Improving Groundwater Policy Using an Alternative Economic Policy Instrument in Ontario

by

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Abstract

Groundwater is a finite and depletable natural resource. According to the Government of Canada, groundwater is the primary source of water for washing and drinking for 28.5% of Ontarians. Over-pumping of groundwater affects its overall quality and can reduce the base flow to rivers and streams, negatively impacting ground and surface water ecosystems. The *Water Resource Act* in Ontario (1990) stipulates that corporations involved in water bottling must apply for permits to the *Ontario Ministry of Environment, Conservation and Parks* to pump groundwater if the firm intends to take more than 50,000 litres of water on any given day. This Research Paper uses Nestlé's water bottling operations in Ontario as a case study. At the current rate that water bottling companies pay for water, the province is not recovering its regulatory costs of administration nor are they incentivizing conservation or signalling a value for groundwater. This MRP examines groundwater policies and agreements in Ontario, that specifically relate to water takings and investigates the potential of an *Inverted Block Rate Structure*, where the cost increases with quantity taken. The findings highlight that this alternative economic policy instrument has the potential to efficiently allocate greater controls over the province's water resources and encourage conservation, thereby improving groundwater governance. To augment the literature review and key document analysis, three key informant interviews were conducted to gain a deeper understanding of Ontario's groundwater governance framework.

Keywords: Groundwater, Alternative Economic Policy Instrument, Great Lakes Water Quality Agreement and Annex 8, Water takings, BluMetric, MECP, Moratorium

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1.0 Introduction

Groundwater is a finite and depletable natural resource (Tietenberg & Lewis, 2015). According to the Government of Canada, groundwater is the primary source of water for washing and drinking for 28.5% of Ontarians (Water Sources, 2013). Since it is below the surface, groundwater is undervalued; yet, it is just as vital as surface water. Therefore, it is important that local, provincial and federal governments monitor, assess, and collect groundwater data to continue to improve its governance framework.

Surface water and groundwater are linked with respect to quantity and quality (IJC TAP, 2017). Over-pumping of groundwater significantly affects its overall quality and can reduce the base flow to rivers and streams, negatively impacting ground and surface water ecosystems (IJC TAP, 2017). Yet, according to the *International Joint Commission's* (IJC) *Triennial Assessment of Progress* (TAP), the degree of toxic materials released into water systems is not collected in a timely way, nor is it reported accurately, or does the public have easy access to easy-to-understand information (IJC TAP, 2017). At the same time, in the Great Lakes Basin (GLB) and Ontario, cultural views of water are informed by the myth of abundance; this is because Canadians have a greater natural awareness of surface water and less awareness of what is underground (Annex 8 Subcommittee, 2015).

The GLB homes 40 million residents and provides water for domestic use to 80% of Ontarians (Government of Ontario F, 2019). At the same time, 8 million inhabitants of the GLB region are dependent on groundwater (Weekes, Krantzberg & Pinheiro, 2019). Weekes, et al. (2019), cite a study conducted in 2000 by Granneman et al. stating that there is 4168km^3 of stored groundwater in the GLB. Groundwater storage is vulnerable to increasing overuse, climate change and land zoning (Weekes et al., 2019)

Climate change and population growth will have the greatest detrimental effects on the availability of potable water for all who live in the GLB (SOGL, 2019; Annex 8 Subcommittee, 2015; BluMetric Environmental Inc. A, 2020). Based on these two main trends, elected bodies will need to monitor water takings, and chart date so that they can plot for the future to protect and conserve current groundwater resources while ensuring that as close to 100% of the water taken returns to the water cycle. Within this context, this MRP looks specifically at water bottling.

2.0 Groundwater Policy History and Context

Groundwater policy and governance is embedded in a multi-tiered governance framework. Policies connected to groundwater occur at the bi-national, federal, provincial, local and watershed levels. Policy review of multi-level governance is therefore vital to an analysis of existing alternative policy instruments such as an *Inverted Block Rate Structure* (IBRS), bilateral agreements, and national and provincial policies.

The *Helsinki Convention of the United Nations International Law Commission* (UNILC), *1966,* was the first treaty to address transboundary groundwater issues. The UNILC accepted 19 articles of the *Draft Law of Transboundary Aquifers* (DLTA) in 2008 (Weekes et al., 2019). These articles addressed the transboundary nature of the hydrogeologically connected aquifer system spread across borders. The DLTA recommended mapping and modelling groundwater use as a guide to plan for the future (Weekes et al., 2019). Although, it is important the DLTA 2008 has yet to be ratified. There is a lack of international law governing groundwater, and this lack is seen as the reason for the distress that groundwater is experiencing (Weekes et al., 2019).

The GLB is the greatest global freshwater resource. The basin supplies water to American and Canadian communities. It is estimated that Canadian and US usage is 251 litres per day and 364 litres per day, respectively (ECCC, 2017; USGS, 2016). Due to the intense use by the 42 million Canadian and US residents, there is research suggesting that continued overuse will lead to the decline of groundwater and permanent damage to the GLB aquifers (Weekes et al., 2019).

Weekes et al. (2019), groundwater policy experts, define sustainability as one where current needs are met, while factoring in those of future generations. The authors argue that sustainable groundwater policy must balance current and future water supplies.

Writing in 2019, Weekes et al. confirm, that in the GLB, "some 8 million, mainly rural, residents use groundwater as their sole drinking water source" (p. 338). Their research finds that 160 billion litres of water are taken per day for commerce, energy, manufacturing and domestic supply. The total extraction of groundwater that does not return to the water cycle is approximately 16 billion litres per day. (Weekes et al., 2019). These researchers explain that pharmaceutical and water bottling industries further compound the strain on groundwater (Weekes et al., 2019). So, growing groundwater extraction produces sustainability issues. Currently, it has been determined that roughly 10% of municipalities in the GLB are experiencing aquifer decline. This has been correlated to intense cumulative groundwater taking over time (Weekes et al., 2019).

In Canada, the decline is most evident in the Greater Guelph, Wellington, Waterloo Area (GGWWA). Weekes et al. (2019) determined that current policy is not sufficient to protect the aquifers that feed into the 186 watersheds that make up the basin.

2.1. Groundwater Policy in the Great Lakes Basin

The International Joint Commission (IJC) has been active since 1909, when the *Boundary Waters Treaty* was ratified. The IJC predates the New Public Governance framework, but has included citizen consultation regarding transboundary water quality since its inception (EPA, 2018). The IJC played a key role in the development of *The Great Lakes Water Quality Agreement* (GLWQA), an accord between Canada and the United States (U.S.) to protect and revitalize the Great Lakes. The commitment offers a governance framework that is used to identify shared U.S.-Canada priorities around improved water quality. In 1972, Canada and the U.S. signed the GLWQA (EPA, 2018). Within the GLWQA, the IJC engages the public with respect to Great Lakes concerns to produce the *Progress Report of the Parties* (PROP), which is released every three years (Johns and Setoodeh, 2019). The GLWQA has made important

contributions to inter-jurisdictional management of shared waters on a bi-national footing and is thus recognized world-wide (Findlay & Telford, 2006). The federal government of Canada amended the International Boundary Waters Treaty Act to ban bulk water takings from the Great Lakes (Findlay & Telford, 2006).

New annexes on groundwater and climate change were added to the GLWQA in 2012. An annex indicates a policy priority. Annex 8 focuses on groundwater and highlights several commitments and policy priorities that this MRP investigates to see if Annex 8 has contributed to positive outcomes. Best outcomes include: recovering the province's regulatory costs, incentivizing conservation, and signalling a value for groundwater. Greater groundwater protection policies will improve water quality, and act to ensure sustainable yield for future generations.

The *Great Lakes-St Lawrence Basin Sustainable Water Resources Agreement* (GLSBWRA) was written in 2005, and adopted in 2007 as an amendment to the *Ontario Water Resources Act* (OWRA) under regulation 225/14 (Weekes et al., 2019). The GLSBWRA covers binational agreements and water diversions (Weekes et al., 2019). Under the North America Free Trade Agreement (NAFTA), now known as the United States Mexico Canada Agreement (USMCA), groundwater that is part of a product is not subject to the 2005 GLSBWRA regulations (Weekes, et al., 2019). Still, this document addresses water taking industries with respect to free trade, whereby an IBRS might prevail over environmental petitions around aquifers. This concept is discussed in more detail in section 3.0. The USMCA encourages trade and acknowledges that groundwater is used in commercial products but does provide a barrier to the resource's use via the free trade agreement.

The expressed goal of Annex 8 is to achieve a deeper understanding of how groundwater effects the water quality of the Great Lakes, as well as to prioritize future actions (Canadian Environmental Protection Act Registry, 2019). These actions include: inspections, measurement, management, protection, remediation of groundwater, and addressing binational groundwater testing and analyzing results (Annex 8, 2012). Furthermore, Annex 8 is committed to the development of ongoing scientific groundwater binational reports, to create an inter-agency groundwater working group. This working group aims to identify and prioritize sites for monitoring, remediation actions, future research and management strategies that pertain to stressors and impacts of groundwater concerns (Canadian Environmental Protection Act Registry, 2019).

A Regional Water Use Database was created by the *Great Lakes Commission* to collect reports and data pertaining to water use, efficiency and conservation. Its copyright is 2011 and contains documents and relevant GLB water research dating up to 2018 (Great Lakes Commission, N.d.).

2.2 Groundwater and Policy Context in Canada & the Intergovernmental Context

In Canada, under the Constitution Act's Division of Powers, resource management is a provincial responsibility (De Loë & Kreutzwiser, 2005). In Ontario, under statutes like the *Environmental Protection Act* (RSO 1990, Chapter E-19), and the OWRA [RSO] 1990, Chapter O-40), the province is responsible for water quality protection, allocation, the administration of the two statutes and the many province wide agencies that have purview over water management

(De Loë & Kreutzwiser, 2005). Provincial law limits the role municipalities can play when it comes to implementing environmental protections (De Loë & Kreutzwiser, 2005).

Since 1971, the federal and provincial governments have been working together utilizing the *Canada-Ontario Agreement* (COA) (Environmental Registry of Ontario, 2019; Findlay & Telford, 2006). The COA creates an avenue for a coordinated response by Ontario and Canada to the IJC instructions (Findlay & Telford, 2006). According to the *Canadian Environmental Protection Act Registry*, the federal government of Canada leads with the province of Ontario's supportive actions (Canadian Environmental Protection Act Registry, 2019). The federal government and the province put together a team that includes technical and scientific experts. This team assesses the condition of groundwater science related to Ontario's Great Lakes, their ecosystem health and the water quality that supports it. The primary goal of the COA is to establish policies which act to minimize stresses on the Great Lakes overall health (Canadian Environmental Protection Act Registry, 2019). To achieve this, the COA coordinates and facilitates the exchange and sharing of key data as a method for ranking sites that are subject to point sources that impact water quality concerns in the GLB and its groundwater (Canadian Environmental Protection Act Registry, 2019).

A component of the COA developed in 2007 is referred to as the *Canada-Ontario Agreement Respecting the Great Lakes Basin Ecosystem* (COARGLBE). Its purpose is, "To restore, protect and conserve the Great Lakes Basin Ecosystem in order to assist in achieving the vision of a healthy, prosperous and sustainable Basin Ecosystem for present and future generations" (Government of Ontario E, 2019). Within this agreement, groundwater is considered. This document acknowledges that the study of both surface and groundwater is necessary to strengthen and support the sustainability of the ecosystem, as well as, the economic, and social well-being and overall health of the population (Environment Canada and Ontario Ministry of the Environment, 2007). Resulting from this specified goal, Environment Canada and the then Ontario Ministry of the Environment agreed to, "undertake and support research and monitoring on surface and groundwater supplies and water-takings to guide sustainable water use and conservation" (Environment Canada and Ontario Ministry of the Environment, 2007, p 36). Another requirement outlined in COARGLBE is to generate scientific source protection policies to mitigate and identify liabilities to Ontario's drinking water (Environment Canada and Ontario Ministry of the Environment, 2007). COARGLBE recognized that more than twelve million people in 2007 were dependent upon the GLB for their domestic use of water, and as such, a special focus on the region's water is essential (Environment Canada and Ontario Ministry of the Environment, 2007)[1]. The renewed agreement acknowledges that activities on the land affect the watershed (Environment Canada and Ontario Ministry of the Environment, 2007). COARGLBE mandates an integrated approach to the GLB, which includes: basin-wide monitoring, conservation, and remediation regarding the land, surface, and groundwater. The federal and provincial governments reached an agreement to collaborate on the protection and maintenance of safe and reliable drinking water supply for the GLB population (Environment Canada and Ontario Ministry of the Environment, 2007).

