Miistakis Institute

Edmonton Ecoroof Initiative for Climate Resiliency: Workshop Report

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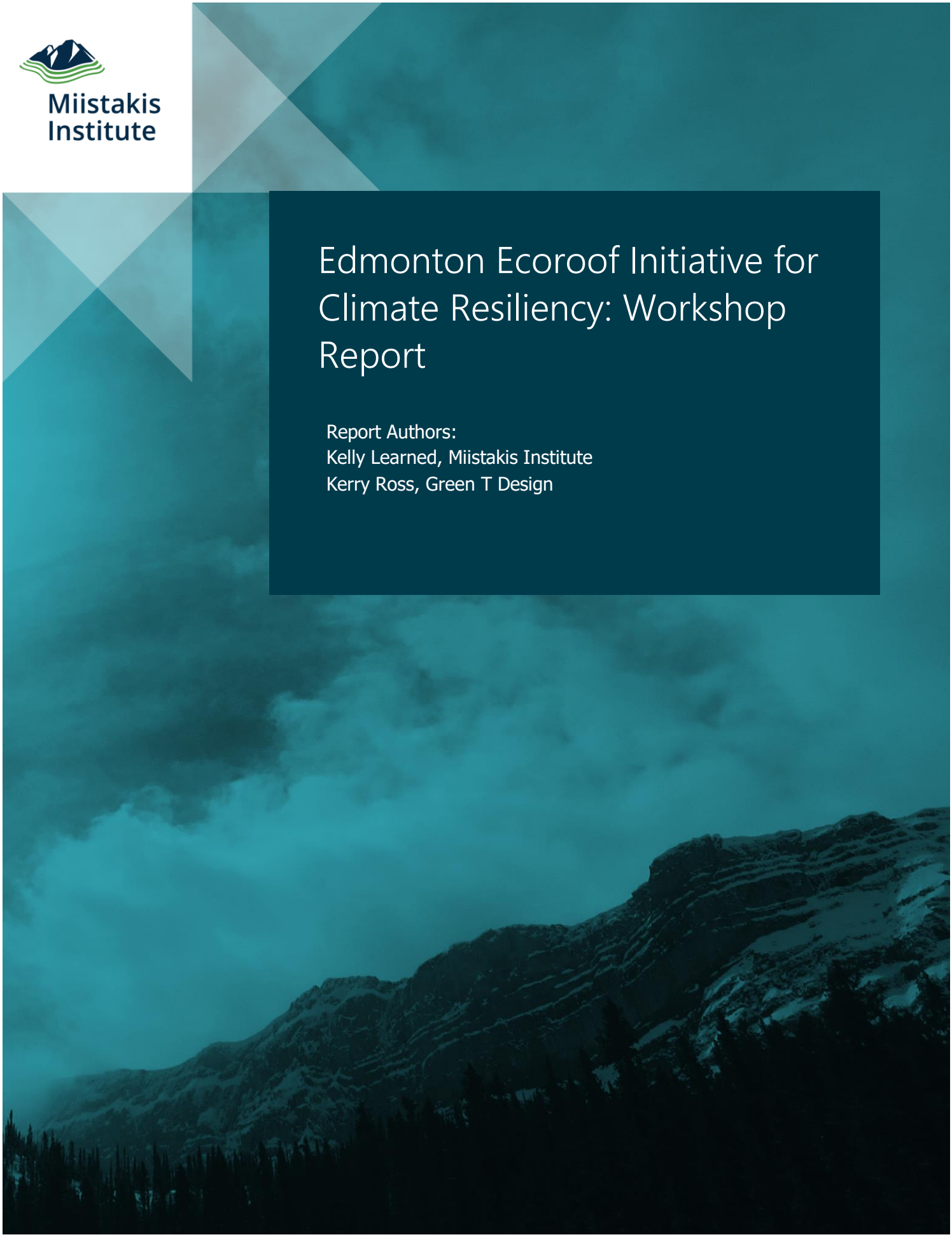

Edmonton Ecoroof Initiative for Climate Resiliency: Workshop Report

Prepared by Kelly Learned and Kerry Ross with contributions from Holly Kinas and Danielle Koleyak

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Project Funders

Thank you to the following organizations for their invaluable funding support:

What are Ecoroofs?

An ecoroof, also known as a green roof, vegetated roof, rooftop garden, or living roof is an extension of an existing roof of which basic components include waterproofing, root repellent layer, drainage, growing medium and plants. Depending upon the type of ecoroof, and the design intent, additional components may include an irrigation system, water fountains, seating areas and other features. Ecoroof implementation involves the creation of "contained" green space on top of a structure. This green space could be below, at, or above grade.

Ecoroofs provide ecosystem services in urban areas including improved stormwater management (both quantity and quality), better regulation of building temperatures, reduced urban heat island effects, and increased urban wildlife habitat and biodiversity (Oberndorfer et al., 2007). Some jurisdictions refer to ecoroofs as a 'no-regrets' climate adaptation measure (Mees, Driessen, Runhaar, & Stamatelos, 2013) because they serve multiple societal goals.

Project Overview

The Edmonton Ecoroof Initiative for Climate Change Resiliency is a research project being led by the Miistakis Institute in partnership with the City of Edmonton and with input and guidance from the Research Advisory Committee. The purpose of the project is to explore the potential for an ecoroof policy program as a strategy for climate adaptation by gathering research, engaging stakeholders and identifying potential key motivators for a policy program.

The ecoroof project research and engagement will inform the preparation of strategy and action development in alignment with the City's Climate Strategy, *Climate Resilient Edmonton: Adaptation Strategy and Action Plan.*

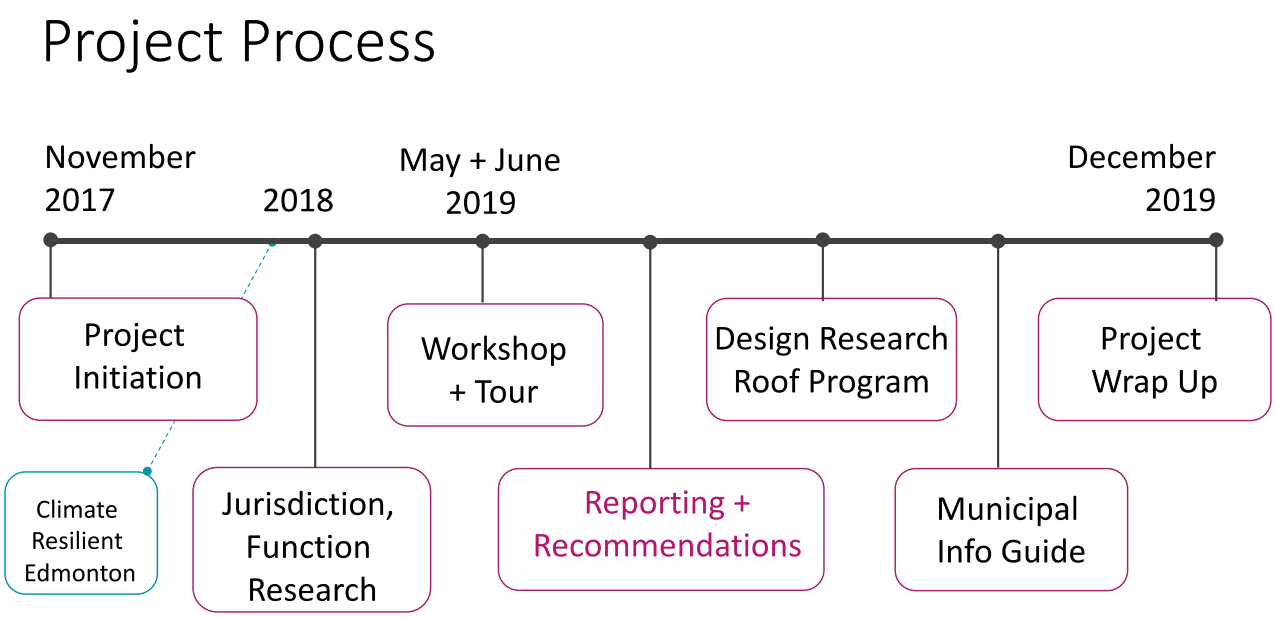
To date, Miistakis has completed two reports - the *Ecoroof Jurisdictional Review* which reports on four North American cities' ecoroof programs and, the *Ecoroof Function Report* that compiles a number of studies on various ecoroof environmental impacts. An *Introduction to Ecoroofs* webinar was also produced to highlight report findings as well as Edmonton's climate change projections and impacts. All reports and the webinar can be found on the Miistakis website (www.rockies.ca).

