City of Kingston
Report to Council
Report Number 24-230

To:	**Mayor and Members of Council**
From:	**Paige Agnew, Commissioner, Growth & Development Services**
Resource Staff:	**Brandon Forrest, Director Business, Real Estate and Environmental**
Date of Meeting:	**September 17, 2024**
Subject:	**Municipal Support for Carbon Storage Through Enhanced Rock Weathering Program**

Council Strategic Plan Alignment:

Theme: 2. Lead Environmental Stewardship and Climate Action

Goal: 2.2 Support climate action and sustainability for residents, businesses and partners.

Executive Summary:

Enhanced rock weathering (ERW) is a process by which atmospheric carbon dioxide (CO2) can be captured and trapped through chemical reaction with minerals within certain types of rock. The use of ERW is an emerging and scientifically robust method for durable removal of atmospheric carbon dioxide. There is a relatively large and concentrated deposit of a favorable ERW mineral, wollastonite, located within Kingston. Representatives from the owners of the deposit, Canadian Wollastonite, have created a program whereby crushed wollastonite is placed on agricultural lands which allows capture of CO2 while providing pH and structure enhancements to the soils that benefit the agricultural operation.

Canadian Wollastonite's proposed program aims to provide wollastonite amendment at no cost to agricultural receiving sites. To achieve this, they require approximately $10 per tonne to cover costs related to transportation of the material to receiving sites. This report recommends the development of a municipal support program that will provide support to participating agricultural operators within the City of Kingston so that a portion of their material transportation costs can

be rebated annually. The proposed municipal support program is intended to provide rebates for two years so that the start-up of the ERW program is assisted and local agricultural operators can gain familiarity with the program.

With approximately 30,000 acres of agricultural land in Kingston, the program has the potential to provide up to 375,000 tonnes of durable and verified GHG capture over the next 10 years while also providing improved agricultural soils and agricultural productivity.

The proposed municipal support program would require $100,000 each year for two years and is expected to generate up to 24,000 tonnes of CO_2 capture.

The proposed municipal support program will also seek to increase wollastonite application by receiving and spreading material on up to 200 acres of open space lands owned by the City annually for three years. The City would be responsible for transportation costs to receive wollastonite at the receiving sites which is expected to cost approximately $4,000 per year in each of the three years.

Recommendation:

That Council approve contribution up to $212,000 to be funded from the Environment Reserve Fund to enable the City's participation in and support of Canadian Wollastonite's enhanced rock weathering carbon capture program during 2025 to 2027; and

That staff provide an annual report back to Council that documents the number of acres of supported agricultural application and estimates of resultant carbon dioxide capture and storage.

Authorizing Signatures:

ORIGINAL SIGNED BY COMMISSIONER

Paige Agnew, Commissioner,
Growth & Development Services

ORIGINAL SIGNED BY CHIEF

ADMINISTRATIVE OFFICER

Lanie Hurdle, Chief
Administrative Officer

Consultation with the following Members of the Corporate Management Team:

Jennifer Campbell, Commissioner, Community Services	Not required
Neil Carbone, Commissioner, Corporate Services	Not required
David Fell, President & CEO, Utilities Kingston	Not required
Peter Huigenbos, Commissioner, Major Projects & Strategic Initiatives	Not required
Brad Joyce, Commissioner, Infrastructure, Transportation & Emergency Services	Not required
Desirée Kennedy, Chief Financial Officer & City Treasurer	

Options/Discussion:

Enhanced rock weathering (ERW) is a process by which atmospheric carbon dioxide (CO_2) can be captured and trapped through chemical reaction with minerals containing calcium or magnesium silicates. The use of ERW is an emerging and scientifically robust method for durable removal of climate change causing CO_2. Most ERW projects utilize reactive basalt rock because of its relative abundance globally; however, some rarer minerals such as wollastonite, a calcium silicate, provide much greater CO_2 capture reaction rates and capacities through the ERW process. There is a relatively large and concentrated deposit of wollastonite located within Kingston near Seeley's Bay (the St. Lawrence deposit).

Representatives from the owners of the deposit, Canadian Wollastonite, have approached City staff, the district councilor and KEDCO and requested consideration of municipal support to assist in implementation of a program that would see crushed wollastonite spread over participating agricultural lands within Kingston where it would allow durable and quantifiable capture of atmospheric CO_2 while providing beneficial pH and structure enhancements to receiving soils.

