Projects at redevelopment sites could generate SVCs by treating pre-development runoff volumes, for example, from an existing or modified parking area. We also propose that the City allow new development and redevelopment sites to treat runoff from offsite to generate additional SVCs.

Credits can also be created by retrofitting an existing property with GI installations or at a new or redevelopment site that does not trigger the new channel protection standards. However, these projects cannot have been constructed to meet compliance with any stormwater or water quality-related regulatory requirement. These projects may be created with the motivation of profiting from the sale of SVCs or may also be intended to provide additional property or neighborhood benefits. These SVCs may be generated by projects funded by philanthropic or other grants, subject to grant and legal restrictions. They may generate SVCs up to the runoff volume produced by the connected impervious area during a 2-year 24-hour storm (i.e., the channel protection standard.)

For both categories, retention practices must exceed a minimum treatment volume threshold to qualify for credit certification. As such, credits may be obtained for GI projects that are designed to retain at least 250 cubic feet of runoff. This volume was chosen to ensure efficient administration of the program by the City while allowing small property owners to participate in qualifying retrofit projects. SVCs may also be banked, that is, created but not immediately used or sold, so long as they are applied to future projects within the same trading area.

In addition to individual property owners and developers, the credit trading program opens up the potential for project aggregators to work with multiple property owners to construct projects to sell on the market. We encourage the City to consider providing resources and conducting outreach to potential credit generators while the program is being established. This could include financial incentives or smaller start-up grants for aggregators as a way to encourage entry into the market.

Administering the Credit Trading Program

Credit supply - certification and tracking

To be eligible for sale, SVCs must first be certified by ESD. While we suggest that ESD and credit sellers coordinate as early as possible, the credit certification process will formally begin after the credit-generating project is constructed and the credit seller submits an application to ESD. The application will require technical information about the project, as well as a detailed maintenance plan. Credit sellers can obtain certification by submitting the calculations they used to derive the channel protection volume

associated with the installed GI. Using the LGROW calculator for this would create consistency with ESD's stormwater permit review, and ease implementation of the market.

In approving the application, ESD will certify the project's SVCs and associated maintenance plan. The City and credit seller will enter into a maintenance agreement that provides remedies for the City should the seller default on their maintenance obligation. This agreement will mirror the one that the City enters into with developers who install GI on-site to meet retention requirements. SVCs will remain valid as long as the seller complies with the maintenance plan. ESD currently proposes to inspect on-site private GI and other stormwater management BMPs on a two-year cycle. GI projects installed to generate SVCs may be subject to the same City inspection cycle, although a 3-year cycle may reduce administrative burdens on ESD. The City may wish to consider requiring that sellers submit an independent certification that their GI projects are functioning as designed on a regular basis (e.g., on the two-year inspection cycle every year). This certification could provide assurances about the functionality of credit-generating GI projects that the City is not able to inspect.

ESD will need to track the generation of retention credits and their eventual purchase. This can be accomplished by a database which serves ESD staff purposes, as well as forming the basis for a publicly accessible registry of transactions, buyers, sellers, and available SVCs.

To track credits coming into the market, ESD's database should identify credit sellers, the amount of SVCs they have generated, sales of these SVCs, and the duration of these sales agreements. Careful tracking of credits and credit-generating projects can help staff ensure that each SVC is only sold once at any point in time, and that there is a match between SVCs provided by sellers and SVCs relied upon by developers.

We suggest that the City / ESD use the twelve months between permit issuance and effective date to develop a set of resources that will provide assistance to potential credit sellers. We suggest that these resources include:

- A handbook detailing the credit generation, approval and sale process
- A site evaluation guide
- A financial return calculator/spreadsheet to help credit sellers set a credit price and estimate return on investment in credit generating projects
- A list of GI design and construction resources available in Grand Rapids
- A GI maintenance guidebook

Maintenance of Credit Generating Green Infrastructure

Fundamental to the function of the credit trading market is the transfer of compliance risk from site developers (credit purchasers) to credit sellers. Site developers are responsible for compliance with the City's stormwater regulations for the lifespan of the development project. This compliance is most easily assured, and most under the developer's control, for GI installed on-site. When opting to comply with regulatory requirements through the purchase of off-site retention credits, site developers generally seek to transfer compliance risk to the SVC provider, who is best placed to exercise control over the design, installation and operation of the GI that provides retention credits. As such, ESD should require credit sellers to enter into a Maintenance Agreement with the City to cover the period for which the SVCs are expected to be on the market or the lifespan of the credit-generating BMPs. This agreement will commit the site developer to paying for ongoing maintenance, obligate the credit seller to perform such maintenance, and provide the City with remedies should the seller default on its obligations. Credit

purchasers and sellers must also enter into a separate agreement that commits the purchaser to pay the seller for the costs of maintenance. The parties can negotiate whether these payments will be made periodically or in one up-front transaction.

Both site developers (or site operators/property owners) and credit providers have a continuing obligation to comply with stormwater management requirements. For site developer/operators this obligation can be met by submitting a certification to ESD that they have entered into binding purchase and maintenance payment agreements with the credit providers. These agreements may cover a period of years shorter than the lifespan of the site development; in this case, when agreements expire, the developer/operator must enter into new ones, and certify as such to ESD. Failure to have purchased SVCs for the lifespan of the development exposes the seller to a Notice of Violation and corrective and/or legal action by the City. Likewise, credit sellers bear the responsibility of maintaining the GI installed to provide SVCs. Failure to maintain certified GI practices exposes the seller to a Notice of Violation and corrective and/or legal action by the City.

