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Policy Recommendations for Passive Parks as a Sustainable Solution to Urban Stormwater Management in Ontario: Lessons from the Hamilton Conservation Authority's East Escarpment Wetland Restoration Project

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Abstract:

This paper aims to analyze policy conditions that permit implementation of large scale sustainable stormwater management systems in Southern Ontario. A case for urban stormwater management solutions through land conservation and passive parks is developed by analyzing the Hamilton Conservation Authority's East Escarpment Wetland Restoration Project in Stoney Creek Ontario. Internal Conservation Authority processes, existing municipal and provincial policy conditions collectively contributed to successful project implementation. A comparison is made between other stormwater and wetland restoration projects in North America to validate the uniqueness of the Hamilton Conservation Authority's approach. Based on the existing conditions in Hamilton, recommendations to Provincial and Municipal policy makers are presented. These recommendations propose new and amended policy that would support establishment of large scale passive parks as a sustainable solution to urban stormwater management across Ontario.

Introduction:

Canadian cities historically have not been known to experience significant flood risk, but with the anthropogenic alteration of the earth's climate systems, weather events are increasing in frequency and intensity. These events result in devastating effects to urban landscapes, often causing major disturbances to economic systems, human health and the natural environment. In 2013, the City of Calgary experienced one of the worst flood events in this nation's history when the High River overwhelmed the downtown core with an estimated $6 billion dollars in combined remediation costs. A month, later the City of Toronto experienced the most expensive natural disaster in Ontario history when high rainfall caused nearly $950 million in damages (Mann & Wolfe 2016).

The composition of urban landscapes is not conducive high rainfall. Surfaces such as roads, parking lots and sidewalks accumulate dangerous contaminants including salt, heavy metals, silt and other solid wastes. Traditional stormwater management (SWM) diverts water and contaminants into streams, rivers and lakes when capacity of the

system is strained. High cost and adverse effects to wildlife and human health are forcing integration of innovative methods for managing urban landscapes stormwater.

The Hamilton Conservation Authority (HCA) of Hamilton Ontario is establishing a new conservation area in Stoney Creek with the core purpose of SWM on a large scale. This paper aims to provide an overview of the innovative approach of the East Escarpment Conservation Area, validate its unique approach among SWM initiatives, present—policy conditions which made implementation possible and advance recommendations to Ontario policymakers to better support subwatershed level SWM projects.

Causes Urban Floods:

Flooding in urban areas results from the combination of a number key factors**:** (1) intense storm events as a result of climate change, (2) urban sprawl creates conditions within cities that are incapable of handling precipitation volume increases, (3) the age of municipal infrastructure limits its effectiveness in 2017. Much of todays urban infrastructure is reflective of impermeable surfaces that restrict natural infiltration of water. Water is managed at designated points, meaning it must sheet across gradients to municipal infrastructure. Stormwater infrastructure in the Ontario context is engineered to accommodate a 100-year storm threshold (ICLR, 2000), where such a threshold implies that systems are designed with Hurricane Hazel as a guide. The October 1954 tropical rainstorm released 280mm of precipitation in a 48-hour period causing 81 deaths (ICLR, 2000). This was the highest recorded rainfall in Ontario history and with the increased frequency of tropical storms, the probability of occurrence at shorter intervals is increased (ICLR, 2000). The presence of combined sewers systems in Ontario will likely hinder its ability to effectively manage stormwater. A combined sewer is SWM system that transports both stormwater and sewage within a single pipe (Podolsky, 2008). During storm events, rainwater fills pipes transporting human effluent beyond capacity, causing a combined sewer overflow (CSO), which is a safeguard for sewer systems (Podolsky, 2008). Instead of causing catastrophic failure at the sewage treatment plant, CSO forces untreated sewage into local water bodies. The concern lies within the variety of substances such as pathogenic bacteria, oxygen depleted substances, suspended solids and nutrient pollutants that outfall water contains. (Podolsky, 2008). This is combined with runoff from paved surfaces, which contains toxic chemicals such as lead, mercury, silver, zinc and synthetic organic chemicals creating a source of pollutants for the natural environment and human health (Podolsky, 2008). Separate sewer systems represent a typical solution to problems that plague combined sewers by diverting rainwater and municipal sewage into separate pipes, drastically reducing the risk of CSO affecting water resources. The fundamental downside is higher capital costs associated with the intensive process of replacing existing systems which require twice the resources

to construct. An alternative to re-configuring municipal SWM infrastructure would be to safeguard existing systems by integrating natural infiltration principles into SWM designs.

