Council Meeting Agenda

Monday, November 10, 2025, 7:00 p.m.
Council Chambers - Hybrid
City of Kitchener
200 King Street W, Kitchener, ON N2G 4G7

People interested in participating in this meeting can register online using the delegation registration form at www.kitchener.ca/delegation or via email at delegation@kitchener.ca. Please refer to the delegation section on the agenda below for registration in-person and electronic participation deadlines. Written comments received will be circulated prior to the meeting and will form part of the public record.

The meeting live-stream and archived videos are available at www.kitchener.ca/watchnow

Accessible formats and communication supports are available upon request. If you require assistance to take part in a city meeting or event, please call 519-741-2345 or TTY 1-866-969-9994.

Pages

1. COMMENCEMENT

The meeting will begin with a Land Acknowledgement given by the Mayor and the singing of “O Canada.”

2. MINUTES FOR APPROVAL

Minutes to be accepted as circulated to the Mayor and Councillors (regular meeting held October 20, 2025, and special meetings held October 27, 2025) - Councillor B. Ioannidis.

3. DISCLOSURE OF PECUNIARY INTEREST AND THE GENERAL NATURE THEREOF

Members of Council and members of the City’s local boards/committees are required to file a written statement when they have a conflict of interest. If a conflict is declared, please visit www.kitchener.ca/conflict to submit your written form.

4. COMMUNICATIONS REFERRED TO FILE

4.1 Flag / Illumination Request under Policy MUN-FAC-442

4.1.a Illumination - World Prematurity Day - November 17, 2025

4.1.b Illumination - International Day for the Elimination of Violence Against Women - November 25, 2025

4.1.c Flag - Albanian National Independence Day - November 28 - November 30, 2025

4.1.d Flag - National Day of Romania - December 1, 2025

4.1.e Flag - Greek Independence Day - March 20 - 28, 2026

5. PRESENTATIONS

5.1 Award Presentations - Transportation Services

5.1.a Parking Staff Member of the Year, Canadian Parking Association - Karl Gallagher

5.1.b Active Transportation Achievement Award, Transportation Association of Canada - Downtown Cycling Grid

6. DELEGATIONS

Pursuant to Council's Procedural By-law, delegations are permitted to address the Committee for a maximum of five (5) minutes. All Delegations where possible are encouraged to register prior to the start of the meeting. For Delegates who are attending in-person, registration is permitted up to the start of the meeting. Delegates who are interested in attending virtually must register by 5:00 p.m. on November 10, 2025, in order to participate electronically.

6.1 Draft Plan of Subdivision Application, 30T-23201, 1700 Strasburg Road & McBrine Drive, 2140221 Ontario Inc., DSD-2025-400, listed as item 7.2.e

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6.1.a Brandon Flewwelling and Nicole Charlton, GSP Group

6.1.b Karly Rath

6.1.c Chantal Stieler

6.1.d Mo Markham

6.1.e Dr. Shane Mulligan

6.1.f Charlotte Goguen

6.1.g Ray Angold

6.1.h Greg Michalenko

6.1.i Leon Boreal

6.1.j Yvonne Fernandes

6.1.k Dianne Rath

7. REPORTS OF COMMITTEES

7.1 HERITAGE KITCHENER - NOVEMBER 4, 2025

7.1.a Heritage Permit Application HPA-2025-V-020 - Victoria Park Picnic Shelter, DSD-2025-436

That pursuant to Section 42 of the *Ontario Heritage Act*, Heritage Permit Application HPA-2025-V-020 to permit the demolition of the picnic shelter at the property municipally addressed as 92 David Street/135 Water Street South (35 Dill Street) be approved in accordance with the supplementary information submitted with this application and subject to the following conditions, as outlined in Development Services Department report, DSD-2025-436:

1.That final building permit drawings be reviewed and heritage clearance provided by Heritage Planning staff prior to the issuance of a demolition permit.

7.2 PLANNING AND STRATEGIC INITIATIVES COMMITTEE - OCTOBER 27, 2025

7.2.a Demolition Control Applications, DC25/025/R/AS and DC25/026/R/AS, 15 and 16 Reinhardt Street, DSD-2025-402

That Demolition Control Application DC25/025/R/AS requesting permission to remove an existing Single Detached Dwelling at 15 Reinhardt Street and Demolition Control Application DC25/026/R/AS requesting permission to remove an existing Duplex Dwelling at 16 Reinhardt Street, BE APPROVED, as outlined in Development Services Department report, DSD-2025-402."

7.2.b Demolition Control Application, DC25/024/W/AA - 42 and 32 Windom Road, DSD-2025-439

That Demolition Control Application DC25/024/W/AA requesting permission to remove an existing single detached dwelling located at 32 Windom Road and a single detached dwelling with an additional dwelling unit (attached) located at 42 Windom Road, BE APPROVED, as outlined in Development Services Department report, DSD-2025-439.

7.2.c Community Engagement Review, COR-2025-435

That staff be directed to update the Community Engagement Policy (GOV-COU-2010), as outlined in Corporate Services Department report, COR-2025-435, to be brought forward through a future Corporate Policy review update report.

7.2.d Zoning By-law Amendment Application, ZBA25/016/W/BB, 137 Woodhaven Road, 2394608 Ontario Inc., DSD-2025-370

That the following recommendation be referred to the November 10, 2025, Council Meeting to allow the Ward Councillor, consultant and staff the opportunity to further discuss concerns related to the potential displacement of existing residents and explore support options for affected residents:

> That Zoning By-law Amendment Application ZBA25/016/W/BB, for the property municipally addressed as 137 Woodhaven Road, requesting to amend Zoning By-law 2019-051 for 2394608 Ontario Inc. be approved in the form shown in the 'Proposed By-law' and 'Map No. 1', attached to Report DSD-2025-370 as Attachments 'A1' and 'A2', BE APPROVED, as outlined in Development Services Department report, DSD-2025-370.

7.2.e Draft Plan of Subdivision Application, 30T-23201, 1700 Strasburg Road & McBrine Drive, 2140221 Ontario Inc., DSD-2025-400

That the City of Kitchener, pursuant to Section 51 (31) of the Planning Act R.S.O. 1990, Chapter P 13 as amended, grant draft approval to Plan of Subdivision Application 30T-23201 in the City of Kitchener, for the property municipally addressed as 1700 Strasburg Road and McBrine Drive, for 2140221 Ontario Inc., subject to the draft plan and draft plan conditions attached to Development Services Department report, DSD-2025-400 as Attachment 'A'; and,

That the Mayor and Clerk be authorized to approve and execute an industrial Subdivision Agreement securing the Draft Plan of Subdivision conditions set out in Report DSD-2025-400, to the satisfaction of the City Solicitor, and that the City Solicitor be directed to register said agreement on title to the Subject Lands identified in Attachment 'A' to report DSD-2025-400; and further,

That the Updated Urban Design Brief Strasburg Technology Business Park, prepared by GSP Group, dated May 2025, amended September 2025, attached as Attachment 'B' to report DSD-2025-400, be endorsed, and that staff be directed to implement this Brief through subdivision conditions and through future Site Plan Applications for individual lots at the discretion of the City's Director of Development and Housing Approvals with significant changes to this Brief to the satisfaction of Council.

7.2.f Enabling 4 Units - 1 Year Check in, DSD-2025-411

That Council endorse the next steps for the Enabling 4 Units - 1 Year Check in, as outlined in Development Services Department report, DSD-2025-411.

8. UNFINISHED BUSINESS

8.1 2026 Council and Committee Calendar, COR-2025-393

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That the following motion be **deferred to the November 10, 2025 Council meeting**:

"That the 2026 Council and Committee Calendar, as attached as Appendix 'A' to Corporate Services Department report COR-2024-459, be approved; and,

That the Mayor in consultation with the Chief Administrative Officer and the Clerk will be delegated the authority to schedule additional Planning and Strategic Initiatives Committee (PSIC) meetings on Council meeting dates, where required, to address legislated Planning Act timelines; and further,

That Council be permitted by resolution to reschedule meetings identified on the 2026 calendar where necessary."

9. NEW BUSINESS

9.1 - MAYORAL BUSINESS AND UPDATES - MAYOR B. VRBANOVIC

9.2 Notice of Motion - B. Ioannidis - Overuse of Salt - Winter Maintenance

Councillor B. Ioannidis has given notice to introduce the following motion for consideration this date:

"WHEREAS road salt is a known toxic substance designated under the Canadian Environmental Protection Act because of tangible threats of serious or irreversible environmental and health damage from road salt; and,

WHEREAS the Region of Waterloo, in collaboration with local municipalities, is actively attempting to mitigate salt pollution using existing policies, programs and site design measures that would be significantly more effective with supporting Provincial legislation; and,

WHEREAS salt levels in Ontario's groundwater aquifers, creeks, rivers, and lakes have increasingly worsened since the 1970s, seriously affecting municipal drinking water sources and aquatic life; and,

WHEREAS numerous situation analyses have recommended salt solutions involving liability protection, contractor certification, government approved Best Management Practices (BMPs) and salt management plans; and,

WHEREAS increased numbers of slips and falls claims, and other injury/collision claims related to snow and ice, are resulting in salt applicators overusing salt beyond levels considered best practices; and,

WHEREAS unlimited contractor liability is making it difficult or expensive for snow and ice management contractors to obtain insurance coverage, resulting in contractors leaving the business, thereby making it difficult for municipalities and private owners to find contractors; and,

WHEREAS the Snow and Ice Management Sector (SMS) of Landscape Ontario is working with the Ontario government to institute a limited liability regime for snow and ice management, including enforceable contractor training/certification and government-approved BMPs for salt application; and,

WHEREAS many Ontario municipalities have Salt Management Plans, but these often require updating considering improved science and better salt management practices now available; and,

WHEREAS the City of Kitchener continues to promote the Region of Waterloo Smart About Salt training wherever the opportunity presents itself; and,

WHEREAS the City of Kitchener provides winter maintenance services in accordance with Ontario Regulation 239 (O. Reg. 239) of the Municipal Act (Minimum Maintenance Standards for Municipal Highways);

THEREFORE BE IT RESOLVED THAT City Council urge the Province of Ontario, and the Attorney General of Ontario, to adopt limited occupier liability legislation that protects property owners, and managers and their contractors, including municipalities, from slip and fall lawsuits, provided that they have taken all reasonable steps to follow Provincial best-management practices for salt use in controlling snow and ice;

THEREFORE BE IT FINALLY RESOLVED THAT the City of Kitchener urge the Province of Ontario, and the Attorney General of Ontario, to work urgently with key stakeholders including the Association of Municipalities of Ontario to develop legislation,

including enforceable contractor training and a single set of Provincially-endorsed standard best management practices for snow and ice management."

10. QUESTIONS AND ANSWERS

11. STAFF REPORTS

11.1 ADMINISTRATIVE REPORTS

11.1.a Gas Infrastructure Research Project, INS-2025-433 39

12. BY-LAWS

12.1 THREE READINGS

12.1.a Being a by-law to close part of the public highway known as Nyberg Street, in the City of Kitchener.

(By-law 2025-126)

12.1.b Being a by-law to amend Chapter 110 of The City of Kitchener Municipal Code regarding By-law Enforcement.

(By-law 2025-127)

12.1.c To further amend By-law No. 2010-190, being a by-law to prohibit unauthorized parking of motor vehicles on private property.

(By-law 2025-128)

12.1.d To further amend By-law No. 88-171, being a by-law to designate private roadways as fire routes and to prohibit parking thereon.

(By-law 2025-129)

12.1.e To further amend By-law No. 2008-117, being a by-law to authorize certain on-street and off-street parking of vehicles for use by persons with a disability, and the issuing of permits in respect thereof.

(By-law 2025-130)

12.1.f To confirm all actions and proceedings of the Council for November 10, 2025.

(By-law 2025-132)

12.2 LATE STARTER BY-LAWS TO BE ADDED TO THE AGENDA, PENDING APPROVAL OF THE REPORTS OF THE COMMITTEES

12.2.a Being a By-law to amend By-law 2019-051, as amended, known as the Zoning By-law for the City of Kitchener – 137 Woodhaven Road - 2394608 Ontario Inc.

(By-law 2025-131)

13. ADJOURNMENT

New UW research shows the importance of small wetlands

New research out of the University of Waterloo illuminates the importance of small, stand-alone wetlands. These are wetlands that are geographically isolated, meaning that they may sometimes be connected to a downstream waterbody, and oftentimes are not. “The main point that we were trying to make i

By **Leah Gerber**

Last updated on May 03, 23

Posted on Feb 16, 23

3 min read

UW's Nandita Basu and her son Rayan at the Laurelwood storm water management area, a small wetland used for stormwater by the City of Waterloo. Basu says small wetlands in urban areas make a difference for filtering and cleaning pollutants. [Leah Gerber]

New research out of the University of Waterloo illuminates the importance of small, stand-alone wetlands.

These are wetlands that are geographically isolated, meaning that they may sometimes be connected to a downstream waterbody, and oftentimes are not.

"The main point that we were trying to make is that a lot of times when you have these smaller upland wetlands that are not near a coastal area, we don't always think that they are connected to downstream waters, and we sometimes think that they are not really that important, because they are a small puddle of water someplace and maybe they don't even have water all throughout the year, they have water part of the year," said Nandita Basu, a tier-one Canada Research Chair in Global Water Sustainability and Ecohydrology and a professor of water sustainability and ecohydrology at the University of Waterloo.

"I'm not saying that they're never connected, I'm saying their connections are less apparent than the more riverine wetlands or coastal wetlands. And

because their connections are less apparent, a lot of times when you're trying to pave over land, they don't have as much protection."