[1] The number of those dependent on the GLB for water has increased to 40 million in 2019 (Government of Ontario F, 2019).

Moreover, there is a new agreement between Canada and Ontario that is currently being developed. Its intent is to conserve, protect, and restore the quality and health of the Great Lakes (Environmental Registry of Ontario, 2019). The new agreement is an intergovernmental contract between six federal ministers and the provincial ministries of *Agriculture, Food and Rural Affairs*; *Natural Resources and Forestry*, and the *Environment, Conservation and Parks* (Environmental Registry of Ontario, 2019). The new agreement is complex in that it supports several environmental initiatives as they pertain to the province's *Made in Ontario Environment Plan* and the GLQWA (Environmental Registry of Ontario, 2019).

2.3 Groundwater Policy in Ontario

The OWRA applies to the provinces' cities, towns and villages, including some that are almost wholly dependent on groundwater for their water supply (De Loë & Kreutzwiser, 2005). The OWRA falls under the Ministry of Environment, Conservation and Park's (MECP) administration, and its purview is oversight of surface and groundwater (Maefs, 2019). The purpose of the OWRA is to regulate the sustainable usage of the province's water resources (Maefs, 2019). The OWRA oversees the terms for offences or prohibitions, which are punishable by a range of fines (Maefs, 2019). The fines individuate between individuals and corporations. For greater detail on penalties for offences, see Appendix III.

The OWRA oversees the remittance of permits for water taking of more than 50,000 litres per day from surface or groundwater sources (North Bay-Mattawa Conservation Authority, 2020). This act also provides regulation and oversight for well operation, construction and abandonment (North Bay-Mattawa Conservation Authority, 2020).

The OWRA (1990) applies the Permit to Take Water Program (PTTWP) (Government of Ontario G, 2020). It stipulates that corporations involved in water bottling must apply for permits to the MECP to pump water (groundwater, pond water, river water, stream water or directly from a lake) if the firm intends to take more than 50,000 litres of water on any given day (Connell, 2019; Government of Ontario G, 2020). The PTTWP assures that in Ontario, water takings are in accordance with the GLSBWRA (discussed in section 2.1 above) (Government of Ontario G, 2020).

Under the OWRA (1990), regulation 387/04: *Water Taking and Transfer* has a specific sub-section 4.2.2, which addresses *Water Taking and Transfer* regulations for the Government of Ontario (Water Taking and Transfer, 1990). The regulation pertains to habitat, streamflow, water quality, and water levels (Water Taking and Transfer, 1990). Regulation 176/17 mandates a flat rate of $500 fee per one million litres of groundwater for water bottling (Charges for Taking Groundwater to Produce Bottled Water, 176/17) and regulation 450/07 legislates a $3.71 fee to commercial and industrial users for every one million litres in water takings (Charges for Industrial and Commercial Water Users, 450/07).

A moratorium on water bottling was initiated by the province on January 1st 2017. This action resulted from citizen concerns about the location of bottled water companies in the GGWWA (PGO, 2020). The moratorium allowed the *Ministry of Environment and Climate Change* (under Premier Wynne), now known as the MECP under Premier Ford to take time to conduct a

comprehensive review of "the province's water taking policies, programs, and science tools to ensure that vital water resources are adequately protected and sustainably used" (PGO, 2020, p. 2).

As of June 18th, 2020, three significant documents were released by the province. The first is the *Water Quantity Management Proposal* commissioned by the Environmental Registry of Ontario, the second is the *Review of Water Resources in Ontario* authored by BluMetric Environmental Inc., and the third is, *Ontario's Bottled Water Moratorium: A Report of a Panel of Independent Experts Assembled by Professional Geoscientists Ontario* prepared for the MECP by Professional Geoscientists Ontario (PGO).

The first document released by the Government of Ontario on June 18, 2020 was posted on the government's website, through the MECP. It included a proposal which would give the municipalities greater control with respect to permitting companies to take groundwater in their localities for bottling purposes, during times of drought (MECP, 2020). The province's request for proposals triggered the extension of the moratorium on bottled water takings to allow for continued review of Ontario's science tools, and water taking policies and programs (Environmental Registry of Ontario, 2020). Here, Minister of the MECP, Jeff Yurek provides the following quote: "We can't take our water for granted - it is a vital resource for our health and well-being, and to the way of life we all enjoy…Ontarians can be confident our water resources are protected by good policy based on solid science and evidence, but we must always be prepared to adapt" (MECP, 2020).

The provincial evaluation concluded that groundwater takings for bottling in Ontario are managed sustainably under existing regulation and legislation, and that bottled water takings in the province are not impacting groundwater sustainability. (Environmental Registry of Ontario, 2020). Their analysis also identified scenarios to enhance the governments' current framework to ensure "the province's water resources are protected and used sustainably in the face of a changing climate and population growth" (Environmental Registry of Ontario, 2020).

The second document from the June 18th release is the *Review of Water Resources in Ontario: A Summary of the Assessment of Water Resources to Support a Review of Ontario's Water Quantity Management Framework* (RWRO). Authored by, BluMetric, a consulting firm who describes itself as "a diverse water, earth, and energy company providing solution-oriented consultation, design, products, and construction services to clients with complex environmental issues in more than 60 countries" on its website (BluMetric Environmental Inc. B, 2020).

The RWRO focuses on ten out of fifteen of the provinces' approved locations for groundwater bottling. All locations that were reviewed require a permit to take water (BluMetric Environmental Inc. A, 2020). The bottled water companies included in this review are: Gott Enterprises Inc (Alnwick, Haldimand, Amaranth. Grey Highlands), Aquaterra Corp. Ltd. (Cataract Site, and Hillsburgh), Gold Mountain Springs Inc., Robins Holdings Inc., Savarin Springs Inc., and Nestle Canada Inc. (Aberfoyle and Erin) (BluMetric Environmental Inc. A, 2020).

The BluMetric Panel pointed out that the Middlebrook well in Elora, was not included in the BluMetric study (BluMetric Environmental Inc. A, 2020).

The third document released on June 18th is the PGO's report, *Ontario's Bottled Water Moratorium* (PGO, 2020).

2.4 Groundwater Policy at the Local Level: Grand River Watershed, the City of Guelph, and Nestle

Within the GLB there are 44 Canadian municipal jurisdictions. The *2001 Ontario Municipal Act* mandates the government of Ontario consult with its municipalities when making decisions around high volume water taking permits (Weekes et al., 2019). In Ontario, the decline in groundwater is most evident in the GGWWA, where the residents are dependent on groundwater (Weekes et al., 2019). The Regional Municipality of Waterloo with the population of 617,870 as of 2019 (Region of Waterloo, 2020) is the largest municipality in the region. It takes 80% of its domestic water supply from its groundwater resources (De Loë & Kreutzwiser, 2005).

Nestlé owns three wells in the province that are in close proximity to Guelph: Hillsburgh, Elora, and Aberfoyle. Hillsburgh is located 34km northeast of Guelph. The multinational owns a production well and its adjacent property, with access to the aquifer (Nestlé Waters, 2012) in Elora. The property was purchased from *Middlebrook Water Company* in 2015 and with this purchase, they have access to the aquifer (Bueckert, 2016). The town of Erin is 10km west of Hillsburgh and their residents rely on water from the Hillsburgh well. Erin's city council voted to accept payments from Nestlé to counter the impact of the water that they are taking from that source (Bueckert, 2017). In Aberfoyle, Nestlé owns a water bottling plant, a well, and has access to the aquifer. The company maintains that the water levels are stable (City of Guelph, 2020). The GGWWA and Nestlé take their water from the Grand River Watershed (City of Guelph, 2020). As of 2015, the City of Guelph required 45 million litres of water per day (City of Guelph, 2020). This data raises questions regarding whether there is room for industrial water extraction, connected to the GGWA's future domestic needs.

Nestlé, one of the biggest multinational corporations, claims its 2018 revenue as $91.4 billion, with $7.4 billion resulting from the sale of bottled water (Nestlé, 2019). In 2017, Nestlé pumped 1.1 billion litres of Canadian groundwater and sold it for profit around the world (The Canadian Press, 2017).

The former CEO of Nestlé, Peter Brabeck, was quoted in 2005 as stating that water should be treated as a "foodstuff commodity" and not a human right (Subramaniam, 2016). This clip was released in 2013, which was the same year that Nestlé was in the midst of a dispute with the town of Hillsburgh. While Hillsburgh has experienced three major droughts in the years since 2007, the corporation has continued to pump millions of litres of groundwater per day without regard for its residents (Subramaniam, 2016).

Nestlé, the world's largest water bottler, began extracting water in Ontario in 1990. According to Doreen Nicoll, they have been "reducing water levels in underground aquifers in the region by 30 centimetres per year" (Nicoll, 2019).

Wellington Centre was seeking safe drinking water for its citizenship when it was outbid by Nestlé in 2018 for the sale of a local well (Leslie, 2018). Keith Leslie from the Globe and Mail, quotes Nestlé as stating that their Middlebrook site will stand as a "supplemental well for future business growth" and serve as a reserve for its facility in Aberfoyle (2018).

Nestlé employs 2500 people in Ontario (Leslie, 2016). Nestlé has been quoted as saying that it is prepared to pay higher rates for groundwater extraction, but only if all water taking companies do (Leslie, 2016).

Ontario's groundwater policies and agreements are the focus of this research paper because: (1) 28.5% of Ontarians rely on groundwater (Water Sources, 2013); (2) Water bottling companies pump more than 1.1 billion litres per year from Ontario's aquifers (The Canadian Press, 2017); (3) Water bottling companies pay $503.71 per million litres of groundwater, equating to 1/20th of a penny per litre of water (The Canadian Press, 2017); (4) little clear information on how much groundwater actually exists in the province is available; although estimates suggest that there is approximately the same volume as Lake Huron, 3540 cubic km (Annex 8 Subcommittee, 2015); and (5) without a clear indication of what Ontarians will need in terms of groundwater now and in the future, it is irresponsible to allow for-profit water bottling companies to take the essential resource at such low rates.

On July 2, 2020, Nestle announced that it was leaving the Canadian bottled water market and selling its brand, *Nestle Pure Life* to *Ice River Springs*. This information was released two weeks after the Government of Ontario's made public BluMetric Environmental Inc.'s *Review of Water Resources in Ontario* and the PGO's *Ontario's Bottled Water Moratorium Report* public (The Canadian Press A, 2020; The Canadian Press B, 2020; Bui, 2020).

2.5 Summary

As demonstrated, groundwater management in the GLB has a governance framework that encompasses many layers. Policies are written at the watershed, local, provincial and federal levels. The province of Ontario, the MECP, and governance bodies, like the IJC use laws, statutes, regulations, evidence-based approaches, science, and public consultation to make decisions. Dominant policy instruments have included: regulation, public ownership (common pool resource), and the remittance of financial penalties (referenced in Appendix III). Quantity thresholds, tracking data and creating a database repository are strategies that have been used too. However, reliance on self-reporting by permittees (Weekes et al., 2019, KI2, June 2020; KI3, June 2020) maybe subject to speculation. Deborah Harford (2015), the Executive Director of the *Adaptation to Climate Change Team*, in the Faculty of Environment at Simon Fraser University, contends that, "in the future, [groundwater may] prove to be more valuable than gold – or fossil fuels" (p. 224).

