

Best practices for household stormwater management programs: A community-  
based social marketing case study

by

Lauren Keira Marie Smith

A thesis

presented to the University of Waterloo

in fulfillment of the

thesis requirement for the degree of

Masters of Environmental Studies

in

Sustainability Management (Water)

Waterloo, Ontario, Canada, 2017

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## Author's Declaration

I hereby declare that I am the sole author of this thesis. This is a true copy of the thesis, including any required final revisions, as accepted by my examiners.

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## Abstract

This research investigates how to most effectively develop pro-environmental stormwater management by homeowners in the Region of Waterloo, Ontario. This centres around strategies that focus on the role risk perception plays in behaviour change and follows successful models from community-based social marketing (CBSM). There is a challenge in encouraging people to adopt preventative measures to problems that are not tangible, such as climate change, where risks may not be directly experienced – people often do not expect a flood until after experiencing a flood. There is room for risk perception research to influence adoption of preventative measure through use of CBSM as minimal research has been done on risk perception for environmental concerns. With increasing commonality of extreme weather events due to climate change, there is a growing need for adaptation and preventative measures to be adopted. The research works collaboratively with non-profit organizations (REEP Green Solutions and Green Communities Canada) and an existing base of citizen participants that have been previously informed of stormwater management measures regarding their properties through involvement in a program aiming to increase engagement in pro-environmental stormwater management behaviours. Participants were interviewed to identify barriers encountered in enacting these behaviours. Identified barriers and solutions can be included in new behaviour change programs to increase adoption of pro-environmental behaviours. Determining how to encourage such behaviours is valuable as climate change is an issue where direct effects are not immediately seen. CBSM will be utilized as the guiding framework to assess and improve the program, and to encourage pro-environmental stormwater management behaviours. The research will conclude with an assessment of the existing program and recommendations for the future, leading to a more effective stormwater management program.

## Acknowledgements

I would like to thank the wonderful professors, colleagues, and friends that I have made in the SUSM program, the Collaborative Water Program, and SWIGS for their support and company throughout this journey. Without such bright minds to bounce ideas off of, this work would not be what it is today. I thank REEP Green Solutions and Green Communities Canada for their cooperation in this research, specifically Cheryl Evans for her time and dedication to this work. I would like to thank my friends and family for their support and for patiently waiting for me when research took over my life - and my fur-babies, Zeus and Odin, for refusing to let it do so entirely. Perhaps most importantly, I thank my partner, Nicole Balliston, for reminding me of the importance of taking time for one's self and the importance of breaks and self-care, for \*trying\* to get me more organized, for ensuring our health and sanity, and for being there no matter how long or difficult the day.

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## 1.0 Introduction

### 1.1 Climate Change and Flooding

### 1.2 Area of Research

#### 1.2.1 The RAIN Home Visit Program – Household Stormwater Management

#### Behaviour Change Program Case Study

### 1.3 Pro-Environmental Behaviour Change and Risk Perception

### 1.4 Objectives

### 1.5 Contributions

## 1.0 INTRODUCTION

### 1.1 Climate Change and Flooding

It is no longer debateable that climate change is a current and persistent threat to life as it is currently enjoyed on this planet (Sims, 2001). Increased extreme weather is expected, with changing weather patterns that will bring increased rainfall to various areas of the world (Giupponi, 2014). It is expected that extreme flooding events currently expected once every fifty or one hundred years, will increase in frequency due to climate change (Coopersmith, Minsker, & Sivapalan, 2014). Devastating floods, such as those seen in Calgary, Alberta and Toronto, Ontario in 2013 and in Windsor, Ontario in 2016, will become more common, resulting in increased damages and costs (Environment Canada, 2016). With increasing stormwater comes increasing demands on municipal stormwater management infrastructure, resulting in a need for strategies to reduce the load on these systems, many of which are outdated (StatCan, 2007; Abouchar, 2015). Stormwater infrastructure is costly to update, in part as the system is mostly located underground; however, investment in improvements are worthwhile. In 2007, stormwater sewer systems treatment in Ontario are, on average, 17 – 20 years in age (StatCan, 2007). Average lifespan of these systems is 33.5 years, and upgrades can be time consuming, taking many years before completion (StatCan, 2007; Aquije, 2016). Thus, actions that can help to decrease the demand on these systems, prolonging their lifespan, are beneficial and cost effective. The strategies that will be examined in this research are those designed to manipulate typical citizen behaviour in order to promote sustainable, pro-environmental behaviour change.

### 1.2 Area of Research

The focus of this research is within the Region of Waterloo, with a population of 511,300 as of 2015 (Statistics Canada, 2016). Of focus more specifically within the Region are the growing

cities of Kitchener and Waterloo which boast a thriving technology industry supported by two well-recognized universities and one college (Statistics Canada, 2016; Region of Waterloo, 2010). The cities of Waterloo and Kitchener have populations of approximately 132,300 and 233,700, respectively (City of Waterloo, 2015; City of Kitchener, 2016) and are growing faster than expected (Region of Waterloo, WEMP, 2015). Stormwater infrastructure in the Region of Waterloo is already reaching or has surpassed its life expectancy, and is in need of repairs (Stormwater Management Program and Funding Review, 2009). Reducing usage of this system can relieve pressure and demand on the system, perhaps providing time for repairs and reducing environmental damages to local waterways (Roy et al., 2008; City of Waterloo, 2015). Development and implementation of programs that reduce stormwater runoff quantity and improve runoff quality will aid in mitigation of stormwater damages.

Of interest to the research, the environmental groups involved, and the cities of Kitchener and Waterloo is the influence of the stormwater tax rebate that citizens of Kitchener or Waterloo can apply for. This rebate provides homeowners with a minimal discount on their stormwater tax for various applications of stormwater management best practices. The usefulness of the tax rebate has direct implications for this research as it can be seen as a form of motivational tool to encourage behaviour change, thus determining its effectiveness is beneficial for program improvements and design going forward.

### 1.2.1 The RAIN Home Visit Program – Household Stormwater Management Behaviour Change Program Case Study

An existing community-focussed household stormwater management program is in practice in the cities of Kitchener and Waterloo, run by the non-profit organization REEP Green Solutions, and was initially developed by a national organization, Green Communities Canada. This

program (RAIN Home Visit) involves scheduled home visits by a stormwater expert who advises the homeowner on what changes can be made to their property to better prepare them for increasing stormwater amounts and to help them better manage stormwater (REEP, 2016). Homeowners are later provided with a report, noting the most important areas for improvement, to guide homeowners in making changes and to encourage maintenance of existing pro-environmental behaviours. An online survey of participants from the program's onset (2012) to 2014 found some information on barriers and level of involvement after the RAIN Home Visit, and the level of engagement (level of changes participants made following the visit) was found to be less than desirable. This was the first and only survey or evaluation of the program, thus highlighting the need for more thorough examination of the program. This research uses in-person interviews to more thoroughly explore and identify common barriers, envision how to overcome those barriers, and compare the existing program to the successful model of community-based social marketing (CBSM) program features. This analysis will allow for recommendations to enhance the current program by following best practices of behaviour change research.

As mentioned, the program under study is administrated in the area of research by REEP Green Solutions. This organization, as well as Green Communities Canada, will be described in more detail in Chapter 2.

### 1.3 Pro-Environmental Behaviour Change and Risk Perception

Novel behaviours can be difficult to adopt, even those that are known to be beneficial. These beneficial behaviours are known as proactive or preventative behaviours – behaviours which are helpful in some way, yet still can be difficult to adopt (Giles, Robalino, Sniehotta, Adams, & Mccoll, 2015). Research into how to best promote positive behaviour change has been ongoing

for decades, and most rely on the theory of free will – that one can choose how to act in a variety of ways and that pressures on that action can be moderated to some degree. Early theories include Operant Learning Theory (Skinner, 1963), the Theory of Planned Behaviour (Ajzen, 1991), and Social Cognitive Theory (Bandura, 1997). Over time, theories have placed more or less importance on socio-cultural influences, and have considered a wide variety of factors that can influence why or why not a certain behaviour is adopted. Research into pro-environmental behaviour change has become a field of its own. The guiding theory for best practices in fostering sustainable behaviour for this research is that of community-based social marketing (CBSM), a blend of psychology and social marketing that promotes lasting, pro-environmental behaviour change (McKenzie-Mohr & Smith, 2000; McKenzie-Mohr & Schultz, 2014). This theory will be explained in more detail in the following chapter.

As will be expanded on in Chapter 2, one's perception of risk to a specific event affects the likelihood that one is to prepare for that event. Participant risk perception will be assessed in this research to determine if the RAIN Home Visit program had any effect on homeowner's awareness of risk. This is useful since, if a homeowner perceives their property to be at risk to flooding or extreme weather damages, they will be more likely to prepare themselves for such events – thus lessening stress on storm sewer infrastructure, natural waterways, insurance company pay-outs, and/or finances of the homeowner themselves. Pushing homeowners to live in constant fear of such damage, however, is not an ethical or socially productive option, so increasing awareness and understanding of the threat at hand is preferred. Perception of risk will be measured directly and via willingness to pay (WTP) for additional extreme weather insurance. The latter factor also provides valuable information for insurance companies interested in promoting additional flooding insurance packages for clients.



## 1.4 Objectives

The objectives of this research are to:

- a. Present best practices for pro-environmental behaviour change programs, following community-based social marketing as a successful framework
- b. Assess the existing homeowner stormwater management program in the Region of Waterloo (RAIN Home Visit) by comparing the existing RAIN Home Visit program to the key features and requirements of community-based social marketing in order to promote and sustain pro-environmental behaviour change
- c. Assess past participants of the program's perception of risk regarding increasing commonality of extreme weather due to climate change and related damages
- d. Assess past participants of the program's openness and willingness to pay for additional extreme weather insurance coverage, relating a measure of perception of risk and a monetary range for insurance companies
- e. Consider influence of risk perception on willingness to pay for additional extreme weather insurance and how an ideal pro-environmental behaviour change program can manipulate perception of risk, increase adoption of such coverage and/or better prepare homeowners for extreme weather by increasing adoption of stormwater management best practices.

Chapter 2 will outline the existing literature on household stormwater management and pro-environmental behaviour change, and further describe the community groups involved with this research. Chapter 3 will outline the methods followed in data collection and analysis, as well as the reasons why those methods were chosen. In-person interviews and questionnaires were utilized in this research. Participant pool is also described in this chapter. Chapter 4 presents

results from the interviews and questionnaires completed during the data collection phase. Chapter 5 discusses the findings in relation to current research and community applications as well as interpretation of results. Lastly, Chapter 6 summarizes the research, highlighting key findings and implications. Throughout this thesis, quotes from research interviews are included to illustrate and highlight points and themes encountered throughout the interview process. Quotes chosen were of points repeated multiple times, and were chosen specifically for their clarity or emphasis of the theme involved.

### 1.5 Contributions

Overall, this research will contribute to the existing literature on pro-environmental behaviour change and community-based social marketing, providing an analysis of an existing program for stormwater management. The cities of Kitchener and Waterloo will benefit specifically as the program in this region can be altered in coming years based off the findings of this study. Successful stormwater management behaviour change programs will help preserve the lifespan of storm sewer infrastructure as well as the natural waterways into which stormwater is drained. Homeowners and insurance companies will both save financially, as damages and costs from stormwater will be reduced with better household stormwater management that can be obtained by following the best practices this research will describe. Insurance companies may also gain insight on what homeowners are willing to pay for additional extreme weather coverage and what they expect that coverage to entail, at least for the region in question. Ideally, the findings from this research will help guide creation of new pro-environmental behaviour change programs in regions similar to that of this study and better protect communities facing increasing risk factors due to climate change.

## 2.0 Literature Review: Preparing for Increased Stormwater with Community-Based Social Marketing (CBSM)

### 2.1 Climate Change: Perception of Risk and Adaptation

#### 2.1.1 Perception of Risk

#### 2.1.2 Adaptation and Insurance

### 2.2 Homeowner Stormwater Management – Best Practices

#### 2.2.1 Benefits

#### 2.2.2 Proactive Behaviours

### 2.3 Pro-environmental Behaviours

#### 2.3.1 Behaviour Change Theories

#### 2.3.2 Best Practices for Pro-environmental Behaviour Change: CBSM

### 2.4 RAIN Home Visit Program

#### 2.4.1 REEP Green Solutions

## 2.0 LITERATURE REVIEW: Preparing for Increased Stormwater with Community-Based Social Marketing

The literature review for this thesis will present various ways of preparing for increased stormwater, with a focus on community-based social marketing. First, the existing evidence for increased stormwater due to climate change will be presented, along with risk perception and climate change adaptation literature. This is discussed as it is unlikely for someone to adapt to an event if it is not seen as a threat. Next, evidence for homeowner stormwater management best practices will be presented, with examples. This will include specific actions that homeowners can take to be best prepared and what the benefits of these actions entail. As a change in behaviour is required to adopt these new practices, literature on behaviour change theories will be presented with specific attention paid to those that apply to promoting environmental behaviours, such as community-based social marketing. Lastly, a description of the organizations involved with the case study of this thesis will be provided for context.

According to the Government of Ontario, stormwater is defined as “rainwater, snowmelt, or other form or precipitation that has contacted the ground or any surface” (Government of Ontario, 2016). After reaching the ground, stormwater may seep into the ground, depending on permeability, or enter storm sewers or bodies of water (Government of Ontario, 2003). In natural settings, where soil is abundant and non-compacted, stormwater is absorbed into the ground, evaporates into the air, or runs off to nearby waterways (TRCA, 2016). In urban settings, with more impervious areas due to asphalt, concrete, and other aspects of development, much more of the stormwater is destined for runoff due to the lack of permeability (TRCA, 2016). Stormwater management in the cities of Kitchener and Waterloo involves a system separate from wastewater, such as that that is flushed down toilets or that drains down sinks and showers (City of Waterloo,

2015). Some areas have combined systems, which can be problematic in heavy rainfall as the system can overflow and cause sewage to leak into public areas or residences before being treated (Sundberg, Svensson, & Söderberg, 2004). The separate system that is used in the region of this study is not without drawbacks, however, as the stormwater sewers drain directly into local waterways, without being treated (City of Waterloo, 2015). As such, any contaminants on surfaces can be washed into these waterways with the stormwater (Sabouri, Gharabaghi, Mahboubi, & McBean, 2013). High levels of runoff can also contribute to erosion, increased particulate in waterways, and higher turbidity in waters (Sabouri, Gharabaghi, Mahboubi, & McBean, 2013). Stormwater sewers may also drain into stormwater management ponds, which rely on settling of contaminants and the use of natural vegetation to filter the water, in hopes to rid it of contaminants before returning to the water cycle at large (City of Kitchener, 2016). However, the plants and animals that are drawn to these ponds are at risk due to the presence of contaminants; these ponds are not managed to a level that requires minimization of contaminants to recommended levels (Gallagher, Snodgrass, Ownby, Brand, Casey, & Lev, 2011; Drake & Guo, 2008).

As such, current stormwater management sustains some obstacles which, it is reasonable to assume, may increase in severity with the increased rainfall from climate change.

### 2.1 Climate Change: Perception of Risk and Adaptation

“Well, first and foremost ... you have to recognize that there’s going to be an ongoing problem and it’s never going to go away. And that freak storm that you had last summer is likely going to happen not 1 in 100 years but maybe, you know, every 2 years or 3 years or more often.” – Quote from interviewed past participant of RAIN Home Visit Program

Climate change adaptation refers to actions taken in response to consequences from a changing climate in attempts to minimize negative effects (European Commission, 2015;

UNEP, 2015). These actions may be proactive or reactive and can help save money or lives that could be lost due to climate change (European Commission, 2015). Climate change mitigation refers to preventing or limiting the emission of greenhouse gases in hopes to reduce the effect of climate change on the planet (UNEP, 2016). Extreme weather insurance options can be seen as a form of climate change adaptation – a step to help protect against the consequences of climate change. Similarly, stormwater management can be viewed as a proactive measure to prevent damage from increased rainfall expected from a changing climate.

The extreme weather of focus in this research is that of increased occurrences of heavy rainfall and flooding events. In recent years, flooding has become a more intense and more common occurrence, as can be seen by the massive flooding events in Calgary, Alberta and Toronto, Ontario in 2013, in particular (Environment Canada, 2016). These massive flooding events are becoming more common and more severe (Environment Canada, 2016; Yazdanfar & Sharma, 2015). As such, it is worthwhile for homeowners to best protect themselves against the damages that may come from these floods and heavy rains. Specific actions for homeowners will be presented in section 2.2, and the current section will focus on risk perception and the role that insurance can play in climate change adaptation.

### 2.1.1 Perception of Risk

Risk perception refers to one's understanding of the costs or consequences involved in a certain activity which may or may not reflect actual risk of the situation (van der Linden, 2014).

Experiential and socio-cultural influences significantly affect perception of risk while cognitive and socio-demographic have a smaller effect (van der Linden, 2015). It is unlikely that someone will partake in preventative behaviours if they do not feel that they are at risk of the threat these

behaviours can prevent (Barr, Gilg, & Shaw, 2011). As such, homeowners are unlikely to adopt pro-environmental behaviours that will protect their properties and community from flooding if they do not feel they are at risk of flooding or that they are contributing to that risk factor (Barr, Gilg, & Shaw, 2011). Thus, it is worthwhile to ensure homeowners are aware of the risks faced and understand how to act proactively. As will be expanded on in section 2.3, education can be helpful in increasing awareness of the risks faced, but it is a highly resource-demanding route with, perhaps, not enough efficacy for the effort involved (McKenzie-Mohr & Smith, 2000; Okrent, 1998). Thus, if intense education is not the most effective option to increase perception of risk, an alternative must be identified. While imposing significant fear of the consequences can be a motivator for change, it may not be the most ethical choice (Kavka, 1983; Baker, 2013). For example, an undesired behaviour may be discouraged via a monetary fine, which may instill sufficient fear to halt the behaviour, yet this is often not the case. Driving about the speed limit carries a set fine, yet many drivers exceed the speed limit regularly. With a larger fine, or more fear, the behaviour may be further discouraged yet a significant fine for a minor offence seems unethical. If it were ethical, such high fines, or threats, would be in place; yet, society opposes such increases, often deeming that, at least societally, such threats are not acceptable or ethical. Relatedly, if fear of consequences is too severe, people may outright reject a change, deeming it too drastic or too threatening to their current identity and way of living (Kavka, 1983; Baker, 2013). How, then, can risk perception be utilized to encourage pro-environmental behaviours? As mentioned above, socio-cultural influences can affect risk perception significantly (van der Linden, 2015). This is where community-based behaviour change programs can prove valuable. These programs target a social grouping of people, such as a neighbourhood or a particular demographic of interest, such as university students living in dorms, middle income families in

suburban areas, or hybrid-vehicle drivers, for some examples (McKenzie-Mohr & Smith, 2000; Darnton, 2008). By targeting groups that are in regular contact with one another and have at least some similar interests and values, similar programming can be utilized for the group and individuals can help hold one another accountable in making the changes that the programs support. This can conserve resources and improve efficiency of behaviour change programs. As well as holding one another accountable, there is also the pressure of new social norms that will push individuals to follow the actions of others in their social grouping. These programs will be discussed in more detail in section 2.3.

#### 2.1.2 Adaptation and Insurance

There is concern over who should cover the costs of the damages from extreme weather events, and even if anyone should at all (Crichton, 2008). Previously it has been thought that the responsibility lies with those choosing to reside in a flood prone area, however, with changing climate and weather patterns, these areas are changing (Crichton, 2008; Glenk & Fischer, 2010). Residential areas that have previously not been at risk of flooding may now become so with increasing occurrences of heavy rainfall events (Yazdanfar & Sharma, 2015). How to address the costs incurred from these events varies per country or region, but often when financial compensation is provided it comes from government or insurance companies (DFAA, 2015). In Canada, flood damage costs are of provincial or territorial responsibility up to a specified dollar amount per capita after which, federal aid is provided according to the federal Disaster Financial Assistance Arrangements in increasing percentages with higher dollar per capita damages (DFAA, 2015). Provinces and territories were responsible for providing funding for only the first dollar per capita until February 2015, when provincial and territorial responsibility increased to the first three dollars per capita (DFAA, 2015). The Ontario Disaster Relief Assistance Program



may help Ontario municipalities cover costs of damage incurred to residents, businesses, and infrastructure provided a disaster event is declared (Ontario Disaster Relief Assistance Program Guidelines, 2013). The insurance industry contributes greatly to damage and repair costs following natural disasters. Following the severe flooding of Calgary and Toronto in 2013, the insurance industry paid out \$1.74 billion and \$940 million, respectively (IBC, 2016). Non-disaster events, however, may not receive such aid from such sources, despite potentially being of a significant cost to the homeowner. Basement flooding from heavy rains, for example, can damage flooring, electronics, furniture, and anything else that rests on the floor on the basement level. Depending on the basement contents, this could total to expensive damages for the homeowner. Additionally, foundations can be weakened by extended exposure to water, a dangerous problem, as well as the mentioned increased pressure on stormwater sewer infrastructure (RAIN, 2016). While insurance companies may offer flood protection to some areas, it is less likely that full coverage will be offered in areas that are prone to floods, as the cumulative insurance payout would be too great (Crichton, 2008). It is debated whether insurance companies should provide coverage for such areas at a higher cost or if coverage should be offered at all (Crichton, 2008). A potential way to mitigate some of the cost and some of the damages incurred would be to provide insurance subsidies for various pro-environmental behaviours, such as sustainable stormwater management practices. Thus, if a homeowner has a number of proactive stormwater management tactics installed on their property, their additional insurance for extreme weather perils, if in place, could be discounted. A higher perception or understanding of risk by homeowners will increase the likelihood of adopting such practices, reducing personal cost as well as that cost to municipalities which may experience overloading of stormwater infrastructure with increased rainfalls (Renn, 1998).

## 2.2 Homeowner Stormwater Management – Best Practices

Homeowner stormwater management entails increasing permeability of surfaces on a given property, decreasing runoff flow and quantity of stormwater into streets and/or sewers, preventing intrusion of stormwater into the home, and preventing contaminants from entering runoff and the stormwater system (REEP, 2016; CMHC, 2011). Best management practices are the most suitable way to address a given problem or situation, considering economic, environmental, and social implications (Martin, Rupert, & Legret, 2007). These practices help guide management strategies in taking the most appropriate action for the most effective results, in this instance, regarding stormwater management (Ministry of Agriculture, Food and Rural Affairs, 2013). There are various ways in which homeowners can manage stormwater on their property to better protect the environment, their municipality, and their homes. Options will be presented first with attention to increasing permeability and slowing of runoff, protection of the home, and then by addressing options for minimizing contaminants in runoff.

### *Permeability and reduction of runoff*

For improved permeability and reduction of runoff, rain barrels can be installed to catch and hold water that runs off the roof, typically from downspouts directed to drain into these barrels (Jennings, Adeel, Hopkins, Litofsky, & Wellstead, 2013). The harvested rain water can be held until needed to water the homeowners garden or lawn, or slowly released over time so that the barrel empties and is able to capture water at the next rainfall. This reduces the strain on stormwater infrastructure, and provides homeowners with free water to use as they wish (Jennings, Adeel, Hopkins, Litofsky, & Wellstead, 2013). Driveways are commonly made up of asphalt or impermeable substances, but can be replaced with interlocking, permeable pavement which can absorb rainfall (Yazdanfar & Sharma, 2015). A rain garden can be installed, which is

an area with naturalized plants that has increased permeability compared to the typical grassy lawn seen with single-detached homes (Jennings, Adeel, Hopkins, Litofsky, & Wellstead, 2013; RAIN, 2016). The plants used are highly water tolerant, absorbing water and reducing the amount of runoff during heavy rains. Additionally, plants can act as natural filtration, which may help improve the quality of the runoff and limit contaminants reaching storm sewers and, ultimately, natural waterways (Read, Wevill, Fletcher, & Deletic, 2008). Other yard renovations can include infiltration beds, cisterns, and weeping tiles, which all help to increase permeability and hold water on the property for slow release at a later time.

#### *Protection from Water Infiltration*

To protect homes from water infiltration, downspouts can be extended away from the home to prevent water pooling at the walls and foundation of the building. Pooling water can lead to foundation leaks and flooding of the home (RAIN, 2016; Green Building Advisor, 2015).

Another way to protect foundation is to remove vegetation around the immediate perimeter of the house, which can weaken and crack foundation, and to cover window wells to avoid pooling water with rainfall (RAIN, 2016; Green Building Advisor, 2015). Additionally, the slope of the property should be adjusted so that land slopes away from the building. While most modern homes now have sump pumps installed when they are built to help drain excess water, this was not always common practice (RAIN, 2016; Green Building Advisor, 2015). Installing a sump pump and/or backflow valve if not present can be helpful, but can be an expensive addition (REEP, 2016; Region of Peel, 2016). Similarly, it is valuable to ensure that if these devices are present, that they are installed and working properly. Some homes may be susceptible to water infiltration due to their age and composition, in which case ensuring basements are left

unfinished and/or all items in the basement are raised at least two inches from the floor can help prevent expensive damages to the home (RAIN, 2016; Green Building Advisor, 2015).