On May 28, 2019, an Ecoroof Workshop was hosted in Edmonton to learn from the Research Advisory Committee members on what they thought the key drivers and challenges are to implementing ecoroofs in the Edmonton context. This document reports on who was invited to the workshop, who attended, the discussions and outcomes of the workshop.

A set of recommendations regarding short and long term actions the City of Edmonton may want to consider should they decide to pursue an ecoroof program will be produced based on the workshop outcomes, research, policy analysis and ecoroof practitioners' advice.

Over the summer and fall of 2019, a Municipal Information Guide will be developed for Alberta municipalities interested in pursuing an ecoroof policy program. The project team is also working on an ecoroof research and monitoring framework the City of Edmonton and partners can utilize to add to the existing studies and research already completed that quantifies the environmental impacts ecoroofs have in urban contexts.

Figure 1: Ecoroof Project Process and Timeline



Engagement

The Research Advisory Committee is comprised of a diversity of stakeholders tasked with providing feedback, input and recommendations on ecoroof research completed to date as well as advice on exploring the potential for an ecoroof program in Edmonton. The following infographic outlines recruitment and participation of the Research Advisory Committee.

RESEARCH ADVISORY COMMITTEE (RAC)

Pre-workshop Items

Online Presentation

The project team developed and recorded a 30-minute presentation to provide Research Advisory Committee members with information on the findings from the Ecoroof Function Study, highlights from the Ecoroof Jurisdictional Review as well as the Climate Resilient Edmonton: Adaptation Strategy and Action Plan. The presentation is available on the Miistakis website.

Pre-workshop Interviews

Fourteen pre-workshop interviews were completed over the phone with representatives of government agencies, community and environmental organizations, academic institutions and private industry. The purpose of these interviews was to gain insight into a sampling of stakeholders' level of knowledge on the subject matter, understand what their questions or ideas are about ecoroofs, and learn about their organization's mandate and the type of work they do. Stakeholders were asked to suggest others that should be included in the workshop to ensure a diversity of perspectives and expertise were represented.

Pre-workshop Survey Highlights

Research Advisory Committee members were asked to complete an online survey between April 25 to May 28, 2019. There were five questions in total. The survey was distributed directly to 47 individuals and 36 completed the survey. See Appendix A for survey outcomes, the survey summary is outlined below.

Participants ranked the top five challenges the City of Edmonton is likely to face should they pursue the development of an ecoroof strategy.

1. The first costs or capital costs to build ecoroofs and developing a way to overcome this initial barrier
2. Finding feasible ways to address industry resistance (building, construction, operations, etc.)
3. Development of effective incentives to encourage ecoroof implementation on private buildings
4. Development of a fair, feasible bylaw that would result in increased ecoroof implementation on private buildings
5. Resources to address technical questions (roof loading, fire suppression, insurance, design, etc.)

The top five public benefits should the City of Edmonton pursue the development of an ecoroof strategy were ranked as:

1. Storm water retention
2. Building energy savings
3. Greenhouse Gas (GHG) emission reductions
4. Air quality improvements
5. Urban Heat Island (UHI) reduction

Survey participants provided recommendations to the City of Edmonton if the decision is made to pursue an ecoroof strategy and can be summarized as follows:

- Create a database to track locations of ecoroofs in Edmonton
- Provide information to address the key challenges (ex. Cost to build etc.)
- Provide information on benefits

Workshop

A workshop was held on May 28th at Grant MacEwan University in Edmonton. Thirty-nine Research Advisory Committee Members attended the workshop. To start the day, presentations on the project process and research completed to date, the Climate Resilient Edmonton: Adaptation Strategy and Action Plan and an overview of Ecoroof policy around the globe were provided.

Workshop Exercises and Outcomes

SCENARIO EXERCISE

Each table was given a different scenario. Each scenario asked participants to 'wear the hat' of a particular stakeholder and answer the question assigned. This exercise provided insight into stakeholders' questions and asked participants to identify opportunities and challenges from a variety of perspectives related to ecoroofs. There was no prioritization done with this exercise as the intent was to get participants thinking about ecoroofs in general and brainstorming ideas. Prioritization occurred in the pre-workshop survey and the next workshop exercise.

The scenarios are listed below along with a summary of common opportunities, challenges and questions posed by the groups. Transcriptions of the scenario exercise notes can be found in Appendix B.

> **SCENARIO A:** YOU ARE A CITY OF EDMONTON COUNCILLOR AND A CHAMPION OF ECOROOFS. WHAT DO YOU THINK IS THE BEST OPPORTUNITY OR REASON FOR DEVELOPING AN ECOROOF STRATEGY IN THE CONTEXT OF A CHANGING CLIMATE?

> **SCENARIO B**: YOU ARE A DEVELOPER IN EDMONTON. WHAT DO YOU THINK IS THE BEST OPPORTUNITY OR REASON FOR DEVELOPING AN ECOROOF STRATEGY IN THE CONTEXT OF A CHANGING CLIMATE?

> **SCENARIO C**: YOU ARE A CITY OF EDMONTON STAFF PERSON. YOU HAVE SEVERAL QUESTIONS ABOUT HOW AN ECOROOF STRATEGY CAN BE SUCCESSFUL. WHAT ARE YOUR QUESTIONS?

> **SCENARIO D**: YOU ARE A BUILDING OWNER AND ARE NOT SURE YOU SUPPORT AN ECOROOF STRATEGY. WHAT ARE YOUR QUESTIONS?

SCENARIO E: YOU ARE A MEMBER OF A COMMUNITY LEAGUE AND HEAR THE CITY MAY BE DEVELOPING AN ECOROOF STRATEGY. WHAT DO YOU WANT TO KNOW?

Scenarios A, B and D Summaries

The discussions from Scenario A, B and D participants resulted in similar topic areas and are summarized together in the section below.

Opportunities Discussed

Table discussions identified a number of opportunities related to:

- environmental benefits - stormwater management, water quality improvements, energy efficiency and air quality improvements;
- social benefits - aesthetics, amenity space, and urban agriculture, and;
- economic opportunities – energy savings/cost savings, long term cost savings (roof lasts longer, building energy and stormwater discharge savings), increased property values, and the marketability of an ecoroof.

Challenges Discussed

Even though the scenarios did not specifically ask participants to discuss possible challenges, it was expected they would be raised (they were!). Below is a list of the challenges provided by stakeholders during the scenario discussions.

- Actual cost as a building owner
- How to maintain (short-term and long-term)
- Public access
    - Access to roof in old buildings
- Codes, standards
    - Roof design criteria
    - Structural load
    - Leak detection (risk management)
    - Water management/drainage
    - Effects on air handling systems
- Design installations
    - Flat roof vs. slope roof
- Impacts on warranty
- Animals (pests?)
- Changing dynamics (vegetation)
- Who are the experts? Northern Climate experts?

Incentives

The most prevalent challenges raised related to the cost of installing and the ongoing maintenance of the ecoroof. The majority of solutions suggested related to some type of incentive for the building owner or developer. Examples of the incentives suggested range from aspirational incentives (City to lead by example and others will follow), to more regulatory approaches (requiring ecoroofs in certain areas or building types). The point was also made by

one stakeholder that incentives are not a solution and should not be considered because they are tax payer dollars.

Here is a summary of stakeholder suggested incentives by incentive type:

- Zoning incentives
    - Larger building footprint permitted in exchange for ecoroof. Some jurisdictions increase floor area ratio (FAR) to offset cost of ecoroof.
        - However, this point was countered with the statement that landscaping/public green space at street level should not be compromised.
    - Reduced site requirements (for example, landscaping at grade, on site stormwater requirements)
    - Require ecoroofs on all parkades
- Voluntary incentives
    - Grant for risk mitigation add-ons (leak detection system added to ecoroof)
    - Potential to expedite the permitting process (saves money)
    - Incentivize through reduced requirements, including support resources for projects
- Direct financial incentives
    - Property tax offsets to property owners
    - Potential for stormwater management discount to building owner from EPCOR

Other items for consideration regarding an incentive program were discussed by participants. These questions and statements are important for the City to consider before it moves forward.