In the event that a credit purchaser eventually opts to discontinue paying for maintenance of the credit generating GI, the provider of SVCs must notify ESD before making the SVCs available to new purchasers.[2] Proof of a payment agreement with the purchaser to cover maintenance will be required upon resale of these credits.

Overseeing Credit Purchases for Off-site Compliance

The development permit process, including permitting for stormwater, credit purchase process begins upon submission of the LUDS form to the Planning and ESD. With some modifications, the LUDS form can provide City staff with initial information to evaluate the need for a site developer to obtain off-site stormwater compliance, including soil and other feasibility constraints, extent of added impervious area and other changes to the property. When coupled with ESD's review of the developer's stormwater management calculations, department staff should be able to review the application for any undesired watercourse or storm sewer impacts from an off-site credit purchase. Following review of the application, and any normal discussions between the developer, Planning and ESD, we suggest that ESD "sign off" on a site developer's plan to obtain retention credits.

Once developers have obtained SVCs, they will need to submit a certification to ESD that describes the number of SVCs purchased, the location (trading area) of the GI used to generate the SVCs, and proof of a maintenance agreement for the GI. ESD staff will then need to enter this information into the SVC tracking database.

The primary quandary for ESD and the project team has concerned the structure of the purchase/payment obligation. As noted, site developers must assure 'permanent' compliance with the City's stormwater retention requirements. This long-term obligation exists in some tension with both the expected functional lifespan of a credit-generating GI installation and the period for which a credit generating property owner may want to dedicate a portion of her/his site to the installation. DOEE's program has responded to this tension by requiring site developers to purchase SVCs on an annual basis. Credits in DC are certified to provide a gallon of retention *per year*. Site developers must demonstrate that they have sufficient credits to meet their requirements each year. They can do so by purchasing credits in multi-year

[2] Note that the credit purchaser may be out of compliance at this point unless they either re-establish maintenance payments or obtain an alternate source of credits.

blocks, or by going to the market each year. Functionally, this means that the site developer will need to secure multiple credit purchase agreements during the lifespan of the development. Some developers in Grand Rapids have expressed concern about this approach, particularly because there is an inherent lack of certainty about both the extent of coverage provided by purchased credits and the cost of those credits. In addition, under this approach credit purchasers must pay the full cost of credits, which reflects both the cost of capital and maintenance, into perpetuity, and long after the credit-seller has recovered their investment. Over time, annual payment begins to make less economic sense from the standpoint of a credit purchaser. This approach works in D.C. because of the high opportunity cost of land in many areas of the District (i.e., developers are happy to pay a higher overall amount because they receive benefits from being able to use their property for things other than GI projects).

An alternative that better suits Grand Rapids would be to establish a market that favors a "one time" purchase of the retention capacity required for the lifetime of the development project, and continued maintenance payments over time. In this scenario, a site developer would contract for the purchase of retention credits from a provider who would then bear the responsibility of assuring sufficient credit-generating GI to provide functional retention capacity 'in perpetuity.' Realistically, the term of an agreement would likely run for twenty or thirty years, with possibility of renewal. The provider may opt to maintain the original GI practices for the entire time, or to substitute equivalent new practices (in the same trading area) during the contract period. We anticipate that the price per SVC would reflect the long-term cost of maintenance, and therefore that this approach would have a higher upfront cost than the annual "pay as you go" approach. In the long-run, however, there may be advantages to this approach: long term costs for the duration of the development's lifetime will be lower, and site developer may be able to bundle the upfront cost into the initial capital financing for the project.

There are downsides to this approach. Primarily, there is a risk that credit generating GSI will not be maintained over the lifetime of the purchase agreement. Because a "one time" payment provides all revenue to the provider in an initial transaction, there is no cash flow to sustain long-term maintenance. Additionally, some credit purchasers (particularly small lot developers) may prefer to pay for credits over time rather than bear a large up-front cost.

Thus, we have developed a third, hybrid approach to structure payments. Under this approach, the developer in need of credits would pay up front (one-time or over multiple years) for the capital cost portion of those credits, including design, permitting, construction, and return on investment for the credit seller. They would then enter into an agreement with the credit seller under which they pay a small amount each year to cover maintenance costs (the developer could also pay for multiple years of maintenance at one time, depending on the buyer-seller agreement).

Payment plan

The terms of a credit purchase are expected to be negotiated by the parties to the agreement. One possible approach is for the parties to agree that the "one time" purchase for capital/construction costs will actually be paid for over time, and to develop a payment plan. This approach provides consistent revenue to the seller and relieves the purchaser of an obligation to secure full funding for the purchase at the onset, if desired. ESD should take steps to clarify that this is an acceptable option.

Tracking Credit Purchases

As with the tracking of credit generation discussed above, ESD will also need to track credit purchases. In order to track SVC purchasers, and projects requiring off-site compliance with retention requirements, we suggest that the database access relevant information from the City's LUDS permits and database. ESD will need to supplement this information with data about the number of SVCs purchased, the identity/identities of the credit providers, the duration of the credit purchase agreement, and the expiration date of any agreement with a duration less than the lifespan of the development project. The database should be programmed to alert ESD staff whenever the SVCs purchased by a development are about to expire. This would enable staff to take action with the developer to ensure that it remains in compliance.