Basu and her team found these isolated wetlands actually outperform connected wetlands when it comes to filtering and cleaning pollutants.

When nutrients like nitrogen and phosphorus make their way through the watershed to wetlands, one of the main ways they clean these pollutants is through micro-bacteria that live in them. The micro-bacteria can break nitrogen down quickly, but need the time to be in contact with the nutrient, says Frederick Cheng, a postdoctoral researcher now at Colorado State University who worked with Basu on the research.

He said whereas more connected wetlands tend to flush nutrient-laden water to continue to move it through the watershed, these less connected wetlands hold the water and give the bacteria time to digest it.

"In isolated wetlands, most of the water leaves through evaporation, so the water leaves and the nitrogen stays in the wetland, so that increases the time that the microbes can then transform the nitrogen," he said.

Cheng notes the process is actually pretty fast. “It’s just a matter of letting the nitrogen come into contact with the micro-bacteria which tend to live in the soil portion of the wetlands, so it can happen in a matter of hours or days. As long as there’s that contact.”

They studied 30 years of satellite imagery measuring water levels in 3,700 wetlands across the United States, and compared this with pre-established measurements of how much pollution wetlands at these water levels can filter to establish a model comparing connected and isolated wetlands.

Basu said that when a small wetland is connected continuously to a downstream water body, it removes about 40 per cent of the nitrogen that comes in. But when the same wetland is disconnected, it removes about 84 per cent.

The wetlands in question don’t need to be large. In fact, many of the wetlands studied for this research were less than 0.5 hectares, and some smaller than 0.1.

Excess nutrients like nitrogen and phosphorous cause algal blooms in the Great Lakes by providing more food for algae. These blooms can be potentially toxic and cause the closure of beaches. In 2014, the water

supply for Toledo, Ohio on the coast of Lake Erie was shut off due to toxic algal bloom.

Recently, protection for wetlands in Ontario has been reduced, which Basu sees as disconnected from the research showing their importance.

“I’ve been thinking about it quite a lot. And this is true in southern Ontario, where we’ve already lost over 70 per cent of our wetlands and now we are at risk of losing more. And we argue that we need to do this because we need to build more houses. But the challenge of that is, if you add more people to our landscape, you create more pollution. And so you will need these wetlands even more. We will be taking them away at a time when we need them even more. And that’s the dissonance that is really striking.”

WATERLOO REGION, Feb 3 2023 — Using high-resolution satellite images and computer modelling, researchers from the University of Waterloo have documented the importance small wetlands play in water purification and conservation.

“What our work showed is that they are actually really important,” said Nandita Basu, a professor at the University of Waterloo and Canada Research Chair in Global Water Sustainability and Ecohydrology.

The research results, published in the peer-reviewed journal Environmental Research Letters, show how small wetlands trap large amounts of nitrogen, phosphorus, and other contaminants, protecting nearby rivers and lakes from the pollutants.

The research findings contradict new provincial legislation that will make it easier for cities and developers to drain and build on small wetlands in Ontario. The new provincial legislation says only large, provincially significant wetlands will be protected.

“At the end of the day we need to protect and restore a whole range of small and large wetlands,” said Basu.

Basu supervised the research. The lead researcher was Frederick Cheng, who is now a post-doctoral fellow at Colorado State University. They reviewed 30-years of satellite data for 3,700 wetlands across the U.S.

Now, the same methodology will be applied to Canadian wetlands using a $6.8 million grant from Environment and Climate Change Canada.

“We are going to do this work for every wetland in southern Ontario and the prairies,” said Basu in an interview Thursday.

Reports of beach closures, algae blooms and degraded drinking water are on the rise as the population expands in southern Ontario, she said.

“As we increase our population we are going to have more pollution, and as we take away these wetlands, which are filters on the landscape, it is going to increase our algae blooms and beach closures,” said Basu.

The small wetlands trap the pollutants, which remain there as the water level drops with evaporation.

Larger wetlands, which are often connected to rivers and lakes, are not as effective as filters because much of the pollution gets washed downstream.

“This is the reason these smaller wetlands turn out to be more efficient in terms of retaining the pollutants because it gets trapped there and it doesn’t go away,” said Basu.

The frequency of severe storms associated with climate change also increases the importance of the wetland filtration. The demand for

more housing increases with a growing population, and the small wetlands are currently left unprotected.

“As we are increasing those pressures there is more pollution that is going to come into play, so now is the time to protect these wetlands, even more than before,” said Basu.

The Ontario government of Premier Doug Ford touched off months of protests with legislation that opens part of the Greenbelt for development, and other legislation that removed protection for small wetlands.

The government says the new legislation is needed to speed up the development of new housing.

The destruction of wetlands also increases our vulnerability to the extreme effects of climate change, including flooding, drought and the frequency of storms, say UW researchers. All wetlands act like sponges, providing flood protection by absorbing the vast volume of water that can be suddenly released from rainfall or snowmelt.

Improving water quality, providing habitat, increase biodiversity and trapping carbon are just some of the many other environmental benefits of protecting wetlands.

From: Greg Michalenko
Sent: Thursday, November 6, 2025 11:42 AM
To: Mariah Blake <Mariah.Blake@kitchener.ca>
Subject: Fw: "Study examined species declines in southern Ontario" article report

Dear Mariah Blake,

I sent in an application yesterday to address the Council meeting on Monday Nov. 10 regarding the proposed industrial land development adjacent to the Huron Natural Area (HNA).

Thank you for your response clarifying that I could not be included because I had already delegated on the same topic at the planning committee meeting held earlier.

A major study on the topic of financing biodiversity conservation, that has direct bearing on the HNA issue, has just been published and released on November 2 (see the appended email from Justine Mossman of the Canadian office of the World Wildife Fund that provides a link to the study).

This very new information is highly relevant to the HNA situation in Kitchener . Tfhe Government of Canada has signed on to the Kunming-Montreal Global Biodiversity Framework which newly obligates that official action is taken kto protect biodiversity. In addition, coincidentally, the study area selected (called the lake Lake Simcoe Rideau Ecoregion) includes and specifically mentions Kitchener and surrounding area.

I would like to address Council strictly regarding the study's implications - which are legal, environmental and financial - for the City of Kitchener's overall natural area conservation strategies. Here are some explanatory citations from the introduction of the article:

"1. Stemming biodiversity loss requires greater investment in conservation and more efficient use of available resources. Prioritizing conservation actions that yield the most bioidiversity benefits for the least cost can maximize return on iinvestment. We...identified actions to secure the greatest number of species groups of conservation concern for the lleast cost...in one of Canada's biodiversity crisis ecoregions.

"Implementing all proposed strategies would yield the greatest biodiversity benefits. The habitat protection and rrestoration strategies also deliver direct carbon benfits. It is also equally important to make the most of currently available resources by maximizing the return on investmwenr by prioritizing actions that yield the greatest conservation benefit for a given investment level, or that achieve a predetermined conservation goal for the least cost."

I propose that a decision on the proposed land development adjacent to the HNA be delayed until Planning has examined and reported on the implications to Kitchener of the new Federal agreement on biodiversity and the relevance of the results of this study.

Thank you for your consideration. Please pass on to Planning the link to this new study,

Greg Michalenko

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Ecological Solutions and Evidence

RESEARCH ARTICLE

Nature requires investment: Applying priority threat management to support biodiversity and climate targets

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Funding information
Natural Sciences and Engineering Research Council of Canada, Grant/Award Number: RGPIN-2019-04535; Reid and Laura Carter; Liber Ero Chair in Conservation; Patrick and Barbara Keenan Foundation

Handling Editor: Jiajia Liu

Abstract

1. Stemming biodiversity loss requires greater investment in conservation and more efficient use of available resources. Prioritizing conservation actions that yield the most biodiversity benefit for the least cost can help maximize return on investment. Actions that have co-benefits for other objectives, such as climate change mitigation, can also help mobilize additional funds for conservation.
2. We used Priority Threat Management to identify actions to secure the greatest number of species groups of conservation concern for the least cost in the Lake Simcoe-Rideau ecoregion, Ontario—one of Canada's biodiversity crisis ecoregions. We also estimated the carbon sequestration benefits of actions related to land protection and restoration.
3. We found that without additional investment in conservation, 13 of 16 species groups were expected to have <50% probability of persistence in this ecoregion by 2050. Implementing all proposed strategies would yield the greatest biodiversity benefits and secure 12 of the 16 species groups with ≥60% probability of persistence, at a cost of CA$113 million per year over 27 years. In comparison, investing CA$97 million per year in landowner stewardship, habitat protection and restoration and regeneration strategies could secure 10 species groups and improve the probability of persistence of one additional group from 39% to 55%.
4. The habitat protection and restoration strategies also deliver direct carbon benefits of around 11.2 Mt in total avoided CO_2 emissions and 137.6 Mt CO_2 in total

potential sequestration, respectively, over the long-term, thus supporting alignment with climate change mitigation targets and delivering co-benefits that may further justify investment.

5. *Practical implication.* By estimating the costs and demonstrating the expected benefits and potential carbon co-benefits of conservation actions, Priority Threat Management can help maximize return on investment and identify actions that address multiple environmental crises.

KEYWORDS
biodiversity conservation, carbon co-benefits, complementarity, conservation prioritization, cost-effectiveness, nature-based climate solutions, return on investment, species at risk

1 | INTRODUCTION

Inadequate funding for conservation action has been linked to species imperilment and repeated failures to meet global biodiversity targets under the Convention on Biological Diversity (CBD) (McKinney, 2002; Waldron et al., 2013). Left unchecked, the continued loss of biodiversity can amplify the interacting effects of climate change and other anthropogenic threats, leading to abrupt and irreversible ecosystem changes (Turner et al., 2020). It is, therefore, critical that we intensify our efforts to halt and reverse biodiversity loss. To this end, the Kunming-Montreal Global Biodiversity Framework (GBF) outlines a set of ambitious goals and corresponding biodiversity conservation targets. The GBF also includes targets to mobilize financial resources through various mechanisms, including enhancing the effectiveness and efficiency of use of those resources and optimizing co-benefits to address the biodiversity and climate crises simultaneously (Convention on Biological Diversity, 2022).

As a signatory to the CBD, Canada is responsible for implementing the GBF within its borders by developing a national biodiversity strategy and action plan and securing sufficient funds for implementation. Since 2018, the federal government has mobilized roughly CA$10 billion in investments to support biodiversity and climate goals (Environment and Climate Change Canada, 2024). However, additional financial resources will still need to be secured to close Canada's biodiversity finance gap, estimated at around US$15–20 billion per year (Rally Assets & Nature Conservancy of Canada, 2020) or about $20–27 billion per year in 2019 Canadian dollars. It is also equally important to make the most of currently available resources by maximizing the return on investment—that is, by prioritizing actions that yield the greatest conservation benefit for a given investment level or that achieve a predetermined conservation goal for the least cost (Boyd et al., 2015; Murdoch et al., 2007).

Conservation return on investment can be improved by taking action at the regional scale (Kennedy et al., 2016), thus benefiting multiple species or ecosystems simultaneously, and by prioritizing actions that maximize biodiversity benefits across a given region for the least cost (Pressey & Bottrill, 2009). In particular, accounting for the complementarity of actions can help minimize costs by reducing duplication of effort and help ensure that benefits of actions are spread across the suite of target biodiversity features in the region of interest (Chadès et al., 2015; Moilanen, 2008). Considering the potential co-benefits of conservation actions, such as those related to climate change mitigation (Shin et al., 2022) or human well-being (Blicharska et al., 2019), can further maximize the overall benefits to society and the environment.

A variety of decision science tools and frameworks are available to help identify conservation actions that maximize the return on investment (Hemming et al., 2022). One example is Priority Threat Management (PTM), a decision analysis framework developed to identify cost-effective and complementary sets of actions to manage and recover multiple species or other biodiversity features simultaneously across broad regions (Carwardine et al., 2012, 2019). It is a participatory process that brings together diverse groups of experts in the ecology and management of species of conservation concern. PTM also allows for the integration of multiple types of data, including empirically derived data and expert knowledge obtained through a structured elicitation protocol (Martin et al., 2012). The application of PTM in Canada (e.g. Camaclang et al., 2021; Kehoe et al., 2021; Martin et al., 2018) and elsewhere (e.g. Carwardine et al., 2012; Chadès et al., 2015; Firn et al., 2015; Lee et al., 2022; Utami et al., 2020) demonstrates its broad applicability and is leading to positive outcomes for biodiversity through increased investment in priority actions and documented improvements in species recovery (Legge et al., 2011, 2023; Semeniuk, 2018).

Here, we applied PTM to the Lake Simcoe-Rideau ecoregion in Ontario, Canada to identify management strategies that would secure the greatest number of species groups of conservation concern in the region for the least cost. We also estimated the potential co-benefits of proposed strategies for climate change mitigation. The aim was to inform the development of a conservation prospectus that could be used to coordinate actions and establish collaborations among different conservation actors in the region, and aid in securing sufficient investment in conservation action.