- As a developer, what happens if an ecoroof is *not* installed?
    - Is there a penalty?
    - Delayed permit?
    - Incentive rescinded?
    - Penalty approach could push developers away
- Why implement an ecoroof policy?
    - Are we (developers) forced to?
    - Ethics (as developers is this something we *should* do?)
    - Quality of life improvements (recreation)
    - Sustainability practices (education)
- How?
    - Ecoroof strategy needs to be clear yet not too prescriptive, flexible, with different options.
    - Can incentives be designed to meet multiple Resiliency goals?
- How is the cost of the ecoroof program sustained?
    - Passed onto tax payers?
- Are there other alternatives that are more cost effective?
- Comparison to other climate change initiatives
    - Finances (is there a personal benefit?)

- The whole story (economics, social, not just climate/environmental)

Scenario C

Staff Person Perspective Discussion

Scenario C asked participants to put themselves in the shoes of a City of Edmonton staff person. They were instructed to ask questions a staff person would have about an ecoroof strategy. Their discussion is summarized by themes in the table below.

Question/Issue Raised from Staff Person's Perspective
Certifications • What certifications would be needed?
Criteria, Evaluation • As a planner/novice what are the key factors to identifying green roof potential (permits etc.)? • Evaluation criteria • Clear requirements for retrofit and new development evaluation and prioritization • Current green roof motivations (Edmonton specific) • Clear understanding of benefits, city objectives and financial incentive availability • Best practices around city policy • How can you best use incentives to meet multiple Resilience goals?
Alignment with City Policy • How can ecoroofs align with urban landscape/green building policy?
Tools Needed • Assessment tool to determine potential for specific sites and target incentives • Green roof prioritization areas (where are they most needed?) • Guidelines on building type, best neighbourhoods for ecoroofs needed
Technical • What are the main requirements for new or retrofit roofs? • Roof slope requirements/limitations (minimum 1-2% building code?) • What are the effects of green roofs on site permeability?
Statements and Observations: • Currently accessible roofs are already structurally robust so could be good for ecoroofs • Warranties for systems above roof structure (existing) (5-10 years for warranties) • Roof age is a factor to consider • Sector or program should focus on buildings with the most potential

Question/Issue Raised from Staff Person's Perspective
(residential/commercial/institutional) • Integration potential with other building water systems (water quality impacts to stormwater system) • Long term cost savings • Energy savings • Direct link to cost savings (water) • Reduced stormwater runoff and infrastructure costs • Social benefits – aesthetics • Air quality improvements • The city could promote their existing or install ecoroofs to lead by example • Getting utility companies onboard is key • Need to promote awareness and the monetary benefit to installing ecoroofs.

Scenario E

Community Perspective Discussion

The last scenario prompted stakeholders to ask questions of a proposed ecoroof program from a community member perspective. The questions created by the Scenario E group will assist the City in preparing information for the public should they decide to pursue an ecoroof program.

- How much will this (program) cost?
- Will the costs be transferred to the community?
- How will this impact property value and business activities?
- Importance of cost/benefit information, easily understood - why we *should* do this.
- What is the value? WHY is the City doing this?
- Will there be subsidies or incentives?
- What are the locations being considered?
- Will these be publicly available sites?
- Does public access impact costs?
- What is the timeline for the ecoroof program?
- What are the hazards?
- How are liabilities addressed?
- Who will design/build it?
- What plants will they be using?
- Importance of considering different types of green roof (extensive vs intensive).
- Need to manage expectations of what will grow.
- What stories will we be able to tell? How will it serve the community?
- Is this something individuals will be able to do?
- How will the community be involved in the strategy?
- What are the opportunities for partnerships?
- How can the community help promote the strategy?
- How will the city respond to incidents/complaints?
- Will this become mandatory?
- "I don't know what I don't know" – what do I need to know?

Scenario Exercise Summary

As part of the scenario exercise, each table facilitator provided highlights of their discussion. Then the floor was opened for the other scenario tables to provide advice from their assigned perspectives or professional experience. During this portion of the workshop, there were a number of insightful technical questions raised about ecoroofs, the need for proof of concept in the Edmonton context, and concerns mentioned by some contractors on the ecoroof systems and warranties currently available.

One key discussion revolved around why focus on an ecoroof policy or incentive? Why not let the market decide? Responses to these points were countered by other participants with the need for climate change action now (and the role of a municipality to enable that); the need to incentivize a 'new' technology otherwise it won't get done because many developers are risk-averse; and recognition of the number of co-benefits that can be realized publicly and privately through the installation of one technology (ecoroofs).

DRIVERS/BARRIERS EXERCISE

This exercise was designed as an opportunity for stakeholders to take some time to reflect on what they heard from the group discussions and provide individual insight into what they thought were key drivers/opportunities and barriers/challenges for a potential ecoroof program in Edmonton. Each stakeholder was asked to provide three opportunities and three challenges.

Stakeholders then placed their responses under one of the four Climate Strategy Consequence themes (p. 12, *Climate Resilient Edmonton: Adaptation Strategy and Action Plan*). The section below summarizes individual inputs into themes. The numbers in brackets indicate how many times the item or a related idea was mentioned by different stakeholders. For transcribed results see Appendix C.

Top Drivers/Opportunities	**Top Barriers/Challenges**
Increased stormwater retention capacity and dollar savings for municipality/EPCOR (17)	Lack of knowledge and education about ecoroofs. People don't know about the existing ecoroofs in Edmonton (18)
Conserve and regenerate biodiversity. Plants, insects, birds. (12)	Cost to install an ecoroof (18)
Minimize/lessen urban heat island (9)	Demonstrating cost/benefit (8)
Cost savings for utilities, energy, etc. (9)	Maintenance (7)
Amenity space for socializing, recreation in dense neighbourhoods (9)	"Way we've always done things" attitude, risk/cost averse developers (7)
Improved air quality (5)	Structural, building codes (6)
Community gardens/urban agriculture (5)	Policy and regulatory barriers, political will (6)
Quality of life, better natural living environment/nearby nature – especially in higher density neighbourhoods (4)	Perception ecoroofs might not be feasible in our climate/proof of concept (5)
New market and jobs (4)	Access (4)
Climate change adaptation, resilience and long-term preparedness (3)	Safety (4)

Top Drivers/Opportunities	Top Barriers/Challenges
	Property value impacts and affordability (residential especially) (4)
	Skills and technology required by developers, architects, designers, operations (3)

Group discussion: What do you hope to see as outcomes for this project?

To wrap up the facilitated portion of the workshop, participants were asked to discuss what they hope to see as outcomes for the Edmonton Ecoroof Initiative for Climate Resiliency project. Below is a summary based on the notes compiled from the discussion.

- Education about what ecoroofs are, what private and public benefits they provide and why the city would want to pursue an ecoroof strategy were mentioned as things stakeholders would like to see happen with this project.
- Resources about ecoroofs for developers or individuals wanting to install an ecoroof would be beneficial. It would also be important to explain the common challenges of installing ecoroofs (roof loading, water proofing, plant selection, maintenance, etc.).
- Several stakeholders stated they would like to see the City of Edmonton lead by example by installing ecoroofs on their buildings or partnering with industry, businesses or developers to showcase ecoroofs in Edmonton. One stakeholder suggested a case study analysis of existing ecoroofs in Edmonton that includes interviews with property owners would help demonstrate what is already happening in Edmonton related to ecoroofs and provide informative lessons learned and successes.
    - Note: The City of Edmonton will be developing more detailed case studies of existing ecoroof projects in response to this suggestion.
- The need for data on the performance of ecoroofs in climates like Edmonton was mentioned several times.
    - Note: The Ecoroof Function Report outlines ecoroof performance data from studies completed in various North American and Canadian cities. Please see the report here: https://www.rockies.ca/miradm/uploads/Function_Research_FINAL.pdf
- The impacts on property value for residential properties was also something stakeholders would find valuable.

Overall, the discussion was supportive of the project and provided insightful suggestions to improve the outcomes and potential success of the project.

Exit Survey

In total there were 30 completed exit surveys (see summary of exit surveys in Appendix D). The first survey question asked participants to indicate on a scale of 1 - 5 how they would rate their support in regard to Edmonton pursuing the development of an ecoroof strategy (1 = not supportive at all and 5 = extremely supportive).