### *Protecting waterways*

To minimize contaminant entry to waterways, household products with strong chemicals should be avoided, as they can be washed over impervious surfaces and into storm drains (City of Waterloo, 2015; RAIN, 2016). This can include products used to clean or maintain vehicles, bicycles, or workshops. Avoiding washing cars in the driveway is recommended as the vehicle can pick up harmful chemicals in its travels that could end up in the storm sewer system and natural waterways (City of Waterloo; RAIN 2016). This is particularly relevant when driveways are impervious and driveway sealants are used as these tend to contain polycyclic aromatic hydrocarbons (REEP, 2016). Commercial car washes treat the wastewater from their facilities before it enters wastewater systems and are a more environmentally friendly option (Canadian Carwash Association, 2016). Feces from household pets should not be left on the ground as this can cause bacterial harm to the waterways they ultimately end up in (Ram, Thompson, Turner, Nechvatal, Sheehan, & Bobrin, 2007). Composting such waste is a more environmentally sound option. Additionally, products used for de-icing in the winter months can wash excess salts into waterways, causing harm and environmental upset. Alternative products, such as sand, beet juice, molasses, or cheese brine, can be safer options (CBC, 2012; Rocha, 2015; Hossain, Fu, & Lake, 2015).

The aforementioned treatments are just some of the ways in which homeowners can protect themselves, their community, and their municipal infrastructure from the damage and consequences of excessive stormwater.

### 2.2.1 Proactive Behaviours

Proactive or preventative behaviours are those that people should act on or are aware that they should do to avoid some negative event. Often, however, these actions are not completed, whether it is eating healthily to avoid getting sick or wearing a helmet while riding a bike to avoid being seriously injured upon a fall, for examples. It may be difficult to adopt new instances of these behaviours because the consequences, good or bad, are not instantaneous or directly tangible (Delmas, Fischlein, & Asensio, 2013). For instance, adopting a regular exercise regime might not show results immediately or even for the first few weeks or months. For various activities, the risk is not immediately apparent. Regarding driving, not every instance results in an accident and consequences of carbon emissions are hard to see immediately. Regarding sexual activity, infections, diseases, or pregnancies are not necessarily immediate or guaranteed consequences. One may not take as much caution as they could when they do not think it could happen to them or do not think the risk is that high (Jackson, 2005). Regarding climate change, it is difficult to see immediately the impacts of behaviours and choices, as emissions are cumulative, greenhouse gases act globally, and impacts are varied (Delmas, Fischlein, & Asensio, 2013). Further, the environmental consequences of some behaviours are not directly apparent (Delmas, Fischlein, & Asensio, 2013). Certain foods or products have different environmental impacts, including water requirements (Hoekstra & Mekonnen, 2011). Certain daily behaviours leave different carbon or water footprints on the environment while others can help mitigate the consequences of climate change – but the impacts may be hard to see in advance. As such, proactive stormwater management behaviours may be difficult to adopt because the negative consequences are not direct or immediate and the benefits may be difficult

to envision and experience directly. While full understanding and access to information on an issue can help, there is more to adopting particular behaviours than knowledge (Jackson, 2005).

### 2.3 Pro-environmental Behaviours

Pro-environmental behaviours are those behaviours that people conduct day to day that help to protect the environment and minimize negative impact on the environment, such as taking public transportation or reducing waste (European Commission, 2012). While often seen as the ‘good’ or ‘right’ thing to do, for the environment and for sustainable futures, these behaviours may not be common practice. These new behaviours must be practiced until they become new norms and commonplace. There has been significant research into the best methods to encourage adoption of new behaviours, thus the importance of addressing behaviour change theories in this literature review. Particular attention will be paid to those theories that apply to sustainable pro-environmental behaviour change, such as community-based social marketing (McKenzie-Mohr & Smith, 2000; McKenzie-Mohr & Schultz, 2014).

#### 2.3.1 Behaviour Change Theories

Attempts to modify behaviour can include theories of planned behaviour (Ajzen, 1991), rational thinking models (Kollmuss & Agyeman, 2002), prosocial models (Blake, 1999), social pressures and normative theories, among others (Lo, 2013). Community-based social marketing, a framework to guide lasting adoption of sustainable behaviours will guide this research. It has previously been thought that people, as rational, thinking beings, when given sufficient information on a situation, should be able to act accordingly in the most desired manner (Kollmuss & Agyeman, 2002). If one knows the benefits of wearing a seatbelt while driving, for example, then it would make sense that the person always wears their seatbelt. Addressing pro-environmental behaviours specifically, linear models from the 1970s argued that increased

knowledge would lead to increased awareness and concern which would in turn lead to pro-environmental behaviours (Harrison, Burgess, & Filius, 1996). Unfortunately, the process is not so direct. Despite this, many environmental programs still follow this model of promoting knowledge and education alone in hope of changing behaviours (Shelton, Rodie, Feehan, Franti, Pekarek, & Holm, 2015). While education may help combat ignorance on an issue and provide indirect experience, it does not provide direct experience which is more influential for behaviour change (van der Linden, 2015). Additionally, the best information may not be enough to convince those from a social or cultural background that does not agree with that information (Kollmuss & Agyeman, 2002). Normative influences, from family, culture, or society, can affect how information is received (van der Linden, 2015). Social network theory notes the influence of one's social network (family, friends, culture, etc.) and how particular members of that network may be more influential than others (Kilduff & Tsai, 2003; Kilduff, Tsai & Hanke, 2014). Various components of social network theory align with CBSM, and will be expanded upon with further explanation of CBSM.

Prosocial behavioural models attempt to explain behaviours that stem from social pressures (Eisenberg & Miller, 1987). One view is that behaviours are voluntary and deliberate, intended to benefit another person in one's social group (Eisenberg & Miller, 1987). This may be for altruistic intentions of doing something good for another person, for more internal, personal social gains from doing as others do, or a combination. Prosocial models argue that a person who has basic needs met (food, shelter, security, etc.) is more likely to adopt pro-environmental behaviours as it is what would be beneficial for society at large (Eisenberg & Miller, 1987). Yet, wealthy nations with environmentally friendly options available to citizens that are not struggling to survive still have many members that do not behave in pro-environmental ways (Kollmuss &

Agyeman, 2002). For example, public transportation or bicycling options are readily available in most major cities, yet many individuals still choose to drive to work or around their city (Frei, Mahmassani, & Frei, 2015). This persists even in countries that have formally committed to combatting climate change, such as Canada. While prosocial models include societal pressures and norms, there is still a disconnection between attitude and behaviour.

Other sociological models addressing pro-environmental behaviours suggest a number of variables that influence a behaviour's adoption. These mainly include attitudes or values, possibility to act pro-environmentally, behavioural incentives to do so, perceived feedback on the behaviour, and knowledge about the behaviour or issue (Lucas, Brooks, Darnton, & Jones, 2008). Each variable influences whether or not pro-environmental behaviours are adopted and how much the attitude-behaviour gap is closed. Tied in with this are issues of power – if the individual does not feel that their actions will make any difference, they are less driven to follow through on that action (Kollmuss & Agyeman, 2002; Blake, 1999). Connected with the lack of basic needs perspective, if one does not have the resources (financially, temporally, physically, etc.) to make pro-environmental choices, they are unlikely to do so (Kollmuss & Agyeman, 2002). This has addressed three types of barriers to behavioural change: individuality, responsibility, and practicality. Individuality concerns individual differences, motivations, personalities and so on (Blake, 1999). Some people are less driven to change or act in certain ways by nature or personal differences. Responsibility addresses the sense of control one has over their situation. If one does not feel they are able to change a situation or trust others to act as they desire, they are unlikely to change their ways. For example, if one does not trust in their government to follow through on environmental promises or to act in pro-environmental ways, they may not bother to support a party based on their alleged environmental stance. Lastly,



practicality addresses social and institutional constraints on behaviour (Blake, 1999). This covers the lack of resources concern mentioned, but does not address the deeper issues of why the lack of resources exists or is of concern. It does not address the reasons behind why someone might not have time or resources to act in pro-environmental ways, despite intentions or beliefs (Blake, 1999).

Clearly, behaviour is more complicated than ensuring sufficient information is available. As mentioned, there is often a gap between perceptions, belief, or intentions and action. Gifford (2011) presents seven psychological barriers to pro-environmental behaviour, specifically regarding climate change adaptation or mitigation. These barriers go beyond the structural and highlights barriers beyond those preventing access to meeting basic needs. These seven “dragons of inaction” will be addressed in turn (Gifford, 2011). First is limited cognition, related to lack of knowledge of the issue at hand. One cannot change if one does not know a reason to or how to change. Second, one’s worldview may conflict with pro-environmental behaviour (Gifford, 2011). If one’s background or upbringing does not include environmental concerns, or has conflicting values, pro-environmental behaviours may be difficult to establish. Next, social comparisons play a role as one is more likely to value the actions of those they admire or look up to, so how leaders or others in a community act can influence additional community members, for better or worse (Gifford, 2011). The fourth barrier addresses ‘sunk costs’ or that which has already been invested in a given behavioural mindset (Gifford, 2011). If one has made an expensive investment, such as in a vehicle, limiting use of that purchase may seem like a waste of finances, pushing against pro-environmental behaviour which might include increased public transportation. Related, if one already acts in a certain way, it can be difficult to redirect those actions (Gifford, 2011). If one is accustomed to driving to their occupation on a daily basis, it

would be more difficult to convince them to start taking public transportation than someone who has just started to travel within the city in such a way. The fifth barrier, discredence, relates to the responsibility realm mentioned earlier. One may not trust the source of environmental information or trust that authoritative figures will follow through on their promises (Gifford, 2011). This discourages people from adopting pro-environmental behaviours that rely on or come from such sources. Next, it is possible that a change in behaviour carries some form of risk to the individual (Gifford, 2011). Perhaps it is a financial investment or a social standing that may influence action versus inaction. If one is concerned that the act will be a waste of time or that it will cost them respect in their social realm (for example, choosing an electric or hybrid car for one's next vehicle purchase when their social circles are avid traditional sports car enthusiasts), they are less driven to adopt the alternate behaviour (in this case, purchasing a more fuel-efficient vehicle). Lastly, there is an issue with a change in behaviour that is overall insufficient. One may make a small change in their environmentally-related behaviours, but the feeling of pride or success for this change prevents them from pursuing larger, more impactful changes (Gifford, 2011). For example, one may choose to stop eating red meat to minimize their carbon footprint but then eat more of other carbon intensive food sources (such as dairy) and not feel the need to seek more sustainable alternatives. Similarly, one may feel accomplished with their electric car purchase, but fail to consider the source of the electricity required to power that car. Related to stormwater management, a homeowner might install a rain barrel or clear out their eaves troughs, but not level the ground surrounding the house to prevent stormwater accumulating around the foundations. While the changes may minimize some impact of the next heavy rainfall, flooding could still be of high concern as a more impactful action was not taken

and may not even be considered as there has been some satisfaction from doing *some* pro-environmental act.

### 2.3.2 Best Practices for Pro-environmental Behaviour Change: CBSM

By combining the valid points from existing theories, a thorough baseline can be established for the study going forward. Combining consideration of structural, psychological, and individual barriers, a thorough approach can be developed for encouraging stormwater management behaviours. Well-recognized best practices for pro-environmental behaviour change programs will be presented and explained. These will serve as guides to idealize what a successful behaviour change program regarding household stormwater management would look like, as successful examples based off these techniques exist. The European Commission conducted an analysis of over 80 studies involving pro-environmental behaviour change programs and found four key techniques required for successful programs: convenience, information, monitoring, and social-psychological (European Commission, 2012). These techniques will be elaborated on below. The program this research focusses on will be assessed in relation to these best practices in Chapter 5.

As mentioned, there is often a disconnection between beliefs, values, or attitudes and behaviours or actions. One framework suggests that social norms can act as a catalyst or mediator between these two domains (Lo, 2013). The Social Amplification of Risk Framework (SARF) suggests that social norms help to better communicate the risk involved with various activities (Kasperson et al., 1988; Renn, 2011). For example, if a person does not believe that their residence is at risk of flooding but, in discussion with peers and neighbours, learns of their social group's concerns and/or actions that are being taken to prevent flooding, the individual may be more encouraged to adjust their behaviour and take preventative measures. The individual may or may not believe

in the general threat of flooding initially, but they do not believe strongly enough that it will happen to them to take preventative action. If the community and social circles act in pro-environmental ways, the individual will be more likely to act in line with their pro-environmental beliefs. Social norms serve to help bridge the gap between attitude or perception and behaviour (Lo, 2013). However, it has been found that people tend to shift their behaviours towards the social norm even if the norm is below their current performance (Dwyer, Maki, & Rothman, 2015). For example, if it is found that a given participant uses less energy than the norm for their community, that participant may be less inclined to be so conservative, and shift towards the norm. To prevent this, positive feedback and reinforcement should be given to those performing above the norm to encourage and maintain the desired behaviour (Dwyer, Maki, & Rothman, 2015).

Relatedly, the European Commission highlights four techniques to best ensure pro-environmental behaviour change, derived from a study of existing successful techniques (European Commission, 2012, Osbaldiston & Schott, 2012). The four techniques are convenience, information, monitoring, and social-psychological (European Commission, 2012; Osbaldiston & Schott, 2012). Convenience techniques involve making the desired behaviour as easy to adopt as possible, by, for example, providing the tools necessary to the audience in question, and by reminding the audience to act (Osbaldiston & Schott, 2012). Information techniques involve providing the reasoning, knowledge, and facts supporting the desired behaviour and monitoring techniques involve providing feedback to the audience in question so far as how they are performing and amount of influence their changes in behaviour may or may not have made (Osbaldiston & Schott, 2012). Social-psychological techniques involve committing to the desired behaviour (in specific amounts or terms) and interacting with others

who already perform or value the desired behaviour (Osbaldiston & Schott, 2012). These vital techniques fit well with those of community-based social marketing (CBSM), a behaviour change model derived from psychology and social marketing (McKenzie-Mohr & Smith, 2000). By combining effective communication tools, methods of behaviour change, targeted marketing, and social pressures, sustainable behaviour change can be achieved. CBSM focuses on pro-environmental behaviours and recommends five steps to “fostering sustainable behaviour”: selecting behaviours; identifying barriers and benefits; developing strategies; piloting the project; broad scale implementation (McKenzie-Mohr & Smith, 2000; McKenzie-Mohr & Schultz, 2014). Participants in CBSM programs are made aware of their performance in relation to their peers and community. Whether or not one is participating and how they are faring is often displayed in a public realm. For example, participation in a program may be indicated by a sticker on a house window or mailbox. Feedback of performance relative to the community can be indicated by a happy face or sad face on an electricity bill, noting higher or lower performance (as in, lower or higher energy use), respectively. Within the strategy step are recommendations that can be linked with SARF and social network theory that involve social norms in guiding behaviour change as well as feedback on individual performance. Social network theory emphasizes need for embeddedness, social capital, structural holes, and centrality (Kilduff & Tsai, 2003) which match with CBSM tools of social norms and social diffusion, convenience, and commitment (McKenzie-Mohr & Smith, 2000; McKenzie-Mohr & Schultz, 2014). The seven tools of strategy development fit within the four key techniques noted by the European Commission and are shown with descriptions in Table 2.3.2a below. These tools are categorized with the four key techniques in Table 2.3.2b.

<b>Table 2.3.2a. Community-based social marketing behaviour change tools. (McKenzie-Mohr &amp; Smith, 2000)</b>	
<b>CBSM Behaviour Change Tool</b>	<b>Description</b>
<b>Commitment</b>	By making a “small” ask of a person, such as signing a petition, they are more likely to agree to a “big” ask, such as donating to that cause, later, as this can alter their perception of self. After agreeing to the small ask, the person then thinks of themselves as someone who values that cause. It is most effective to make commitments public, as it assists in holding the person responsible and most affects the perception of self.
<b>Social Norms</b>	People are likely to model the behaviours of others around them. If many neighbours maintain grassy lawns, an individual is likely to maintain a similar lawn. If many have rain barrels at their front downspouts, an individual is more likely to add a rain barrel of their own. Injunctive norms (those that inform what behaviours are approved or disapproved of) and descriptive norms (those that show the behaviour normally done) must be used one at a time, or, if together, not used in opposition. For example, a pamphlet promoting extending downspouts should not include photos of neighbourhoods full of misplaced downspouts.
<b>Social Diffusion</b>	One’s social group (friends, family, co-workers, etc.) has influence on behaviours that are adopted and maintained. If one discusses installation of a rain garden to a neighbour, the neighbour is more likely to follow suit if someone they know and trust models the behaviour for them first. If a sign is also posted on yards with rain gardens, where others can see it clearly, it can be even more effective in maintenance of the existing garden and increasing implementation of new rain gardens
<b>Prompts</b>	Simple, clear, timely prompts should be utilized to promote the desired behaviour/s and to remind individuals of what they committed to. A

	follow-up phone call a few days after the RAIN Home Visit to schedule a future progress evaluation could improve engagement in recommended changes.
<b>Communication</b>	Effective, clear communication requires holding the given audience's attention. The means to do this may vary depending on the audience in question, so it is important to target communication appropriately. Vivid, personal messages are more effective – describing things in terms the target audience understands and can visualize. If warning of dangers of consequences, ensure the audience feels empowered to conquer the threat, lest it be avoided entirely out of fear.
<b>Incentives</b>	Incentives are motivational reasons to engage in a given behaviour, yet they must be tailored to the audience in question. Financial incentives may not be most effective for some groups, perhaps because money is not a desired reward or it is not an area of concern. Incentives can also be used to discourage behaviour, such as a residential fee for stormwater which can be minimized with implementation of household stormwater management tools.
<b>Convenience</b>	The desired change must, ultimately, be convenient to the target audience. If there are barriers to engaging in the desired behaviour, they must be addressed and a suitable alternative presented to ensure maximum uptake. Alternatively, the undesired behaviour could be made to be more inconvenient, making the desired change more appealing. For example, if, when discounted rain barrels are sold, transportation of the barrel to the homeowner is provided, purchase of rain barrels should increase.

<b>Table 2.3.2b. Categorization of CBSM behaviour change tools according to European Commission's four key techniques required for pro-environmental behaviour change.</b>	
<b>Convenience</b>	Social norms; Convenience; Prompts; Incentives
<b>Information</b>	Prompts; Communication

<b>Monitoring</b>	Prompts*
<b>Social-psychological</b>	Commitment; Social Norms; Social Diffusion
*It should be noted that a later stage in CBSM requires follow-up to assess how the behaviour change tools are functioning, which serves a monitoring purpose.	

The current research will be focusing on the first three steps of a CBSM program - selecting behaviours; identifying barriers and benefits; developing strategies - and will set the stage for piloting of the new program and wider, potentially national, implementation. Regarding successful behaviour change, the existing RAIN Home Visit Program will be assessed for inclusion of CBSM recommended behaviour change methods, or lack thereof.

#### 2.4 RAIN Home Visit Program

The purpose of the RAIN Home Visit Program is to inform homeowners about how they can best manage stormwater on their property to better protect homes, municipal storm sewer systems, and the environment – particularly nearby waterways (RAIN, 2016). The program stems from RAIN Community Solutions, developed by Green Communities Canada (GCC), a national organization that works with community groups to assist in transitioning to more environmentally conscious ways of living (GCC, 2016). In addition to stormwater projects such as RAIN, GCC works to protect well-sourced drinking water with Well Aware, to increase walkability of Canada with Canada Walks, and to promote renewable energies with Affordable Energy Canada (GCC, 2016). The RAIN program has three key points for managing stormwater: slow it down, soak it up, keep it clean (RAIN, 2016). This means, slow down the flow of runoff during heavy rains by collecting and storing rain water, absorbing rain water via permeable surfaces to recharge groundwater, and avoiding contaminants from entering the stormwater system and waterways (RAIN, 2016). The program works with community groups to help instill these three messages into their target audience, be it a homeowner, business, or municipality



(RAIN, 2016). The Home Visit program specifically targets homeowners, and while it was once subsidized by Ontario government, visits currently cost \$300 per home (REEP, 2016). Once a homeowner has registered for this program, a trained RAIN Guide visits the home and surveys the yard, driveway, outside of the building, as well as the basement to note current state of stormwater management, to highlight any areas of concern, and to make recommendations for improvements. A comprehensive report is filled out during the visit, with pictures taken of particular features, to be sent to the homeowner digitally after the visit. This report begins with an overview of the main four or five “priority for action” points covered during the RAIN Home Visit, and provides contact information for REEP and the RAIN guide. The next few pages cover in more detail specific areas, highlighting what is being done well by the homeowner and what needs attention. This is displayed in a number of tables which include criteria for ‘performing well’, ‘needs consideration’, and ‘priority for action’ designations. Rationale and recommendations are provided for each area, often with internet links that can be clicked on for additional information. The guide engages in conversations with the homeowner about any problems they may have experienced and to answer any questions they may have (Evans, 2015; Schaefer, 2015). A selection of informative pamphlets is typically left with the homeowner as well as a sticker or sign for their lawn and/or rain barrel promoting the three key messages (Schaefer, 2015). Following the delivery of the report, contact from the guide ceases unless contacted by the homeowner.

#### 2.4.1 REEP Green Solutions

REEP Green Solutions is an environmental charity based in Kitchener and Waterloo that encourages energy efficiency in residences and best management of stormwater, in effort to combat climate change (REEP, 2016). The Residential Energy Efficiency Project (REEP) began

in 1999 from a collaboration of the University of Waterloo and the Elora Environment Centre in hopes to bring research from the university into action (REEP, 2016). REEP provides workshops, seminars, home evaluations for energy efficiency and stormwater management, as well as a demonstrative house, open to the public, that displays various renovations a homeowner can make to improve their home regarding energy efficiency and water management (REEP, 2016).

In 2005, REEP joined GCC. In 2011, the cities of Kitchener and Waterloo began the running the RAIN program locally, collaborating with REEP Green Solutions, to help promote a new stormwater credit program (REEP, 2016). The stormwater credit program allowed residents to apply for a refund of a portion of their taxes if they provided evidence of stormwater management techniques in practice on their property (REEP, 2016; City of Waterloo, 2016; City of Kitchener, 2016). General qualifying features were a given amount of rainwater held on property or in the soil during heavy rains and certain strategies for minimizing impact of stormwater on the city infrastructure and environment (City of Waterloo, 2016; City of Kitchener, 2016). REEP maintains a team designated for the RAIN program and stormwater management, which now expands to businesses (REEP, 2016). REEP is presently in development of revised approaches to the RAIN Home Visit program, to ensure success of household stormwater management in the region (REEP, 2016).

## 3.0 Methods

3.1 Overview

3.2 General Research Approach

3.3 Interviews

3.4 The Interview Questions

3.5 Demographic Survey

3.6 Home Visit Report

3.7 Participants

3.8 Instrumentation/Measures

3.9 Procedures

3.10 Limitations

## 3.0 METHODS

### 3.1 Overview

This chapter will begin by describing methods used in previous studies before elucidating the methods used in this study and detailing how this study was carried out and assessed. Initially, a review of existing literature on household stormwater management programs, methods of behaviour change, and influence of risk perception was conducted. A mixed method approach was adopted to best explore and identify opinions, beliefs, perceptions, and behaviours of homeowners while also gathering numerical data to describe and identify trends between participants.

### 3.2 General Research Approach

This research takes a mixed methods approach, utilizing aspects from both quantitative and qualitative research methods. This approach is more comprehensive than a solely quantitative or qualitative approach, and is best suited for the research question and style (Cresswell, 2014). The research takes a constructivist stand, and builds on information as research continues, rather than seeking a definitive conclusion or particular answer to a hypothesis. The approach is exploratory and broad, to allow comprehensive and thorough assessment and analysis.

Qualitative interviews were conducted with past participants of a household stormwater management program, which aimed to improve homeowners' management of stormwater on their properties. Demographic surveys were also conducted with these participants, administered just before the in-person interview. These surveys collected information such as number of residents in the household, property size, age of home, and so on, in cohesion with Statistics Canada measurements. The purpose of the surveys was to explore and identify any demographic trends relating to behaviour change and/or risk perceptions. Copies of interview and survey

questions can be found in Appendix B. Interviews were transcribed verbatim and analyzed to identify common themes. Surveys were compiled in an Excel file, with key points from interview responses which were then grouped by similar response types (e.g. low concern, mid-range concern, high concern of storm water damage issues in future). Comparison of themes and demographic data was conducted to identify trends. All material for this study was reviewed and received ethics clearance by the University of Waterloo Office of Research Ethics. Copies of the recruitment script, information letter, consent form, and feedback letter are included in Appendix A.

### 3.3 Interviews

Qualitative interviews were conducted between summer 2015 and spring 2016 with previous participants in the RAIN Home Visit program in the Region of Waterloo, in cooperation with REEP Green Solutions and Green Communities Canada. By conducting one-on-one, face-to-face interviews, full exploration of questions and responses were investigated (Bush & Hair, 1985; Chalmers, 1999). This method allows the interviewee to expand on certain areas if desired and allows the interviewer to note body language and tone of voice in responses (Bush & Hair, 1985). By using an in-person interview method, if participants were unclear about any of the questions, the question could be easily rephrased and/or explained by the interviewer. Key themes, such as noted barriers and benefits, perception of risk, and helpful versus unhelpful components of the visit and report were repeated throughout the interview to ensure consistent answers. Interview length was designed to avoid participant fatigue, though length and detail of some respondents could lengthen the interview time considerably.