The Lake Simcoe-Rideau ecoregion (Figure 1) is highly productive and biodiverse and encompasses most of Ontario's unique

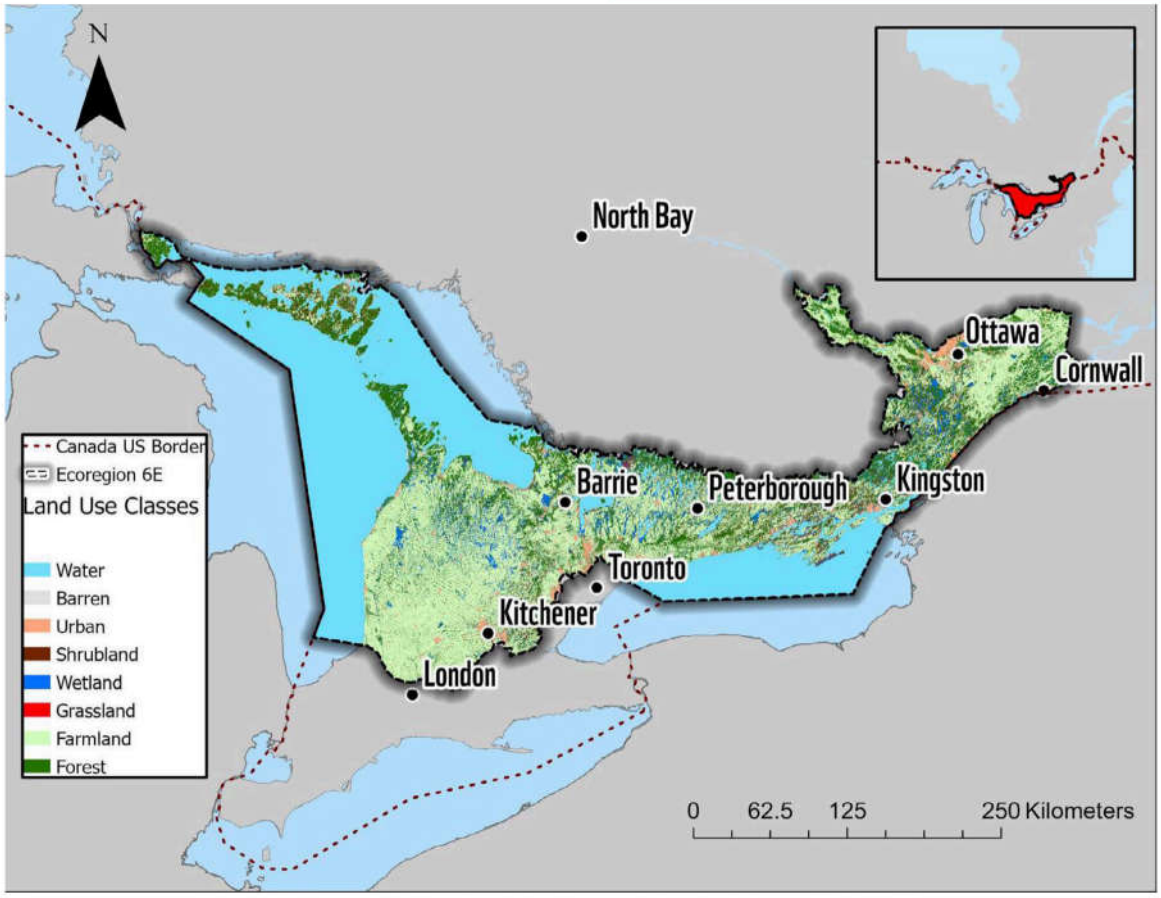

FIGURE 1 The Lake Simcoe-Rideau ecoregion (Ontario Provincial Ecoregion 6E) of southern Ontario, Canada. Data layers: Ecoregion 6E—Ontario GeoHub, Ontario Ministry of Natural Resources and Forestry. *EcoRegion* [Data set]. 2023. Land Information Ontario; https://geohub.lio.gov.on.ca/datasets/lio::Ecoregion/about. Land Use Classes—Agriculture and Agri-Food Canada. *Annual Space-Based Crop Inventory for Canada, 2020* [Data set]. 2020. Agroclimate, Geomatics and Earth Observation Division, Science and Technology Branch; https://open.canada.ca/data/en/dataset/32546f7b-55c2-481e-b300-83fc16054b95.

alvar habitats and nearly 30 natural heritage areas with significant biological or ecological importance (Crins et al., 2009; see also Supporting Information: Appendix B). This ecoregion is the second most densely populated in Ontario and also one of Canada's conservation crisis ecoregions (Kraus & Hebb, 2020) due to high development pressure and risk of habitat conversion. Climate change is also expected to greatly impact the region by mid to late century (2050–2080) (Climate Risk Institute, 2023). A 2021 report by the Auditor General of Ontario concluded that the provincial government is failing to protect species at risk, suggesting that populations will continue to decline (Office of the Auditor General of Ontario, 2021). In recent years, the Ontario government also decreased funding for species at risk and dismantled many biodiversity-focused legislative frameworks and programs, resulting in a reduced ability to act at a pace and scale required for species recovery (Bethlenfalvy & Olive, 2021; Mitchell et al., 2021). Given the scale and urgency of conservation issues in Ontario, there is a need to act strategically and collaboratively to ensure that available resources are invested in actions with the greatest benefits for biodiversity and the recovery of species of conservation concern in the region.

2 | MATERIALS AND METHODS

2.1 | Expert elicitation

To identify managements strategies that would help secure the persistence of the greatest number of species of conservation concern for the least cost in the Lake Simcoe-Rideau ecoregion, a total of 145 prospective experts—individuals with knowledge of or practical experience with the ecology and management of the species of conservation concern in the ecoregion—were invited to participate in the PTM process. Of those invited, 28 experts agreed to participate. Experts were from government agencies, conservation authorities, First Nations, conservation non-profit organizations, industry and research institutions.

Experts participated in a series of five online workshops and a two-day in-person workshop held between May 2022 and January 2023. With the help of several workshop facilitators, experts discussed and refined the spatial extent (Figure 1), agreed on a 27-year time horizon (i.e. to 2050) as the temporal scope of the study, identified 133 species of conservation concern in the region (Supporting Information: Table A1), assessed key threats to those species and

developed a list of actions to implement over the time horizon that would address threats and improve the probability of persistence of those species. Experts were instructed to include only actions that were not already expected to occur and continue over the time horizon. Experts identified a total of 48 actions (Supporting Information: Table A2), which were organized into eight broad management strategies, with the criteria that each strategy could be implemented independently of any other strategy. Experts also identified six combinations of two or more individual strategies that may have synergistic effects when implemented together (S9–S14); along with a final combination that included all individual strategies (S15), this resulted in a total of seven combined strategies (Table 1).

Experts were then asked to provide estimates of the annual costs, in 2022 Canadian dollars, of planning and implementing the proposed actions (Table 1; Supporting Information: Table A2; Appendix B). Costs were converted to present values using the recommended social discount rate of 3% (Treasury Board of Canada Secretariat, 2022). For each action, experts were also asked to provide estimates of the probability that it will be implemented assuming that sufficient funds will be available (i.e. probability of uptake or the social and political feasibility), and the probability that it will be successful if implemented (i.e. technical feasibility). These two estimates were multiplied to obtain a value for the feasibility of the action. We calculated the overall feasibility of a strategy as the average feasibility across all the actions within that strategy, and the overall feasibility of a combined strategy as the average feasibility of all the individual strategies that make up that combination.

To simplify the elicitation of benefits, species were grouped into 16 species groups based on similarities in responses to threats and management actions (Supporting Information: Table A1). A modified Delphi structured elicitation protocol (Carwardine et al., 2012; Hemming et al., 2018) was used to obtain expert estimates of the probability of functional persistence in the region in 2050 for each species group. We defined functional persistence as having viable, self-sustaining populations that continue to perform their ecological function (Camaclang et al., 2021; Chadès et al., 2015; Firn et al., 2015), where a probability of 0 equates to a zero chance of persistence and 1 equates to a 100% chance of persistence. For each value, the most likely estimate (i.e. best guess), as well as the estimate under the most pessimistic scenario (i.e. lowest plausible estimate) and the most optimistic scenario (i.e. highest plausible estimate) were elicited.

For each species group, experts were first asked to provide their individual estimates of the probability of persistence under the baseline or counterfactual scenario—that is, the future without any of the strategies considered in the analysis. Ongoing biodiversity protections and conservation actions were considered 'business-as-usual' and form part of the baseline scenario, along with potential threats and pressures within and beyond the study region over the given time horizon that could impact the species of conservation concern within the region, such as development pressures and impacts of climate change. To inform the development of the baseline scenario, experts were asked to identify and discuss current and anticipated conservation initiatives as well as ongoing and future threats to biodiversity in the region (Supporting Information: Appendix B).

With reference to future conditions under the baseline scenario, experts were then asked to provide their individual estimates of the probability of persistence with each individual strategy and combination strategy, assuming that all the actions within a given strategy are implemented successfully. The benefit of a strategy was estimated as the difference between the probability of persistence with the strategy and the probability under the baseline scenario. We aggregated the individual expert estimates using the arithmetic mean and used the mean value for subsequent analyses. See Supporting Information: Appendix B for more details about expert elicitation process.

Of the 28 experts, 24 attended two or more workshop sessions. Nine experts attended the in-person workshop to provide estimates of the cost and feasibility of actions, while 16 experts provided individual estimates of the conservation benefits of the proposed management strategies.

2.2 | Cost-effectiveness and complementarity analysis

We used estimates under the most likely scenario to evaluate the cost-effectiveness and the complementarity of management strategies. We calculated the expected benefit of each management strategy as the summed benefit of the strategy across species groups weighted by the estimated feasibility of the strategy. We then derived a cost-effectiveness (CE) score by dividing the expected benefit by the total cost of the strategy.

To assess the complementarity in the benefits of management strategies, we assumed that species groups that achieve a probability of persistence equal to or greater than a particular threshold value to be 'secure'. We set this threshold value to 60%, based on the range of estimates for the expected probability of persistence under the proposed management strategies and the preference of experts for higher probabilities of persistence. We identified the optimal sets of complementary management strategies that could maximize the number of species groups secured while minimizing the cost by solving the integer linear programming problem for a range of budgets (Chadès et al., 2015). The solutions identified are Pareto optimal solutions, representing trade-offs wherein greater benefits can only be achieved by increasing costs (Chadès et al., 2015; Ruzika & Wiecek, 2005).

When the budget is fixed, the solution to implement is typically determined by the budget constraint. However, if the budget is flexible or is yet to be secured, a choice must be made on which of the solutions should be adopted. To help inform this choice, we performed an additional analysis to determine which sets of strategies could maximize both the number of species groups secured with at least 60% probability of persistence and the number of groups that could gain at least 15% probability of persistence above the baseline for the least cost.

TABLE 1 Candidate management strategies for the Lake Simcoe-Rideau ecoregion and their estimated benefits, feasibility, costs and cost-effectiveness (CE) scores.

Management strategies		Number of actions	Total benefit	Feasibility	Total expected benefit	Total cost (million CA$)	Annualized cost (million CA$)	CE score	CE rank
Individual strategies									
S1	Human–wildlife management	6	1029.68	0.55	566.32	28.63	1.56	19.78	2
S2	Landowner stewardship	4	1742.55	0.65	1132.66	100.97	5.51	11.22	4
S3	Legislation and policy	6	2262.89	0.42	950.41	27.48	1.50	34.59	1
S4	Protecting habitat	5	1962.82	0.51	1001.04	1461.94	79.77	0.68	15
S5	Wildlife-safe crossings	4	996.68	0.66	657.81	88.51	4.83	7.43	6
S6	Invasive species and diseases management	7	1546.27	0.44	680.36	96.34	5.26	7.06	7
S7	Restoration and regeneration	8	2212.40	0.62	1371.69	216.58	11.82	6.33	8
S8	Industry-targeted policy and practices	8	1562.47	0.60	937.48	57.63	3.14	16.27	3
Combination strategies									
S9	S5+S7	12	2331.24	0.64	1492.00	305.09	16.65	4.89	10
S10	S7+S4	13	2797.16	0.56	1566.41	1678.53	91.59	0.93	13
S11	S7+S4+S2	17	3206.14	0.59	1891.62	1779.49	97.10	1.06	11
S12	S3+S4	11	2774.09	0.47	1303.82	1489.42	81.27	0.88	14
S13	S1+S7	14	2274.43	0.58	1319.17	245.21	13.38	5.38	9
S14	S2+S8+S3	18	2818.12	0.56	1578.15	186.07	10.15	8.48	5
S15	All strategies (S1–S8)	48	3838.57	0.56	2149.60	2078.07	113.39	1.03	12

Note: Total costs are in present values, calculated using a 3% discount rate per year over the 27-year time period.

