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HALTON ENVIRONMENTAL NETWORK

GREEN DRIVE OAKVILLE

A FEASIBILITY STUDY

Funded by the Investment Readiness Program via the Oakville Community Foundation

Report written by

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Executive Summary

What is this study all about?	This study explores the feasibility of advancing a social purpose organization (an SPO, whose mission supports the creation of profit and community benefits) to help Oakville homeowners to take sustainability actions by supporting installation of permeable driveways and Level 2 electric vehicle chargers. This process is called **Green Drive Oakville**. This study is part of Phase I - 'Early-Stage Innovation' - of the Investment Readiness Program (IRP). Funding was provided by the federal Investment Readiness Program (IRP) via the Oakville Community Foundation. This study focuses on exploring the above-mentioned idea through research and community engagement and provided the opportunity to document the lessons learned for further advancement in the IRP program and to share the lessons learned with other stakeholders.
What is a permeable driveway and why is it important?	Permeable driveways are specially designed driveways that seek to **reduce stormwater runoff** by using porous materials to allow rainwater to filter through the driveway into the soil by using different layers of stone aggregate and infill. They can be designed to work in areas that are flood-prone, as well as areas that have clay soils. Permeable driveways offer several benefits to the property owner and the wider community including slowing down the flow of rainwater, which helps to prevent flooding and pollution on the property and in the community.
What are Level 2 electric vehicle chargers and why are they important?	Fully electric and plug-in hybrid electric vehicles come with a Level 1 charger which allows for vehicle charging using a standard 120 volt (20 amps) wall outlet. **Long charge time is considered a barrier to EV adoption.** Level-2 chargers are able to charge vehicles in under 8 hours (depending on the model). Level-2 chargers require a dedicated 240 volt (80 amps) outlet which can be installed by a certified electrician. In addition to substantially reducing charge time, a private level-2 charger provides increased convenience and reliability when compared to using public charging stations.
Why did the Small Change Fund choose to study this?	Oakville, like many communities across Canada, has declared a climate emergency. Rapid action is needed, on many fronts, to advance action to reduce greenhouse gas emissions and to increase community resilience to the effects of climate change. Homeowner action to advance best practices for environmental sustainability is necessary to address the climate crisis and meet the 2030 Sustainable Development Goals.
Who provided input?	The research team conducted interviews, webinars, and a survey. The study includes input from municipal representatives, social service agencies, community organizations, service suppliers, and Oakville residents.

What are some of the findings?	Select high level results of the feasibility study demonstrated that the following regarding permeable driveways: • A SPO tackling stormwater runoff on residential properties offers a purpose driven mandate focused on protecting water quality and reducing flood risks. Given high costs and other barriers there does not appear to be sufficient market demand for an SPO focused *solely* on permeable driveways. • A SPO targeting residential stormwater management should consider a community economic development focus to facilitate local job creation as part of its mandate. • Education and awareness will be critical to increase broader implementation of permeable driveways and Low Impact Development (LID). • Strategic partnerships could facilitate efficiency in program delivery and help an SPO reach an established network. And regarding EV charger installation: • The market need for EV information and charger installation appears to be full. • Short term EV adoption and Level 2 charger demand are most likely to be driven by incentive programs and car manufacturing commitments to stop selling gasoline vehicles. • Currently, there are no financial incentives for permeable driveways or Level 2 chargers in Oakville. Bold government incentives could stimulate demand creating a potential role for an SPO as property site evaluators, grant administrator, and source of reliable information regarding service providers.
What's next?	Based on the analysis, at this time, there appears to be insufficient market demand for a SPO that offers EV chargers and/or green driveway installations to Oakville residents. There appears to be market interest in lower cost, less disruptive, residential LID services than permeable driveways alone, such as a suite of products including rain gardens, rain barrels, and depaving initiatives. However, there are already many groups in Oakville helping residents to learn about, and install, LID features. If community partners are interested, the Small Change Fund and the Halton Environmental Network is open to pursuing further exploration of the establishment of a social purpose organization to advance the concepts of Green Drive Oakville, in partnership. If a willing partner emerges and wishes to explore the collaborative establishment of a social purpose organization, some regulatory and focus area considerations are included on pages 29 and 30.
Contact	Interested in learning more or exploring opportunities together? Please get in touch! info@smallchangefund.ca

Acknowledgements

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The Small Change Fund gratefully acknowledges that this study was funded by the Investment Readiness Program (IRP) via the Oakville Community Foundation.

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The Small Change Fund gratefully acknowledges the contributions of community partners including interviewees, survey respondents, and webinar attendees.

Acronyms

Acronym	Definition
EV	Fully electric vehicle
FCM	Federation of Canadian Municipalities
GHG	Greenhouse gas
HEN	Halton Environmental Network
HEV	Hybrid electric vehicle
LIDs	Low impact developments
PHEV	Plug-in-hybrid electric vehicle
NGO	Non-governmental organization
SDG	Sustainable development goal
SPO	Social purpose organization

1. Overview

Study Objective

This study explores the feasibility of advancing a **social purpose organization** (SPO) to help Oakville homeowners take sustainability actions by supporting the installation of permeable driveways (green driveways) and electric vehicle chargers. Over the course of the project, this became known as **"Green Drive Oakville."**

Homeowner action to advance best practices for environmental sustainability is necessary to address the municipally-declared climate crisis and to meet the 2030 Sustainable Development Goals.

The Green Drive Oakville study was initiated by the Small Change Fund, a charitable organization focused on a crowdfunding platform to raise funds needed to achieve real tangible impacts in communities across Canada.

The Small Change Fund is the next step in change. It's the easy and effective way for communities across Canada to amplify their impact with expert advice, greater awareness and crowdfunding. And for people with vision to get behind them.

For this study, the Small Change Fund partnered with Halton Environmental Network, a local not-for-profit and action-oriented organization working across Halton on actions to advance climate change adaptation and mitigation.

Halton Environmental Network (HEN) strives to make the community of Halton a region with educated citizens, engaged stakeholders and best practice policies for climate change mitigation and adaptation, and environmental sustainability.

This study considers two service options to **increase home-based green infrastructure**:

- installing permeable driveways to help mitigate stormwater runoff and/or
- installing level-2 electric vehicle chargers on residential properties to foster faster adoption of electric vehicles (EVs).

This study seeks to assess the feasibility of a potential SPO to deliver the respective services and examines whether establishing an SPO could:

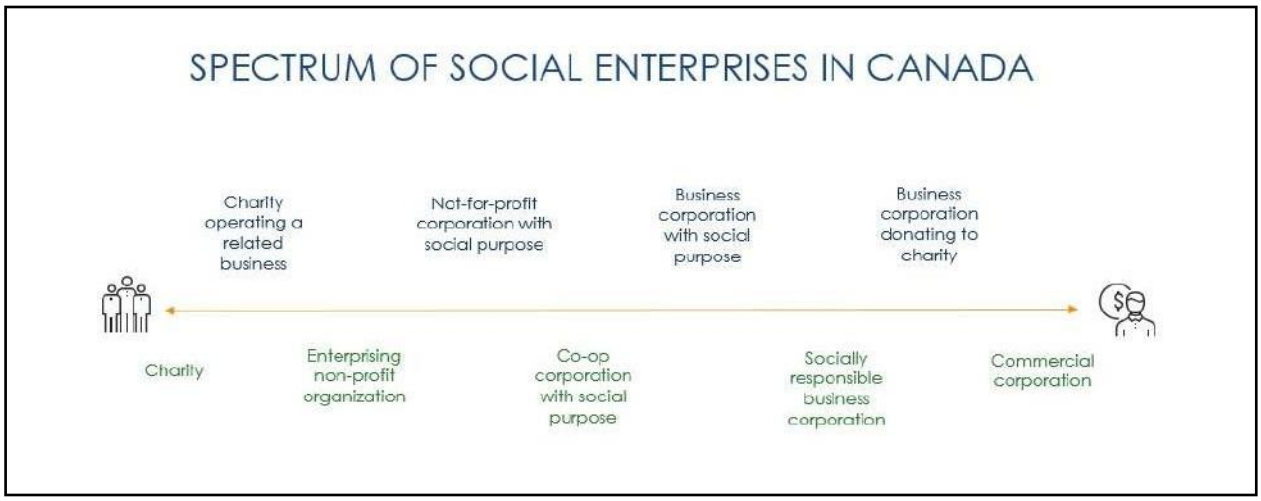
(1) advance the uptake of permeable driveways and level-2 electric vehicle chargers by local homeowners in Oakville;
(2) be profitable; and
(3) achieve social and environmental benefits.

Context

Social Purpose Organization

What is a social purpose organization? "… [A]n organization whose mission combines revenue growth and profit-making with the need to respect and support its environment and stakeholder network. This includes listening to, investing in, and actively managing the trends that are shaping today's world." (Deloitte, April 2019)

As seen in the figure from the Government of Canada, social enterprises (or SPOs) can take on many structural forms – from charitable organizations to for-profit corporations.



Source: Government of Canada, 2019

Funding for the Green Drive Oakville study was provided by the federal Investment Readiness Program (IRP) via the Oakville Community Foundation. The Investment Readiness Program has five stages of development for social purpose organizations. This study falls into Phase 1 "Early-Stage Innovation" in the investment readiness continuum.

- **Early-Stage Innovation**: Exploration and ideation of the initiative - aligning a proposed solution to an identified need.
- **Strategic Impact Focus**: Feasibility analysis and community support development.
- **Impact Sustainability**: Business model development, use of data for planning & impact measurement, diversification of funding sources.
- **Financial Resilience**: Revenue generation, legal structure (incl. debt & equity), ability to scale and replicate.
- **Investor Ready**: Sustainable cash flow and assets, track record for sustainability and networking with prospective investors.

The Small Change Fund is interested to continue exploring the spectrum of impact available via the IRP investment readiness pathway.

Permeable Driveways

One of the possible service offerings considered for Green Drive Oakville is the installation of permeable driveways.

Why install permeable driveways?
Permeable driveways are specially designed driveways that seek to **reduce stormwater runoff** by using porous materials to allow rainwater to filter through the driveway into the soil by using different layers of stone aggregate and infill. They can be designed to work in areas that are flood-prone, as well as areas that have clay soils. They are an alternative option to asphalt and/or concrete driveways that are commonly found on private property in Oakville.

Why is this important?
Permeable driveways offer several benefits to the property owner and the wider community.

- These types of driveways slow down the flow of rainwater, which helps to prevent flooding on the property and in the community.
- In many municipalities, water that flows into the on-street storm drains is not treated before it is released into local waterways. Due to the construction of the permeable driveway, rainwater that flows onto its surface filters down through several layers of aggregate and soil, resulting in the water returning to the water table and eventually to the local waterways. This process, called infiltration, helps to naturally remove pollutants from the water and allows clean water to return to the local waterways.
- Permeable driveways can reduce the amount of ice buildup and the amount of salt used on the driveway during the winter months. The grids and paver stones allow for snow and ice to melt to drain into the soil, instead of re-freezing on the driveway like with asphalt driveways.
- Permeable driveways can provide aesthetic appeal to the property because the stone pavers or grass in-fill grids can be placed in interesting patterns and designs.

What are the options/"products"?
There are three common types of permeable driveways available for residential properties in Ontario:

- specialized permeable paving stones,
- permeable grid-lock systems, and
- porous asphalt.

Some sample images of permeable driveways are provided below:

Gravel infill

Grass infill

Permeable pavers

Permeable concrete

Permeable asphalt

There are several contractors offering permeable driveway installation in the Greater Toronto and Hamilton Area. Ensuring proper drainage is very important during installation and does require some expertise.

Who is the target audience?

The target audience is homeowners in Oakville, looking to replace their current driveway. An SPO could also play a role in promoting permeable driveways in new developments.

Why focus on permeable driveways?

The study team hypothesized that surfaces on publicly-owned land are well regulated, and that private property represented an area for a potentially profitable and impactful service offering.

Level 2 EV chargers

The second possible service offering considered for Green Drive Oakville is the installation of Level 2 EV chargers.

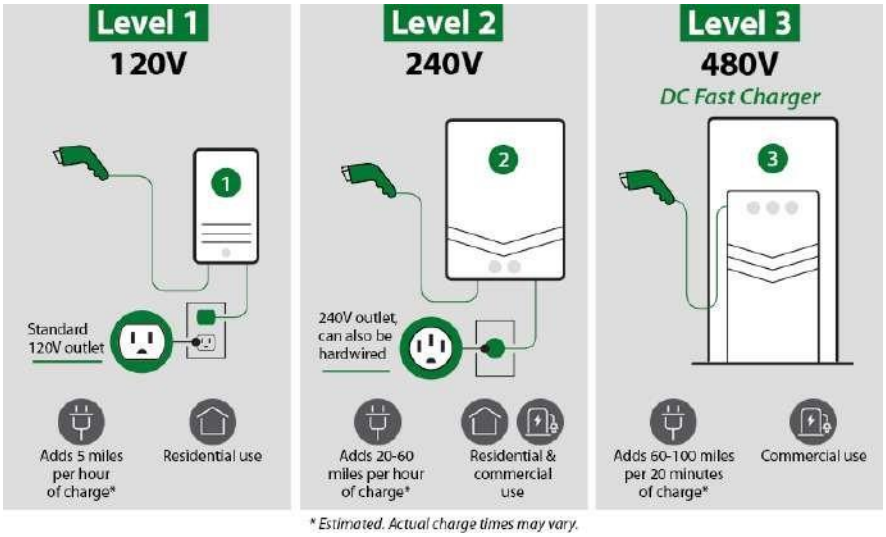
Why focus on installing Level 2 EV chargers?
Long charge time is considered a potential barrier to EV adoption. Level 2 EV chargers decrease vehicle recharge times substantially when compared to a Level 1 charger.

Why is this important?
Achieving climate change reduction targets will require rapid adoption of EVs.

What are the options/"products"?
Three types of electric vehicle chargers allow for recharging of fully electric and plug-in hybrid electric vehicles.

- Level 1 chargers allow for charging of electric vehicles using a standard 120 volt (20 amps) wall outlet.
- Level 2 chargers use a specific 240 volt (80 amps) outlet to recharge. Level 2 chargers are suitable for residential properties.
- Level 3 chargers are the fastest charging type because they use a specially designed 480 volt (300 amps) outlet. Level 3 chargers are available at publicly accessible charging stations.

The primary benefits of installing a Level 2 charger in your home are the convenience and reliability it offers. A Level 1 charger can take up to 24 hours to fully charge a car (depending on the model), while a Level 2 charger could recharge in about 8 hours (depending on the model). Level 3 charging is not an option in the home.

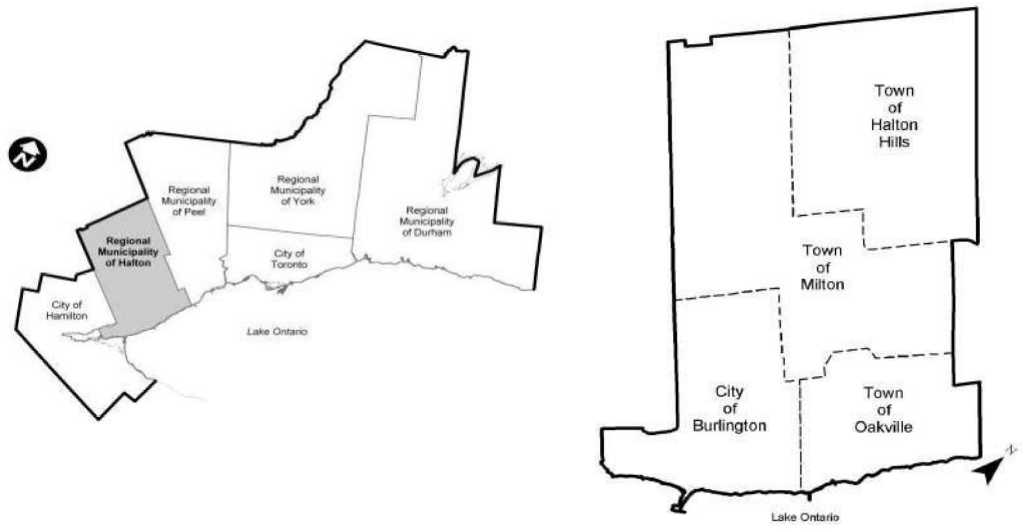


Level 1, 2 and 3 chargers. Image extracted directly from https://www.cenhud.com/my-energy/electric-vehicles/how-to-charge/

Who is the target audience?
The target audience for this Green Drive Oakville service would be homeowners owning or leasing an EV or considering to purchase or lease an EV.

Focus and Location

This study focused on engaging with residents within the community of Oakville, which is located within Halton Region (Map 1).



Map 1. Map of the Town of Oakville showing its location in the Greater Toronto and Hamilton Area (Source: Region of Halton's Official Plan)

Participants

This study reached across - and beyond - Oakville and involved several participants. Participants were selected based on their knowledge and experiences related to addressing environmental issues in the Oakville area or because they could have a potential stake in the success of the proposed social organization. In general, the following list outlines the types of participants included in this study, for specific participants please see the appendices.

Participant	Role
Small Change Fund	To oversee the process To liaise with the funders
Halton Environmental Network	To coordinate community outreach To liaise with the community
Consulting Team	To conduct background research To support the engagement process To provide feasibility analysis
Municipal Representatives	To share insights on the alignment of the proposed permeable driveways and EV chargers with the Town of Oakville's operations, bylaws, and planning documents
Community Groups and Employment Service Agencies	To assist in the feasibility study by providing their thoughts on the barriers and opportunities associated with a SPO focused on the installation of permeable driveways and Level 2 EV chargers
Residents in the Oakville Area	To share insights on their awareness of, and opportunities and challenges with, permeable driveways and EV charger installation
Service Providers and Suppliers	To share insights on their sense of the market and pricing for permeable driveways and EV chargers
Municipal program coordinators in other communities	To understand their sense of existing LID incentive programs

Research Approach

The research approach included six steps. Each step was designed to collect detailed information to help assess the feasibility of the proposed SPO.

Step 1: Background research was conducted to assess the existing marketplace, identify best practices of organizations and jurisdictions advancing similar objectives, and identify funding programs and opportunities. Background research is available in Appendix A.

Step 2: A **webinar** was held to share the intent of the study, background information and was used to launch an online survey.

Step 3: An **online survey** targeting Oakville residents was developed to understand the pulse of the community, including opportunities and barriers to action regarding the installation of permeable driveways and electric vehicle charging stations on private properties. The survey was conducted online between June 2, 2021, and June 27, 2021. One hundred and forty-two respondents completed the survey. For a list of survey questions and summary of results see Appendix B.

Step 4: Interviews with municipal program coordinators for existing LID incentive programs to obtain information related to the design and uptake of their programs. See Appendix C for a list of LID programs and findings.

Step 5: Interviews with permeable driveway contractors and electricians were conducted to gather insights about market conditions, service demands and pricing for respective services. See Appendix D for a list of companies contacted, interview questions, and findings.

Step 6: Community interviews were held with representatives from the Town of Oakville, neighbourhood and community associations, STRIDE (Supported Training & Rehabilitation in Diverse Environments) and Centre for Skills Development, Sheridan College, Ford Canada, and environmental organizations. See Appendix E for a list of interviewees, interview questions, and a summary of the findings.

The information gathered from each stage was analyzed by the consulting team. The background research was used to inform the development of the survey and interview questions and drawn upon to support findings. The data collected through the online survey were analyzed using descriptive statistics and content analysis. The interviews were analyzed using thematic content analysis, which seeks to extract the common themes and perspectives shared by the participants. The results for each step were examined holistically and informed the findings presented in the body of this report.

2. Research Findings

This section synthesises the information gathered from initial background research and data analysis of the online survey, interviews and community conversations. Findings are organized under four headings

- Contextual Findings
- Permeable Driveways
- Electric Vehicle Charger
- Moving Forward

Contextual Findings

Climate change is a very serious problem: The online survey found that community members are very concerned about climate change and lowering GHG emissions was an important motivator for the purchase of electric vehicles.

People are willing to take climate action: In the online survey, respondents were asked whether they would be willing to make lifestyle changes to address climate change. Nearly all respondents indicated that they would be willing to make changes.