Addressing urban flooding through land conservation- Implementing Passive Parks:

Passive Parks Defined:

The concept of passive parks exist under many synonymous names such as passive open space, passive recreation areas, environmental parks but share a common definition: land that is set aside for recreation, stormwater management, natural resource protection, preservation of cultural and historic resources and conservation of environmentally significant features (University of Delaware, 2004). A clear distinction exists between the passive format and the traditional active park: active land refers to intensive recreational development such as outdoor sporting facilities, intensive campground and event spaces. These require significant amounts of maintenance and resources to operate (University of Delaware, 2004), in some cases, grass cutting alone can require significant annual investment. Active parks such as golf courses or soccer fields require a high degree of water usage for irrigation coupled with greenhouse gas emissions from regular maintenance equipment and active parks produce a substantial environmental impact (University of Delaware, 2004). Passive parks focus on minimizing consumptive recreational activities and cater more towards activities such as biking, walking, bird watching or canoeing. This approach requires limited infrastructure development and maintenance of lands, as well as provides significant environmental benefits as opposed to land developed for active applications.

Benefits of Passive Park Implementation on Local Communities:

Environmental:

Passive parks provide a vehicle for land conservation and preservation. They are used to protect, create or enhance environmentally significant features resulting in multiple benefits to a local community's natural landscape. Wetlands and vegetated stream buffers retain flood waters, reduce the amount of pollutants entering streams and mitigate erosion resulting in positive effects on downstream ecosystems. In this scenario, peak low and high rainfall impacts can be moderated if a landscape allows for slow release of water down watercourses over time (University of Delaware, 2004). From a SWM perspective, passive parks have the ability to retain water on a larger scale than a combination of smaller lot level controls. Infiltration from wetlands and larger ponds will also provide clean groundwater recharge for aquifers as opposed to the alternative engineered solutions which move water away from groundwater storage (University of

Delaware, 2004). Wildlife and native plant habitat also benefit significantly from passive park implementation especially within highly fragmented urban environments. Passive parks provides habitat opportunities for larger mammals which lot level stormwater controls simply cannot support (University of Delaware, 2004). The promotion of biodiversity through reestablishment or enhancement of native plant species creates opportunities for pollinators and migratory birds to thrive. The inherent ecological monoculture associated with active parks does not result in comparable air quality improvements per acre as the passive model. Wooded open spaces absorb carbon dioxide and pollutants from the atmosphere and provide shade, reducing air pollution levels and reducing the heat island phenomenon (Prasad 1987).

Social:

From a human physical and mental health perspective, recreational opportunities are extremely important in the urban environment. Obesity in both children and adults as a result of inactivity is one of the most pressing health concerns in contemporary healthcare (Chiesura, 2004). Providing the ability for hiking, fishing, and birdwatching can reduce inactivity and aid municipalities in promoting exercise (Chiesura, 2004). Studies have also shown connection with nature is an important contributor of overall sound mental health. Spending time in natural landscapes will reduce stress and improve quality of life (University of Delaware, 2004). Neighbourhood spaces promotes interaction and socializing within the citizenry, thus positively impacting the development of strong communal bonds and community character (University of Delaware, 2004).

Economic:

Wetlands and natural buffers have a very high economic value as a result of the ecosystem services they provide to municipalities. Ducks Unlimited Canada and the University of Guelph measured the economic value of phosphorus removal from a Lake Simcoe watershed and concluded that this one specific function of wetlands saves the local municipality up to $300,000 dollars annually (Greenbelt, 2011). On a larger scale, it is estimated that Southern Ontario urban wetlands provide $40 billion worth of ecosystem services in water filtration to the Province each year (Ontario, 2016). At a local neighbourhood level, Crompton (2001) suggests that a passive park can provide economic incentives to local neighbourhoods. Passive designs have the ability to raise adjacent property values by up to 20% and a heavily used active park can decrease neighbouring property values up to three blocks away by 10% as a result of parking requirements, noise and light pollution (Crompton, 2001). Wetland conservation should be considered an economically viable investment for municipalities as they are among the most valuable environmental features across local, municipal and provincial scales.

East Escarpment Wetland Restoration Project: A Passive Park for SWM

Stoney Creek and Battlefield Creek subwatershed:

From headwaters to the Lake Ontario basin, the Stoney Creek and Battlefield subwatershed encompasses an area of 2070 hectares, of this 1619 exists above the Niagara Escarpment forming the upper Stoney Creek and Battlefield Creek subwatershed (HCA, 2015). The underlying soil consists mostly of clay and bedrock, which creates low infiltration conditions, but also indicates that the two creeks have minimal amount of groundwater feeds,making them vulnerable to seasonal variation in peak flows (HCA, 2015). Due to development of the upper watershed, both Stoney Creek and Battlefield Creek have seen an increase in degradation related to erosion and stream widening. Without sufficient baseflow, both creeks are considered suboptimal habitat for aquatic species. Annual rainfall directly affects the distribution of fish communities, as there are no physical barriers apart from the escarpment that hinder fish migration from Lake Ontario (HCA, 2015). Existing development has also degraded water quality in both Battlefield Creek and Stoney Creek and both have been identified as a high priority for improvement by HCA.