A cross-sectional interview design was used to assess participants' satisfaction and experience with the RAIN Home Visit program, as well as the visit's impact on their perception of risk and

motivation to make changes to their behaviours to better manage stormwater on their properties. Due to the diverse nature of barriers, limiting assessment to a forced-choice survey would be too restrictive and could miss important factors (Cresswell, 2014). Perception of risk was operationalized both by targeted questions regarding this perception (e.g. “On a scale of 1 to 5 how prepared do you feel your home is regarding stormwater and flooding? (5 being completely prepared/protected, 1 being not at all prepared/vulnerable)”), and by willingness-to-pay questions regarding storm water damage and extreme weather or climate change damage alleviation additional insurance coverage. These insurance-related questions will also contribute to the research regarding what protection people desire and what an expected price point might be, information that insurance companies seek to construct additional extreme weather coverage plans that are of increasing desire with a more volatile climate (Botzen & Van Den Bergh, 2012). These plans may become more common as climate change progresses and weather patterns change, bringing heavier rainfalls, for example. Interview questions can be found in Appendix B1. Interviews typically took 30 - 50 minutes to complete, depending on specificity of answers and level of detail.

### 3.4 The Interview Questions

Interview questions were developed to be straight-forward and understandable to the lay-person. Some questions were of specific interest to REEP Green Solutions, so were included for that reason (e.g. “How can REEP support you in maintaining simple changes in the long run?”; “How often and in what manner would you prefer to be contacted by REEP for reminders of stormwater updates, workshops, or follow-up to the plan?”). Subjects were asked questions related to their experiences with the program. More specifically, they were asked what was helpful and unhelpful about the visit, what changes they had and had not made, what barriers

prevented completion of changes, what helped in completing changes, and what would have been helpful or needed to complete changes. Subjects were also asked to rate their perception of risk from stormwater before and after the visit, and to consider if the visit or changes resulting from the visit had had any effect on this. In addition, subjects were asked if they currently had or felt the need for extreme weather home insurance, what a desired coverage program would entail, and how much they would be willing to pay for such coverage. As noted, questions were developed to evaluate the program experience, extract specific barriers to change, and perception of risk. These questions and responses would then, in turn, allow for an evaluation of the RAIN Home Visit program in comparison with CBSM best practices for promoting pro-environmental behaviour change.

As a goal of this research was to improve the existing RAIN Home Visit program, a broad exploration of potential barriers was required to best recommend suggestions for the program going forward. Barriers encountered to implementing stormwater management tools were identified and methods to overcome these barriers were explored. CBSM requires the identification of barriers specific to the group, situation, and behaviour of interest to best then identify the most appropriate methods to overcome these barriers, ultimately leading to sustainable behaviour change (McKenzie-Mohr & Smith, 2000). As such, specific attention was paid during the interview to barriers encountered by participants as well as exploring the participants' ideas on resolving these hurdles. These barriers will be addressed in more detail in Chapter 4 and 5, and management strategies will be included in future programs to increase participation in stormwater management in future.

### 3.5 Demographic Survey

In-print surveys were administered to participants prior to the interview to gather background data on participants (e.g. gender, age, education, occupation) as well as of their property (e.g. lot size, house age, number of occupants). Categories for the demographic questions were based on data measurements used in Statistics Canada surveys and reports (e.g. level of income, level of education, house size). While square footage of home and property were requested, most responses were estimates so should be used with some caution. Full copy of the survey can be found in Appendix B2. It should be noted that, initially, respondents were asked to indicate number of rooms in their household, but due to inconsistent counting between participants, this question was removed.

### 3.6 Home Visit Report

Following the initial Home Visit, participants received via e-mail or in hard copy, a comprehensive report for their property noting ‘priorities for action’ and recommendations to follow to better protect their property from storm water damage. These recommendations covered paved areas, eaves and downspouts, drainage and infiltration, foundation and basement, and common pollutants. Features in each category were rated as ‘performing well’, ‘needs consideration’, or ‘priority for action’. Rationales and some online resources were provided for each feature, but participants were left to themselves to research options in detail and to contact others for assistance. Priority recommendations typically entailed installing and maintaining rain barrels, extending downspouts away from the building’s foundation, planting a rain garden, and/or regrading property to slant away from the building. Also included in these reports were photographs taken during the visit of specific problem locations or areas where better stormwater management strategies could be installed.



Copies of these reports given to participants were obtained, to compare responses and for clarification purposes. By comparing the reports to participant responses, increased clarity can be obtained as generally several years had passed since the visit, so some participants' memories of detailed recommendations could have faded. This also helps clarify if some information participants wanted was missing or if it had actually gone unnoticed – two distinct issues. Report information was cross-checked with interview and survey responses to ensure consistency. If there were contradictions between sources, such as in property size, the report information was used. Discrepancies between top priorities and/or recommendations were noted, as some issues may have been stressed or discussed more in person during the visit but were not the main concerns for improvement. Cross-checking was done as participants may remember particular issues more vividly, even if they were not in actuality the most pressing concerns (Ackil & Zaragoza, 2011; Cohen & Java, 1995; Conway, 1990).

### 3.7 Participants

Twenty-three (23) participants were chosen via random cold calling through the list of approximately 300 past RAIN Home Visit participants in the Region of Waterloo. Ideally, a mix of participants would be accessed – those that have adopted several of the recommendations as well as those that have adopted few or none; those that indicate strong pro-environmental attitudes and those that do not; those that associate or acknowledge a high level of personal or direct risk related to stormwater issues and those that do not. Due to the random nature of selection, this was not possible to predict, but a decent variety of participants was obtained, as can be seen in Chapter 4. This diversity will help develop best practices for different types of people with different motivators, barriers, or background (Gifford, 2011).

These participants agreed to partake in an in-person semi-structured interview about their experiences with the program. In return, participants were entered in a random draw for one of two \$100 gift cards to a local hardware store, provided by REEP Green Solutions.

### 3.8 Instrumentation/Measures

A Zoom H1 portable handheld digital voice recorder was used to record all interviews, as well as a tape recorder as back up. Notes were taken throughout the interview to track inflection, body language, events, and situation. Interviews were transcribed at a slowed speed into electronic written document form. Reports were consulted to verify responses and trends were noted throughout measures. Transcriptions were scanned for similar responses and themes to identify main trends of participant responses.

### 3.9 Procedures

After phone contact and agreeing to participate in the interview, participants were met either at their residence or a neutral public location (e.g. coffee shop). Participants read through an information letter before signing a consent form for the interview, use of recording devices, and the use of their responses in this research. The demographic form was filled out next by the participant, and compiled later by the researcher. The interview was conducted in a semi-structured manner, allowing participants to elaborate or add additional details to any responses throughout the discussion. Interviews, surveys, and reports were analyzed to determine common barriers to adopting the suggested pro-environmental behaviour, and to assess the overall experience of the visit for participants. Responses were compiled and compared to elucidate correlations between attitude, behaviour, and risk perception, as can be seen in Chapter 4. More in depth analysis relating to behaviour change and CBSM in particular are presented in Chapter

5, assessing the RAIN Home Visit program overall for its effectiveness in creating sustainable pro-environmental behaviour change.

### 3.10 Limitations

As noted above, an ideal participant pool would include those of varying socioeconomic status, environmental attitude, awareness of stormwater risk, and level of completion of recommended improvements. This was not possible to select for in advance, but a sufficiently diverse participant pool did result, as noted above. The nature of the research involved only participants already involved with the stormwater management program and who had already had the Home Visit conducted on their property. Of this group, only those interested in participating in graduate level research involving in-person, recorded interviews were accessed. This research, then, may not be applicable to those who are not interested in such research, discussion methods, visits, or improvements. Additionally, some potential participants contacted by phone refused contribution due to an overly negative experience with the program. This would seem to be an important group to access that was somewhat missed as they may hold valuable insights on program failures, leading to non-response errors (Daly, Jones, Gereau, & Levy, 2011). Regardless, this research is beneficial as when more people adopt pro-environmental behaviours, it becomes more of a social norm and expectation, influencing those who may have previously been uninterested or uninvested in change (Jackson, 2005).

Generally, two to three years had passed since participants engaged in the home visit, leading to possible memory lapses of the experience. Feelings of the visit would maintain, and completion of recommendations serves as an indicator of commitment to change or effectiveness of the visit. As mentioned, the reports of the visit were consulted to verify participant responses and to clarify what the visit suggested. Additionally, interviews were conducted over the span of

approximately one year, with varying seasons and weather. This may or may not have influenced responses, as certain weather could affect memories from the visit or of other weather events. Due to technical errors, three interview recordings were lost during data collection, but questionnaire data and notes from the interview process remained, so these were utilized for these participants.

## 4.0 Results

### 4.1 Demographic Analysis

#### 4.1.1 Participants

#### 4.1.2 Household

### 4.2 Interview Analysis

#### 4.2.1 RAIN Home Visit

#### 4.2.2 Recommendations Made During the RAIN Home Visit

#### 4.2.3 Preparedness

#### 4.2.4 Insurance

#### 4.2.5 Materials

#### 4.2.6 Report

#### 4.2.7 Benefits & Barriers

##### 4.2.7a Personal and Homeowner

##### 4.2.7b Community and Municipal

#### 4.2.8 REEP Green Solutions Specific

### 4.3 Report Analysis

#### 4.3.1 Participant Performance Rankings

#### 4.3.2 Inconsistencies

### 4.4 Sources of Error

## 4.0 RESULTS

This chapter presents the analysis and findings from the demographic questionnaire and interview responses. Quotes are utilized to aide in illustration of some points and findings. This section includes review and analysis of questions requested by REEP Green Solutions and their responses. More complex analysis and review of the program overall regarding its effectiveness in fostering sustainable pro-environmental behaviour change is presented in Chapter 5.

### 4.1 Demographic Analysis

#### 4.1.1 Participants

A total of 23 participants were interviewed, all of which completed the demographic questionnaire. Ranges and descriptions of items on the questionnaire followed those used by Statistics Canada. Eight (35%) of the participants were male and 15 were female (65%). Age of participant interviewed ranged from the 30 – 39 year old bracket to the 70 – 79 year old bracket, the majority being 60 – 69 years of age at n=10 (44%). If two household members were present for the interview, the age of the participant that was contacted by the researcher and that dealt with the RAIN Home Visit was used. Annual income before taxes of households ranged from the \$5000 - \$5999 bracket to the \$150000 and above bracket. Level of education was recorded for all participants. In instances where two household members were present for the interview, the highest level of education was recorded. Results can be seen in Table 4.1.1.

<b>Table 4.1.1. Demographic information for participants interviewed.</b>									
<b>Age</b>	30-39		40-49		50-59		60-69		70-79
	n=7; 30%		n=2; 9%		n=1; 4%		n=10; 44%		n=3; 13%
<b>Income (in \$1000s)</b>	5 - 9	30 - 39	40 - 49	50 - 59	60 - 79	80 - 99	100 - 124.9	125 - 149	150 +
	n=1; 4%	n=1; 4%	n=3; 13%	n=3; 13%	n=2; 9%	n=3; 13%	n=4; 17%	n=3; 13%	n=3; 13%

Education	Apprenticeship/ Trades certificate or diploma	College, CEGEP, or other non-university certificate or diploma	University certificate, diploma, or degree (Bachelor's)	Master's degree
	n=1; 4%	n=8; 35%	n=6; 26%	n=5; 22%

While 14 participants noted various occupations in eight different fields, the largest contiguous group were retired at n=9 (39%). When multiple household members were present for the interview, the occupation of the contacted participant who most closely dealt with the RAIN Home Visit was recorded. Occupation distribution can be seen below in Figure 4.1.1.

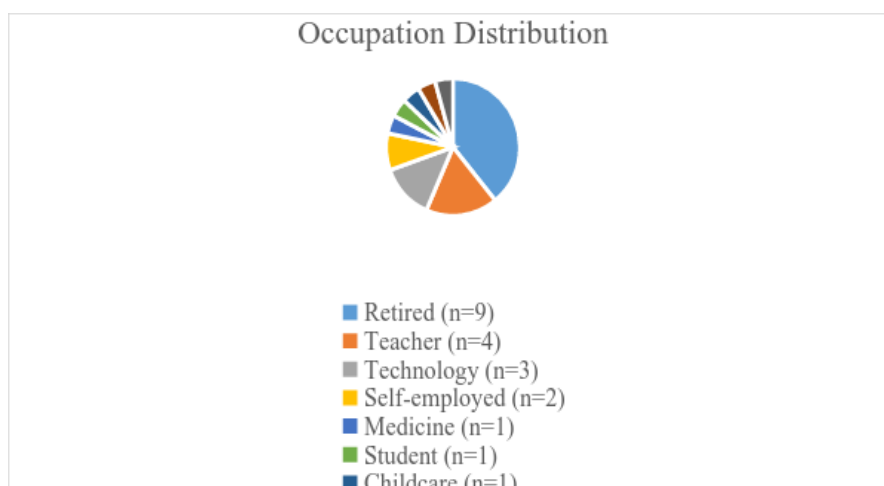


Figure 4.1.1. Occupation distribution of participants interviewed.

#### 4.1.2 Household

Participants were asked about the make-up of their households as well as descriptive aspects of their properties.

- Most households had two adults at n=19 (83%) and no children at n=16 (70%) residing at the time of interview.
- Two households (9%) had one adult residing, while fewer had three (n=1, 5%) or four (n=1, 5%) adults residing at time of interview.
- Three households (13%) had one child residing at time of interview, and other households had two children at n=2 (9%) or three children at n=2 (9%). The vast majority

of housing type was single, detached at n=21 (91%). Other housing types included triplex at n=1 (5%) and townhouse at n=1 (5%).

The age of the house was variable, with some being relatively newer buildings while others were pre-1900s. Most were built in the 1950s, at n=6 (26%). The distribution can be seen below in Figure 4.1.2a.

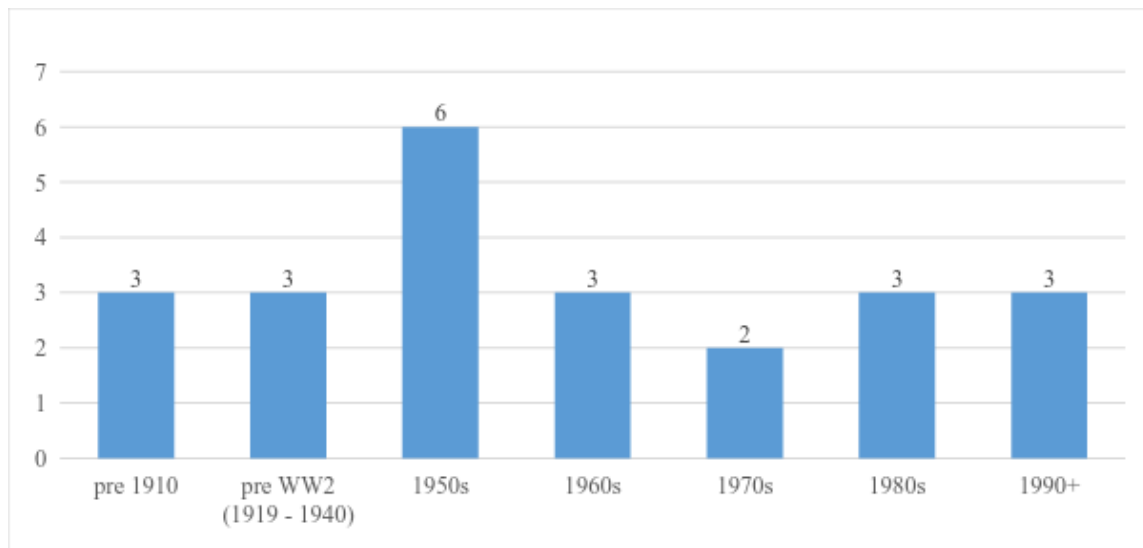


Figure 4.1.2a. Age distribution of houses involved in this study.

The size of homes ranged from less than 1000 square feet to 3000 square feet. Most homes ranged between 1500 square feet to 2500 square feet, at n=17 (74%). Size distribution can be seen below in Figure 4.1.2b.



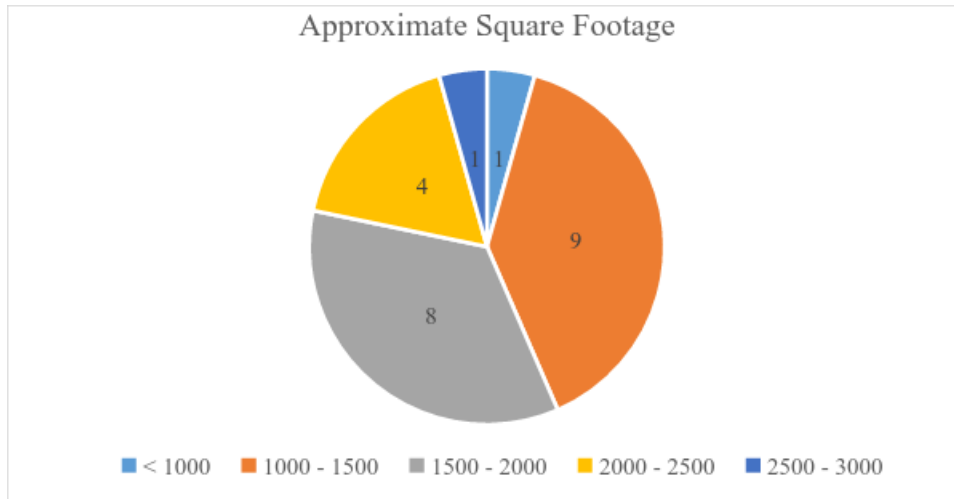


Figure 4.1.2b. Size distribution of homes.

The property size of homes was relatively consistent, the vast majority being less than  $\frac{1}{4}$  acre in area at n=17 (74%), few at up to  $\frac{3}{4}$  acre at n=4 (18%), and minimal at up to 1 acre at n=2 (9%).

This follows as most households in this study were within the city area of Kitchener and Waterloo. One household was in a more rural area, and the uniqueness of this location will be addressed in the section 4.3.2.

## 4.2 Interview Analysis

### 4.2.1 RAIN Home Visit

Interviews took place between September 2015 and April 2016, ranging from one to three years since the participant had had the original RAIN Home Visit. Participants often had multiple reasons for having the Home Visit, the most common of which were out of “interest” at n=7 (30%) and due to an “ongoing stormwater problem” at n=6 (26%). “Savings” and “environmental responsibility” also rated highly, both at n=5 (22%). Distribution of reasons for the initial visit can be seen in Figure 4.2.1a.

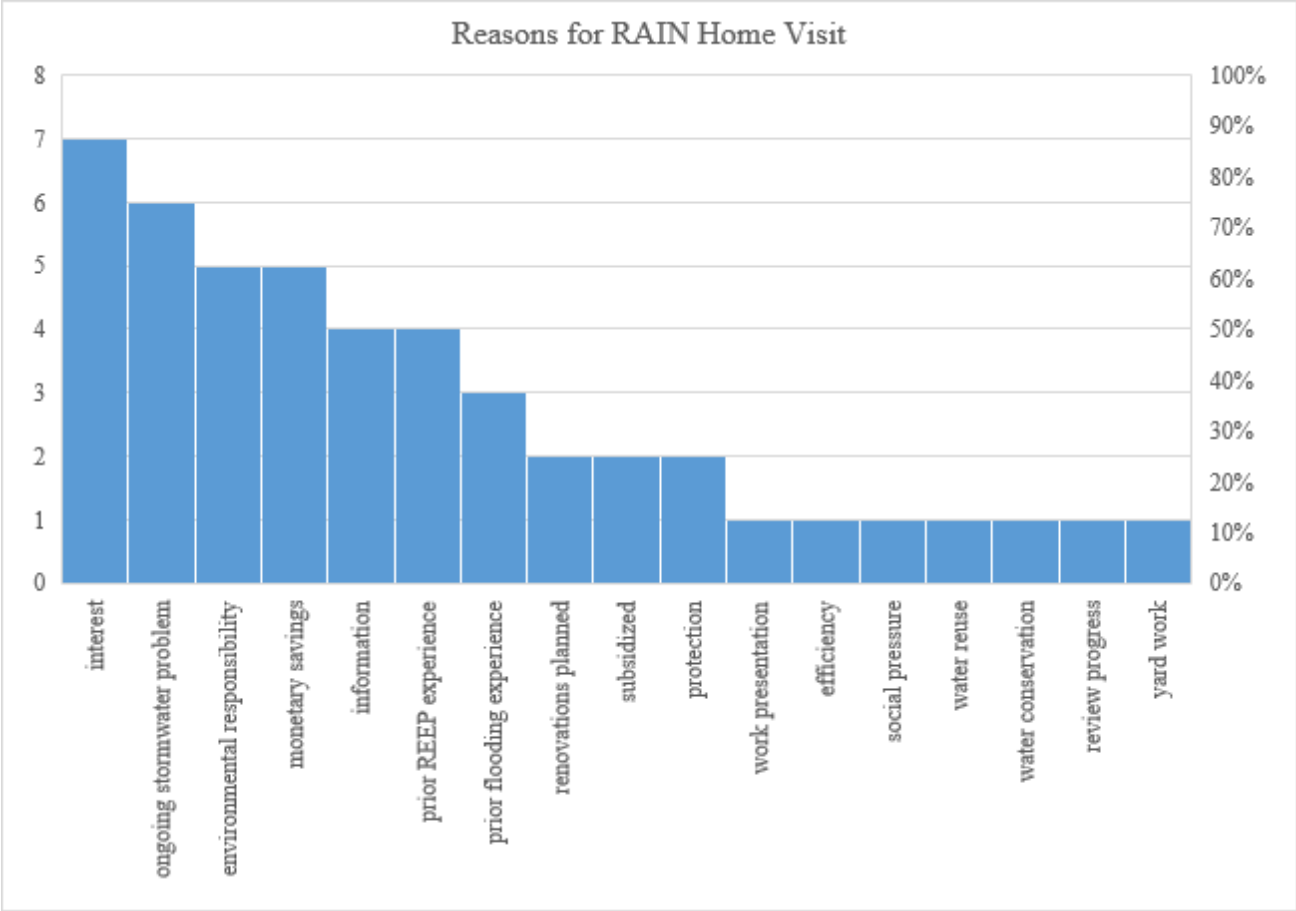


Figure 4.2.1a. Reasons given by participants for initial RAIN Home Visit.

Most participants heard of the Home Visit program by “word of mouth” at n=7 (30%), whether from friends, neighbours, or family. Others reported hearing of the program through “newspaper articles”, n=4 (17%), notices within their utility bill, n=4 (17%), or other advertising venues, n=5 (22%). Key concerns that participants hoped the visit would address varied, but again an “ongoing stormwater problem” was the most common concern at n=11 (48%). Distribution can be seen below in Figure 4.2.1b.

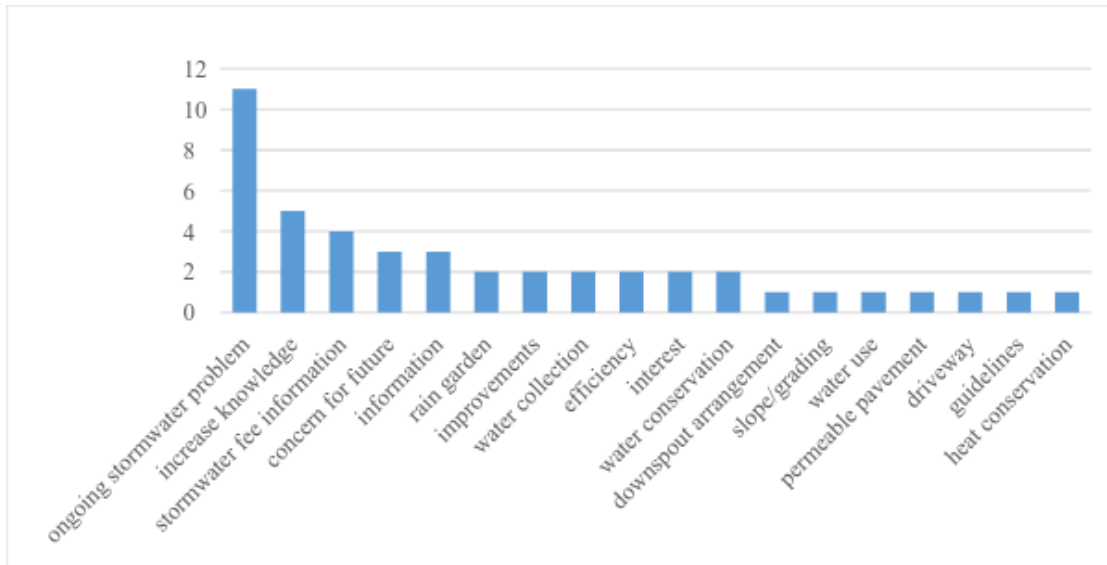


Figure 4.2.1b. Distribution of key concerns that participants hoped the RAIN Home Visit would address.