All of the respondents were between neutral (3) to extremely supportive with no respondents on the not supportive (1 -2) end of the scale. The majority (25) were either very (4) or extremely supportive (5).

The majority of comments participants provided on why they supported Edmonton pursuing an ecoroof strategy relate to the numerous public environmental impacts that would likely result in productivity, health and well-being benefits as well.

Participants were asked to indicate the top benefit and the top challenge for the City of Edmonton if they decided to pursue an ecoroof strategy. In summary, benefits included: showing/demonstrating leadership as a municipality; stormwater management; urban heat island reduction; improving the quality of life of citizens; and cost savings. The challenges listed can be summarized as cost; resistance/buy-in by developers and potentially the public; awareness and education on ecoroofs and the potential policy.

Frequently Asked Questions

Throughout the workshop, the project team tracked questions raised during discussions. The team thought it would be helpful to provide a Question and Answer section in the workshop report.

Can roofs hold the extra weight of an ecoroof?
Before an ecoroof is installed, it is required that roof loading be reviewed by a certified professional (structural engineer) as it would be in any other retrofit which impacts the structure of a building, or with a new build. Roof load would consider snow loading in addition to the ecoroof loading.

Are the upfront costs higher than a conventional roof?
Yes. Up-front costs to install an ecoroof are more expensive than an ecoroof and can vary widely. More labour and materials are required to construct an ecoroof compared to a conventional roof.

[Text below is adapted from an internal report to the City of Calgary entitled *Green Roofs: A Potential For Calgary- Response to September 2017 Notice of Motion* (Ross, 2019)*]*

The capital costs or first costs of an ecoroof are higher than that of a conventional roof. In Alberta, the cost differential between the two roofing systems is greater than many other jurisdictions which are advancing ecoroofs. The first costs for ecoroofs in Toronto dropped as much as 30% since mandating green roofs in 2009 (Lilauwala & Peck, 2017). A host of other cities such as Vancouver, San Francisco, Chicago and Portland, OR have also experienced cost reduction in ecoroof installation as the markets matured.

For example, the first costs of an extensive ecoroof in Calgary can range from $34 to as much as $50 per square foot. This cost range includes the cost of the conventional roofing membrane ($14-16/SF). Some reasons for this large gap may be due to the differences in the complexity of green roof design, travel distance of many of the supplies to the Calgary market and a lack of market competitiveness. Typically, costs will vary depending upon the building type, size and height of the roof above grade. Other factors influencing the first cost include whether there is

sufficient storage space for materials on site, access for cranes and hoisting and ease of mobilizing on site. The scheduling and lead times of a project also have an impact, as does the number of trades to coordinate involved in the construction.

A small sample of local cost information was obtained through the surveying of local architects, landscape architects, green roof professionals, roofing and general contractors, and suppliers. Cost data from academic and grey periodicals were also sourced and a weighted cost average was used.

What are the maintenance and operations costs?
The maintenance required for an ecoroof is dependent upon the system type, plant species selection, whether irrigation is used, aesthetic design goals, purpose and use by public. Typically, the first few years of the life of an ecoroof will require more maintenance while the plants are establishing. Ecoroof maintenance costs can range from $0.30-$1.00/SF, annually. Conventional roofs require regular inspection and maintenance, the costs of which may be overlooked. As a minimum, conventional roofs should be inspected twice yearly, as well as after major storm events. Maintenance costs for conventional roofs is estimated at $0.18/SF, annually (Lilauwala & Peck, 2017).

What is the difference between an ecoroof and a white roof?
A reflective or albedo roof is often proposed as an alternative sustainable roofing system to an ecoroof. Its first cost is lower than an ecoroof but often higher than a conventional roof. The purpose or a reflective roof is to reduce heat gain in the summer. However, it creates a heating penalty in the winter and shoulder seasons (spring and fall). To keep its effectiveness, it must be cleaned regularly.

A reflective or white roof does not contribute to any of the other benefits afforded by an ecoroof (stormwater management, biodiversity, biophilia, etc.). Research in northern climate contexts has shown that an ecoroof can outperform a reflective roof in fall, winter and spring in terms of energy savings. A reflective roof is vulnerable to hail damage and mechanical damage and can produce condensation at the metal fasteners. A reflective/white roof may be an inappropriate choice when installed adjacent to windows as it produces a lot of glare and reflected heat.

Can I use any type of membrane?
Not all membranes are suitable under an ecoroof. A high-quality waterproof membrane that can withstand hydrostatic pressure is required. As the membrane is buried under the overburden of an ecoroof, it is difficult to inspect or repair similarly to an inverted roof where the insulation is placed on top of the waterproofing and ballasted in place with pavers or washed rock. Therefore, it is critical to select an appropriate waterproofing system and ensure that it is installed properly.

Do ecoroofs have less leaks or less maintenance than other types of roofs?
It is expected that when ecoroofs are designed and constructed properly, that they should have less leaks and require less repairs. This is because the waterproof membrane is protected from mechanical damage, wear and tear, thermal shock which causes repeated cycles of expansion and contraction. They are also protected from UV degradation which ages exposed membranes prematurely.

Is there fire and safety risks with ecoroofs?
Over the past decade, robust standards for ecoroofs have been developed with multi-stakeholder committees. When designed in accordance with these accepted standards, the roofing system is more resistant to wind and fire. As well, for any roof type, roof safety has become more stringent.

Is liability a challenge?
As with the integration of new building technologies, there can be increased liability resulting from potential errors in design, installation and maintenance (or lack of adequate maintenance) particularly with inexperienced design or construction teams. To mitigate liability, project stakeholders in a project that features an ecoroof should clearly detail their expectations and performance requirements in their contract documents.

Green building owners and general contractors should engage experienced green roofing professionals (GRPs) when building an ecoroof. The green roofing industry has begun to assist in this regard by designating GRPs in a manner similar to that of the LEED Green Associate or Accredited Professional designations. Green Roofs for Healthy Cities, the green roof and living wall industry association, has established the Green Roof Professional https://greenroofs.org/living-architecture-academy ("GRP"), which designation was created to distinguish certain individuals that have achieved a specific knowledge level with regard to the full spectrum of ecoroof/green roof design, project management, installation and maintenance.

The above was adapted from post from Geoff White, May 2009 on Green Real Estate Law website; accessed July 2019. Website: http://www.greenrealestatelaw.com/2009/05/mitigating-risks-when-building-green-roofs/ (White, 2009).

Summary of Findings

The focus of our project team is from a public policy perspective – policy that benefits the public at large. Therefore, we are interested in analyzing what a municipality can influence through policy to achieve the goals they have established – such as climate change resiliency.

The outcomes from the workshop indicate that from a public policy perspective, stormwater retention, addressing urban heat island, reducing energy use (and in turn GHG emissions), biodiversity and improved air quality should be considered as policy development drivers for the City of Edmonton if they decide to pursue an ecoroof strategy.

Stakeholders also identified a number of barriers/challenges for developing ecoroofs that should be addressed by the City of Edmonton if the City wants to encourage more ecoroof installation by private developers. As a municipality, the City has several tools it can use to mitigate barriers or challenges to implement public policy. The barriers/challenges listed are related to increasing knowledge, education and experience. Ecoroof design, installation, maintenance and performance as well as up-front cost and how that affects developers' willingness and ability to install an ecoroof, the impacts on property values and affordability, and the long-term sustainability of the ecoroof itself are challenges and questions that can be answered. If knowledge and cost can be addressed by the municipality in a way that is useful to those installing the ecoroofs, a number of barriers will be removed.

Next Steps

Based on the workshop outcomes, research completed and input from ecoroof policy and industry professionals, the project team will develop a set of recommendations for the City of Edmonton to consider. These recommendations will be distributed to the Research Advisory Committee for their information.