Project Summary

The HCA has identified land above the Niagara Escarpment as an opportunity to create a new passive park conservation area within their jurisdictional boundaries. The area of interest includes floodplains and corresponding watercourses, forested land and some small wetlands. By acquiring key tracts of land, there will be opportunities to restore natural heritage features and create new wetlands/forested areas on existing farmland (HCA, 2015). The overarching goal of the project will be to provide hazard attenuation, natural heritage enhancements and passive recreational opportunities to the east end of the city (HCA, 2015). HCA staff explained the concept of the East Escarpment Wetland Restoration Project (EEWRP) as a large scale low impact development project, upscaling traditional lot level infiltration principles, which will allow for an entire subwatersheds flood concerns to be mitigated (Peck, 2016).

An innovative approach to Stormwater Management:

The EEWRP passive park has some defining features that make it unique among other implemented stormwater projects in the province and abroad. The innovation does not derive from any single design element or specific focus, but from the integration of multiple approaches and conditions used in other SWM projects.

Headwaters Management

A crucial aspect of the EEWRP is its positioning within the watershed (Peck, 2016). Residing atop of the Niagara Escarpment in a headwaters position of the catchment area, the entire subwatershed drains through this area before heading down stream (HCA,

2015). Headwater drainage features have broad implications on downstream health as up to 90% of a river's flow may be derived from a headwater catchment making it a key contributor to the downstream health of the watershed (CVC, 2009).

Scale

The sheer size of the project area is identified by HCA staff as the most distinguishing characteristic of the EEWRP (Peck, 2016). Initial land acquisition for the core conservation area consists of two key properties totalling 178 acres of land, which contains 831 meters of Battlefield Creek's main channel (HCA, 2015). Significant woodlands, meadows and karst features are all included in the purchase that links the Dofasco 200 trial and the Devil's Punchbowl. After initial purchases, HCA will be pursuing further expansion of the area by working with landowners and funders (HCA 2015).

Soft Engineering Techniques:

Stormwater projects, specifically those implemented as an end of pipe solution tend to be engineered in a complex way. Hard engineering techniques are widely for flow regulation, filtration or monitoring. HCA staff, however, have indicated their interest in a departure from this philosophy of project implementation (Peck, 2016). Soft engineering methods minimize human intervention and excavation both key objectives under the Ontario Greenbelt plan (Peck, 2016). HCA plans to limit physical construction opting for unobtrusive changes to the landscape to reinforce natural processes. First Rd E will be raised by one meter to permit the completion of the natural bowl that exists around the Battlefield creek main channel (Peck, 2016). This along with some other minor planting initiatives and channelization is all that is required to make this facility operational.

Provincial Case Studies:

Dingman Creek Erosion Control Wetland Facility

In 2013, the City of London and the Upper Thames Conservation Authority broke ground on a 30 hectare large scale erosion control constructed wetland (City of London, 2013). Not unlike the Battlefield and Stoney Creek subwatershed area, Dingman Creek (Tributary of the Thames river) has below average watershed health (UTCA, 2012). Suffering from poor water quality, lack of wildlife habitat, loss of tree cover, systemic erosion and flooding, the municipality required a comprehensive plan for improvement and management of this subwatershed area (UTCA, 2012). To address these concerns, the City of London implemented an erosion control facility using sustainable principles and hard engineering techniques to achieve a suitable solution to the challenges faced by the Dingman Watershed (City of London, 2013).

Rumble Pond Project: Richmond Hill

Construction on Rumble pond finished in the 1980s and aimed to service a 44 hectare urban area (Richmond Hill, 2014). Over its operational period, significant sediment build up hindered its effectiveness, resulting in warm water being discharged into the downstream watercourse of Patterson Creek, elevated temperature resulted in a creek not suitable for fish habitat (CVC, 2009). Refurbishment was completed in 2014 making Rumble Pond a clear demonstration of modern stormwater management techniques (Richmond Hill, 2014). Restoration goals centred around improving the quality and quantity of managed stormwater as well as improving recreational opportunities around the pond for the local community (CVC, 2009). The installation of mechanical control systems to manage outfall provided the ability to selectively discharge when water temperature drops to avoid raising downstream temperatures (CVC, 2009). This coupled with real time monitoring of level, flow turbidity and temperature of the water permits the operator to respond and adapt to local weather and pond conditions.

Stouffville Ontario:

Applying a headwaters management approach similar to the EEWRP, Credit Valley Conservation provides a case study of a SWM facility in the Town of Whitchurch-Stouffville. An infill development site threatened Stouffville Creek with erosion and entrenchment concerns, as well as a high concentration of litter and debris (CVC, 2009). A headwaters drainage feature was installed to manage untreated stormflow from upstream development. The installation of constructed wetlands and swales was complemented by increasing buffers on purchased lands upstream of the headwaters to slow and deflect flows and reduce erosion (CVC, 2009). After several years of operation, the feature now maintains year round fish species.