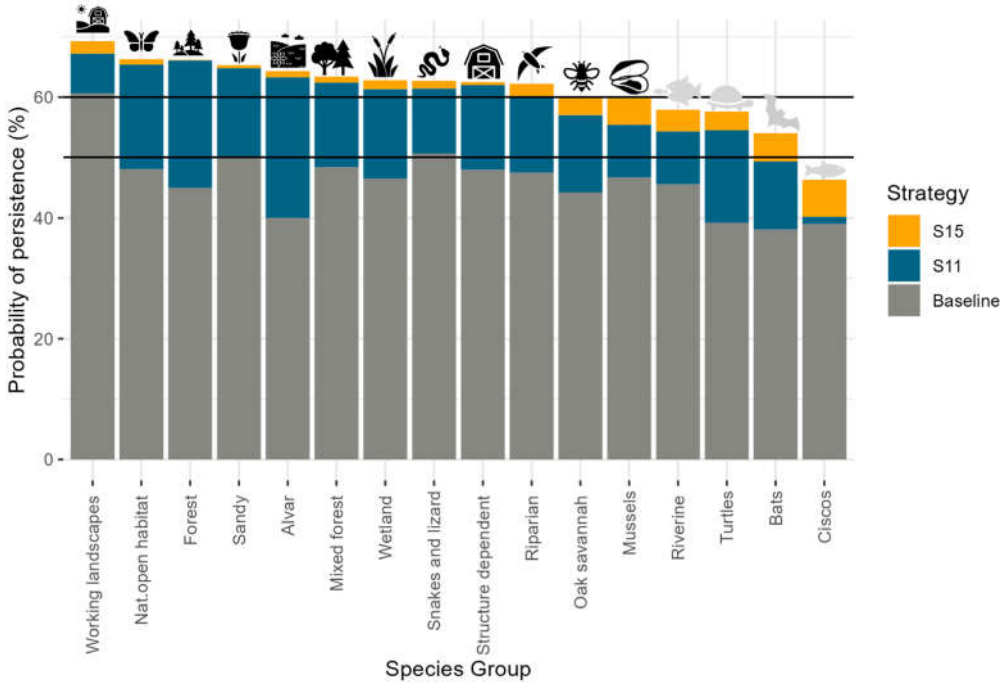

FIGURE 2 Expected probability of persistence of species groups in the Lake Simcoe-Rideau ecoregion over 27 years under the Baseline scenario (business-as-usual) and with implementation of either strategy S11 (combination of S2, S4 and S7) or S15 (combination of all strategies, S1–S8).

See Supporting Information: Appendix B for a detailed description of the cost-effectiveness and the complementarity analysis, as well as the methods and results of uncertainty analyses that explored the potential effect of variability in benefit estimates and cost discounting rates on the outputs of the complementarity analysis.

2.3 | Carbon co-benefits

To examine how management strategies align with climate change mitigation priorities, we estimated the potential carbon co-benefits of management actions. Here, we use the term 'co-benefits' to refer to additional or ancillary benefits that strategies aimed at one objective—in this case, maximizing biodiversity benefits while minimizing the cost—might have for other objectives (IPCC, 2014). In this sense, biodiversity benefits were the primary consideration in identifying optimal sets of complementary strategies; carbon co-benefits were estimated to provide additional information that could be used to help justify or leverage additional funding for conservation. Thus, we focused on actions that are likely to have direct benefits for climate change mitigation, such as avoided CO_2 emissions from habitat protection and long-term sequestration resulting from restoration activities (Drever et al., 2021; Duncanson et al., 2023), and for which we could derive reasonable quantitative estimates—that is, actions with quantitative targets that could be mapped spatially, and for which data on carbon storage values were available. For habitat protection, we calculated potential avoided CO_2 emissions from future land use conversion using a national carbon dataset (Sothe et al., 2022). In the case of restoration, we adapted the approach used in Currie et al. (2023) to estimate the net restorable carbon for target restoration areas, with higher priority applied towards areas used by species of conservation concern considered in the PTM. For a detailed description of the carbon co-benefits analysis and results for specific actions, see Supporting Information: Appendix C.

3 | RESULTS

3.1 | Expected benefits of management strategies

Under the baseline scenario, 15 of the 16 species groups in the region were expected to have less than 60% probability of functional persistence by 2050 (Figure 2). In contrast, if all strategies were to be implemented (i.e. S15), all but the cisco species group were predicted to have greater than 50% probability of persistence and 12 species groups were expected to have a probability of persistence of 60% or higher (Figure 2). None of the species groups were expected to reach a 70% probability of persistence, although the working landscapes species group comes close with a 69% probability of persistence under strategy S15 (Table 2).

Of the individual strategies, restoration and regeneration (S7) could secure the most species groups (four groups) up to the 60% threshold, while landowner stewardship (S2) was predicted to secure three species groups (Table 2). Overall, S7 and S2 had the highest expected benefits relative to the baseline for all but four species groups (alvar, riverine, turtle and bat species groups). The alvar species group was expected to benefit most from legislation and policy (S3) or protecting habitat (S4), while riverine and turtle species

TABLE 2 Expected probability of persistence (%) of species groups in the Lake Simcoe-Rideau ecoregion over 27 years under the Baseline scenario (business-as-usual; no additional management) and under each individual and combination strategy.

Species groups	Base-line	Individual strategies								Combination strategies						
		S1	S2	S3	S4	S5	S6	S7	S8	S9	S10	S11	S12	S13	S14	S15
Alvar species	40	42	49	51	50	40	43	48	47	49	58	63	57	49	59	64
Artificial structure-dependent species	48	48	60	53	49	48	48	59	52	60	59	62	55	59	61	63
Bats	38	39	46	43	43	38	48	43	40	43	46	49	46	44	47	54
Forest species	45	54	59	55	55	47	54	62	58	62	64	66	59	62	63	66
Mixed forest species	48	56	55	54	55	52	51	58	55	59	60	62	58	60	60	63
Ciscoes	39	39	39	42	40	40	42	39	41	40	40	40	43	40	45	46
Mussels	47	48	53	51	50	52	54	51	54	54	53	55	53	53	58	60
Naturalized open habitat species	48	53	60	56	57	51	54	59	57	59	63	65	59	60	61	66
Oak savannah species	44	56	54	54	52	44	50	57	50	54	55	57	51	57	57	60
Riparian species	48	50	53	54	56	48	51	59	52	57	59	60	55	57	56	62
Riverine species	46	48	52	52	51	56	50	53	52	55	52	54	53	51	54	58
Sandy species	50	56	58	57	60	50	55	64	56	61	63	65	59	62	59	65
Snakes and lizards	51	54	57	57	58	62	54	62	56	63	59	61	57	59	58	63
Turtles	39	45	48	48	48	56	44	52	45	56	51	55	49	51	50	58
Wetland species	46	50	53	54	56	50	50	57	52	57	59	61	57	55	58	63
Working landscapes species	61	61	68	64	62	61	62	66	65	65	65	67	64	65	68	69
No. of groups secured to ≥60%	1	1	3	1	2	2	1	4	1	5	5	10	1	5	5	12

Note: Highlighted cells indicate probabilities of persistence of 60% or greater.

groups were both expected to benefit most from wildlife-safe crossings (S5). For bats, invasive species and disease management (S6) were expected to be the most beneficial individual strategy.

Of the combined strategies, the combination of all strategies (S15) had the highest expected benefit across all species groups (Table 1) and was expected to secure the most species groups (Table 3) but was also estimated to be the most expensive to implement, with an estimated present value (PV) cost of $2.1 billion over 27 years or $113 million per year in annualized values (Table 1). Combination strategy S11—a combination of S2, S4 and S7—was estimated to be $300 million cheaper (or $16.3 million per year cheaper) than S15, had the second highest expected benefit (Table 1) and could secure up to 10 species groups (Table 3).

3.2 | Cost-effective and complementary strategies

The single most cost-effective individual strategy was legislation and policy (S3), followed by human–wildlife management (S1) and industry-targeted policy and practices (S8) (Table 1). The high cost-effectiveness scores for these three strategies were largely driven by their costs—at $27, $29 and $58 million, respectively, these strategies were estimated to be the least expensive to implement. However, they were expected to have low to moderate expected benefit across all species groups (Table 1) and were not expected to secure any additional species groups to ≥60% probability of persistence beyond what would already be considered secure under the baseline scenario (Table 2). In addition, there are likely additional costs for implementing proposed legislation and policy changes in strategy S3 that were not accounted for in the cost estimates due to the high degree of uncertainty regarding those costs.

The complementarity analysis identified the best sets of strategies for 'securing' the most species groups to at least a 60% probability of persistence for different levels of investment. For lower levels of investment, S5 would be the optimal strategy at a cost of $5 million per year over 27 years (Figure 3), securing the snakes and lizards group in addition to the working landscapes species group that was expected to remain secure under the baseline scenario (Table 3). Given a slightly higher budget of $5.5 million per year, however, it would be optimal to invest instead in S2 (Figure 3), which would secure the artificial structure-dependent and the naturalized open habitat species groups in addition to the working landscapes species group (Table 3). With higher levels of investment, S11 would help secure 10 species groups at a cost of $97 million per year over 27 years (Figure 3). Securing additional species groups, up to 12 species groups comprising 100 out of 133 species of conservation concern (Table 3), would require investing $113 million per year to implement S15 (Figure 3).

Most of the Pareto optimal solutions that could maximize the number of species groups secured for the least cost were also

TABLE 3 Species groups that could be secure with ≥60% probability of persistence over 27 years under the Baseline scenario and under each optimal set of management strategies.

Species groups	Number of species in group	Baseline scenario	Optimal strategies						
			S5	S2	S14	S5 + S14	S7 + S14	S11	S15
Turtles	8								
Riverine species	19								
Ciscoes	2								
Mussels	10								✓
Oak savannah species	2								✓
Riparian species	3							✓	✓
Alvar species	8							✓	✓
Wetland species	18							✓	✓
Sandy species	7						✓	✓	✓
Bats	4								
Mixed forest species	6				✓	✓	✓	✓	✓
Forest species	19				✓	✓	✓	✓	✓
Artificial structure- dependent species	3			✓	✓	✓	✓	✓	✓
Naturalized open habitat species	12			✓	✓	✓	✓	✓	✓
Snakes and lizards	9		✓			✓	✓	✓	✓
Working landscapes species	3	✓	✓	✓	✓	✓	✓	✓	✓
Number of species groups secured		1	2	3	5	6	7	10	12
Annualized cost (million CAD)		0.0	4.8	5.5	10.2	15.0	22.0	97.1	113.4

Note: Total costs have been discounted to present values at a rate of 3% and annualized to derive an average cost per year.

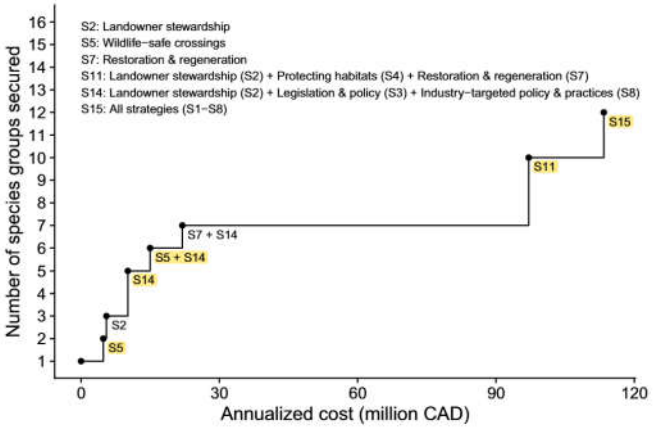

FIGURE 3 Pareto front indicating the number of species groups that could be secured to at least a 60% probability of persistence by different Pareto optimal solutions (represented by the black dots along the line). Highlighted solutions indicate strategies that were also optimal when maximizing the number of species groups that would experience ≥15% benefit. Annualized costs are based on the total costs discounted by a rate of 3%.

expected to maximize the number of species groups that gain >15% in probability of persistence (Figure 3; Supporting Information: Appendix B). In particular, under S11, the turtle species group had an expected probability of persistence of 55%, which is below the 60% threshold but still represents a gain of 16% relative to the baseline scenario (Table 2). Similarly, although neither the turtle nor bat species groups were expected to achieve a 60% probability of persistence under combination strategy S15, the expected benefits of S15 for both groups were >15% (Table 2).

The uncertainty analysis also revealed that most of the Pareto optimal solutions identified based on the most likely estimates would also be considered Pareto optimal under the most optimistic and most pessimistic scenarios. This suggests that the uncertainty in estimates did not have a great effect on the results (Supporting Information: Appendix B).

3.3 | Carbon co-benefits

Of the 48 actions considered in this PTM assessment, only seven actions had direct and quantifiable carbon benefits. Of these, sufficient information to calculate carbon co-benefits was available for only four actions: (1) protecting 10% of the ecoregion (S4); (2) restoring 1% of shoreline area (S7); (3) restoring 50 km^2 of wetland and 25 km^2 of areas connecting wetlands (S7); and (4) restoring 1200 km^2 of forest transition zones (S7). We found that protecting habitat (S4) has direct carbon co-benefits equivalent to 11.2 Mt of avoided CO_2 emissions while restoration and regeneration (S7) has direct carbon co-benefits equivalent to 137.6 Mt of CO_2 sequestration (Table 4; Supporting Information: Appendix C).

TABLE 4 Potential carbon co-benefits, in megatonnes (Mt) of carbon (C) or carbon dioxide emissions equivalent (CO_2e), of actions in the protecting habitat (S4) and restoration and regeneration (S7) strategies in the PTM with direct and quantifiable carbon benefits.

Strategy	Action	Total area (km^2)	Average carbon density (kg/m^2)	Area of avoided land conversion (km^2)	Avoided C release (Mt)	Avoided CO_2e release (Mt)	Restorable C (Mt)	Restorable CO_2e (Mt)
S4	Protect 10% of priority areas	6392.53	27.82	109.83	3.06	11.2	-	-
S7	Restore 1% of shorelines	47.55	28.01	-	-	-	1.33	4.88
	Restore 50 km^2 of wetland and 25 km^2 of areas connecting wetlands	75	33.86	-	-	-	2.54	9.31
	Restore 1200 km^2 of forest transition areas	1200	27.82	-	-	-	33.65	123.38
Total					3.06	11.2	37.52	137.57

4 | DISCUSSION

Our analysis revealed that without additional investment in conservation, 13 species groups, or 114 out of the 133 species of conservation concern, in the Lake Simcoe-Rideau ecoregion, will have <50% probability of persisting with viable, self-sustaining populations that continue to perform their ecological function (i.e. functional persistence) by 2050 (Figure 2). Investing $97 million per year over 27 years in the combination of landowner stewardship, protecting habitat and restoration and regeneration strategies (i.e. S11) could help secure 10 species groups (88 species) with ≥60% probability of persistence, while implementing the combination of all proposed management strategies (i.e. S15) for $113 million per year could secure 12 species groups (100 species) (Figure 2; Table 3).