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Appendices

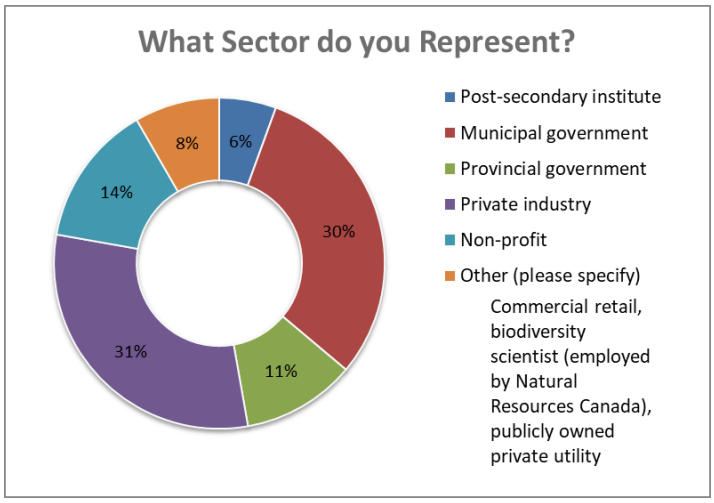
A. Pre-Workshop Survey
B. Scenario Discussion Notes
C. Drivers/Barriers Notes
D. Exit Survey Summary

Appendix A: Research Advisory Committee Pre-Workshop Survey Summary

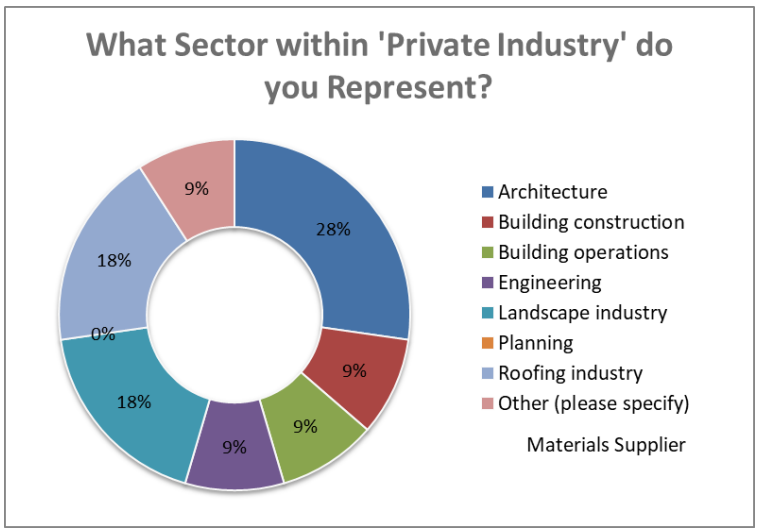
General Survey Information

- Online survey conducted using SurveyMonkey
- 5 questions
- 36 Total Respondents
- 92% completion rate
- 7 mins typical time spent on survey
- Responses from April 25-May 28, 2019

1. What sector do you represent?

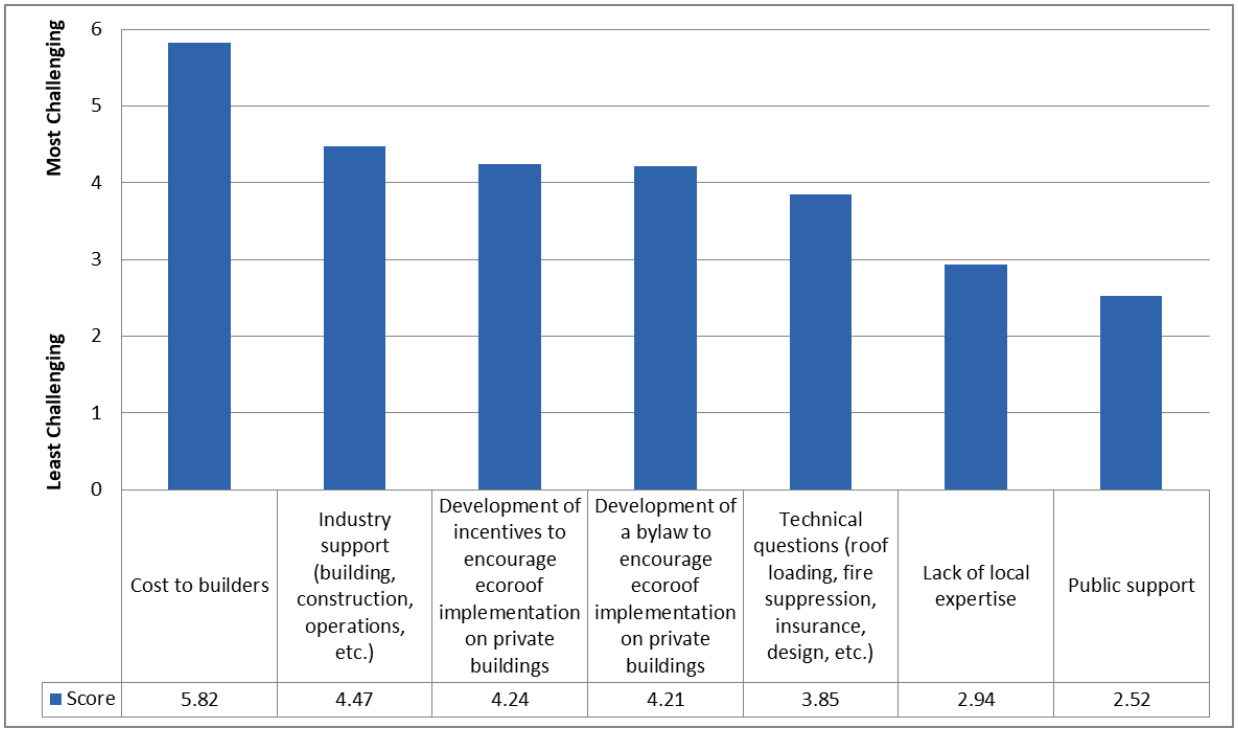


What sector within 'Private industry' do you represent?



Questions and Results

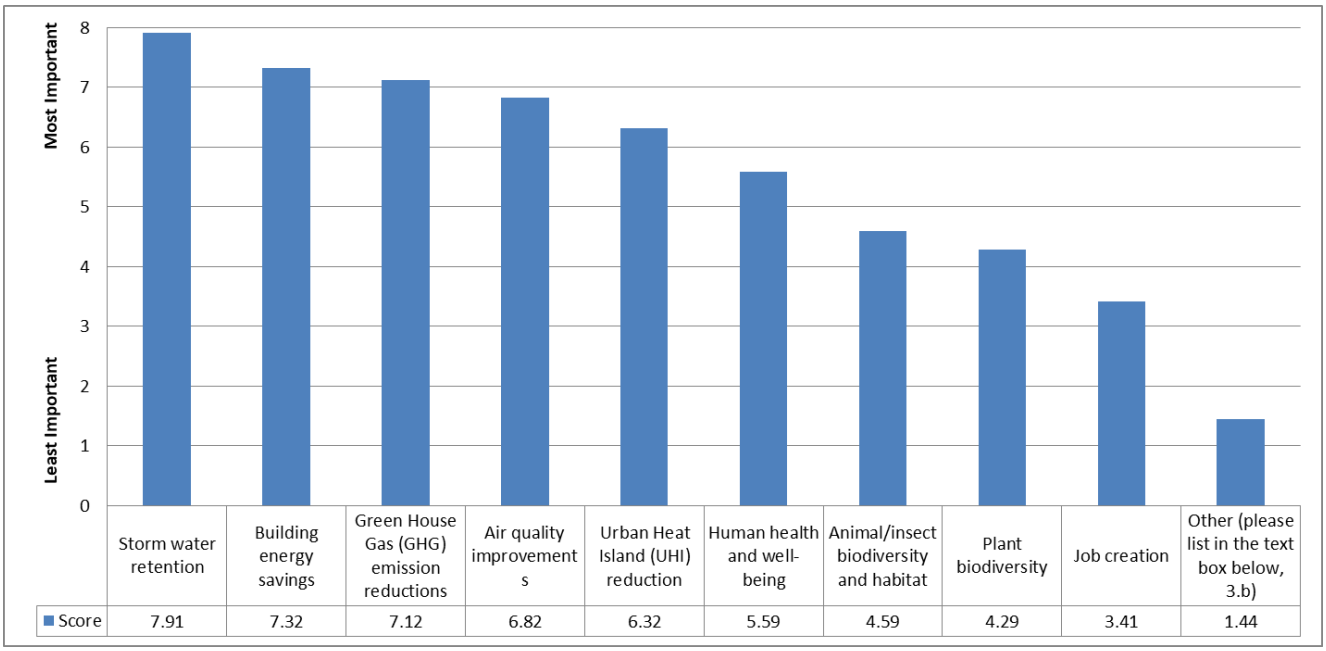
2. The research conducted for this project revealed common challenges (or in some cases misconceptions) associated with ecoroof implementation. Rank the following challenges the City of Edmonton may experience if they pursue development of an ecoroof strategy (1 being most challenging, 6 being least challenging):



Findings: The top five challenges associated with ecoroof implementation, should the City of Edmonton pursue the development of an ecoroof strategy are:

1. Cost to build
2. Industry support (building, construction, operations, etc.)
3. Development of incentives to encourage ecoroof implementation on private buildings
4. Development of a bylaw to encourage ecoroof implementation on private buildings
5. Technical questions (roof loading, fire suppression, insurance, design, etc.)