Lake Simcoe:

The use of stormwater management ponds has been widely accepted in Ontario as a means to provide runoff control prior to entering watercourses. Over time deposited silt and other materials hinder their effectiveness. The collection of phosphorus in an anoxic zone may produce a source of soluble phosphorus, which in turn contributes to excessive vegetative growth and an over warming of downstream waters (LSCA,2009). The Lake Simcoe Protection Act triggered the need for three major stormwater pond retrofits to help restore a self sustaining coldwater fish community (LSCA, 2009). The retrofits abandoned the use of traditional pumping systems in favour of adjustments to support a gravity fed solution and the installation of small wetland areas.

Ducks Unlimited- Ann Arbour Michigan:

A model for sustainable development and smart growing practices, Ducks Unlimited (DU) has completed a 100 acre grassland and wetland restoration in the Wahtenaw Food Hub in Ann Arbour Michigan (DU, 2016). The project re-naturalized 96 acres of heavily farmed areas to support a more biodiverse landscape and a low input

food growth system (DU, 2016). The site now boasts 14 acres of wetlands which serve as nesting habitat for mallards and other migratory bird species (DU, 2016).

Uniqueness of the EEWRP:

Although the EEWRP features do draw inspiration and possess simallar characteristics to the previously mentioned projects, the combination and execution of the design makes it unique among other examples. None of the above projects truly attempt to mitigate stormwater and erosion on such a large scale, adopt a headwaters approach or do so through soft engineering techniques **(**Table 1**)**. The Richmond Hill Pond, Dingman Creek and Lake Simcoe restoration are projects with the intended purpose to control stormwater and manage downstream effects on a watershed, however, they do not exist on the same scale as the EEWRP. The utilization of hard engineering controls such as flow regulation and downstream monitoring in the case of Richmond Hill and Dingman Creek also will not feature in the EEWRP. The softer renaturalization approach will yield substantially less control, but does provide an opportunity for the restoration of natural heritage, a main goal of HCA's approach. The Ducks Unlimited project in Michigan is the only project that rivals the EEWRP in size and many Ducks Unlimited projects eclipses the initial 72 hectare proposed conservation area in East Hamilton. The biodiversity oriented difference lies more so in the intended purpose.Wetland restoration in the DU context is directed first and foremost at restoring habitat for waterfowl and other migratory birds. The Stouffville project is very similar direction as the EEWRP but again at a much smaller scale. Both are a stormwater oriented design, both prioritize the use of the space for recreation and both conserve land in a headwater position in order to mitigate challenges down the watershed. HCA staff have made it clear that the defining characteristics of this project are its scale, the focus on stormwater management and its geographical position at the headwaters of the subwatershed (Peck 2016, Peck 2017).

Table 1: Comparison of SWM facility features.

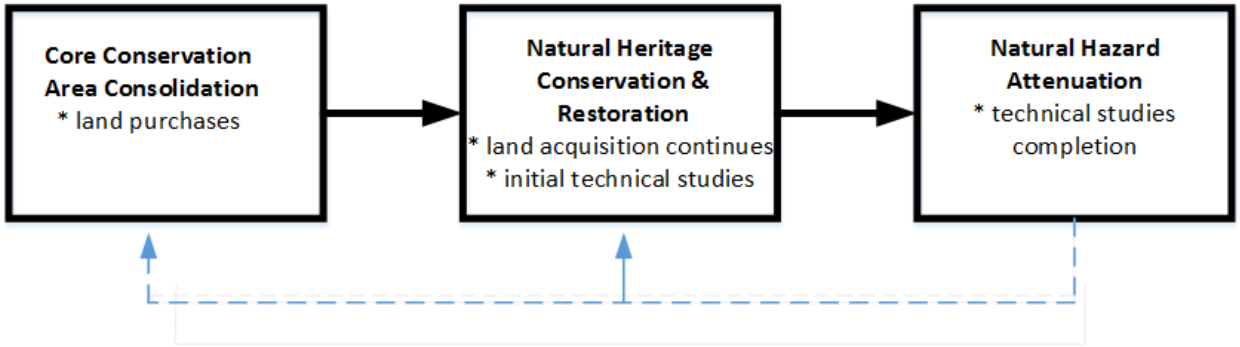
Project Features	**EEWRP**	**DU Ann Arbour Michigan**	**Lake Simcoe Stormwater Pond Restoration**	**Stouffville Headwaters Stormwater Retention**	**Richmond Hill Stormwater Pond**	**Dingman Creek Erosion Control**
Large Scale 100 Acres and Above	Yes	Yes	No	No	No	No
Soft Engineering Approach	Yes	Yes	Yes	No	No	No

Headwaters Position	Yes	No	No	Yes	No	No
Stormwater Focus	Yes	No	Yes	Yes	Yes	Yes
Recreational	Yes	No	No	Yes	No	Yes