Permeable Driveways

There are a variety of practices that can be used to manage stormwater runoff on private properties: In addition to permeable driveways, stormwater runoff from private properties can be reduced by integrating multiple types of low impact developments (LIDs) (see Sheikh & Izanloo (2021) and Wadhwa & Pavan Kuma (2020)); these include:

- Rain barrels
- Rain gardens
- Redirecting downspouts to lawns instead of hard surfaces
- Cisterns, and/or
- Infiltration galleries

Many residents have a poor understanding of the environmental impacts associated with stormwater runoff: Education and awareness will be critical to increase the broader implementation of permeable driveways and LIDs. Many homeowners and renters are not aware of what stormwater is or how, in many cases, stormwater is untreated and flows directly into local streams/creeks. This role could be provided by an environmental organization. Survey results suggest a high level of trust and comfort with an environmental organization as a point of information and advice regarding permeable driveways.

Public education about types of LIDs and benefits: In addition, municipal representatives stressed the need for increased public awareness regarding the types of LIDs available for

residential properties and the importance of stormwater management. These conversations also revealed that owners typically focus on increasing the runoff from their property because property owners are concerned that stormwater will cause flooding on their property if it is not drained away. If done properly, LIDs would not cause flooding. Hence the need for community engagement and public education about stormwater management. Additionally, permeable driveway installers also highlighted the need for more public awareness about the benefits of permeable paving.

Residents have implemented some LIDs to address stormwater management: In the online survey respondents were asked to select any and all LIDs they had on their property. All five LIDs were selected at least once by the respondents. The majority of respondents had already moved their downspout from flowing onto an impervious surface to flowing out onto a lawn.

Homeowners feel that they have a role in reducing stormwater runoff: The results of the online survey found that 70% of respondents felt that homeowners should be taking action to reduce the amount of runoff their properties generate.

Flooding is a concern for residents: When asked about their thoughts and experiences with flooding, some respondents to the online survey indicated that flooding was a concern for them. However, few respondents reported experiencing flooding firsthand.

There is interest in installing permeable driveways: Respondents to the online survey indicated that they would be interested in installing a permeable driveway. The conversations with paving and landscape companies also indicated that there is demand for permeable paving in the Oakville area.

Permeable driveways are expensive: The background research and community conversations indicated that the average cost of permeable driveways was higher than traditional asphalt. Additionally, respondents to the online survey also discussed how the price of permeable driveways was a deterrent for them.

There are cheaper LID alternatives to permeable driveways: Rain barrels and rain gardens both contribute to reducing stormwater runoff and are more cost-effective alternatives to permeable driveways. Among options, rain barrels are the most cost-effective LID option (Joshi et al., 2021; Sheikh & Izanloo, 2021).

Cost is not the only challenge for permeable driveways: Conversations with driveways installers and landscapers found that there are issues with the lack of construction standardization and regulations for the permeable paving industry.

The standardization challenge can be remedied: The most frequently suggested solution provided by contractors and landscapers was for municipalities, or the provincial government, to mandate a specific percentage of permeable surfaces that must be included on a property.

Ideally, this mandate would apply to all properties that are undergoing major upgrades or for new buildings.

Pricing permeable driveways is a complicated process: Conversations with permeable driveway installers found that the costs of permeable driveways are not determined the same way as a traditional asphalt driveway. Some installers were able to provide a price per square foot for permeable driveways. Other installers were unable to provide a price per square foot because they use the price per job method, which requires a more detailed costing approach. Some of the factors that can influence the cost of a permeable driveway, other than size and materials, include the underlying soil type, the type of exfiltration needed, the proximity to the quarry, water storage needs of the property and whether the existing driveway needs to be removed.

Financial incentive program could encourage the adoption of permeable driveways: When asked to select an ideal rebate percentage, the majority of online survey respondents selected the 50% rebate option, thereby highlighting the influence financial incentives could have on the adoption of permeable driveways. Additionally, the conversations with contractors indicated that more incentive programs for both permeable driveways and LIDs are needed at the municipal level.

There is low to medium demand for permeable driveways in the Oakville area: The conversations with permeable driveway installers and landscapers indicated that the current demand for their permeable services is low to medium. However, several respondents were optimistic that demand will increase in the future. As well, one landscaper mentioned that if the design plan for a project includes hardscaping, they typically suggest permeable paving to the client.

Stormwater management is a growing concern for municipalities: The background research and conversations with municipal stormwater managers have indicated that flooding and subsequent runoff management is being addressed through the adoption of incentive programs. These programs take the form of either a financial incentive program (e.g. a rebate program) or a fee and credit program. Examples of incentive programs include the Downspout Disconnection Financial Assistance Program offered by the Region of Peel (Public Works: Waste and Water, 2021). Additionally, examples of active fee and credit programs can be found in the cities of Mississauga, Brampton, Kitchener and Waterloo.

There are several sources of reliable advice for permeable driveways: The online survey found that respondents would be most comfortable contacting someone who already had a permeable driveway, an environmental organization or their municipal government to gain insights about permeable driveways. Additionally, the background research found that reliable information about permeable driveways can be obtained from Canadian and American NGOs.

Permeable pavers are the preferred material for permeable driveways: Respondents for the online survey were asked to rank their preference for four different types of driveways and the permeable paving stone driveway was determined to be the most appealing.

Rain gardens might be an alternative or complementary service to permeable driveways: The results from the online survey indicated that there was strong and moderate interest in rain gardens. Additionally, the concern about costs was not a primary deterrent, unlike the case for permeable driveways.

Rain gardens may not appeal to everyone: The online survey highlighted several reasons as to why respondents would not want a rain garden, with the second most popular reason being the aesthetic appeal. Several respondents noted that they did not like the physical look of rain gardens.

The installation of rain gardens can be influenced by incentives: When asked to select an ideal rebate percentage for rain gardens, the majority of online survey respondents selected the 50% rebate option.

There are multiple sources for reliable information for rain gardens: The background research indicated that there are several reliable sources regarding the design and planting suggestions for rain gardens. Some reliable sources include Conservation Halton, the Toronto and Region Conservation Authority (TRCA), REEP Green Solutions, and Credit Valley Conservation (CVC). Also, there are municipal run programs providing grants or rebates for rain garden installation, such as the City of Guelph's rain garden initiative and the rain garden grant program offered by the Municipality of Bluewater. Furthermore, the online survey found that respondents would be most comfortable obtaining information about rain gardens from a local nursery or garden center, a local landscaper, an environmental organization or from the internet.

Electric Vehicle Charger Findings

The dominant type of vehicle is gasoline: Respondents to the online survey were asked to indicate which vehicle type(s) they owned or leased; multiple selections were allowed if the respondent owned or leased more than one vehicle. The most commonly selected vehicle was gasoline with 82% of responses, while fully electric vehicles (EV) were the second most common with 16% of respondents selecting that type.

For multi-vehicle ownership, the most common pairing was gasoline and EV: Analysis of the multiple vehicle ownerships indicated that it was common for respondents to own or lease a gasoline vehicle alongside another vehicle. Of the possible gasoline pairings, the most common pairing was gasoline and EV, and the second most common pairing was gasoline and HEV.

Lowering greenhouse gas (GHG) emissions and fuel cost savings are strong motivators for electric vehicle adoption: Part of the online survey asked respondents to select issues from a predetermined list that were most important to them when they were making the decision to purchase or lease an electric vehicle. The issues of lowering GHG emissions and saving money on fuel costs were the most commonly selected. Furthermore, respondents who did not own or lease an electric vehicle were also asked to select which issues they would find important if they were deciding to purchase an electric vehicle. Again, the issues of lowering GHG emissions and fuel cost savings were the most frequently selected.

There is interest in electric vehicle ownership: The online survey indicated that the majority of respondents (56%) who owned a gasoline or diesel vehicle would consider leasing or purchasing an electric vehicle.

Cost and range anxiety are barriers to the adoption of electric vehicles: As part of the online survey, gasoline and diesel vehicle owners were asked to provide some reasons as to why they would not purchase or lease an electric vehicle. The most frequent reason was the general purchasing cost of electric vehicles, with the availability of charging stations being the second most common response.

Many electric vehicle owners do not have a Level 2 charger installed on their property: The online survey asked respondents who owned an electric vehicle to indicate whether they had a Level 2 charger available to them in their home. The majority of respondents (64%) indicated that they did not have a level-2 charger, while 31% of respondents did have a level-2 charger installed.

Lack of urgent need for Level 2 chargers: While Level 2 chargers substantially decrease charging times, half of the survey respondents who owned or leased an electric vehicle that did not have a Level 2 charger already installed indicated they were not interested in installing one. This may be explained in part by the fact that most respondents with an EV also owned a second vehicle which was commonly a gasoline vehicle.

There are multiple sources for reliable information for Level 2 chargers: Several NGOs that specialized in disseminating reliable information about electric vehicle ownership and level-2 chargers, with Plug'n Drive being the most relevant for Ontario residents. For the online survey, all respondents were asked to indicate where they would look to obtain reliable information about the installation of Level 2 chargers. The most commonly selected option were dealerships that sold electric vehicles, followed by a business that specializes in charger installation. Respondents also indicated that they would contact someone who already had a Level 2 charger installed. The option with the lowest response rate was contacting an environmental organization.

Existing incentive programs for Level 2 chargers are limited: Neither Oakville nor Halton Region offer incentives to support the installation of Level 2 chargers. Other cities in Ontario do, such as Ottawa and Toronto.

Barriers for renters, non-detached dwellings, and those without garages: Interviewees and survey respondents noted several challenges with installing electric vehicle chargers on private properties including:

- If an EV car owner is renting a property, the property owner may not approve the installation of a Level 2 charger or pay for installation. Renters may be reluctant to incur the costs unless they have a long tenure.
- Challenge to reach homeowners without garages and those living in townhouses and apartments.

There is growing interest in facilitating the adoption of electric vehicles and charging stations: Several government and municipal programs seek to increase the availability of public charging stations, such as the Zero Emission Vehicle Infrastructure Program from Natural Resources Canada (NRCAN) and electric vehicle charging network in Kinston. Additional research found that car manufacturers seem to be interested in partnering with specialized electric vehicle service providers to offer discounted services to new electric vehicle owners. Specifically, General Motors has partnered with Qmerit to facilitate the adoption of residential charging stations. As well, a conversation with an Oakville based electrician found that demand for charger installation services is starting to increase for them.

Electric vehicle charger installation is becoming a specialization: A scan of websites, and conversations with electricians in the Oakville area, found at least six electricians promoting electric vehicle charger installation as part of their service packages.

Incentives and subsidized infrastructure for electric chargers reinforces dependency on the automobile: Some interviewees noted that public funds could be better used to support public transportation and active transportation. From an environmental perspective, fewer cars, walkable cities should be the priority. Interviewees also noted that electric cars help reduce greenhouse gas emissions when compared to gasoline cars but still come with large associated environmental costs.

Moving Forward

Community partnerships are possible: The interview results indicated that there are community groups that could provide support or guidance regarding a SPO that focuses on providing employment opportunities for LID evaluators. Additionally, the background research highlights the trend of utilizing evaluators for programs targeting rain gardens. Thus, there is an opportunity to partner with rehabilitation or community employment services to hire people who could benefit from gaining skills and provide the chance to work on an important environmental issue. Moreover, the community groups indicated that it might be possible to

develop three-way partnerships between their organization, the SPO, and the federal or provincial governments to obtain funding.

Clear training and supervision are needed: Each of the community groups stressed that in order for the proposed SPO to be successful it should develop detailed training protocols that will allow potential employees to succeed in their job. As well, proper supervision would be needed. A possible barrier for installing permeable driveways is the high level of technical expertise required to ensure proper infiltration.

An environmental focused SPO could be viable: The community groups interviewed indicated that there is a need for meaningful employment and that the Oakville community is receptive to environmental initiatives. Thus, the proposed SPO could develop a unique niche by offering both environmental and social benefits if it facilitates local job creation.

Homeowners concerns about permeable driveways suggest tepid widespread adoption. Key concerns identified and raised individually in the permeable driveway section include:

- higher cost
- higher level of ongoing maintenance than for hard surfaces
- Concern that a permeable driveway could increase onsite flood risks
- Concern about winter maintenance (although the literature suggests equal or lower winter maintenance)
- Preference to direct stormwater off the property
- Lack of general awareness about environmental impacts of stormwater and LID options.

Planning for a SPO will require a strategy in place to handle the above-noted concerns.

3. Market Analysis

Permeable Driveways

Market Potential

The market for permeable driveways in Oakville is in its infancy. 10% of survey respondents indicated they had a permeable driveway. Interviews with contractors suggested less than 5% of homes in Oakville have permeable driveways. While there is market potential, interviews with contractors indicated that current demand for permeable paving services is low. A few interviewees were optimistic that demand will increase in the future. Survey results echo this sentiment that future demand could be higher with thirty-one percent of survey respondents indicating they were very interested and 45% indicating moderately interested in having a permeable driveway installed.

Several important barriers need to be addressed to stimulate higher demand, most notably the higher costs when compared to alternatives. As noted in the results section, cost estimates provided by contractors range substantially and will vary depending on a number of factors. At best, a permeable driveway is at least three times the cost of an asphalt driveway of similar size and potentially much higher.

Service Suppliers

Installing a permeable driveway requires technical expertise. Driveway paving companies and larger more established landscape companies typically offer the service. Our analysis reached 15 contractors in the local region that provide permeable driveway installation. The list of companies contacted was based on a Google search. Clearly, more service providers offer the service in the region. There are also a handful of specialty companies focusing on permeable driveway installation and specialized permeable products. Current supplier capacity can fill an increase in market demand for permeable driveways.

Cost Analysis

Permeable driveways are substantially more costly than asphalt. Assuming a price range of $25-$50 ft^2, permeable driveways are at best, 3 times more costly to install. Asphalt driveways range from $2-$8 ft^2 depending on numerous other factors including thickness, quality, labour costs and other installation factors. Contractors were very reluctant to provide pricing information without being able to quote on a specific job. One company provided a cost range of $35-$50 ft^2. Two other companies provided general estimates of $25 ft^2 and $30 ft^2 respectively. Another company was not able to provide a square foot price but did state that the price for their projects typically ranges from $10,000 to $25,000.
It is unclear if these price estimates included the same level of service. Pricing should take into account completed excavation, base installation, bedding material, paver, edge restraints, joint

material, labour and equipment. Pricing will also vary by the product chose, size of the driveway, underlying soil type (e.g. sand or clay), whether the permeable system has full, partial or no exfiltration, whether the company will need to remove the existing driveway, proximity to the quarry and water storage needs of the property among others.

With regards to the pricing of different permeable materials, one of the companies was able to provide insights into the various price points for different permeable products. According to their experience, the price for a gravel or grass grid driveway could range between \$7-\$16 ft^2, permeable pavers could be between \$17-\$25 ft^2 and porous driveway materials was \$12- ft^2.

LID Cost Comparison

While permeable driveways can play an important role in reducing stormwater runoff on residential properties, there are other low impact development (LID) options[1] to reduce stormwater runoff on residential properties including rain gardens and rain barrels. Permeable driveways reduce runoff on residential properties by 20-75%. The table below compares the costs and runoff reduction potential of different LID options. Permeable driveways are more expensive than rain barrels and rain gardens with similar upper end runoff reduction potential. In the academic literature, rain barrels and rain gardens have been shown to have lower effectiveness than permeable driveways in terms of reducing runoff volume during simulated rainfall events but can be more effective than permeable driveways in reducing the peak flow of runoff during a storm event.

Table 1: Estimated LID costs adjusted for CAD\$ 2021 dollars. These prices do not include labour.

LID	Costs (\$)*	Runoff Reductions (%)*
Permeable grass/gravel pavers	4-14 ft^2	20-75
Permeable pavingstones	12-24 ft^2	20-75
Rain Gardens	22-26 ft^2	40-81
Rain barrels	\$150 - 200 per 185L (50G) barrel	24-77
Asphalt	4-6 ft^2	0
* Adapted from Montalto and Hua		

[1] As defined by the US EPA The term *low impact development* (LID) refers to systems and practices that use or mimic natural processes that result in the infiltration, evapotranspiration or use of stormwater in order to protect water quality and associated aquatic habitat.

EV Chargers

Market Potential

The market potential for EVs and subsequently EV chargers is very large. Demand will fueled by government incentive programs to support climate reduction targets and car manufacturing commitments to stop selling gasoline vehicles. Within Oakville, an electrician interviewed noted a substantial increase in demand in recent years for charger installation. This viewpoint is backed by data from Plug'n Drive which indicates rising demand for EV and EV chargers in the greater Toronto region. While macro economic conditions suggest high demand, survey results found that approximately 50% of respondents with an EV did not think they needed a level-2 charger.

Service Suppliers

A certified electrician can install a 240-volt outlet required for a Level 2 EV charger. While not a specialty area, several electrical companies in Oakville promote the installation of electric vehicle chargers for residential properties as a service. Examples of companies include:

- Colony Electrical
- Effective Electrical
- JPR Electrical Services
- Lankan Electric Inc.
- Spark Power
- Wiljan Electrical Inc.

Effective Electrical has an informal relationship with a Tesla dealership and specifically highlights installation of chargers for Tesla vehicles.

Cost Analysis

Current hardwired Level 2 chargers, sold by Plug'n Drive, range from $749 CAD to $1,295 CAD. Installation of 240 volt outlet cost approximately $1,000 CAD. Exact prices will vary by electrician labour rates. This assumes the property does not need to upgrade its panel box to a 200 amps service to accommodate the added electrical load from the charger. A Level 1 charger does not require the addition of 240 volt outlet and comes with all EV models.

4. Role for a Social Purpose Organization

Permeable Driveways

Tackling stormwater runoff on residential properties could offer a purpose-driven mandate focused on protecting water quality and reducing flood risks. Given high costs and other barriers noted in the findings there does not appear to be sufficient market demand for an SPO focused *solely* on permeable driveways.

There may, however, be a role for an SPO focused on effectively managing residential stormwater management. The expanded focus could provide a clearer mandate and rationale than focusing solely on permeable driveways. An emphasis on residential stormwater management practices offers flexibility to promote a broader range of LID products and initiatives including rain barrels and rain gardens providing homeowners other options at different price points to reduce stormwater runoff than permeable driveways. In addition, the academic literature has found that combining multiple LIDs increases the effectiveness for reducing stormwater runoff (Hua et al., 2020; Nowogoński, 2021; Wadhwa & Pavan Kumar, 2020).

A SPO could generate revenue through grant administration, site evaluation, installation support, and product sales. The SPO could fill an important role as a trusted purveyor of information on the benefits of LIDs and the importance of stormwater management more generally. The SPO could also provide and maintain a list of vetted service providers for the various product options.

Education and awareness to communicate the benefits of stormwater management practices will be critical to increase the broader implementation of permeable driveways and LIDs. Survey results suggest a high level of trust and comfort with an environmental organization as a point of information and advice regarding permeable driveways. One example of a social purpose organization successfully supporting LID implementation is REEP Green Solutions operating in the Kitchener, Waterloo, and Guelph region.

Government incentives could stimulate demand creating a potential role for an SPO as property site evaluators or grant administrator. Currently, there are no financial incentives for permeable driveways or other LIDs in Oakville. A potential opportunity for the municipality is to offer grants to subsidize implementation costs or adopt a stormwater charge system that could encourage the adoption of on-site stormwater management practices.

Background research identified several municipal programs that encourage the adoption of LIDs, including permeable driveways, on residential properties through the use of stormwater fee and credit programming. A stormwater fee and credit program consist of applying a user

fee or financial charge to residential properties, which can be offset by a credit for the implementation of LIDs. For instance, the Cities of Kitchener, Waterloo and Guelph provide a forty-five percent credit to the stormwater fee of property owners that have installed a permeable driveway. The City of Ottawa recently launched the Rain Ready Ottawa program that offers grants for property owners to help offset the costs of installing large or costly stormwater management projects. Permeable driveways are eligible for a rebate of up to $5,000 and rain gardens are eligible for up to a $2,500 rebate. This program is offered in partnership with a local environmental organization, EnviroCentre (Infrastructure and Economic Development Dept Planning, 2021).

A SPO targeting residential stormwater management should consider a community economic development focus to facilitate local job creation as part of its mandate. As highlighted in the findings sections there is potential alignment between the proposed SPO and existing non-government vocational organizations such as Centre for Skills Development or STRIDE (Supported Training & Rehabilitation in Diverse Environments). For example, both organizations could envision their clients working for a SPO that installed green driveways. They noted that proper training and supervision would be required. As well, both the Guelph rain garden program and the Ottawa program utilized specially trained assessors or evaluators to assist in the review of program applications. The training and hiring of evaluators are completed by the environmental organizations, while the applications are collected by the municipal partner. This co-benefit model has worked for REEP Green Solutions and EnviroCentre, allowing these organizations to address environmental issues *and* support job creation in their communities.

