Report of the Commissioner of Public Works
Update on Public Works Research and Innovation Program

1. Recommendation

1. Council authorize the Commissioner of Public Works to approve matters and execute agreements and other instruments to enable Public Works' Research and Innovation Program activities and initiatives.

2. The Regional Solicitor and General Counsel include this delegation of authority in the Delegation Bylaw in the next update to the Delegation Bylaw.

3. The Regional Clerk circulate this report to Clerks of local municipalities.

2. Purpose

To update Council on research and innovation projects undertaken by Public Works in 2023. As in previous years, this update highlights research and innovation activities related to service delivery for water, wastewater, waste management, forestry, energy conservation, roads, and transit programs.

Additionally, this report is requesting Council approval for delegated authority concerning Public Works' research and innovation program. This authority aims to enhance the Region's current capacity in this program area by reducing process burden for responding to research proposals and fostering collaboration with potential partners.

Key Points:

- By intent, Procurement and Delegation Bylaws limit the tools and parties staff can engage to conduct and participate in research activities. Recommendations above seek to broaden the category of instruments staff can sign and expands the types of parties the Region may enter into research agreements through the Delegation Bylaw. This will create the authority staff can leverage to enhance the Region's current capacity for delivering Public Works' research and innovation programs and allow for timely engagement

- Public Works' research and innovation program drives efficiencies, advances York Region's strategic priorities and provides direct benefits by:
  - Addressing operational challenges and business needs
  - Leveraging strong partnerships that help drive research and innovation resulting in cost savings and awards that recognize industry leadership
  - Developing a roadmap for enhancing procurement, food systems, reuse, and community capacity through Circular Cities research
  - Increasing surface resilience and advancing sustainability goals on road and intersection asphalt by reducing raw material needs
  - Reducing costs while enhancing survival of street tree assets through innovative technology solutions
  - Collaborating with partners to assess cost-saving measures for wastewater treatment
  - Increasing traveller and transit safety

3. Background

Streamlined processes enable a nimble response to engage in research and innovation

Research and innovation initiatives are enabled through various delegations of Council, including the Procurement Bylaw, which enables procurement when necessary, and the Delegation Bylaw when entering into agreements with institutions and other levels of government. Staff is seeking an amendment to the Delegation Bylaw to enable the Region to streamline execution of research and innovation agreements, instruments, and authorizations, where the budget permits.

Public Works continues to address business needs and operational challenges through research and innovation projects

Since 2008, staff have been engaged in research and innovation that supports protection of public health and the environment, while optimizing services to our residents. Public Works research continues to provide direct benefits to the Region by aligning with the Region's innovation mindset and vision to build strong, caring, and safe communities. Public Works pursued more than 30 research initiatives in 2023, driving process improvement efficiencies and new customer experience approaches that optimize community health and wellbeing for residents.

Strong partnerships help drive research and innovation resulting in awards that recognize our industry leadership

Public Works collaborates with various entities like research institutions, academia, industry, municipalities, and funding organizations to tackle challenges related to delivering essential services to York Region residents efficiently. In 2023, Public Works partnered with over 55 organizations to

explore new approaches, enhance understanding of emerging challenges, and improve processes. An emphasis on partnerships has facilitated implementation of solutions showing promising results.

Public Works received several awards in 2023, including Water Systems Challenge award from the Water Environment Federation for Inflow and Infiltration Machine Learning, and Project of the Year from Ontario Traffic Council for the Transportation Master Plan. These awards recognize the exceptional work of staff and highlight York Region's leadership in adopting technology and planning for long-term infrastructure.

4. Analysis

Research and innovation opportunities assist in the continual improvement of Public Works service delivery

Additional delegated authority will enable the Region to leverage resources to take advantage of funding and partnership opportunities and timely engagement in research and innovation activities. Research and innovation opportunities assist with continual improvement of Public Works services and helps sustain the Region's reputation with regulators and our residents.

Circular Cities research in 2023 yields roadmap for enhancing procurement, food systems, reuse, and community capacity

York Region was one of 12 municipalities selected across Canada to participate in the pilot Circular Cities and Regions Initiative research project. Completed in 2023, this project resulted in development of a roadmap to guide the Region's work on circular economy projects in key areas including circular procurement, sustainable food systems, reuse, and sharing economies. The initiative is an ongoing learning, capacity building and networking program for municipalities. Knowledge gained informed decision-making on circular economy initiatives proven to work in other jurisdictions and will increase the quality of circular economy initiatives Public Works delivers to residents. Specifically, it provided a tailored workshop for municipalities on circular procurement that helped Public Works to better understand and plan for work on the 30% baseline waste reduction research project.