On-line marketplace

The credit generation and purchase tracking database discussed above are tracking registry is a fundamental component of the trading program. Internally, the registry's database serves as ESD's primary means for tracking the purchase and 'consumption' of credits for off-site compliance with the new stormwater regulations. It also will enable ESD to track whether credits purchased by site developers are subject to on-going maintenance agreements (and when they expire), and issue notices of deficiency when coverage (either credit or maintenance) lapses are experienced. A public-facing component of the registry, ideally Web accessible, allows site developers to identify and contact credit sellers in order to negotiate credit purchase agreements. Providing such a resource enables ESD and other City staff to have a relatively 'hands off' role in connecting credit buyers and sellers, reducing the need for staff to be involved in this process. The City will need to develop a web-based resource that serves as the credit trading "marketplace." This marketplace will serve as a publicly available roster of all credits that have been certified by ESD, their location within one of the City's three trading areas, a calculation of the capacity (or number of SVCs) on offer by each provider, and a point of contact for each credit seller. Additional useful information may be the date of certification, presence of a current maintenance agreement, and any notations relevant to other requirements that the credits may be able to offset (e.g., tree canopy).

The marketplace should also provide information to the public, and interested 'customers' about completed transactions, including the identity of the parties, the purchase price, and location of both the site developer and the GI that provided credits. The District of Columbia Department of Energy and Environment's registry is a useful example of design, content and functionality.[3]

Other Considerations

Equity and Gentrification

Grand Rapids, like many cities, is increasingly concerned about ensuring that investments in GI equitably benefit all of the city's neighborhoods and residents. City staff are also alert to potential that GI investments that may contribute to increased property values, and associated gentrification and displacement of established, lower-income residents.

[3] Available at https://octo.quickbase.com/up/bjkxxcfcp/g/rb7/eg/va/levels.html?sitelevel=1&pagerecord=167&userrole=Everyone%20on%20the%20Internet

If functioning as intended, the credit trading program should have the effect of distributing funds from property investment dollars across the city's neighborhoods. In this way, a portion of the private sector investment in high-development neighborhoods are available to redress stormwater problems in neighborhoods that would otherwise not benefit from such investments. By engaging early with potential credit sellers, the City may be able to help identify project locations that would redress historic investment inequities or address localized concerns or needs.

It is difficult to fully understand and quantify the role that new investments in GI have in gentrification. However, there is considerable evidence that a connection does exist and that the City should actively prepare for this eventuality. Members of this project team have been involved in efforts to better understand and respond to this dynamic and are prepared to advise City staff and departments about current best-practices.

Path to Implementation

Given the resource and staffing limitations at ESD and other City departments, it is important that the implementation of a credit trading program not create overly burdensome demands on budgets and personnel. We believe that the programs and processes that the City will need to adopt to comply with the new MS4 permit can be adapted to serve as the foundations for a functional trading program. Some investment in additional capacity will be required, however we expect that these should be manageable.

The role of ESD and its sister City departments will be to ensure that the credit trading program confers compliance with the requirements of the new MS4 permit and City stormwater ordinance. To do so, City staff must: ensure that developers purchasing SVCs have encountered site-specific feasibility constraints that make them eligible to participate in the credit trading program and have purchased the necessary amount of SVCs to comply with their off-site stormwater obligations; certify that credit sellers have installed and are operating GI capable of providing adequate retention of stormwater; that SVCs are sufficiently tracked to demonstrate compliance: and that a marketplace for trading in SVCs is easily accessible and up to date. Much of this activity would also be necessary in the absence of the credit trading because the new permit allows for offsite compliance. Beyond these fundamental competencies, the City can (and should) facilitate connections between would-be purchasers and sellers of credits; ensure that off-site compliance does not create localized flooding or water quality concerns; incentivize projects that create credits on Voluntary or Regulatory sites.

As an initial, and high priority matter, ESD and City will need to make changes to the stormwater ordinance and design manual, including:

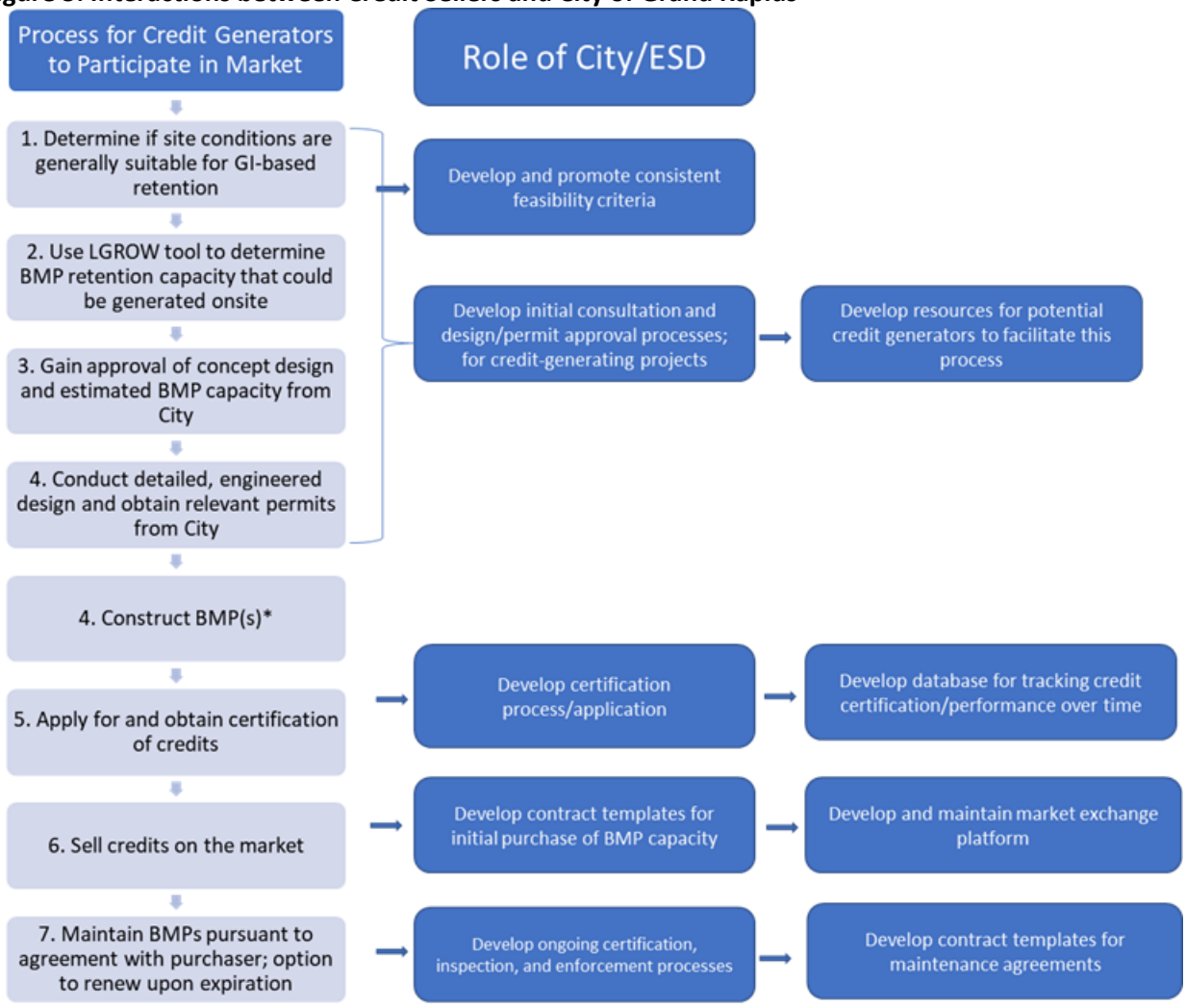
1. The Manual states that "an alternative approach using extended detention is preferred by the Municipality over payment in lieu programs when the full channel protection volume cannot be retained onsite. These standards provide specific criteria for determining the conditions under which the alternative approach will be approved for use. A flow chart is outlining this process is shown on the following page." Although the flow chart shows extended detention as a last resort option so need to clarify this in text. We should stress this is super important for credit trading program to work – otherwise everyone will just do underground extended detention;
2. The flow chart in the Manual shows soil filtration rates as only feasibility criteria – this should be changed to include all infeasibility criteria;
3. Overall, the Manual needs to include credit trading as a form of alternative compliance

In a separate, companion document, we have presented a list of specific actions that ESD will need to undertake in advance of launching the retention credit trading program. We have grouped these actions into three categories: Program Launch and Administration, which focuses on the internal process and resource development that will enable ESD to establish and manage a successful program; Developing Support and Participation, which outlines suggested actions and partnerships to build a community of credit generators and purchasers, as well as overall stakeholder support; and Creating and Assuring Adequate Credit Supply, which details a range of steps that ESD and local partners can take to ensure that credits come into the market in a manner that meets demand while meeting community goals.

In addition, we suggest that ESD and City leadership could benefit from additional research to fully understand the legal issues associated with enforcing offsite compliance through a credit trading program. The level of research that we have undertaken indicates that trading is a valid and legal approach to managing stormwater, but finer details such as the mechanics of property liens, tax implications (if any) of market administration, and general liability were not fully explored. Finally, we encourage the Department to remain open to and search out additional sources of funding incentive programs and purchase guarantee