A SPO could focus on partnerships with existing programming and initiatives pursuing similar mandates. Numerous groups are leading LID initiatives in the Oakville area. Table 2 includes select examples of orgnizations and programs. Strategic partnerships could facilitate efficiency in program delivery and help an SPO reach an established network. Two possible programs to consider offered by Halton Environment Network include Depave Paradise and the Greening Sacred Spaces initiative.

Table 2: Examples of organizations leading LID initiatives in the Oakville area

Conservation Halton, Healthy Neighboursheds Program	The Healthy Neighboursheds program helps homeowners develop gardening plans to minimize stormwater runoff on their properties.
Halton Environmental Network, Depave Paradise	Depave Paradise supports community groups to rip up pavement and plant gardens by providing training and support to implement depaving projects.
Halton Environmental Network, Greening Sacred Spaces (GSS)	The GSS initiative assists faith communities in Halton and Peel Regions in creating more sustainable and environmentally-friendly places of worship through education, capacity building and supporting concrete action

	in the community. Projects have included depaving parking lots and implementing LID practices such as rainbarrels and gardens.
OakvilleReady	OakvilleReady is a collective initiative composed of team members from The Town of Oakville, Halton Environmental Network, and Faith & the Common Good. OakvilleReady supports an Oakville resiliency hub network that engages diverse community stakeholders to increase their personal resiliency, community capacity, and understanding around how we can work together to support each other during extreme weather events.
Oakvillegreen Conservation Association, Oakville Ready for Rain Program	The Oakville Ready for Rain Program supports projects that reduce stormwater run-off. In addition to providing education material on rain gardens, the program has implemented four demonstration storm-water retrofits including three rain gardens and one French drain.

Level 2 Electrical Vehicle Chargers

The market need for EV information and charger installation appears to be full. This study found an abundance of information related to purchasing EVs, the benefits of EVs and information specific to Level 2 chargers. Two notable NGOs providing information include Plug n' Drive and Electric Mobility Canada. Plug n' Drive and Electric Mobility Canada provide a range of information regarding the installation of Level 2 chargers, lists of active incentive programs, along with educational outreach and EV advocacy. Plug n' Drive has an educational facility in the Toronto region where people can test drive and learn about EVs.

Car companies appear to be taking a lead role as well. In addition to dealerships providing information on Level 2 charger installation, General Motors recently partnered with Qmerit to support the standard installation of a Level 2 (240 volt) charging home outlet (General Motors, 2021; Qmerit, 2021). Chevrolet will install a level 2 charger or provide $750 in charging credits for eligible customers who purchase or lease a new 2022 Chevrolet Bolt EUV or Bolt EV (Guy, 2021). Furthermore, when asked about where you could go to get reliable advice on EV chargers, the most common response among survey respondents was to seek information from electric vehicle dealerships.

The primary benefits of installing a Level 2 charger are the convenience and reliability it offers. The Level 1 charger can take up to 24 hours to fully charge a car (depending on the model), while a Level 2 charger could recharge in about 8 hours (depending on the model of the car). Additionally, there are publicly available Level 2 and Level 3 chargers in Oakville. Almost half of

the survey respondents who own or lease an EV or are thinking about leasing or buying an EV indicated they were not interested in a Level 2 charger. The convenience of faster speed time does not seem to be a sure driver for demand.

Short term EV adoption and Level 2 charger demand are most likely to be driven by incentive programs and car manufacturing commitments to stop selling gasoline vehicles. There are some incentive programs in Ontario that focus on the purchase of an EV, such as the Transport Canada grant or the used electric vehicle incentive from Plug'n Drive. These incentive programs are open to anyone living in Ontario. Only two jurisdictions offer incentive programs for Level 2 chargers, Ottawa and Toronto.

Without a large stimulus of demand for chargers, an SPO focused on Level 2 charger installation does not seem warranted at this time. Bold action by Oakville to require all new houses and potentially all detached houses to install a Level 2 charger could spark a role. An SPO could play a role as a grant administrator if a local incentive program is put in place. Playing a role as an installer does not seem viable. Level 2 chargers can be installed by any certified electrician.

Capitalizing on currently available federal funding opportunities, such as applying for the Zero Emission Vehicle Infrastruture program may also serve to advance the uptake of residentially-based green infrastructure in Oakville.

Recommendation

The Small Change Fund and HEN are both committed to supporting bold actions and exploring partnerships to help homeowners adopt sustainability practices to reduce environmental impacts in Oakville, and across Ontario.

This study used background research, interview results and the results of a community survey to assess the feasibility of a potential social purpose organization to install:

- Permeable residential driveways, and/or
- Level-2 residential electric vehicle chargers.

The study examined whether establishing an SPO could:

- Advance the uptake of permeable driveways and/or level-2 electric vehicle;
- be profitable; and
- achieve social and environmental benefits.

Based on the analysis, at this time, there appears to be insufficient market demand for a SPO that offers EV chargers and/or green driveway installations to Oakville residents. The EV charging market seems to be fully saturated by existing market players, and the permeable driveway market, alone, does not seem to be viable.

Given the spirit and intent of the study – essentially, to suggest interventions that would increase the resilience of households in Oakville to the effects of a changing climate - there appears to be market interest in lower cost, less disruptive, residential LID services than permeable driveways alone, such as a suite of products including rain gardens, rain barrels, and depaving initiatives. However, there are already many groups in Oakville helping residents to learn about, and install, LID features.

If community partners are interested, the Small Change Fund and the Halton Environmental Network is open to pursuing further exploration of the establishment of a social purpose organization to advance the concepts of Green Drive Oakville, in partnership.

If a willing partner emerges and wishes to explore the collaborative establishment of a social purpose organization, some considerations include:

- Working alongside local governments to support regulatory changes to enhance market conditions and support LID. These include:
    - Government incentive programs targeting homeowners to install rain barrels, rain gardens, permeable driveways and other technologies that reduce stormwater runoff;
    - Municipal storm water pricing;
    - A public education campaign to promote the merits of LID.
- Involviing existing LID educators installers in future discussions to ensure alignment with ongoing work and a fulfilment of a market niche.
- Workign alongside employment services agencies to collaborate on the development amd execution of training programs to support the SPO.
- Examining ways to expand the service offerings of the SPO to include:
    - Non-residential surfaces (for instance commercial or industrial parking lots)
    - Education and installation of other (lower cost) products and services to reduce stormwater runoff (rain barrels and rain gardens, for instance).

Appendices

Appendix A: Background Research

Electric Vehicle Charging

What is an electric vehicle charger?

In general, three types of electric vehicle chargers allow for recharging of fully electric and plug-in hybrid electric vehicles. The first type, called Level 1, allows for charging of electric vehicles by using a standard 120 volt (20 amps) wall outlet but has the slowest recharging rates because of the low voltage (ChargeHub, 2020). The second type, called Level 2, uses a specific 240 volt (80 amps) outlet to recharge, this type is significantly faster than level-1 chargers (ChargeHub, 2020; Plug'n Drive, 2021d). The third type, Level 3, is the fastest charging type because it uses specially designed 480 volts (300 amps) charging stations (Plug'n Drive, 2021f). Typically, Level 3 charging stations are publicly accessible, with some locations also allowing for Level 2 charging. However, it is common for electric vehicle car owners to have a Level 2 charging station installed on their property for their convenience.

Having a Level 2 charger installed in your private property provides you with reliable access to a charger, compared to having to rely on using public charging stations which may be in use by other car owners. As well, a private Level 2 charger will decrease the time it takes to recharge your vehicle. Instead of waiting 24 hours for a Level 1 charger to recharge the vehicle, a Level 2 charger could recharge the vehicle overnight.

Active Non-Governmental Organizations

Plug'n Drive

Plug'n Drive is a Canadian based NGO with the purpose of facilitating the adoption of EVs through educational outreach and knowledge sharing. Their website provides detailed information about EV benefits, the types of EV models available in Canada, EV incentives, and information on charging options and the location of charging stations.

With regards to EV incentives and charging, Plug'n Drive provides a list of all current federal and provincial EV incentive programs (Plug'n Drive, 2021b). As well, they provide an online store where individuals can purchase home charging units (level 1 and level 2) (Plug'n Drive, 2021e). Relevant rebates are provided in the listing details. Additionally, the website provides links to find licensed electricians (Plug'n Drive, 2021d).

Plug'n Drive offers several services to businesses and individuals. Including a corporate/employee engagement program and workplace charging program (Plug'n Drive, 2021h). The corporate/employee engagement program consists of a webinar series covering the benefits, how to get started and the trends in EVs, as well as providing an opportunity to book EV test driving for the employees (Plug'n Drive, 2021i). The workplace charging program

provides consulting services aimed at establishing on-site charging for corporations. This workplace program also helps businesses convert their current vehicle fleet to electric alternatives (Plug'n Drive, 2021c).

Plug'n Drive has an educational outreach facility called The Electric Vehicle Discovery Centre in North York, ON (Plug'n Drive, 2021a). This facility acts as a hub for EV information and public engagement. The organization provides visitors with the ability to test drive various EV models (Plug'n Drive, 2021a).

Used Electric Vehicle Incentive

Plug'n Drive provides an incentive for pre-owned fully electric vehicles worth $1,000 CAD (Plug'n Drive, 2021b). In addition to vehicles being sold for less than $50,000 CAD, the purchaser must attend one of Plug-n Drive's webinar/seminars on used vehicles in order to qualify for the incentive (Plug'n Drive, 2021b). This program is only available to Ontario residents and is in collaboration with the Clean Air Partnership and the M. H. Brigham Foundation (Plug'n Drive, 2021b).

Scrappage Program

Plug'n Drive provides an incentive to encourage car owners to recycle their current internal combustion cars and purchase a used EV vehicle (Plug'n Drive, 2021g). This incentive is worth $1,000 CAD and can be combined with Plug'n Drive's used EV vehicle program. To qualify the car must be fully operational, have an internal combustion engine, have valid insurance, be registered to the person seeking the incentive and has been owned by this person for more than 6 months (Plug'n Drive, 2021g). This program is only available to Ontario residents and is in collaboration with the Clean Air Partnership and the M. H. Brigham Foundation (Plug'n Drive, 2021g).

Electric Autonomy Canada

Electric Autonomy Canada is an independent news outlet focused on EV trends, news and information (Electric Autonomy Canada, 2021a). The site includes information on incentives and funding, EV education, policy and planning, and municipal programs (Electric Autonomy Canada, 2021b, 2021d, 2021c). This site recently published an interesting story about electric vehicle charging in Oakville (Jarratt, 2021).

Clean Air Partnership

The Clean Air Partnership supports active and low carbon transportation to improve the air quality of communities in Canada (Clean Air Partnership, 2021a). This organization provides resources related to EV charging stations or creating an EV fleet (Clean Air Partnership, 2021b).

Electric Mobility Canada

Electric Mobility Canada is a national membership-based not-for-profit organization dedicated exclusively to the advancement of e-mobility as an exciting and promising opportunity to fight

climate change and stimulate and support the Canadian economy (Electric Mobility Canada, 2021a). Electric Mobility Canada group provides information on EV benefits, EV charging stations and information for homeowners who would like to install an EV charging station (Electric Mobility Canada, 2021c). Additionally, Electric Mobility Canada advocates federally and provincially for clean electricity, more intensive EV adoption, EV tax credits and incentive programs (Electric Mobility Canada, 2021b).

TakeCHARGE

TakeCHARGE is a partnership between Newfoundland Power and Newfoundland and Labrador Hydro (TakeCHARGE, 2021a). TakeCHARGE provides information for improving the energy efficiency of the province and residential homes (TakeCHARGE, 2021c). Their website provides three electric vehicle calculators to demonstrate the benefits of EV vehicles (TakeCHARGE, 2021b).

Municipal Programs and Incentives

Ottawa, Home Charging Station Grant

Hydro Ottawa Limited is piloting a program for home charging stations for electric cars (Hydro Ottawa Limited, 2021). As Ottawa's local utility distribution company, Hydro Ottawa offers eligible applicants a FLO Home X5 EV Charging Station (level 2) electric vehicle charging station at a reduced price of $ 777 (Charge Hub, 2021; Hydro Ottawa Limited, 2021). Applicants pay for the installation costs which ranges from $ 600 to $ 1,800 (Hydro Ottawa Limited, 2021). Hydro Ottawa will put successful applicants in contact with an electrical contractor to install the charging terminal (Hydro Ottawa Limited, 2021).

Toronto, Home Energy Loan Program

The Home Energy Loan Program (HELP) is a funding tool offered by the City of Toronto to help residents improve the energy efficiency of their homes and save money (Natural Resources Canada, 2018). The HELP program offers reduced interest loans to eligible homeowners who wish to improve the water and energy savings of their homes (Natural Resources Canada, 2018). Through the HELP program, the City of Toronto will provide the funding necessary to implement these improvements, and homeowners will reimburse the City through payments on their property tax bills (Environment and Energy Division, 2017). Improvements include home charging stations (level 2) and the maximum loan is $75,000 (Environment and Energy Division, 2017).

Eligibility requirements for the HELP include:

- you own a detached, semi-detached, or row house;
- all of the property owners on title consent to participate in the program;
- your property tax and utility payments to the City are in good standing; and
- you obtain written consent from your mortgage lender, if applicable.

City of Kingston – Public EV Charging Stations

The City of Kingston offers level 2 and level 3 charging stations for public use (City of Kingston, 2021). Users are required to pay a fee for use. These stations are offered at several locations throughout the city and can be geolocated using the Flo charge mobile phone app (City of Kingston, 2021). This initiative helps increase the accessibility to EV charging while also generating revenue for the city.

Provincial Programs and Incentives

Ontario Ministry of Transportation – EV charging website

The website provides information on dedicated EV charging stations. Stations reserved for EV vehicles are subject to the Highway Traffic Act, as of January 1 2021 (Ministry of Transportation, 2020). Thus, any non-EV parked in a reserved charging spot is now subject to a fine of $125 CAD. In addition to this legislative change, this website provides information on getting an EV charging station installed in your home (Ministry of Transportation, 2020).

Ontario Rebate Program- Energy Savings Rebate Program

The Energy Savings Rebate program, which expired in March 31, 2021, provided funding to eligible retailers to support energy-efficient products in Ontario (Environment and Climate Change Canada, 2021). As part of the program, Autochargers.ca offered rebates to Ontarians for electric vehicle home chargers up to 25% of the purchase price, no more than $500 per item (Auto Chargers, 2021). This program was funded by the Federal Government and open to Ontario businesses (Environment and Climate Change Canada, 2019). No new applications by businesses are being accepted and all funding has been exhausted/released. As of April 30th, 2021, there is no indication that the program will be renewed (Environment and Climate Change Canada, 2021).

Federal Programs and Incentives

Transport Canada

The federal government provides two types of incentives, one for battery-electric, hydrogen or longer-range plug-in vehicles worth $5,000 CAD (Transport Canada, 2021a). The second incentive is for short range plug-in vehicles worth $2,500 CAD (Transport Canada, 2021a). The website provides information regarding eligible vehicles (Transport Canada, 2021b).

The Electric Vehicle and Alternative Fuel Infrastructure Deployment Initiative

The Electric Vehicle and Alternative Fuel Infrastructure Deployment Initiative (EVAFIDI) offers repayable contributions to support the construction of a coast-to-coast EV fast-charging network in Canada (Natural Resources Canada, 2021a). The program is administered by Natural

Resources Canada (NRCan). Eligible recipients include electric utilities, companies, industry associations, research associations, Indigenous communities, and local governments(Natural Resources Canada, 2021a). EVAFIDI projects must include the permanent installation of networked DC fast chargers, with a strong bias for sites located directly off of national highways (Natural Resources Canada, 2021a). The last round of EVAFIDI closed on July 23, 2020. NRCan has not yet announced any future EVAFIDI funding, though the program is scheduled to run until March 2024

Zero Emission Vehicle Infrastructure Program

NRCan is seeking applications from eligible Delivery Organizations to distribute Zero Emission Vehicle Infrastructure Program (ZEVIP) funding to install EV charging infrastructure projects in public places, on-street, in multi-unit residential buildings, at workplaces or for light-duty vehicle fleets (Natural Resources Canada, 2021b). NRCan's contribution through this Program will be limited to 50% of total eligible costs up to a max of $2,000,000 per project for Delivery Organizations (Natural Resources Canada, 2021b).

Workplace Electric Vehicle Incentive Program

The Workplace Electric Vehicle Incentive Program (WEVCIP) provides substantial rebates for workplaces, building owners and building managers to install electric vehicle charging stations for their employees to promote sustainable transportation choices and to get more EVs on Ontario's roads (Electric Mobility Canada, 2018; Plug'n Drive, 2018).

Federal Budget 2021

The federal budget 2021 includes specific funding for the development of regulatory standards for electric vehicle charging stations (Department of Finance, 2021). These standards include accreditation and inspection frameworks. It appears that the focus of these standards is on publicly accessible charging stations (Department of Finance, 2021). At the time of writing, there are no further details about how these regulatory standards would apply to in-home charging stations.

Understanding EV Charging Options

Level 1 charging

120 = very slow, but useful in specific situations.

- Nissan LEAF – 4.5 miles of range per hour; 21 hours to full charge.
- Tesla Model S – 3-4 miles of range per hour; 63-81 hours to full charge.
- Chevy Volt – 5 miles of range per hour; 10.5 hours to full charge.

Level 2 charging

240v = 2-4x faster than 120v charging (depending on electrical current capacity).

- Nissan LEAF – 12-25 miles of range per hour; 4-7 hours to full charge.
- Tesla Model S – 20-25 miles of range per hour; 10-12 hours to full charge.
- Chevy Volt – 13 miles of range per hour; 4 hours to full charge.

Full-electric cars will most likely require Level 2 charging to get a full battery overnight. Hybrids may get a full charge off of Level 1 charging overnight, but it's best not to count on it.

DC charging

This method is *much* faster than AC charging, but it's not yet widely available—and the chargers cost a fortune to install.

However, some companies are seeking to make ultra-fast DC charging stations more widely available. For example, EVgo is offering Freedom Station Plans that could put 480VDC chargers in the heart of cities and along major highways. These charging stations can charge up to 150 miles of range in one hour. They could revolutionize EV driving if they're widely adopted.

Note: not all EVs can accept a charge from a DC source. Consult the owner's manual for your car before plugging in to a DC charging station.

There are 3 standards currently in use. Note that the Tesla Supercharger method is proprietary and only works on Tesla cars.

For information on chargers available see,
https://www.zap-map.com/charge-points/connectors-speeds/
https://chargehub.com/en/electric-car-charging-guide.html

Home Charging Costs

In Ontario, it is roughly 65% less expensive to charge at home than at a public charger and 5 times less expensive to drive 100 km (62 miles) on electricity than on gas.

Permeable Driveways and Paving

WHAT IS A PERMEABLE DRIVEWAY?

Permeable driveways are specially designed driveways that seek to reduce stormwater runoff by using porous materials to allow rainwater to filter through the driveway into the soil (Sustainable Technologies Evaluation Program, 2020b). These types of driveways can be created by using a grid-fill system, stone or concrete pavers, or special porous concrete or asphalt (Sustainable Technologies Evaluation Program, 2020b).

A permeable driveway is engineered to allow for rainwater filtration by using different layers of stone aggregate and infill. These types of driveways can be designed to work in areas that are flood-prone, as well as areas that have clay soils.

Permeable driveways offer several benefits to the property owner and the wider community (Adapted from Credit Valley Conservation, 2015):

- These types of driveways slow down the flow of rainwater, which helps to prevent flooding on the property and in the community.
- In many municipalities, water that flows into the on-street storm drains is not treated before it is released into local waterways. Due to the construction of the permeable driveway, rainwater that flows onto its surface filters down through several layers of aggregate and soil, resulting in the water returning to the water table and eventually to the local waterways. This process, called infiltration, helps to naturally remove pollutants from the water and allows clean water to return to the local waterways.
- Permeable driveways can provide aesthetical appeal to the property because the stone pavers or grass in-fill grids can be placed in interesting patterns and designs.
- Permeable driveways can reduce the amount of ice buildup and the amount of salt used on the driveway during the winter months. The grids and paver stones allow for snow and ice to melt to drain into the soil, instead of re-freezing on the driveway like with asphalt driveways.