Project Process:

Divided into three main phases, the EEWRP project began with the consolidation of core conservation area. This involved securing lands directly adjacent to the existing Devils Punch Bowl site and provides a starting point for further land acquisition (HCA, 2015). The next stage focused on the Natural Heritage Conservation and Restoration (HCA, 2015). In this stage, the continuation of land acquisition processes, coupled with initial technical studies to determine restoration designs for wetlands creek and reforestation occurred. Finally, the Natural Hazard Attenuation stage involves the completion of technical studies to determine how flooding and low flow augmentation can potentially be addressed through the restoration of wetlands, woodlands and creeks (HCA, 2015). Despite these stages being laid out in a linear fashion in initial project proposals, key HCA staff members have made clear the inherent fluidity of this process (Peck 2016). Technical studies may have to be altered in scope or re-evaluated upon the securement of other land not available at the time of study completion (HCA, 2015). Timing of these stages will also be dependant on the availability of funding and securing partners.

Table 2. EEWRP Project Process.



Consolidation and Acquisition:

Land acquisition is an integral component of the success of the EEWRP. A land acquisition team has been established to direct and focus the acquisition of key features of interest in the watershed (HCA, 2015). Where optimal lands are identified, the

acquisition negotiation is undertaken by HCA on a willing buyer/willing seller basis (HCA, 2015) .

Tools for Acquisitions:

Conservation Authorities (CAs) exist as a separate entity from provincial and municipal governments. Authorities receive funding through multiple avenues, drawing from municipal and provincial designated funds, revenue from operation of conservation areas and finally through donations from community members and organizations. Although provincial funding for general operations decreased heavily from the levels in the 1990's, conservation authorities derive advantage by retaining purchasing/acquisition tools unavailable to private buyers.

Property Purchase

Purchase of full title to a property from a willing seller. These can be properties listed on open real estate or through landowner contacts. Value is based on appraised property value or best offer by the CA (LSCA, 2010; NVCA, 2009).

Option to purchase

Contract that allows the CA to buy property for a specific period of time. Often used as a means to prolong the buying process to allow for gathering of funds through fundraising or other methods (LSCA, 2010; NVCA, 2009).

Right of first Refusal:

An agreement that allows the CA to match the offer on a specific piece of property before it is sold (LSCA, 2010; NVCA, 2009). This is set out by the registered title to the property.

Donation:

Donations of land to a CA at appraised value may qualify as a charitable donation under the Tax Act through the Ecological Gifts Program which CAs have been designated to receive by the Minister of the Environment (LSCA, 2010; NVCA, 2009).

Partial Takings:

This entails the acquisition of a segment of the property through purchase or donation. A landowner may want to dispose of the majority of the property, but still retain residence and amenity area (LSCA, 2010; NVCA, 2009).

Split Receipt:

Considered either a donation or easement with cash consideration back to the donor or a purchase or land with a donation of land value in cash back to the purchaser.

An appraisal will take place in order to assess the market value of land (LSCA, 2010; NVCA, 2009). Through the eco gift program, the landowner cannot receive more than 80% cash for the appraised value (LSCA, 2010; NVCA, 2009).

Life Interest Agreement/Lease Back Arrangements:

Donors or sellers wishing to retain interest in a property can enter into a life interest agreement or lease back arrangement (LSCA, 2010; NVCA, 2009). When the land is donated or purchased, the value of the retained interest is deducted from the purchase or donation value (LSCA, 2010; NVCA, 2009).

Planning Process:

The plan review process under the Planning Act, environmentally significant lands may be designated for protection under provincial or municipal plans. These lands may be available for acquisition to conservation authorities at various times (LSCA, 2010; NVCA, 2009).

Trade Lands:

If property is donated to a CA that does not contain any environmentally significant features, these properties can be sold and proceeds used to secure land or for other programs as directed by the donor (LSCA, 2010; NVCA, 2009).

Exchanges:

Individuals who own environmentally sensitive property may be eligible to exchange their parcel for a surplus non-sensitive surplus lot owned by the CA (LSCA, 2010; NVCA, 2009).

Project Requirements:

Lands part of an approved CA project can be purchased outright or a specific interest obtained. Landowners may be required to deed property rights to ensure future access for maintenance (LSCA, 2010; NVCA, 2009).

Municipal lands:

Parcels of property interests under municipal ownership may be acquired at a nominal cost when the lands exist within the approved project area or contains significant ecological features (LSCA, 2010; NVCA, 2009).

Joint Ownership:

Partnership agreement between the CA and one or more outside organizations to co-own a property (LSCA, 2010; NVCA, 2009).

Agreement Land:

Property owned by a NGO, nonprofit or other public agency may be managed by the CA under an agreement (LSCA, 2010; NVCA, 2009).