3. a) As outlined in the presentation you viewed prior to doing this survey, there is potential for numerous public benefits to be realized from ecoroof implementation. Ecoroofs could assist with adapting to the anticipated changing climate projections outlined in Climate Resilient Edmonton, including higher temperatures, more extreme precipitation and weather events over time. Rank the following public benefits from most important to least important (in consideration of the Edmonton context), by dragging the benefit (1 being the most important, 10 being the least important):



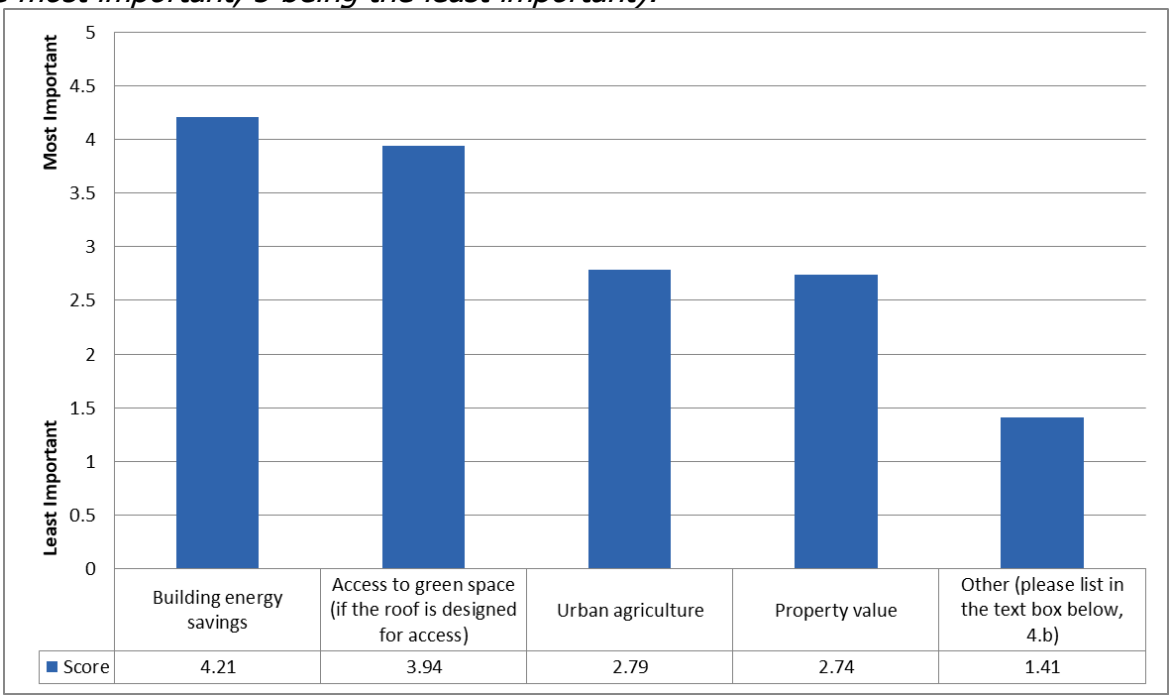
3. b) Other

Responses
Edmonton Demonstrating Leadership in Adaptation Actions
Amenity space for downtown residents
Community is Food provision gardening
Building appearance
n/a
Biophilia
aesthetics are improved
This methodology is flawed. I don't see how you can get meaningful information for this type of ranking
Roof Durablity (increase in service life)
none

Findings: respondents identified the following public benefits as the top five most important:

1. Storm water retention
2. Building energy savings
3. Greenhouse Gas (GHG) emission reductions
4. Air quality improvements
5. Urban Heat Island (UHI) reduction

4. a) There are also a number of benefits building owners and occupants can realize by installing an ecoroof. Rank the following benefits from most important to least important (in consideration of the Edmonton context), by dragging the benefit (1 being the most important, 5 being the least important):



	Building energy savings	Access to green space (if the roof is designed for access)	Urban agriculture	Property value	Other (please list in the text box below, 4.b)
Score	4.21	3.94	2.79	2.74	1.41

4. b) Other

Responses
Reduced noise-pollution impact
I don't think any of your listed benefits are primary motivators in Alberta. roof longevity, temperature fluctuation moderation for both occupants and solar panel operations, aesthetics
Aesthetics
biodiversity - garden pollinators
Reputation
Resident sense of community
Biodiversity
n/a
If the city had tax or other incentives
sustainability = durability, maintainability, longevity
Greenhouse gas reductions
Roof Durablity (increase in service life)
none

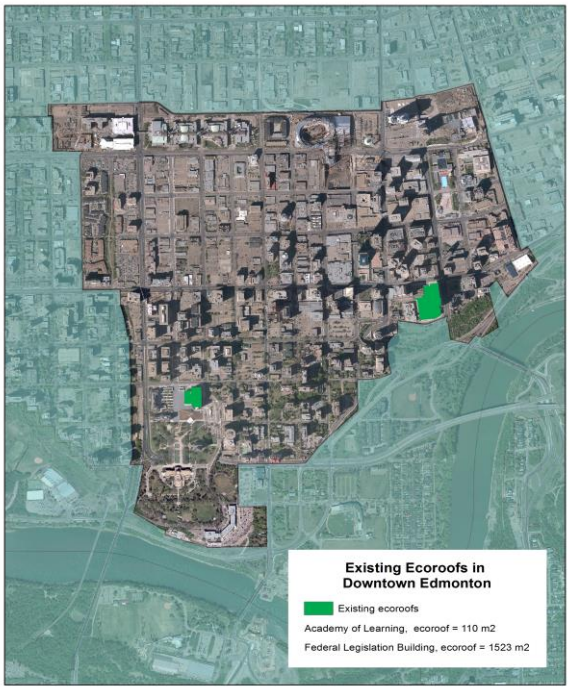
Findings: respondents identified the following building owner and occupant benefits as the top two most important:

1. Building energy savings
2. Access to green space (if the roof is designed for access)

5. Please view the map provided. Our project team has identified two existing ecoroofs in the Downtown Neighbourhood. Please list the building name and (if possible) the location of any we have missed within the Downtown Neighbourhood boundaries.

Findings: respondents identified the following additional ecoroofs, both in and outside of the Downtown community:

- Downtown Community
    - Manulife Place - 10180 101 St NW
    - Manulife Place Podium - 10180 102 Street
    - Williams Engineering Canada - 10065 Jasper Ave #200
    - Legislature grounds parkade, 97 Ave.
- Outside of the Downtown Community
    - 10160 112 Street (Oliver)
        i. former Stantec office 112 street and Jasper Ave.
    - Royal Alexandra Hospital - 10240 Kingsway NW, (Central McDougall)
    - Waste Management and Development - 250 Aurum Road NE (Clover Bar Area)
    - Stantec building
    - MacDonald building



Appendix B: Scenario Discussion Notes

Scenario A: You are a City of Edmonton Councillor and a champion of ecoroofs. What do you think is the best opportunity or reason for developing an ecoroof strategy in the context of a changing climate?

- Opportunities:
- Long term cost savings
- Energy savings
    - Reduced heating/cooling, emissions
    - Need to cost this out
- Reducing storm water runoff
    - Reducing infrastructure costs
        - Need data to support
- Social benefits
    - City doesn't just consider the dollar benefit
    - Aesthetics
    - How to quantify?

- How to sustain the cost?
    - Concern passed to tax payers
    - Other alternatives more cost effective?
    - Financial incentives to builders?
        - Property tax offsets?
- Potential air quality improvement
- Concerns for fire and public safety
- Need better membranes to use on ecoroofs
    - Liability is a challenge
- Need to promote awareness
- Need to promote a monetary benefit to installing ecoroofs
- Get utility providers on board
    - Show increase in utilities
- Need specific context for Edmonton
- City leading by example
- Need for guidelines on big type, best places/neighbourhoods etc. for ecoroofs
- How can ecoroofs align with urban landscape policy?
- Need for more options for membrane/roof
- Show companies of different kinds of roof maintenance
    - Ecoroof – less leaks? Less maintenance than others?

