StormStore: A feasibility study examining stormwater credit trading in Cook County

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Executive Summary

Exploring the Feasibility of Stormwater Credit Trading in Cook County

Across America, many communities face the adverse effects of stormwater management systems that cannot handle storm volumes. In the Chicago region, modest rain and snow melt can overwhelm sewer systems, causing street flooding and basement back-ups. These effects are disproportionately experienced in low-income or minority neighborhoods. There are also water quality consequences. The excessive stormwater volumes cause combined sewer overflows—mixtures of stormwater and sewage with high levels of pollutants releasing to rivers and Lake Michigan. Even in areas with separate storm and sanitary sewers the stormwater carries pollution into the Chicago Area Waterways System and negatively affects water quality and habitat. People, aquatic life and industry from Lake Michigan to the Mississippi are all impacted. This problem is expected to worsen as climate change progresses and storms grow larger and more frequent.

The Metropolitan Planning Council (MPC) and The Nature Conservancy (TNC)—working closely with the Metropolitan Water Reclamation District of Greater Chicago (MWRD) as a key project partner—evaluated the viability of a stormwater credit trading market in Cook County as an additional approach to stormwater management that challenges the notion that government will solve all stormwater problems through centrally managed, hard infrastructure.

Stormwater credit trading is an innovative approach to provide flexibility in meeting stormwater requirements while simultaneously bolstering detention capacity and/or decentralized green infrastructure (volume control) in optimal locations for maximum benefit. In this system, landowners or collaborating third parties install detention capacity or volume control at *supply sites*, receive certification for stormwater detention or volume control value, and sell the bonus capacity as credits to developers on *demand sites* proven eligible to go "offsite" with their stormwater controls, buying credits from another location. We refer to the potential marketplace or online exchange where credits are bought and sold as "StormStore."

The main objective of StormStore is to provide controls in priority areas and thereby mitigate urban flooding *without* creating adverse impacts near development sites. By harnessing market forces, StormStore can potentially facilitate development at infill or transit-oriented development sites and at the same time incentivize green and grey stormwater infrastructure at suitable sites—with the potential to serve communities most vulnerable to the effects of urban flooding and other climate impacts. At its core, StormStore encourages the use of natural stormwater infrastructure for detention and volume control measures where it will have the greatest environmental benefit. Rather than simply placing new stormwater infrastructure where real estate development is occurring, it enables the intentional siting of equivalent infrastructure in an area where its impact is maximized.

In addition to managing stormwater, these investments provide other climate-related and environmental benefits including water filtration, reducing pollutants flowing into our rivers and streams, carbon sequestration, air pollution reduction, lessening urban heat island effects and supporting biodiversity. Therefore, we believe that StormStore has the potential to build regional resiliency to a changing climate which will include more frequent and intense storms, heat waves and severe drought.

StormStore operates under the premise that detention features and volume control practices—currently required to be built into the layout and design of real estate development sites by the Cook County Watershed Management Ordinance (WMO)—can be challenging in certain circumstances for a developer to meet onsite (e.g. soil conditions or space constraints). Required detention volume is the amount of water that must be held on a site and discharged at or below the release rate specified in the WMO to prevent flooding. Current required volume control storage is the total amount of water generated by one inch of rainfall over the impervious areas of a site which must be managed using green infrastructure practices (e.g. permeable pavement or bioretention).

By providing a cost-effective and transaction-friendly alternative whereby stormwater detention and/or volume control credits are purchased from offsite locations, developers have an incentive to proceed with a project they might otherwise have dismissed. In turn, these developments can serve as economic and community opportunities while also contributing to urban flooding mitigation. .

MPC and TNC believe that StormStore can be a unique stormwater management strategy that addresses a range of urban environmental and social challenges, including:

- Expanding the use of natural infrastructure for reducing stormwater impacts where it will have the most benefit, while providing beautiful green space, recreational opportunities and natural habitat
- Incentivizing infill development, or construction on undeveloped land within already developed areas, and increase development density where it has wider benefits, such as adjacent to mass transit lines
- Improving the use and ecosystem services of underutilized or open land which is common in many flood-prone areas in Chicago and some suburbs that have undergone disinvestment
- Bringing investment dollars to stormwater controls including in underinvested neighborhoods which can ease fiscal pressures on local budgets for stormwater management while also generating jobs

Positive Findings and Steps Forward

This report summarizes the three components to the feasibility study analysis conducted between November 2016 and August 2017 to determine 1) the potential demand, 2) the potential supply and 3) critical policy levers to consider for establishing a successful stormwater credit trading market in Cook County for both detention and volume control. Separate reports were prepared for each component.