Features of Interest:

Not all lands within the Battlefield Creek and Stoney Creek subwatershed area are considered of interest as some may be more environmentally significant than others. HCA has identified that ideal land for acquisition should include floodplains, wetlands, woodlands, parcels identified by technical studies or any land that would be a part of the initial core conservation area (HCA, 2015). This establishes the criteria to guide the scope of land acquisition for the duration of the project.

Policies Affecting Project Implementation

Conservation Authorities Act:

Administered by the Ministry of Natural Resources and Forestry (MNRF), the Conservation Authorities Act enables the establishment of a Conservation Authority. Their main role as set out by the Act is to deliver resource management at a local level. Section 20 identifies a CA jurisdiction extends beyond any municipal boundaries to provide authority at a watershed level (Conservation Authorities Act, 1990). Section 21 establishes the right to acquire land by purchase, lease, expropriation or other means (Conservation Authorities Act, 1990). CA's environmental responsibilities are reflected in the Act through their ability to legally alter flows and direction of rivers or divert surface water to prevent floods and pollution. Section 24 requires any capital project to be registered with the Minister in order to proceed (Conservation Authorities Act, 1990).

Watershed and Subwatershed Studies:

Watershed planning is an ecosystem approach to land use and infrastructure planning based on the boundaries of a watershed or subwatershed. A watershed or subwatershed is a planning unit drawn from the drainage areas of water bodies (Hardy et al, 1993). Watershed planning provides a comprehensive approach to managing watercourses and associated natural resources. This responsibility in the Ontario context is left to CA's and mandated under the Conservation Authorities Act (Hardy et al, 1993) The role of Watershed Planning in the EEWRP is both to identify optimal land for acquisition, as well as create an overarching management plan for the Battlefield Creek, which has previously not been completed. The Hamilton official Urban and Rural plan identify environmentally sensitive land and designate them as "core areas" governed by stricter regulation for development. The designation limits the type of activities that can

take place and which type of structures can be erected. The acquisition of these lands by CA's for stormwater and conservation purposes is consistent with the guidelines set out in the plans. For these core area boundaries to be amended or expanded, significance must be identified by a technical study such as an environmental assessment or a watershed study. Section 2 of the official rural plan provides the opportunity for CA's to have a great deal of influence over the protection and development regulations where they can present such studies.

Planning Act:

The Planning Act sets out regulations for land use planning in the Province of Ontario and is designed to promote sustainable economic development. It extends autonomy to municipalities to set out their own strategic interests through an official plans, governs severance of properties, ensures public consultation and notice for changes to zoning (Ontario, 1990). Section 53 provides the ability for a landowner under specific conditions to sever sections of their land and avoid the municipal process with consent from the Minister (Ontario,1990). Section 28 provides opportunities for municipalities to acquire, hold or sell land within a certain area and provide grants to property owners to undertake improvement activities (Ontario, 1990).

Greenbelt Act:

The Greenbelt is a band of permanently protected greenspace. Its core mission is to protect agricultural, recreational and environmentally sensitive land from loss and fragmentation as a result of sprawling urban centres (Molnar, Stewart and Iseman, 2012). Section 4.2.3 provides policies and standards relating to stormwater management taking place within protected areas (OMMAH, 2005). Language within this section is supportive of sustainable stormwater approaches, especially in regards to systems that utilize natural heritage features. It also supports the soft engineering approach of the EEWRP, as projects taking place in protected area must minimize excavation, vegetation removal, soil compaction and introduction of impermeable surfaces (OMMAH, 2005). Broad stormwater objectives are consistent with the main objective of the HCA project such as protecting water quality, preventing flood risk and protecting aquatic species, but specific language supports lot level controls with no mention of control at a larger scale (OMMAH, 2005). Inclusion of watershed level stormwater controls would allow for more supportive policy conditions for future large scale projects within the greenbelt.

Niagara Escarpment Plan:

The Niagara Escarpment Plan provides regulation for the maintenance and development of the Niagara Escarpment. This includes adjacent land in its vicinity as a continuous natural environment ensuring that development is compatible with that natural

environment. The plan contains a formal definition for green infrastructure with mention to parklands as a tool for increasing municipal infiltration capacity (Ontario, 2017). The guidelines limit the ability to build intensive recreational areas such as golf courses or sports fields, attempting minimize the impact and further encroachments in the Escarpment environment (Ontario, 2017). Support for CA acquisition comes from the limitation on the creation of new lots. Severance is not permitted, unless for the purposes of correcting conveyances, enlarging existing lots or acquisition by a public body or authority (Ontario, 2017). This creates conditions which favours public acquisition of land.