Groundwater is a finite and depletable resource that is coming under increasing pressure due to population growth and climate change. With 8 million dependents on groundwater for domestic supply (Weekes et al., 2019), policy makers must consider amending current regulations to incorporate alternative economic policy instruments like the IBRS that would: charge the largest users the most; achieve funding which allows for sustainable use of the resource; recoup the costs of administering the regulatory regime; signal a value for water; and encourage conservation.

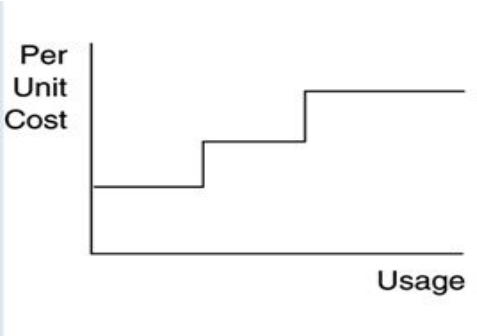
3.0 Alternative Economic Policy Instrument: Inverted Block Rate

This MRP investigates the feasibility of Ontario developing and implementing an alternative policy instrument such as an *Inverted Block Rate Structure* (IBRS). This is so that the province can collect revenues that more accurately reflect the regulatory costs of managing the extracted resource.

An IBRS is an economic tool where the cost of a resource increases with the quantity taken (Tietenberg & Lewis, 2015). If used properly, it has the potential to recover the costs of the regulation of Ontario's water resources. An illustration of the IBRS can be seen in *Figure 1*.

The research looks at the practicality of implementing an IBRS with respect to collecting permittee fees that allow the MECP to recover its regulatory costs, hire more inspectors and conduct more inspections. In the literature review and key informant interviews, it was discovered that water permittees were responsible for self-reporting on their water taking, using a meter to document their water use.

Figure 1: *Inverted Block Rate Structure*



Note: Tietenberg & Lewis, 2015

Three other Variable Charge Rate Structures relate to policy instrument choices and design: (1) *The Uniform Rate Structure*, or "flat rate", where the cost of the resource does not vary with changes in consumption; (2) *The Declining Block Rate Structure*, where the cost decreases as the quantity extracted increases; and (3) *The Seasonal Rate Structure*, where there are higher costs during peak periods and lower costs during non-peak seasons (Tietenberg & Lewis, 2015).

Brock University Professor, Mohammed Dore, discusses potable water supply in his book *Water Policy in Canada*, published in 2015. In it, the economist/researcher argues that water is inefficiently used and underpriced in Canada (Dore, 2015). Nagendra Sanoor is an economist who writes about the IBRS. He suggests ways an IBRS can be implemented; breaking down usage into blocks, whereby the price for water taking increases according to the blocks (Sanoor, 2010). The first block would address domestic use, the second would be designed to address large residential consumption, like pools and multi-acre lots, the third would look at large commercial use and the final blocks would cover large institutional or industrial users (Sanoor, 2010). Sanoor provides clear steps to how the IBRS could be used to apply incremental price increases based on consumption (2010). Thus, not only would the IBRS recover the costs for the regulatory regime, it could also be seen as a method to encourage conservation.

Robert Glennon is a Law Professor and water researcher at the University of Arizona, writes about sensible water policy, arguing that governments should create incentives to conserve (Glennon, 2005). Glennon states that by charging the biggest water takers the most, governments can deter excessive use and simultaneously promote conservation.

Law professor and past mayor of Chapel Hill, North Carolina, Keven Foy, writes that as North American populations grow, water shortages are more probable (2016). He points out that, drought is something that most communities in North America have experienced. Drought has many negative consequences, but it can also provide an opportunity to create the context in which to think through sustainable water policies (Foy, 2016). Based on Foy's logic, flat rate water taking fees encourage increased consumption and are counter-productive. From an economic point of view, it is rational to preserve groundwater. Foy (2016) recommends applying an IBRS as a top strategy to promote the sustainable use of water. He also recommends using economic rationality to motivate consumer behaviour.

When Foy was the mayor of Chapel Hill, he implemented the IBRS, and it worked! Residents reduced their water consumption and the city had more money to regulate (Foy, 2016).

4.0 Methods

Due to COVID-19, all aspects of research were conducted online, over Zoom and phone.

Throughout the literature review, document analysis and key informant interviews, the MRP looks at the economic rationale for the province to sustain its groundwater resources in the GLB (how permits are released, how water is monitored, how water taking is metered). Throughout the process, the principal investigator looks for the relationship between economic rationality and sustainability.

Research leads to more research.

The first phase of research was a literature review, that collected and examined various government policy documents, reports, newspapers, books, and scholarly peer-reviewed journals.

The key terms were tracked in Excel. Key literature was saved and organized in alphabetical order, by author, for quick retrieval. Information was gathered using the Ryerson library, Google Scholar, the MECP and Government of Ontario websites. A broad inquiry took place. The investigator reviewed and analyzed economic, government, and academic sources, and refers to professors, conservationists, hydrogeologists, policy analysts, lawyers, politicians, environmental organizations and government bureaucrats throughout the MRP. The literature was used to gain a clear understanding of the current and historical policies related to groundwater in Ontario.

The second phase of research investigates several key documents and regulations related to groundwater in Ontario, including: *Groundwater Science Relevant to the Great Lakes Water Quality Agreement: A Status Report* prepared by the Annex 8 subcommittee, the Canada-Ontario Agreement, the OWRA and the regulations related to groundwater and bottling within it (regulation 176/17 and 450/07). The publications released by the government of Ontario on June 18th, 2020: *Review of Water Resources in Ontario: A Summary of the Assessment of Water Resources to Support a Review of Ontario's Water Quantity Management Framework, Review of Professional Geoscientists Ontario (PGO) Ontario's Bottled Water Moratorium Report* were also reviewed and analyzed. These key documents were instrumental in understanding the sustainability of groundwater in Ontario, the threats groundwater faces and the effects of the bottled water industry in the regions that are most dependent on the resource.

The third phase of research was accomplished by conducting semi-structured interviews with key informants to gain expert perspectives on groundwater taking issues and related policies and legislation. The key informants included: a research scientist for Environment and Climate Change Canada (KI1), a hydrogeologist working for a Conservation Authority (CA) in Ontario (KI2), and a senior policy analyst for Ontario's MECP (KI3). Two of the interviews were conducted over *Zoom* and one was done over the phone. The material was recorded, transcribed, and sorted for relevancy. Once the raw data was clearly organized, it was incorporated directly into the MRP.

Through the research and analysis, recommendations are made related to developing, adopting and implementing an alternative economic policy instrument as a tool to improve groundwater policy and governance. The IBRS has the potential to create a monetary disincentive for the extraction of groundwater in that it would charge commercial and industrial water users at a rate that encourages conservation.

5.0 Findings and Discussion

Section 5.1 will review three key documents: *Groundwater Science Relevant to the Great Lakes Water Quality Agreement: A Status Report, Review of Water Resources in Ontario: A Summary of the Assessment of Water Resources to Support a Review of Ontario's Water Quantity Management Framework,* and the *Review of Professional Geoscientists Ontario (PGO) Ontario's Bottled Water Moratorium Report.* In section 5.2, this MRP will discuss the significant findings from the three key informant interviews.

Since conducting the three key informant interviews, in the month of June 2020, Nestle announced on July 2, 2020 that it would divest its Canadian water bottling interests (The Canadian Press A, 2020; The Canadian Press B, 2020; Bui, 2020).

In Ontario's review of its *Water Quantity Management Framework* (2020), four primary areas of action have been highlighted: (1) where there are competing demands for water, establish clear provincial priorities for use to inform decision-making; (2) in water quantity stressed areas, update the approach to water management; (3) make accessible to the public, water taking data collected by the Ministry with respect to permitted water takers; and (4) bring host localities to the table when making water taker permit decisions. In order to implement these actions, the provincial government has proposed amendments to the *Water Taking and Transfer Regulation* (*Ontario Regulation 387/04*) under the OWRA, *1990* (Environmental Registry Ontario, 2020).

5.1 Findings from Key Reports and Document Analysis

5.1.1 Groundwater Science Relevant to the Great Lakes Water Quality Agreement: A Status Report

To protect the Great Lakes as a source of domestic water supply and its ecological wellbeing, a need to monitor and manage the GLB is established in the Annex 8 Report (Annex 8 Subcommittee, 2015).

The Annex 8 Report (2015) recognizes that more accurate quantification of groundwater discharges to surface water reporting is necessary to properly maintain and protect the GLB. However, appraisals of direct groundwater discharge to the individual Great Lakes remain uncertain. Therefore, more data regarding groundwater contributions to wetlands, ponds, rivers, and lakes is needed to analyze the real importance of groundwater to each (Annex 8 Subcommittee, 2015).

A main limitation to the protection of groundwater in Ontario that is exposed by the Annex 8 Report (2015) is the real lack of groundwater data. While groundwater quality is monitored at a local and regional level, in some places in Ontario and the US, there is still poor collection of information overall and the data that is collected is not available or circulated widely (Annex 8 Subcommittee, 2015).

In the US, the cumulative results of population growth, climate change, land management, and groundwater availability were assessed in 2008 (Annex 8 Subcommittee, 2015). The American study found that climate change, followed by population growth will create the greatest water stressors that will be felt at a local level. The key recommendation coming from the US study is to continue to monitor and assess land use and climate change as it relates specifically to water quality and quantity (Annex 8 Subcommittee, 2015). The report predicts that the need for groundwater is likely to increase, due to climate change. At the same time, it acknowledges there is a huge lack of data on climate change and groundwater (Annex 8 Subcommittee, 2015).

The Annex 8 Report points out two concerns that transpire around bottling water companies: the potential to mobilize contaminants that would have otherwise laid dormant and introduce them to the larger water supply, (Eberts, Erwin & Hamilton, 2005; Eberts, Thomas & Jagucki, 2013; Warner and Ayotte, 2014) and to change the groundwater direction flow, which can induce leakage of contaminated water into the more general supply (Hunt, Borchardt, Richards & Spencer, 2010).

Withdrawing groundwater although it is not perceptible, will affect the quality and quantity of the drinking water of the 8 million people who rely on groundwater (Weekes, Krantzberg & Pinheiro, 2019), as well as the 40 million people dependent on water supply from the GLB. (Annex 8 Subcommittee, 2015; Government of Ontario F, 2019).

5.1.2 Review of Water Resources in Ontario: A Summary of the Assessment of Water Resources to Support a Review of Ontario's Water Quantity Management Framework

The publications that were released on June 18th show that Ontario's water (ground and surface) is safe overall, but certain regions will be subject to scarcity in the next 10 to 20 years (BluMetric Environmental Inc. A, 2020). Hence, it will be increasingly incumbent upon the province to signal value and incentivize conservation when it comes to water takings.

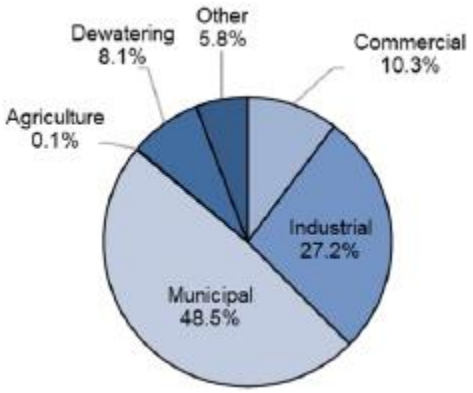
The review found that currently in Ontario, overall, water quantity is sustainable; but the report notes exceptions to some municipalities who experience high water consumption in the summer months (BluMetric Environmental Inc. A, 2020). To continue the sustainability of water quantity into the future, flexibility in how water is managed is necessary. BluMetric determined that "the amount of water taken for water bottling does not affect the sustainability of water resources locally or in the surrounding areas" (BluMetric Environmental Inc. A, 2020, p. 1). However, while their findings demonstrate that Ontario's water quantity management is effective, there is room for improvement.