The results of this analysis confirm enough potential demand and potential supply across the six watersheds of Cook County (excluding the City of Chicago) exist to merit advancing the next phase of work to further analyze and determine how StormStore could function as a viable stormwater credit trading system.

Is there enough demand?

Summary of suburban Cook County real estate demand analysis

The real estate analysis was driven by this central question: to what extent would real estate developments in suburban Cook County benefit from a program allowing management of a portion of the stormwater detention or volume control required under MWRD's WMO to take place offsite? **The analysis found sufficient overall demand for an offsite option in all watersheds in suburban Cook County and significant economic benefits at the individual project level.**

Methods: The team developed a model to examine how fiscal and physical footprints of stormwater affect real estate development and how that calculus changes if some portion of the required stormwater volume can be managed offsite. Arriving at findings involved a look at the different kinds of development and redevelopment taking place in Cook County between 2006-2016, the market values involved, and the costs of stormwater management for different site plan types as well as types of stormwater facilities that may be used for detention and volume control.

The database that underpins the real estate analysis model was assembled by combining MWRD permit information with real estate, engineering, and construction cost information from a variety of sources. A core component was the data provided by MWRD of stormwater discharge permits issued under its Stormwater Protection Ordinance (2006 to 2013) and the WMO (2014 to 2016) for jurisdictional development and redevelopment in Cook County[1]. Key data used in the model calculations included watershed location, site area, total and created/new impervious area, detention type and volume (where detention was required), and green infrastructure volume and type for WMO permit.

Additionally, the model differentiates results for permitted projects on sites under ten acres in size, which may use offsite compliance under the current WMO, and sites ten acres and larger, which would only be eligible to participate if the WMO language were amended. Site size eligibility thus represents one of the first and most significant policy levers for potential demand explored in this study.

Model Calculation Assumption: The real estate demand analysis makes the following fundamental assumption to test whether it would be financially viable for a developer to explore an offsite scenario:

If an offsite stormwater program gives developers the opportunity to utilize site surface area for development (whether buildings or supporting land cover such as parking, landscaping, outdoor areas, etc.) rather than for stormwater management, developers will build more square footage or units on a site, up to a maximum assumed floor area ratio for the development type and land use setting.

To arrive at a decision whether the project would benefit from offsite compliance and what the net benefit would be, a series of calculations were made, including:

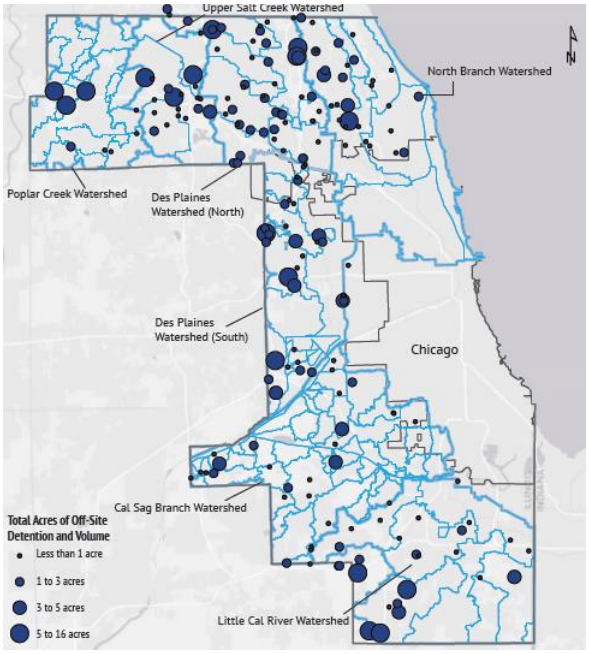
- Detention and volume control storage volumes, construction costs and onsite land area requirements
- Construction cost and land required to construct equivalent offsite stormwater treatment systems
- Real estate value created using additional land surface area
- Net benefit calculated as the additional profit/intrinsic value less the cost to construct or otherwise participate in an offsite program (i.e. construct a treatment system, complete a third-party transaction, or pay a fee-in-lieu), also taking into account a 7.5% transaction cost to participate in the offsite program
- An assumption was made that a transaction would only occur if there was a substantive net benefit (in this model, at least USD$20,000).