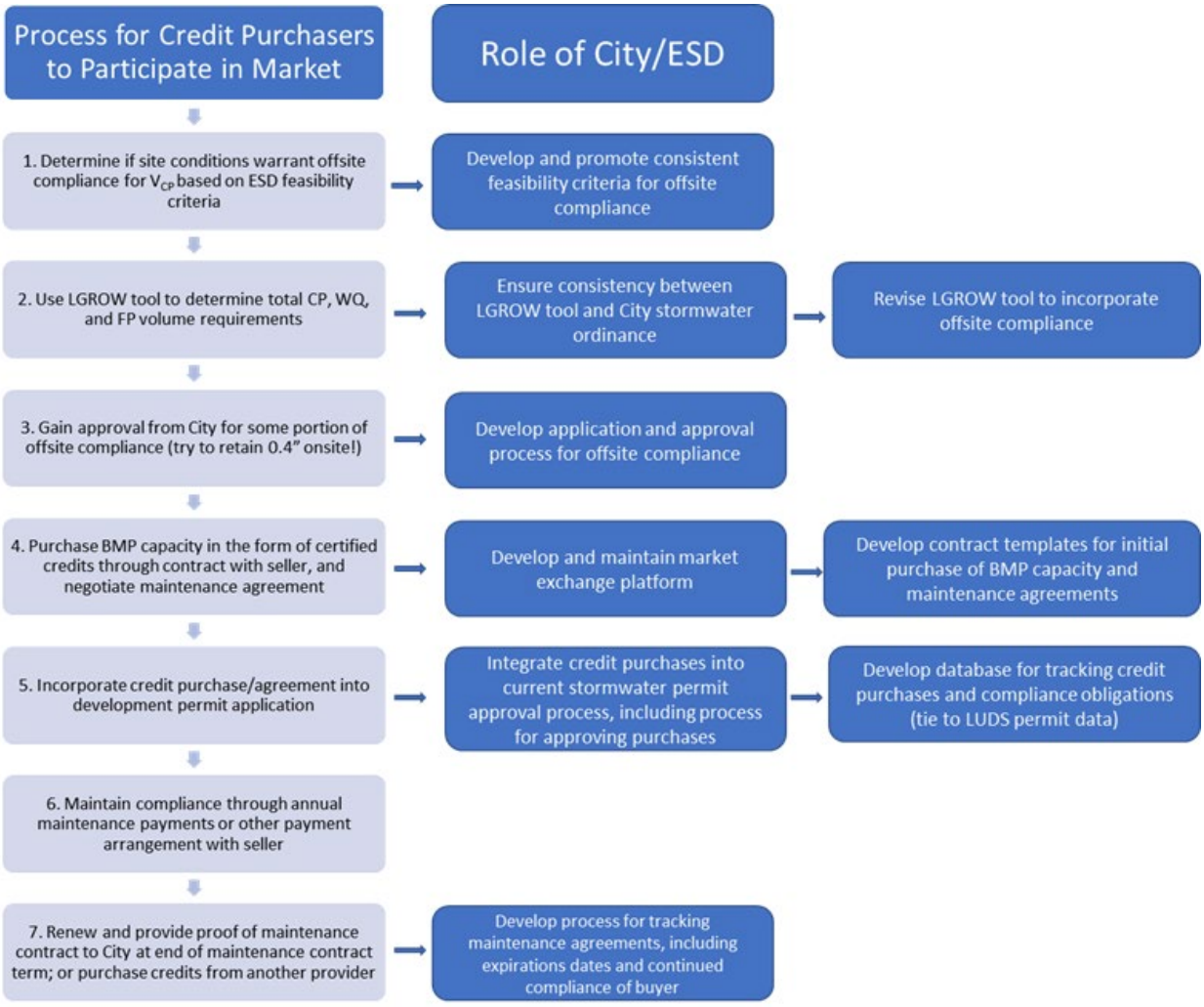
The following diagrams are intended to illustrate the interaction between the City and ESD and both credit purchasers and credit sellers, and to simply convey the steps we have described above. Read vertically, each step that a credit purchaser or credit seller will go through is matched by a corresponding City/ESD action. Some of these actions will need to occur in advance to set up the market's structure, while others will occur in response to applications from credit purchasers and sellers.

Figure 3: Interactions between Credit Sellers and City of Grand Rapids



*Credit generators can also list themselves as a potential credit generator and a make deal with a credit purchaser before they construct BMPs.

Figure 4: Interactions between Credit Purchasers and City of Grand Rapids



Appendix 1. Calculating an In lieu Fee

This appendix describes the purpose and calculation of the in lieu fee (ILF) for meeting channel protection requirements. The ILF will be implemented as part of the stormwater volume credit (SVC) trading market.

Purpose

An ILF program allows developers and property owners subject to stormwater management requirements to pay a fee to the City of Grand Rapids Environmental Services Department (ESD) in lieu of meeting their requirements onsite. The City's forthcoming municipal separate sanitary storm sewer (MS4) permit requires ESD to establish an ILF option for the new channel protection standards; it also stipulates that projects completed with ILF revenues must be completed within two years of receiving those revenues.

The ILF is a key component of the SVC trading market. The way the market is designed, developers subject to stormwater management standards have the option of meeting channel protection requirements by retaining the required stormwater volume on site, paying the ILF to ESD, purchasing SVCs, or some combination of these alternatives. The ILF is intended to serve as a price ceiling for SVCs because it is typically more expensive for ESD to implement GI within the public realm than it is for private property owners to install stormwater management BMPs on their properties. Thus, ESD would have to charge a higher price to developers (via the ILF) than a private credit-seller selling SVCs on the market.

Having the ILF as a price ceiling for SVCs provides certainty to potential SVC buyers that credit-sellers will not unreasonably increase SVC prices; it also ensures developers that there will always be an offsite compliance option (e.g., if there are not enough SVCs for sale through the market). In addition, if the market is functioning correctly, very few developers will pay the ILF because purchasing SVCs will always be a cheaper option. This reduces the number of projects that ESD must build with ILF revenues.

For the credit trading market, we have proposed a one-time upfront payment to cover initial capital costs associated with implementation of a stormwater retention BMP for the expected useful life of the project with a minimum of 20 years, as well as an ongoing maintenance fee to cover the expected useful life of the BMP. After 20 years, the payer can confirm that it still needs offsite compliance through the ILF program and pay for another 20 years of up-front capital plus ongoing maintenance, or switch to another form of offsite compliance (such as purchasing SVCs in the market to cover the next 20 years (minimum) of compliance obligation).