BluMetric offers up the following suggestions: improve data collection, organization and information sharing when it comes to future water quantity studies in Ontario; improving existing water management tools, and help localities develop a plan to manage water quantity across multiple boundaries (BluMetric Environmental Inc. A, 2020).

BluMetric's study discovered that the province's water resources are sustainable, and not currently under any great duress. However, they point out, that due to naturally limited ground supply, seasonal water usage, and periods without rain, will all produce exceptions (BluMetric Environmental Inc. A, 2020). Thus, going forward, to meet the needs of future generations, who will be subject to population growth and climate change, water will need to be managed (BlueMetric Environmental Inc. A, 2020). Some flexibility in how the resource is managed will be required as part of the calculation to ensure there is enough water to meet the needs future generations.

The RWRO defines the Guelph-Wellington County Study Area as: the city of Guelph, Aberfoyle, Acton, Eden Mills, Elora, Ennotville, Erin, Everton, Fergus, Hillsburgh, Marden, Maryhill, Morriston, and Rockwood (BlueMetric Environmental Inc. A, 2020). These localities use both surface and groundwater for farming, industry, business and domestic purposes. The team who worked on this report had access to ample evidence-based data (BlueMetric Environmental Inc. A, 2020). BluMetric concluded that climate change and a growing population will be the key pressures on water quality in the Guelph-Wellington County. Of note, this report was published in 2020, and the data was collected in 2017. Seventy-four million cubic metres of water was recorded as the amount of water extracted that year (BlueMetric Environmental Inc. A, 2020). As seen in *Figure 2*, almost 50% of the water taken was for municipal use. BluMetric used *The Drinking Water Source Protection's* (DWSP) water budget for Guelph-Wellington County to determine groundwater levels. The consulting firm used two studies to extrapolate findings: the quantity of water pumped from municipal wells and the DWSP water budget. Since water quantity data collection is dependent on the permittees self-reporting; the water budget would be an aggregate of all these water taking reports from the area.

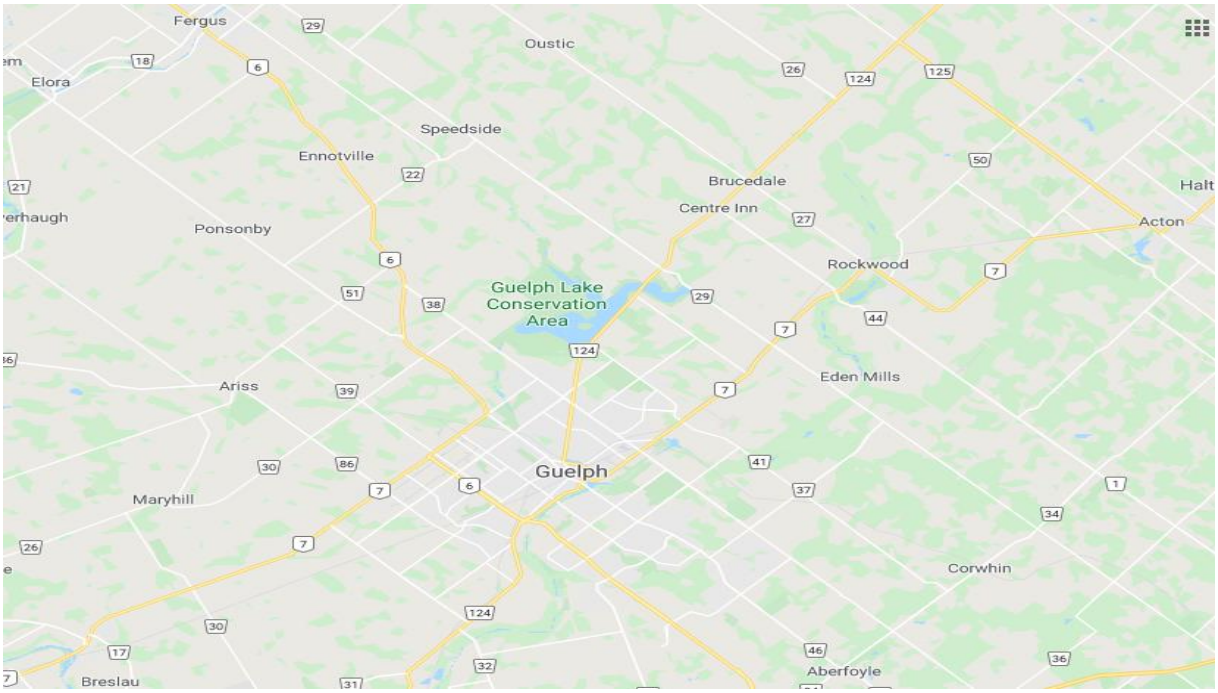
Figure 2: *Guelph-Wellington County Water Use, 2017*



Note: BluMetric Environmental Inc. A, 2020, p. 7

Based on the measurements of groundwater, BluMetric reiterates that the "groundwater quantity is sustainable at this time for most of the area…Increases in population, changes in climate, and changing land use will put pressure on water quantity. As a result, the *Drinking Water Source Protection* water budgets predicts that the sustainability of future municipal water supply systems in Guelph, Fergus, and Elora is uncertain" (BluMetric Environmental Inc., 2020, p. 7). In particular, impact will be felt in the Eramosa and Speed Rivers (BlueMetric Environmental Inc. A, 2020). Projections are that municipalities will continue to grow and as such will have a greater need for water (BlueMetric Environmental Inc. A, 2020). A map of Guelph region, as seen in *Figure 3* shows that there is very little surface water for Guelph-Wellington County. Essentially, the population that resides here is reliant on groundwater.

Figure 3: *Map of Guelph-Wellington County*



Note: Google Maps, Guelph Region, 2020

BluMetric made two types of recommendations. The first pertained to data collection and the second pertained to water management. BluMetric acknowledges that going forward, there will be opportunities to improve data collection, sharing and assessments. They recommend making scientific data readily available to the public, and thinking about the larger regional picture when assessing the impacts of stressors upon water quality and quantity (BlueMetric Environmental Inc. A, 2020). Another recommendation provided by the RWRO is to increase the monitoring of ground and surface water levels and flow related to the effects of drought and water taking. With respect to the water management recommendations, BluMetric advises that the province looks at water resources at the front end of its land use planning process (BlueMetric Environmental Inc. A, 2020). The report emphasizes ongoing monitoring and reporting, continued studies, particularly with regard to drought and that the province develop a plan that will assist municipalities in the management of water quality and quantity across jurisdictions.

The main takeaway from BluMetric's report is that while water quantity and quality are currently acceptable in Ontario, without active management of this vital resource it could be imperilled in the near future. Nevertheless, the while RWRO says that groundwater availability is stable over all, the report pulls out that it is uncertain in the GGWWA.

5.1.3 Review of Professional Geoscientists Ontario (PGO) Ontario's Bottled Water Moratorium Report

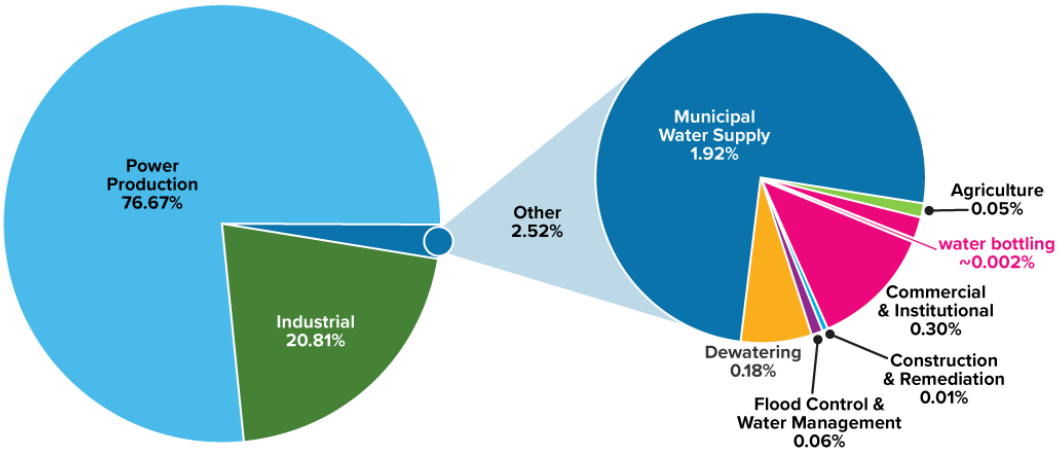
Governments have traditionally been concerned with the technical aspects of managing the province's water supply, particularly groundwater and water bottling operations, as well as other components pertaining to water bottling, such as: pricing, water management costs, allocation of water for profit, plastic use, and more (PGO, 2020).

The PGO researched and published a report titled, *Ontario's Bottled Water Moratorium*, for the MECP in 2020. While they say that bottled water takings are not impacting surface and groundwater in the province, the PGO recognizes that water bottling operations could expose water supplies to risk (PGO, 2020). The findings here are somewhat contradictory to the findings in BluMetric's report. Whereas, the PGO contends that continued pumping at the same level will not 'likely' impact the groundwater system; BluMetric is clear that in Guelph-Wellington County, population growth and climate change stressors will have impacts on available water; and that municipalities will need to oversee water taking during droughts.

The PGO suggests that the best way to assess the effects of permitted takings on neighbouring users is via monitoring relevant water taking and volumes and levels at the MECP (PGO, 2020).

A Report from a Panel of Independent Experts Assembled by Professional Geoscientists Ontario, states "The science does not support the need to regulate water bottlers any differently than other takers" (PGO, 2020, p. 6). PGO says that bottled water takings are looked at in terms of specific hours in the day, specific days in a week and specific weeks in a year and when the findings are compared to other water takings in the province, the amount taken is insignificant in comparison to other water use, as seen in *Figure 4*. The panel argues that other types of water taking also result in water loss, such as when it becomes incorporated into products, through evapotranspiration, or by transfers to surface water. They further argue that prior to making decisions about water taking allocations, an understanding of geology/hydrogeology in the proposed area of resource extraction as well as a knowledge of water availability within the projected water shed is required.

Figure 4: *Percentage of Water Takings in Ontario by Sector, 2018*



Source: Government of Ontario D, 2020

Like BluMetric, the PGO believes that the province's water allotment framework could benefit from improvements. The PGO advances the following with respect to permit volumes; that the PTTWP does not encourage conservation as there are no incentives to take less once a permit is issued (PGO, 2020).

In terms of monitoring, the PGO suggests that BluMetric rethink economic expedience over long-term data collecting when making decisions about how many sites to maintain for its studies. The PGO report notes that there is a growing public interest in water conservation and stewardship (PGO, 2020). The group of geologists urges that two types of data be kept: the actual pumping data collected by the MECP from the permittees, and long-term water level monitoring data. This information should be easily accessed by the public, but they also recommend compiling it using graphs and charts to show long-term trends (PGO, 2020). Furthermore, easy to access and easy to understand information, will improve public relations around water.

The PGO's review points out that the BluMetric Report did not look at the Middlebrook well in Elora. At the time of the review, this well was owned by Nestle. The PGO suggests that while an analysis of potential impacts of water takings to the water table of this well would not fully alleviate public concern, it would be helpful in terms of providing clarification (PGO, 2020). The PGO is critical of the BluMetric report, as BluMetric did not use all of the sophisticated data modelling that is available from the Elora area, which includes the Middlebrook well. The PGO further argues that it would have been beneficial to include the pumping rate so that the staff at the MECP would be comment-ready when the inevitable questions arise (PGO, 2020). The PGO proposes that technical information and numerical models of groundwater in the GLB should be readily available to the public and updated regularly. This is so that both the MECP and other ministries can effectively communicate and assist in decision-making (PGO, 2020).