Many participants felt these concerns were addressed via the recommendations made during the visit and while most had a positive opinion of the visit overall, some felt the information was lacking applicability, depth, or was too complicated to navigate once on their own. This conflict will be discussed more in the Chapter 5.

#### 4.2.2 Recommendations Made During the RAIN Home Visit

A total of 89 recommendations that were made to participants during the RAIN Home Visit were mentioned during the interviews, falling into 24 categories. Participants noted between one and eight recommendations that they recalled being mentioned during the visit, with only one participant that refused to answer this question. The most common recommendations noted by participants was to add or address rain barrels (n=12, 14%), permeable paving options (n=11, 12%), and rain gardens (n=10, 11%). Grading and downspout issues were also commonly recommended to be addressed, at n=9 (10%) and n=8 (9%), respectively. The full distribution can be seen below in Figure 4.2.2a.

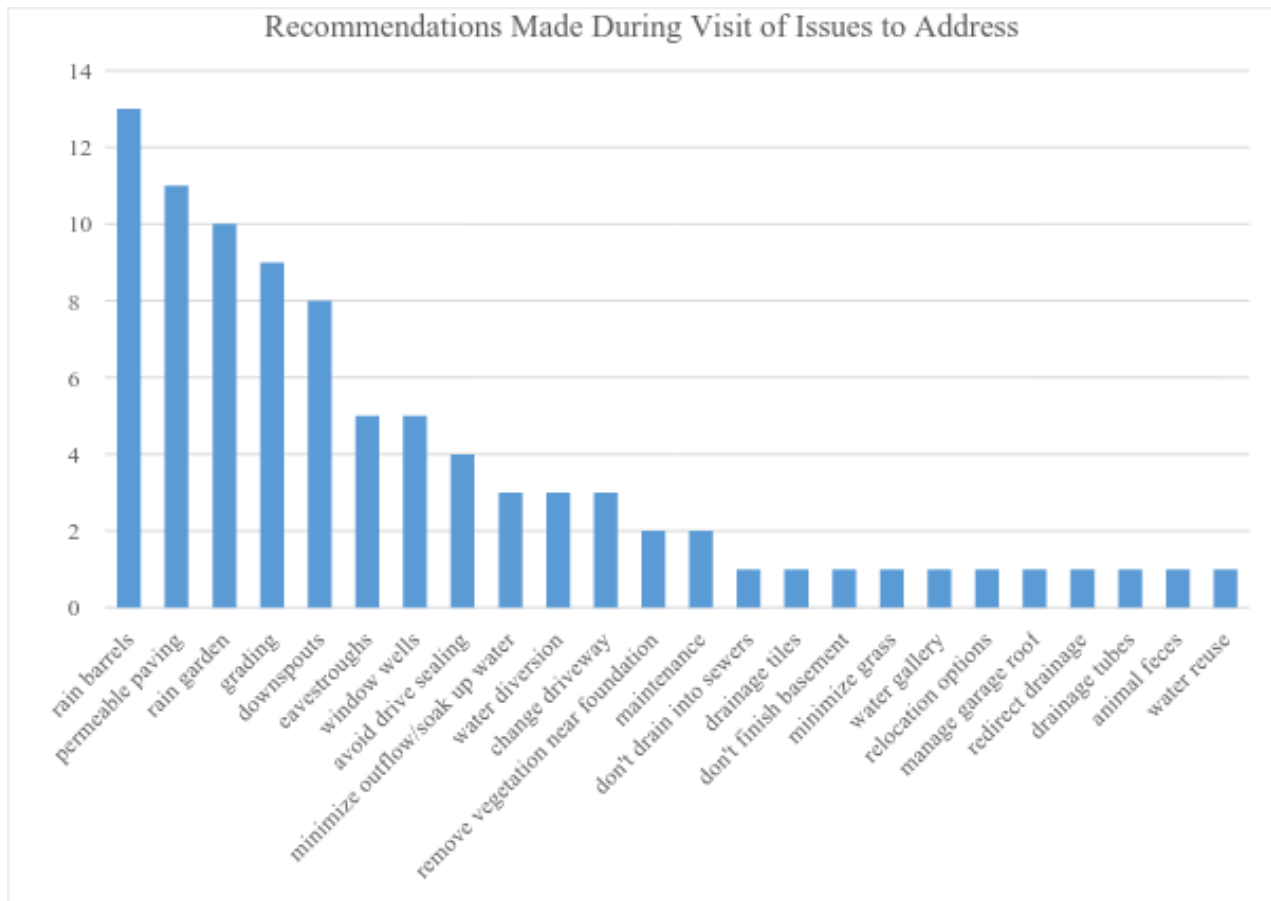


Figure 4.2.2a. Distribution of recommendations mentioned during in person interviews.

Difficulties that participants noted for completing the recommendations were grouped into 19 categories, with 51 responses total, ranging from one to four difficulties noted per participant with only one refusing to answer this question. The most common difficulty to acting on the recommendations that was mentioned was “cost” at n=13 (26%), with the next most common being “property specific obstacles” at n=8 (16%). This category included obstacles such as lack of space to extend downspouts, lack of room for additional rain barrels, or lack of yard space to install a rain garden.

“I’m on maternity leave and we have no extra money. Uh. So there are probably 3 or 4 projects that I would really like to do that we’re just kind of hoping don’t become a problem before we can address them.” – P08CL

“...then the rain garden seems more complex and again I don’t really understand how to do it. And it feels like I don’t even know who to call that I would trust ‘cause every time you get a quote from a different contractor like, we had a crack in the basement – one person says this, one says that you put in insulation, they say this, they say yeah, I don’t know who to believe. You know? So. Kind of just after a while like oh well, it’s good enough.” – P10JH

Additional difficulties can be seen in Figure 4.2.2b below.

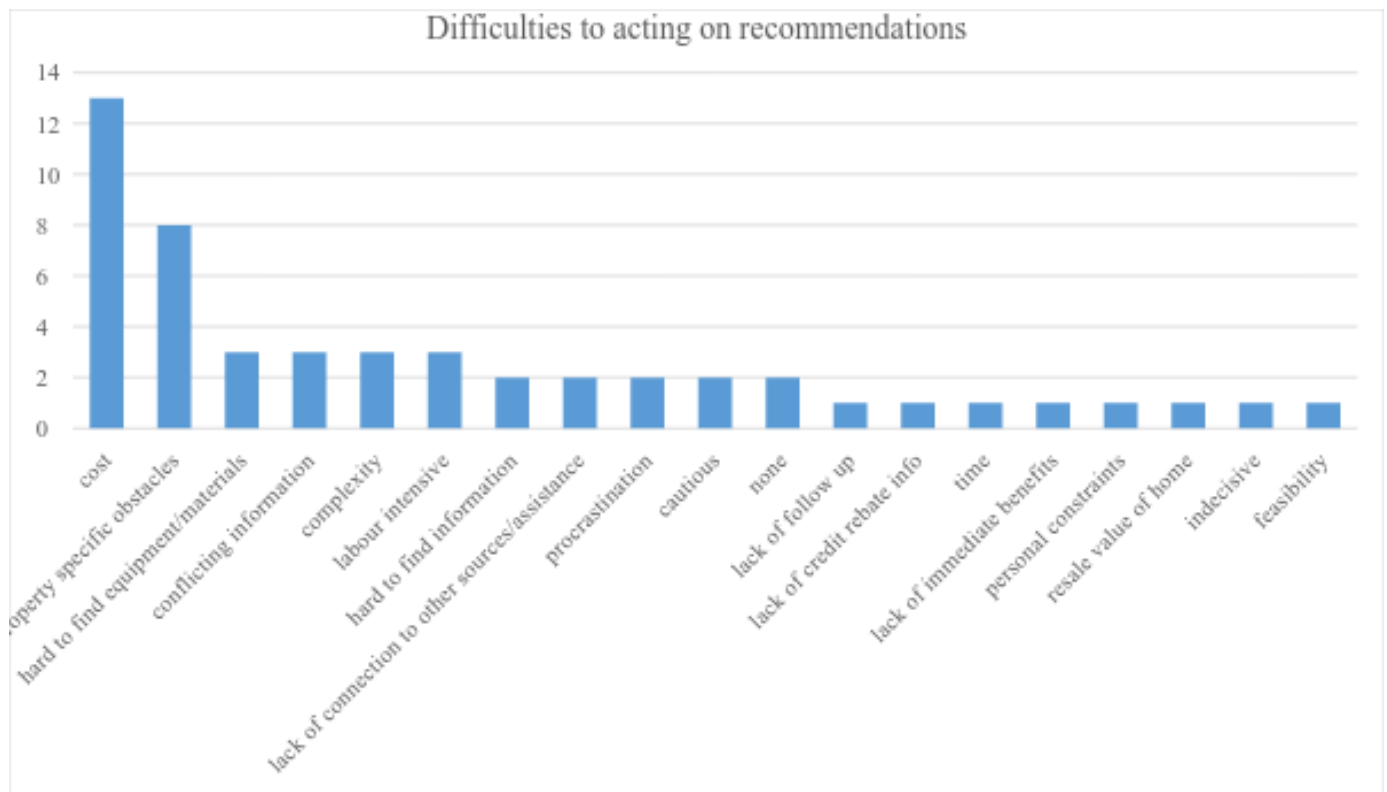


Figure 4.2.2b. Distribution of mentioned difficulties in acting on recommendations.

When asked what helped participants to complete the recommendations, 21 responses were made falling into 14 different categories. While “simplicity” and “knowledge gain” were most commonly noted as helpful, “nothing” was noted the same amount, each at n=3 (14%).

Interestingly, despite multiple participants noting a lack of connection with recommended contractors, one participant did have some contractor contacts provided, and greatly appreciated this addition.

“... probably the most helpful thing was that it provided a series of contractors ... I was pretty pleased that REEP this time had ... the other time when I’ve had, like, a heat assessment done, they were unable to give me any contractors suggestions and ... I find it’s pretty hard to get people to come out for little jobs ... You have to really talk people into it so I was really pleased that they had done the work of lining up about 10 different contractors that would be interested and if I had some problems they would identify. So that was a big help.” – P07MB

However, this participant also noted that some of the advice gained from the contractors contradicted what was said in the RAIN Home Visit.

“... the first person I called on that list ... I wondered why he’d been chosen ... his solution was to simply have both of my downspouts connected to underground tubes that would come out at the sidewalk. And I thought, ‘well, that’s defeating the whole REEP idea, right? The whole idea of conserving water, right? ... and I said to him, ‘but I don’t want to waste all that water into the gutter’. And he said, ‘well that’s what they’re for’. And I thought, ‘how did you get on the REEP list then?’ I mean, it’s a little counterintuitive.” – P07MB

Additional responses are noted below in Figure 4.2.2c.

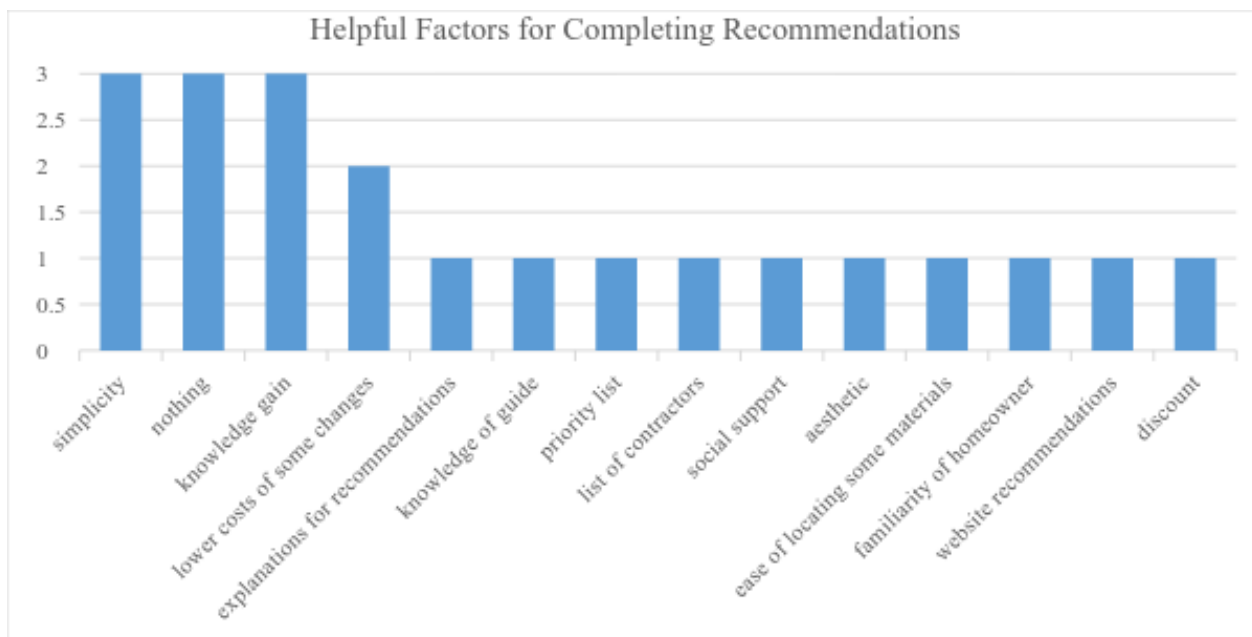


Figure 4.2.2c. Factors mentioned that were helpful for completing recommendations.

Lastly regarding recommendations, participants were asked what would be or what would have been helpful for completing recommendations. 43 responses were recorded, falling into 13 categories. Most often mentioned were “financial assistance” at n=7 (16%), reliable additional information at n=7 (16%), and “connection with contractors” at n=6 (14%). The latter came up often in interviews, as participants did not know where to turn for assistance in completing the recommendations, for answers to their questions, or for other help. Another common response was the desire for “appropriate incentives or motivational tools” at n=5 (12%). As will be noted later in this section and expanded on in the Discussion, the amount of savings from the stormwater credit rebate program, despite being a motivational tool in theory, was often too minimal to be worth the hassle of application for many participants.

<b>Table 4.2.2. Response rates from participants for what would make completing the recommended changes easier.</b>		
<b>Factor</b>	<b># of Responses</b>	<b>% of Responses</b>
Financial assistance	7	16%
Reliable additional information (specific advice; direct contact with guide)	7	16%
Connection with recommended contractors	6	14%
Appropriate incentives/motivational tools and access to them	5	12%
Labour	3	7%
Nothing/already had lots done	3	7%
Community approach (relative performance to neighbours; comparative examples)	3	7%
Convenience of work already underway	2	5%
Follow-up/reminder	2	5%
Relevance to specific property	2	5%
Connections through REEP (other than contractors)	1	2%

Provide materials	1	2%
Alternate materials	1	2%
<b>Total</b>	<b>43</b>	<b>100%</b>

#### 4.2.3 Preparedness

Participants were asked how concerned they felt regarding stormwater damage before and after the visit, how prepared they felt their property was for stormwater damage, and how likely they expected damage to their property from stormwater in the next 5 – 10 years. These questions sought to operationalize participants’ perception of risk regarding stormwater damage at present and in the future, as well as any effect the RAIN Home Visit may have had on that perception. Most participants noted that there was no change in their level of concern about stormwater before and after the visit, n=9 (39%), and some, n=4 (17%), specified they felt more aware, but perhaps not more concerned.

“As result of some of the changes that we made. Um. A 2 [somewhat unlikely to experience damage due to extreme weather in the next 5 – 10 years] and again only in those really severe weather situations that we might have. And we seem to be getting more of them lately so it’s definitely uh always going to be a concern but it’s but we feel much better prepared.” – P11DH

Initially, eight participants (35%) noted that they were not concerned about stormwater before the visit, two (9%) of which became more concerned after the visit and two others (9%) noted they felt more aware. Three (13%) of those not concerned noted no change to their level of concern after the visit and one (5%) participant felt less concerned about stormwater after the visit. One other participant (5%) felt less concerned after the visit, despite being initially moderately concerned about stormwater damage. The change was noted as being due to resolving issues in a specific problem area of their property. Additional explanations for the increase or decrease in level of concern will be explored in the following section. Figure 2.2.3a



below shows the distribution of changes in level of concern from before to after the RAIN Home Visit.

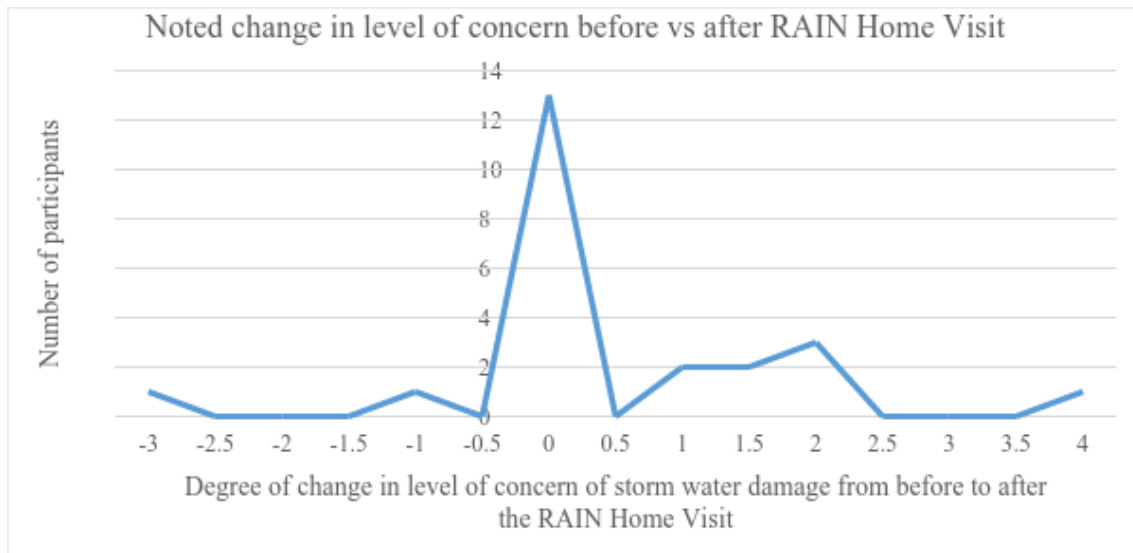


Figure 4.2.3a. Change in level of concern of stormwater damage per participant from before the visit to after the visit.

Most participants felt better prepared after making the recommended changes to their property at n=11 (48%), and others felt somewhat better prepared or the same at n=10 (43%). Two participants (9%) did not feel any better prepared, due to property specific challenges such as the lack of a sump pump or specific changes that were yet to be made. Considering the risk of future damage to their property due to stormwater or extreme weather, the vast majority of participants responded that they felt this was not at all likely, at n=8 (35%), compared to only two participants (9%) thinking this was extremely likely.

“So I’m in 100% danger because of there’s no sump pump. Externally, I have done as much as I can. Internally, the city should have mandated everyone with a sump pump especially when you’re on a grade like I am. With a walk out basement. It was not mandated. So, my biggest fear is that it will come up through the sewer and I have no way of protecting myself. So that’s a city contractor problem. I’ve done the external as much as I can.” – P15AK

Overall, five (5) participants (22%) felt some future damage to their property due to stormwater was somewhat to extremely likely. The distribution is shown below in Figure 4.2.3b. Most participants felt future damage was unlikely due to the location of their property, n=9 (39%), or due to the changes they had made, n=6 (26%).

“We’re situated in a very good location in Kitchener in terms of the um, structure of our soil. It’s um, it’s very absorbent. We’re also at the top of a hill as opposed to the bottom of a hill where a lot of Kitchener residents might be. Our lot slopes from front to back.” – P02CA

Three (3) participants (13%) felt that since there had not been damage in the past, they did not expect any different in the future, despite the mention of climate change and the increase in extreme weather systems.

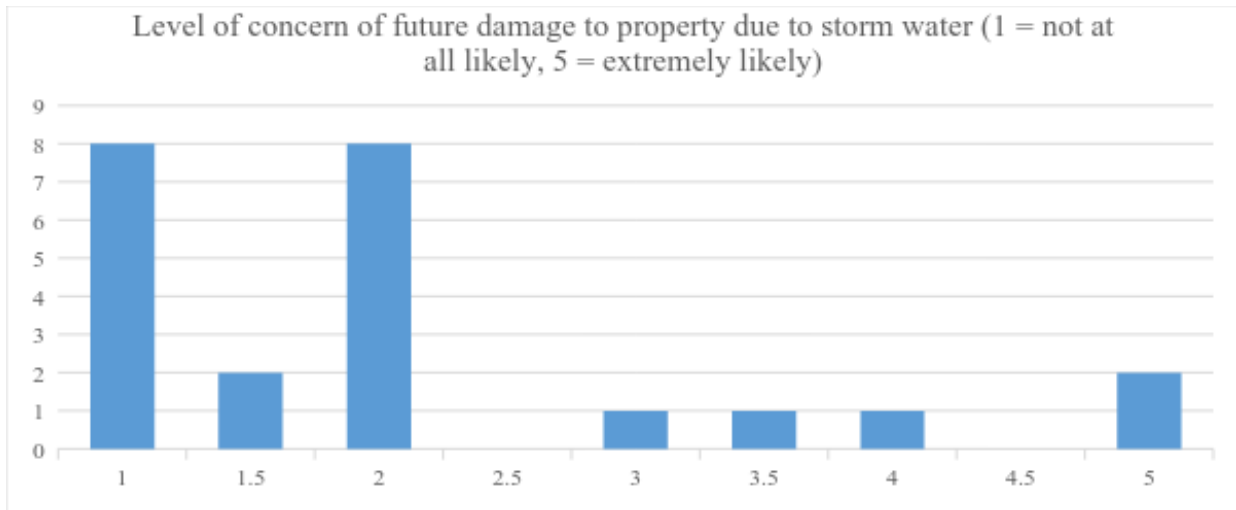


Figure 4.2.3b. Participants’ self-reported expectation of stormwater damage to their property in the next 5 – 10 years.

#### 4.2.4 Insurance

When asked if participants had any additional insurance covering damages from stormwater, most responded having the basic level of insurance or no additional coverage at n=12 (52%). It should be noted that uncertainty of current insurance coverage was a common theme among participants. Participants either had to consult their plans, had done so recently, or expressed not

knowing for certain what their coverage consisted of. It was explained to participants that typical home insurance covered sewer backup but not overland flooding. Five participants (22%) abstained from this question, two of which were somewhat (n=1, 4%) to extremely (n=1, 4%) concerned about stormwater damage to their property in the next 5 – 10 years. The remaining three participants who had expressed concern of future stormwater damage in the same range, were not interested in additional insurance coverage, preferred proactive measures, or noted their interest was cost dependent, at n=1 each. These three participants made up 17% of participants who answered the question of interest in additional insurance coverage. Of participants potentially interested in additional coverage, n=10 (43%), most preferred. Of participants potentially interested in additional coverage, n=10 (43%), most preferred proactive measures or, at very least, discounted insurance based on how prepared their property was for damages from stormwater. Eight participants (35%) were not at all interested in additional insurance, and six (26%) abstained from this question. Of the 11 participants that described what an ideal additional coverage extreme weather insurance plan would include, 21 different responses were given in 11 categories. “Repairs” and “damages” were most common at n=3 (14%) and n=7 (33%) respectively, with “clean-up” and “resolution of the problem” next at n=2 (10%) each. Other responses are shown in Figure 4.2.4 below.

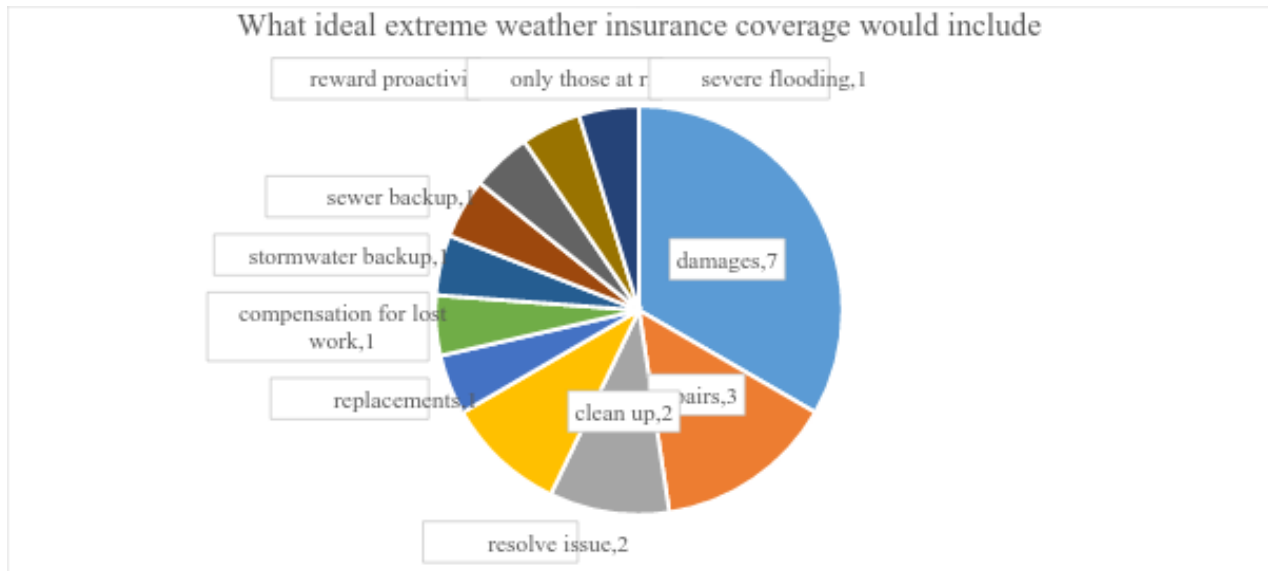


Figure 4.2.4. Responses from participants noting what ideal additional extreme weather insurance coverage would include.