Scenario B: You are a developer in Edmonton. What do you think is the best opportunity or reason for developing an ecoroof strategy in the context of a changing climate.

- Life expectancy of roof
- Amenities for tenants

    - Positive exposure/marketability
        - Increase sale price
- Receive municipal incentives/tax breaks to help with associated costs
    - Grant for risk mitigation add-ons (ex. leak detection system added to ecoroof)
- Energy savings!
    - People will move into more efficient buildings
- Negative: Deterrent: maintenance costs
    - Concerned of weight/cost
- Negative: increased upfront costs
- Positive: electronic leak detection under ecoroof
    - Reduce maintenance cost
- Positive: get ahead/expedited permitting process
    - Saves money, minimal delays
- Strategy – clear but not too prescriptive, flexible, with different options
- As a developer, 'what if I don't install an ecoroof?'
    - Penalty? → $, delayed permit
    - Penalty approach could push developers away
- Potential opportunity for use for infills → which put strain on stormwater management (ecoroofs could help mitigate that strain)
- City leading by example
    - Installing ecoroofs
- Stormwater management (EPCOR) discount to building owner
- Zoning incentive
    - Trade-offs: larger building footprint in exchange for ecoroof
        - Argument to above point:
            - Should maintain landscaping
            - Public green space (along curb)
- Urban agriculture →restaurant, grocery store
- Any new parkade = ecoroofs
- Ease of sale → trendy/modern/benefits/desired
- Difficult to incentivize a developer

Scenario C: You are a City of Edmonton staff person. You have several questions about how an ecoroof strategy can be successful. What are your questions?

- Certifications
- As a planner/novice what are the key factors to identifying green roof potential (permits etc.)
- Evaluation criteria
- Currently accessible roofs (already structurally sound)
- Warranties for systems above roof structure (existing) (5-10 years for warranties)
- What are the main requirements for new or retrofitting roofs
- Roof age
- Clear understanding of benefits and city objectives and financial incentive availability
- Best practices around city policy

- Green roof prioritization areas (where are they most needed)
- New neighbourhood evaluation of benefits
- Clear requirements for retrofit and new development evaluation and prioritization
- Roof slope requirements/limitations (1-2% building code?)
- Sector to focus on, most potential (residential/commercial/institutional)
- Effects of green roofs on site permeability
- Direct link to cost savings (water)
- Assessment tool to determine potential for specific sites and target incentives
- How can you best use incentives to meet multiple resilience goals?
- Integration potential with other building water systems (water quality impacts)
- Current green roof motivations (Edmonton specific)
- Incentives in other forms (reduced requirements, including support)

Scenario D: You are a building owner and are not sure you support an ecoroof strategy. What are your questions?

- Economic benefits
    - Short-term (maintenance costs in Edmonton) vs. long-term
- Liabilities
- Subsidies/tax break (incentives)
    - Not a solution
- Roof criteria (engineering)
- Impacts on warranty
- How to maintain (short-term and long-term)
- Animals (pests?)
- Weight load
- Actual cost as a building owner
- Fire hazards
- Effects on air handling systems
- Changing dynamics (vegetation)
- Ecoroof intensities
- Public access
- Codes, standards
- Water management
- Who are the experts? Northern Climate experts?
- Design installations
    - Flat roof vs. slope roof
- Can I use any type of membrane?
- Competitive advantage with tenants? Added liability?
- Detection leaks (risk management)
- Steps:
    - 1. Why?
        - Capital
        - Are we forced to?

        - Ethics
        - Quality of life (recreation)
        - Proof (Edmonton specific)
        - Sustainability practices (education)
    - 2. How?
    - 3. Costs, risks
    - 4. What type of ecoroof (garden, grass, etc.)?
- Comparison to other climate change initiatives
    - Finances (personal benefit)
    - The whole story (not just climate)
- Competition/difference with white roof
- Service life
- Access to roof (old buildings)
- Grandfather older roof

Scenario E: You are a member of a community league and hear the City may be developing an ecoroof strategy. What do you want to know? Note: underlined statements were ones the group rated as key questions.

- How much will this cost?
- What plants will they be using/
- How will they be protecting the environment?
- What stories will we be able to tell? How will it serve the community?
- How will they use it for public education?
- Who will design/build it?
- Will there be subsidies/incentives
- What is the value? WHY are they doing this
- How will the community be involved in the strategy?
- What are the locations being considered?
- Is this something individuals will be able to do?
- What is the timeline for this?
- What are the opportunities for partnerships?
- What are the hazards?
- How can the community help promote the strategy?
- How will this impact property value and business activities?
- Will these be publicly available sites? How does this impact costs?
- How are liabilities addressed?
- Importance of cost/benefit information, easily understood. Why we should do this?
- Importance of considering different types of green roof (shallow vs. deep). Need to manage expectations of what will grow.
- City needs to have information readily available
- How will the city respond to incidents/complaints?
- Will this become mandatory?
- "I don't know what I don't know" – what do I need to know?
- Will the costs be transferred to the community?

Appendix C: Drivers/Barriers Notes

Social Well-being: derived from social interactions, sense of place, and community connectedness in addition to access to and the preservation of resources, buildings, activities and events of significant cultural or heritage value.

Key Drivers/Opportunities	**Barriers/Challenges**
Enhanced or increased amenity space for socializing, recreation in dense neighbourhoods (6)	Lack of knowledge and education about ecoroofs. People don't know about the existing ecoroofs in Edmonton (11)
Alternate use of an otherwise useless space for urban agriculture i.e. large roofs could be community gardens or used to grow food for the food bank (5)	Demonstrating the 'why' (2)
Quality of life, better natural living environment – especially in higher density neighbourhoods (4)	Lack of support or direction, political will (2)
Reconnect (rewild) human beings and nature (2)	Quantifying social benefits (2)
Opportunity to create ecoroof policy to enhance social well-being (2)	Barriers to access ecoroofs (not all are publicly accessible (2)
We are ALL in this climate change challenge, so we ALL have/need to be part of the solution	Fear of unknown. Hesitance to participate. People want proof of success. Harder to start than continue.
Peer pressure and ethics	Climate change isn't true, it's a natural cycle of the earth
Your employer 'the city' is doing the right thing	
City beautification: potential to inspire a cleaner/greener city mindset	
Community connectivity	
Connection with climate change and opportunity for education	

Health and Safety: of individuals, families, workers, and vulnerable groups in Edmonton. This category includes physical and mental illness and disease, injuries, and fatalities.

Key Drivers/Opportunities	**Barriers/Challenges**
Will drive improved roof construction, waterproofing techniques	Safety when using ecoroof (3)
Build community resilience by transitioning to an eco-aware civilization	Fire safety, fire department concerns.
Climate change adaptation, resilience and long-term preparedness (3)	Structural, building codes (3)
Minimize/lower urban heat island (2)	Maintenance of current and new ecoroofs (2)
Manage increased stormwater	Access (2)

Key Drivers/Opportunities	Barriers/Challenges
Building temperature control	
Smaller carbon footprint	
Improved air quality (3)	
Better overall health	

Economy: including both goods and service-producing sectors of Edmonton's local economy.

Key Drivers/Opportunities	Barriers/Challenges
Roof as potential money maker (vegetable garden for profit). Increased revenue for rental spaces	Cost to install an ecoroof (18)
Opportunity to create a tenant amenity. i.e. green space for gatherings (2)	Cost of maintenance. (5)
Increased stormwater retention capacity and dollar savings for municipality/EPCOR (8)	Demonstrate best use of capital $ (cost/benefit) over other carbon reduction strategies (3)
Reduction of roofing materials due to increased roof life (replacement costs) (2)	Who pays? (2)
Cost savings for utilities, energy, etc. (4)	Recognize value in a way beyond economics (and not brush it off as naïve). Values
Benefits of reduced heat (winter) and cooling (summer), improved energy performance (5)	Developer limitation based on client's range of affordability
New market. Open economy to sustainable methods and education on ecoroofs (2)	Property value impacts (residential especially)
New careers and employment opportunities. Growth in jobs (2)	Skills and technology required by developers, architects, designers, operations (2)
Development of data to support this initiative	Policy and regulatory barriers (2)
Property value increased (residential especially)	Incentives vs regulation (2)
Opportunity for policy development and incentives (2)	"Way we've always done things" attitude, risk-averse developers (4)
Cooling value against "heat island effect"	Education needed (public) (7)
	Fear due to lack of knowledge
	Liability
	Structural issues or unknowns with existing buildings (3)
	Feasibility in our climate/proof of concept (3)
	It's just a fad, who looks after it. Why bother!