Active Non-Governmental Organizations

Federation of Canadian Municipalities, Stormwater Community Funding

The Stormwater Community Funding program helps municipalities reduce their stormwater runoff (Federation of Canadian Municipalities, 2021). Municipal governments or their community project partners (i.e. NGOs, research institutes, private sector entities) can apply for funding. Under this program, permeable pavement is eligible (Federation of Canadian Municipalities, 2021).

Sustainable Technologies Evaluation Program

The Sustainable Technologies Evaluation Program (STEP) is operated by several Ontario conservation authorities and seeks to improve water management within the province (Sustainable Technologies Evaluation Program, 2019a). STEP has created a wiki website that provides information on low impact development (LID) (Sustainable Technologies Evaluation Program, 2020a). The wiki is designed to provide information related to the application of LID in Ontario, including a section on permeable paving. Under the permeable pavers section, homeowners can find information pertaining to the process of installing the permeable pavers and maintenance of the pavers, along with sections on planning considerations and an explanation on how a permeable paver system is designed (Sustainable Technologies Evaluation Program, 2020b).

STEP also has a simulation tool freely available to the public. This tool allows for the creation of a model to assess the impacts of a LID infrastructure project. This modelling software requires background knowledge regarding stormwater best management practices, basic hydrology, and geographic information systems (Sustainable Technologies Evaluation Program, 2019b). This tool might not be suitable for all homeowners due to the need for pre-existing knowledge. However, this tool would be useful for other NGOs.

Interlocking Concrete Pavement Institute

The Interlocking Concrete Pavement Institute (ICPI) is a trade organization that represents the segmental concrete pavement industry in Canada and the United States. Their purpose is to advocate for this sector of the pavement industry and provide educational resources for their members (Interlocking Concrete Pavement Institute, 2021a). They offer a contractor toolkit that provides training, marketing, and resources for ICPI members to start a concrete paver installation business (Interlocking Concrete Pavement Institute, 2021b). The contractor toolkit program is separate from the certification programs ICPI offers (Interlocking Concrete Pavement Institute, 2021c). ICPI offers three free guides for homeowners (Interlocking Concrete Pavement Institute, 2021d). These guides provide information on maintaining concrete pavers, information on the process of installing concrete pavers, insights regarding the selection of contractors and a checklist for the homeowner. As well, the website features a page of completed permeable paving projects (Interlocking Concrete Pavement Institute, 2021f).

The Interlocking Concrete Pavement Institute has a separate charitable foundation called the ICPI Foundation. The purpose of the ICPI Foundation is to fund research related to the concrete pavement industry, which allows for industry or academic researchers to submit grant proposals for research funding (Interlocking Concrete Pavement Institute, 2021e).

National Asphalt Pavement Association

The National Asphalt Pavement Association (NAPA) is a USA based group that seeks to advocate for the asphalt paving industry and support its members through education and research

initiatives (National Asphalt Pavement Association, 2021a). NAPA is registered as a corporation, however, they appear to focus on education and advocacy. Although the primary focus of this group is on asphalt, they do have research publications related to porous asphalt (National Asphalt Pavement Association, 2021b). The educational material this organization provides could be useful for permeable paving companies or other organizations. In addition to the primary NAPA mission, this group also has a research and education foundation that focuses on philanthropic initiatives.

Municipal Programs and Incentives

Winnipeg

The City of Winnipeg has developed a new Combined Sewer Overflow (CSO) master plan to help address stormwater management in the city (Water and Waste Department, 2020). The CSO master plan has been approved by the province and it includes a mention of the use of pervious pavement as an alternative to the standard asphalt pavement. The city conducted a pilot permeable paving project for back lanes, called the Green Back Lane initiative (Li, 2012). This project sought to study the effectiveness of reducing or delaying stormwater flow to the City's combined sewer system. This study only included one lane way and permeable pavers were used in the center of the lane, with poured concrete wheel paths (City of Winnipeg, 2020).

Kitchener, Stormwater Credit Program

The City of Kitchener has a stormwater fee and credit program. Under this program, residential, commercial, industrial, and institutional properties are charged a monthly utility fee for stormwater (City of Kitchener, 2021). Residential property owners can offset 45% of their stormwater fee, depending on the amount of stormwater mitigated, by implementing approved low impact development (LID), which includes permeable pavers (City of Kitchener, 2021).

Waterloo, Stormwater Credit Program

The City of Waterloo offers a similar stormwater credit program as Kitchener for residential properties and permeable pavers are listed as eligible for the credit (City of Waterloo, 2021).

Guelph, Stormwater Credit Program

The City of Guelph applies stormwater charges to the water bills for residential, commercial, industrial, and institutional properties. Only charges applied to commercial, industrial and institutional properties can be reduced through credits (City of Guelph, 2021b). To obtain a stormwater credit the property would need to have an approved low impact development (LID) feature that achieved pre-determined performance or mitigation criteria. Permeable paving is included as an eligible LID practice and the maximum credit offset is 50% of the stormwater service fee (City of Guelph, 2021b).

Mississauga, Fee and Credit Program

The City of Mississauga has a limited fee and credit program. All property types are charged a stormwater fee, but only multi-residential and non-residential properties qualify for credits (City of Mississauga, 2021a). The city uses the parcel assessment process with help of aerial imagery to measure the roof area. As well, Mississauga offers a stormwater charge subsidy program for low-income seniors and persons with disabilities (City of Mississauga, 2021b). There are several types of credits available, but the total amount of credits cannot exceed 50% of the stormwater charge (City of Mississauga, 2021a).

Brampton, Stormwater Credit Program

The City of Brampton adopted a stormwater management charge as of July 2020 (City of Brampton, 2021). For residential properties, the charge is based on the roof area. For multi-family and non-residential properties all hard surfaces are measured per property. Only multi-family and non-residential properties can apply for a credit of up to 50% of their stormwater charge (City of Brampton, 2021).

Ottawa, Stormwater Management Grants

In February 2021, the City of Ottawa launched a new pilot program to facilitate the uptake of residential stormwater management (Innovative Client Services Dept, 2021). Property owners can apply for a grant for up to $5,000 CAD to help offset the cost of adding stormwater management best management practices to their property (Infrastructure and Economic Development Dept Planning, 2021). Currently, only two subwatersheds are eligible for the program. Permeable driveways are included as part of the eligible best management practices.

US - State and City Programs and Incentives

Minnesota Pollution Control Agency, Minnesota Stormwater Manual

Minnesota Pollution Control Agency is a State-run organization that monitors and prevents environmental pollution (i.e air, water, and land) (Minnesota Pollution Control Agency, 2021a). As part of their water monitoring division, they provide an online stormwater manual that takes the form of a 'wiki'. The 'wiki 'provides information on stormwater management and green stormwater infrastructure (GSI), which is comparable to the concept of low impact development (LID) (Minnesota Pollution Control Agency, 2021b). The wiki provides a dedicated section that collates all of the articles related to permeable pavement. Some of the information provided discusses the benefits of permeable pavement, case studies of municipal applications, construction specification and maintenance (Minnesota Pollution Control Agency, 2021b).

Buffalo Green Building Code

As part of updating the City of Buffalo's zoning by-laws, sustainable building practices were integrated to address environmental concerns within the city (City of Buffalo, 2021a). In terms

of impervious surfaces, this code stipulates a maximum percentage of impervious area lots can have, this percentage varies depending on the lot zoning (City of Buffalo, 2021b). The code creates an incentive for the adoption of permeable paving in site plans that intend to have large patios, driveways, parking lots or paved surfaces.

Rain Check Buffalo

Rain Check is a broad initiative to integrate green infrastructure into the city, on both public and private properties (City of Buffalo, 2021c). The website provides links to several case studies of completed stormwater projects, many of which include street improvement projects. It appears that this program is trying to expand its reach by attracting new partners and develop more projects. At this time, there is no specific initiative focusing on permeable driveways.

Onondaga County, Save the Rain

This initiative operated by Onondaga County focuses on stormwater management on both public and private properties. The initiative includes a rain barrel program for residential properties and a Green Improvement Fund (McMahon, 2021). The improvement fund focuses on commercial, business and not-for-profit properties. Porous pavement is listed as an acceptable green infrastructure technology or practice.

Portland, Environmental Services

The City of Portland provides a stormwater manual that provides detailed requirements for pervious pavement. Additionally, in 2004, the City of Portland conducted a pervious pavement pilot project that sought to reduce stormwater runoff on three city streets (Environmental Services, 2021). This pilot project consisted of one street being paved with permeable blocks, another with permeable pavement only on the curb lanes and standard asphalt down the center lanes, while the last street was paved with standard asphalt. A similar pilot project was conducted in 2005 in a different part of the city. The webpage provides details related to the case study process (Environmental Services, 2021).

City of Portland, Community Watershed Stewardship Grant

The Community Watershed Stewardship Grant helps community groups and residents improve the overall health of the watershed. Several types of projects are eligible for funding, including projects that seek to replace impervious pavement with plants or pervious pavement (City of Portland, 2021). These projects must be on land that is accessible to the public and the outcomes of the project should benefit all residents. This grant cannot be applied to private property. The maximum funding available per project is $12,000 USD (City of Portland, 2021).

For-Profit Permeable Driveways/Paving Companies

L.I.D Permeable Paving (lidpermeablepaving.ca)

L.I.D Permeable Paving serves the Greater Toronto Area (GTA) and provides permeable paving installation for both residential, commercial and industrial properties (LID Permeable Paving, n.d.). They primarily use a paving product called Ecoraster, which is a gridded tile system with the option of having block, grass/vegetation, or gravel filling (LID Permeable Paving, 2021a). L.I.D Permeable Paving is part of the Purus North America Distribution Group, which is the manufacturer of the Ecoraster products for Ontario.
On their website, L.I.D Permeable Paving provides several case studies of the larger projects they have completed. Some of their past clients include George Brown College, the Metro Toronto Zoo and Giant Tiger (LID Permeable Paving, 2021b). One interesting application includes using the grid tiles in equestrian paddocks to manage puddling and mud. With regards to residential properties, the grid tiles can be used for driveways, pathways and to increase the drainage under or stability of a turfed area.

Permeable Paving Products

- Ecoraster: A gridded tile system that is intended to be used for driveways and parking lots (LID Permeable Paving, 2021a).
- Organic-Lock: An organic based aggregate that is designed to be permeable and resistant to water erosion (Organic-Lock, 2021). This product is typically used for pedestrian pathways or sports complexes, but this product has been used on Toronto City Hall's green roof to establish pathways.
- TRUEGRID (A gridded tile system that is intended to be used for driveways and parking lots (TRUEGRID Pavers, 2021).

Low Impact Development and Stormwater Fees

LID Insights – Rain Gardens

There are several initiatives that focus on providing information on designing and installing rain gardens. Two good sources are the Toronto and Region Conservation Authority (TRCA) (Toronto and Region Conservation Authority, 2021) and the Credit Valley Conservation (CVC) (Credit Valley Conservation, 2010). The TRCA webpage is designed with homeowners in mind, it provides a simplified overview of what Rain Gardens are. The CVC PDF is a little more technical but provides good information for people who are seriously considering rain gardens.

Rain gardens are not only beneficial in stormwater management but can also be used to promote the planting of native and pollinator plant species. These gardens can offer multiple benefits to a property owner. CVC also offers useful sources about pollinator plants (Credit Valley Conservation, 2017)

Program examples:

- The City of Guelph, Rain Garden initiative: The Rain Garden Rebate program is a partnership between the City and REEP Green Solutions (an environmental NGO) (City of Guelph, 2021c). This program allows homeowners to receive up to a $2,000 rebate if they install a rain garden. The NGO helps with planning the size and requirements for the garden. Homeowners then submit an application to the City, who would issue the rebate when the work is completed by the homeowner. In this model, the NGO's purpose is to help guide the design process and answer questions from the homeowner. The City's website also provides a sample rain garden layout/design (City of Guelph, 2020).
- Fusion Landscaping, Region of Peel: Fusion Landscaping is a collaborative organization between the Region of Peel, York Region and the Landscape Ontario Horticultural Trades Association (Fusion Landscape Professionals, 2021). This organization has a list of vetted landscaping companies, referred to as Fusion Landscape Professionals, that homeowners can contact for more information about having a LID landscape installed. Fusion Landscape Professionals based in Oakville listed on the site include:
  - Golden Mean Landscaping (http://www.gmlandscapes.ca/about-us/)
  - International Landscaping Inc. (http://internationallandscaping.com/)
  - Jacob's Gardenscape (https://www.jacobsgardenscape.com/)
- The Ausable Bayfield Conservation and the Municipality of Bluewater Rain Garden program: The rain garden program provides grants in Bayfield up to a maximum amount of $500 (Ausable Bayfield Conservation Authority, 2018). As well, there is "soakaway" program where Bayfield residents can be eligible for grants up to $500. According to the website, a soakaway is like a rain garden, except it uses stone aggregate and/or stormwater crates (plastic gridded crates that look similar to milk crates) (Ausable Bayfield Conservation Authority, 2021).

Rain Barrels

Rain barrel programs typically take one of two forms.

1. The first type is where a municipality sells rain barrels, eg. Region of Peel (Region of Peel, 2021)
2. The second type of program provides a rebate on the property's water utility bill if a rain barrel is installed on the property. In Kitchener, homeowners can use their rain barrels to help offset their stormwater utility fees (City of Kitchener, 2021).

In the City of Guelph, homeowners can receive a credit of up to $2,000 per 500 litres if there is an approved rain harvesting system on the property (City of Guelph, 2021a).

Stormwater charges, fees and credits

Municipalities implement stormwater charges to help offset the cost of stormwater infrastructure improvements or maintenance. Often the stormwater charges are structured in a way to influence property owners' behaviour to adopt practices on their properties that minimize the amount of runoff and strain on the existing stormwater system.

Charges, fees and credits are not all the same. Typically, a municipality can generate income or impose regulatory measures for stormwater by applying a flat rate surcharge fee for a property type (for example, Kearney, Nebraska has a surcharge of $2/month for residents and $6/month for non-residential regardless of property size (City of Kearney, 2018)), an additional stormwater tax based on property tax rates (not very common), or a fee and credit program (for example, Kitchener (City of Kitchener, 2021)).

Oakville does not currently have a stormwater charge (Town of Oakville, 2019). They are in the process of developing an implementation plan for their new stormwater management plan (Town of Oakville, 2021b). A potential outcome from the final phase of the project is that staff will submit a recommendation to the council to adopt a stormwater fee as means of funding the needed stormwater infrastructure upgrades.

How stormwater fees/charges determined?

Stormwater fees are typically calculated based on the size of impervious/hard surfaces on a property, this can include driveways, patios and roofs. A common method, often referred to as bulk assessment, includes determining an overall average charge for each property type (residential, non-residential, industrial and institutional) and using that to set the fee for the associated properties. A second method, parcel assessment, includes measuring the amount of impervious area on individual properties using spatial data.

Stormwater Fees in Ontario

In 2016, the Environmental Commissioner of Ontario issued a report entitled *'Urban stormwater fees, how to pay for what we need'* (Environmental Commissioner of Ontario, 2016). Municipalities typically pay for stormwater management through general property tax revenue and development charges. At the time of the report, eight municipalities charged a separate stormwater fee to pay for stormwater management.

Table 1 below provides an updated list of fee charges for the 8 Ontario municipalities that charged stormwater fees at the time of the 2016 report. The reported stormwater fees are based on a single-detached home/residential property

Table 1. Stormwater fee charges, examples Ontario

Municipality	Updated Fee Amount (2021)	Type of Fee

Aurora	$7.09 per month	Flat rate charge
Kitchener	$16.39 per month	Charge with a Fee and credit program (up to 45%)
London	Depends on the size of the property: - Land area 0.4 hectares or less = $17.13 per month (flat rate) - Residential land area 0.4 or less without a storm drain within 90m = $12.87 per month (flat rate) - Land area above 0.4 hectares = $142.58 per hectares per month (based on property size)	Variable rate charge
Markham	$50/year ($4.16/month)	Flat rate Surcharge
Mississauga	Multi-tiered annual rate system based on property size: - Smallest = $55.20/year ($4.60/month) - Small = $77.28/year ($6.44/month) - Medium = $110.40/year ($9.20/month) - Large = $132.48/year ($11.04/month) - Largest = $187.68/year ($15.64/month)	Variable Surcharge
Richmond Hill	$73.95 per year ($6.16 per month)	Flat rate Surcharge
St. Thomas	$11.36 per month	Flat rate Charge
Waterloo	Multi-tiered annual rate system based on property size: - Small = $9.10/month - Medium = $13.64/month - Large = $18.61/month	Variable charge

Oakville, Policies and Planning Documents

Climate Emergency Declaration (oakville.ca/townhall/nr-19jun25.html)

Oakville's Climate Emergency Declaration specifically mentions the need to identify the public's role in addressing climate change and gathering momentum to support the Town's current climate change initiatives. EV charging station and the permeable driveway initiatives align with Oakville's climate emergency declaration. Leveraging NGOs to develop new programming that facilitates the adoption of climate mitigation and adaptation actions on residential properties is critical toward achieving community greenhouse gas reduction targets.

Livable Oakville Plan

Liveable Oakville is the official plan for the Town (Town of Oakville, 2021b). According to this plan, the town is committed to the adoption of sustainable development in order to achieve environmental sustainability. Objectives outlined as part of the sustainability section include reducing the Town's ecological footprint, as well as improving air quality and water quality. The plan notes that development applications are assessed based on the inclusion of sustainable development practices including on-site stormwater management in the form of providing rain barrels or cisterns, and LEED NH (neighborhood) or LEED certified buildings. The Plan makes specific mention of actions to mitigate or lessen the effects of climate change including promoting green buildings and energy conservation. As part of the green building section, the plan states that permeable paving is one of the features that the town encourages for stormwater management. There is no specific mention of EVs within this plan.

Community Energy Plan

The Community Energy Plan calls for the establishment of an energy retrofit business that also offers EV charging systems to help achieve the strategic objectives of increasing the number of EVs and reducing GHG emissions (Town of Oakville, 2020).

Environmental Sustainability Strategy (2018-2022)

The Environmental Sustainability Strategy communicates the initiatives being undertaken by the Town and future actions (Town of Oakville, 2018b). The sustainable community section mentions partnering with Oakville Enterprises Corporation to install charging stations. The sustainable government section calls for developing a town-wide electrification strategy in advance of a potential increase in private EVs. The sustainable households section outlines actions residents or homeowners can take to address issues related to residential energy use, water consumption, and waste. This section does not mention specific actions related to EV adoption or residential stormwater management.

State of the Environment Report, 2017

The State of the Environment Report presents key indicators that measure the progress of sustainability and environmental initiatives undertaken in Oakville (Town of Oakville, 2018a). This report is part of the Environmental Sustainability Strategy. The 2017 report noted a downward trend in per capita residential energy use attributed to the Town's energy efficiency and conservation campaigns. Additionally, the report noted 45% of the land cover in the town is impervious, thereby supporting the argument for increasing the number of green driveways and increasing green infrastructure.

Stormwater Master Plan

The current focus of the master plan is to study the current stormwater system in an effort to understand its deficiencies, the potential impacts from climate change and possible solutions to address the identified deficiencies including a specific focus on reducing flood risks on private

properties (Town of Oakville, 2021b). This plan draws from the town's official plan to support the use of permeable driveways. Additionally, the plan outlines several options or alternatives to addressing stormwater quality with alternative 4 focusing on lot-scale stormwater management retrofits and LID developments, which includes permeable driveways.

Mapping of impervious areas was completed to assist in understanding the current stormwater system. There is a detailed analysis of the percentage of imperviousness area per residential property type within the town. The lot analysis of low residential properties indicates that there is a range of imperviousness from 34% to 80%, with many properties falling between the range of 40% to 60% impervious coverage.

Oakville Driveway Policies/Guidelines

In Oakville's driveway and policy guidelines, there is no specific reference to permeable driveways (Town of Oakville, 2021a).

Social Purpose Organizations Operating in Oakville, Select Examples

Habitat for Humanity

Habitat for Humanity has created an innovative model to help support people along the journey of becoming homeowners (Habitat for Humanity Halton-Mississauga, 2021). With the goal of reducing the housing crisis, this model involves building homes through their program with the help of volunteers and providing them at a low cost to those in need. The model encourages people to become homeowners, build equity, and become self-reliant. To support the program, Habitat for Humanity has ReStores which take monetary donations or recycled home items that can be used for building. The recycled items are then sold to people in the community. The money that is generated from sales at the ReStore is used to offset building costs. Habitat Halton-Mississauga-Dufferin has been especially successful in the ReStore locations, with 4 ReStores in the region (Habitat for Humanity Halton-Mississauga, 2021).