Participants were also asked what was a reasonable percentage of their annual insurance for additional extreme weather insurance to cover. Most (n=6, 60%) responded they would pay under 10% of their annual insurance fee for such coverage, out of a total of 10 participants (43% of total participant pool) that gave an estimated willingness to pay. One participant (10% of participants who answered) was not interested regardless of cost and ten (43% of total participant pool) abstained from answering this question. Two participants (20% of those that responded to this question) felt the cost should be risk based, but did not provide an estimate of what they felt would be a reasonable cost for coverage.

#### 4.2.5 Materials

At the end of the RAIN Home Visit, the guide typically left informational pamphlets, contact information for REEP Green Solutions, and a sign or sticker for the participants' lawn or window, indicating they participated in the visit and reminding them of the key principals of the program (Slow it down, Soak it up, Keep it clean). When asked if the materials left with participants after the RAIN Home Visit were helpful, participants were split. Six (26%)

abstained from this question, and, of the remaining 17 (74% of total participants), ten (59% of those who responded) found it helpful, two (12%) of which only at the time, and seven (41%) others did not find it helpful. Of the total 23 participants, four (17%) could not recall materials being left at all after the visit. 21 (91%) participants noted 29 items in 7 categories that would have been helpful to have been left with, and those responses are noted in Table 4.2.5 below. Responses were varied, with a focus on desire for more specific information, sources, and examples (n=8; 28%), increased guidance for recommendations (n=6; 21%) and financial support, be that in pricing options, rebate information, or sources for discounted products (n=6; 21%).

<b>Table 4.2.5. Items participants would have wanted left with them following the RAIN Home Visit.</b>		
<b>Material that would be helpful</b>	<b># of responses</b>	<b>% of responses</b>
Relevant, helpful sources (online content, step by step diagrams and/or guides, contractor list)	8	28%
Guidance	6	21%
Financial support (sources, rebate information, pricing options)	6	21%
Nothing	5	17%
Sources of materials	2	7%
Residential property information	1	3%
Review recommended sources	1	3%
<b>Total</b>	<b>29</b>	<b>100%</b>

Participants were also asked what items they would recommend removing from the materials left after the visit, to which 15 participants (65% of total participants) responded. 73% (n=11) responded that they would not remove anything from the materials left while 13% (n=2) felt

there was irrelevant information that should be removed. This included information that did not apply to their property or was not feasible for their property. One participant (6% of responses) felt the stormwater credit information was not useful as it was too difficult to apply for, and another felt the small yard sign and/or window sticker was not useful.

#### 4.2.6 Report

The report participants received after the RAIN Home Visit highlighted priority areas for change, reminded participants of what items needed addressed on their properties, and provided website links for more information on various problem areas. The reports were e-mailed in digital format to participants a week or two after their visit. When asked what the main takeaways were from the report, participants most often mentioned permeable pavement (n=6, 14%), grading (n=5, 12%), downspouts (n=4, 10%), addressing unique property specific features (n=4, 10%), and increasing permeability (n=3, 7%), out of a total of 42 responses grouped into 21 categories. When asked what was useful about the report, 24 responses were recorded grouped into 16 categories. The comprehensive nature of the report was appreciated, as well as the level of detail, n=3 (13%) and n=2 (8%), respectively. Photos taken at the time of the visit were helpful, at n=3 (13%), but “nothing” was noted as useful in the same frequency, at n=3, (13%). Additional useful features can be seen in Figure 4.2.6a below. Information on various recommendations or specific items were noted to be useful by multiple participants.

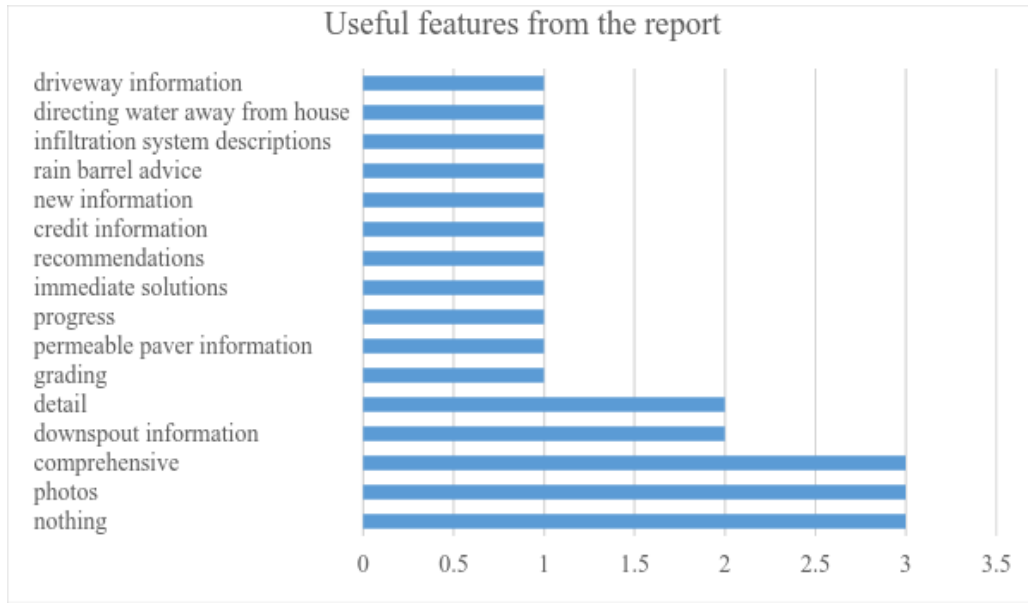


Figure 4.2.6a. Mentioned features that participants found useful from the RAIN Home Visit report.

When asked what was not useful or could be removed from the report, 19 responses were recorded in 8 categories, with “nothing” comprising n=10, 53%. Also mentioned was lack of applicability (n=2, 11%), too general or too much information (each at n=1, 5%), and irrelevant information (n=2, 11%). Conflicting information (from the visit with other sources), difficulty of some recommendations, and minimally impactful recommendations were also mentioned at n=1, 5% each.

When asked what could be added to the report, 29 responses were recorded in 19 categories most participants (n=7, 24%) responded “nothing”, while others wanted more information on the stormwater tax credit (n=3, 10%), connections with recommended contractors (n=2, 7%), or more details on specific items that were recommended (n=2, 7%). The remaining responses were quite varied, with 15 categories each having only one response (3% of total responses) and can be seen in Figure 4.2.6b below.

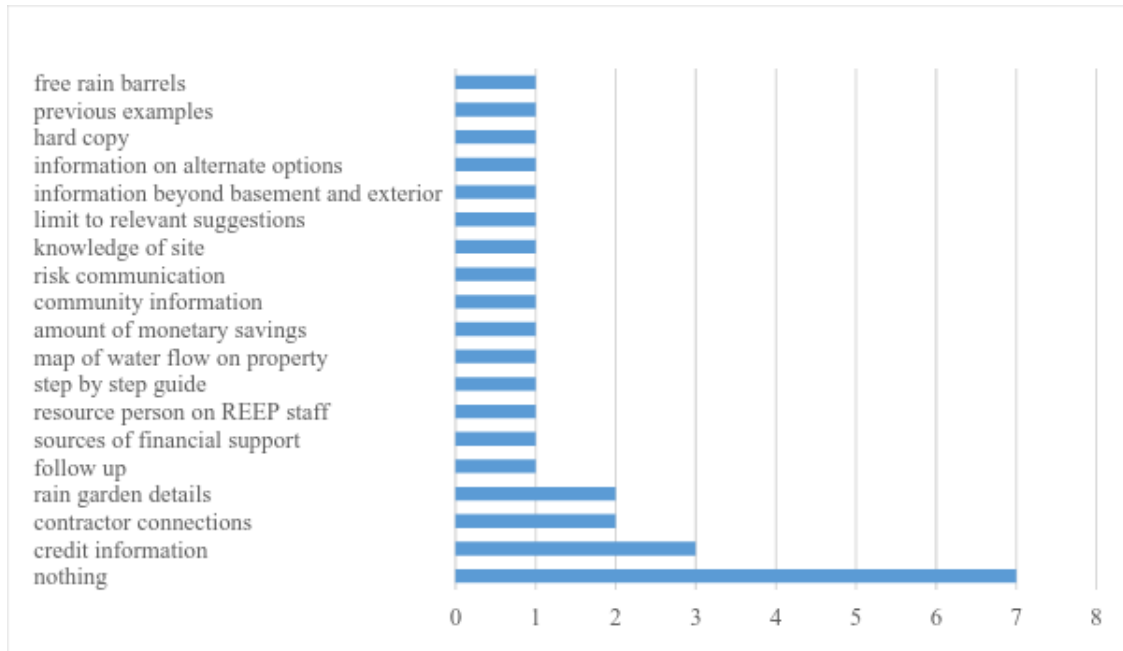


Figure 4.2.6b. Distribution of responses from participants for what could be added to the RAIN Home Visit report.

#### 4.2.7 Benefits & Barriers

##### 4.2.7a Personal and Homeowner

“Well, the first one obviously is to to protect your home. Um. That’s the biggest and and that is the single largest reason of why we went through what we did was to protect not just us but our neighbours and stuff like that. I mean, water is, I hear dripping water now and I get paranoid right? so and then we find out it’s just the sump pump going or whatever it’s, water is crazy it’s it’s amazing damage it can cause. So I think the the single greatest uh benefit is is obviously protecting your ... assets. ... beyond that, I mean, obviously there’s there’s environmental uh listen we’re we’re dealing in a in a world where, debated or not, but climate change exists and, um, you know it’s every every little bit that anybody can do to sort of help out is is, obviously a benefit, right?” – P11DH

Participants were asked to consider what the personal and/or homeowner benefits of better managing household stormwater issues might be, as well as what is preventing action on these changes and how to overcome those barriers. For personal benefits specifically, 50 responses



were made, grouped into 14 categories. Most frequently mentioned was the benefit of stress relief, at n=10, 20%, followed by financial benefits and protection, at n=7, 14% each.

“I think just the expense is the big thing...when you actually find out how much more does it actually cost this year [for water]... how much more taxes do we have to pay for sewage and water ... it seems like, you know, it doesn't seem to- they want to give us a straight answer as to how much... you have to pay it more for the region, more for the city, and what's the actual price that you actually have to pay for, for water and sewage and whatever? It seems to me to be quite confusing as to how much more it will actually cost for the next 10 years or whatever.” – P16SB2

Additional responses are shown below in Figure 4.2.7ai. Homeowner benefits were less varied, with 31 responses in 12 groups. The most common noted benefit was water reuse/conservation at n=7 (23%), followed by environmental responsibility at n=5 (16%). Distribution of responses can be seen in Figure 4.2.7aii below.

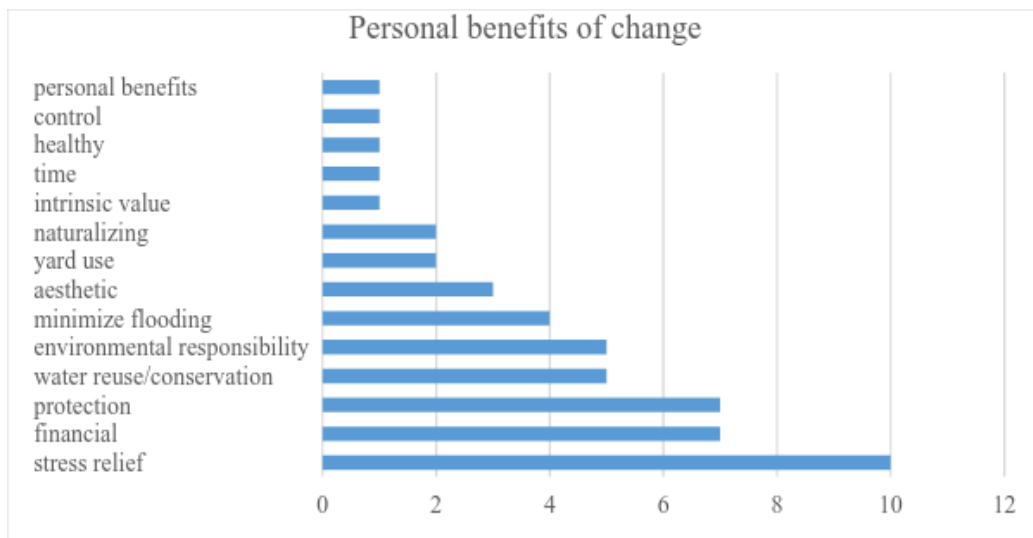


Figure 4.2.7ai. Personal benefits of changes as noted by participants.

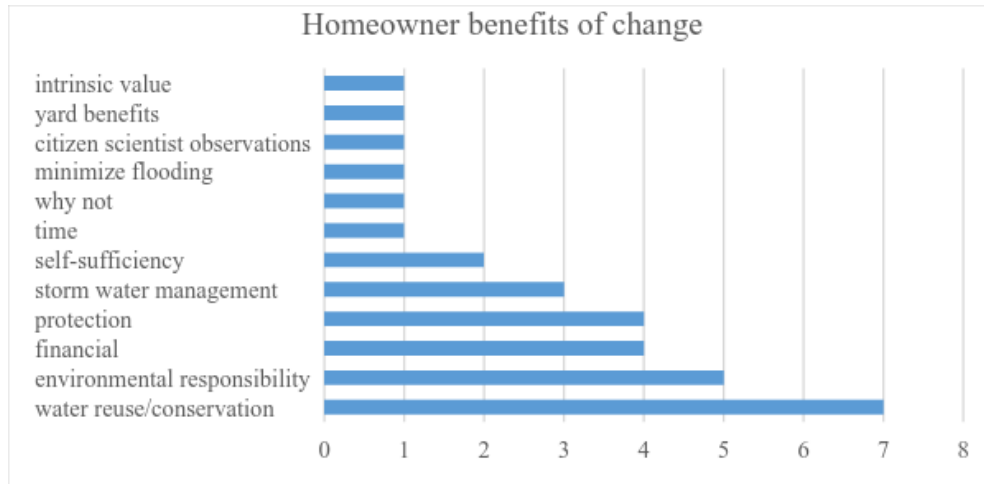


Figure 4.2.7aii. Homeowner benefits of changes as noted by participants.

When asked what might be barriers for homeowners to making the recommended changes to better manage stormwater on their property, 65 responses in 23 categories were collected. The vast majority of participants noted “lack of knowledge” and “cost” as barriers, both at n=15, 23%.

“We’re not wasting 10000 bucks on a new driveway we don’t need. That’s 10000 dollars we don’t have so, if we did or if we had won millions of dollars, that’d be different. We could make our permeable driveway, that’d be good, but, uh, I don’t think that’s happening right now. I don’t know we need a new driveway per se.” – P16SB2

Additional barriers are shown below in Table 4.2.7a.

<b>Barrier for change</b>	<b># of responses</b>	<b>% of responses</b>
Lack of knowledge	15	23%
Cost	15	23%
Time	5	77%
Ignorance	5	77%
Unhelpful personality traits	3	46%
Lack of connections to reliable help	2	3%
Location	2	3%

Feasibility	2	3%
Access to supplies	2	3%
Credit information confusing	1	2%
Lack of reminders	1	2%
Unknown expected costs/quotes	1	2%
Ongoing problem	1	2%
Aesthetic conflicts	1	2%
Resistance to environmental change	1	2%
Labour	1	2%
Relevance to individual	1	2%
Seen as city's problem	1	2%
Lack of urgency	1	2%
Lack of modeling	1	2%
Hard to see all of the problem	1	2%
Misplaced incentives	1	2%
Lack of interest	1	2%
<b>Total</b>	<b>65</b>	<b>100%</b>

When asked what was needed to overcome such barriers, 59 responses were given in 24 groupings – 16 of which only had one or two responses, comprising n=22, 37% total. The most common responses were that of funding, n=8, 14%, providing education, n=7, 12%, and showing examples of successful projects, n=6, 10%. Opinions on what might be helpful were diverse, and can be seen in Appendix D1.

“...without the crisis can persons build incentives you know incentive to change behaviour. Uh I guess I would say speaking from my own temperament and preference this lack of modelling like it’s made such a big difference to me that I have some friends who are environmentally active and more aware than me.” – P13CD

#### 4.2.7b Community and Municipality

Participants were also asked to consider the same questions for municipalities and communities: what the benefits are for these groups from making changes, what the barriers are preventing change, and what would help these groups overcome those barriers. 52 responses for benefits were recorded in 17 categories. The most common responses were financial benefits, n=8, 15%, protection of infrastructure, n=7, 13%, and protection of waterways, n=5, 10%. Responses are shown below in Figure 4.2.7b.

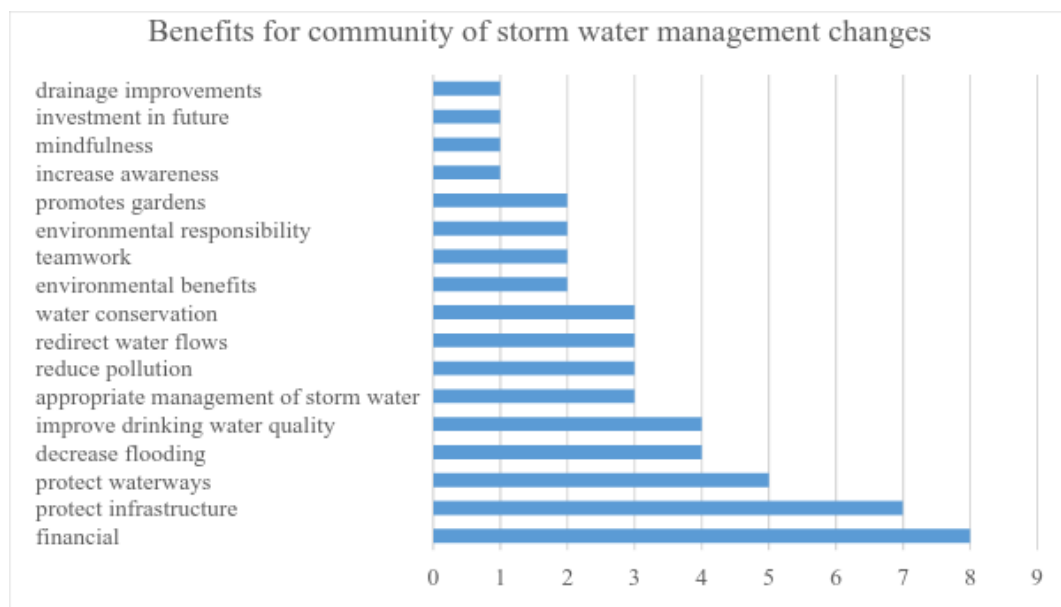


Figure 4.2.7b. Benefits noted by participants for the community if making positive changes to stormwater management.

The vast majority of participants noted “cost” as a barrier to better managing stormwater at the community and/or municipality scale, at n=13, 30% of 44 responses in 13 categories. “Lack of public support” and “municipal conflicts” were the second most common responses, at n=7; 16% each. There was a theme in responses relating to a lack of importance and urgency for implementing best practices of stormwater management.

“...if you could have some influence with, um, the city- whichever city it is- and how the stormwater’s managed there in the conservation areas, it would help, um. Expand

the program especially in small communities like New Hamburg that are still getting nailed because of all these leisure and pleasure vehicles in the water. Sorry, that's not the reason to have a conservation area.” – P15AK

Barriers mentioned were diverse, with seven groups having only one response, comprising 16% of the responses recorded. Distribution of responses can be seen in Table 4.2.7b below.

<b>Table 4.2.7b Community/Municipal barriers for change noted by participants and response rates.</b>		
<b>Barrier for community/municipal change</b>	<b># of responses</b>	<b>% of responses</b>
Cost	13	30%
Lack of public support (opposition to higher taxes, economic benefits unclear)	7	16%
Municipal conflicts (conflicting demands; bureaucracy; understaffed; inconvenient)	7	16%
Lack of communication, connections, mobilization	5	11%
Infrastructure complexity	3	7%
Lack of awareness	2	5%
Low cost of water	1	2%
Education	1	2%
Unclear how to resolve increasing water prices	1	2%
Nothing	1	2%
Lack of innovation	1	2%
Time	1	2%
Don't know	1	2%
<b>Total</b>	<b>44</b>	<b>100%</b>

To overcome the barriers noted, most common responses were increasing education, communication of costs, provision of appropriate incentives, clarification of savings/simplification of rebate process, and increased community involvement, all at n=4, 8%

each. This was another diverse response area, with 53 responses in 27 groups, 19 of which had only one or two responses, comprising 45% of total responses at n=24. Responses for possible ways to overcome the barriers can be found in Appendix D2.

#### 4.2.8 REEP Green Solutions Specific

Participants were asked a selection of questions regarding REEP Green Solutions specifically, particularly relating to how REEP could best support its community in future. First, it was asked what REEP could do to support participants in any future smaller changes they may want to make on their property. This could include rerouting downspouts, adding rain barrels, or other relatively low commitment changes. Participants were also asked what REEP could do to support them in larger changes that may be made in the future, such as adding a permeably paved driveway or more complex projects. For smaller changes, 35 responses were made in 17 categories, the most common being “specific suggestions for given recommendations”, n=5, 14%, and “nothing/not interested”, n=4, 11%. Distribution of responses can be seen in Figure 4.2.8a below.

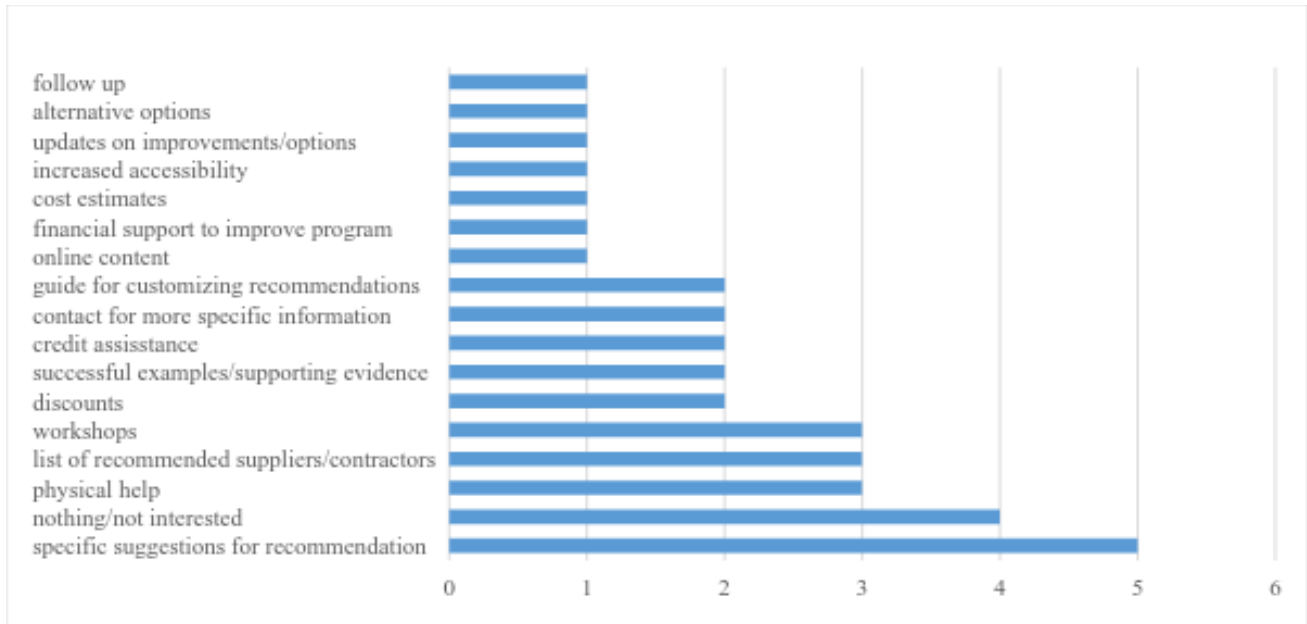


Figure 4.2.8a. Response distribution of ways in which REEP could help assist participants in future smaller changes.

For larger, more complex changes, 10 participants (43% of total participants) did not elaborate or add any different ways in which REEP could assist. Responses (15 in total, in 12 categories) that were collected for this question were similar to those made in the previous question. More information of various types and in various forms were desired by participants, particularly relating to recommended contractors (n=2, 13%), financial support (n=2, 13%), and alternative options (n=1, 7%). Distribution of responses can be seen below in Figure 4.2.8b.