Canadian Wollastonite's proposed program aims to provide wollastonite amendment at no cost to agricultural receiving sites. To achieve this, they require approximately $10 per tonne to cover costs related to transportation of the material to receiving sites. This report proposes a municipal support program that rebates a maximum of $5/tonne for transportation costs back to receiving agricultural operators. A $5/tonne of Wollastonite rebate equates to a subsidy cost for carbon capture of approximately $8 per tonne CO_2 which is significantly lower than many other common methods of CO_2 avoidance or capture. Canadian Wollastonite is proposing to place 40,000 tonnes of wollastonite on to Kingston farms over a two-year period (20,000t/yr) which, if supported by the City, would require a municipal rebate cost of $100,000 in each year and produce a carbon capture of approximately 24,000 tonnes CO_2 over a three-year weathering period. Following the initial two-year municipal rebate period, the program is expected to have achieved acceptance by the local agricultural community and will not require the municipal rebate to continue.

With approximately 30,000 acres of agricultural land in Kingston, the program has the potential to provide up to 375,000 tonnes of durable and verified GHG capture over the next 10 years while also providing improved agricultural soils and agricultural productivity. If the program becomes successful over the longer term, Canadian Wollastonite will provide support for Kingston's climate action initiatives via tree planting or other yet to be determined contributions.

The wollastonite amendment is verified as safe and has been registered with the Canadian Food Inspection Agency (CFIA) and certified as an organic approved input in both Canada and US through the Organic Materials Research Institute (OMRI).

The City may be able to leverage its support for the program with grant funding from FCM Green Municipal Fund or other grant funding agencies. If municipal support for this program is approved, staff will initiate applications to leverage City support.

Enhanced Rock Weathering to Capture GHGs

The process of using rock materials to capture GHGs and store them in mineral form is known as enhanced rock weathering (ERW) and is an accepted method of carbon capture. ERW projects typically use reactive basalt rock because of its favourable mineralogy and because of its relative abundance. In the ERW process, naturally occurring calcium and magnesium silicates in the basalt rock react with atmospheric CO_2 in rainwater to create stable bicarbonates that lock the carbon away from the atmosphere. The process relies upon the weathering breakdown of the added rock and so is slow (years); but the speed of the process is "enhanced" by crushing the basalt rock to a fine grain size. Capture of CO_2 through ERW is regarded as durable because it can reliably store atmospheric carbon for thousands of years.

Less common deposits of minerals such as wollastonite (a calcium-magnesium silicate) can also be used for ERW and provide much greater capacities and rates of CO_2 capture because of the purity and abundance of the calcium and magnesium chemistry relative to basalt rock.

The St. Lawrence Wollastonite deposit straddles the border between the City of Kingston and the Township of Leeds and Thousand Islands and contains over 17 million tonnes of high purity wollastonite ore. The deposit is owned by Canadian Wollastonite who are proposing to utilize crushed wollastonite as an agricultural soil amendment that will provide durable (>10,000 years) capture of atmospheric CO_2 while also providing soil chemistry and structure benefits that can improve agricultural yields.

Canadian Wollastonite's Proposed Carbon Capture Initiative

Canadian Wollastonite is proposing to market the use of wollastonite as an agricultural soil amendment to Eastern Ontario farm operators and generate revenue through the production of verified durable carbon offset credits. By targeting local agricultural lands rather than more distant parts of the province (e.g. SW Ontario, northern US, etc.), transportation costs and related emissions can be minimized. Verification research undertaken for Canadian Wollastonite by the Yale University Centre for Natural Carbon Capture has estimated that each tonne of crushed wollastonite applied can provide a durable (>10,000 years) capture of up to 0.6 tonnes of CO_2 over a weathering period of 36 months (approx. 0.2 tonnes CO_2 per year per tonne of wollastonite applied). An overview of Canadian Wollastonite's agricultural application program is provided in Exhibit A.

Canadian Wollastonite has partnered with UNDO Carbon Ltd. to market verified carbon credits produced from their proposed ERW initiative to companies wishing to purchase verified and durable carbon credits. Canadian Wollastonite and UNDO will utilize verification standards developed by a third party (PURO Earth) so that the quantities of carbon storage achieved can be measured and verified with accuracy and precision. The result of this will be rigorously verified carbon capture quantities that can be relied upon by the carbon credit market and by the City and others providing support for the proposed program.