Moreover, the PGO suggests that the BluMetric report provide a clearer explanation of the PTTWP framework and how it is applied. They recommend that the MECP continue to share scientific data on its website (PGO, 2020). They advise that ministry staff develop short reports, that include: figures and flow charts to point to checks and balances within the system; summaries of water taking in the province; demonstrate the relatively small amounts of water that water bottlers take in comparison to other industries; and indicate how many permits are operating at any one time (PGO, 2020).

Both the BluMetric and the PGO reports build on findings that were reported in the *Groundwater Science Relevant to the Great Lakes Water Quality Agreement: A Status Report.* The RWRO and the PGO report do not look at water management from a societal perspective, nor does the review compare water bottlers to other types of water takers (PGO, 2020). These reports establish a framework to discuss water issues in the GLB. Each document finds that water quality and quantity in the GLB is currently satisfactory, although they each indicate that there will be concerns going forward. The reports also compile data for future comparables and long-term trend charting. In terms of encouraging conservation within the PTTWP, this MRP points out that, an IBRS would function as an economic tool that encourages conservation through a monetary inducement.

5.2 Finding from Key Informant Interviews

5.2.1 How has the addition of Annex#8 on Groundwater, under the Great Lakes Water Quality Agreement in Ontario improved groundwater policies and outcomes?

The first of the three key informants interviewed is from the federal level. They explain that an integrated approach to water management, one where communication is open and transparent is vital to the advancement and protection of groundwater. According to KI1, departments, ministries, agencies, and conservation authorities often are siloed with limited interaction. They carry on saying that to improve groundwater outcomes through policy, it is necessary to use an integrated approach.

KI1, a research scientist for *Environment and Climate Change Canada*, concludes that Annex 8 has not had much impact on policy to date. They state that the Annex 8 Report lays the foundation for more research to be conducted. KI1 points out that data collection projects are currently underfunded. Additionally, there is a fear these projects may lose their funding altogether. But, without good data collection, it will be difficult to understand the impacts and outcomes on groundwater that allow for good policy development.

KI1 acknowledges one possible policy outcome from Annex 8, added in 2012, which pulled together information that lead to actions that resulted in the development a groundwater quality indicator (KI1, June 2020). The groundwater indictor the informant is referring to is found in, *The State of the Great Lakes Highlights Report*, published by the Government of Canada and the Environmental Protection Agency in 2019. It sets out indicators pertaining to the Great Lakes Ecosystem Health. Here, the status of groundwater is considered an indicator of the overall health of GLB (Government of Canada and Environmental Protection Agency, 2019). The Highlights Report finds that groundwater can be assessed as “fair”, while its long-term trend is

considered “undetermined” due to a lack of tangible data (Government of Canada and Environmental Protection Agency, 2019).

KI3, a senior policy analyst for Ontario’s MECP discloses that, “folks I work with in the ministry who have been involved in the GLWQA and the annex, describe it as an impetus to get some additional work done, initiatives started and to begin to understand groundwater better” (KI3, June 2020); aligning well with KI1’s position.

By virtue of being a groundwater annex within the larger GLWQA, it signifies, that the groundwater is vital to the health of the GLB. KI1 and KI3 agree that the Annex 8 Report is a foundational document and a starting point for groundwater policy development in Ontario.

5.2.2 Do the new and existing policies and governance bodies properly address the extraction of groundwater for bottling?

Key Informants were asked several questions in relation to new and existing policies and governing bodies to address the use of groundwater for bottling. KI1 was able to speak from a quality perspective, while KI3 spoke to quantity and KI2 provided responses from the standpoint of a Conservation Authority (CA).

KI1 was matter-of-fact. They say that current groundwater policy in Ontario is “underfunded, the data is too dispersed, and that communication is poor between different departments and agencies that have responsibilities in groundwater.” The research scientist emphasized the need for well-developed integrated water management, because all water in the GLB is apart of the water cycle, and that water cannot be compartmentalized and managed in silos”. When discussing overall water quality, KI1 notes that groundwater interacts with elements outside of surface water boundaries and all factors must be considered.

KI2, a hydrogeologist working for a CA, describes the groundwater policy framework in Ontario as improving, substantially over the past decade, particularly with respect to the policies and tools relating to municipal water provision, source protection and aggregate harvesting. They believe that these tools have had a positive effect on the protection of groundwater flows and usage within the GLB. This informant added that CA’s work with the province to come up with new ideas, while conducting open discussions to improve conservation services.

KI3, the policy analyst from the MECP, agrees the framework for managing groundwater withdrawals in Ontario is extremely effective. They cite threshold limits for permits, the monitoring and technical work that goes into new proposals, the PTTWP and the findings of the recent moratorium. This informant stated that while the threshold for managing a groundwater withdrawal in the province is high; 50,000L per day, that when compared to other jurisdictions, it is actually quite low. Overall, KI3 believes that Ontario in conjunction with the MECP are keeping track of, and regulating withdrawals from groundwater at a conservative threshold, and that the process for doing so is strong.

In discussing the findings from the recent moratorium on water-taking bottling permits KI3 revealed that there is room for improvement. They explain that the policy framework is effective at managing individual water withdrawals at specific sites. But advancements can be made in the MECP’s ability to look at the cumulative effects of multiple groundwater withdrawals across the

GLB, and how these impact groundwater levels on a broader scale, while observing its effects on surface water. One significant challenge is that groundwater is underground and cannot be seen, and as such relies on monitoring information, assessments, and modelling to be able to understand what is going on below the surface.

A bi-national water policy between Canada and the US was offered by KI3 as an example of a regional agreement for managing water quantity in the GLB, where Ontario is a signatory. The GLSBWRA was signed in 2005 and adopted in 2007 (introduced in section 2.1). This agreement binds American and Canadian jurisdictions in the basin to manage water withdrawals and transfers to common standards. KI3 acknowledges that groundwater management could be improved here. The policy analyst also states that "the boundaries of the agreement pertain to surface water only, as we do not know enough about groundwater and aquifer boundaries".

KI3 highlights another tool for the management and protection of groundwater, the *Groundwater Monitoring Network* (GMN). They explain that on the surface, the network appears robust with many monitoring sites, but notes that, "there are not enough monitoring points to be able to give [GMN] the practical knowledge they would need to be able to understand changing trends in a groundwater area, like whether groundwater levels are declining or increasing". They further submit, "it is tough to find the resources to expand the [GMN], to take that work on". KI3 says that it would be worth it to support the gaps in policy. Reiterating that it is especially important to find the resources to expand the monitoring network in certain parts of Ontario that experience intensive water use, like the GGWWA. The analyst emphasizes the importance of taking on this work in order to better understand groundwater at a broader regional scale. Hence, when moving forward, the questions are: how do the long-term effects of groundwater takings and climate change come into play, and how do we detect and understand how groundwater trends are changing?

At a CA level, there is an understanding that information is shared, which contrasts with the view of the research scientist who works at a federal level. Overall, KI1 thinks that the current policy tools that are used to mange the use and protection of groundwater in the GLB are insufficient, contrasting starkly with KI3's view. Like the PGO report, KI3 reasons that the current framework does a good job of looking at withdrawals at site specific scale but acknowledges the need to do better with the cumulative effects and how they affect the GLB and its aquifers.

When asked about the tools to effectively manage the use and protection of groundwater, all key informants discuss using a variety of methods.

KI1 explained the importance of efficient monitoring programs, data sharing, environmental indicators and accessibility to data and information across agencies and levels of government that work with a range of surface and groundwater issues. They add that accurate research is of the utmost importance in terms of updating conceptual models, as well as the ability to adapt programs, monitor, update and understand policies. In other words, finding a method where information and data are continuously revised.

KI2 makes a case for the Clean Water Act, which they regard as an effective tool. This act targets municipal water sources, and there are provisions within the act for the protection of areas outside of municipal boundaries. CA's identify the places that fall beyond municipal boundaries,

and analyze and assess the land usage with respect to groundwater flows, quality and quantity. More than anything, the Clean Water Act is an analysis tool.

Another tool the second informant discusses is Ontario's PTTWP. They explain that it was designed specifically to manage the use and protection of groundwater in the province; noting that it is quite effective at regulating groundwater takers. KI2 adds that CA's are not involved in in the costing of water, but are more concerned with the preservation of water quality and water for environmental uses.

The informant continues answering, while there is controversy around water bottling and associated permits; there are no water bottle companies operating in their CA jurisdiction. Nestle pumps in the Grand River Watershed, adjacent to KI2's CA. As such, KI2's CA works closely with the Grand River CA, as well as Nestle, to analyze the multinational's takings and hydrogeological studies. KI2 articulates that, "Nestle seems to be transparent, in that they organize annual meetings, that CA's attend. Nestle provides all of the data from their monitoring and pumping wells. Nestle hires their own consulting firms to conduct their hydrogeology studies, and the CA's work with these firms to understand the data and relevant conclusions." Nonetheless, KI2 deviates from this position when stating that "because the consulting firm works for Nestle, the consultant is contracted for a certain end game".

KI3 states that licences and permits to use groundwater are an effective tool for the resources' protection. Ontario provides permits for a finite period of time, generally less than ten years, and they must be reviewed. The informant explained that it is important to have a permit system to allow the MECP to regularly review and re-evaluate impacts of withdrawal in relation to other users in the area and the environment. The requirement for permittees to self-monitor and self-report on the amount of groundwater they take is notable. Reports are generated daily and annually, and sent to the MECP for review. KI3 continues explaining that, if a groundwater taker has a permit, they must use a meter and there are rules around how to calculate how much water is taken out of the ground each day. Every year by March 31st permittees provide the ministry with a report of the previous year that details how much water was taken daily. This rule applies to all permit holders, not just to corporations.

KI3 recommends that there is room for additional enforcement. While the ministry does some proactive inspections, the frequency could increase. They clarify that, "If there are 4000-5000 permits at one time, the MECP would do about 100 inspections per year." These inspections function as an administrative check: has the permittee provided a report, and does the report match what they are permitted to take. During an inspection, an inspector will look at pumping and water distribution equipment and verify that the permittee is doing what they are supposed to be doing under a given permit. KI3 pulls out the fact that, Nestle owns a number of wells that are in close proximity and fall under the same permit (Aberfoyle, Hillsburgh). They also acknowledge a second permit that Nestle holds for their site in Elora. The vast majority of Nestle's water taking is used to put water into bottles.

The provincial policy analyst concludes this question by emphasizing the importance of having a charge for groundwater, stating that, "maybe not applying a groundwater charge for everyone, but definitely for those who use groundwater for commercial or industrial purposes, who are using the water in a product or as part of their process and then profiting from that". In theory,

they recommend that the ideal rate would be high enough to incentivize some water use efficiency and the conservation of groundwater. Even if the ministry is unable to implement a charge that is high enough to do that, some charge for water that signals to companies that there is value in the resource and that it costs money to mange it, is effective.

KI3 summarizes that overall, existing policies and governance bodies properly address the extraction of groundwater for bottling and other purposes. The informant continues explaining that one aspect of the framework that could be improved is that land planning decisions should involve the MECP much earlier in the process. They explain that Ontario has a Growth Plan that attempts to predict which areas of the province will likely have population growth and stemming from that, municipalities make decisions around land use planning, zoning, bylaws and official plans about the types of facilities that will be developed and where. KI3 declares that "what needs to happen more from a groundwater quantity perspective is thinking about the amount of the resource that is available in these areas, as a part of making planning decisions. So, before a decision is made to begin an intensive development, confirming the water resources are available and sustainable in that area first". KI3 advises that decisions around locating a bottled water plant or new municipality should be done earlier on in the process. Currently, this step occurs at the end after all of the investments, applications, and approvals have been submitted.