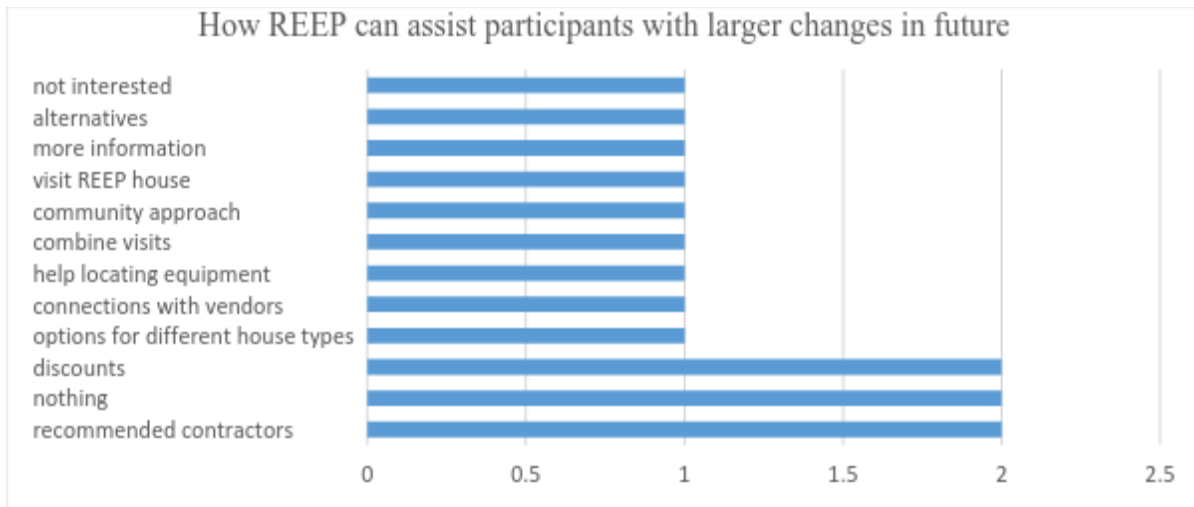


Figure 4.2.8b. Response distribution of ways in which REEP could help assist participants in future larger changes.

Participants were asked to consider if and how they would like to remain in contact with REEP Green Solutions. 26 responses were made, with two participants (9% of total participants) abstaining from this question. Number of responses per participant ranged from one to three items. Most commonly mentioned was the desire to stay in contact with REEP via e-mail, n=14, 54%. Many of these participants were mentioned that they were already on the REEP mailing list. Social media and follow-ups were mentioned as well, at n=2, 8%, for each response. The remaining six categories had one response each, comprising 23% of total responses for this question. When asked how frequently participants wanted to be contacted by REEP, 17 participants (74% of total participants) responded, six (35%) of which noted they found the current frequency of e-mails sufficient. Four (24%) wished to be contacted seasonally. Distribution of frequencies can be seen in Figure 4.2.8c below.





Figure 4.2.8c. Distribution of frequency of contact from REEP preferred by participants.

Participants were also asked if there were any other sources of support they would like to be connected with that could help them in any way regarding stormwater management in future. All participants answered with one to three responses, though nine participants (39% of total participants) did not indicate any other sources they desired contact with. The next most common desired contact was a list of recommended contractors, as shown in the quote below from participant P11DH who had thorough changes made to their property and direct contact with a contractor. This participant said they wished to be connected with:

“...a comprehensive list of ... contractors that’s readily available that are recommended by REEP because ... they have more experience doing it or... certified ... so for example, if we were going to do the permeable driveway, knowing which contractor would be the best choice in terms of, uh, uh of getting that done would be useful.” – P11DH

Two participants (9% of total participants) desired additional sources of support but did not know what or who that would be. Response distribution is shown below in Figure 4.2.8d.

“...if REEP could keep us informed on some of these issues like the insurance ... if REEP thought that the liberal government was making some serious changes or in a federal environmental policy that might impact us, sure ... Love to know.” – P13CD

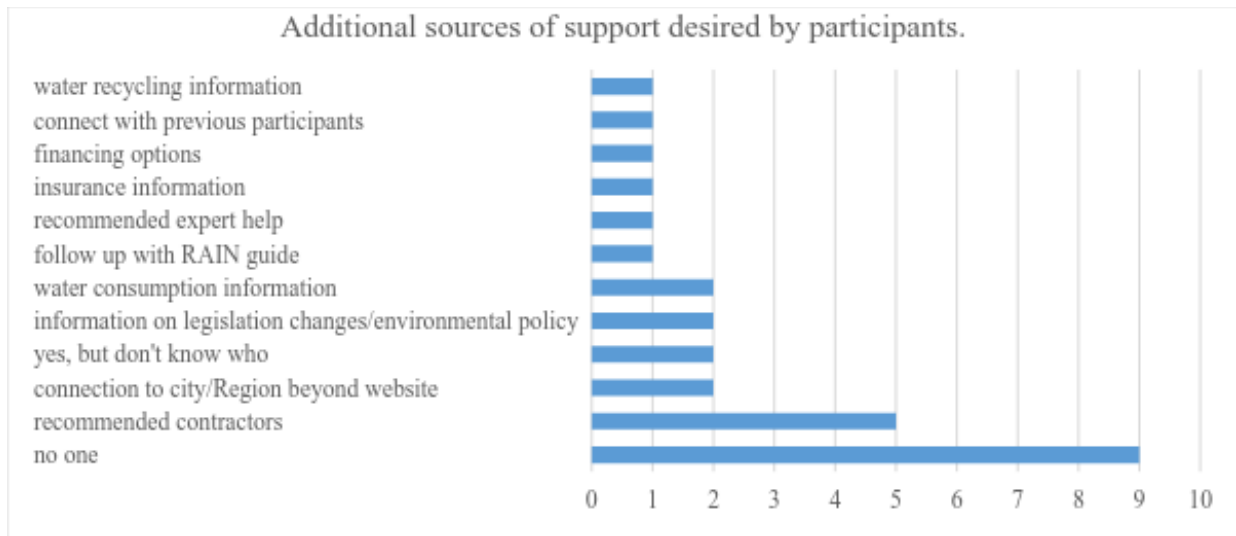


Figure 4.2.8d. Distribution of additional sources of support desired by participants.

Overall, the majority of participants were pleased with REEP’s work, hoped that work would continue, and/or wished there was more funding or power behind the organization.

P02CA: “...I think that they can keep on doing what you’re doing. I really like the ... house. So in terms of REEP doing stuff I think that ... the organization in this community is doing a wonderful job, we just need more REEPs.”

Interviewer: “Which means more money...”

P02CA: “Yeah, exactly, right? So that comes from you know I don’t know grants and all sorts of things. And uh. Yup. And it also just the recognition that that this can actually benefit the economy.”

### 4.3 Report Analysis

#### 4.3.1 Participant Performance Rankings

Following interview completion, access to the RAIN Home Visit Reports was possible and reports were consulted to compare and verify interview responses. Reports provided priority actions for participants, and the range is detailed below along with average performances and trouble areas of households. Distribution of this feedback per participant can be seen in Figure 4.3.1 below.

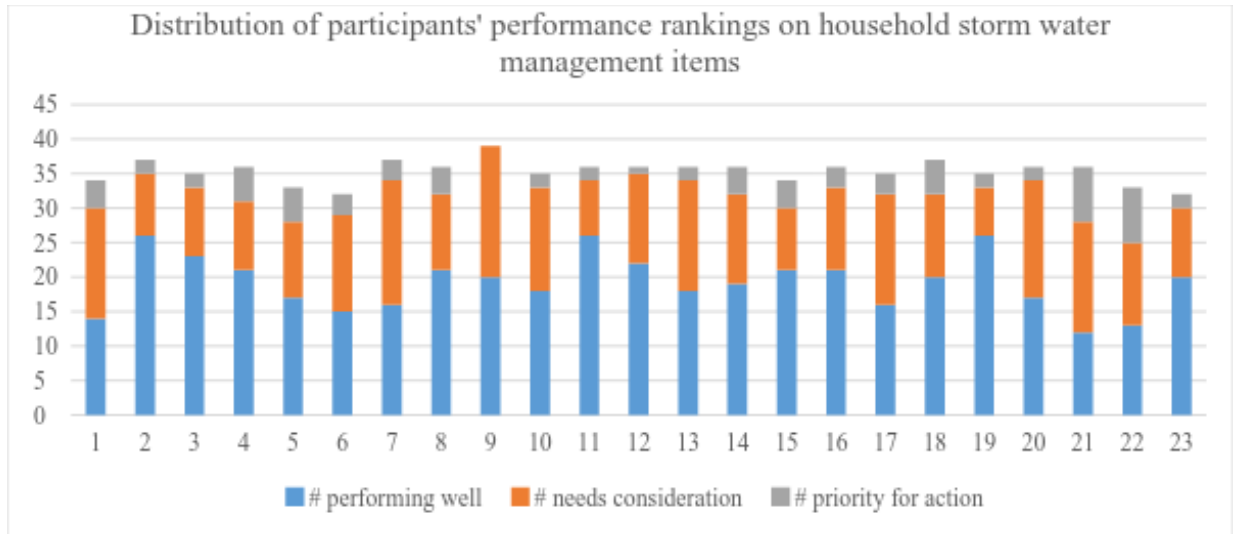


Figure 4.3.1. Distribution of participants' performance rankings on household stormwater management items from the RAIN Home Visit report.

Regardless of the number of priority for action items noted within the report, three to five priorities for action were noted on the first pages of the report for each participant. These typically included more specific actions tailored for the given property. The performance rankings were related to a standardized form with categories that all properties were rated on. This included permeability, window wells, stormwater grate, tree canopy, slope, grading, flashing, foundation, eavestroughs maintenance, downspout direction, downspout outflow, and more. Detailed priority recommendations can be seen in chart form in Appendix C.

#### 4.3.2 Inconsistencies

Oddly, the summary performance ranking numbers differed on 12 reports from that counted per category by the researcher. These 12 reports are for participant numbers 1, 5, 6, 7, 9, 12, 13, 17, 19, 21, 22, and 23. For example, the report for P1NM indicated 14 items performing well, 16 items needing consideration, and 4 priority for action items. When recounting the individual items, 16 were noted as performing well and 15 were noted as needing consideration. The alternate distribution for participants is shown in Figure 4.3.2 below.

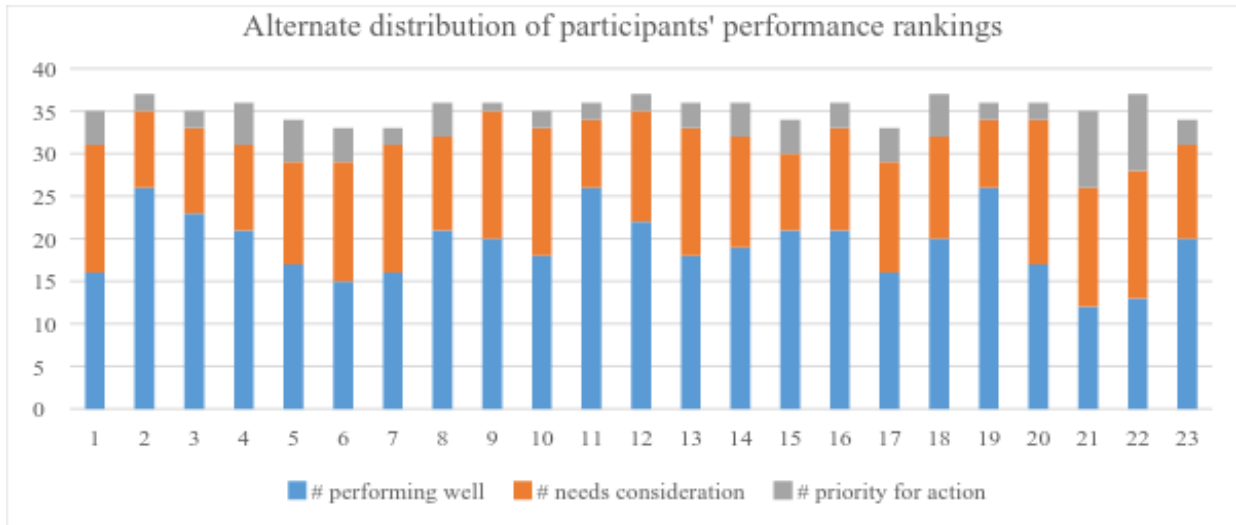


Figure 4.3.2. Alternate distribution of participants’ performance rankings on household stormwater management items from the RAIN Home Visit Report (differing participants are 1, 5, 6, 7, 9, 12, 13, 17, 19, 21, 22, and 23).

An additional issue arises from two reports in particular: P15AK and P17GB. P15AK had a particularly negative experience with the RAIN Home Visit guide, and did not allow the guide inside the building. As such, certain areas of the visit could not be assessed fully, such as the basement or evidence of flooding within the home.

“The person who comes into your home.....security wise that’s an issue. They don’t need to see every nook and cranny of your home and the...the type of questions that were asked already for the exterior, I was not comfortable inviting him in inside. But the person who comes out should know the geography of the land that you’re question- the person offering suggestions. So for example, Lauren, if you’re coming to my home, it would be beneficial for you to know the slope of the land, where the sewer run off is in my neighbourhood, where there’s a catch basin in case there are things catching there. Background knowledge for you so that if I ask you a question you can offer the help for me.” – P15AK

P17GB was a unique property, located in a more rural location than all other participants. This property did not have the same stormwater management infrastructure as the city properties, causing the participant some confusion as to why they were paying a stormwater fee for a service

they did not receive. Further analysis of these reports and the implications of these unique properties to this study will be provided in the following section.

#### 4.4 Sources of Error

While interviews were semi-structured and covered the same content, some sources of error and inconsistency are impossible to avoid. Initially, it was hoped that participants would discuss issues of protection and extreme weather insurance without being prompted, but after the fourth interview, a specific question on insurance was added to ensure data was collected for this area. Due to the nature of interviews and varying personalities of participants, some provided more detailed and lengthy responses than other participants. Efforts were made to encourage more brief participants to expand on their responses, but lengthy, detailed responses were not possible in all instances. Additionally, there could be concern with participants presenting an inaccurate description of their visit and experience, whether due to time passed or desire to present a particular image of themselves to the interviewer. For example, some may have been hesitant to bring up negative opinions of the program or areas where they did not excel due to embarrassment or courtesy. This was minimized as much as possible by assuring participants that the research was independent of the program, that responses were anonymous, and that the researcher was not an employee of the associated organizations.

## 5.0 Discussion

### 5.1 Perception of Risk and Behaviour Change

#### 5.1.1 Change in Risk Perception

### 5.2 Barriers to Implementing Household Stormwater Management Options

#### 5.2.1 Lack of Knowledge

#### 5.2.2 Cost

#### 5.2.3 Lack of Communication

### 5.3 Potential Resolutions to Barriers

#### 5.3.1 Education/Dissemination of Knowledge

#### 5.3.2 Funding/Incentives

#### 5.3.3 Community Approach, Expectations/Norms

### 5.4 Comparison to Successful Behaviour Change Programs: Community-Based Social Marketing

## 5.0 DISCUSSION

This chapter will describe in more detail the findings of the research, expanding on and providing interpretation for the results presented in Chapter 4. First, perception of risk and its relation to behaviour change will be discussed, followed by specific barriers identified for implementing those behaviour changes (that is, the household stormwater management best practices that were recommended to the homeowner during the RAIN Home Visit). Next, noted possible resolutions to those barriers will be discussed and compared to CBSM recommended key features and practices. Lastly, the program as a whole will be compared to CBSM, noting ways in which the program follows this framework and in ways in which the program differs. This will leave areas for improvement as well as key areas that should be maintained in future programs to provide most effective means of creating lasting pro-environmental behaviour change regarding household stormwater management. It should be kept in mind that the participant sample had many retirees, perhaps affecting responses due to ability, time, and resources available. In addition, all participants likely were at least somewhat interested in environmental protection prior to the interview as they had all participated in the RAIN Home Visit program.

### 5.1 Perception of Risk and Behaviour Change

As noted in Chapter 4, most participants did not feel that they were at risk for future damage due to stormwater or extreme weather, despite acknowledging extreme weather will become increasingly common with climate change. This could be due, in part, to the presumption of safety from never having experienced damage previously.

P16SB2: “We never really had an issue with water so much from our back backyard...”

P16SB: "... had we been having, um, flooding problems, we probably would have been more likely to follow through on the recommendations but because ...there's not the need, we're a bit lazy."

Behaviour change literature has shown that without direct experience, it is more difficult to create preventative behaviour for the given event (van der Linden, 2015). Without the direct experience, the individual does not perceive themselves to be at risk, and is less motivated to adopt preventative or proactive behaviours that are not already in their repertoire.

"...And the fact that we haven't had any trouble. You know. History shows that, I mean, we've had some pretty bad storms and, you know... we had a few things happen because of the eaves trough but once that's cleared up I don't I don't foresee any further damage or problems." – P05EN

However, when asked if participants were more or less concerned after the RAIN Home Visit, most participants' concern increased slightly (Figure 4.2.3a). Participants that made changes often felt that this left them prepared for future stormwater damage. It is interesting, however, that although participants did often recognize that increasingly severe weather patterns were likely, few connected this with increasing their own risk of damage. This can be seen in part as few participants were interested in insurance coverage for potential damage from extreme weather yet recognized a likely increase in extreme weather. It would be expected that if an individual is concerned of risk of damage in future, steps would be taken and preventative measures adopted to best protect one's self (Xiang, Hansen, Pisaniello, & Bi, 2016; Crane et al., 2012). Participants seem to feel that any changes they had made were sufficient to keep them protected even with increasingly extreme weather events. There could be several reasons for this. One is optimism bias, where an individual does not expect a particular negative event to ever happen to them and instead overestimates the frequency of positive events that will be encountered (Sharot, 2011).



P13CD: “I mostly think of these apocalyptic events [likelihood of damage from extreme weather] as happening elsewhere, Florida, maybe the mid west, maybe ... gulf shores area United States. It’s interesting how you sort of position ... it elsewhere ...”

P13CD2: “Well that’s where the main stories have been from – elsewhere. But, you know, we don’t have any reason to think stuff couldn’t happen here, right? I mean heavy rainfalls or tornadoes.”

P13CD: “Yeah but we don’t talk about that. I mean, we’re being stimulated into answering the question. But you and I don’t sit around and go, ‘oi vey there’s going to be a storm’. We don’t!”

P13CD2: “So we’re not worried nearly enough.”

If individuals spent their time worrying about all the possible negative things that *could* happen to them, it could be consuming and prevent daily functioning (Sharot, 2011).

For those that had not yet experienced flooding or damage from stormwater, they may not see any reason to expect any change to their experiences, despite acknowledging the potential for changing weather patterns. The reality, however, involves a changing climate which brings more extreme weather patterns and expectations of increased heavy rainfall events (Botzen, Aerts, & van den Bergh, 2009). Even properties that are seemingly well-prepared for past weather patterns may not be prepared for the changes that may come, as their strength is uncertain (Spence, Poortinga, & Pidgeon, 2011). For participants that had made changes to their property, there maintains a risk that they are under a false sense of security (Spence, Poortinga, & Pidgeon, 2011). Depending on what the priority areas of concern were, and what changes they had made, they may or may not be prepared for future heavy rainfalls.

Interviewer: “So with the changes that you did make...do you feel better prepared for extreme weather now?”

P08CL: “Yes! There’s still things that we haven’t addressed that we’d like to and...cost is the reason. I’m on maternity leave and we have no extra money...So

there are probably 3 or 4 projects that I would really like to do that we're just kind of hoping don't become a problem before we can address them. But we did invest probably between 8 and 10 thousand dollars in improving our...water management system."

The most often adopted changes were those that were more affordable and that provided more direct benefits to participants. For example, introducing window wells or regrading the yard to slope away from the building directly decreases the chances of flooding into a participant's home. Homeowners then reported feeling better protected. What is unclear, though, is where the water has been diverted to. In heavy rains, water may now be flowing onto a neighbour's property, potentially contributing to future flooding or problems on this new location.

Redirecting or extending downspouts helps adjust where water would flow off of a participant's roof during rainfall events, yet this may or may not help minimize stormwater impact on the storm sewer system (REEP, 2015; Waters, Watt, Marsalek, & Anderson, 2003). To reduce stormwater runoff into storm drains, properties must increase the amount of water that is being diverted from these drains by, for example, increasing permeability on the participant's property. As increasing permeability tended to include more expensive options (permeable driveway, rain gardens), less of these recommendations have been acted on. As such, excess water may be diverted off of a homeowner's property but continues to ultimately run through streets and into storm drains. City infrastructure then takes on the stormwater runoff despite the need for repair in this system (Stormwater Management Program and Funding Review, 2009). The runoff, ultimately, ends up in stormwater ponds or natural waterways, risking pollution and harm to plants and animals interacting with these sources (City of Waterloo, 2015). While not a problem directly for the homeowner, it is a problem for the community and environment at large.

If participants do not feel they are at risk, it greatly decreases the likelihood that they will make changes in their behaviour to better protect themselves (Xiang, Hansen, Pisaniello, & Bi, 2016; Crane et al., 2012). As mentioned, they may feel the changes that they have made are sufficient for their protection, when in reality they may still be at risk or contributing to stormwater management problems. With low perception of risk or a false sense of security, behaviours are less likely to change towards pro-environmental behaviours.

As described in Chapter 2, linear models of behaviour change that presume change comes from increased knowledge seem not to apply in this case. Participants were given a thorough visit and report regarding changes required, but this was not enough for all to adopt prescribed pro-environmental behaviours. Prosocial models seem to have some application here, as participants who had friends who exercised pro-environmental behaviours were more likely to have completed more options with their property.

“...it helped that my friends, I’m thinking of Sarah and Julian, over on [street name] they kept a kind of running commentary on their own, it was kind of fun to talk about. Pretty practical topic so if you’re not very practical like me you know, ‘well what do you do with’ you know, it’s like recipes or something. It’s something nice and concrete. I think it’s encouraging when other people are up to the same darn thing. And they kind of know a thing or two more than you do and you kind of exchange the information.” – P13CD

As noted, several participants desired a community approach to help hold them accountable and to have easier access to sources of support. This fits with prosocial models and CBSM as both emphasize the need for community, public commitment, and accountability (McKenzie-Mohr & Smith, 2000; Kollmuss & Agyeman, 2002).

Barriers to pro-environmental behaviour found in this study follow similarly to those “seven dragons of inaction” described by Gifford, 2011. Table 5.1 below describes this pattern.