Calculation of In Lieu Fee for Grand Rapids

The value of the ILF is based on the average cost to ESD of installing GI-based best management practices (BMPs) that meet the stormwater management requirements for new and redevelopment sites. The project team calculated the ILF on a dollar per cu. ft. of BMP capacity basis, consistent with how the price of an SVC will be calculated and sold through the SVC trading market (see Appendix 2).

To calculate the ILF, we reviewed data provided by ESD for construction of stormwater BMPs. This included information from ESD's database of stormwater management projects, which provided us with information on the number of BMPs installed by the City, as well as BMP area, capacity, and costs (for some BMPs). We also reviewed data from the City's annual MS4 compliance reports to obtain additional

information on BMP costs. Table 1 shows the initial data we obtained from the City's data sources for public stormwater projects.

Table 1. Summary of data from City's stormwater BMP database and MS4 annual reports				
BMP type	**# of practices**	**Average BMP area (sq. ft.)**	**Average BMP capacity (cu. ft.)**	**Cost per cu. ft. of capacity**
Street Trees	911	N/A	8	$66.12
Bioswales	19	973	226	N/A
Infiltration basin	66	N/A	N/A	$5,364 (per basin)
Permeable pavement	129	1,900	168	$81.08
Rain garden	65	400	326	N/A

The ESD database did not contain capacity or area estimates for infiltration basins. However, we were able to estimate the average cost per basin using data from the City's annual MS4 compliance reports. Based on the average cost, we estimated the average area for infiltration basins using the BMP cost curves that EPA developed for its' Stormwater Calculator.[4] We then used WMEAC's RainWater Rewards calculator[5] to estimate the BMP capacity associated with the average area.

To estimate the capital cost per cu. ft. of stormwater runoff capacity, we used data from Grand Rapids ESD, where available. For those BMPs where cost data was not available, we relied on the EPA cost curves referenced above. For those BMPs, we took the average cost per cu. ft. from EPA's "typical" and "complex" cost curves. Next, we accounted for additional cost factors, as follows:

- Design costs (assumed to be 10% of capital costs)
- Construction management costs (assumed to be 20% of capital costs)
- ESD program management costs for one BMP lifecycle (assumed to be 10% of capital costs)
- Value of land committed BMP installation ($14.81 per sq. ft., based on the average value of commercial property within Grand Rapids, converted to $ per cu. ft. based on cu. ft. retained per area ratio)[6]

As shown in Table 2, we calculated total costs per cu. ft. for each BMP type. We then calculated a weighted average BMP cost based on the total retention capacity that the City has installed for each BMP type. Table 2 shows the in lieu fee calculation (based on $ per cu. ft. of capacity), assuming a one-time upfront

[4] Available at https://swcweb.epa.gov/stormwatercalculator/

[5] Available at http://rainwaterrewards.com/

[6] This information was obtained from the City of Grand Rapids Assessor's database

payment for the ILF for capital costs only. Assuming maintenance costs are 5% of capital costs (construction only), the weighted average annual ILF maintenance payments amount to $1.42 per cu. ft. of capacity per year. ESD will likely need to apply the methodology described herein to adjust the ILF and maintenance payment each year, as data becomes more available, and to adjust for inflation. The 20-year maintenance cost is calculated to be $39.35/cu. ft. (using a 3.38% discount rate, based on the 80-year average inflation rate from the Consumer Price Index) This would be the maintenance cost to pay if it is all paid up-front.

Based on the mix of BMP types proposed here for calculating the in lieu fee, we suggest that the City should assume that the expected useful life of BMPs to be installed under the ILF program is 20 years.

Table 2. In lieu fee calculation ($/cu. ft. of capacity), one-time upfront capital payment

	Street Trees	**Bioswales**	**Infiltration Basin**	**Permeable Pavement**	**Rain Garden**
Capital cost for one BMP life cycle ($/cu. ft.)	$66.12	$46.34	$9.76	$81.06	$26.25
Design costs	$6.61	$4.63	$0.98	$8.11	$2.63
Construction management for one BMP lifecycle	$13.22	$9.27	$1.95	$16.21	$5.25
ESD program management costs for one BMP lifecycle	$6.61	$4.63	$0.98	$8.11	$2.63
Value of land committed to BMP installation (SF/cu. ft.)	$162.92	$63.89	$14.11	$0.00	$18.06
Total of above costs	$255.48	$128.76	$27.77	$113.49	$54.81
Total cu. ft. retained by the BMPs	7,287	4,284	79,145	21,637	21,202
Weighted average BMP capital cost per cu. ft.	**$61.62**				

Appendix 2. Projected Initial SVC Price Estimate

This appendix describes the SVC price payment structure and provides a methodology and template to help credit generators calculate the price of SVCs offered for sale.

SVC Price Payment Structure

As described in the detailed program design manual, we have proposed that SVC sellers separate the calculation of SVC prices for the capital cost of the credit-generating BMP from the fee charged for ongoing maintenance of the BMP. This allows for flexibility between the buyer and seller regarding payment arrangements. For example, in most cases, we envision that the buyer will buy SVCs that cover for the capital costs associated with credit-generating projects plus a reasonable return on investment. The SVC will be formulated as an upfront, one-time payment (which could be factored into the financing of their development). However, the seller and buyer may negotiate a schedule by which the buyer pays for capital costs over an agreed upon time period (e.g., over 5-years), if desired. In this case, the seller would likely charge additional interest, and/or expect a higher return on investment to reflect lost opportunity cost. In either case, the cost of capital SVCs is calculated on a dollar per cu. ft. basis.