A second recommendation to improve the current framework for groundwater takings is provided by KI3. They mention that the PTTWP is not equipped to deal with broader environmental, and social issues. One social concern revolves around the argument that corporations should not be allowed to bottle Ontario water and then sell it back to its residents. This potential change could improve how the ministry thinks about and makes decisions around groundwater use. It would require a mechanism that allows broader environmental concerns to be considered, which would be separate from decisions around permits for water taking. KI3 suggests that this is a policy gap and a challenge that many jurisdictions face. However, they counter, there is also a risk of being overly protectionist. KI3 recaps, "while Ontario has not gotten as far as we need to, the province has made definite progress".

Each informant provided a different perspective. The informant's responses range from the framework needs improvement, to the framework is improving, to the framework is effective. Each key informant responded to questions around new and existing policies and governance bodies that address groundwater takings distinctly. KI2 and 3 agree that the PTTWP is an effective tool. The program is about regulating and managing water takings at a particular location, and different municipalities have separate permits. KI2 and 3 also mention that Nestle hires there own consulting firms who conduct hydrology studies for the multinational. This practice is problematic in as much as the optics can be questioned by environmental groups such as the *Wellington Water Watchers* and *the Council of Canadians*. KI2 refers to the Clean Water Act and municipal boundaries; KI1 is interested in environmental indicators, monitoring and data sharing because they allow for the incorporation of broader environmental and social issues to inform the groundwater management framework.

5.2.3 What progress has been made in Ontario with respect to the development and implementation of groundwater policy?

In response to the question, 'what progress been made in Ontario with respect to the development and implementation of groundwater policy?' KI1 identified the introduction of the groundwater annex (also known as Annex 8) under the Canada-Ontario Agreement. The Annex was developed as a means to acquire a deeper knowledge around how groundwater influences water quality in the GLB and to locate areas that will be prioritized for future action (Government of Canada, 2019). Some of the results stemming from this Annex are the development of the *Binational Groundwater Science Report* that compiled scientific findings, as well as the identification of groundwater priorities in the GLB (Government of Canada, 2019). This agreement also emphasizes remediation actions around groundwater quality in the GLB (Government of Canada, 2019).

KI1 echo's the main finding found in the *BluMetric's* 2020 report, which is: water is well managed by the province. The MECP's policy analyst cites the DWSP and the PTTWP as examples of programs that do a good job of factoring data collection into their scientific decision-making. They explain that the "[PTTWP] requires large water users who take more than 50,000L/day to get a permit from the ministry." The informant goes on to say that, "the program has been around since 1961 and has evolved since then. The PTTWP is supposed to be focused on water taking issues and issues related to water resources. The MECP's technical review is concerned with the following: will this proposed water withdrawal impact other users and ecosystems in the area." KI3 adds that "regulation 176/17 is a charge of $500.00 per million litres, that strictly applies to bottled water companies that have a permit to take water. Its purpose is to recover the provinces costs specifically related to managing bottled water takings". Another informant, hydrogeologist by trade, referred to in this paper as, KI2, provides a corresponding observation. They say, "the provinces [PTTWP] was specifically designed to regulate the takers. For the most part, it is very effective." The MECP made a number of amendments, including requiring the monitoring and reporting of water use information from permit holders in 2005. The ministry also articulated more clearly the criteria they would use to evaluate a water taking application. KI3 suggests that this was significant step that improved Ontario's water taking framework.

KI3 also identified the introduction of a basic framework for charging for water that occurred in 2007. Commenting that this was an important improvement in the establishment of a foundation to achieve objectives like: signalling a value for water and encouraging conservation of the resource. This provincial informant contends that "the work that has happened with the GLSBWRA is important for several reasons." According to KI3, the GLSBWRA sets up a framework for collaborating within the basin with other jurisdictions, for collecting data on groundwater quantity, science, and standards towards water conservation. Importantly, the agreement provides a system for jurisdictions to review and give input on significant withdrawals of water, including groundwater, from any one jurisdiction. The policy analyst explains that, "if certain jurisdictions want to take millions of litres of water including groundwater, then other jurisdictions are warned and given an opportunity to comment." There is also a more formal review process. Here, the proposal is jointly and formally reviewed by all jurisdictions to determine if water taking is appropriate with respect to impacts on the GLB, the

reasonableness of its use, and if it is implementing reasonable water conservation standards. KI3 concludes that this is a more recent improvement in groundwater policy.

With respect to the province's technical review and June 18th release, KI3 hopes that the recent changes are finalized soon. They comment that, "the two proposed changes give us the ability to look at water takings cumulatively, on an area basis and identify water use priorities in our framework". KI3 goes on to say that, while these concerns may not be critical at this moment in time, in the next 20 years they will become more important as the province experiences greater water scarcity in certain parts of Ontario.

In summary, the province has actually moved forward. In particular with respect to: the Canada-Ontario Agreement and its related groundwater Annex, the administration of the PTTWP, the GLSBWRA, while improving the framework for charging for water takings and most recently the province's technical review conducted during the moratorium and released on June 18th 2020.

5.2.4 Can the implementation of an alternative economic policy instrument, improve provincial protection and management related to water bottling corporation's takings of groundwater in Ontario?

Only KI3 was comfortable answering the question 'are alternative policy instruments being explored in the Great Lakes basin related to groundwater and aquifers?' They say that in Ontario, the work is done by expanding on the current framework. The MECP is exploring options for managing water takings on an area basis, as opposed to site specific. For example, "if there is an area where the ministry is aware of water conflicts, or if there is concern in regards to a high density of water takers impacting the resource, we give ourselves the ability to look at that area specifically to see if we need to take a unique strategy for managing water takings in that area. This is our best practice for managing water withdrawals." When dealing with regions experiencing conflict over water, KI3 explained the introduction of a prioritization scheme. They stated that, "if there is conflict between two or more users using water for different purposes, we are adding something to our regulation that would direct us on who should get water if there is not enough to go around". The MECP proposed that the environment, drinking water, and agricultural irrigation are priorities compared to aesthetic purposes, or industrial and commercial use. KI3 said that this is an enhancement that will be important moving forward, especially in parts of Ontario where there will be more conflicts over water.

With respect to water pricing, KI3 reflects that, "we have put the foundation in place for charging for water use" and points out that, "the problem right now is that the charge is miniscule. It barely raises the money to cover any of the provincial costs for managing water, let alone acting as an incentive for companies to use less. But it was a big step getting the authority for charging added to our legislation". So, the foundation is there, now, the province will need the political will to make the necessary changes to instill a more effective charging scheme.

When discussing Ontario's regulation 176/17, where the province of Ontario requires facilities that take groundwater for bottling to have a water taking permit and are charged $500 per million litres of water, the informants had fulsome responses.

KI1 is straight to the point, articulating that $500 per million litres of water is too low of a price point to support the responsible use and protection of groundwater resources. KI2 notes that costing is beyond the purview of CA's, but comments that, "it is no stretch to think that companies are taking advantage of the current rules and regulations."

KI3 worked directly on regulation 176/17 and explains that the charge of $500 per million litres of groundwater strictly applies to bottled water companies that have a permit to take water. They state that, "the purpose is to recover the provinces costs specifically related to managing bottled water takings." This informant goes on to say that, "the authority we have for charging for water now gives us the ability to apply a regulatory charge. Ontario has never claimed ownership of water, and as such it is considered a common good in Ontario (unlike most other provinces). We do not have the ability to charge a royalty, but we are allowed to use a regulatory cost…which is for the purpose of recovering costs to support a regulatory regime". Regulatory costs are used to recover the costs related to managing bottled water withdrawals.

KI3 also highlights that regulation 450/07, which was introduced in 2007. They explain that it is "a broader charge that could potentially apply to any industrial or commercial water user in Ontario. That charge is currently $3.71 for every one million litres of water". While regulations 176/17 and 450/07 are similar; the purpose of 450/07 is to recover the broader costs related to water quantity management. Bottled water companies in Ontario are subject to both charges. Unfortunately, KI3 says that, "the $3.71 charge only raises $200,000 per year, so, in terms of achieving its objectives of providing financial support to our management of water, it is not really doing anything. KI3 suggests that "[the charge] probably covers the costs of a couple of staff at the ministry, let alone the costs of monitoring and assessing water users." It is important to note that when regulation 450/07 was first applied, a decision was made that the fee would not apply to farmers. Its intent is to apply broadly to any industrial or commercial water user who is making a profit directly or indirectly from the use of water.

The informant points out that "when regulation 450/07 was first introduced it was at a very low amount and continues to only apply to a small subset of high-consumptive industrial and commercial users, who incorporate groundwater into a product, such as a bottle. The regulation applies to food processors who put water into containers, as well as, ready-mix concrete and certain chemical producers that actually put water into a product." KI3 pulls out that the regulation has not been expanded to other types of industrial and commercial users like: steel and iron, pulp and paper, or nuclear power plants. However, they state, "the province does have the ability to do so, but it will take political will to expand 450/07 to those other users."

In part of the interview the informant is critical of regulation 450/07; below KI3 speaks to the strengths of regulation 176/17.

The policy analyst from the MECP says that regulation 176/17 is more significant in that it achieves its objective. The $500 fee raises moneys that goes toward science and research related to groundwater and bottled water takings. KI3 explains that the regulation also supports the program and policy work that relates to those types of water takings. The province may want to impose more significant charges for water to meet objectives like: signalling to corporations that

water has a value, as well as incentivizing water conservation behaviour among water takers. KI3 states that, "regulation 450/07 and its related $3.71 fee does not meet those objectives, and I am uncertain if the $500 charge is high enough either."

KI3 explains that while bottled water is the focus of attention because it is a controversial type of water taking, when compared to different types of water takings, like industrial and other commercial takings, water bottle takings are just a drop in the bucket. Water bottlers take a very small amount of water, as seen in *Figure 4*. Thus, KI3 does not believe that focusing a charge strictly on water bottling is an effective way of achieving water management objectives. They say that, "ideally, you would want to apply regulation 450/07 more broadly and at higher rates to achieve more significant outcomes."

Key informants were asked specifically about an IBRS for the pricing of groundwater and its feasibility as an instrument to improve provincial management of firms that extract and use groundwater in Ontario and the GLB.

KI1 thought that a system where the cost increases with the quantity taken would be a good way to encourage conservation and protection of the resource, while signalling value to industrial and commercial water users. The federal research scientist thinks that other than lobbyist opposition, the IBRS would be a feasible alternative economic tool.

KI2 supposed that the IBRS would be a tool that is worth exploring. They explain that at present, water takers are charged a flat rate for use of the resource, but acknowledges that some takers earn a profit directly from the water, when most do not. KI2 reasons that it is important to differentiate between businesses that use water as a part of a process or as a part of product.

The informant clarifies that, "Ontario recognized this inconsistency and as a result conducted the moratorium, which gives the province a chance to look at the rules and regulations, and eventually come up with something a little more equitable." With respect to the feasibility of an IBRS, KI2 tended to agree with KI1 in that, water bottlers, like Nestle, are giant multinational corporations that have their fair share of lawyers and lobbyists at their ready.

As an aside, this interview was conducted 1-week prior to the release of the moratorium findings on June 18, 2020.

Kelsey Scarfone a Project Manager at Environmental Defense argued that, at the current rate Nestlé pays for water, the province does not recover the true value of the resource that the multi-national removes, nor is the province recovering the costs of its regulatory regime. She further articulates that charging corporations the true cost of water may be a best way to conserve groundwater (Scarfone, 2018). One Senior Policy Analyst from the MECP, agrees with this reservation, stating that to make rate structures work, the government will really have to get right down into the weeds and differentiate how water is used when it comes to profit, ie as part of a product or as part of a process (KI3, June 2020). This analyst recommends that an IBRS, where the cost increases with quantity taken has the potential to efficiently allocate greater controls over Ontario's water resources and that if properly implemented, could be effective (KI3, June 2020).