Research on road and intersection asphalt will reduce raw material needs, increase surface resilience and advance sustainability goals

The Recycled Asphalt Pavement in Asphalt Mixtures project, led by Transportation Association of Canada, examines improvements to materials and road resurfacing techniques, and will be an integral part of operating sustainably. The project will help establish best practices for recycled asphalt pavement use that can be applied immediately, implementing a circular approach to paving roads. Implementation would result in a reduction of new raw materials to pave roads resulting in reduced greenhouses gas emissions.

Many ongoing research projects explore opportunities to find feasible solutions to reduce short and long-term operating and capital costs for the Region. A partnership with the University of Waterloo

for intersection pavement research is testing various asphalt mixes to establish performance specifications to ensure pavement at intersections is resilient to high traffic volumes. The purpose of this research is to reduce the frequency of intersection pavement replacement resulting from current and future climate projections, while maintaining or enhancing performance and safety measures.

Innovative technology solutions reduce costs and enhance survival of street tree assets

Technology is an important tool used to manage Regional green assets. In 2023, a pilot to monitor and optimize landscaping watering needs was initiated at three sites across Highway 7 in the cities of Vaughan and Richmond Hill. The pilot provided real-time data on plant moisture which reduced the need for staff to manually monitor moisture levels. Data gathered from this pilot will lead to process improvements that will reduce manual monitoring and trigger watering activities only when necessary. The pilot has demonstrated an opportunity to further reduce costs associated with plant replacement. Overall, the pilot will help the Region's efforts to increase plant survivability, maintain the streetscape, and reduce costs.

Collaborating with partners to assess cost-saving measures for wastewater treatment

The benefits of partnership are further exemplified through the partnership with the Ministry of Environment, Conservation and Parks on the Advanced Biological Nutrient Removal/Recovery Demonstration Pilot at the Kleinberg Water Resource Recovery Facility. The Ministry of Environment, Conservation and Parks is fully funding the demonstration pilot to evaluate effectiveness of algae-based wastewater treatment technologies for nutrient removal. The objective is to leverage algae as an innovative, cost-effective way to remove phosphorus and nitrogen from wastewater effluent.

Research projects aim to increase traveller and transit safety

Researching short and long-term solutions enable staff to find new approaches to plan, design and operate a safer transit system. For example, Public Works has partnered with intelligent transportation system companies to pilot technology on York Region Transit buses to monitor and provide alerts to help maintain driver focus. This technology has potential to improve driving techniques by reducing sudden braking and swerving, potentially increasing traveller and road safety.

Public Works research and innovation is helping to advance York Region's strategic priorities

In 2023, over 30 projects were being actively advanced to continually improve delivery of Public Works' services and align with York Region's strategic priorities. All projects reflect a balance of potential outcomes that span all Strategic Plan Areas of Focus. Appendix A summarizes key projects and alignment with York Region's Strategic Plan Areas of Focus. Descriptions for complete, ongoing, and new projects are described in Appendix B.

5. Financial Considerations

Research and innovation program funding is included in the approved 2024 budget and outlook for 2025-2026. Partnerships leverage available external funding to increase the total value of research and innovation investment, maximizing the impact of York Region's contribution. In addition to direct funding, the Region provides in-kind resources to achieve project outcomes – for example direct staff involvement and allocating space at facilitates are valuable contributions to facilitating research.

In 2023, Public Works engaged in research and innovation projects with an assessed value of $10.9 million. This total includes funding from upper levels of government, in-kind staff participation, and other contributions from partners. Out of this total, the Region's direct funding to advance projects is estimated at $1.9 million, which corresponds to approximately 17% of the overall value represented by these projects.

6. Local Impact

This program provides benefits to local municipalities by sharing and leveraging partnership opportunities to improve service delivery. Collaboration with local municipal staff helps leverage expertise, distribute knowledge, and develop common solutions for informed decision-making.

7. Conclusion

This report requests Council to authorize the Commissioner of Public Works to approve matters and execute agreements and other instruments to further enable Public Works research and innovation activities in a streamlined manner.

This report also provides Council with an update on research and innovation undertaken by Public Works in 2023. It demonstrates the Region's leadership engaging in research to improve operations delivered by Public Works in alignment with the Region's Strategic Plan priority areas.

For more information on this report, please contact David Szeptycki, Director, Sustainability, Communications and Innovation at 1-877-464-9675 ext. 75723. Accessible formats or communication support are available upon request.