Food for Life

Food for life is a grassroots organization with the goal of creating a more sustainable food system (Food for Life, 2021). The organization accomplishes this goal by partnering with grocery stores and other food suppliers to collect surplus perishable food. After obtaining the food, it is distributed to people in need within the community through a network of volunteers. By creating this additional food network, Food for Life diverted over four million pounds of food last year. Food for Life promotes healthy eating by providing fresh food to those in need, while simultaneously reducing food waste and greenhouse gas emissions.

Terrapure Environmental

Terrapure Environmental is a company that seeks to create environmental solutions that can provide additional benefits for businesses (Terrapure Environmental, 2021). To accomplish this, the company focuses on partnering with organizations to create better waste management solutions for organizations. Terrapure helps companies reduce the amount of waste they generate, ensuring they can run at peak efficiency and recovers resources from operational waste which would otherwise be disposed of. The company is changing waste management to create a system that respects people, the economy, and the planet.

Safetynet

Safetynet is a non-profit that was founded to help financially disadvantaged families (Safetynet, 2021). The organization relies on community donations and volunteers to provide free services and donations to families experiencing financial hardships. An initial needs assessment is completed to determine how to best support the needs of individual families. The type of support that is provided ranges from clothing and household item donation to personal services such as tutoring or music lessons. By providing tailored support to each family, Safety Net encourages family resilience and helps break the cycle of poverty.

Appendix B: Online Survey Questions and Results

WHAT QUESTIONS WERE ASKED TO THE COMMUNITY, AND HOW DID THEY RESPOND?

Survey Questions

1. Please select the option that best applies to your current home.
2. Do you, or your family, currently own or lease any of the vehicle(s) below? (select all that apply)
3. When you were making the decision to purchase or lease a fully electric or hybrid electric/gasoline vehicle, how important were the following issues to you?
4. Do you have a level 2 (240 Volt) charging station installed in your home?
5. If you do not own or lease a fully electric or hybrid electric/gasoline vehicle, are you considering purchasing or leasing one?
6. If you were to make the decision to purchase or lease a fully electric or hybrid electric/gasoline vehicle, how important would the following issues be to you?
7. If you were to make the decision to purchase or lease a fully electric or hybrid electric/gasoline vehicle, would you consider installing a level 2 charger in your home?
8. If you are not considering purchasing or leasing a fully electric or hybrid electric/gasoline vehicle, what are some reasons for your choice?
9. Are you considering installing a level 2 charger in your home?
10. If you do not have a level 2 (240 Volt) charging station installed in your home, what are some reasons as to why? (select all that apply)
11. If you wanted to have a level 2 charger installed, who would you look to for reliable advice? (Select all that apply)
12. Which of the following statements apply to you? (Check all that apply)
13. Does your property include any of the below features? (select all that apply)
14. Permeable driveways allow stormwater to drain below the driveway and slowly filter into the ground. The driveways can be either paving stones, gravel, porous asphalt or cement. Please indicate your interest in considering adding this feature to your property in the next 2-5 years.
15. Please provide some comments as to why you are not interested in installing a permeable driveway?
16. At what price point, if any, would an incentive rebate program encourage you to implement a green driveway?
17. If you wanted to have a permeable driveway installed, who would you look to for reliable advice? (Select all that apply)
18. Rate the visual appeal of the four driveways presented in the images above.
19. Rain gardens are specially designed garden beds that allow for rainwater, from a downspout or other surfaces like driveways, to filter down into the ground, which helps

to reduce the amount of stormwater flowing from your property. Please indicate your interest in considering adding this feature to your property in the next 2-5 years.

20. Please provide some comments as to why you are not interested in installing a rain garden?
21. At what price point, if any, would an incentive rebate program encourage you to implement a rain garden?
22. If you wanted to have a rain garden on your property, who would you look to for reliable advice? (Select all that apply)
23. Which phrase below best describes your view of climate change?
24. To help address climate change, my family has or would be willing to consider some personal lifestyle changes.

Survey Results

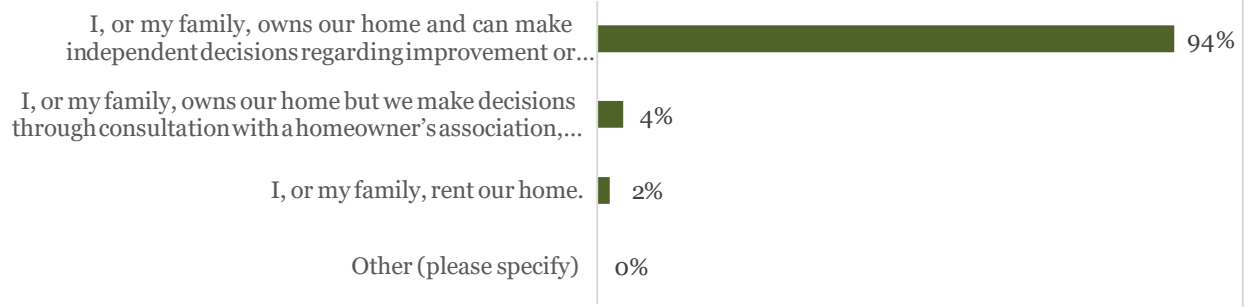
This section outlines the primary findings from the online survey. The survey was divided into two sections, the first section asked respondents to answer questions related to electric vehicle (EV) charging stations and the second section asked respondents to answer questions about permeable driveways. For a list of survey questions see the previous section. The survey was conducted online between June 2, 2021, and June 27, 2021. Halton Environment Network (HEN) launched the survey to understand the pulse of the community, including opportunities and barriers to action regarding the installation of green driveways and electric vehicle charging stations on private properties. In addition, HEN promoted the survey on their social media channels. 142 respondents completed the survey.

Homeownership Results

Q1: Please select the option that best applies to your current home.

Prior to answering questions regarding EVs and permeable driveways, respondents (n=142) were asked to share their current home status. As Figure 1 highlights, the majority of respondents (94%) currently own their own homes and can make independent decisions about property changes or improvements.

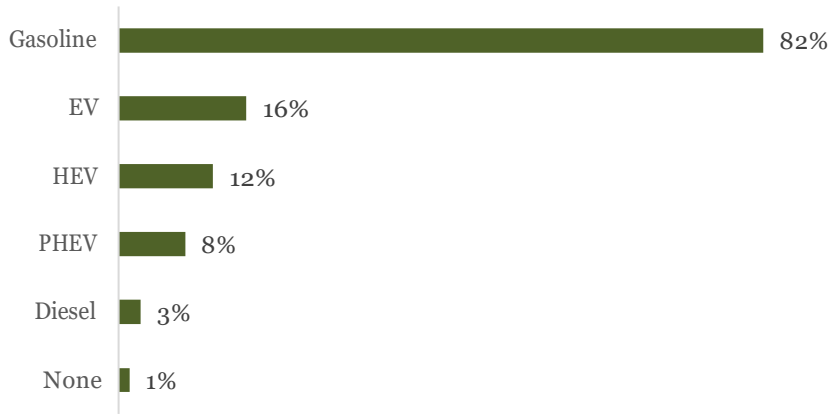
Figure 1: Homeownership



Q2: Do you, or your family, currently own or lease any of the vehicle(s) below? (select all that apply)

Of the total number of respondents (n=142), thirty-six percent (36%) of the vehicles owned or leased by respondents are electric vehicles. The most frequently owned type was the fully electric model (EV) (16%) followed by the hybrid-electric vehicle (HEV) (12%) and the plug-in-hybrid electric vehicle (PHEV) (8%) (Fig. 2). For the remainder of this summary, the use of the term electric vehicle will refer to all three types of vehicles (e.g. EV, HEV and PHEV) in general, while EV will refer to the specific fully electric model. In addition to electric vehicles, eighty-two percent (82%) of the vehicles owned or leased by respondents are gasoline. Please note, the total number of vehicles owned by respondents exceeds a hundred percent (100%) because 22% of respondents own more than one vehicle, see Figure 2.

Figure 2: Vehicle Ownership per Vehicle Type



N.B. the total number of vehicles in the above graph exceeds a hundred percent (100%) because 22% of respondents own more

Most respondents (78%) indicated that they owned one vehicle, while 21% indicated they owned two vehicles and 1% owned three vehicles (Fig. 3). Additionally, some respondents (1%) indicated that they did not own any of the selected vehicles. Among respondents who had one vehicle (n=111), 83% owned or leased a gasoline vehicle and 15% owned or leased an electric vehicle model (Fig. 4). For those who owned multiple vehicles (n=31), 39% percent owned or leased a gasoline vehicle and an EV (Fig.5). Interestingly, 10% of respondents owned or leased an EV and PHEV (Fig. 5). Please note, due to the limitations of the survey instrument, multiple vehicle ownership of the same vehicle type (e.g. two EVs or two gasoline) could not be measured.

Figure 3: Vehicle Ownership

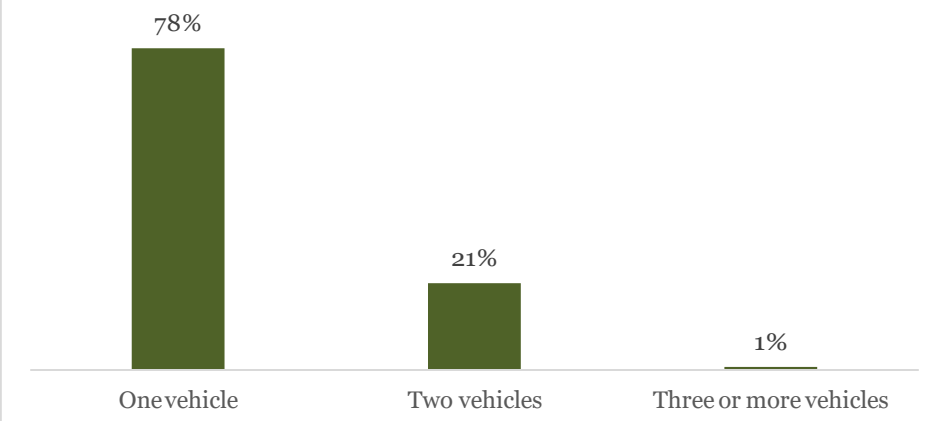


Figure 4: Single Vehicle Ownership

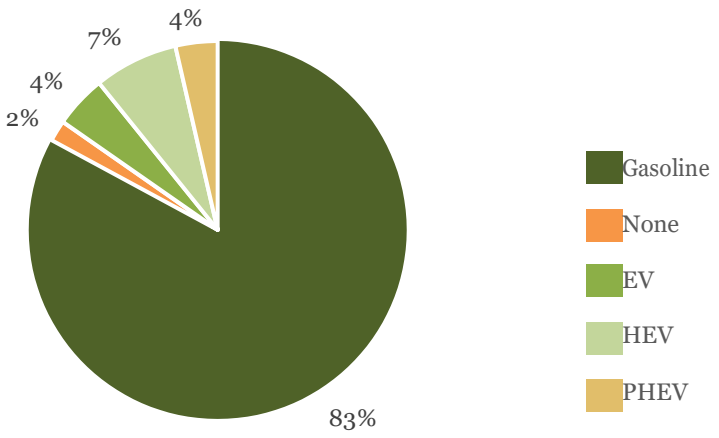
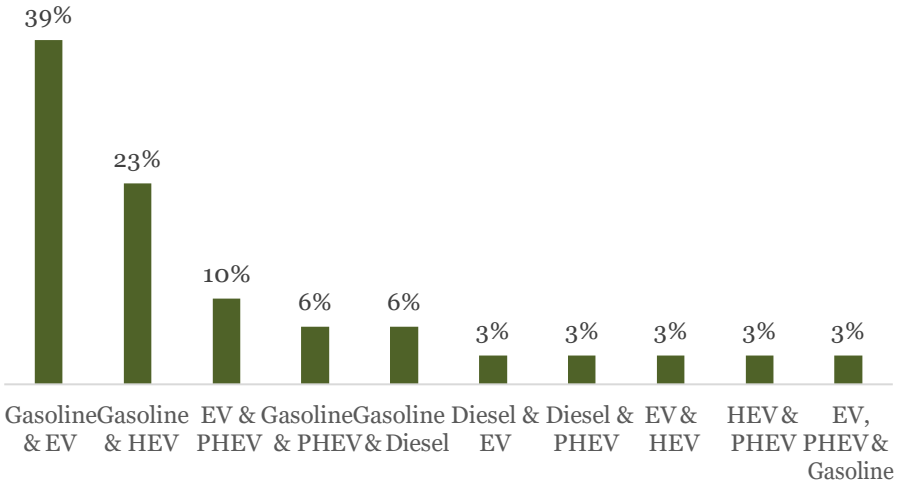


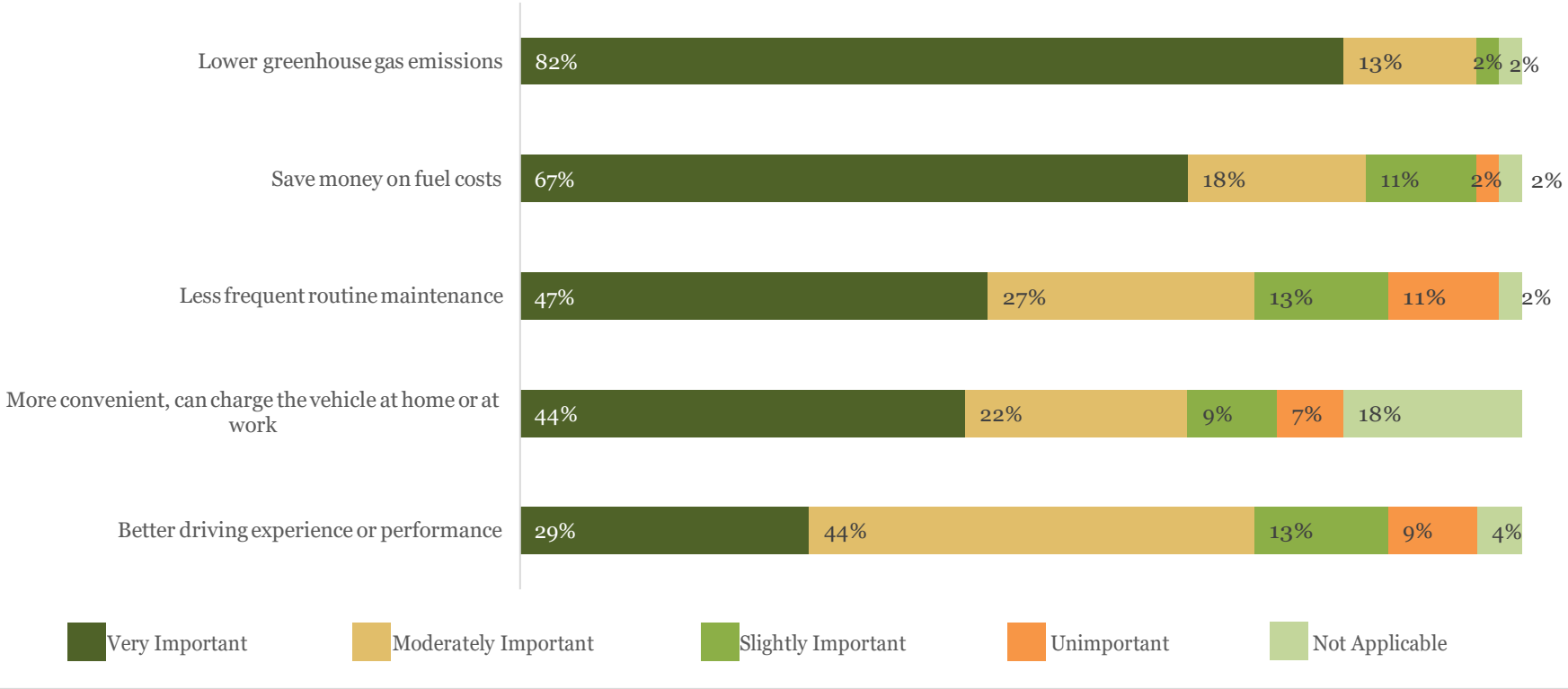
Figure 5: Multi Vehicle Ownership



Q3: When you were making the decision to purchase or lease a fully electric or hybrid electric / gasoline vehicle, how important were the following issues to you?

The purpose of this question was to determine which factors influenced the decision to buy or lease an electric vehicle. There were 45 respondents for this question. Most of the respondents indicated that lowering greenhouse gas (GHG) emissions (82%) and saving money on fuel costs (67%) were very important issues influencing their decision (Fig. 6). Other very important influential factors noted by respondents include less routine maintenance (47%) and charging convenience (44%) (Fig. 6).

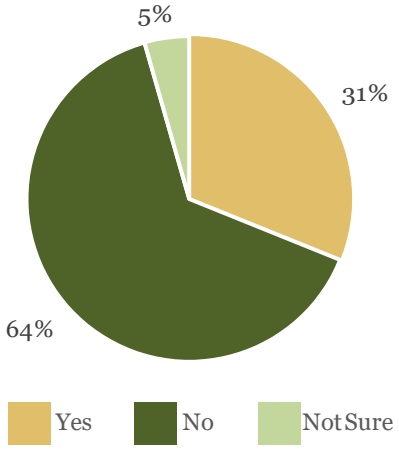
Figure 6: Important Issues



Q4: Do you have a level 2 (240 Volt) charging station installed in your home?

This question was answered by respondents who own an EV, HEV or PHEV (n=45). Sixty-four percent (64%) of respondents indicated they do not have a level-2 charger installed on their property (Fig. 7). For more information regarding the respondents' reasoning behind not installing a level-2 charger, please see question 9.

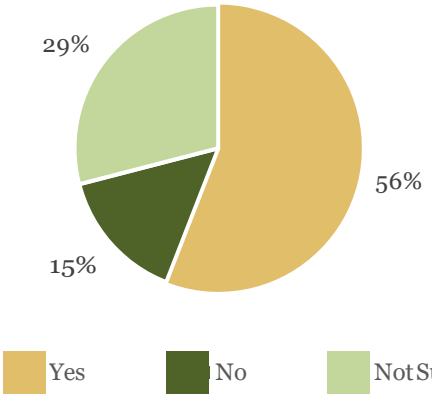
Figure 7: Level-2 Charger Installed



Q5: If you do not own or lease a fully electric or hybrid electric/gasoline vehicle, are you considering purchasing or leasing one?

Question 5 asked respondents who do not own or lease an electric vehicle model (n=93) if they were considering the possibility. Fifty-six percent (56%) indicated they were, 15% indicated they were not, and 29% were not sure (Fig. 8).

Figure 8: Considering Purchasing or Leasing an Electric Vehicle Model

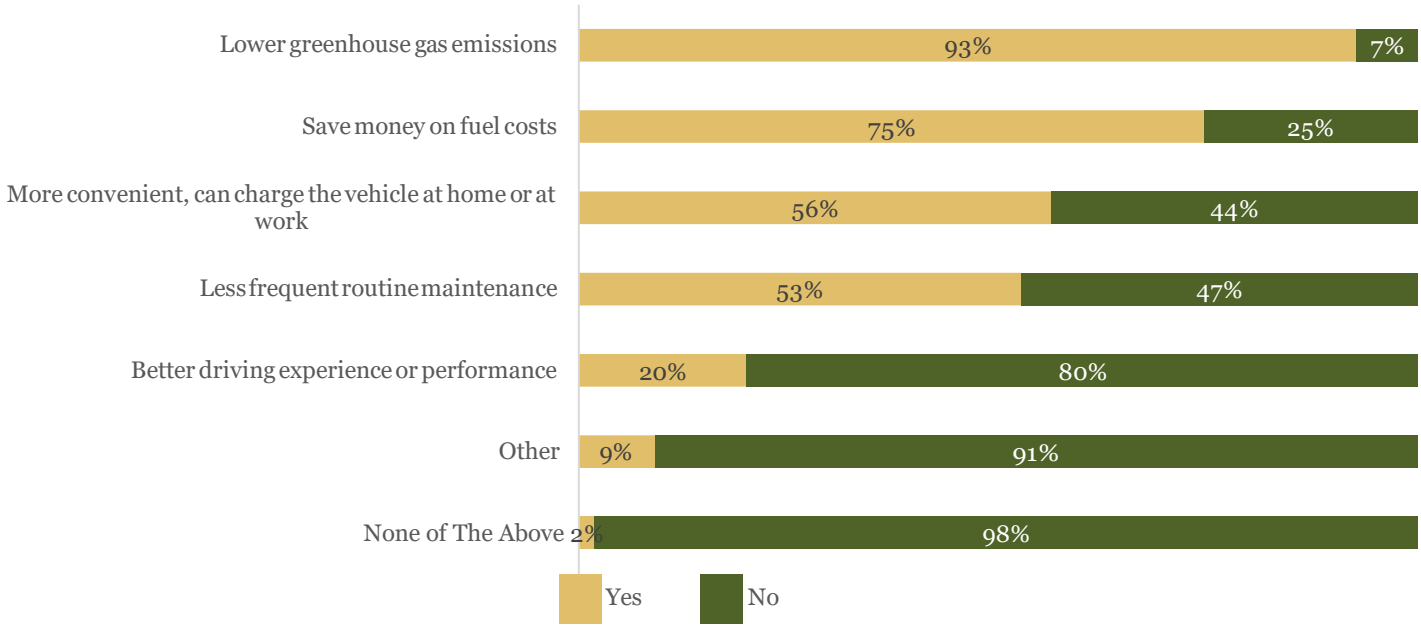


Q6: If you were to make the decision to purchase or lease a fully electric or hybrid electric/gasoline vehicle, how important would the following issues be to you?