Ministry of Environment (MOE) Design Manual:

In 2003, the Ontario government produced a Stormwater Management Planning and Design Manual providing design guidelines for stormwater management systems and sewage works. These tools are intended to assist municipalities in obtaining a Certificate of Approval for stormwater management systems. Certificates of Approval for stormwater management systems are considered by MOE on a site-specific basis (MOE 2003). Sections 2.3.1 and 2.3.2 describe a conceptual design for larger scale stormwater management projects, which includes land use planning, open spaces and regional approaches to stormwater management (MOE, 2003). This is one of the few references to large scale solutions from provincial policy, yet does not lay out any guidelines for size or provide any incentivization for controls at this level.

Key Policy Decisions

Although many policies technically did affect the EEWRP implementation, HCA staff indicated three mechanisms as being vital to its success. The first being section 24 of the Conservation Authorities Act and its ability to activate section 50 of the Planning Act (Peck, 2016). The elimination of the public process for severance of lands proved to be an effective means of quickly acquiring land for renaturalization. Due the heavy integration of the Greenbelt Plan in the City of Hamilton's Official rural plan, the soft engineering approach to development fits well with the direction of those two documents. This consistency with the objectives of the City of Hamilton was a contributing factor the the $2 million dollar grant HCA received from the municipality, which was matched by Heritage Green Community fund providing a budget of $4 million for land acquisition (HCA, 2015). The Greenbelt Plan also played an indirect role in making this project possible. The controversial and polarizing decision to restrict development of farmland to reduce urban sprawl had a drastic effect on the land prices within the Greenbelt (Peck, 2017).

Policy Recommendations to Support Passive Stormwater Management Parks in Ontario:

Stormwater management through land conservation and passive park establishment presents an opportunity for alteration of stormwater policy in the Ontario context. Despite the fact that the vast majority of Ontario policy is progressive, changes can be made in order to support larger scale projects as opposed to those functioning at a lot level. Conservation Authorities are the best positioned organizations to handle stormwater at a watershed scale, since they are not bound by municipal jurisdictions and already posses high bodies of knowledge related to sustainable stormwater implementation and design. The proposed changes to Ontario policy are broken down into three main categories, creating supportive policy language in relevant legislations, improving land acquisition mechanisms finally restructuring funding to CAs

Supportive Policy Language

Provincial Policy Statement (PPS):

Currently Ontario's stormwater policies are highly fragmented, despite the tendency of water to ignore politically established borders. Support for sustainable SWM is relatively consistent across the province, but still their is no province wide standard (Binstock, 2011). The establishment of an overarching vision for sustainable stormwater in the provincial policy statement would provide a long term objective for Ontario stormwater practitioners. The next version of the PPS should include a formal definition for passive parks, as well as language that encourages municipalities to support water management through conservation of lands that could play a role in downstream flood prevention (Binstock, 2011). Revisions to define passive parks and requirement of green infrastructure-based stormwater management would make municipalities better positioned to advocate for implementation of sustainable solutions and force developers to integrate them into new projects (Binstock, 2011).

Funding to Conservation Authorities

CA funding has been severely restructured over the past 20 years, forcing a shift in core focus and generation of revenue. In 1992, the provincial transfer from the Ministry of Natural resources totalled over 50 million dollars and by 2004 only 7.4 million dollars was being provided as general provincial funding (Conservation Ontario, 2004). Today conservation authorities produce almost half their revenue through the operation of parks, leasing lands and municipal plan revenue. This funding structure has forced CAs to drift from their mandated responsibilities of ensuring watershed health to an eco-tourism role in order to generate sufficient revenue. At this point Ontario CAs have reached their capacity to provide for themselves and a change in funding would allow for more focused programs and a return to their mandated responsibilities (Conservation Ontario, 2004).

Former Premier Mike Harris' Common Sense revolution election platform shifted government spending away from social services, government departments and environmental agencies (Clark, 2000). Reductions in provincial funding are illustrative of fiscal downloading policies placing more responsibility for environmental issues onto Ontario municipalities (Clark, 2000). The drastic cuts downloaded many environmental responsibilities to municipalities and left many government and outside agencies without sufficient resources including Ontario CAs (Clark, 2000). Provincial funding was cut by 87% since 1992 and over that time the provincial population has grown by over 3 million people (Conservation Ontario, 2004; Statistics Canada, 2016). This has resulted in rapidly sprawling urban centres and increased pressure on outdated municipal infrastructure, both of which are identified as causes of urban flooding and watershed issues.