Natural Environment: including Edmonton's urban forest and parks, terrestrial and aquatic habitat and ecosystems.

Key Drivers/Opportunities	Barriers/Challenges
Maintain and regenerate biodiversity. Plants, insects, birds. (12)	Perception ecoroofs may not be suitable for local climate (2)
Bringing nature to the city. Connecting with nature. (2)	Learning best practices in terms of building/plants survival at different heights
Ecological sustainability (4)	There are other cost-effective ways to have

Key Drivers/Opportunities	Barriers/Challenges
	stormwater (LIDs) management
Environmental benefits positively impact health. Removal of particulate matter. Urban heat island. Cooling of air temperature.	Sustainability
Recreation and aesthetics value	Attracting biodiversity is considered good, but what about pests, invasive species? (2)
Stormwater retention, permeability (9)	
Improved river health	
Improved air quality (2)	
C02 reduction. (2)	
Reduce GHG emissions	
Climate adaptation	
Reduction and mitigation of urban heat island effect (7)	

Appendix D: Workshop Exit Survey Summary

1. On a scale of 1 - 5 where do you rate in regard to Edmonton pursuing the development of an ecoroof strategy? (1 = not supportive at all and 5 = extremely supportive)

   1 2 3 4 5

   In total there were 30 completed exit surveys.

   There were four ratings of 3. Here are the responses to "Please share why":

   - Cost is a large factor
   - Very very early in the market transformation; lack of awareness and competencies.
   - I think there would be pushback from the development industry and there are other more important initiatives the City can take toward Climate resilience.
   - It is important but the current market activity may be hard pressed to take on any additional capital costs.

   There was one rating of 3/4. Here is the response to "Please share why":

   - Will need to show action. This should not be political, but good common sense with loads of precedent elsewhere.

   There were six ratings of 4. Here are the responses to "Please share why":

   - I like this in concept. Need assurance of its success in order to fully support (more info re: costs/benefits/risks)
   - BOMA BEST is an environmentally based program to support sustainability in building operations.
   - Sustainability initiatives are very important to the cities livability
   - Overall Edmonton has support across private, public and government. Perhaps lacking only due to not enough information on goals.
   - There is challenge of showing the best return on investment for available $ capital funding ie carbon reduction with HVAC and building envelope are what clients/government focus on.

   There was one rating of 4 with a "+" written beside. Here is the response to "Please share why":

   - Green roofs are good I don't think it will happen without good policy and incentives

There were 18 ratings of 5.
Here are the responses to "Please share why":

- It is long due. I have been involved in the green roof industry since 2004 Although there has been advancement in application, it is not moving quick enough.
- Climate resilience; direction of future city development; lots of good benefits
- The environmental benefits are desperately needed. Added mental health and infrastructure ones are good too.
- I think this is a really important step forward in climate change resilience and overall sustainability.
- Policy is needed to support implementation through other city strategies and plans
- Green roofs will play a huge role in our urban environment
- As climate change becomes a reality understanding and designing for our ever changing climate is paramount
- It's important for everyone's future health, food, etc.
- The city has an opportunity to demonstrate value of natural environment, health, and social benefits over the uncertainties economically to start a movement that can later become profitable small-scale
- Sustainable; climate change adaptation; storm runoff reduction
- Important for quality of life
- From my (ecological) perspective it seems the benefits certainly outweigh the costs in the long term.
- So many good reasons, both economical and environmental. Not alot of possibilities are positive on both these fronts.
- Important emerging technology with manifold benefits
- Many benefits but get limited awareness
- Lead by example. Community resilience will be increasingly important

2. In your opinion, what is the **top benefit** for Edmonton if they pursue an Ecoroof strategy?

- Most northern city green roof program.
- Being a major leader in green roof growth for a northern city.
- Become a leader rather than a follower
- Green the City – support many of the City's environmental strategy
- Environmental benefits – heat island reduction, stormwater management, ecological diversity
- Environmental
- Better for the overall environment
- Storm water management, currently a high priority within Edmonton

- Stormwater infiltration/management
- Stormwater retention (City should actually look into implementing it on their buildings)
- Stormwater retention in the face of climate change increasing flood risk
- Precipitation management and urban heat island
- Reduction of urban heat island and reduction in storm water infrastructure cost.
- Storm water management
- Biodiversity and stormwater management
- I am a biodiversity person, but perhaps savings on infrastructure
- Beautification, prestige → progressive, stormwater management
- Give Edmonton a more beautiful skyline.
- Climate change mitigation
- Increased technical capacity, community vibrancy
- Resilience! Water; air; temperature; monetary; the list goes on…
- Increased sustainability and climate change resilience.
- Promote jobs; climate resilience
- Overall, quality of life - air quality, aesthetic, local food, etc
- Biophilia, health well-being, pride, stormwater management.
- Livability and desirability of making Edmonton a healthy place to live
- Reconnecting people with nature. Plants, insects etc.
- Cooling effect
- Cost savings
- Cost savings

3. In your opinion, what is the **top challenge** for Edmonton if they pursue an Ecoroof strategy?

- Climate/maintenance
- Lots of competing priorities
- Cost
- Cost
- Proof of economic benefits, low risk, etc.
- Cost
- Cost
- Initial cost to building owners/developers
- Initial cost/education (choose either)
- Information and cost
- Budget available for ecoroof implementation initially (because this will require grassroots' support)
- Upfront cost (need to use "incentives")
- Return on investment for private building owners

- An obsession with recognizing only economic value. Who pays? Who pays if we don't?
- Resistance by developers to perceived cost and hassle
- The increased up-front costs, causing resistance among builders and building owners.
- Community and developer buy in
- Developers willing to risk
- Individual buy in
- Liability/buy-in
- Public buy-in – Need for education
- Encourage and incentivising private industry/developers
- Socializing/educating about the benefits
- Incentives – what will they be and are tax payers on board
- Not enough transparency for goals and public benefits
- Making sure the policy/program is sound and effective and people, developers, etc. are aware and supportive of it
- Education and promotion
- Increasing awareness
- Education and policy
- Providing clear policy and instruction for implementation and maintenance.

4. Please provide your thoughts on additional information or data required should the City of Edmonton decide to pursue an ecoroof strategy.

- Provide historical data for similar climate
- Data on "savings"
    - Re water drainage off roofs,
    - Cost savings – energy
    - Public perception
- Education
- Data/information on current examples
- Case studies on existing green roofs in Edmonton
- Provide case studies (Terwillegar)
- Data on the best species to plant; specific data on the costs/benefits of energy consumption.
- Make sure to set up a data collection strategy while implementing new roofs (and of current ones). What plants work, best materials, longevity, snow weight… specific to Edmonton.
- Info specific to the Edmonton context → rationale, data, benefits, costs, etc.
- Regionally appropriate data re. outcomes, benefits, costs; best practices from other municipalities – policies, outcomes
- Data on membrane timeline; plant species; maintenance cost; savings etc.

- Case studies reflective of our climate zone/region/context with hard data that is easily defendable.
- Need more local proof/evidence/data
- Data supporting benefits
- Long-term data being available. Success stories
- Cost benefits – building benefits – urban health
- Costing; types of buildings, quality, types of plants
- Detailed cost-benefit analyses, tailored to Edmonton conditions.
- Clearly articulate the cost/benefit analysis where the cost includes “full cost” of not taking action.
- Comparative cost benefit between ecoroof vs rooftop vs triple bottom line. Other LID approaches.
- Step by step guides, interactive website components – a design and implementation competition
- Property value impacts
- How to attract private capital into this implementation eventually. Because the city has limited budget to spend on ecoroof, homeowners, developers, or private investment firms need to participate to keep it alive.
- City should engage with stakeholders of a new build project at initial design stage to ensure proper delivery of a green roof.
- How are all the current roofs doing?
- Provide a broad menu of options for many various users.