Following from question 5, question 6 asked participants who indicated they were considering purchasing or leasing an electric vehicle model (n=55) to identify issues that may motivate their purchase decision. Responses mirrored motivational factors identified by those who own electric vehicles (question 2). Respondents indicated that lower GHG emissions (93%) and saving money on fuel costs (75%) were important issues to them (Fig. 9). The issues of convenient charging (56%) and less routine maintenance (53%) were also noted as being important by a majority of respondents (Fig.9).

Respondents were able to provide additional information on other issues that could influence their decision-making. The most commonly cited responses were concern about the availability or accessibility of community charging stations (e.g. public level-2 or level-3 charging stations). The second issue was the overall safety of electric vehicles.

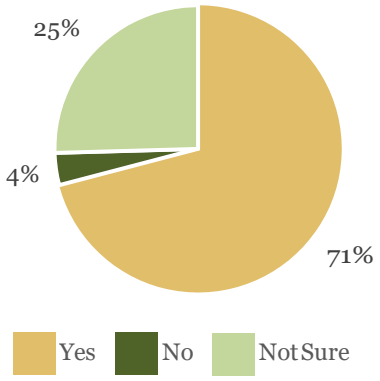
Figure 9: Important Issues



Q7: If you were to make the decision to purchase or lease a fully electric or hybrid electric/gasoline vehicle, would you consider installing a level 2 charger in your home?

Question 7 asked respondents who were considering purchasing an electric vehicle (n=55) if they would also consider installing a level 2 charger in their home. Seventy-one percent (71%) of respondents indicated that they would consider installing a level-2 charger (Fig. 10). Twenty-five percent (25%) of respondents were not sure if they would consider installing a level-2 charger (Fig. 10).

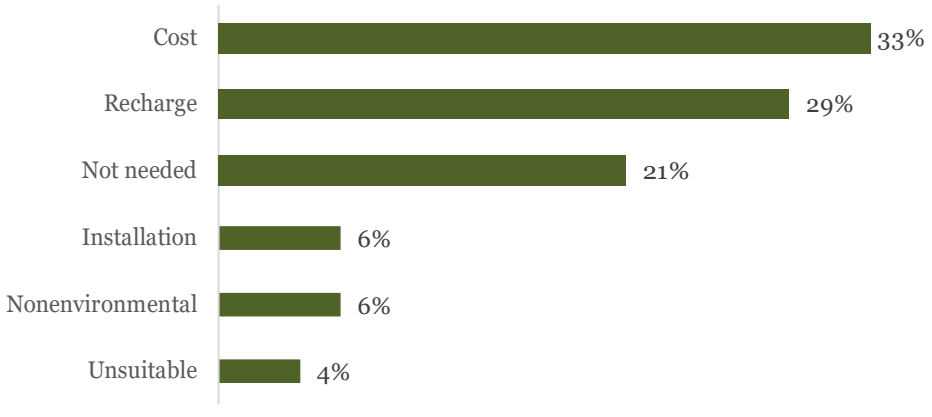
Figure 10: Would Consider Installing a Level-2 Charger



Q8: If you are not considering purchasing or leasing a fully electric or hybrid electric/gasoline vehicle, what are some reasons for your choice?

This question follows from question 5 targeting respondents (n=48) who indicated they were not interested in leasing or purchasing an electric vehicle as to why. As highlighted in Figure 11, the primary reasons noted include the purchase price of the vehicle (33%) and concerns about the limited availability of charging stations or recharging facilities (29%), which was also referred to as "range anxiety" by some respondents. Furthermore, some respondents indicated that they did not feel the need to purchase an electric vehicle (29%) because their current vehicles are new or still in perfect operation (Fig. 11). A small percentage of participants (6%) discussed how the

Figure 11: Reasons For Not Purchasing or Leasing an Electric Vehicle Model

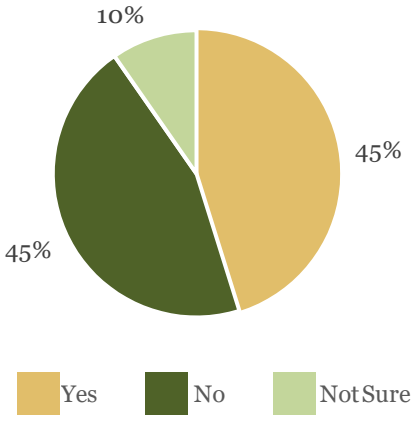


manufacturing and eventual disposal of electric vehicles are not environmentally friendly, while others (6%) had concerns about limitations related to installing level-2 chargers (Fig. 11).

Q9: Are you considering installing a level 2 charger in your home?

Question 9 sought to understand whether those respondents who own an electric vehicle and did not already have a level-2 charger (n=31) would consider installing a level-2 charger. There is an equal split between those who would be interested and those who are not interested, with a response rate of forty-five percent (45%) respectively (Fig. 12). The remaining ten percent (10%) of respondents were unsure as to whether they would install a charger (Fig. 12).

Figure 12: Interested in Installing a Level-2 Charger

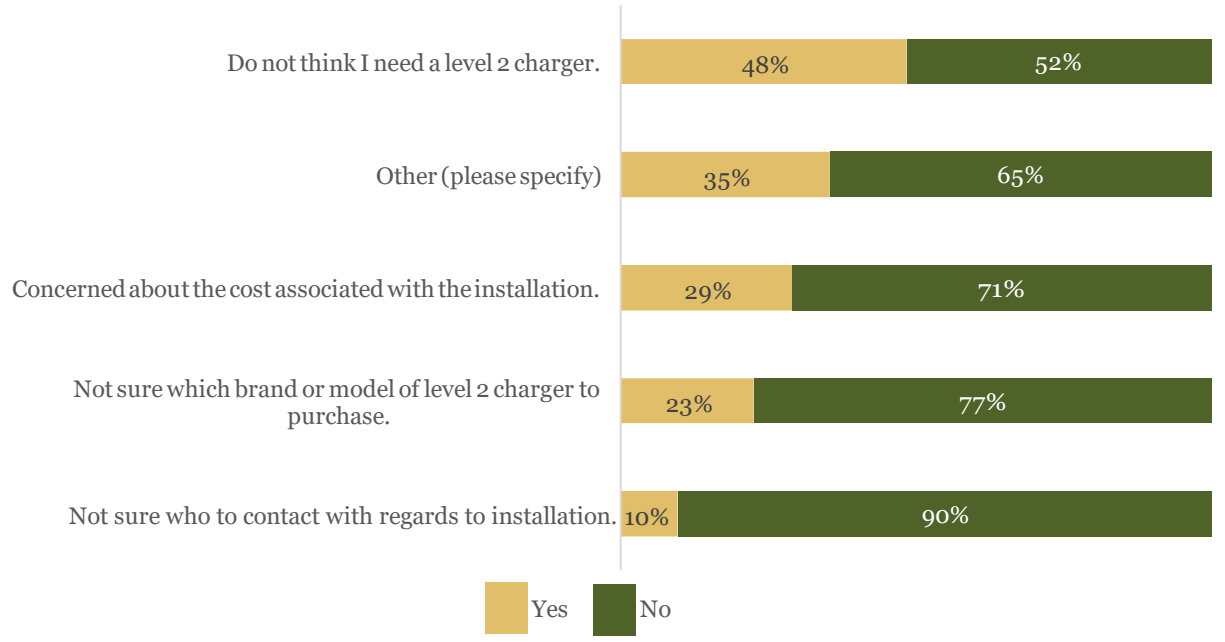


Q10: If you do not have a level 2 (240 Volt) charging station installed in your home, what are some reasons as to why? (select all that apply)

Question 10 asked respondents who own or lease an electric vehicle but do not have a level 2 charging station in their home (n=31) for reasons as to why they do not. The most commonly selected response was that respondents did not think they needed a level-2 charger (48%), while the least common response was the option about uncertainty regarding whom to contact for installation (10%), please refer to Figure 13. Confusion regarding which brand or model of level-2 charger and costs associated with the installation had response rates of twenty-three (23%) and twenty-nine (29%) respectively (Fig. 13).

This question allowed respondents to provide additional reasons via an "other" option. Many respondents for this "other" option mentioned that they do not need a level-2 charger because their electric vehicle is self-charging, such is the case of some HEVs, or the respondent felt that a level-2 charger was unnecessary because they do not use their EV on a regular basis, meaning the vehicle does not require frequent charging. Additional responses indicated that respondents are still planning on purchasing a level-2 charger, but they would like to conduct more research before they purchase one. Also, a couple of responses highlighted concerns about the ability to install a charger because of limitations due to the respondent's accommodations (e.g. rents or lives in a condo).

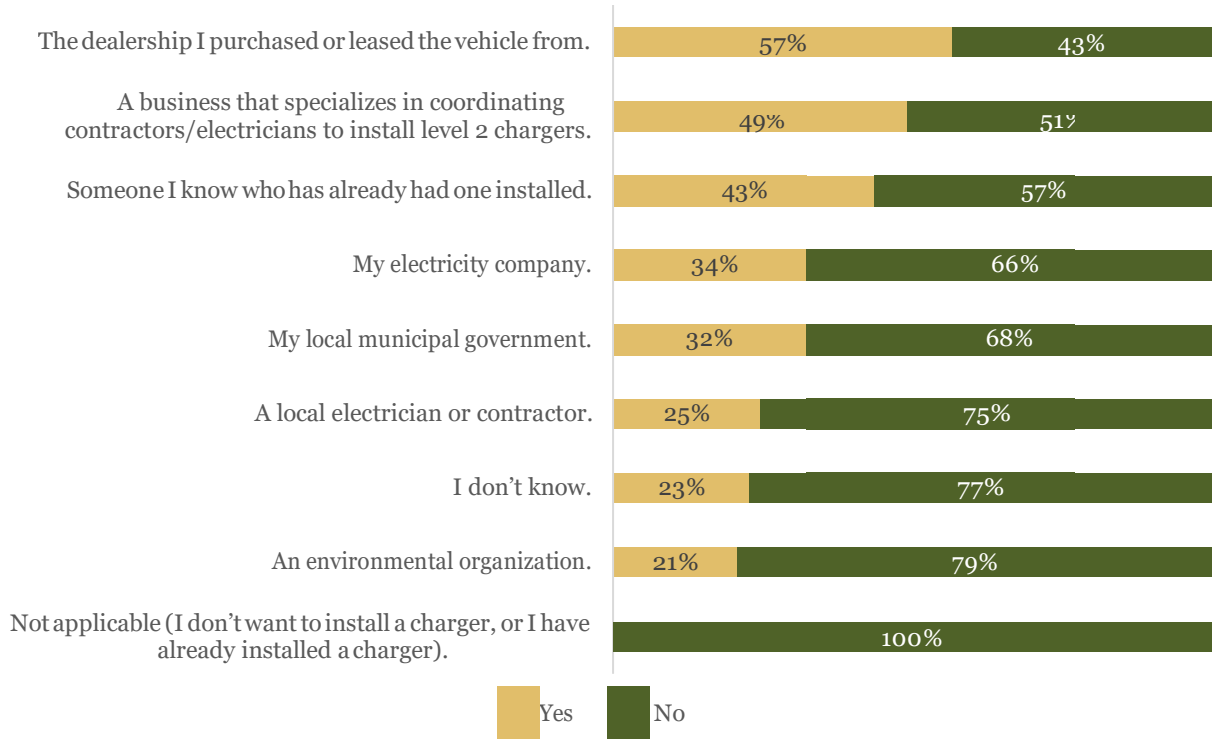
Figure 13: Reasons for Not Installing a Level-2 Charger



Q11: If you wanted to have a level 2 charger installed, who would you look to for reliable advice? (Select all that apply)

Question 11 targeted respondents who would consider installing a level 2 charger in their home (answered "yes" to question 7 and question 10) (n=53). As Figure 14 indicates, fifty-seven percent (57%) of respondents indicated that they would contact a dealership for reliable installation advice. Forty-nine percent (49%) of respondents indicated they would look to a specialized business (49%). Forty-three (43%) of respondents indicated they would look to someone they know who has already had a charger installed (Fig. 14). Twenty-one percent (21%) of respondents indicated they would look to an environmental organization for reliable advice to have a level 2 charger installed (Fig. 14). This was the lowest response rate among the choices available.

Figure 14: Reliable Advice



EV Charger Supplemental Analysis – Gasoline Vehicle Owners

This section of the results reports findings from additional analysis of respondents who only own a gasoline vehicle. This supplemental analysis was conducted because there was a high percentage of respondents (83%) in question 2 who indicated that they only own a gasoline vehicle. The analysis is intended to understand the motivations and preferences of this large group of respondents.

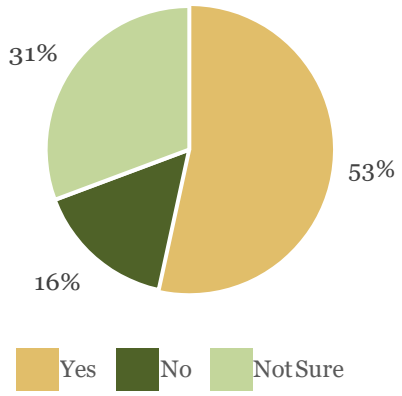
Respondents with only a gasoline vehicle were separated from the data to determine whether these respondents would consider purchasing or leasing an electric vehicle. Fifty-three percent (53%) of gasoline vehicle owners would consider purchasing or leasing an electric vehicle (Fig. 15).

A closer examination of question 6 highlighted that the issues of lowering GHG emissions (94%) and saving money on fuel costs (74%) were the most frequently selected issues by those who indicated that they would consider purchasing or leasing an electric vehicle (Fig. 16). With regards to the "other" answer option for this question, previously identified issues of vehicle safety and availability or accessibility to community charging stations were noted.

Moreover, seventy-two percent (72%) of gasoline vehicle respondents would consider installing a level-2 charger if they purchased an electric vehicle (Fig. 17).

For question 11, gasoline vehicle owners would prefer to contact a dealership (62%) for reliable advice regarding the installation of level-2 chargers, while some would prefer to contact their electricity provider (41%) or specialized businesses (44%), see Figure 18). Only 15% of

Figure 15: Supplemental Consider Buying or leasing an Electric Vehicle



respondents indicated they would contact an environmental organization for reliable advice (Fig. 18). Similar to the overall sample of respondents, this was the least selected option among the choices presented.

Figure 17: Supplemental Consider Installing Level-2 Charger

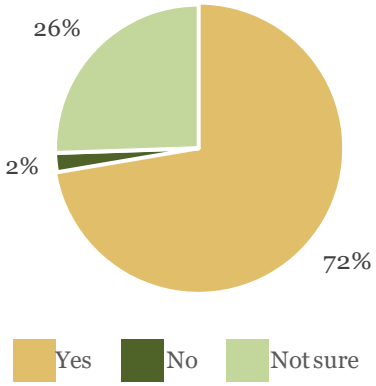


Figure 16: Supplemental Important Issues

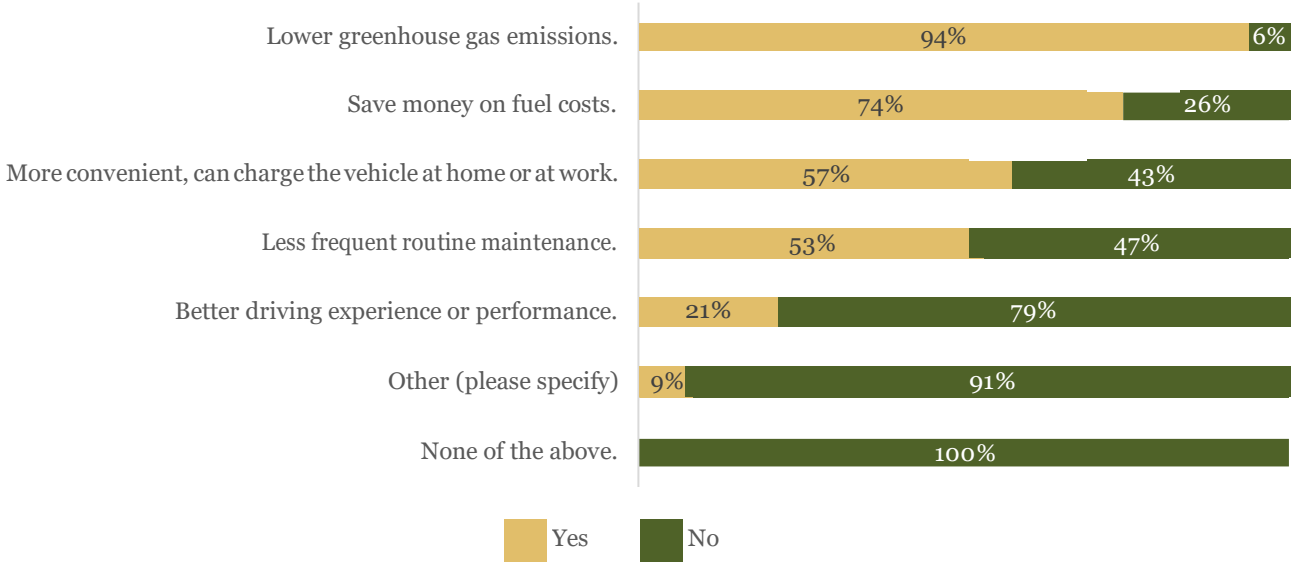
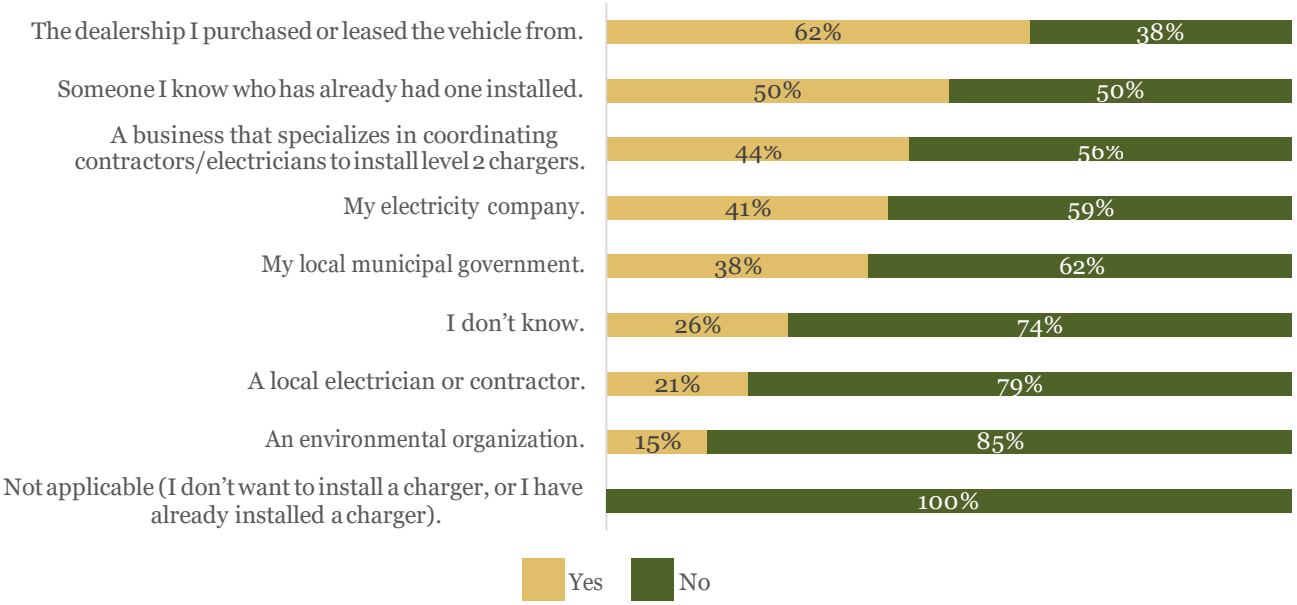