However, even with this level of investment, none of the species groups were expected to have ≥70% probability of persistence. The low estimates of the probability of persistence reflect the high level of threats in the area and are comparable to those for the Fraser River Estuary, British Columbia, Canada (Kehoe et al., 2021)—an area also characterized by high human footprint (Hirsh-Pearson et al., 2022) and high levels of threat from competing demands for space and resources (Kraus & Hebb, 2020). The low expected probabilities of persistence may also be indicative of the inherent difficulty in recovering species that are already at a high risk of extinction, and the current lack of effective management options that adequately address the impact of key historical and ongoing threats to these species groups. For example, the poor status and low potential for recovery of the cisco species group has been attributed to historical overexploitation and more recent threats of habitat degradation and introduced species (COSEWIC, 2003; Fisheries and Oceans Canada, 2012). Similarly, the four bat species are endangered due to the threat of white-nose syndrome, a rapidly spreading infectious disease for which prevention and treatment has proven challenging (Cheng et al., 2021; Grider et al., 2022). For turtle and riverine species, the main threats are the impacts of urban development and agricultural activities, such as habitat loss and alteration (e.g. Ogden's Pondweed, COSEWIC, 2007), changes to water quality (e.g. Redside Dace, Rapids Clubtail; COSEWIC, 2017, 2018) and hydrological flow (e.g. Black Redhorse, COSEWIC, 2015), and barriers to movement (e.g. American Eel, Spotted Turtle; COSEWIC, 2012, 2014). Recovery of these species groups to ≥60% probability of persistence will rely on the successful mitigation of these threats, which will prove to be challenging given the high population density and development pressures in this region.

Uncertainties surrounding the potential impacts of recent policy and legislative changes in Ontario could also have influenced estimates of the expected probability of persistence of species groups. Beginning in 2019, the Ontario provincial government introduced significant changes to the Endangered Species Act (ESA), which led to the delisting of many species at risk and the weakening of previously strong protections under this legislation (Bethlenfalvy & Olive, 2021; Olive & Penton, 2018). In 2022, the provincial government introduced Bill 23, the 'More Homes Built Faster Act', which

made substantial changes to environmental and biodiversity protections in Ontario. Experts noted that these changes will likely lead to further exacerbation of environmental challenges and greater difficulty in implementing conservation actions, with wide-ranging implications for biodiversity.

These recent changes to environmental and conservation policy were also met with controversy (Jones, 2022; SpearChief-Morris, 2022), fuelled partly by Canada's colonial legacy and the provincial government's largely unsuccessful efforts to engage meaningfully and work with Indigenous groups on environmental policy and conservation initiatives (McIntosh, 2023). Indigenous groups in the region were invited to engage with and participate in the PTM assessment; however, many expressed reluctance to participate in the process, in part due to the lack of clarity regarding the views held by participating experts from government agencies about Indigenous-led conservation. In addition, there was insufficient time and funding for this study to support a more inclusive process as has been successfully done recently in a similar elicitation process for the Central Coast of British Columbia (Adams et al., 2023). For conservation to be successful and grounded in just approaches, it is necessary to ensure that there is engagement, consent and collaboration with the First Nations and Métis communities in the region (Seddon et al., 2021). The limited representation of Indigenous values and perspectives in this PTM process means that species, threats or actions may have been overlooked and excluded from the analysis, potentially leading to incomplete conclusions about cost-effectiveness and complementarity. Therefore, when considering the implementation of the proposed strategies, it is crucial to meaningfully engage and work with Indigenous groups in the region (Townsend et al., 2020), through processes that are inclusive, trauma-informed and grounded in the principles of respect and reciprocity (Adams et al., 2023). The outcomes from this PTM process can serve as a valuable starting point for conversations with Indigenous communities, to gather feedback and work together to determine the gaps in the analysis, the potential impacts of the proposed strategies on communities and ways to reduce the barriers to Indigenous participation in the PTM process. Ideally, these discussions will form the basis of a second iteration of the PTM process that is more inclusive, with more explicit consideration of Indigenous values and objectives, and that work to strengthen relations in the region.

The complementarity analysis identified multiple Pareto optimal solutions, representing the trade-off between maximizing benefit and minimizing costs. Without strict constraints on the number of species groups that must be secured or on the total budget, the choice of which Pareto optimal solution to adopt will depend on the values and preferences of those involved in making the decision. This decision may also be influenced by other considerations, such as co-benefits for other objectives and availability of opportunities to generate or leverage additional funding. For example, a solution that also contributes to other targets, such as protected area and restoration targets of the GBF or national climate change mitigation targets, could further increase the total benefits gained and help secure additional funding and resources for conservation action. In this PTM assessment, protecting habitat (S4) and restoration and regeneration (S7) included actions with potential carbon co-benefits of 11.2 Mt CO_2 equivalent in avoided emissions and 137.6 Mt CO_2 emissions equivalent in sequestered carbon, respectively (Supporting Information: Appendix C) and thus could be considered as nature-based climate solutions. While these values were based only on a subset of actions in those strategies for which we were able to derive quantitative estimates, the potential carbon co-benefits of S4 and S7 combined could, over the long term, make up for all of Ontario's greenhouse gas emissions in 2021 (Environment and Climate Change Canada, 2023). Choosing a solution that includes one or both strategies would help support alignment with climate change mitigation targets. Doing so can help justify investment and improve the likelihood of securing additional funding for implementation. We note, however, that our estimates were derived from maps of existing carbon stocks (Currie et al., 2023; Sothe et al., 2022) based on several simplifying assumptions and did not account for changes in stored carbon over time due to natural or anthropogenic processes. The estimates therefore represent the maximum potential carbon benefit that could be gained by implementing those actions. A more comprehensive carbon accounting, in accordance with accepted standards, along with independent verification and certification will be needed to secure additional funding through market mechanisms, such as voluntary carbon markets (Kreibich, 2024; Sadikman et al., 2022).

Some actions considered in the PTM may also have carbon co-benefits that we were unable to quantify due to the lack of available data on carbon storage in certain habitats such as sand dunes, or insufficient understanding of the pathways through which the action can yield carbon co-benefits. Further research and modelling of the causal mechanisms linking the actions to their carbon benefits will be needed to estimate the carbon co-benefits of these actions. For others, the main barrier to the quantification of carbon co-benefits was the lack of specificity regarding where, when and how the action will be implemented; carbon co-benefits could potentially be estimated for these actions once these details have been fully specified, for example, during the planning stage prior to implementation.

Many of the actions suggested by experts may also have co-benefits for other environmental and social objectives. For instance, water quality could be improved directly by implementing wastewater treatment (S2) or water allocation (S3) actions (Buttle, 2011). The implementation of actions in urban areas (S7) or in recreational activity hotspots (S6) can contribute to long-term urban regeneration, recreation and overall human and cultural well-being (Colléony & Shwartz, 2019). Finally, co-benefits can be generated through the creation of jobs (Gómez Martín et al., 2020; Raymond et al., 2017). Quantitative pre-assessments of co-benefits can be data-intensive and may be impractical in many cases (Molina et al., 2024) and development of frameworks and methods for assessment are greatly needed (Ommer et al., 2022). Where possible, however, demonstrating and quantifying these co-benefits and any potential disbenefits will allow them to be explicitly incorporated into formal decision science frameworks, such as multi-criteria decision analysis

(Ürge-Vorsatz et al., 2014), and thus improve the likelihood of uptake and successful implementation and further support the business case for financing biodiversity conservation.

5 | CONCLUSIONS

Our analysis revealed that considerable additional investment—$2.1 billion over 27 years—is required to safeguard the future of species of conservation concern in the Lake Simcoe-Rideau ecoregion, Ontario. By estimating the costs and expected benefits of different combinations of strategies, PTM can help maximize the return on investment and make the business case for conservation, which can lead to increased investment and positive outcomes for biodiversity. Identifying and implementing actions with co-benefits for climate change mitigation or other environmental or social objectives can further maximize the return on investment in conservation actions, help secure additional funding for implementation and contribute to Canada's efforts to meet its commitments to the CBD's Global Biodiversity Framework.

AUTHOR CONTRIBUTIONS

Abbey E. Camaclang and Tara G. Martin helped develop the data collection methods and analysis used in this study. Emily Giles was responsible for recruiting expert participants and organizing workshops, and Aranya Iyer conducted literature reviews, prepared elicitation materials and conducted data analysis. Abbey E. Camaclang also provided technical advice and assistance with workshop organization and data analysis. Abbey E. Camaclang, Aranya Iyer, Emily Giles, Beatrice Frank and Catherine Paquette facilitated expert elicitation workshops. Chris Liang conducted the carbon co-benefits analysis, with assistance and advice from Victoria Hemming, Abbey E. Camaclang and Tara G. Martin. Katherine I. Alambo, Jennifer Lamoureux, Sarah Matchett, Tyler Miller, D. Ryan Norris, Mary Ann C. Perron, Robyn H. M. Rumney, Frederick W. Schueler and Laura Timms contributed data used in this study. All authors contributed to writing and reviewing the manuscript.

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CONFLICT OF INTEREST STATEMENT

The authors declare that they have no conflicts of interest.

DATA AVAILABILITY STATEMENT

The anonymized summary data elicited from experts, along with the code for both PTM and carbon co-benefits analysis, are available from https://doi.org/10.5281/zenodo.17247132 (Camaclang et al., 2025). Input spatial data used for the carbon co-benefits analysis were derived from publicly available sources listed in Supporting Information: Appendix C.

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SUPPORTING INFORMATION

Additional supporting information can be found online in the Supporting Information section at the end of this article.

Appendix A. Data tables.

Appendix B. PTM detailed methods and additional results.

Appendix C. Carbon co-benefits of management strategies.

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Written Submission

- I would like to speak of regeneration, healing, of the subject lands.
- Becoming a welcome species. How life begets life... becoming part of the healing team
- Positive tipping points, biodiversity begets biodiversity
- The importance of creating more of these safe havens for organisms, during these times of climate change and massive biodiversity loss.
- Social norms, social contracts that help support collective action.
- HNA is a beautiful example of this. Our video demonstrates this... Creating a culture of care, a culture of generosity.

Chantal Stieler

From: Tom Clancy
Sent: Friday, November 7, 2025 11:13 AM
To: 'Tom Galloway'
Cc: 'Frank Glew'; Joshua Shea <Joshua.Shea@kitchener.ca>; Andrew Pinnell <Andrew.Pinnell@kitchener.ca>; Garett Stevenson <Garett.Stevenson@kitchener.ca>
Subject: RE: HNA report

Well said and well timed comments. I concur and endorse your comments as many future issues have been laid out for some time.

These actions would enhance what is already utilized as an outstanding special open space within the city of Kitchener. Hopefully Activa concurs and works willingly with staff toward that result.

Well done Tom.

Tom c.

From: Tom Galloway
Sent: Friday, November 7, 2025 10:31 AM
To: allcouncil@kitchener.ca
Cc: Tom Clancy; Frank Glew; Joshua Shea <Joshua.Shea@kitchener.ca>; Andrew Pinnell <Andrew.Pinnell@kitchener.ca>; Garett Stevenson <Garett.Stevenson@kitchener.ca>
Subject: HNA report

I want to add my support to this report. As you know I have a long history with the HNA both as a school trustee and City Councillor.

I am very pleased that another 10 critical acres is being added to the project. Back in the day we knew that certain lands needed to be purchased and certain lands would come through the development process as in this case.

Thank you to staff for their efforts in securing these critical lands for the HNA.

However, full land acquisition for the HNA is not yet complete. Three remaining parcels, I believe all in Activa ownership, need to be acquired through development processes currently underway. I anticipate there will be similar outcomes in these situations as in this current one.

Tom Galloway

REPORT TO: **Finance and Corporate Services Committee**

DATE OF MEETING: **October 27, 2025**

SUBMITTED BY: **Dianna Saunderson, Manager, Council and Committee Services / Deputy Clerk, 519-904-1410**

PREPARED BY: **Dianna Saunderson, Manager, Council and Committee Services / Deputy Clerk, 519-904-1410**

WARD(S) INVOLVED: **N/A**

DATE OF REPORT: **September 10, 2025**

REPORT NO.: **COR-2025-393**

SUBJECT: **2026 Council and Committee Schedule**

RECOMMENDATION:

That the 2026 Council and Committee Calendar, as attached as Appendix 'A' to Corporate Services Department report COR-2024-459, be approved; and,

That the Mayor in consultation with the Chief Administrative Officer and the Clerk will be delegated the authority to schedule additional Planning and Strategic Initiatives Committee (PSIC) meetings on Council meeting dates, where required, to address legislated Planning Act timelines; and further,

That Council be permitted by resolution to reschedule meetings identified on the 2026 calendar where necessary.

REPORT HIGHLIGHTS:

- The purpose of this report is to establish the Council and Committee Schedule for 2026.
- This report supports the delivery of core services.

BACKGROUND:

Each year, a schedule of Council and Standing Committee meetings is adopted. Meetings are scheduled on rotating Mondays and generally include a one-week recess between Standing Committee and Council. This break provides Council with additional time to consider agenda items and connect with constituents on matters of public interest while also providing an opportunity for staff to gather further information as requested by Committee. Where possible, the 2026 schedule also takes into consideration the Region of Waterloo's Council and Committee meetings.