<b>Table 5.1. Gifford’s seven dragons of inaction in relation to the RAIN Home Visit program.</b>		
	<b>Concept</b>	<b>Stormwater example</b>
<b>Limited cognition</b>	Lack of knowledge	<p>Many participants expressed lack of knowledge/information.</p> <p>“When the program started they said it was they were collecting this money to fix the stormwater pipes. Stormwater system. Infrastructure, I don’t even know what that word means.” – P17GB</p>
<b>Worldview</b>	Background does not include or conflicts with environmental concerns	<p>Many participants not raised with ideas of harvesting rain water, but those that did completed more recommendations or were already better prepared.</p> <p>Interviewer: “Why initially did you choose to have a rain home visit?”</p> <p>P05EN: “...I strive always to be as environmentally responsible as possible...So, let’s see what we can do with my water. Uh. Initially I- I read up on all this stuff and I read about it. And I was interested in ... the general concept and ...what I can do? I grow flowers, I have fruit trees, I have children that like to play with water and, and city water’s expensive and rain water’s good and so, it all seemed a useful process.”</p>
<b>Social comparison</b>	Comparing behaviour to that of leaders and peers	<p>Not many environmental role models for participants to follow, but those that did have environmentally conscious peers were able to complete more recommendations.</p> <p>“Well I found the rain barrels barrels of fun and I initiated that project and my friend from Little City Farm helped me build the garden. And that was</p>

		<p>really a nice project. Maybe this one is a little less glamorous.” – P13CD</p> <p>“...and it helped that my friends...kept a kind of running commentary on their own, it was kind of fun to talk about. Pretty practical topic so if you’re not very practical like me you know, ‘well what do you do with’ you know, it’s like recipes or something. It’s something nice and concrete. I think it’s encouraging when other people are up to the same darn thing. And they kind of know a thing or two more than you do and you kind of exchange the information.” – P13CD</p> <p>Interviewer: “Are there any other key sources that you’d like to be connected with? ...”</p> <p>P08CL: “Yes, but I don’t know what they are. Yeah, network me up.”</p>
<b>Sunk costs</b>	Pre-existing investment in conflicting behaviour	Some participants had already repaved driveway in asphalt, decreasing likelihood of repaving soon in an expensive pervious material.
<b>Discredence</b>	Distrust in source of information	<p>Several participants noted receiving different information from different sources and/or not knowing that companies would treat them fairly/honestly in what was charged.</p> <p>“We were getting conflicting advice about window wells so we just kind of stopped asking questions after a while... [It would help] if I knew who to trust to call to get some help. ‘Cause ... we hire stuff out, we don’t try to do everything on our own... just the trying to figure out who to call and trust I find difficult.” – P10JH</p>

<b>Risk</b>	Potential negative consequences of changing behaviour; unsure change worthwhile	Most changes required some form of investment, which, depending on the change, could put the homeowner at financial risk or increased exposure with large changes conducted on property. “I just wanna make sure that I get one that I’m happy with, and it has a cover and it kind of blends into the house. I didn’t want, really want to stick a, you know, bright green one out the front of the house. So, yeah. But again, that’s, that’s just simply on me.” – P19LT
<b>Insufficiency</b>	Change in one area counteracted by lack of change or opposing behaviour in another area	Although many participants noted adding rain barrels or redirecting downspouts, some do not empty their rain barrels before the next storm and it is unclear if downspouts are redirected in the most beneficial way. P17GB: “A lot of the time it’s depending on how much rain you get, if there’s, if the rain barrels are full, and then it rains the next day, I’m not running out there and taking, you know?” P17GB2: “Emptying them, and then letting them get full again. That doesn’t make any sense.” “If we have a real downpour or long period of rain, and your rain barrel’s full, it’s still, overflowing a bit. Not quite as bad maybe as it was but...I don’t know how you deal with that. I know you’re supposed to empty those rain barrels but when you have periods where it’s raining a lot...it’s kind of like, ok, I’m not gonna water with ‘em, right?” – P21RL

One motivator for change is the desire to leave a better world for future generations. According to the UN Sustainable Development Goals, inter- and intra-generational equity is something that must be valued and pursued if the planet's resources are to be utilized sustainably (UN, 2015; Raworth, 2012). Some participants recognized the need to consider future generations and conservation of resources:

“...[by managing stormwater appropriately] we leave a better world for our, our grandkids and stuff like that because, you know, um, and we're such an excessive society right now, just learn to live, kind of, within our, everyone, that there'd be enough for everyone, only use what you need.” – P16SB

#### 5.1.1 Insurance

“And maybe not 'cause you've, they're going to say it was an act of god but in- they're not going to give you any coverage anyway.” – P10JH

“Insurance is a piece of paper. Pieces of paper don't protect you. You can stand there outside in a rain storm, put a piece of paper over your head and you're still going to get wet.” – P15AK

Participants were asked about their current insurance relating to extreme weather damages and if they would be interested in additional coverage. Many participants exhibited a distrust, dislike, or negative association with insurance companies, and were reluctant to commit to the consideration of additional coverage, what it might include, or what it might cost. This could decrease the likelihood that insurance companies could provide coverage plans for homeowners in future regarding stormwater and/or flooding protection. It may require these companies working to improve their image and reputation with citizens, or offering particularly attractive plans. In addition, many participants did not know what their home insurance covered – another area of interest to insurance companies. Other participants felt they would not need this sort of

insurance coverage, having a low risk perception of future stormwater damage. If they do not feel at risk, they would not see the use in purchasing additional coverage or protection. A stronger behaviour change program could be of use in this area. SARF notes that social norms aide in communication of risk (Kasperson et al., 1988; Renn, 2011). With an effective CBSM program, sustainable household stormwater management would become the norm, demonstrating to neighbourhoods that there is indeed a risk from improper stormwater management, so, perhaps, additional insurance coverage would be worthwhile.

When asked for an estimate of what a participant would be willing to pay for extra coverage, most responded that they would expect it be no more than an additional 10% of their current coverage costs. Of those that considered additional coverage, a theme emerged with participants desiring coverage based on their level of proactive measures. That is, if a homeowner had a certain amount of preventative measures included on their property, they would expect a lower insurance rate as they are proactively attempting to protect their property. This would be a way to lower additional costs for the homeowner, yet still provide protection from extreme weather events – perhaps making the plan more attractive to homeowners. However, many participants felt that if they were to install sufficient proactive stormwater management tactics, they would no longer be at great risk of stormwater damage. If a homeowner feels protected by the changes that they have made to their property, they may be less likely to seek out additional insurance coverage. This reconnects to the dilemma of who is responsible for covering the cost of extreme weather damage in a non-emergency event. Even with preventative measures installed, there remains a chance that extreme weather could cause damage to a property. Even in emergency cases, where disaster relief programs may cover costs, there maintains the psychological damage and loss of time and productivity due to the damages and their resolution.



## 5.2 Barriers to Implementing Household Stormwater Management Options

“Oh boy, that’s a big sell. Because ... they would really have to ... be personally motivated and, unless there is um a crisis ... or whatever that would impact them and that would ... really force them to see it. I...I don’t think...where would that motivation come from you know?” – P06SC

As noted in the results section, the most common barriers encountered by participants were cost, property specific obstacles, and lack of knowledge. Also mentioned was lack of connection with additional resources, such as a list of recommended, reliable contractors. This relates to the aforementioned barriers to change: individuality, responsibility, and practicality (Blake, 1999) and to barriers found in a similar study examining uptake of permeable driveways (Cote & Wolfe, 2014). Some participants were limited by their sense of responsibility - some did not feel they could make a difference, that their actions would be impactful enough to matter, or did not feel they had control over stormwater. Relatedly, some participants did not believe the governing bodies would be able to make pro-environmental choices, leaving the participant feeling powerless and discouraged. Overall, a lack of communication hindered participant follow through of recommendations, as many did not know where to access additional information, resources, assistance, or how to go about the recommendations made. This links to participant’s feeling a lack of control over ability to make changes that matter. Participants often mentioned lack of resources and lack of ability to make changes, which ties to the barrier of practicality. Individuality was a barrier for some participants, as some did not have the motivation, inherently or from incentives, to act on the recommendations that were made. Relatedly, some participants simply forgot about making the recommended changes, as it was not a pressing issue and there was no consequence for lack of participation. This is where follow ups and appropriate incentives could be of great use. Research has shown that minimizing barriers to implementing a

change in behaviour is important for that change to be successful. As such, this section will focus on the most common noted barriers for participants, before touching on methods to overcome those barriers. The latter will be addressed first from participants' suggested methods and then compared to methods that have shown success in past.

### 5.2.1 Lack of Knowledge

In Chapter 2, it was mentioned that one approach to behaviour change is extensive education (Kollmuss & Agyeman, 2002). The success of this approach relies on the depth and immersion in educational content. While the visit provided much information for the participant, it seems it was not as usable or accessible as it could have been. Some felt overwhelmed by the amount of information presented, while others felt it was not enough. Often, participants desired information specific to the issues on their property that they faced, and did not want the extra information that was not applicable. Participants did not want to sort through the many provided web sites to find the information that was relevant for their specific issue.

“REEP is really good at providing ... resources for solving the problem on your stuff. Um, I find that in some cases if you give only one or two choices, it actually facilitates change faster...So, maybe if they had built in their home visit system, um, somebody that was working to help network them with specific people to help them. Not just leaving it up to the, uh, the residence owner but to go, ‘ok. Well, do you mind if I put you in touch with this person, they’re interested in this’ or whatever.” – P08CL

Participants not only felt overwhelmed by information, but also felt they were lacking key details for specific upgrades, for example, where to locate the necessary materials and tools required for these changes. Participants were not only unsure how to contact companies to help with improvements but also how to identify if a company was worthwhile to work with for their desired change.

“...they weren’t allowed to promote specific products and companies... he would say, ‘Well, there are products but I can’t really name products’ and that kind of stuff...I think that was probably one thing that I would have found a lot more useful out of the program... A lot of these companies too I find you don’t know if you’re getting reliable service and if it’s worth what you’re spending ... ‘cause part of it seems like it shouldn’t be that complicated to do yourself but then at the same time ... it could put me in a dangerous position.” – P01NM

A better approach, perhaps, could be to have specific information and guides for each recommendation, and only leave with participants the information that is applicable to their specific issues.

“...so that’s part of the reasons I just didn’t have information on it. So...if they have more specific recommendations ... ‘cause I had somewhat of an interest to do stuff but I’m not like, 100% like I’m I’m not committed to it. So if they had specific things then I think that would help me out a lot more. ‘Cause I have a lot of other things that I would rather do.” – P01NM

Prior to the visit, separate packages could be prepared relating to various issues (i.e. implementing a rain garden, contracting a permeable driveway, maintaining rain barrels) and only the relevant packages would be left with the participant after the visit. More options will be discussed in section 5.4.2 with direct comparison to CBSM requirements.

### 5.2.2 Cost

The cost of recommended changes was often mentioned as a barrier to acting on the changes, which links to the barrier of practicality (Blake, 1999). Many participants desired extra funding of some kind, whether through grants, tax rebates, discounts on materials, or cheap/free labour.

“Oh, I don’t know how you’d ever get the time. ... If you’re working, you don’t have the time, and if you’re retired you don’t have the energy [laughs] Um, I think if there were some kind of ... discount for doing some of these things, or some help with the cost of it. ... Having people come out and have them do it for you?” – P18JB

“Like when you have a kid like my wife and I both work full time so, then having time after work even to call people...a lot of people do things during the week and...you don’t have time to be at home to like meet someone to ... quote for an eavestrough ... The other thing is money.” – P01NM

Although there exists a stormwater credit in the form of a tax rebate, the application process was too confusing and too complex for many participants to bother applying. Additionally, the amount of savings a participant could receive from this rebate was too minimal to be worthwhile for many participants. While the incentive is intended to be a motivational tool, it fails as it is not an appropriate incentive for the target audience. It does not relieve the financial stress of making stormwater management improvements nor does it encourage participants to change their behaviour by acting as a motivational tool.

“So in the end, it was almost a \$10000 project [referring to upgrades since the visit]. I don’t know if the government would like to assist with those type of projects, that would be lovely. A discount on our stormwater management, which is what, 8 dollars a month? Yeah, no [disapproving]” – P14MJ

Effective incentives will be discussed in Section 5.4. Compounding the barrier of cost with a low perception of risk, even minimal costs seem less worthwhile. An additional factor that complicated costs was that participants did not know what to expect for costs of various recommendations. Not only did participants not know where or how to access and put recommendations in place, but they did not know what a reasonable, expected cost of those recommendations might be.

“When they’re going through these recommendations if they had maybe, and it doesn’t have to be a specific price list, but rough ideas, if they’d even gone out and gotten a few quotes of what typical things cost. Like, ‘oh a rain garden with these

types of plants should cost you, like 300 dollars' or...um, I think that would be really helpful. Especially for your specific location.” – P01NM

Participants did not feel prepared to estimate what the cost of recommendations would come to, and so felt unprepared to inquire about services from professionals as many did not want to be taken advantage of or waste their time and money. A lack of knowledge permeates the barrier created by cost, making it even more difficult for participants to act on the given recommendations. This practicality barrier is closely tied with a lack of communication, as, perhaps, improved communication could also help improve the knowledge exchange from guide to participant.

### 5.2.3 Lack of Communication

An issue with communication that became apparent in this study was in the language used to describe recommendations to participants. In many cases, participants sought more specific directions for what changes they needed to make, and less information on aspects that were not relevant to their issues. This is illustrated by the following interview excerpts:

“I would have liked the visit to have been more practical and more um, sort of hands on ... to me it was just too ... theoretical...Yeah, it was very, very general.” – P06SC

“I think, like, really clear diagrams or step by step- if you're going to build a rain garden, this is what you need to do so we're not left then going to the internet to figure it out 'cause then you get a zillion pieces of information. And, you probably can't do this at REEP, but if they could say, 'these companies are really well versed in stormwater management, or landscaping'.” – P10JH

Participants needed more concise information applying directly to their issues and clear guides to how to resolve those issues. Additionally, there was minimal to no follow-up with participants following the visit – direct communication ceased after the delivery of the

report. Behaviour change programs stress the need for follow up to remind participants of the actions they have (ideally) committed to (McKenzie-Mohr & Smith, 2000). This also makes change easier for participants as it provides someone knowledgeable of the process easily accessible and available for answering any questions that may arise. Additionally, the more a desired behaviour is demonstrated as a social norm, the more likely others are to adopt that particular behaviour. Being that this program is in early stages, effective household stormwater management has not been the norm for most neighbourhoods. If and when it is, this will help encourage other homeowners to follow suit and adapt their behaviour.

### 5.3 Potential Resolutions to Barriers

“If everybody ... makes conscientious efforts to improve the way that water moved through their property, then we would be well ahead ... of the game when, when we have to really start worrying about water conservation.” – P08CL

This section will break down potential resolutions for barriers in implementing household stormwater management strategies. The resolutions described are those most often mentioned by participants and those which are key requirements in successful behaviour change models: education; appropriate incentives; community approach (McKenzie-Mohr & Smith, 2000).

#### 5.3.1 Education/Dissemination of Knowledge

As mentioned above, the existing program has had difficulty communicating the necessary and desired knowledge to participants regarding best management of stormwater on their properties. Whether it is too much information, inaccessible information, or not enough specifically applicable information, participants have been left feeling lost. Appropriate education and dissemination of knowledge will help to overcome the barrier of practicality and individuality, noted by Blake, 1999.

Multiple participants desired to access material online, for various reasons. Some had young children, family members to look after at home, or too busy schedules to make it out to educational workshops or seminars help by REEP. Similar, some did not have the time to search through documents for the information they specifically needed. Organizing information and tutorials online could help these participants access content needed and help them to implement the changes suggested at the visit.

“You know what I think is really great? Is online content. That does the same thing that workshops do. Especially, you know, somebody’s who’s interested and stuff but has 3 children [children arguing] can’t go to the workshop... But part of me ought to learn about this stuff and I have all the content available to me online, whether it’s like webinars or whether it’s, uh, short videos, just, helpful online content is absolutely great.” – P08CL

An alternative or addition to online content could be a specific, designated resource person that participants could contact following the visit. Ideally, this resource person would check in on participants to assess their progress and to assist with any troubles that the homeowner may have. This fits with the follow-up component of successful behaviour change programs (McKenzie-Mohr & Schultz, 2014).

“Actually a resource person who ... would come out and look at our property and say, ‘ok this is the best place that for you to put rain barrels’ or um, ‘this is how you would make a rain garden and this would be a good spot for it and this is how you would go about doing it’ ... he wouldn’t have to do it himself but at least someone who could give us those kind of practical helps.” – P06SC

In fact, in RAIN Home Visits going forward, REEP Green Solutions has now implemented a RAIN Coaching program, where an informed stormwater ‘coach’ will be visiting homeowners on multiple occasions to assist with the improvement process (Gilbride, 2016; REEP, 2016).

### 5.3.2 Funding/Incentives

“...if there could be... the benefits of doing all that work ... laid out in a way that, you know, you sort of felt like, ‘ok this is good to do because...’ or if there were rebates or other sort of programs in effect so that you kind of got rewarded for doing it again. Like I said, for us the reward was how rain wasn’t coming in the house, right? So we were motivated but in our last house, I don’t know if we’d have gone to that much work because we weren’t having those kind of issues.” – P14MJ

As mentioned previously, cost was a major practicality barrier for participants in following through on recommendations made during the RAIN Home Visit, and the stormwater tax rebate provided was too complicated and too minimal for participants to bother applying for. Multiple participants desired funding, which could be possible through municipal or provincial governments, but there must be demand and pressure to do so. Appropriate incentives for homeowners could be determined by surveying various neighbourhoods and determining what are motivating factors for the given area. Some areas may value community effort and cohesion, some may most highly value financial savings, and some may value recognition of doing something environmentally conscious. Matching incentives for a given area is integral for success in pro-environmental behaviour change programs (McKenzie-Mohr & Smith, 2000). This will be discussed further in relation to CBSM in Section 5.4.

### 5.3.3 Community Approach, Expectations/Norms

“Instead of focusing on individual homes, it would be amazing if REEP worked with neighbourhood associations or if REEP worked with full streets or communities. And engaged a group of people to make changes... we’re doing what we can to improve the way that water runs through our property ... but we have neighbours that either have no idea or they could care less and it’d be nice to see ... other kind of like-



minded people on our block and then we can all go through it together so that we feel ... supported and and enthusiastic.” – P08CL

Fitting with what is involved with successful behaviour change programs and CBSM, some participants noted the desire for and benefit of a community approach to stormwater management. This would allow neighbours to hold one another accountable to their commitments to improve their properties and to better manage stormwater. This could also help relieve some pressure or demand the REEP could face from homeowners seeking assistance with recommendations. If other homeowners physically nearby to them, that they likely are at least somewhat acquainted with, are doing similar things at the same time, there is the opportunity to combine their knowledge and resources to accomplish the changes that were suggested.

“I think it’s encouraging when other people are up to the same darn thing. And they kind of know a thing or two more than you do and you kind of exchange the information.” – P13CD

Furthermore, if a portion of or an entire neighbourhood is addressed at the same time, at least for that immediate area it will become more of an expected act to manage stormwater appropriately on one’s property. With more of a community adopting these behaviours, it would become more of a social norm. This would prevent regression towards a mean that does not hold effective household stormwater management as a norm (Dwyer, Maki, & Rothman, 2015). This, too, fits with successful behaviour change programs.

#### 5.4 Comparison to Successful Behaviour Change Programs: CBSM

As described in Chapter 2, CBSM provides a valuable guide to creating successful pro-environmental behaviour change programs. As such, the RAIN Home Visit program will be compared to this guideline to determine areas for improvement, what factors to maintain with the

program, and what factors may be hindering or not necessary for the program’s success. To reiterate, CBSM behaviour change tools include commitment, social norms, social diffusion, prompts, communication, incentives, and convenience. Table 5.4 displays the tools noted in the existing program and those recommended to enhance future programs.

<b>Table 5.4 Synthesis of CBSM tools used and recommended for future programs.</b>		
<b>Tools currently used by RAIN</b>	<b>Barriers Addressed</b>	<b>Benefits Addressed</b>
<b>Commitment</b> Participation in program	Lack of awareness of sustainable household stormwater management options	Inform homeowners and set some expectation for participation in program and adoption of behaviours
<b>Social diffusion</b> Yard signs & indicators of participation	Novel behaviours difficult to adopt; lack of modeling	Attempt to increase normality of new behaviours and inform community of engagement in such behaviours; methods inappropriate for target audience as most did not engage in this step
<b>Communication</b> Dense report Information provided during visit	Lack of knowledge	Informative; provide homeowners with necessary information – yet overwhelming
<b>Incentives</b> Stormwater tax credit	Lack of motivation; inappropriate incentive (credit too minimal and too complicated)	Motivation (limited)
<b>CBSM tools recommended</b>	<b>Barriers identified</b>	<b>Benefits identified</b>
<b>Commitment</b> Public, written, ongoing	Lack of uptake/maintenance of changes	Public commitment helps hold homeowners accountable; increase expectation of desired behaviour in place
<b>Social norms</b> Community approach will aide in normalization	New behaviours; change of lifestyle; conflicting	The more the behaviours become normalized and expected, the more likely homeowners are to follow through and

Targeting a group helps hold others accountable	current normative messages	maintain changes. By increasing normality of desired behaviours, or at least appeared normality initially, behaviours easier to adopt
<b>Social diffusion</b> Community approach	Lack of community	Targeting a community provides increased pressure, reminders, and support to stick to commitments
<b>Prompts</b> Phone and in-person reminders RAIN Coach check-ins	Forget; lack of follow-up	Remind homeowners to change; check in on homeowners to track changes, note difficulties, and provide assistance
<b>Communication</b> Clarify, provide specific material for homeowners, written and verbal	Too much information; mixed messages	Clear information targeted per homeowners will be more useful and more clear; clarification and review of materials will ensure consistent messages provided
<b>Incentives</b> Identify alternate incentives of value to homeowners Indicate monetary savings from changes	Cost	Appropriate incentives will encourage behaviours and make change easier
<b>Convenience</b> Minimize identified barriers Identify alternate methods for homeowners to conduct changes	Confusion; Lack of knowledge	Clear directions and support will make changes easier for homeowners; implementation of previous tools will make behaviours easier to adopt

“Laziness. They’re lazy. People are too busy. And education, I mean, they don’t know. I mean I thought I was pretty up to date on what to do with the water but I ended up learning a few things. I was a little surprised actually.” – P14MJ

Initially, the RAIN Home Visit program has clear behaviours that are desired as well as those that are undesired. This is an important first step for a behaviour change program, and these

behaviours must be easy to understand for participants. While the behaviours were often described within the report, due to the novelty to some participants, more thorough explanation was needed. As mentioned, participants were confused by some recommendations or unsure how to follow through on the desired change. Going forward, increased clarity on what change is desired and *how* to go about that change would be beneficial. Additionally, identification of the most impactful behaviours may be beneficial for both the program to stress and for homeowners to be aware of. Some participants expressed a desire to know what change would be most worthwhile, so as to know where to focus their energies. While the report notes “Priorities for Action”, a clear explanation for these items would be beneficial, as it is evident participants are unsure. Furthermore, it would be helpful to consider the probability and permeability of the behaviours chosen. That is, how likely homeowners are to adopt a particular behaviour and how much that behaviour adoption will permeate into their surrounding environment. For example, the high cost of installing a permeable drive seems to be too large a barrier for participants to overcome. Including this as a desired behaviour change may turn off participants at it is too large to conceive as possible, perhaps decreasing openness to other changes. Permeability relates to how visible the behaviour change is. For example, installing rain barrels at the front of house downspouts would be quite visible, but a rain garden in the backyard would not be. This factor is much more variable for the given program, as each property is unique in layout and in what may be required.

The RAIN Home Visit program itself does not specifically identify barriers for participants, and the benefits are not clear to all participants beyond a vague sense of ‘doing good’ for the environment. While participants were able to identify some barriers and benefits of improved stormwater management, these are not addressed by the program itself. It would be worthwhile

for the program to revisit their literature to emphasize the benefits of participation for homeowners, as this could increase uptake. By considering the barriers noted in this study and in the earlier survey by REEP, methods to counteract these barriers can be implemented in further versions of the program. For example, should a particular participant not have room on their property to extend their downspouts away from their foundation, a suggestion could be made to install extra rain barrels for them to drain into instead, overcoming some individual barriers. These particular methods would need to be suggested on a more case-by-case basis, as barriers for homeowners vary greatly from property to property, and person to person. The findings from this research can help serve to guide adaptations to the program going forward, or in development of stormwater management programs elsewhere.

Some of the recommended tools for behaviour change from CBSM are utilized in the RAIN Home Visit program, while several others were left out. Some of those that were included are not utilized to their full ability and should be rethought to create a more impactful program. The stormwater tax rebate is intended to be an incentive and a motivational tool to act on the prescribed stormwater management changes. However, as mentioned, it is too minimal a rebate and too complicated a process to apply for for many participants. For this to be an effective incentive tool, it must be easier to apply for and be of a greater value to homeowners, or perhaps a different incentive altogether. It must be convenient (European Commission, 2012). Some homeowners may value knowing their degree of impact or social recognition (in the form of a public acknowledgement, for example) more than the financial benefit, as noted in some interviews. The program attempts to utilize communication and social diffusion tools, but there are issues with participant follow through in this area in particular. First, participants have difficulty understanding the message and the recommendations and are unsure of what the

benefits are to them in concrete terms. It is not clear how much stormwater upgrades could save the homeowner financially nor the impact of such changes on their local environment. Perhaps with more tailored messages, empowering homeowners in that the changes are worthwhile, in language that is familiar, increased uptake can be achieved. This would help to make the program more informative and convenient (Osbaldiston & Schott, 2012). An attempted social diffusion tool utilized in the program involves the RAIN stickers and yard signs that participants are intended to display on their front lawns. Multiple participants noted not wanting to have such items on display, some preferring to keep rain barrels at the back of their house and others simply thinking the sign was not appealing. This is an area to be revisited to identify a more appealing sign or public display method to help with social diffusion. Improved social diffusion tools will improve the socio-psychological techniques of this program, a key technique as noted by the European Commission, 2012. Social norms as a tool could be beneficial here, as it does not necessarily require additional signage, and ties to the socio-psychological techniques (McKenzie-Mohr & Smith, 2000; European Commission, 2012; Kilduff & Tsai, 2006). If neighbours utilize best practices for stormwater management on their properties, this will be evident to the community if visible from the front of the house. To recognize this work publicly could help increase injunctive norms, indicating these behaviours are approved of, and if enough members of the community participate in such practices, the norms will be descriptive, showing that the behaviour is normally done. To ensure these norms are not working in conflict, the material left with participants should be revisited. The RAIN Home Visit report, provided to participants shortly following the visit, includes photos of the participant's property to illustrate areas that are doing well or poorly. While the areas are described within text, a caption explaining the photographs may be more effective to clearly let the participant know if the area

shown is a good example or an area that needs improvement. The final page of the report discusses common pollutants, and while rarely includes photographs from the participant's home, several images of how to properly manage these pollutants are provided. For example, an image of a pet waste composter (Figure 5.4.1a) is shown to illustrate how to best handle this pollutant. However, the next image warns of hazardous household waste, with a home full of common home products that are hazardous (Figure 5.4.1b). This provides conflicting messages as it informs the participant that although these products are harmful if not managed properly, they are illustrated as common items in the home. Proper display and use of images will increase effectiveness of this socio-psychological technique (European Commission, 2012).



Figure 5.4.1a. Photo from RAIN Home Visit report positively promoting descriptive norms for proper pet waste management.



Figure 5.4.1b. Photo from RAIN Home Visit report negatively promoting descriptive social norms regarding hazardous household items.