The program aims to gain local acceptance by supplying and spreading the beneficial soil amendment on local agricultural lands at no cost to the farmer in the initial two-to-three-year

start-up period. Receiving sites are expected to cover the cost of trucking the wollastonite from the mine site near Seeley's Bay to the receiving property.

Placement of wollastonite is being proposed as a replacement for more traditional applications of lime that are used to create optimal soil pH conditions for agriculture. Canadian Wollastonite is asking the City to consider providing a subsidy to local farmers who use the amendment so that they are able to recover some of the transportation costs during a two-year start-up period.

The use of wollastonite is not something that local agricultural operators have experience with, and once the 2-year start-up period has been completed it is expected that local agricultural operators will be able to confirm the benefits provided by the amendment and the City's proposed transportation subsidy will no longer be needed.

Canadian Wollastonite has approached City staff to request the City's consideration of support for the carbon capture program by rebating a portion of the transportation costs back to participating farm operators. Canadian Wollastonite is proposing to deliver 40,000 tonnes of wollastonite to Kingston farms over an initial two-year period. The per tonne cost to transport wollastonite will be dependent on actual distance from mine to farm but on average is expected to be about $10/tonne.

City of Kingston Participation

The benefits of carbon capture through enhanced rock weathering can be quantified and included as a CO_2 reduction within the City's annual community greenhouse gas emission inventory reporting. The use of wollastonite within the geographic area of Kingston will assist the City in achieving its community greenhouse gas emission reduction goals and produce beneficial economic activity within the rural portions of the municipality while assisting local agricultural operators by improving soil quality and crop health.

Staff have examined the projected costs provided by Canadian Wollastonite and are recommending that the City support the carbon capture initiative by providing a $5 contribution (approximately 50% of transport costs) for each tonne of wollastonite amendment verified as placed within the City of Kingston municipal boundary during a two-year start up period.

Each year, a verification report will be prepared by Canadian Wollastonite and provided to the City so that the City may provide Wollastonite Transportation Rebates directly to participating farm operators. The budget for the Wollastonite Transportation Rebates will be managed by the Climate Leadership Division and funded through the Environment Reserve Fund.

It is possible the City's contribution to the program's start-up may be leveraged or shared by attracting additional funding from FCM's Green Municipal Fund or similar granting agencies.

Potential Impact on Kingston's Community GHG Emissions

Each tonne of wollastonite product applied to agricultural fields is expected to capture up to 0.6 tonnes CO_2 over a weathering period of 36 months (or 0.2 tonnes per year). The actual capture

of CO_2 achieved will be verified by UNDO Carbon Ltd. using verification standards developed by PURO Earth.

Canadian Wollastonite has indicated they believe they can achieve placement of 20,000 tonnes of wollastonite soil amendment within Kingston each year in 2025 and 2026. The placement of 40,000 tonnes of wollastonite amendment in the two-year start-up period would require the following municipal contributions and create removal and durable capture of the following amounts of atmospheric CO_2:

Year	Wollastonite Applied (t)	Municipal Support	Estimated CO_2 Capture (t)
2025	20,000	$100,000	- 4,000
2026	20,000	$100,000	- 8,000
2027			- 8,000
2028			- 4,000
	Totals	**$200,000**	**- 24,000**

Application of Wollastonite on Municipally Owned Lands

The proposed municipal support program will also seek to increase wollastonite application by receiving and spreading material on up to 200 acres of open space lands owned by the City annually for three years. The City would be responsible for transportation costs to receive wollastonite at the receiving sites which is expected to cost approximately $4,000 per year in each of the three years.

Potential application sites will be assessed further for suitability but currently include:

- Norman Rogers Airport
- Grass Creek and Cecil & Wilma Graham Parks
- Closed landfill sites

Public Engagement

Public consultation was not carried out by the City as part of this proposed program.

Climate Risk Considerations

The proposed support will enable a project that has the potential to significantly reduce local GHG emissions at the community level through durable capture of atmospheric CO_2.

Indigenization, Inclusion, Diversity, Equity & Accessibility (IIDEA) Considerations

No IIDEA requirements or considerations have been identified for matters covered by this report.