Figure 18: Supplemental Reliable Advice

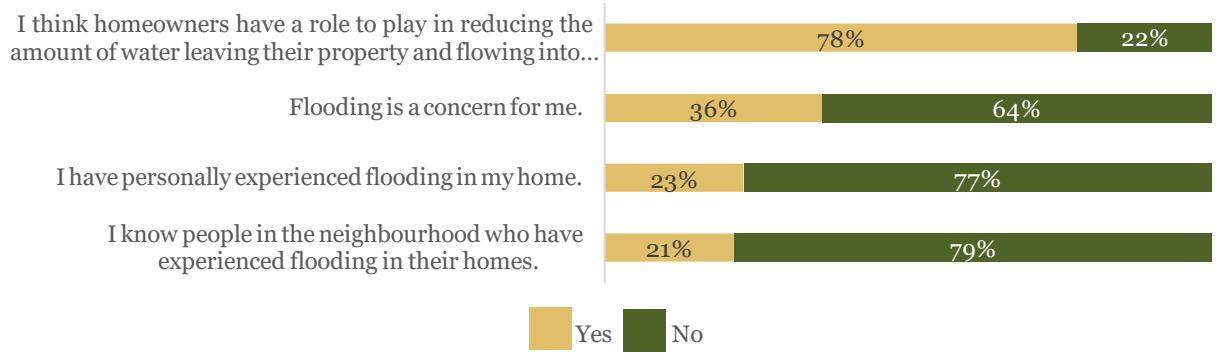


Permeable Driveways Results

Q12: Which of the following statements apply to you? (Check all that apply)

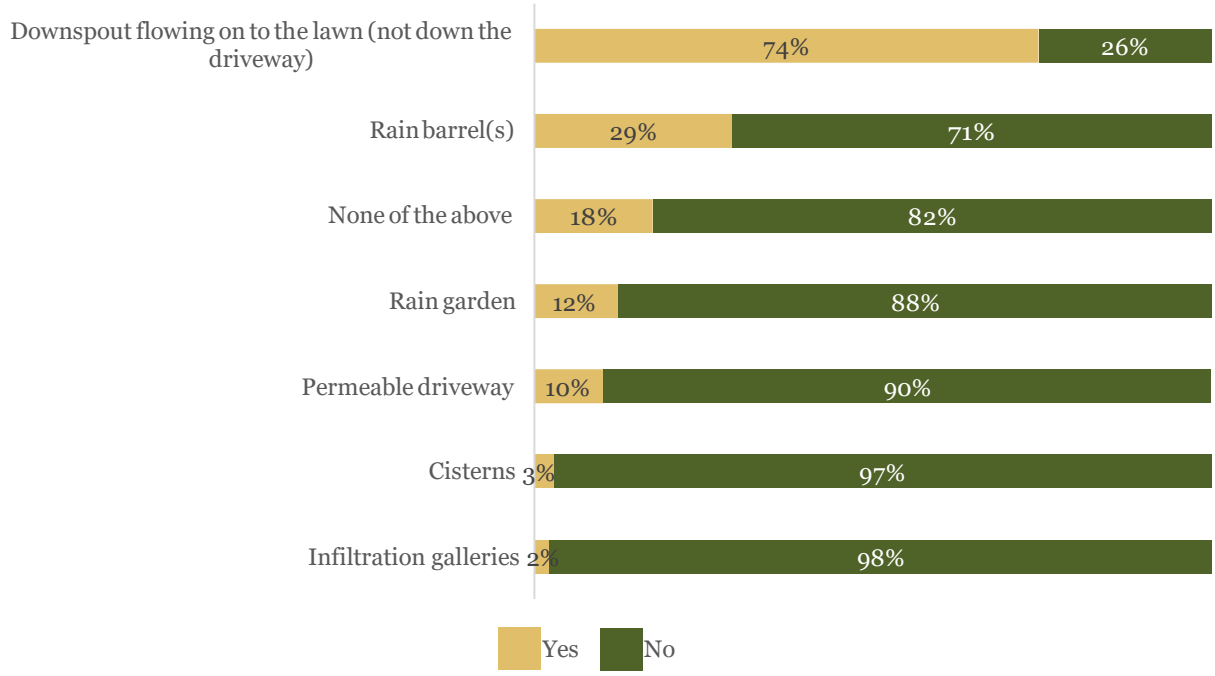
Question 12 asked respondents to consider statements regarding flooding and stormwater management. Among the 131 respondents for this question, the majority of respondents (78%) indicated that they feel homeowners should take action to help address stormwater runoff. Thirty-six percent (36%) of respondents were concerned about flooding (Fig. 19). Twenty-three percent of respondents (23%) had personally experienced flooding in their homes and 21% of respondents knew neighbours who had experienced flooding in their homes (21%), please refer to Figure 19.

Figure 19: Flooding



Q13: Does your property include any of the below features? (select all that apply)

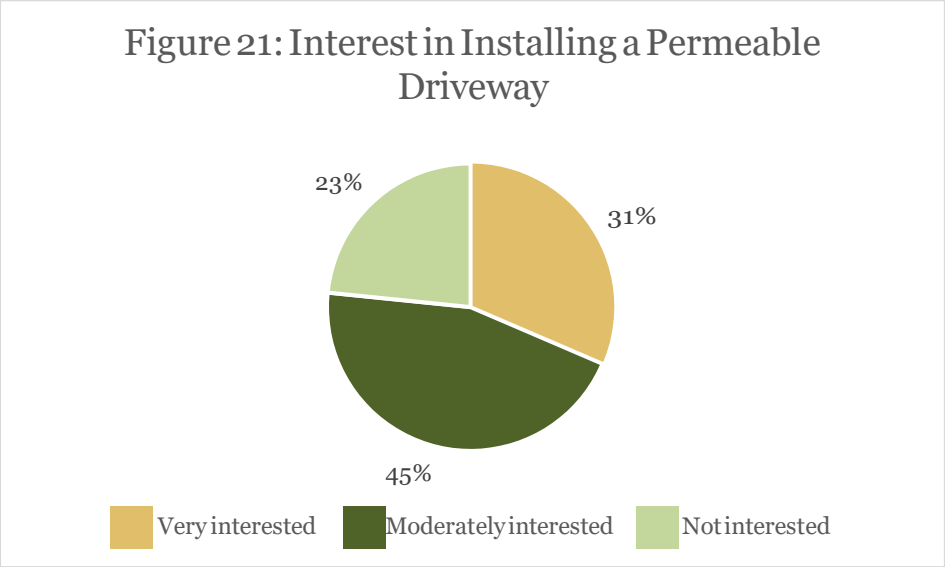
Figure 20: Stormwater Management Features



This question sought to understand what stormwater management features property owners already have installed on their property and whether permeable driveways were a common feature. Of those who responded (n=137), 74% had a downspout draining onto a lawn (Fig. 20). Twenty-nine percent (29%) of respondents had a rain barrel, while 10% of respondents had a permeable driveway (Fig. 20)

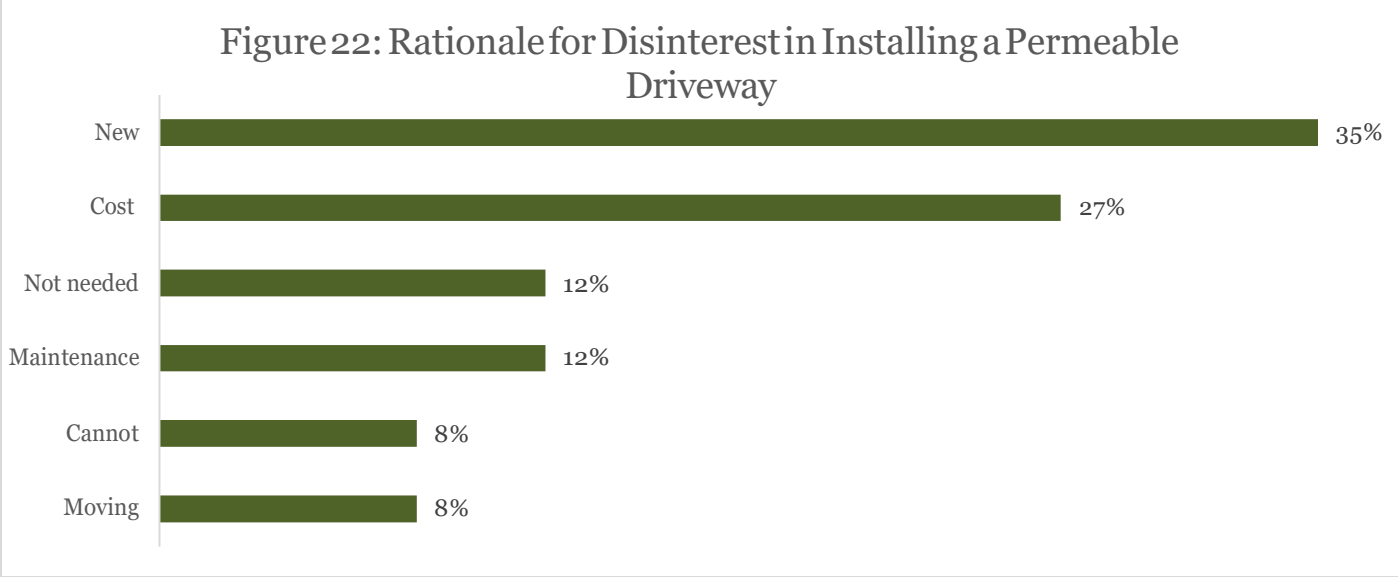
Q14: Permeable driveways allow stormwater to drain below the driveway and slowly filter into the ground. The driveways can be either paving stones, gravel, porous asphalt or cement. Please indicate your interest in considering adding this feature to your property in the next 2-5 years.

This question was asked to help determine the consumer demand for permeable driveways. There were 124 responses to this question. Seventy-six percent (76%) of respondents indicated that they were moderately interested (45%) or very interested (31%) in adding a permeable driveway within the next two to five years (Fig. 21). Twenty-three (23%) of respondents were not interested (Fig. 21).



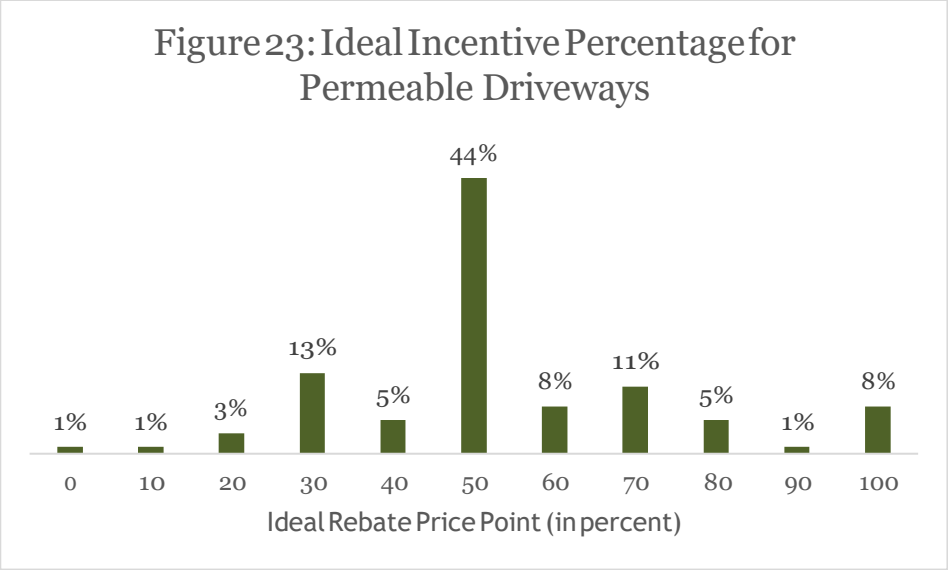
Q15: Please provide some comments as to why you are not interested in installing a permeable driveway?

Following question 14, this question sought to gather additional insights from respondents who were not interested in installing a permeable driveway. The two most commonly cited answers from respondents were that they had recently installed a new driveway and the costs associated with installing a permeable driveway (Fig. 22).



Q16: At what price point, if any, would an incentive rebate program encourage you to implement a green driveway?

Question 16 was designed to gather insights on how a financial incentive could influence the adoption of permeable driveways. Among respondents (n=93), 44% indicated that a 50% financial rebate program would encourage them to consider installing a permeable driveway (Fig. 23).

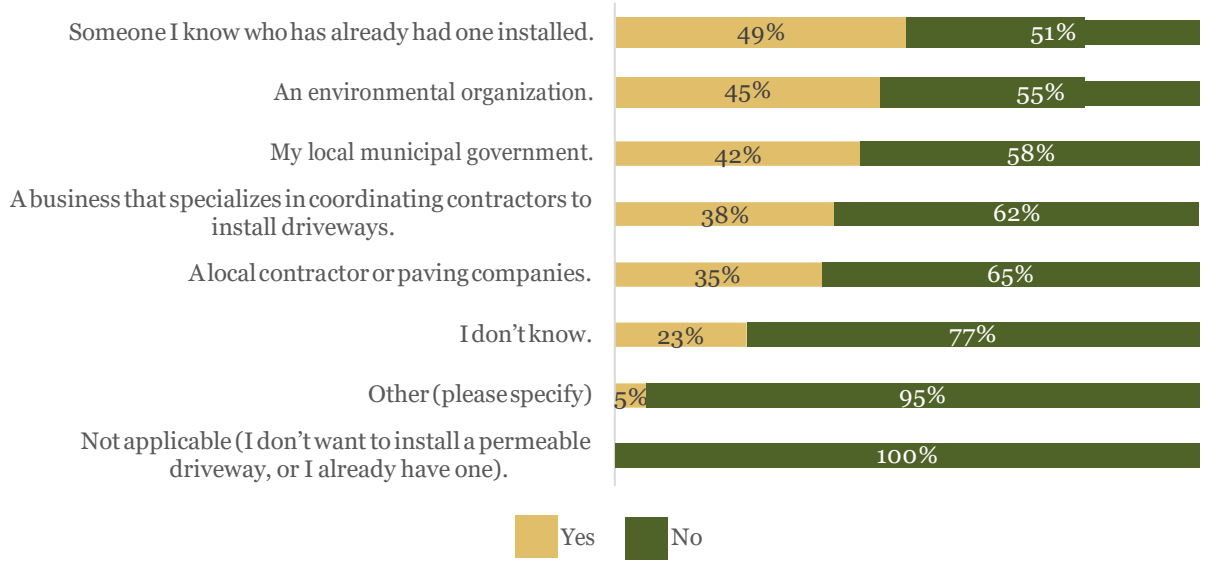


Q17: If you wanted to have a permeable driveway installed, who would you look to for reliable advice? (Select all that apply)

Following from question 14, question 17 targets respondents who indicated that they would be very interested or moderately interested in installing a permeable driveway (n=93). Forty-nine percent (49%) of respondents indicated that they would look to someone who has already installed a permeable driveway for reliable advice (Fig. 24). Forty-five percent (45%) of respondents indicated they would look to an environmental organization for advice (Fig. 24). Forty-two percent (42%) indicated they would look to a specialized business (38%), please see Figure 24.

Respondents were able to provide additional insight regarding where they would obtain reliable advice via an "other" category. Responses included bonified experts in permeable driveway installation, such as an engineer and third-party reviews and ratings (e.g. Google review, Yelp etc.).

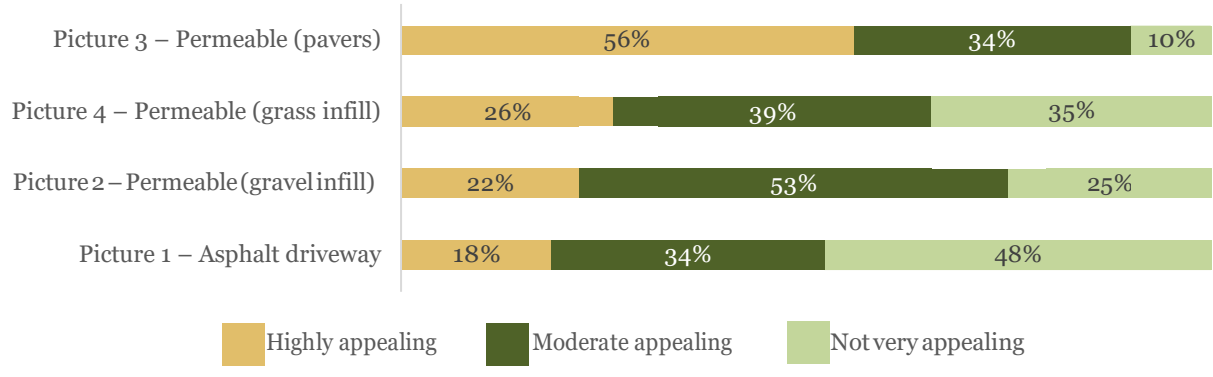
Figure 24: Reliable Advice



Q18: Rate the visual appeal of the four driveways presented in the images above.

Question 18 asked respondents (n=133) to rate the visual appeal of four driveway images. As highlighted in Figure 25, permeable pavers received the most ratings of being highly appealing (56%) followed by permeable grass infill (26%), permeable gravel infill (22%) and asphalt (18%). Compared to the other driveway types, asphalt was most frequently rated as not very appealing (48%) (Fig. 25). Permeable grass infill and permeable gravel infill respectively had more respondents rate them as not very appealing than highly appealing.

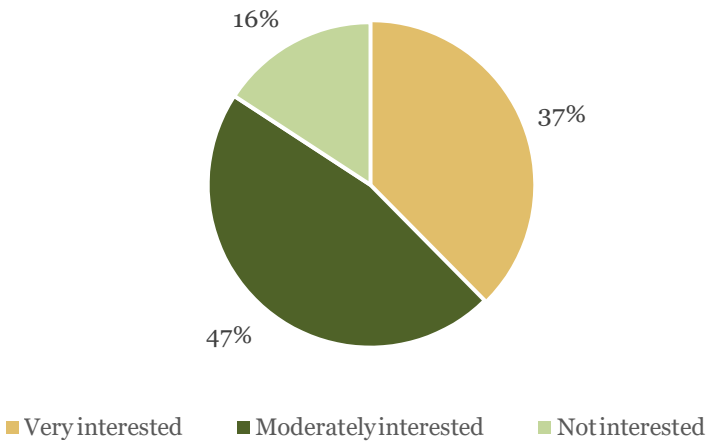
Figure 25: Aesthetic Appeal of Permeable and Asphalt Driveways



Q19: Rain gardens are specially designed garden beds that allow for rainwater, from a downspout or other surfaces like driveways, to filter down into the ground, which helps to reduce the amount of stormwater flowing from your property. Please indicate your interest in considering adding this feature to your property in the next 2-5 years.

Question 19 was asked to help determine the consumer demand for rain gardens. There were 133 responses to this question. Eighty-four (84%) percent of respondents indicated they were moderately interested (47%) and very interested (37%) in adding a rain garden to their property within the next two to five years (Fig. 26).