Recommended by: **Laura McDowell, P.Eng.**
                    Commissioner of Public Works

Approved for Submission: **Erin Mahoney**
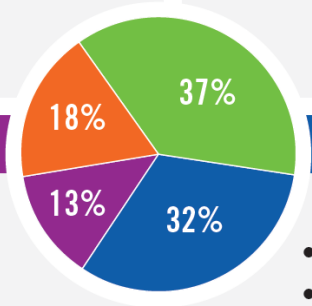Chief Administrative Officer

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Appendix A – 2023 Research and Innovation Highlights
Appendix B – 2023 Research and Innovation Projects List

2023 Research and Innovation Highlights

PARTNERSHIPS	**55+ PARTNERS** 🤝 from academia, industry and municipalities

PURPOSE	📖 **RESEARCH**	"The creation of new knowledge and/or the use of existing knowledge in a new and creative way so as to generate new concepts, methodologies and understanding"
	💡 **INNOVATION**	"The application of new ideas resulting in increased value to customers and/or increased productivity or reduced costs."

Research Focus Areas

💗 Healthy Communities

- Granular activated carbon core resting
- Measuring park traffic
- Testing tertiary UF membranes at low temperatures

7 PROJECTS TOTAL
0 Starting in 2024 « **7** Ongoing « **0** Completed

🌿 Sustainable Environment

- Biological controls for dog-strangling vine
- Algae to reduce phosphorus in wastewater
- Recycled asphalt pavement in asphalt mixtures

14 PROJECTS TOTAL
3 Starting in 2024 « **11** Ongoing « **0** Completed

Pie chart: 37%, 32%, 13%, 18%

📊 Economic Vitality

- Flood risk assessment model
- Pavement deficiency system
- Resource recovery baseline study

5 PROJECTS TOTAL
0 Starting in 2024 « **3** Ongoing « **2** Completed

🏛 Good Government

- Intersection pavement research
- Microsurfacing Treatment Options for Pavement
- Precursor to Digital Twin

12 PROJECTS TOTAL
3 Starting in 2024 « **7** Ongoing « **2** Completed

Research & Innovation Spotlight

Precursor to Digital Twin
(Water/Wastewater)

Study to create a Digital Twin program of the water system and gap analysis of data required

ChatBot AI
(Transit)

The study will assess if the AI technology can automatically provide customers with real-time bus departure information

Hortau project
(Transit)

Using new technology to reduce costs and staff time while supporting street tree maintenance

Recycled Asphalt Pavement in Asphalt Mixtures (Roads)

Utilizing recycled asphalt pavement (RAP) with the goal of achieving net-zero emissions. RAP conserves natural resources, reduces landfill waste, and minimizes energy consumption.

2023 Research and Innovation Projects List

COMPLETED RESEARCH IN 2023 ✓			
Economic Vitality	Healthy Communities	Sustainable Environment	Good Government
AREA OF FOCUS	**RESEARCH PROJECT**	**PARTNER(S)**	**RESEARCH BENEFIT**
📈	Water Reuse/Resource Recovery from Wastewater Effluent Economic Assessment	Hatch Ltd.	Assess feasibility of developing a water reuse program from groundwater dewatering and wastewater effluent sources
📈	Circular Cities and Regions Initiative	Federation of Canadian Municipalities, National Zero Waste Council, Recycling Council of Alberta, Recyc-Quebec and various municipalities	First phase of the research resulted in development of a roadmap to focus the Region's work on circular economy projects, policies and research in key areas of sustainable food systems, reuse and sharing, increasing community capacity, circular procurement and asset management and built environment. Ongoing participation will enable York Region to collaborate on common challenges and share work to encourage others
🏛	Measuring the Impact of Utility Driven Innovation Investments and Programs	Arcadis and various other North American utilities	Provides tactics for utility innovation leaders to advance innovation opportunities from staff to address business problems
🏛	Technology pilot to monitor and optimize water management of landscaping	Hortau Inc., Sustainability Development and Technology Canada	Monitors moisture levels to reduce staff time from manual validation and reporting; saves water by watering when and where required; reducing the cost of replacing dead plants; and ensure healthy growth of landscaping