Existing Policy/By-Law

City of Kingston Climate Leadership Plan; 2021

City of Kingston Strategic Plan 2023-2026: Net Zero by 2040

Kingston City Council declaration of Climate Change Emergency; March 5, 2019

Financial Considerations

There are sufficient monies within the Environment Reserve Fund to support the $212K requested for the implementation of the wollastonite enhanced rock weathering carbon capture program.

Municipal support for implementation of the program would take the form of annual rebates directly to participating farm operators within Kingston with supporting documentation provided by Canadian Wollastonite and UNDO Carbon.

Contacts:

Paul MacLatchy, Environment Director, 613-546-4291 extension 1226

Other City of Kingston Staff Consulted:

Julie Salter-Keane, Manager Climate Leadership

Lana Foulds, Director Financial Services

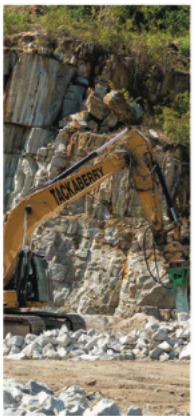
Exhibits Attached:

Exhibit A Canadian Wollastonite Information Pamphlet

Exhibit A
Report Number 24-230

WHAT ARE THE BENEFITS OF WOLLASTONITE?

Mineral-rich rocks have been applied as soil amendments for hundreds of years to improve soil fertility, biology, crop yield, and health. Wollastonite is a unique, locally sourced lime alternative that rapidly releases calcium, silicon, magnesium, and more. Silicon is a beneficial nutrient that has been proven to increase tolerance to pests, diseases, and climate extremes across a wide range of crops. Each tonne of lime can be replaced with 1.3 mt of wollastonite. For every 1.6 metric tons of wollastonite spread, 1 metric ton of CO_2 is captured.






	NUTRIENT	%	LBS/MT	VALUE
Macro Nutrients	Calcium as CaO	24-27	570	$15 as lime
	Silicon as SiO2	54-58	1200	$25 as basalt
	Magnesium as MgO	5-7	140	$12 as dolomite
Major Nutrients	Sulphur as SO2	1-2	30	$8 as elemental
	Potassium as K20	1-2	30	$12 as muriate of potash
	Iron as FeO3	2-3	47	
	Sodium as NaO	1-2	30	
Micronutrients	Manganese as Mn	0.03-0.05	0.7	$3 as manganese sulphate
				$75 per mt of wollastonite

HOW DO WE WORK WITH FARMERS?

We supply crushed wollastonite to you or your contractor at no cost and cover up to half of the trucking to bring scientifically proven benefits to your crops. Wollastonite is suitable for every kind of farming (row-crop, pasture, vineyards, orchards) and can be applied anytime of the year with a lime spreader.

Step 1. Contact us to discuss your land and questions

Step 2. We confirm fields to spread, and the amount of wollastonite needed for your first application

Step 3. Once delivered, you or your contractor spread the wollastonite and provide photographs of the spread

Get the power of wollastonite to increase pH and resistance to diseases, pests, and weather extremes while capturing thousands of tonnes of CO_2. The carbon captured in this program is used to subsidize the costs of trucking and the wollastonite. We look forward to working with you to make this program successful for your operation.

"I've been applying wollastonite for 8 years and my fields keep getting better. I get less lodging and my crops grade higher. Yields are up overall, and the crops seem to handle the weather extremes better. From sod to corn I use wollastonite on a wide variety of crops. Signing up for the carbon project was straight-forward. The fact wollastonite captures carbon is a nice bonus for the planet."
Matt Gauthier, Markham, Ontario

LETS CONNECT

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www.canadianwollastonite.com/carboncapture

CANADIAN WOLLASTONITE + UNDO CARBON + FARMERS

Canadian Wollastonite and UNDO are coordinating a pioneering enhanced rock weathering (ERW) project to provide agronomic benefits for farmers and demonstrate how ERW can be used to capture carbon in agricultural soils.

Join us on our mission and help keep our planet fit for future generations.

LEARN MORE:

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OMRI LISTED
For Organic Use · OMRI.org

UNDO
PUTTING CARBON IN ITS PLACE

Wollastonite is registered as a soil amendment with the CFIA #2019140F

www.canadianwollastonite.com | www.un-do.com
Material Safety Data Sheet available on our website