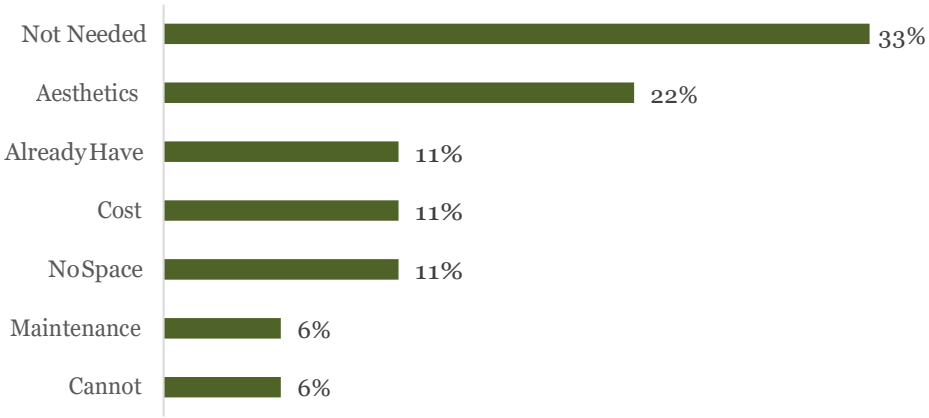
Figure 26: Interest in Installing a Rain Garden



Q20: Please provide some comments as to why you are not interested in installing a rain garden?

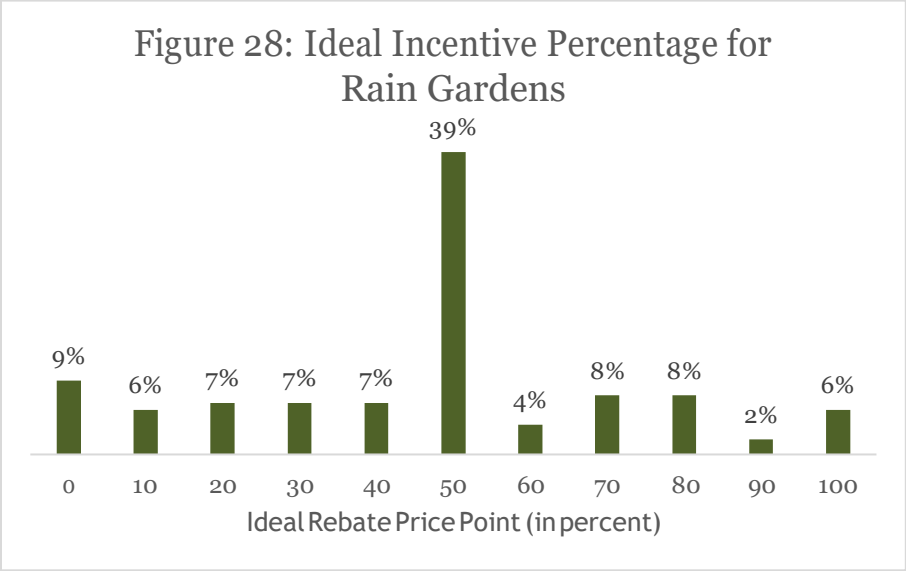
Question 19 asked respondents (n=15) not interested in installing a rain garden in the next two to five years for reasons why. The most commonly cited responses why were the property already had stormwater management features and because landscaping had recently been done. Some respondents did not like the aesthetics of rain gardens (Fig. 27).

Figure 27: Rationale for Disinterest in Installing Rain Gardens



Q21: At what price point, if any, would an incentive rebate program encourage you to implement a rain garden?

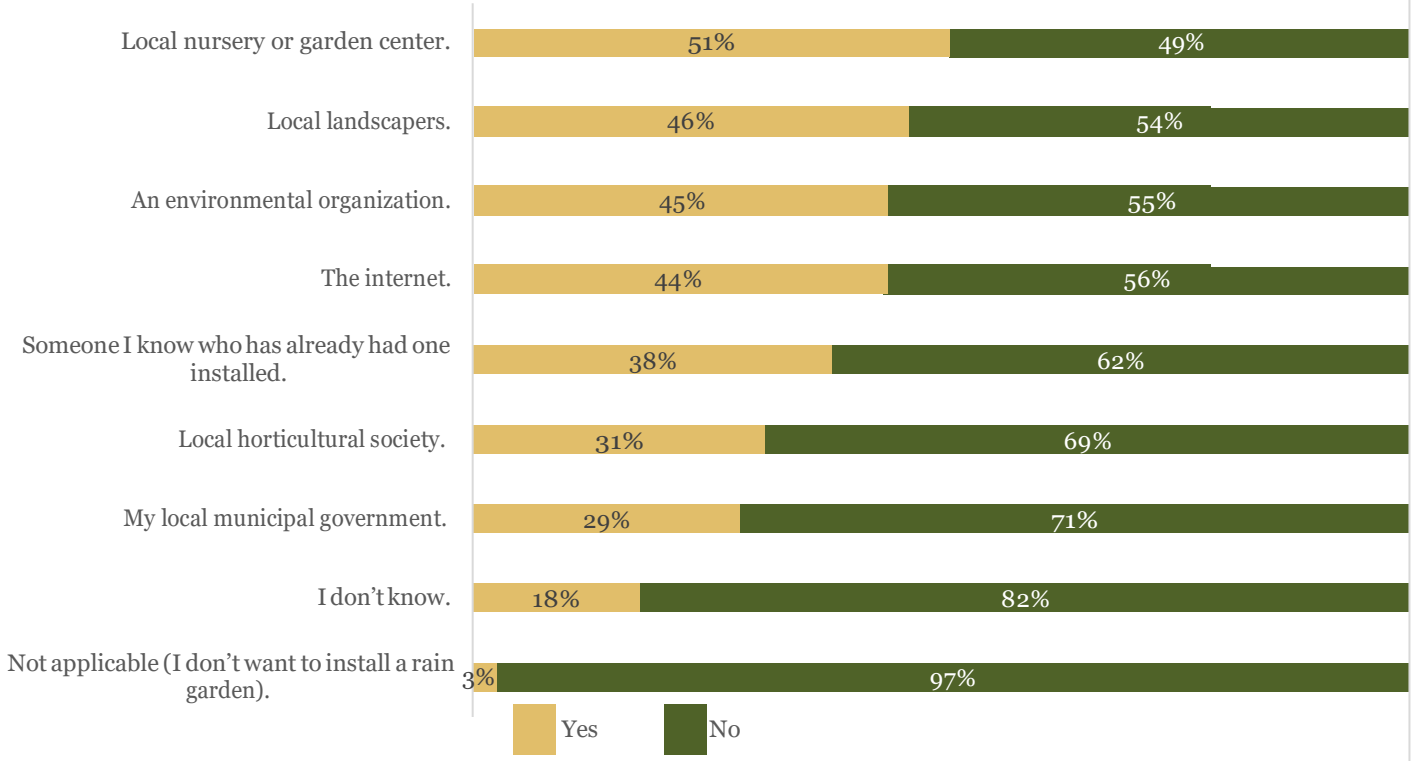
The purpose of this question was to understand if a rebate program would encourage homeowners to install a rain garden. One hundred and six respondents answered this question. The most commonly cited response was that a 50% rebate would encourage implementation (Fig. 28).



Q22: If you wanted to have a rain garden on your property, who would you look to for reliable advice? (Select all that apply)

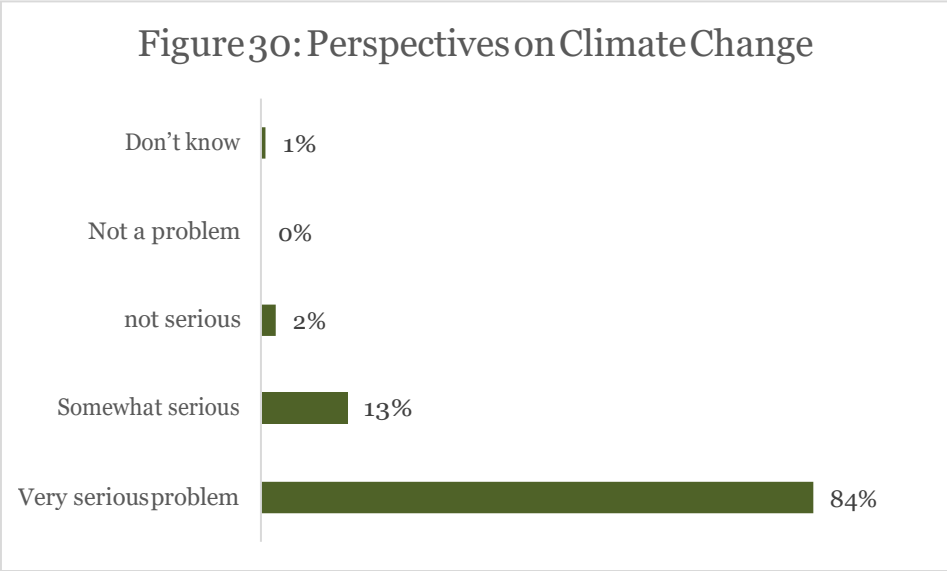
Following from question 19, question 22 asked respondents, who indicated they were very interested or moderately interested in installing a rain garden (n=122), whom they would look to for reliable advice (n=112). Fifty-one percent (51%) of respondents indicated they would look to a local nursery or garden center for reliable advice (Fig. 29). Forty-six percent (46%) of respondents indicated they would look to a local landscaper for reliable advice (Fig. 29). Forty-five percent (45%) of respondents indicated they would look to a local landscaper for reliable advice (Fig. 29).

Figure 29: Reliable Advice for Rain Garden Installation



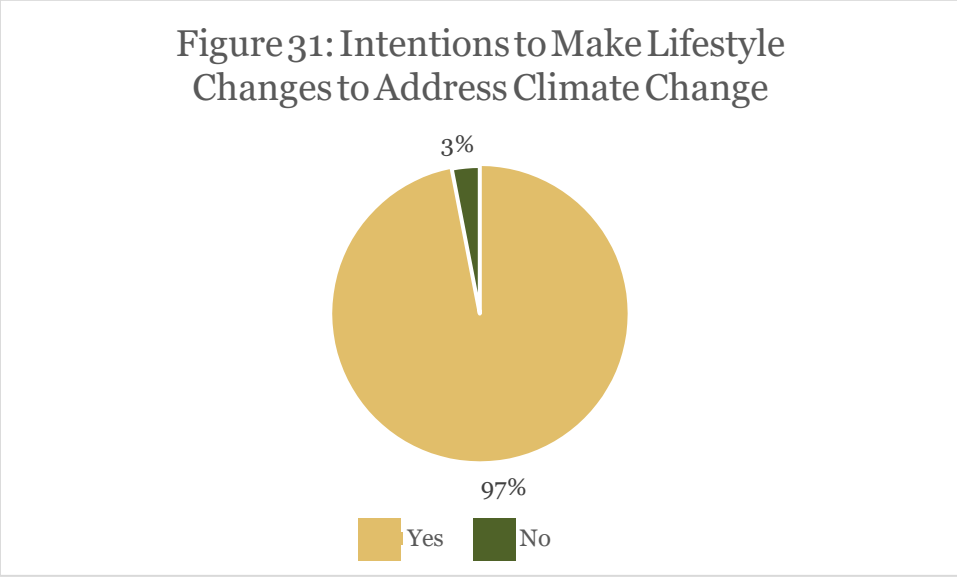
Q23: Which phrase below best describes your view of climate change?

The majority of respondents (84%) indicated that climate change is a very serious problem (Fig. 30).



Q24: To help address climate change, my family has or would be willing to consider some personal lifestyle changes.

Nearly all respondents (97%) indicated that they would be willing to make lifestyle changes in order to address climate change (Fig. 31).



Appendix C: Municipal Program Review Interviews

WHAT DID WE LEARN FROM OTHER MUNICIPAL PROGRAMS?

List of Contacted Municipalities

We contacted the program coordinators for three existing LIDs incentive programs in order to obtain information related to the uptake or popularity of their programs. Below is the list of the LID programs and municipalities that were contacted:

- Community Watershed Stewardship Program (City of Portland)
- Rain Garden Rebate Program (City of Guelph)
- Rain Ready Ottawa (City of Ottawa)

These three specific programs were selected from further consultation because their websites specifically listed permeable paving as an approved practice and because the programs offer a rebate or grant for LIDs.

Each program coordinator was asked if they could provide insights into the current demand or uptake of their program, and to provide the average rebate applicants received. All three program coordinators responded to our requests and their insights are provided below.

The Community Watershed Stewardship Program (CWSP) coordinators indicated that their current focus for this program is to offer education and public outreach about stormwater management. They currently prefer to promote the uptake of rain gardens, even though permeable paving is listed as an option. When asked to provide a specific number of completed permeable paving projects, the coordinators were not able to do so but did mention there were very few, and they were unable to provide an average grant. The consensus was that permeable paving was not the primary focus for this program, instead of reducing runoff from roofs through vegetated stormwater management systems is their preferred approach.

Rain Garden Rebate Program coordinator was able to provide specific details about the uptake and success of this program. The program was started in 2019 with a goal of twenty-five property visits and installing 10 rain gardens. Those goals were exceeded, there were thirty-one property visits and 16 rain gardens installed during the 2019 season. The coordinator went on to mention that COVID-19 did hamper their efforts in the 2020 season, resulting in their 2020 goals of sixty property visits and 30 rain gardens installed were not achieved. Instead, they were able to complete twenty-seven property visits and 12 rain gardens. Similarly, the 2021 season success was diminished by COVID-19, nevertheless, the coordinator was optimistic about the uptake of the program when the pandemic restrictions end. In terms of rebates, the average rebate for 2019 was $862.50 and the average for 2020 was $1,321.67. The program

also calculates the total amount of stormwater diverted from the rain gardens installed, which is a unique monitoring and communications tool. For the 2019 season, a total of 39,800 L of stormwater was diverted from the stormwater system, and for 2020 there was a total of 28,600 L diverted. Overall, it appears that there is community interest in this rebate program.

Rain Ready Ottawa is a new program that started in early 2021. As a result, the program coordinator was not able to provide any data but did indicate that there had been strong community interest due to the initial news release. When asked about the prospects for permeable driveways, the coordinator stressed that large LIDs, like permeable driveways, may only appeal to property owners with larger amounts of disposable incomes, thereby suggesting that a large portion of Ottawa area property owners would not adopt permeable driveways. In general, the coordinator was optimistic that this program would receive applications starting the later summer early fall, once COVID-19 restrictions were lifted.

Appendix D: Interviews with Local Contractors and Service Providers?

Permeable Driveway Installers

To better understand the potential cost of installation for homeowners, 15 Ontario based companies were contacted via email to see if they would be able to provide any insights about the potential installation costs and current market conditions. Below is the list of the contractors selected.

- Adams Landscape Supplies
- Avesi Stormwater
- Ecoraster
- Fern Ridge
- Golden Mean Landscapes
- Helmotz Interlock
- Heritage Stoneworks Ltd.
- HortiCraft Landscaping Inc.
- International Landscaping Inc.
- LID Permeable Paving
- Porous Pave
- Ross Yantzi's Pavestone Plus Ltd.
- Sean James Consulting & Design
- The Escarpment Company
- TNT Property Maintenance

To gather insights regarding market conditions, service demands and pricing, the installers were asked to comment on the following questions:

1. Based on your experience, what do you consider to be an average permeable driveway and the ballpark price for installation? This can be in ft^2 or any other unit.
2. From your perspective do you see any challenges or barriers regarding the uptake or adoption of these types of driveways?
3. Do you have any ideas as to what could be done to help increase the adoption of permeable driveways or address the barriers you previously mentioned?
4. In your view, do you think there is a strong, medium, or low demand for permeable driveways in your area of operation?

All fifteen companies were asked to comment on the above questions. In total eight companies replied, with only five providing direct comments regarding costs and market conditions. Contractors were very reluctant to provide pricing information without being able to quote on a specific job.

Findings

In terms of pricing, the respondents provided a wide range of estimates. One company provided a cost range of $35-$50 ft^2. Two other companies provided general estimates of of $25 and $30 respectively. It is unclear of these price estimates included the same level of service. Pricing should take into account completed excavation, base installation, bedding material, paver, edge restraints, joint material, labour and equipment.

Another company was not able to provide a square foot price but did state that their price for their projects ranges from $10,000 to $25,000. This service provider also mentioned that they typically install permeable and asphalt hybrid driveways because the hybrid type is more cost-effective for the property owner.

With regards to the pricing of different permeable materials, one of the companies was able to provide insights into the various price points for different permeable products. According to their experience, the price for a gravel or grass grid driveway could range between $7-$16 ft^2, while the price for permeable pavers could be between $17-$25 ft^2. Furthermore, a different contractor indicated that the price for porous driveway materials was $12 ft^2 - $17 ft^2 .

Each company mentioned that there are several factors to take into account in order to provide an accurate quote, and the pricing they provided is a "rough estimate". The typical factors contractors consider when pricing includes the following:

- The size of the driveway
- The underlying soil type (e.g. sand or clay)
- Whether the permeable system has full, partial or no exfiltration
- Whether the company will need to remove the existing driveway
- The proximity to the quarry
- Water storage needs of the property

With regards to the challenges or barriers to adoptions of permeable driveways, the most commonly mentioned challenge is the lack of awareness about permeable driveways by property owners and the need for additional educational outreach. Additional barriers and challenges include:

- Challenges with permit approval at the municipal level
- High costs are a deterrent for property owners
- The need for construction standards for permeable driveways

Furthermore, to address some of the above challenges and barriers, respondents provided the following insights:

- Improve the permit process by educating municipal staff about permeable driveways and the different types of permeable systems available for residential properties.

- Provide incentives and grants for permeable driveways and other LIDs. This includes having municipalities provide incentive programs.
- For new builds or property upgrades, there should be a mandated percentage of permeable surfaces that must be included on the lot.
- Have manufacturers and landscaper associations collaborate to develop permeable driveways standards.
- Actively educate clients about the benefits of permeable paving when projects include hardscaping elements.
- Finally, when asked about the demand for their services, there was a general consensus that current demand is low but demand slowly increasing. Some companies stated that there was low to medium demand because they only receive contracts due to zoning requirements or because property owners are not familiar with permeable paving. Another company mentioned that they are seeing medium to strong demand because they specialize in eco-based landscaping practices.

Electrical Vehicle Chargers

Thirteen Oakville based electrical vehicle charger installers were contacted via email to see if they would be able to provide any insights about the potential installation costs and current market conditions.

Companies contacted include:

- Can Power Electric
- Canadian Electrical Services
- Colony Electrical
- Connectus Electric Inc.
- Crown Electric Ltd.
- Effective Electrical
- JML Electrical Inc.
- JPR Electrical Services
- Lankan Electric Inc.
- North Star Electric
- Ohmega Electric Inc.
- Spark Power
- Wiljan Electrical Inc.

Only one electrician responded to our questions. As part of our research, we identified several companies in the Oakville area that specialize in the installation of electric vehicle chargers for residential properties. These specialized companies include:

- Colony Electrical
- Effective Electrical (they specifically mention that they install Tesla chargers)
- JPR Electrical Services

- Lankan Electric Inc.
- Spark Power
- Wiljan Electrical Inc.

Each electrician and electrical company were asked to provide their comments and insights on the following questions:

1. Are you able to comment on what the average cost of installing a level-2 charger is?
2. From your perspective do you see any challenges or barriers regarding the uptake or adoption of level-2 chargers?
3. Do you have any ideas as to what could be done to help increase the adoption of level-2 chargers or address the barriers you previously mentioned?
4. In your view, do you think there is a strong, medium, or low demand for installing level-2 chargers in your service area?

Findings

The estimated price for a level-2 charger was $1,000. This assumes the property does not need to upgrade its panel box to a 200 amps service. A current challenge and barrier for charger installation are delays associated with high demand for hydro service inspectors, permit approvals, and obtaining materials and supplies. This respondent suggests having the amperage of the chargers dropped to 20 amps would mean that electric vehicle manufactures would need to redesign their chargers. In terms of demand, the electrician was not able to provide the exact number of chargers they have installed but did mention that demand appears to be increasing.

Appendix E: Community Interviews

WHO DID WE SPEAK WITH, AND WHAT DID WE ASK THEM?

List of Interviewees

Below is the list of selected community groups that were interviewed for this study:

- Centre for Skills Development
- STRIDE Supported (Training & Rehabilitation in Diverse Environments)
- Town of Oakville (municipal staff and managers)

Interview Questions

(1) What is your initial gut response to Green Drive Oakville?
(2) What barriers do you see (employing your clients to perform) the activities described?
(3) Do you see any opportunities?
(4) What information would you suggest we collect to better assess the feasibility of employing your clients?
(5) Generally speaking, what conditions would have to be in place in order for this
(6) SPO to successfully train and employ people from marginalized communities in
(7) Oakville?
(8) Who else should we be talking to about this?
(9) What questions aren't we asking that we should be asking

Appendix F: Report References

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