[1] The City of Chicago is not subject to either ordinance, and as such has not been included in this feasibility study evaluation. The StormStore team aspires to conduct a similar analysis separately examining the City of Chicago.

Overall Demand Findings: The model analysis indicates that **roughly 17% of all projects permitted between 2006 and 2016 on sites under ten acres (132 of 764) could have used an offsite option to realize a net economic benefit of at least $20,000.** If all sites including those over ten acres were able to make use of an offsite option, approximately **21% of all projects (197 of 928)** would meet the benefit threshold.

Offsite Capacity Demand: Providing offsite stormwater control measures for all the projects under ten acres for which offsite participation might be desirable would require just over 79 acres of surface area devoted to stormwater detention and volume control. Adding the offsite capacity that could be desired for larger sites would require another 267 acres of land surface area for offsite, bringing the **total demand for offsite participation to 347 acres.**

Geographic Distribution: Potential demand for offsite capacity was spread across the six watersheds in Cook County. The Lower Des Plaines North sub-watershed, which encompasses the high-demand, high-value area around O'Hare International Airport, had the most projects that would have benefitted and the greatest average financial benefit per project).



Detention offsite and volume control offsite for all permits.

Courtesy: Orion Planning + Design

Land Use Distribution: Retail projects of all sizes were most likely to benefit from offsite, followed by municipal projects (including schools), hospitals and institutional uses. A variety of housing and office projects also met the offsite compliance benefit threshold, with larger single-family subdivisions showing a particularly strong demand.

Potential for Infill and TOD: The largest number of projects with a potential benefit—132 of 197 or 67%—were for projects on sites under ten acres, highlighting the potential importance of offsite compliance to infill and redevelopment sites, although the full dataset of projects over ten acres would have much greater demand for offsite land.

Economic Benefit of Offsite: The economic benefit in the model is measured by the additional development profit or value gained by freeing up land for development, less the assumed cost of the

offsite stormwater treatment system and less a transaction cost for using offsite compliance. **The total economic benefit for all the 197 projects** that exceeded the $20,000 threshold was estimated in the model to be **$47,407,095, with an average economic benefit per project of $240,645.**

Is there enough supply?

Summary from suburban Cook County land and hydrologic analysis

The primary objective of the land and hydrologic analysis component of the feasibility study was to identify and quantify opportunity areas with favorable characteristics for stormwater detention or volume control and to determine the geographic distribution of opportunity areas. **The analysis found adequate surface area of potential sites to meet the potential demand modeled in all watersheds in suburban Cook County**.

Methods: The analyses were performed on a geospatial platform, building on Geographic Information System (GIS) tools in which the physical and functional attributes of land were evaluated for their potential for stormwater detention or volume control. The analyses used to identify opportunity areas are based on existing and available geospatial data, which determines the precision of the results. Desirable characteristics differ for detention and volume control facilities; thus, two sets of data compilations were prepared, one showing opportunity areas for detention and one for volume control. The offsite supply areas were identified based on an inventory and analysis of locational and functional potential of areas for providing stormwater management controls (detention or volume control).

The suitability of any location for stormwater detention or volume control facilities depends on numerous physical, hydrologic, ecological and anthropogenic factors. The general physical, functional and typological categories analyzed included land use, environmental conditions and special conditions, such as potential contamination and historic building sites.

From a preliminary evaluation of the suitability of these layers, the team quantified (by sub-watershed and by municipality) the acreage of land area that has characteristics indicating it is an opportunity for stormwater management. A review of the spatial distribution of these characteristics indicated the potential for detention and/or volume control facilities that meet multiple objectives.