ONGOING RESEARCH IN 2024

	Economic Vitality	Healthy Communities	Sustainable Environment	Good Government

AREA OF FOCUS	RESEARCH PROJECT	PARTNER(S)	RESEARCH BENEFIT
	Flood Risk Assessment Model Development for Infrastructure in York Region	LEA Consulting	Maps flood impacts on public and private infrastructure to assess high risk zones in the Region to be prioritized in climate change adaptation planning.
	Pavement Deficiency System – Pilot for signs and pavement marking	CityRover Inc.	Uses image capture and analytics with artificial intelligence to properly identify and report issues. This system integrates with asset management systems to automatically create service requests to be actioned, removing a manual process
	Resource Recovery Baseline Study for select service areas	Cambium, Inc.	Baseline study will apply a 'circular economy' lens to determine how to reduce, reuse and recover resources generated by selected Regional lines of business
	Emerging Substances of Concern Prioritization Pilot Project	McGill University	Develop and execute a pilot parameter prioritization and water sampling prioritization program to enhance York Region's knowledge of the presence of key emerging substances of concern
	Wastewater Surveillance	Universities of Waterloo and Ottawa, Province of Ontario, Public Health Ontario, Public Health Agency of Canada, and several Ontario municipalities	Provide wastewater samples and advance detection of viruses such as COVID-19 and influenza in wastewater. The program partnership enables analysis of the presence of variants of concern detected in wastewater
	Granular activated Carbon Core Sample Challenge Testing	Drinking Water Research Group, WSP	Testing of granular activated carbon adsorptive capacity to remove by-products from drinking water

AREA OF FOCUS	RESEARCH PROJECT	PARTNER(S)	RESEARCH BENEFIT
	Microplastics in sewage sludge exploration and detection	York University (Lassonde School of Engineering)	Measuring new approaches to address microplastics and their impact on wastewater treatment systems and advance understanding of their prevalence and fate
	Cyanotoxin control strategies in drinking water	Drinking Water Research Group, Hamilton, Union Water, Durham, and Niagara	Evaluating effectiveness of granular activated carbon and other treatment processes to remove cyanotoxins, as well as developing monitoring tools for improved response to harmful algal blooms growing in proximity to water intakes
	Measuring Park Traffic	SmartCone	Assessing York Region Forest visitor traffic to understand volume and type of users
	Mitigation of Fouling of Tertiary Ultrafiltration Membranes at Low Temperatures	University of Waterloo	This study will examine alternative operating strategies that will reduce clogging and thereby reduce the need for extra energy and chemical consumption under these operating conditions.
	Greening the Landscape Consortium	Vineland Research and Innovation Centre	Supports urban greening research by setting priorities reflecting industry needs and supporting economic success
	Biological controls for dog-strangling vine	Silv-Econ Ltd., Agriculture and Agri-Food Canada	Tests biological control informing management of the invasive species dog-strangling vine and protects York Region forests and biodiversity
	Monitoring and mitigation of mussel impact to treatment facilities	Drinking Water Research Group	Research on protecting water treatment infrastructure
	Microplastics sampling from plastics manufacturers	Ministry of the Environment, Conservation and Parks	Sampling program to understand loading to sanitary sewer from different plastic manufacturers.

AREA OF FOCUS	RESEARCH PROJECT	PARTNER(S)	RESEARCH BENEFIT
	Net Zero GHG Emissions Design for York Region's Wastewater Projects	GHD	Results will be used by Public Works to assess feasibility of net zero designs or/and retrofits of existing and new Water Resource Recovery Facilities
	Trees and their socio-ecological effects	University of Toronto	Improves understanding of the social and ecological benefits of urban trees by quantifying how much social and ecological benefit is lost when trees are removed
	Carbon sequestration study adjacent to Holland Landing Lagoons	Lake Simcoe Region Conservation Authority (LSRCA)	The study will assess the viability of lagoons as a carbon sink for the Region.
	Development of sustainability key performance indicators (KPI's) for internal operations of Public Works, York Region	York University	The research will produce a set of criteria to measure sustainability for internal operations of Public Works, broken down for selected service lines: Corporate Fleet Management; Energy Conservation; Wastewater; and Forestry
	Kleinburg WRRF Advanced Biological Nutrient Removal/Recovery Demonstration Pilot	Ministry of the Environment, Conservation and Parks Gross-Wen Technologies	This demonstration pilot will evaluate the effectiveness of algae-based wastewater treatment technologies for nutrient removal
	Navigating One Water Planning through Municipal Water Programs: Meeting Multiple Objectives and Regulatory Challenges (Project 5175)	Water Research Foundation (WRF); HDR Engineering, Inc.	This project will provide the water sector with a utility-facing One Water Planning guidance document to identify, prioritize and implement interconnected strategies across all phases of the urban hydrologic cycle, while meeting regulatory requirements, environmental objectives, and community priorities.
	Requirements for Quantification of Greenhouse Gas Emissions and Evaluation of Reduction	GHD	This project will contribute to the Region's larger body of climate change work to help reduce GHG emissions. Furthermore, including the quantification of emissions in the evaluation of alternatives during