Recommended changes to CA funding structures would provide equitable and sustainable funding for basic operations defined in the Ontario Ministry of Natural Resources' Policy and Procedures Manual for Conservation Authorities (Conservation Ontario, 2004). Re-investment should be directed towards activities such as floodplain/hazard land regulation municipal review and shoreline management**.** All of which are of significant provincial interest and should be included as eligible expenses under provincial transfer payments (Conservation Ontario, 2004). Achieving an optimal funding structure should be achieved through municipal and provincial partnership. Investment by the municipalities should be matched dollar for dollar by the Province. This reduces the need to raise municipal levies for services and refocuses conservation authorities' objectives back to those legislated to them. Flood and erosion control are the core responsibilities of the conservation authorities and large scale stormwater projects area direct mitigation strategy for these issues. With greater resources, conservation authorities could shift spending away from maintaining their core revenue, generating properties and designated funds for acquiring key properties to best fulfill their legislated responsibilities

<u>Improving Land Acquisition Mechanisms:</u>

Subwatershed Studies

Subwatershed studies represent a guiding document for the management of natural features in a given area. Their importance lies in the ability to act as justification for the protection of land within a municipal official plan. In Hamilton's case, protected land within the Natural Heritage System consists of Greenbelt Natural Heritage Systems, Greenbelt Protected Countryside and Core Areas defined by the City. These all reside under heavier regulations in terms of development and land use (City of Hamilton, 2017). If a technical study, such as a subwatershed study, identifies environmentally significant areas, they can be added to this Natural Heritage System protection, without the need for a full plan

amendment (City of Hamilton, 2017). Official plans in other Ontario jurisdictions, such as Ottawa, Mississauga, Burlington and Kingston make mention of subwatershed plans as a guide for municipal developments. Hardy et al, (1993) conducted a literature review of Ontario CAs and their progress in subwatershed planning for their jurisdiction. The findings showed that of the 24 CA respondents, nearly all of them had completed a subwatershed study. These studies are typically triggered by the submission of development proposals for a certain section of the watershed and are reactive in nature (Hardy et al, 1993). An ideal situation would be to complete studies prior to development pressures in order for significant features to be best protected. Lack of funding has been listed as a major impediment to the completion of subwatershed studies and in the absence of significant reinvestment by the provincial government, the following cost sharing is recommended (Hardy et al, 1993). When plans are created as a response to urban development pressures, developers should be required to contribute towards the cost of the study. In a scenario where plans have already been completed, developers should be required to share the cost of plan preparation.

EcoGifts Program:

Canada Revenue Agency implemented the EcoGifts program to help incentivize the donation of environmentally significant land to public bodies for protection. Its primary attractive quality is the 0% capital gains applied to the tax credits. However, HCA staff have made it clear in practice EcoGifts underperforms especially for individuals with a modest annual income. The program favours land rich-cash rich individuals or corporations (Peck, 2017). Land rich-cash poor taxpayers are generally unable to take full advantage of the tax benefits (Zweibel & Cooper 2010; Peck, 2017). Therefore, the program only provides advantage to land rich-cash rich owners who have access to financial advisors and a network of friends and family would would be willing and able to utilize a discounted tax credit. Under the current provisions of the EcoGifts program, a 5 year carryforward period exists, meaning in the land rich-cash poor scenario **a** substantial portion of the donation is left unused after the carryforward period (Zweibel & Cooper 2010).

The first revision of the program would be to extend the carryover period and allow for bequeathment of tax credits upon landowner death. This will ensure that in a lower income scenario the landowner will receive the full benefit of the donation. Zweibel and Cooper (2010) provide a case study of an individual with an annual income of $40,000. Under the current Canadian provisions tax would not be paid within the donation year but at the time of expiry over $850,000 would be left unused on a $1,000,000 donation. Apply a 20 year carryforward period and the owner would not pay taxes for 20 years and only leave $218,000 unused. Another possibility is to allow for the transferability of tax credits to other taxpayers (Zweibel & Cooper 2010). Despite this being a general departure from

typical Canadian tax practices, selling a portion of the tax credit to a third party buyer in exchange for cash value, the donor is able to utilize the entirety of the donation (Zweibel & Cooper 2010). This could be used in parallel with a split receipting arrangement to reduce the amount of allowable credit transfers while still allowing the full amount of the donation. In each of the scenarios the EcoGifts program becomes more equitable for a high land low cash donor.

Conclusion:

Implementation of passive parks for SWM should be seriously considered by stormwater practitioners when addressing the issues with urban flooding in Ontario. The coordination that is required to achieve similar results with lot level controls can be reduced with the establishment of projects like the EEWRP. HCA has developed a unique approach to water management by re-naturalizing large tracts of land using soft engineering techniques in a specific position within the watershed. This approach is already consistent with much of the language and regulations regarding activities occurring within the Greenbelt and rural Hamilton, yet specific supporting language for the implementation of passive parks is missing from these documents. An increase in funding from the Province will permit CAs to return their focus to their mandated responsibilities including erosion and flood control. It will also allow them to undertake more technical studies to better understand the needs and functions of their watersheds and subwatersheds. EEWRP, once implemented, is poised to become an important educational tool for Ontario stormwater professionals, displaying the effectiveness of sustainable stormwater control at a subwatershed scale. Through the development of a working case study in Stoney Creek and the alterations to provincial and municipal policy, projects at the scale of the EEWRP can create a paradigm shift for urban stormwater management in Ontario.

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