Many participants described difficulties following through on the recommendations made during the visit and within the report. All of these difficulties and barriers add to the inconvenience for participants to make changes to their properties and behaviours. For example, a lack of information or resources, conflicting information from multiple sources, lack of clarity for next steps, and cost decrease the likelihood participants will follow through with the new changes. To improve both this and communication, clear, step-by-step guides of relevance should be provided for participants regarding the next steps that are relevant for the property in question. This may take large changes to the program, but the easier it is for participants to act, the more likely they are to do so (European Commission, 2012).

“It’s easy to lose track of the recommendations. We had an evaluation but it’s sort of a lot of documents that you don’t study as thoroughly as you might. So if someone had or there was a system to kind of remind us you know, ‘you said you were going to do that’. Maybe told us about new things.” – P13CD2

Lastly, an important, beneficial practice for this program would be to include prompts to remind the participants to act, which ties into the monitoring key technique. Multiple participants noted simply forgetting about the recommendations or other issues arising that took precedent to household stormwater management. Following up with participants, by phone or in person, serves as a reminder as well as a way to bolster accountability. This helps to monitor the program



and participant engagement as well as assist in placing responsibility on the participant (European Commission, 2012; Blake, 1999). This could be further enhanced by having participants, either verbally or in writing, agree to implementing a certain number or type of changes within a given time frame and letting the participants know that they will be contacted to assess their progress towards this goal. This would combine commitment and prompt tools, as well as help in holding participants accountable, overcoming the responsibility barrier.

## 6.0 Conclusion

6.1 Objectives

6.2 Next Steps

## 6.0 CONCLUSION

### 6.1 Objectives

As described in Chapter 1, the objectives of this research are to:

- a. Present best practices for pro-environmental behaviour change programs, following community-based social marketing as a successful framework
- b. Assess the existing homeowner stormwater management program in the Region of Waterloo (RAIN Home Visit) by comparing the existing RAIN Home Visit program to the key features and requirements of community-based social marketing in order to promote and sustain pro-environmental behaviour change
- c. Assess past participants of the program's perception of risk regarding increasing commonality of extreme weather due to climate change
- d. Assess past participants of the program's openness and willingness to pay for additional extreme weather insurance coverage
- e. Consider influence of risk perception on willingness to pay for extreme weather insurance options and how an ideal pro-environmental behaviour change program can manipulate perception of risk, increase adoption of such coverage and/or better prepare homeowners for extreme weather by increasing adoption of stormwater management best practices.

These objectives have been addressed in the following ways. Best practices were researched, presented, and discussed in Chapter 2 and 5, highlighting the success, techniques, and process of community-based social marketing for sustainable pro-environmental behaviour change.

The RAIN Home Visit program has been thoroughly assessed and compared to successful CBSM requirements, noting the factors that are working well for sustained pro-environmental

behaviour change and those that are missing. While preferred behaviours are explained and incentives are provided, more thorough, clear explanation is needed for homeowners as well as incentives of suitable size and value to effectively motivate homeowners to change. Key features that should be included in future RAIN Home Visit programs are public commitments, follow-up, and reminders. The latter two features are already being incorporated into novel versions of the program by the inclusion of a RAIN ‘coach’ who will check in on homeowners, provide additional support, and follow-up on progress of changes that were recommended during the initial visit. It was noted that most participants did not feel they were at risk or increased risk, even when considering an increase in extreme weather patterns due to climate change. Participants did, overall, note a slight increase in concern about increasing occurrence of extreme weather patterns, yet this did not seem to change their perceptions of risk for their own properties. As the perception of risk did not change, participants were unwilling to pay for additional insurance coverage for protection from extreme weather events. Many participants felt that if they were to adopt additional coverage, a rebate or lower cost should be available for those with various methods of stormwater damage prevention measures. This caused some confusion as the participants then often felt they would not need the coverage if they had the measures in place, further lowering the desirability of additional insurance coverage. When an estimated willingness to pay for insurance coverage was provided, participants would not exceed a 10% increase in their current payments at most. Future programs could focus on stressing the risk and concern of increased extreme weather events, perhaps addressing the specific homeowners level of risk of damage if no changes are made. By increasing homeowners’ perception of risk, it could be possible to increase their openness to additional insurance coverage. It should be noted that many participants exhibited a distrust and/or dislike of insurance companies and were not

familiar with what their insurance covered. It would be beneficial for insurance companies to address this perceived image of their business and to enhance homeowner understanding of just what their insurance plan includes. As mentioned, social norms can increase perception of risk (Kasperson et al., 1988; Renn, 2011; Kilduff & Tsai, 2003). As household stormwater management becomes the norm, homeowners should better understand the risk of improper management and/or extreme weather.

It would be worthwhile to further consider risk perception impacts with CBSM, to determine how these can work together and, perhaps, which precedes the other. Some people may be more influenced by social norms to act and others by perception of risk. The latter, as mentioned, can influence social norms, so it is debateable as to which is more important or should be emphasized initially in behaviour change programs. It would seem by this research, that both should be used together in order to best motivate and sustain pro-environmental behaviour change.

## 6.2 Next Steps

As noted, several key features should be included in future household stormwater management programs, including follow-up, reminders, ensure clarity of information, avoid conflicting messages or images, and community involvement to increase permeability of the program, thus increasing impact. Including these features will help overcome the barriers of individuality, practicality, and responsibility. Specific communities or neighbourhoods could be surveyed to identify motivational factors that are unique to that area, ensuring incentives are appropriately designed for the given audience. Follow-up studies would be worthwhile to assess the progress and changes with the new additions to the RAIN Home Visit program, involving RAIN ‘coaches’ and a community focussed approach. Additionally it would be valuable to provide

positive feedback to early participants adopting new behaviours. This is to prevent engaged participants from regressing towards a mean that does not maintain effective household stormwater management behaviours. With increased engagement, such intense positive feedback would not be as necessary as the behaviours will have become more of a social norm. Future studies should compare other stormwater management programs to the key features involved in CBSM, to ensure the programs are functioning as effectively as possible. This research can be used as a guide for future program development, as it provides an assessment of an existing program, key areas for improvement, and key features of successful pro-environmental behaviour change programs, by highlighting the requirements of CBSM programs. Due to the well-researched and supported nature of CBSM, this model should serve as a guide for future pro-environmental behaviour change programs.

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## Appendix A

### ORE materials

#### A1. Sample telephone script

P = Potential Participant; I = Interviewer

I - May I please speak to [name of potential participant]?

P - Hello, [name of potential participant] speaking. How may I help you?

I - My name is Lauren Smith and I am a Masters student in the Faculty of Environment at the University of Waterloo. I am currently conducting research under the supervision of Dr. Jennifer Lynes on homeowner storm water management. As part of my thesis research, I am conducting interviews with previous participants in the REEP RAIN Home Visit program to discover their perspectives on the utility and success of this program, as well as areas for improvement.

As you were a past participant of this program, I would like to speak with you about your experience with the RAIN Home Visit program and progress or maintenance of storm water management strategies on your property. Is this a convenient time for me to give you further information about the interviews?

P - No, could you call back later (agree on a more convenient time to call person back).

OR

P - Yes, could you provide me with some more information regarding the interviews you will be conducting?

I - Background Information:

- I will be undertaking interviews starting in one week.
- The interview would last about one hour, and would be arranged for a time convenient to your schedule.
- Prior to the interview, a pre-interview questionnaire will be administered to determine basic demographic information and participation level in the RAIN Home Visit program.
- Involvement in this interview is entirely voluntary and there are no known or anticipated risks to participation in this study.
- The questions are quite general (for example, Why did you choose to have a RAIN Home Visit?).
- You may decline to answer any of the interview questions you do not wish to answer and may terminate the interview at any time. With your permission, the interview will be tape-recorded to facilitate collection of information, and later transcribed for analysis.
- All information you provide will be considered confidential.
- The data collected will be kept in a secure location and disposed of in 10 years time.

- If you have any questions regarding this study, or would like additional information to assist you in reaching a decision about participation, please feel free to contact Dr. Jennifer Lynes at 519-888-4567, Ext. 35487.
- I would like to assure you that this study has been reviewed and received ethics clearance through a University of Waterloo Research Ethics Committee. However, the final decision about participation is yours.
- After all of the data have been analyzed, you will receive an executive summary of the research results.

With your permission, I would like to email/mail/fax you an information letter which has all of these details along with contact names and numbers on it to help assist you in making a decision about your participation in this study.

P - No thank you.

OR

P - Sure (get contact information from potential participant i.e., mailing address/fax number).

I - Thank you very much for your time. May I contact you in 2 or 3 days to see if you are interested in being interviewed? Would you prefer a phone call or e-mail? Once again, if you have any questions or concerns please do not hesitate to contact me at 519-590-3761.

P - Good-bye.

I - Good-bye.

## A2. Information letter and consent form

University of Waterloo

Date \_\_\_\_\_

Dear \_\_\_\_\_

This letter is an invitation to consider participating in a study I am conducting as part of my Master's degree in the Department of Environment at the University of Waterloo under the supervision of Professor Dr. Jennifer Lynes and in collaboration with REEP Green Solutions and Green Communities Canada. I would like to provide you with more information about this project and what your involvement would entail if you decide to take part.

This study will identify the barriers various groups of homeowners face when considering the installation of storm water management practices (ex. rain barrels, permeable drive ways, etc.) on their property. Some may be aware of the risks of climate change and motivated to take preventative actions, while others may not be aware or may be unmotivated. By identifying the different barriers for these groups, better storm water management programs can be designed in future. Future programs can benefit from this research by being better prepared to prevent and/or manage the barriers homeowners may encounter when adding storm water management recommendations on their property. Additionally, future participating homeowners may benefit by having an easier time adding storm water management recommendations. With more frequent extreme weather events, this research can provide financial savings for homeowners (by preventing property damage), municipalities (by preventing over-stressing of storm water infrastructure and preventing pollution of water sources/catchments), and insurers who may pay out on climate change damages.

Your responses and information will remain confidential and will not be linked to any personal information. Responses will be used to identify best practices for future storm water management programs as part of a graduate thesis through the University of Waterloo. As collaborating partners, data and findings will be shared with REEP Green Solutions and Green Communities Canada without any identifying personal information. Participation in this study is voluntary. It will involve a prescreening online survey that will take approximately 10 minutes to complete and an interview of approximately **1 hour** in length to take place in a mutually agreed upon location. In appreciation of the time you have given to this study, you can enter your name into a draw for 1 of 2 \$100 gift cards, provided by REEP Green Solutions, redeemable at Home Hardware locations. Your odds of winning one of the prizes is based on the number of individuals who participate in the study. We expect that approximately 30 individuals will take part in the study. Information collected to draw for the prizes will not be linked to the study data in any way, and this identifying information will be stored separately, then destroyed after the prizes have been provided. The amount received is taxable. It is your responsibility to report this amount for income tax purposes.

You may decline to answer any of the interview questions if you so wish. Further, you may decide to withdraw from this study at any time without any negative consequences by advising the researcher. With your permission, the interview will be audio recorded to facilitate collection of information, and later transcribed for analysis. Shortly after the interview has been completed, I will send you a copy of the transcript to give you an opportunity to confirm the accuracy of our conversation and to add or clarify any points that you wish. All information you provide is

considered completely confidential. Your name will not appear in any thesis or report resulting from this study, however, with your permission anonymous quotations may be used. Data collected during this study will be retained for 3 – 5 years in a locked cabinet in EV3 4237. Only researchers associated with this project will have access. There are no known or anticipated risks to you as a participant in this study.

If you have any questions regarding this study, or would like additional information to assist you in reaching a decision about participation, please contact me at 519-590-3761 or by email at [lkmsmith@uwaterloo.ca](mailto:lkmsmith@uwaterloo.ca). You can also contact my supervisor, Professor Jennifer Lynes at 519-888-4567 ext. 35487 or email [jklynes@uwaterloo.ca](mailto:jklynes@uwaterloo.ca)

I would like to assure you that this study has been reviewed and received ethics clearance through a University of Waterloo Research Ethics Committee. However, the final decision about participation is yours. If you have any comments or concerns resulting from your participation in this study, please contact Dr. Maureen Nummelin in the Office of Research Ethics at 1-519-888-4567, Ext. 36005 or [maureen.nummelin@uwaterloo.ca](mailto:maureen.nummelin@uwaterloo.ca).

I hope that the results of my study will be of benefit to those organizations directly involved in the study, other voluntary recreation organizations not directly involved in the study, as well as to the broader research community.

I very much look forward to speaking with you and thank you in advance for your assistance in this project.

Yours Sincerely,  
Lauren Smith

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## CONSENT FORM

By signing this consent form, you are not waiving your legal rights or releasing the investigator(s) or involved institution(s) from their legal and professional responsibilities.

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I have read the information presented in the information letter about a study being conducted by Lauren Smith of the Department of Environment at the University of Waterloo. I have had the opportunity to ask any questions related to this study, to receive satisfactory answers to my questions, and any additional details I wanted.

I am aware that I have the option of allowing my interview to be audio recorded to ensure an accurate recording of my responses.

I am also aware that excerpts from the interview may be included in the thesis and/or publications to come from this research, with the understanding that the quotations will be anonymous.

I was informed that I may withdraw my consent at any time without penalty by advising the researcher.

This project has been reviewed by, and received ethics clearance through a University of Waterloo Research Ethics Committee. I was informed that if I have any comments or concerns



resulting from my participation in this study, I may contact the Director, Office of Research Ethics at 519-888-4567 ext. 36005.

With full knowledge of all foregoing, I agree, of my own free will, to participate in this study.

YES NO

I agree to have my interview audio recorded.

YES NO

I agree to the use of anonymous quotations in any thesis or publication that comes of this research.

YES NO

Participant Name: \_\_\_\_\_ (Please print)

Participant Signature: \_\_\_\_\_

Witness Name: \_\_\_\_\_ (Please print)

Witness Signature: \_\_\_\_\_

Date: \_\_\_\_\_

### A3. Participant feedback letter

University of Waterloo

Date \_\_\_\_\_

Dear \_\_\_\_\_,

I would like to thank you for your participation in this study entitled “Best management practices for household storm water management programs assessing risk perception and barriers to change”. As a reminder, the purpose of this study is to identify best practices for promoting homeowner storm water management in the Waterloo and Kitchener regions and how to best communicate the associated risks.

The data collected during interviews will contribute to a better understanding of storm water management in the Kitchener and Waterloo region and how to best increase homeowner participation in such strategies.

Please remember that any data pertaining to you as an individual participant will be kept confidential. Once all the data are collected and analyzed for this project, I plan on sharing this information with the research community through presentations and journal articles. As collaborating partners on this project, REEP Green Solutions and Green Communities Canada will be provided with data and findings that are without any personal identifying information. If you are interested in receiving more information regarding the results of this study, or would like a summary of the results, please provide your email address, and when the study is completed, anticipated by May, 2016, I will send you the information. In the meantime, if you have any questions about the study, please do not hesitate to contact me by email or telephone as noted below. As with all University of Waterloo projects involving human participants, this project was reviewed by, and received ethics clearance through a University of Waterloo Research Ethics Committee. Should you have any comments or concerns resulting from your participation in this study, please contact Dr. Maureen Nummelin, the Director, Office of Research Ethics, at 1-519-888-4567, Ext. 36005 or [maureen.nummelin@uwaterloo.ca](mailto:maureen.nummelin@uwaterloo.ca).

Lauren Smith

University of Waterloo

Department of Environment

Contact Number 1-519-590-3761

lkmsmith@uwaterloo.ca

Appendix B  
Interview materials

B1. Interview questions

REASONS FOR VISIT

1. Why did you choose to have a RAIN Home Visit?
2. How did you hear about the RAIN Home Visit program?
3. A. What were the key concerns that you had that you wanted the visit to address?  
B. How did the visit and report address each of these?
4. Before the RAIN Home Visit, were you concerned about storm water affecting your property or your municipality?

Were you more or less concerned after the visit?

→ If changes were made, do you feel better prepared for extreme weather?

Why/why not?

On a scale of 1 to 5 how prepared do you feel your home is regarding storm water and flooding? (5 being completely prepared/protected, 1 being not at all prepared/vulnerable)

→ If you did not make changes, did the visit increase your concern or awareness of potential damage to your property?

On a scale of 1 to 5, how prepared do you feel your home is regarding storm water and flooding? (5 being completely prepared/protected, 1 being not at all prepared/vulnerable)

→ On a scale of 1 to 5, how concerned were you about storm water management before the Home Visit?

After?

(5 being extremely concerned, 1 being not at all concerned)

→ On a scale of 1 to 5, how likely do you expect that your property will experience damage due to storm water in the next 5 – 10 years?

(5 being extremely likely, 1 being very unlikely)

Can you point to specific reasons for this concern?

### AFTER VISIT

5. What steps were recommended to you after the Home Visit?

Have you been able to follow through on these recommendations? (all, some, none) – why or why not?

6. If you had trouble following through on recommendations, did you contact REEP or anyone else for assistance?

What did you find difficult about following through on the recommendations?

What would have made those recommendations easier?

7. For recommendations you were able to complete, what helped make this process easier?

What was challenging about completing these recommendations?

What was the most challenging?

8. What personal benefits can you think of from making these changes? (ex. flood prevention, less water-soaked yard, improved storm water management for my region, attractive natural rain gardens, etc.)

9. What additional benefits (for example, for the community) can you think of from making these changes?

### MATERIALS & RESOURCES

10. (Show them typical handout materials/resources distributed in print, online, or in person)

- A. Which of these materials were you shown/are familiar to you?
  - B. Which did you find helpful and why?
  - C. Which did you not find helpful and why not?
11. A. What additional materials would have helped you?
- B. What materials would you recommend removing and why?

### INSURANCE

12. Do you currently have any form of flooding or extreme weather insurance for your home or property? Any form of climate change mitigation insurance?
13. Would you be interested in such an insurance program? If yes, what would you expect such a program to entail?
14. What would you be willing to pay monthly/annually for such a program?

### REPORT

15. Look carefully at the report from your RAIN Home Visit.
- A. What are the main takeaways that you got from the report?
  - B. What information was most useful and why?
  - C. What information was not useful and why?
  - D. What additional information would you like to see in the report? Why?

### REEP RAIN FUTURE/ONGOING CONTACT

16. How can REEP RAIN support you in maintaining simple changes in the long run?  
How can REEP RAIN support you in maintaining more complex changes?
17. How often and in what manner would you prefer to be contacted by REEP RAIN for reminders of storm water updates, workshops, or follow-up to the plan? (ex. monthly e-mail updates, seasonal mailings, etc.)

18. Are there any other key sources of support that you would like to be connected with?
19. Considering the main concerns of homeowners and insurance companies regarding storm water management (ex. cleaning debris out of eavestroughs twice per year; extending downspouts 8' from foundation, etc.), what do you see as benefits and/or barriers to each of these?
- What would be needed for you to take action on these objectives?
20. Considering the main concerns of municipalities regarding storm water management (ex. reducing quantity of storm water runoff to preserve city infrastructure; improving quality of runoff to limit pollutants entering natural water bodies) what do you see as benefits and/or barriers to each of these?
- What would be needed for you to take action on these objectives?
21. Is there any other information that you think is important to share in order to help REEP RAIN improve the effectiveness of the program?

## B2. Demographic questionnaire

Date:

Initials:

Age of interviewee involved with RAIN visit: (circle one)

20 – 29;  
30 – 39;  
40 – 49;  
50 – 59;  
60 – 69;  
70 – 79;  
80+

Gender:

Male

Female

Postal Code

Household Income before tax (circle nearest range)

Under \$5000;	\$5000 - \$9999;	\$10,000 - \$14,999;
\$15,000 - \$19,999;	\$20,000 - \$29,999;	\$30,000 - \$39,999;
\$40,000 - \$49,999;	\$50,000 - \$59,999;	\$60,000 - \$79,999;
\$80,000 - \$99,999;	\$100,000 - \$124,999;	\$125,000 - \$149,999;
\$150,000+		

Level of Education (of main decision maker/s of household) (circle one)

DNC High school;  
High school diploma or equivalent;  
College, CEGEP or other non-university certificate or diploma;  
Apprenticeship/Trades certificate or diploma;  
University certificate, diploma, or degree (Bachelor's);  
Master's degree;  
Doctorate degree

Occupation

Number of People in House

# adults

# children

House Type (circle one)

Single, detached  
Semi-detached

Row house  
Apartments or flats in a duplex  
Apartments in a building with fewer than five stories  
Apartments in a building with five or more stories  
Other dwellings

Age of House/Year built

House Size

# stories

Sq Footage of house (approximate)

Property Size (approximate)

Sq footage/acres



## Appendix C

### Summary chart of priority actions noted in RAIN Home Visit report

Category	Priority for action
<b>Paved Areas</b>	
Permeability	0% < 25% paved areas are permeable.
Slope	Some paved areas slope towards the foundation.
Car washing	Car is washed in driveway with soap and solvents.
Car maintenance	Car is maintained at home with no spill containment available.
Snow	Snow is packed against foundation or melting snow runs toward foundation.
De-icing salt	Used often.
Nearest storm sewer grate (down the street)	Is often blocked with debris.
Driveway sealant	Reapplies annually.
<b>Eaves &amp; Downspouts</b>	
Eavestroughs (continuous coverage)	Much roof area not covered.
Eavestroughs (maintenance)	Eavestroughs are completely blocked.
Downspouts (direction)	Not directed away or is <1.2 m (4') away from foundation.
Downspouts (outlet on permeable area)	Not soaking in or <50% soaking in and remainder directed to storm sewer.
Rain barrels	No rain barrels.
Cistern (if existing)	Full of water, but not used or leaking.
Flat roof areas	Membranes are failing (leaking) and slopes toward house or sags in spots causing flooding.
<b>Drainage, Infiltration</b>	
Slope	Some areas slope towards the foundation.
Permeable surfaces	Very little (<25%) is permeable (gardens, mulched areas, gravel, permeable paving).

Lawn	Completely compacted and provides no infiltration.
Plantings	No gardens.
Tree canopy	No trees or canopy provided.
Leaves	Leaves are blown onto curb or street, can block sewer grates.
Path of run-off	Owner is not sure where the water runs off.
Erosion	Considerable evidence of erosion (sloped areas that have bare soil and you can see ruts).
Window wells	No window wells in place and window extends below level of surrounding grade.
Sealants	Sealants are missing or in need of serious repair/replacement.
<b>Foundation Basement</b>	
Foundation walls	Moisture is infiltrating the basement.
Flashing	Flashing is missing and/or in need of serious repair/replacement.
Moisture/mold	Mold in evidence.
Floor drains	Floor drains are blocked or smell is evident.
Sewer backflow protection	Evidence of, or homeowner recalls sewage back-up.
Sump hole	No sump hole or pump. Area is flood prone or basement has history of infiltration.
Storage	Personal goods are on floor and water damage is evident or area is prone to flooding.
Furniture	Furniture is on floor, no legs and water damage in evident or area is prone to flooding.
Finishes	Area is finished with drywall and wall to wall carpets.
<b>Common Pollutants</b>	
Cleaning and personal products	No natural or biodegradable products used.
Cigarette butts	Butts are not confined and litter the property.
Fertilizers	Chemical fertilizer is spread on compacted lawn.
Pet waste	Pet waste is left on compacted lawn or hard surface.

Fuel storage	Evidence of fuels in unapproved containers without spill containment (sand, sawdust, kitty litter) available.
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## Appendix D

### Overcoming barriers to making recommended changes

#### D1. Suggestions from participants for overcoming homeowner barriers.

<b>How to overcome homeowner barriers</b>	<b># of responses</b>
Funding	8
Education	7
Show examples	6
Better communication	4
Recommend reliable contractors	3
Direct experience	3
Access and demos for tool use	3
Appropriate incentives	3
Make it easier	2
Information	2
Community involvement	2
Advertising	2
Reminders and follow up	2
Highlight benefits	2
Specific recommendations	1
Cost estimates	1
Promote science and environment	1
Stress simplicity	1
Target community leaders	1
Highlight property value increases	1
Increase availability	1
Physical assistance	1
Legacy value	1
Encouragement	1
<b>Total</b>	<b>59</b>

D2. Suggestions from participants for overcoming community or municipality barriers.

<b>How to overcome community or municipality barriers</b>	<b># of responses</b>
Education	4
Communicate cost breakdown	4
Community involvement	4
Appropriate incentives	4
Clarify savings/simplify rebate process	4
Public support	3
Environmental awareness	3
Communication	3
Increase water pricing	2
Funding	2
Infrastructure development	2
Don't know	2
Awareness	2
Information packages when buildings change hands	1
Recommendations with utility bill	1
Experience	1
Stop water bottling extraction	1
More stakeholders	1
City sets example	1
Link to climate change	1
Applicability	1
Stress importance	1
Improve building requirements	1
Train exterior building inspectors	1
Explain value and vulnerability of water	1
Show long term benefits	1
Prioritize	1
<b>Total</b>	<b>53</b>

## Appendix E

### Interview transcriptions

Interview transcriptions are stored in the office of Dr. Jenn Lynes, Environment 3, 200 University Ave, Waterloo, Ontario, Canada.