Data Sets Reviewed: The following eleven datasets were reviewed for this analysis:

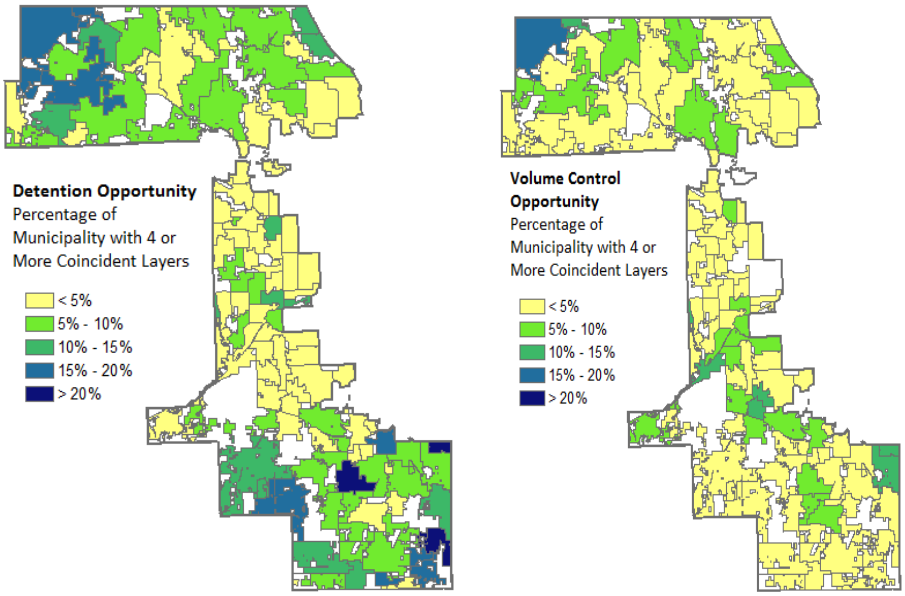
- Topographical Wetness Index
- Chicago Wilderness Green Infrastructure Vision
- Public and Private Conservation Areas
- Floodplains
- Flooding Claims
- Road Right-of-Way
- Soil Survey Data
- Stack-Unit Map, showing the distribution of geologic materials to a depth of 15 meters
- Greenways and Trail Plans
- Land Use Inventory (CMAP)
- Problem Areas (MWRD) to identify stormwater related problems in a watershed

The detention opportunity layer was created by combining 11 prepared GIS layers together. These layers are open lands, land use, road right of ways, flood claims, flood areas, greenways, MWRD problem areas, green infrastructure vision, wet areas, poorly drained soils and poorly drained geology.

The volume control opportunity layer was similarly created by combining these same 11 layers except that instead of poorly drained soils and geology, well drained soils and well drained geology were used.

Assumptions: Site development that uses offsite stormwater detention or volume control will meet the basic precepts of the WMO. Offsite storage upstream of the development site could reduce peak flows upstream, providing additional benefits to the area. Likewise, offsite volume control holds great promise in spurring the creation of the natural, multifunctional sites that enhance the study area and provide ecological and economic benefits.

Overall Supply Findings: The general finding is that **ample land has the potential for stormwater supply throughout the six watersheds in Cook County**, since many land types and land conditions exist that can be retrofitted to provide stormwater management. Based on the analysis, the total supply potential for detention was 197,572 acre-feet and 101,056 acre-feet for volume control. Within this feasible land, however, there are certainly more optimal configurations of land to manage this supply, depending on the environmental and economic issues of a given municipality and of the market drivers that will lead to decision-making about where and how to invest and retrofit.



Opportunity layers color coded by the occurrence of coincident layers by municipality. Courtesy: MWRD

What are the policy considerations for a viable market?

Summary of policy analysis

Concurrent to the demand and supply analyses, MPC and TNC conducted a preliminary policy analysis to identify important aspects of successful credit trading programs, best practices and potential key features of an effective StormStore policy framework for further exploration. The team carried out this analysis by examining the current WMO requirements and proposed changes, as well as reviewing stormwater ordinances and program documentation from other areas including DuPage County, IL; Kane County, IL; Lake County, IL; City of Chicago; Chattanooga, TN; Washington, D.C.; and Detroit, MI. The team also examined features of the stormwater credit trading programs currently operating in

Washington, D.C. and Chattanooga, TN, and lessons learned from wetland mitigation banking and carbon trading.