The schedule also considers factors that Council has historically taken into account when scheduling meetings, such as all Statutory Holidays, March Break, a summer break in July, conferences such as Federation of Canadian Municipalities (FCM), Association of Municipalities of Ontario (AMO) and Association of Municipal Clerks and Treasurers of Ontario (AMCTO).

REPORT:
The proposed 2026 calendar, attached as Appendix 'A', was developed based on the factors outlined above, and also incorporates the following list of Holidays, March Break, and municipal conferences:

- New Year's Day: Thursday, January 1, 2026
- Family Day: Monday, February 16, 2026
- Good Friday: Friday, April 3, 2026
- Easter Monday: Monday, April 6, 2026
- Victoria Day: Monday, May 18, 2026
- Canada Day: Wednesday, July 1, 2026
- Civic Holiday: Monday, August 3, 2026
- Labour Day: Monday, September 7, 2026
- Thanksgiving Day: Monday, October 12, 2026
- Remembrance Day: Wednesday, November 11, 2026
- Christmas Day: Friday, December 25, 2026
- Boxing Day: Monday, December 28, 2026 (Observed)

The calendar also takes feedback from City business units including Planning, Engineering, Procurement, and Financial Planning and Reporting.

Additionally, the schedule and staff recommendation continue to take into consideration the timelines of Planning Act Bill 109, *More Homes for Everyone Act, 2022* came into effect in April 2022. Bill 109 is a first step response to the Ontario Housing Affordability Task Force Report, which have the following approval requirements:

Application Type	Approval Requirement
Zoning By-law Amendment	Decision within 90 days
Official Plan Amendment & Zoning By-law Amendment (combined)	Decision within 120 days

Finally, because 2026 is an election year, the schedule limits the number of meetings after Nomination Day in order to minimize exposure to restrictions on a Council as outlined in Section 275, Restricted Acts After Nomination Day, Municipal Act, 2001, but will still allow for one cycle of Standing Committee and Council meetings in order to attend to Council business. As in previous election years, no meetings will be scheduled for the month of October leading to Election Day.

STRATEGIC PLAN ALIGNMENT:

This report supports the delivery of core services.

FINANCIAL IMPLICATIONS:

Capital Budget – The recommendation has no impact on the Capital Budget.

Operating Budget – The recommendation has no impact on the Operating Budget.

COMMUNITY ENGAGEMENT:

INFORM – This report has been posted to the City's website with the agenda in advance of the council / committee meeting.

PREVIOUS REPORTS/AUTHORITIES:

There are no previous reports/authorities related to this matter.

APPROVED BY: Victoria Raab, General Manager, Corporate Services

ATTACHMENTS:

- Attachment A - Proposed 2025 Council and Standing Committee Schedule

CITY OF KITCHENER
2026 MEETING SCHEDULE

JANUARY

Su	Mo	Tu	We	Th	Fr	Sa
				1	2	3
4	SC	6	7	8	9	10
11	C	13	14	15	16	17
18	19	20	21	22	23	24
25	SC	27	28	29	30	31

FEBRUARY

Su	Mo	Tu	We	Th	Fr	Sa
1	S	3	4	5	6	7
8	SC	10	11	12	13	14
15	16	17	18	19	20	21
22	23	24	25	26	27	28

MARCH

Su	Mo	Tu	We	Th	Fr	Sa
1	C	3	4	5	6	7
8	SC	10	11	12	13	14
15	16	17	18	19	20	21
22	A	24	25	26	27	28
29	SC	31				

APRIL

Su	Mo	Tu	We	Th	Fr	Sa
			1	2	3	4
5	6	7	8	9	10	11
12	C	14	15	16	17	18
19	SC	21	22	23	24	25
26	27	28	29	30		

MAY

Su	Mo	Tu	We	Th	Fr	Sa
					1	2
3	S	5	6	7	8	9
10	11	12	13	14	15	16
17	18	19	20	21	22	23
24	SC	26	27	28	29	30
31						

JUNE

Su	Mo	Tu	We	Th	Fr	Sa
	SC	2	3	4	5	6
7	8	9	10	11	12	13
14	15	16	17	18	19	20
21	22	23	24	25	26	27
28	A	30				

JULY

Su	Mo	Tu	We	Th	Fr	Sa
			1	2	3	4
5	6	7	8	9	10	11
12	13	14	15	16	17	18
19	20	21	22	23	24	25
26	27	28	29	30	31	

AUGUST

Su	Mo	Tu	We	Th	Fr	Sa
						1
2	3	4	5	6	7	8
9	SC	11	12	13	14	15
16	17	18	19	20	21	22
23	S	25	26	27	28	29
30	31					

SEPTEMBER

Su	Mo	Tu	We	Th	Fr	Sa
		1	2	3	4	5
6	7	8	9	10	11	12
13	SC	15	16	17	18	19
20	21	22	23	24	25	26
27	A	29	30			

OCTOBER

Su	Mo	Tu	We	Th	Fr	Sa
				1	2	3
4	5	6	7	8	9	10
11	12	13	14	15	16	17
18	19	20	21	22	23	24
25	E	27	28	29	30	31

NOVEMBER

Su	Mo	Tu	We	Th	Fr	Sa
1	2	3	4	5	6	7
8	9	10	11	12	13	14
15	I	17	18	19	20	21
22	23	24	25	26	27	28
29	SC					

DECEMBER

Su	Mo	Tu	We	Th	Fr	Sa
		1	2	3	4	5
6	7	8	9	10	11	12
13	A	15	16	17	18	19
20	21	22	23	24	25	26
27	28	29	30	31		

C — COUNCIL / COMMITTEE OF THE WHOLE	S — COUNCIL / STRAT SESSION	A — COUNCIL / AUDIT COMMITTEE
HOLIDAYS / STATUTORY LIEU DAY	SC — STANDING COMMITTEE	
E — ELECTION DAY	I — INAUGERATION DAY	
MARCH BREAK (Mar 16-20)	FCM CONFERENCE (June 4-7)	AMCTO (Jun 7-10)
AMO CONFERENCE (Aug 16-19)	AC — All Council Meeting (Region)	

REPORT TO:	**Committee of the Whole**
DATE OF MEETING:	**November 10, 2025**
SUBMITTED BY:	**Greg St. Louis, Director, Gas & Water Utilities, 519-783-8792**
PREPARED BY:	**Khaled Abu-Eseifan, Manager, Gas Supply and Engineering, 519-783-7953**
WARD(S) INVOLVED:	**Ward(s)**
DATE OF REPORT:	**October 9, 2025**
REPORT NO.:	**INS-2025-433**
SUBJECT:	**Research Agreement with University of Waterloo**

RECOMMENDATION:

That the Sponsored Research Agreement between University of Waterloo and City of Kitchener as proposed in report INS-2025-433 Attachment A be approved; and,

That the General Manager Infrastructure Services be authorized to execute said agreement, to the satisfaction of the City Solicitor.

REPORT HIGHLIGHTS:

- The purpose of this report is to provide recommendation to approve a research agreement between University of Waterloo and City of Kitchener to create a digital twin model and study the condition of gas infrastructure.
- The key finding of this report is that the research agreement with University of Waterloo would support Kitchener Utilities in understanding gas infrastructure requirements under different demand scenarios. It will also support condition assessment efforts to address gas aging infrastructure issues.
- The financial implications are the total of two hundred thousand dollars ($200,000. CDN) in direct contributions over the period of four years plus a further three hundred thousand ($300,000 CDN) of in-kind support.
- This report supports the delivery of core services.

BACKGROUND:

Over the last couple of years, Kitchener Utilities (KU) started investigating methodologies to assess gas infrastructure condition. Some of KU gas pipelines are reaching their design life and KU has limited tools to understand the conditions of these pipelines and plan for future replacement requirements. KU is also developing energy transition strategy which would impact customer growth and demands. This amplified the need for modeling tools to understand the impact of different future scenarios on the gas pressures and flows within the pipelines and the implications on the future of the distribution system.

KU has been discussing with the University of Waterloo Engineering and Math faculties about various areas of interest. They both agreed to sign a research agreement to fund and conduct research on some of these topics. This research agreement is first of its kind between the City and the University. Council approval through delegated authority is required to approve the agreement.

REPORT:
The Sponsored Research Agreement between University of Waterloo and City of Kitchener can be seen in Attachment A. The agreement defines deliverables in three research pillars:

Research Pillar 1: Gas pipe network digital twin
This research pillar is aimed at developing core simulation software capabilities to

1. build a digital twin of the city's pipe network,
2. simulate changes to the network under different growth scenarios, and
3. provide optimal sensor placement to develop predictive models.

Research Pillar 2. Growth modelling and optimization
This research pillar aims to model future gas demand under different scenarios of residential, commercial, and industrial development, and potential gas-electrical grid energy integration.

Research Pillar 3. Maintenance assessment modelling
This research pillar aims to investigate two critical areas:

1. investigate how to model corrosion in metal pipes and degradation in plastic pipes. The outcomes of these studies will inform future modelling activities to improve the simulation software in Pillar 1. and,
2. evaluate current data from sensors and other modalities for their predictive capacity and evaluate the potential of new and existing sensors for improving predictive capabilities.

The research will be conducted by a minimum of three graduate or post doctoral students. The city will directly fund the project by two hundred thousand ($200,000 CDN) over four years period with additional three hundred thousand ($300,000 CDN) of in-kind contribution. The in-kind contributions represent staff time dedicated to the project over the period of four years. The University will match these funds through other government grants.
The agreement in attachment A has been reviewed by the City's internal legal services. A delegated authority to the General Manager Infrastructure Services is required to approve the agreement.

STRATEGIC PLAN ALIGNMENT:
This report supports the delivery of core services.

FINANCIAL IMPLICATIONS:
Capital Budget – The agreement impact natural gas capital budget by $50,000 annually for 4 years. The total impact is $200,000.

Operating Budget – The agreement has no impact on the Operating Budget. The in-kind contributions representing staff time will be managed through efficiency and re-assignment of tasks.

COMMUNITY ENGAGEMENT:
INFORM – This report has been posted to the City's website with the agenda in advance of the council / committee meeting.

PREVIOUS REPORTS/AUTHORITIES:
There are no previous reports/authorities related to this matter.

APPROVED BY: Denise McGoldrick, General Manager Infrastructure Services

ATTACHMENTS:
Attachment A – Sponsored Research Agreement SRA#105892

SPONSORED RESEARCH AGREEMENT SRA#105892

Optimized infrastructure planning through simulation and AI driven gas pipe-network digital twin growth scenario prediction research program

Between

University of Waterloo
Office of Research
Research Partnerships
200 University Avenue West
Waterloo, Ontario N2L 3G1
(hereinafter referred to as the "**University**")

and

City of Kitchener
200 King Street West,
Kitchener, Ontario N2G
4G7
(hereinafter referred to as the "**Client**")

WHEREAS the University and the Client wish to enter into this agreement to define the performance of the research as set forth in Schedule "A" and the terms and conditions for the Client's participation in the research as set forth in Schedule "A";

NOW THEREFORE in consideration of the premises and the mutual covenants, terms, conditions and agreements contained herein, and other good and valuable consideration, the sufficiency of which is hereby acknowledged, the parties hereto agree as follows:

ARTICLE 1 – DEFINITIONS

1.1 "**Agreement**" means this Sponsored Research Agreement including all attached schedules, as the same may be supplemented, amended, restated or replaced in writing from time to time;

1.2 "**Background Intellectual Property**" means proprietary and/or Confidential Information of the University, the University Research Personnel and Students, or the Client which is disclosed to the other for the purpose of the Research Plan;

1.3 "**Client Confidential Information**" means Confidential Information of the Client which has been disclosed by the Client to the University, but not including the Research Results;

1.4 "**Confidential Information**" means the specific terms and conditions set forth in this Agreement, the Research Results, and any information, which is disclosed by

one party to the other party for the purpose of the Research Plan provided that tangible materials are clearly marked as "Confidential" and any information provided orally or visually is identified as confidential at the time of disclosure, but shall not include information that:

(a) is or becomes generally available to the public other than as a result of any act by a receiving party to this Agreement;

(b) is rightfully received from a third party without similar restriction or without breach of this Agreement;

(c) a receiving party is able to demonstrate, in writing, was known to it on a non-confidential basis; or

(d) was independently developed by a receiving party without the use of any of the Confidential Information.

1.5 "**Creators**" means any University Research Personnel and Students who make a creative contribution to the Research Results;

1.6 "**Field of Use**" has the meaning set forth in Section 7.3;

1.7 "**Principal Investigator**" has the meaning set forth in Section 2.2;

1.8 "**Research Personnel and Student Agreement**" has the meaning set forth in Section 2.3;

1.9 "**Research Plan**" has the meaning set forth in Section 2.1.

1.10 "**Research Results**" means the technical information, know-how, copyrights, models, specifications, prototypes or inventions, whether patentable or unpatentable, developed in performance of the Research Plan;

1.11 "**University Research Personnel and Students**" means University researchers, including, but not limited to, the Principal Investigator, students, post doctoral fellows, research associates, who participate in the Research Plan.

ARTICLE 2 - OBJECTIVES

2.1 The University shall work with the Client to perform, or procure the performance of, the research plan as set forth in Schedule "A" (the "**Research Plan**") upon the terms and conditions hereinafter set forth.

2.2 The principal investigator(s) of the Research Plan shall be Professor David Del Rey Fernandez of the University's Department of Applied Mathematics (the "**Principal Investigator**"), and the Principal Investigator shall be responsible for the technical content of the Research Plan.