KI3 stated that the MECP has explored an IBRS as an alternative economic tool to a certain extent, and suggests that it could be effective in incentivizing conservation of groundwater.

The informant explains that volumetric incremental blocks as a pricing scheme ratchets up the cost for very large water takers. The challenge of strictly having a charge that incorporates higher costs for larger users, is that the system does not capture the different ways that different industries use water. There is a spectrum of water-users with extremes at each end.

KI3 says that, "at one extreme are bottle corporations that strive to put 100% of that water into their product, so it is very highly consumptive in terms of none of that water goes back into the water cycle. And at the other end of the spectrum, you have a company like Bruce Power, a nuclear power facility taking billions and billions of litres of water per year. The water goes through their cooling system, but 99% of it goes back into Lake Huron." So, Bruce Power has a relatively low consumption rate compared to Nestle who is bottling water. The provincial analyst with MECP summarizes what would happen without the differentiation of water use is that corporate water bottlers who use comparatively little water, but are removing groundwater from aquifers, which are more vulnerable than Lake Huron, and putting all of it into a bottle, and none of that water returns to the water cycle. At the other end of the spectrum you have a power company taking billions of litres of water, but most of it is being returned back to the source. Thus, what would happen if Ontario had a pricing structure that was purely the IBRS is that Nestle would be paying very little and Bruce Power would pay a huge amount of money.

Additionally, KI3 expresses the provinces' concern for financial impacts on businesses. An IBRS without differentiation for the type of use would put the most significant water-users out of business.

This informant concludes their response by hypothesizing, "if there is a way of incorporating [an IBRS] into a system where you might have different charges for different types of water use, like how much water you return to the water cycle, or whether the water is a part of a process or a product." In other words, the pricing system should attempt to reflect the different ways that water is used, so that there could be a rate structure for companies that incorporate water into a product and within that rate structure it might make sense to have an IBRS for facilities in that sector, where the more water that is taken the more that company pays. Then, having a separate IBRS built in for the firms who are using water as a part of process (like cooling) and then returning it to the environment.

KI3 adds, "I think that the [IBRS] is appealing in principle and makes a lot of sense from an economic theory point-of-view, but there are some practical issues that come up when considering how it might be applied." Ontario is only allowed to impose a regulatory charge, which is mainly about recovering the costs from programs. From a legal perspective, the ministry has to show that companies are paying an appropriate amount given the costs that the province incurs to manage their water takings.

In discussing the strengths of an IBRS, KI3 reiterates that water systems must be constantly monitored and improved. The funds that could be collected from an IBRS would go a long way towards contributing the fiscal resources to cover the costs of continuous evaluation and improvement of the provinces water resources. As it stands, KI3 states that, "regulation 450/07

does not recover its costs to the province and regulation 176/17 does not signal that water has value nor does it incentivize conservation." Subsequently, an IBRS may go a long way to promote these ideals and generate revenue adequate to cover regulatory costs.

When looking at a pie graph of water takings in Ontario (see *Figure 4*), 77% of the water takings are for power production. A very small amount of water is used for things like irrigation, municipalities, and other industrial or commercial users. When talking about feasibility, KI3 explains some of the practical challenges associated with implementing an IBRS. They contend that, "trying to demonstrate to lawyers that you are obeying the laws of a regulatory charge, strictly using an [IBRS] would be difficult. You would have power producers and other large industrial companies paying virtually all of your costs, and companies like Nestle and smaller companies using water for other purposes, paying very little amounts of your costs, and that likely is not representative of how much money the province is actually spending to manage those different sources". Under the current regulatory framework, the government cannot turn a profit on common pool resources. Consequently, it may be difficult to advocate for the IBRS as an alternative economic tool.

Key Informants were also asked, 'Do you feel there are other policy options or instruments that need to be developed or changed in order to improve groundwater governance?'

KI1 believes that moving towards a more integrated approach, one where provincial ministries and CA's come together to review water management policies, with greater frequency, and with a particular focus on the water cycle and human health concerns. To do this, KI1 says that increased staffing and resources are necessary.

They offer the example of the Source Water Protection Program, as a response to the Walkerton tragedy in 2000. At first, the federal research scientist recalls that a lot of funding was thrown at the program including the hiring of private consulting firms who generated a lot of reports. However, they note, "there was not enough effort put into the day-to-day operations… throwing a lot money at the E.coli problem, collecting a lot of information and then underfunding and little attention paid to evaluation procedures was not a good policy."

KI2 is somewhat optimistic, they communicate that groundwater governance in Ontario has improved over the last 15 years and that the system is dynamic; citing the *Clean Water Act* as an example. They say that, "as time goes on and we look at studying the costs [of water takings] to the environment, different policies and tools are being explored to attempt to make the process more efficient and effective at protecting the environment."

KI3 emphasizes that groundwater withdrawals ought to be looked at on a cumulative basis, especially in certain areas that experience a high density of groundwater withdrawals, like the GGWWA. This informant also echoes the sentiments of KI1 in that, to support the need for monitoring and science, resources and staffing are of the utmost importance.

All three of the key informants thought that an IBRS could work as an effective alternative economic tool to incentivize two main objectives: water conservation, and signal a value for

water. They acknowledge that expanding the application of regulation 450/07 to a broader range of water takers, and increasing the rates charged under regulations 450/07 and 176/17 would be effective in achieving the above-mentioned objectives. Significantly the foundation for charging businesses for water has been laid, but the necessary political will be required to ramp up effectiveness.

According to KI1, policy changes and developments are necessary to improve groundwater governance for the future. Developments should look at: integrated approaches to water management, better systems for sharing data and information (within and across organizations and agencies), appropriate staffing levels, and amplified financial resources.

Looking to the future, KI2 says that, "we will need to look at a lot of the rules and regulations governing aggregate extractions and how they impact groundwater movements and flows. As well as regulating the takers, as this is still a work-in-progress. The system could improve its capacity to assess how a taking of an aggregate operation will impact all takers on a regional scale."

KI3 stresses the importance of examining and documenting the cumulative affects of groundwater takings across the GLB, as well as, consideration for the Ontario Growth Plan in relation to land planning management and where populations are likely to grow in the coming years. With respect to what can be done within the current groundwater management framework, the policy analyst summarizes that, "thinking about water takings more strategically, so when we make decisions about planning communities, where industrial and commercial facilities will locate, and where populations will likely grow, we take into account, as much as possible, water resources". Adding that, this is especially true for regions that are dependent on groundwater resources, like the GGWWA.

6.0 Findings from Illustrative Case: Nestle Case in Guelph?

The province's proposal, released on the MECP's website on June 18, 2020, included four proposed changes, one of which enclosed the following statement: "Requiring water bottling companies to have the support of their host municipalities for new and increasing bottled water takings, with an exemption for small businesses" (MECP, 2020).

Operating in Ontario since 1990 (Nicoll, 2019), Nestle announced in July 2020, that it will sell its Canadian Brand, Nestle Pure Life and related wells in Ontario and B.C (The Canadian Press A, 2020; The Canadian Press B, 2020; Bui, 2020).

The three key informant interviews revealed important insights into Nestle's water bottling operations in Ontario.

KI3 outlined the fact that Nestle has a number of wells in close proximity that fall under the same permit. They bring forward as examples, Aberfolyle (South of Guelph) where the multi-national performs its water bottling operations, and groundwater takings; and Erin where Nestle holds a separate permit. However, the informant notes that these wells could pump water from the same aquifer. Another finding they pull out is that the majority of water taking puts water

into the bottles; it is notable that this resource extraction does not return to the water taken to the water cycle.

KI2 and KI3 disclose that Nestle's permits are about regulating and managing groundwater takings at specific sites; the company hires consultants to monitor and report on their consumption. According to KI2 Nestle is transparent, organizes annual meetings, and works with the CA's. The water-bottling corporation provides all monitored data from their pumping wells. Nestle also hires consulting firms to do their hydrology studies. CA's work with these consultants to better understand the data they generate, in order to be comfortable with the conclusions drawn. KI2 makes clear that the consulting firm hired by Nestle, are contracted for a certain end game. Therefore, CA's must ensure these firms are transparent. This informant shares that there has been lots of working with the corporation, and that there is a sense of progress on this front.

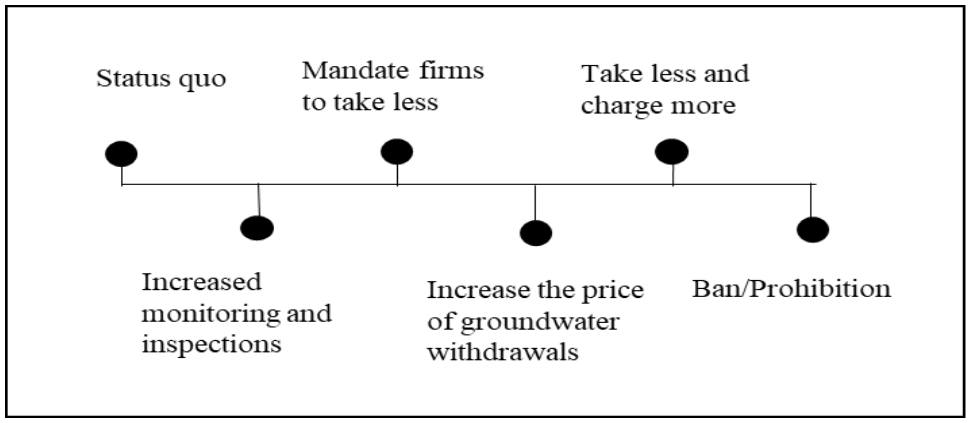
From a different perspective, KI3 says that it is important to have a charge for groundwater, maybe not for everyone, but definitely those who use it for commercial or industrial purposes, who are using the water in a product or as part of their process and then profiting from that, in theory you want a charge that is high enough to incentivize some water use efficiency and the conservation of water. Even if you can't have a charge that's high enough to do that, but if you can have some charge for water that signals to companies taking water, that there is a cost comes with managing water and that there is value in the water. They say "Ontario has not gotten as far as it needs to, but it has made definite progress." Echoing KI2's optimism with respect to progress on groundwater governance.

7.0 Conclusions and Recommendations

Globally, the Great Lakes hold most freshwater. The GLB is the source of water to over 42 million North American (Weekes et al., 2019). Left unchecked, overuse will lead to decline and permanent damage of the aquifers, surface and groundwater (Weekes et al., 2019). Groundwater is the sole source of drinking water for 8 million in the region (Weekes et al., 2019). Approximately 16 billion litres of groundwater is not returning to the water cycle per day. (Weekes et al., 2019). Presently, 10% of municipalities in the GLB are experiencing aquifer decline, and scholars correlate this to the intense and cumulative groundwater taking (Weekes et al., 2019).

Water bottling companies pump more than 1.1 billion litres per year from Ontario's aquifers (The Canadian Press, 2017). To address and regulate this issue, a spectrum of actions related to groundwater withdrawals are placed on a scale in *Figure 5*. Each presents its own set of challenges and opportunities.

Figure 5 *Spectrum of Actions for Groundwater Withdrawals*



Maintaining the *status quo*, over the long term, puts the province's groundwater resource at risk to over extraction, especially in particular regions, like the GGWWA that are almost solely dependent upon groundwater. Further, this action does not allow the government to recoup its regulatory costs for managing the resource. Conversely, continuing with the status quo takes the least time and money.

Increasing provincial monitoring and inspections of groundwater withdrawal sites and permittees takes time, money and staffing resources, but also increases accountability and checks and balances. Currently, according to one informant, if there are 4000-5000 water taking permits at any one time, there are only about 100 inspections of these permittees per year. Vast improvements could be made here.

Mandating that water takers take less than their current threshold is an option that would not raise revenue for the province to recover its costs, but would promote conservation.