AREA OF FOCUS	RESEARCH PROJECT	PARTNER(S)	RESEARCH BENEFIT
	Opportunities in Water and Wastewater Infrastructure Capital Delivery		upfront planning and design will help integrate climate change mitigation into investment decision-making for York Region water and wastewater infrastructure assets.
🏛	Pipe Reactor and Pipe Loop Study	Drinking Water Research Group, Town of Newmarket	Developing a bench scale pipe loop equivalent that can accurately emulate distribution system conditions including flows, sheer force, etc.
🏛	Driver Monitoring System	Intelligent transportation system companies	York Region Transit is piloting a facial scanning technology for bus operators that can monitor and provide alerts to help drivers maintain focus.
🏛	Electric bus management (electromobility)	INIT	MOBILEcharge optimizes fleet charging based on operational requirements and has several benefits: avoids expensive peak loads, delivers predictive analytics to optimize tariffs and prolongs the battery life
🏛	Precursor to Digital Twin	CIMA+	Study to create a Digital Twin program of water system and gap analysis of data required
🏛	Intersection Pavement Research	University of Waterloo	Tests performance of various asphalt mixes to establish preliminary performance specifications that ensures pavement at intersections is resilient to high traffic volumes and the impacts of changing weather conditions due to climate change.

AREA OF FOCUS	RESEARCH PROJECT	PARTNER(S)	RESEARCH BENEFIT
	Microsurfacing and Thin Overlay Treatment Options for Pavement Preservation	Internal project	Compares the performance of pavement preservation treatments, including microsurfacing and thin overlay. This helps the Region make data driven decisions that support investments in pavement from a long-term asset management lens. Pavement is one of the highest value transportation assets with a replacement value of $2.46 billion.
	ChatBot AI	Comm100	The study will assess if the AI technology can provide customers with real-time bus departure information and provide answers to other inquiries.

NEW RESEARCH STARTING IN 2024

	Economic Vitality	Healthy Communities	Sustainable Environment	Good Government

AREA OF FOCUS	RESEARCH PROJECT	PARTNER(S)	RESEARCH BENEFIT
	Recycled Asphalt Pavement in Asphalt Mixtures	Transportation Association of Canada	The project would develop a practice-ready guideline on the use of Recycled Asphalt Pavement (RAP) in asphalt mixtures that can be applied immediately by Canadian transportation agencies. The guideline would be based on effective agency practices and input from industry leaders, and would address material management, mixture design, plant production, and laydown of asphalt mixes produced with RAP to ensure proper performance.
	Maximizing and Accounting for the Value of Natural Assets and Green Infrastructure at Watershed Scale (WRF 5253)	Water Research Foundation	This project will outline benefits of a natural asset management system and solution for utilities and water resource managers and incorporate assessment metrics into natural assets, which will provide a more complete accounting framework that can be scaled up to watershed and community levels, including initial capital investment and long-term impacts.
	Gearing up for Resourcing of Organic Fraction of Municipal Solid Waste (OFMSW) in a Circular Economy Mode	York University (Lassonde School of Engineering)	This research project will focus on: 1) Research and Innovation recovery and valorization of OFMSW 2) Technology integration to enhance OFMSW valorization 3) Life cycle analysis assessment of waste management strategies and database development that addresses the pressing bioeconomy issues of Canada with a particular interest in developing sustainable circular bioeconomy concepts to meet the environmental and waste management challenge of the next few decades via an interlinked research framework

	Predicting water demand based on historical data	Triple Point Solutions Inc	This pilot project will explore using Supervisory Control and Data Acquisition (SCADA) data and historical water demands to predict future water demands
	Validation of an Integrated Framework of Wastewater and Stormwater Treatment Options of constituents of emerging concern (WRF 5244)	Water Research Foundation	Project will address current research gaps in the One Water framework such as analytical techniques and screening tools, characterization and predictive modeling, and potential health impacts.
	Approaches to Build Strong Partnerships and Solidify Successful Interagency Reuse Projects (WRF 5052)	Water Research Foundation	This research will identify characteristics of successful inter-agency water reuse projects that identify the characteristics of partnerships that strengthen reuse project planning and the characteristics of those projects that lent themselves to successful collaboration.