2.3 The University shall ensure that each University Research Personnel and Student shall sign a Research Personnel and Student Agreement as set forth in Schedule "B" prior to working on the Research Plan.

2.4 Notwithstanding Section 2.1 hereof, the Client and the University agree that until such time as all regulatory requirements have been obtained, including all necessary approvals of any regulatory or research ethics board concerned, no

work requiring such regulatory or ethics approvals shall commence (excepting any preliminary preparations which are not restricted by such requirements). For greater certainty, any delay in obtaining such approvals shall not be considered a default or breach by either the Client or the University.

2.5 The Client and the University acknowledge that some research, particularly that in the natural sciences and engineering, may be subject to export control laws and regulations of Canada or the U.S. For example, transmitting the results of, or information about, certain research may require first obtaining an export permit or other authorization. Certain research may also be subject to regulation by the Controlled Goods Directorate (CGD) of Public Services and Procurement Canada (PSPC), in accordance with the *Defence Production Act* (DPA) and the Controlled Goods Regulations (CGR). Information may be obtained from the CGD Website at: https://www.tpsgc-pwgsc.gc.ca/pmc-cgp/index-eng.html.

2.6 The Client shall use reasonable efforts to determine whether or not the Research Plan contains or may result in, items subject to these laws and regulations mentioned in s. 2.5 above (a "**Controlled Item**"). In the event that a Controlled Item is identified in the Research Plan, then the Client and the University shall comply with all applicable Canadian and U.S. export control laws and regulations. In the event that the Client wishes to include a Controlled Item into the Research Plan at any time during the term of this Agreement, then the Client and the University agree as follows:

(a) the Client shall promptly notify the University of the Controlled Item's classification prior to any shipment or transmission to the University;

(b) the University may, at the University's sole discretion, accept or reject the delivery of the Controlled Item; and

(c) in the event that the University rejects the delivery of the Controlled Item, such rejection by the University shall not constitute a breach of this Agreement.

ARTICLE 3 - FEES

3.1 In consideration of the University carrying out the Research Plan, the Client shall pay the University the sum of two hundred thousand dollars ($200,000.00 CDN), which amount is inclusive of overhead expenses, a portion of which shall be for the purposes of hiring a minimum of three (3) graduate or post doctoral Students to carry out the Research Plan. In addition, the parties agree that the Client will provide a further three hundred thousand ($300,000 CDN) of in-kind support.

3.2 The sum stipulated in Section 3.1 shall be paid by the Client electronically or by cheque made payable to the University of Waterloo (Attn: Finance Department, EC5, 200 University Avenue West, Waterloo, Ontario N2L 3G1) within thirty (30) days of receipt of invoice(s) according to the following schedule:

(a) $50,000.00 due upon execution of this agreement;

(b) $50,000.00 due 1 September 2026;

(c) $50,000.00 due 1 September 2027;

(d) $50,000.00 due 1 September 2028;

3.3 Invoices to the Client shall be sent by email to:

City of Kitchener Accounts Payable:

accountspayable@kitchener.ca

3.4 The Interest on overdue accounts may be charged at current bank rates on amounts not paid within thirty (30) days of submission of invoice.

3.5 The University shall not be obliged to perform any work beyond the Research Plan which would cause the aggregate costs to exceed the amount set forth in Section 3.1.

ARTICLE 4 – RESEARCH RESULTS

4.1 The University, through the Principal Investigator, will provide the Client with any reports specified in Schedule "A", if applicable to the Research Plan.

ARTICLE 5 - EQUIPMENT

5.1 Unless otherwise agreed upon by the Client and the University in writing, or specifically provided for pursuant to the terms of this Agreement, all equipment and materials purchased by or provided to the University for the carrying out of the Research Plan, shall be, and remain, the property of the University.

ARTICLE 6 - CONFIDENTIALITY

6.1 All Confidential Information will remain the property of its owner or the party that furnished it as the case may be.

6.2 For a period of three (3) years from the date of disclosure of Confidential Information, the receiving party agrees to maintain in confidence all Confidential Information disclosed to it with the same degree of care as the receiving party normally takes to preserve its own confidential information of similar grade, but in any event, no less than a reasonable degree of care.

6.3 The receiving party may only disclose Confidential Information to persons with a "need to know" who shall be made aware of, and be required to observe and comply with the covenants and obligations contained herein, and the Confidential Information shall only be used for the purpose of the Research Plan.

6.4 A receiving party may disclose Confidential Information pursuant to the requirements of a government agency or pursuant to a court order, provided that the receiving party gives the disclosing party sufficient notice to enable it to seek an order limiting or precluding such disclosure.

ARTICLE 7 - INTELLECTUAL PROPERTY

7.1 All aspects and parts of the Background Intellectual Property shall be exclusively owned by its owner and nothing herein shall serve to, or should be construed to;

transfer any ownership rights whatsoever in the Background Intellectual Property. Such Background Intellectual Property may be used by the receiving party solely as required to perform that party's obligations in performing the Research Plan. The limited, non-transferable license granted herein will automatically terminate upon expiration or termination of this Agreement. Any further use of the Background Intellectual Property shall be on terms and conditions to be agreed upon in writing between the parties. Background Intellectual Property belonging to the University and the University Research Personnel and Students includes the items listed in Schedule "C".

7.2 All Research Results shall be owned by the University whereby the University will assign its interest in and to the Research Results to the Creator(s), subject to Sections 7.3 and 7.4 below.

7.3 The Creator(s) are required to promptly disclose the Research Results to the University and to the Client. The University hereby grants to the Client a fully paid-up, royalty-free, irrevocable, non-exclusive license to use the Research Results the following field of use: gas distribution system design, operations, and maintenance(the "**Field of Use**"). The Client acknowledges and agrees that a similar non-exclusive license will be granted by the University to the other NSERC Sponsors.

7.4 The University will specifically retain the perpetual and irrevocable right to use the Research Results for continued research and educational purposes without charge, fee, or royalties notwithstanding any other provision of this Agreement.

7.5 Nothing herein shall constrain the Client from selling or monetizing any new or more efficient processes it develops within the Field of Use where such developments are based in whole or in part on the research provided by the University or the Creator(s).

ARTICLE 8 – PUBLICATION AND DISCLOSURE

8.1 The Client and the University agree that it is part of the University's function and policies to disseminate information and to make it available for the purpose of scholarship. The Client further acknowledges that some of the Client Confidential Information must be included in a publication, including but not limited to scholarly articles, in order for the University to give proper context to and meaningfully publish the Research Results. The University acknowledges that the Client has legal obligations under the *Municipal Freedom of Information and Protection of Privacy Act* and may be required by law to withhold certain information.

8.2 At any time during the term of this Agreement, the University will provide the Client with a draft copy of any proposed publication or disclosure of Research Results for its review at least sixty (60) days before submission for publication or disclosure. Upon the Client's written request, which shall be received by the University within the same sixty (60) day period, the University will:

(a) work in good faith with the Client to ensure that only Client Confidential Information that is necessary for the University to meaningfully publish the Research Results shall be included in the final publication or disclosure, notwithstanding the University's obligation of Confidentiality as set forth in Section 6.2 above; or

(b) delay publication, subject to Section 8.3, up to a maximum of sixty (60) additional days for the purposes of filing for intellectual property protection on terms and conditions to be negotiated and agreed upon by the Client and the University.

8.3 Notwithstanding any other term or condition of this Agreement, the University retains the right to have any thesis reviewed and defended without delay for the sole purpose of academic evaluation in accordance with the University's established procedures. The Client may request, and the University shall not unreasonably deny, that a closed thesis defence is held and that the members of the thesis examination board, including the external examiner(s), be required to sign a non-disclosure agreement.

ARTICLE 9 - INDEMNITY

9.1 Each party agrees to indemnify and save harmless the other party, its affiliates, elected officials, directors, officers, employees, agents, students and representatives from and against all claims, losses, damages or expenses of any kind (individually a "**Claim**" and collectively the "**Claims**") by any third party based upon, occasioned by, or attributed to actions, errors, omissions, or negligence of the indemnifying party and its directors, officers, employees, agents or representatives during the performance of this Agreement, except to the extent such Claim(s) are attributable to the negligence or wilful misconduct of the indemnified party.

9.2 In addition, the Client hereby agrees to indemnify the University, including its governors, directors, trustees, officers, researchers, employees, students, volunteers and agents against all Claims arising from the use by or through Client of the Research Results, and the design, production, manufacture, sale, use, lease, or promotion of any product, process, service or data developed by the Client, directly or indirectly, through use of the Research Results except (and subject to Section 10.3 below) to the extent such Claim(s) are attributable to the negligence, error or omission or misconduct of the University, including its governors, directors, trustees, officers, researchers, employees, students, volunteers and agents.

9.3 The indemnity in this Article 9 shall not affect or prejudice a party from exercising any other rights it may have under the law.

ARTICLE 10 – REPRESENTATIONS AND WARRANTIES AND LIMITATION OF LIABILITY

10.1 Each party represents and warrants to the other party that it is duly organized, validly existing and in good standing, and it has the right and authority to enter this Agreement and do all acts and things as required or contemplated to be done, observed and performed by it hereunder.

10.2 The Client makes no warranty, express or implied, concerning the Client's Background Intellectual Property under this Agreement which are all provided "as is". THE CLIENT MAKES NO REPRESENTATIONS AND EXTENDS NO WARRANTIES OF ANY KIND, EITHER EXPRESS OR IMPLIED. THERE ARE NO EXPRESS OR IMPLIED WARRANTIES OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE, OR THAT THE USE OF THE CLIENT'S BACKGROUND INTELLECTUAL PROPERTY WILL NOT INFRINGE ANY PATENT, COPYRIGHT, TRADEMARK OR OTHER PROPRIETARY RIGHT.

OF ANY THIRD PARTY.

10.3 The University, on behalf of itself and the Creators, makes no warranty, express or implied, concerning the Research Results under this Agreement, which are all provided "as is". THE UNIVERSITY MAKES NO REPRESENTATIONS AND EXTENDS NO WARRANTIES OF ANY KIND, EITHER EXPRESS OR IMPLIED. THERE ARE NO EXPRESS OR IMPLIED WARRANTIES OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE, OR THAT THE USE OF THE RESEARCH RESULTS WILL NOT INFRINGE ANY PATENT, COPYRIGHT, TRADEMARK OR OTHER PROPRIETARY RIGHT OF ANY THIRD PARTY. FURTHER, CLIENT ACKNOWLEDGES AND AGREES THAT ANY RESEARCH RESULTS PROVIDED UNDER THIS AGREEMENT DOES NOT CONSTITUTE LEGAL OR HEALTH ADVICE OR ADVICE OF ANY OTHER REGULATED INDUSTRY NOR DO THE RESEARCH RESULTS CREATE A WARRANTY OF ANY KIND BY THE UNIVERSITY. CLIENT ACKNOWLEDGES AND AGREES THAT IT SHALL CONSULT AN APPROPRIATE PROFESSIONAL FOR SPECIFIC ADVICE TAILORED TO ITS SPECIFIC SITUATION. UNIVERSITY ACCEPTS NO LIABILITY WHATSOEVER FOR ANY LOSS OR DAMAGE CLIENT MAY INCUR THROUGH ITS RELIANCE UPON THE RESEARCH RESULTS TO SATISFY ANY LEGAL OR REGULATORY REQUIREMENTS.

10.4 NEITHER THE CLIENT NOR THE UNIVERSITY WILL BE LIABLE TO THE OTHER FOR ANY CONSEQUENTIAL DAMAGES, LOST PROFITS, LOST SAVINGS, LOSS OF ANTICIPATED REVENUE OR ANY EXEMPLARY, PUNITIVE, SPECIAL OR INDIRECT DAMAGES, EVEN IF ADVISED OF THE POSSIBILITY OF SUCH DAMAGES UNLESS (AND SUBJECT TO SECTION 10.3 HEREOF) CAUSED BY THE NEGLIGENCE OF THE INDEMNIFIED PARTY.

ARTICLE 11 - INSURANCE

11.1 Each party shall obtain and maintain comprehensive general liability insurance and any other insurance that a prudent person would deem necessary, with at least a $5,000,000 per occurrence limit with respect to its operations. Such insurance shall contain provisions for cross-liability and severability of interest, and each party shall provide a certificate of insurance adding the other parties as additional insured as evidence of such coverage if requested by the other party with a 30-day cancelation notice clause.

11.2 If, as an integral part of the Research Plan, a party, including its employees, agents and representatives, drives a vehicle onto the other party's property, then such party shall carry owned and/or non-owned automobile insurance with at least a $5 million per occurrence limit and the other party shall provide a certificate of insurance as evidence if requested by the other party.

11.3 It shall be the sole responsibility of each party to determine what additional insurance coverage, if any, is necessary and advisable for its own protection and/or to fulfill its obligations under this agreement. Any such additional insurance shall be obtained and maintained at the sole cost of the party.

ARTICLE 12 – PERMITS AND LICENSES

12.1 For work to be carried out off the University's premises, the Client shall identify any

permits, licenses or other required by any governing authority in relation to any of the work to be performed and agrees to obtain or to assist the University to obtain such permits, licenses or other.

ARTICLE 13 – TERM & TERMINATION

13.1 This Agreement shall come into effect on September 1, 2025 (the "Effective Date"), and unless earlier terminated in accordance with the terms hereof, shall terminate August 31 2029. In the event that the Research Plan is funded in part by any federal or provincial agency or other government institution, the term of this Agreement shall, at a minimum, be equal in duration to the period of the agency award. Upon request the University shall forthwith provide to the Client duration of the period of such agency award.