The policy evaluation team identified a number of key considerations relevant to the establishment of a stormwater credits system in suburban Cook County. These are:

- Criteria for under what circumstances offsite controls would be allowed
    - assuring *no adverse impacts* near/downstream of the development site resulting from offsite stormwater controls—this is a requirement in the WMO and would be a core tenet of StormStore's framework
    - volume managed on the supply site will need to be equal to or exceed the required amount for both the supply and development site
- Criteria for credit sites
    - how a site earns/is awarded credits, and how credits are renewed or re-confirmed over time
- Spatial proximity, e.g. relative locations of credit buyers and credit sellers
- Timing considerations
    - initiation of operations at the development and credit site
    - timing of decision to use credits; timing of when supply credits are available
    - duration of credits
    - maintenance of credit sites over time
- The role of municipalities in a credits market
- How to spark creation of credit sites to establish the market
- Equity considerations, e.g. how costs and benefits of the market are to be distributed

The Policy Analysis Executive Summary explains these considerations that will be further investigated and tested in the next phase of work.

Summary and Next Steps

Through this feasibility study, the StormStore project team has determined that there is sufficient potential demand, potential supply and potential policy frameworks that merit proceeding with a further investigation of the concepts, policies, details and steps needed for successfully establishing a stormwater credit trading market for Cook County. The project team has identified the following components to begin working toward as part of StormStore Phase II:

- Conduct further stakeholder outreach and investigate market-enabling policy development
- Execute collaborative workshops to explore and understand market structure, administrative and regulatory options, online platform development, trading rules and regulations
- Model investment potential via pro forma finance models for StormStore in Cook County
- Pilot stormwater credit trades in Cook County to further refine market structure and other considerations
- Feasibility study of the demand and supply within the City of Chicago for participating in StormStore

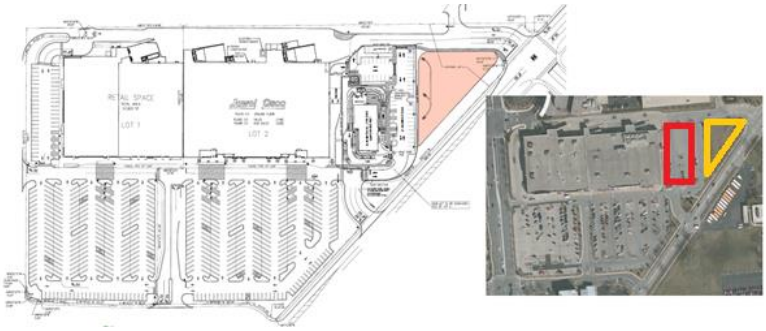
Appendix – Hypothetical Trading Scenario

Potential Demand-Side Participant

Redevelopment Project: Additional retail in existing shopping center

This represents a redevelopment project proposed and permitted in the past. The existing site was a shopping center with stores and a large parking area—predominantly impervious surfaces. There is an existing detention pond in the northeast corner of the site (yellow triangle). The proposed redevelopment would convert some of the parking area to a new retail opportunity (red box). The WMO detention requirements would apply because of the area to be disturbed.

The opportunity: The existing detention pond cannot be enlarged; how do they manage the stormwater runoff and comply with the WMO? If the developer had StormStore available they could go offsite and purchase stormwater credits. Offsite compliance would make the redevelopment project more feasible. The new retail would provide jobs and increase the local tax base. Even with the stormwater controls offsite, there would be no net increase of runoff into the local storm sewer system, meeting the *no adverse impact* requirement applicable to trades.



Potential Supply-Side Participant

Near the redevelopment site there is a ½ acre vacant parcel owned by a land bank. There is no demand for the reuse of this parcel due to its location. The parcel is an eye sore to the community and offers very little stormwater storage or other environmental benefits.

The opportunity: The existing site can be retrofitted with a detention basin with trees and vegetation, possibly native planting to support butterfly habitat. The owner can then sell the stormwater storage capacity into the market. The initial installation becomes the main cost, assuming there is no land acquisition cost to the land bank who already owns the land. This is additionally an opportunity to turn a vacant lot into generating revenue for the land bank while becoming a park-like amenity for the community that also provides other environmental co-benefits to address biodiversity and urban heat island effect. The supply site can be retrofitted to provide the required detention amount at a cost significantly lower than an underground stormwater vault at the shopping center.