To ensure continued maintenance over time, the buyer also needs to pay for maintenance of the BMP capacity over the expected useful lifetime of the BMP, for a minimum of 20 years. The seller and buyer will agree, with ESD approval, on the expected useful life of the BMP and thus the term of the maintenance payment agreement between buyer and seller. The buyer and seller can agree to the frequency of payment during the length of the maintenance payment agreement - payments could be made annually, every 5 or 10 years, or all up front. So, for example, an SVC buyer may commit to 20-years of maintenance payments for a rain garden that had a capacity to retain 1,000 cu. ft. We estimate that the cost of maintenance for credit-generating projects will amount to approximately $1.12 per cu. ft. of BMP capacity per year. Purchasing 20-years of SVCs would therefore cost $22,400, not including inflation ($1.12 per cu. ft. x 1,000 cu. ft. x 20 years). The buyer has an obligation to meet their stormwater compliance obligation in perpetuity (or for as long as they own the property), so after the 20-year time period, the buyer and seller would need to renew their maintenance payment agreement when they agree on the capital payment to recapitalize the BMP for another 20-year expected lifetime Alternately, the buyer could find another stormwater SVC seller through which to meet the buyer's stormwater obligation, or pursue an ILF contract with the City. We recommend that the City set a minimum time period for maintenance agreements between a buyer and a seller of at least 20 years.

Calculation of SVC Price

In this section, we provide a methodology and assumptions for calculating the SVC price associated with credit-generating green-infrastructure (GI) BMPs that meet the stormwater management requirements for new and redevelopment sites. To calculate the price of SVCs, we made several assumptions and calculations that can easily be changed or re-calculated based on site conditions and the nature of the credit-generating projects. Our methodology is outlined below and demonstrated in Table 1:

- First, we estimated the capital costs associated with credit-generating projects based on the average cost per cubic feet of retention estimated using cost curves developed by the U.S. EPA for the EPA Stormwater Calculator. The cost curves reflect costs for bioswales, infiltration basins,

and rain gardens (they do not include costs for green roofs or trees). These costs amount to approximately $ 22.44per cu. ft. of retention.

- Next, we estimated the value of the land that would be dedicated to credit-generating projects, and converted this value to a cost per cubic foot of retention. We calculated land cost per gallon based on an assumed BMP capacity of approximately 1.5 cubic feet of retention per square foot of land area and an average land price of $8.41/ft2. The average land value was obtained from Kent County's assessor's data and reflects the average across all land use types.
- We assumed that annual maintenance costs amount to approximately 5% of total capital costs; we also assumed a rate of inflation for maintenance of 3.38%. The inflation rate reflects the 80-year average through 2010 of the urban consumer price index.
- We estimated SVC prices and maintenance costs using three different return on investment (ROI) scenarios. We used a 5% ROI as relatively low rate of return; 7.16% is the inflation-adjusted, compound annual growth rate for the S&P 500 from 1920-2010, which is used as a more moderate ROI. As the highest ROI, we used 12.72% - the three-year average return on the S&P 500 between 2016 and 2018.

Table 1 shows the methodology and estimate for SVC prices (i.e., for capital), based on the assumptions above. As shown, these assumptions yield an estimated credit/capital price ranging from $29.65 to $31.80 per cu. ft. of BMP capacity, depending on the level of ROI. As shown in Table 2, at 5% of capital, annual maintenance costs amount to approximately $1.12/cu. ft. in 2019 USD. However, depending on the structure of the buyer/seller maintenance agreement, the seller may need to adjust this price to account for inflation over the life of the maintenance agreement and the number of years for which the buyer is paying for maintenance at once. For example, if the buyer is paying annually for maintenance, the seller will need to increase the price each year by the inflation rate. The seller may also choose to add in a ROI for maintenance costs. Table 2 shows the present value cost for maintenance that a seller would charge to cover upfront 20-years of maintenance.

Table 1. SVC price calculation example.

				Cost-Covering SRC Price		
SVC price	**Capital cost per cu.ft. of retention[1]**	**Land cost per cu.ft.[2]**	**Sum of Costs (cap. cost + land value)**	**5% ROI[3]**	**7.16% ROI[3]**	**12.61% ROI[3]**
Capital SVC cost	$22.44	$5.80	$28.24	$29.65	$30.26	$31.80

1. Based on average cost per cu. ft. of retention from EPA simple and complex cost curves for bioswales, infiltration basins, and rain gardens. Does not include green roofs or trees.
2. Based on average capture of 6.99 gal/ft2 of land at $8.41/sq. ft. land value, which is the average across all property types and watersheds in GR (not weighted).
3. 5% Return on Investment (ROI) is used as relatively low rate of return. 7.16% is the inflation-adjusted, compound annual growth rate for the S&P 500 from 1920-2010, which is used as a more moderate ROI. 12.72% is the three-year average return on the S&P 500, 2016 - 2018.