13.2 This Agreement may be terminated by either party upon sixty (60) days written notice to the other party. Such termination will reflect in the termination of the Client's participation in the Research Plan, but not the termination of the Research Plan which shall continue with the other NSERC Sponsors.

13.3 Upon termination of this Agreement by either the Client or the University, the University will be reimbursed by the Client for all costs and non-cancellable commitments incurred by the University in the performance of the Research Plan, such reimbursement not to exceed the total estimated expenses set forth in Section 3.1.

13.4 Termination as set forth in this Article 13 shall not relieve any of the parties of any obligations accrued under this Agreement prior to the date of termination. Each of Articles 5 (Equipment), 6 (Confidentiality), 7 (Intellectual Property), 8 (Publication), 9 (Indemnity), 14 (General Provisions), Sections 10.2 and 10.3 (Disclaimer), 10.4 (Limitation of Liability), 13.3 (Reimbursement for expenses), and 13.4 (Survival) shall survive termination of this Agreement.

ARTICLE 14 – GENERAL PROVISIONS

14.1 The Client shall not use the name, or any variation, adaptation, abbreviation, trademark or other, of the University, nor the name of any member of the University's staff or governors, in any publicity without the prior written approval of an authorized representative of the University. Subject to Section 14.2, the University will not use the name of the Client, or any variation, adaptation, abbreviation, trademark or other, nor the name of any employee of the Client, in any publicity without the prior written approval of the Client.

14.2 The University may at its own discretion provide a brief listing of this Research Plan as part of any public statement disclosing research taking place at the University. Such disclosure may include, but is not limited to, the title of the Research Plan, the name of the Client, the name of the Principal Investigator, and the amount of funding.

14.3 The parties are independent parties and nothing in this Agreement shall constitute either party as the employer, principal or partner of or joint venturer with the other party. Neither party has any authority to assume or create any obligation or liability, either express or implied, on behalf of the other.

14.4 Any notice pursuant to this Agreement shall be in writing and shall be given by hand delivery or sent by registered mail, courier, email or facsimile addressed to the other party at the address set out below or to such other person or address as the parties may from time-to-time designate in writing delivered pursuant to this notice provision. Any such notices, requests, demands or other communications shall be received and effective: (a) upon the date of delivery if delivered personally; or (b) on the date of receipt of confirmation by answer-back, in the case of mail, email or facsimile.

University:

Laura Grafton, Grants and Contracts Manager Research Partnerships
University of Waterloo
Office of Research
200 University Avenue West
Waterloo, Ontario N2L 3G1
E-mail: llgrafton@uwaterloo.ca with a CC to Or-contracts@uwaterloo.ca

Client:

Brad Kowaleski
City of Kitchener
4th Floor, Procurement Services
200 King Street West, Kitchener, Ontario
N2G 4G_
Brad.Kowaleski@kitchener.ca

14.5 For this Agreement, neither the Client nor the University shall be liable to the other for any failure or delay in performance by circumstances beyond its control, including but not limited to, acts of God, fire, labour difficulties or governmental action.

14.6 Unless otherwise specified in this Agreement, this Agreement and the schedules attached hereto shall supersede all documents or agreements, whether written or oral, in respect of the subject matter thereof. For greater clarity, no direct or indirect separate arrangement, whether oral or written, with the Principal Investigator or other person, involving any component of the work to be performed, is permitted unless prior agreement, in writing, is given by the authorized signing authorities of the Client and the University. The Client acknowledges and agrees that the University provides no insurance coverage whatsoever to faculty members or other university persons who may provide direct or independent services relating to this Agreement.

14.7 The terms herein stipulated may not be modified in any way without the mutual consent of the Client and the University in writing given by their authorized signing authorities.

14.8 This Agreement shall not be assigned by either the Client or the University without the prior written consent of the other party, such consent not to be unreasonably withheld. The University and the Client shall not subcontract any work to be performed under this Agreement without the prior written consent of the federal or provincial agency or other government institution, as applicable, and the other party (such consent not to be unreasonably withheld).

14.9 In the event that a translation of this Agreement is prepared and signed by the Client and the University for the convenience of the Client, this English language version shall be the official version and shall govern if there is a conflict between the two.

14.10 This Agreement shall be governed by and construed in accordance with the laws of the Province of Ontario and the laws of Canada applicable therein.

14.11 This Agreement may be executed digitally, and/or electronically, and may be transmitted digitally, and/or electronically, in any number of counterparts, each of which upon execution and delivery shall be considered an original for all purposes; provided, however, all such counterparts shall, together, upon execution and delivery, constitute one and the same instrument.

14.12 The following appendices are attached to and form part of this Agreement:

Schedule A – Research Plan

Schedule B – Research Personnel and Student Agreement

Schedule C – University Background Intellectual Property

IN WITNESS WHEREOF the Client and the University hereto have executed this Agreement in a legally binding manner.

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)
)
)

UNIVERSITY OF WATERLOO

Per: _____

Name: Erin Windibank

Title: Sr. Manager

I/We have the authority to bind the corporation

_____

Date

The City of Kitchener

)
)
)
)
)
)
)
)
)

Per: _____

Name:

Title:

I/We have the authority to bind the corporation

_____

Date

Acknowledgment and Consent of Principal Investigator

I, having read this Agreement, hereby agree to comply with all the terms and conditions contained herein and further agree to ensure that all University Research Personnel and Students who are involved in the Research Plan are informed of their obligations under the provisions of this Agreement and have acknowledged and consented by signature of a Research Personnel and Student Agreement (Schedule B).

_____ Date: _____

David Del Rey Fernandez, Professor

SCHEDULE A

RESEARCH PLAN

Deliverables for optimized infrastructure planning through simulation and AI driven gas pipe-network digital twin growth scenario prediction research program

Natural gas pipelines are critical infrastructure in municipalities, as residents use natural gas furnaces to provide domestic hot water and heating. To ensure reliable, accessible, and affordable gas supply, pipeline network upgrade and modification need to be carefully planned. On the one hand, dated pipelines should be upgraded in a timely and cost-effective manner to maintain a reliable gas supply to current customers and avoid costly infrastructure failures. On the other hand, new pipelines need to be laid to adapt to the change in population and its density in different neighbourhoods in a municipality, while maintaining adequate gas supply pressure in the entire network. Both pipeline upgrade and modification require significant investment from a municipality, but decisions are difficult to make. This results from uncertainties in real estate development, population change, local industry development, consumers' gas utilization patterns, and electrification (e.g., heat pumps), etc., which create further uncertainties in future gas demand. These uncertainties make the decision to upgrade and modify pipeline network very difficult without a full picture of all possible options. In such a complex decision-making situation with uncertainties, it is useful to implement mathematical and artificial intelligent tools to explore a wide range of options and provide useful decision-making metrics.

Objective: The overall objective is to develop the mathematics, algorithms, software tools, and write reports to support data-driven decision making for gas pipeline network upgrade and modification. The software tools will provide simulation capabilities to predict, for example, maintenance costs, pipeline performance (e.g., pressure distribution) while accommodating the uncertainties in gas demands. The reports will provide analysis to drive decision making regarding, for example, growth scenarios, optimal placement of sensors, etc. This objective will be accomplished through three interdependent research pillars and deliverables described below, where research pillar one provides the mathematics, algorithms, and software to drive pillars two and three. Such research shall be conducted by a minimum of three (3) graduate or post doctoral students.

Research Pillar 1: Gas pipe network digital twin
This research pillar is aimed at developing core simulation software capabilities to 1) build a digital twin of the city's pipe network, 2) simulate changes to the network under different growth scenarios, and 3) provide optimal sensor placement to develop predictive models.

Deliverable 1: Software for modular multi-fidelity physics-based simulation tool for gas pipe networks with data assimilation capabilities. This will be accomplished by developing simulation capabilities with different fidelity levels ranging from machine learning reduced-order modelling techniques, one-dimensional models, through three-dimensional models for pipe segments. To enable coupling of multi-fidelity models as well as rapid network modification, the various pipe segment models will be coupled using the port-Hamiltonian approach.

Deliverable 2: Algorithms and software for optimal sensor placement.

Research Pillar 2. Growth modelling and optimization
This research pillar aims to model future gas demand under different scenarios of residential, commercial, and industrial development, and potential gas-electrical grid energy integration.

Deliverable 3: Software to examine different growth scenarios.

Deliverable 4: Technical report examining different growth scenarios and demand and their implication on infrastructure investment.

Deliverable 5: Technical report on optimal placement of different sensors with similar cost and compare their utility.

Research Pillar 3. Maintenance assessment modelling

This research pillar aims to investigate two critical areas: a) investigate how to model corrosion in metal pipes and degradation in plastic pipes. The outcomes of these studies will inform future modelling activities to improve the simulation software in Pillar 1. And, b) evaluate current data from sensors and other modalities for their predictive capacity, and evaluate the potential of new and existing sensors for improving predictive capabilities.

Deliverable 6: Consolidate all existing data and documentation into a centralized database, and apply machine learning models to assess the predictive capability of the current information for pipe corrosion.

Deliverable 7: Develop a numerical model, informed by laboratory experimental data, to asses the reliability of current resistivity measurements in evaluating the condition of pipe cathodic protection coatings.

Deliverable 8: Technical report evaluating the effectiveness and cost-efficiency of available sensors for predicting metal pipe corrosion.

Deliverable 9: Technical report that reviews and evaluates available sensors for assessing the degradation of plastic pipes, with a focus on the trade-off between cost and predictive effectiveness.

SCHEDULE B

RESEARCH PERSONNEL AND STUDENT AGREEMENT

WHEREAS the University of Waterloo and the Client are parties to a Sponsored Research Agreement number # 107616 to which this Research Personnel and Student Agreement is appended; and

WHEREAS the undersigned is associated with the University of Waterloo and will be involved in the Research Plan defined by the Sponsored Research Agreement;

NOW THEREFORE, in consideration of information and facilities made available to me in connection with my work in relation to the Research Plan and other valuable consideration, I agree that:

1. **Defined Terms.** All terms denoted with initial capital letters herein shall have the meanings ascribed to them in the Sponsored Research Agreement.

2. **Reasonable Efforts.** I will use all reasonable efforts to achieve the objectives and deliverables defined in the Article 2 of the Sponsored Research Agreement for those activities in which I am involved.

3. **Research Results** I will co-operate fully and in good faith in discussion and agreement with all conditions regarding Research Results as set forth in Article 7 of the Sponsored Research Agreement.

4. **Confidential Information.** In accordance with Article 6 of the Sponsored Research Agreement, I will keep confidential all of the Confidential Information that I may receive.

5. **Publications.** I will comply with all publication conditions that are set out in Article 8 of the Sponsored Research Agreement.

6. **Ownership**. I understand that ownership of and rights to any Research Results shall be determined in accordance with Article 7 of the Sponsored Research Agreement, as per Article 3(A) (third bullet) of the *University of Waterloo Policy #73 (Intellectual Property Rights)*.

7. **Invention Disclosure.** I shall keep the University and the Principal Investigator fully and promptly informed on an on-going basis of the development of Research Results and shall not take any steps with respect to filing intellectual property protection for any Research Results without prior consultation with the University.

8. **Cooperation in Patent Matters.** I will cooperate fully in the signing of documents and taking such other steps as may be reasonably requested to obtain and maintain patent and other intellectual property protection for the Research Results relating to the Sponsored Research Agreement and in connection with any infringement action in any way relating to said Research Results, and I will

sign all documents and do all things necessary or proper to give effect to this Research Personnel and Student Agreement and any rights granted by the University under the Sponsored Research Agreement.

9. **Acknowledgement.** I have obtained or have been afforded the opportunity to obtain independent legal advice with respect to this Research Personnel and Student Agreement and all documents and transactions related thereto and I fully understand the nature and consequences of this Research Personnel and Student Agreement and all documents and transactions related thereto.

By signing below, I indicate my acceptance of these terms.

____
Personnel/Student's Signature

____
Print Name

____
Date

Role in Research Plan (for statistical purposes only):

☐ Postdoc
☐ PhD Candidate
☐ Master's Student
☐ Undergraduate Student
☐ Other: ________________

____
Personnel/Student's Signature

____
Print Name

____
Date

Role in Research Plan (for statistical purposes only):

☐ Postdoc
☐ PhD Candidate
☐ Master's Student
☐ Undergraduate Student
☐ Other: ________________

____
Personnel/Student's Signature

____
Print Name

____
Date

Role in Research Plan (for statistical purposes only):

☐ Postdoc
☐ PhD Candidate
☐ Master's Student
☐ Undergraduate Student
☐ Other: ________________

_____
Personnel/Student's Signature

_____
Print Name

_____
Date

Role in Research Plan (for statistical purposes only):

☐ Postdoc
☐ PhD Candidate
☐ Master's Student
☐ Undergraduate Student
☐ Other: _____

_____
Personnel/Student's Signature

_____
Print Name

_____
Date

Role in Research Plan (for statistical purposes only):

☐ Postdoc
☐ PhD Candidate
☐ Master's Student
☐ Undergraduate Student
☐ Other: _____

_____
Personnel/Student's Signature

_____
Print Name

_____
Date

Role in Research Plan (for statistical purposes only):

☐ Postdoc
☐ PhD Candidate
☐ Master's Student
☐ Undergraduate Student
☐ Other: _____

SCHEDULE C

UNIVERSITY BACKGROUND INTELLECTUAL PROPERTY

The background IP consists of a partial differential equations simulation framework, written in Julia, that can be run on multiple hardware systems including CPU and GPU clusters.