Increasing the price of groundwater withdrawals is a viable action. This method would encourage conservation while signalling a value for the resource. One key informant points out that while something like an IBRS works well based on economic theory, there are some glaring challenges that need addressing. For example, whether the water used is returned to the water cycle or not, or, if the water is used as a part of a product or a part of process. Overall, this option has potential to accomplish environmental objectives. Another benefit of increasing the charges for groundwater to takers who use the resource for profit is that the province would be able to recover its regulatory costs. This is especially true for regulation 450/07.

Legislating firms to *take less groundwater while simultaneously charging more* for the resource could be implemented through an IBRS or by increasing the flat rate. At present, there may not be the political appetite for this approach, but it has the potential to recover regulatory costs and while signally value and incentivizing conservation.

A Ban or Prohibition on groundwater taking for water bottling is the most radical action on the spectrum. With this option, the province would not need to recoup regulatory costs for withdrawals; but it would still have to monitor groundwater health. Another concern related to this action include job loss whether they be at the water bottling plants or within the ministry. While unlikely, consecutive years of drought in areas that rely solely on groundwater, may create the circumstances upon which this action may come to pass.

Overall, to improve the groundwater governance framework, there will need to be political appetite, bureaucratic support, and technical feasibility. Groundwater used for bottling can be seen as a non-partisan issue, as conservatives and liberal are likely to agree that the province should not be giving natural resources away for free. In consideration of economic feasibility, it is important to acknowledge if the province is able to recover its regulatory costs, and would actions taken result in significant job loss.

This MRP investigates whether the implementation of an alternative economic policy instrument, would work to improve groundwater policy and governance in Ontario. The research reveals there is a need to differentiate between corporate water bottling, industrial and commercial uses, agricultural, and domestic use. Using the economic tool of an *Inverted Block Rate Structure* to charge the biggest users the most, is a clear and precise way to address corporate water bottling and extraction. The charge for water extraction at this scale is an effective tool to ensure water for the future, while signalling value for the resource and simultaneously incentivizing conservation. There is a current and increasing requirement to put a fair per litre fee on groundwater taking for commercial water bottling companies. Foy asserts in the Duke Environmental Law & Policy Forum, '*Balancing multiple goals at the local level: water quality, water equity, and water conservation*' that an IBRS designed to be a disincentive for increased water quantity would be an effective tool (2016).

More research is needed to know how to best implement an IBRS as an alternative economic policy instrument with respect to how it is applied. One way, is to differentiate between water uses, as a part of a process or a product. Another, would be to consider how much water is returned to the water cycle. Developing a formula so that firms pay for what they do not return would be a good first step. A draw back may be accounting for the quality of the water returned to the cycle.

Climate change and population growth will have the greatest detrimental effects on the availability of potable water for all who live in the GLB. Based on these two main trends, governments know that they have to monitor water taking, take information and chart it, so they can plot for the future. The province must protect and conserve groundwater resources, so that future generations have similar access to water. Within this context, this MRP looks specifically at water bottling.

According to the BluMetric Report (2020) and key informant interviews; certain municipalities, like those located in the GGWWA, face water scarcity. Since this factor is already known, current and future policy analysts are required to ask, how can commercial water bottlers permit

fees be raised? Fees need to offset the costs for data collection, monitoring, sharing, assessing and regulating water takings.

Key findings include: the Annex 8 Reports acted as an impetus to get more research done related to groundwater resources in the GLB; self-reporting is the norm for Ontario's four to five thousand water taking permittees; 100 provincial inspections are conducted per year on permitted wells; regulation 450/07 does not recover the costs of administration; a lack of communication between townships, municipalities, organizations, agencies and ministries; the two and a half year long moratorium lead to the publication of key documents; land planning will become increasingly important as the climate continues to change and populations grow; and clear and concise information with respect to groundwater is insufficient, and not easily accessible.

At the time the Annex 8 report was written, there continued to be a lack of information regarding groundwater levels in the GLB. What the report did accomplish was stimulus for further research, and data collection. The Annex 8 subcommittee along with two of the key informants agree that watershed systems including surface and groundwater are interdependent and must be studied and legislated as such (Annex 8 Subcommittee, 2015).

The cumulative effects of the moratorium, including the research generated, the key documents produced, and the potential policies and legislation resulting, might have affected Nestle's decision to sell their *Nestle Pure Life* water bottling brand and wells.

According to KI2 and KI3, some groundwater data is collected and analyzed. However, they revealed that it is paid for by water bottling companies themselves. Corporations like Nestle, hire their own private consultants to generate data. One possible concern is that the information could be skewed towards the client's interests.

Data sharing and discussion within and between agencies and organizations could be strengthened. On the one hand, KI1 who works in research in the federal government expresses that communication tends to be one-way and is often siloed. On the other hand, KI3 works in the MECP, and as such receives information and data from every direction, whether they be CA's, the federal government, permittees, activist groups, or agriculture, commercial, and industry. Based on inconsistent informant responses, this MRP extrapolates, peripheral departments and organizations experience one-way communication; sending more information out than comes in. A two-way flow of information would allow for more nuanced and effective policy making. Better information sharing could allow the government to be more-nimble in its response to groundwater resource concerns.

KI3 stated that there needs to be greater political appetite to raise both withdrawal fees (176/17 and 450/07). They propose this idea because at the current rate, the fees that are collected by the province for groundwater bottling are not recovering the costs of the regulatory framework. If Ontario is not recovering costs, one outcome is to cut regulations. Evidently, cutting regulations leads to problems like we saw in Walkerton in 2000 (De Loë, Di Giantomasso, and Kreutzwiser, 2002). Thus, we still need fees for groundwater takings – at the very least high enough to meet the cost of regulating the resource.

Research is also necessary to determine if there are examples of governments that charge businesses for use of common pool resources, as well as, to examine the cumulative impacts of groundwater withdrawals over time on a regional basis. Additional investigations that focus on comparative studies between water bottlers and other significant water takers is crucial.

Amongst the informants, there is a common sentiment that the groundwater governance framework is improving and there is a shared sense of progress.

Based on the literature review, key document analysis and key informant interviews, a number of recommendations can be made.

1. Apply regulation 450/07 more broadly and at much higher rates; to incentivize conservation, signal a value for the resource and recover regulatory costs.

2. Increase the fee associated with regulation 176/17 significantly; use the revenue generated to increase monitoring and inspections, data collection and groundwater mapping.

3. Investigate how to best differentiate between water users and apply an IBRS within distinct frameworks, as opposed to applying an IBRS across all water uses evenly.

4. Add groundwater that is part of a product to the 2005 GLSBWRA, currently not subject to this agreement's regulations.

4. Create an accurate surface and groundwater aggregate database to get a more complete picture of fresh water availability in the province and in particular the localities expected to experience drought in the next two decades, such as the GGWWA.

5. When engaging in land use planning activities, think about groundwater resources in advance when developing new communities, or building new facilities. Water permits need to be applied for in the earliest phases of planning process to ensure that water is included as part of development decisions.

6. Improve public relations around water resources (PGO, 2020) by making information easy to access. This approach is a strategy that *Nestle* might have used. *Ice River Springs* should follow this recommendation to help ease public concern.

7. To ready the population for policy and legislative changes, the government might consider developing and delivering an education program around the domestic, agricultural, industrial, commercial and ecological value of groundwater and its importance as a resource.

8. Groundwater that is part of a product is not subject to the 2005 GLSBWRA regulations. Expand the GLSBWRA to include groundwater.

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Appendix I: Interview Guide

Section 1: Background

1) Can you describe your current role and background related to groundwater?

2) What are you currently working on that addresses groundwater concerns?

3) Who are the key policy stakeholders you interact with related to groundwater policy?

Section 2: General groundwater policy

4) How would you describe current groundwater policy in the Great Lakes region?

5) Has the addition of Annex# 8 on Groundwater, under the Great Lakes Water Quality Agreement improved groundwater policies and outcomes?

6) In your opinion, are the current policy tools used to manage use and protect groundwater in the Great Lakes region sufficient?

7) What in your opinion are the most effective tools to manage the use and protection of groundwater?

8) Are alternative policy instruments being explored in the Great Lakes basin related to groundwater and aquifers?

9) In your opinion, do existing policies and governance bodies properly address the extraction of groundwater for bottling and other uses?

Section 3: Opinions about potential new/alternative tools in Ontario

10) What progress has been made in Ontario with respect to the development and implementation of groundwater policy?

11) Under Ontario Regulation 176/17, the province of Ontario requires facilities that take groundwater for bottled water and are required to have a water taking permit are charged $500. per million litres of water (strictly to water bottling companies). Do you feel this regulation supports the goals of Annex 8 and the responsible use and protection of groundwater resources?

12) One of the alternative policy instruments I am interested in is an Inverted Block Rate Structure for the pricing of groundwater; where the cost increases with quantity taken. This alternative instrument was extracted from the text, Environmental & Natural Resource Economics, written by Tom Tietenberg and Lynne Lewis in 2015.

Do you think this is a feasible instrument to improve provincial protection and management related to companies that extract and use groundwater in Ontario and the Great Lakes region for water bottling or other uses?

13) Do you feel there are other policy options or instruments that need to be developed or changed in order to improve groundwater governance?

Section 4: Future

14) In your professional opinion, what policy changes/developments will be required to improve groundwater governance in the future?

15) Would you be able to recommend any other people who I could interview related to my research project?

Appendix II: Research Questions

Research Question:
Can the implementation of an alternative economic policy instrument, work to improve groundwater policy and governance in Ontario?

Subsidiary Questions:

What progress has been made in Ontario with respect to the development and implementation of groundwater policy?

Has the addition of Annex#8 on Groundwater, under the *Great Lakes Water Quality Agreement* in Ontario improved groundwater policies and outcomes?

Do the new and existing policies and governance bodies properly address the extraction of groundwater for bottling?

Can the implementation of an alternative economic policy instrument, improve provincial protection and management related to water bottling corporation's extraction and use of groundwater in Ontario?

Appendix III: OWRA Penalties

OWRA Penalties: General, Corporations, and More Serious Offences

General S108 (1)	**Corporations S108 (2)**	**Corporations: More Serious Offences S109 (2)**	**Individuals: More Serious Offences S109 (3)**
Every individual convicted of an offence under this Act, other than an offence described in subsection 109 (1), is liable	Every corporation convicted of an offence under this Act, other than an offence described in subsection 109 (1), is liable	Every corporation convicted of an offence described in subsection (1) is liable, for each day or part of a day on which the offence occurs or continues, to a fine of	Every individual convicted of an offence described in subsection (1) is liable,
(a) on a first conviction, for each day or part of a day on which the offence occurs or continues, to a fine of not more than $50,000; and	(a) on a first conviction, for each day or part of a day on which the offence occurs or continues, to a fine of not more than $250,000; and	(a) not less than $25,000 and not more than $6,000,000 on a first conviction;	(a) for each day or part of a day on which the offence occurs or continues, to a fine of,
			(i) not less than $5,000 and not more than $4,000,000 on a first conviction,
			(ii) not less than $10,000 and not more than $6,000,000 on a second conviction, and
			(iii) not less than $20,000 and not more than $6,000,000 on each subsequent conviction;
(b) on each subsequent conviction	(b) on each subsequent conviction, for each day or part of a day on which the offence occurs or continues, to a fine of not more than $500,000. 2005, c. 12, s. 2 (33).	(b) not less than $50,000 and not more than $10,000,000 on a second conviction; and	(b) to imprisonment for a term of not more than five years less one day; or

(i) for each day or part of a day on which the offence occurs or continues, to a fine of not more than $100,000,		
(ii) to imprisonment for a term of not more than one year, or		
(iii) to both such fine and imprisonment. 2005, c. 12, s. 2 (33).		
	(c) not less than $100,000 and not more than $10,000,000 on each subsequent conviction. 2005, c. 12, s. 2 (34).	(c) to both such fine and imprisonment. 2005, c. 12, s. 2 (34).

Note: Government of Ontario B, 2019