Table 2. PV Maintenance cost over 20-year maintenance period

	Maint. costs per year per cu.ft.		**20-year maintenance Cost[1]**	**5% ROI[2]**	**7.16% ROI[2]**	**12.61% ROI[2]**
20-years of maintenance	$1.12		$31.34	$32.91	$33.59	$35.30

1. Based on annual maintenance cost equal to 5% of capital cost, calculated as a future value over the payback period with inflation rate of 3.38% based on the 80-year average increase through 2010 of the urban CPI.
2. 5% Return on Investment (ROI) is used as relatively low rate of return. 7.16% is the inflation-adjusted, compound annual growth rate for the S&P 500 from 1920-2010, which is used as a more moderate ROI. 12.72% is the three-year average return on the S&P 500, 2016 - 2018.

Appendix 3: Illustrative Case Studies Based on Past Real Estate Development Projects

The following two examples illustrate likely scenarios that real estate project developers would face in deciding whether, and how, to pursue an off-site option for complying with the forthcoming stormwater regulations. For each scenario, we modeled the costs associated with three scenario options for compliance: meeting the first 0.4" runoff volume on-site (a green roof was the only feasible BMP for attaining this volume in both case studies) and purchasing SVCs for the remaining volume at 1.5:1 ratio; meeting all volume retention requirements off-site by purchasing SVCs for the entire channel protection volume at 2:1 ratio; and paying the City the appropriate in lieu fee.

Case Study #1: 414 Benson Ave NE Grand Rapids

Before redevelopment, the site was composed of urban residential housing with some green space. The site was part of a larger (two site) development. Post development the site consists of a large multi-use residential building with 287 (market rate) units for a total project investment of $53 million. Post-redevelopment, the site is 2.82 acres (122,839 sq. ft.) and the project added .87 acres (37,897 sq. ft.) of impervious surface. New stormwater permit management requirements would be: 3,688 cu. ft. CPv, 6,731 cu. ft. WQv and 34,778 cu. ft. FPv.

Option 1: Meet the minimum on-site requirement of 0.4" and purchase SVCs to cover the remaining channel protection volume at the 1.5:1 ratio

GI option	**Volume**	**Size of practice**	**Cost of practice**
Green Roof	576 cu. ft.	5,238 sq. ft.	$40,509
Credit Ratio	**SVC Purchase**	**SVC Price**	**Total Price**
1.5:1	4,668 cu. ft.	$30.57/cu. ft.	$142,800 (SVCs)
Ongoing Annual Maintenance:		$1.12 per SVC	$5,237+ annual inflation
Total Net Present Value (NPV) (SVCs + onsite capital/maintenance)			**$351,521**

Option 2: Purchase SVCs for entire retention requirement at 2:1 credit ratio

Credit Ratio	**SVC Purchase**	**SVC Price**	**Total Price**
2:1	7,376 cu. ft.	$30.57/cu. ft.	$225,650

Ongoing Annual Maintenance:		$1.12 per SVC	$8,275 + annual inflation
Net Present Value (NPV)			**$417,341**

Option 3: In lieu fee payment to ESD

The developer also has the option of choosing not to implement GI or purchase SVCs but instead pay the City an in lieu fee to meet channel protection requirements. The in lieu fee SVC price includes an annual maintenance fee.

In Lieu Fee Option	**Volume Required**	**In Lieu Fee Price**	**Total Price**
2:1	7,376 cu. ft.	$61.61/cu. ft.	$454,440
Ongoing Annual Maintenance:		$1.41 per SVC	$10,500 + annual inflation
Net Present Value (NPV)			**$697,423**

Case Study #2: 538 Fairview Ave NE Grand Rapids

Before redevelopment, the site was composed of urban residential housing with some green space. Post development the site consists of a multi-family residential building with 10 (market rate) units for a total project investment of $3.4million. The site is .34 acres (14,810.40 sq. ft.) and the project added .17 acres (7,405 sq. ft.) of impervious surface. New stormwater permit management requirements would be: 721 cu. ft. WQv, 977 cu. ft. CPv and 3,049 cu. ft. FPv.

The soils on this site are infeasible and therefore the options are similar to the previous case study, except in this example, a green roof can infiltrate a larger portion of the required volume, reducing the need to purchase SVCs.

Option 1: Implement green roof onsite to capture more than 0.4" (about 46% of CPV) and purchase the remaining channel protection volume as SVCs offsite at the 1.5:1 ratio

GI option	**Volume**	**Size of practice**	**Cost of practice**
Green Roof	328 cu. ft.	1,250 sq. ft	$31,950
Credit Ratio	**# SVCs Purchased**	**SVC Price**	**Total**

1.5:1	589 cu. ft.	$30.57/cu. ft.	$18,000 (SVCs)
Ongoing Annual Maintenance:		$1.12 per SVC	$660 + annual inflation
Net Present Value (NPV) over 30 years			**$102,275**

Option 2: Purchase SVCs for retention offsite only at the 2:1 credit ratio

Credit Ratio	**SVC Purchase**	**SVC Price**	**Total Price**
2:1	1,442 cu. ft.	$30.57/cu. ft.	$44,080
Ongoing Annual Maintenance:		$1.12 per SVC	$1,615 + annual inflation
NPV over 30 years			**$75,316**

Option 3: In lieu fee payment to ESD

In Lieu Fee Option	**Volume Required**	**In Lieu Fee Price**	**Total Price**
2:1	1,442 cu. ft.	$61.61/cu. ft.	$88,842
Ongoing Annual Maintenance:		$1.42 per SVC	$2,050 + annual inflation
NPV over 30 years			**$135,900**