Evaluating the Impacts and Current Legislation of Aggregate Extraction in Tiny, ON

Includes:

Final Report

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Completed for: AWARE Simcoe

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Course Code: ERSC 3160H

Course Name: Community-Based Resource Mgmt

Completion Date: April 21, 2025

Project ID: 6144

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Introduction

Aggregate extraction is a process where materials like gravel, sand, or stone are mined below the earth's surface and used for industrial production (Philpot et al., 2022). Aggregates are crucial for development as many urban areas are dependent on them to build and maintain infrastructure (Philpot et al., 2022). Despite the recognized importance of aggregate production, the process cannot be done without causing a plethora of socio-environmental impacts in and around the area that it is being done (Langer & Arbogast, 2002). The demand for aggregate production is growing at a rate in parallel with increased urban development, which highlights the need for pristine and affordable aggregate extraction sites.

Site 42, commonly known as the Teedon Pit located in Tiny, Ontario, is a site for aggregate extraction operated by Dufferin Aggregates, a division of CRH Canada. The aggregates from the Teedon Pit are abundant and inexpensive, making it a site of interest for Dufferin Aggregates. The pit, however, is situated on the Alliston Aquifer, which holds significance in Tiny and surrounding towns. The Alliston Aquifer is significant because of its pristine quality of water. The Aquifer is widespread across central Ontario, and supplies water to towns such as Tiny, Springwater, Oro-Medonte, and Tay (Adams, 2024). Tiny Township in particular, is significant in relation to the water supply from the aquifer as the town lacks a municipal water supply, which means that they rely entirely on well water from the Alliston Aquifer (Adams, 2024). Aside from the overall reliance on the aquifer for water supply, the water sourced from the aquifer holds significant status as it has been described as the "purest water in the world" by many (Cecco, 2021). Due to its significance, any threat to the quality of water

from the aquifer results in a controversial reaction from Tiny township residents, along with those with an interest in maintaining the pristine state of the water source (Cecco, 2021).

Project Purpose and Research Questions

The purpose of this project is to assess the environmental implications of aggregate extraction for a valuable aquifer located in Alliston, Ontario, as well as evaluate Ontario's regulatory framework and its effectiveness in protecting water resources. Following this, recommendations for best management practices based on case studies and successful policy implementation will be suggested.

Research questions discussed with this project's host – Aware Simcoe – include the following:

1. What are the environmental impacts of aggregate extraction, particularly on groundwater quality?
2. How effective are current policies in regulating aggregate washing and protecting groundwater?
3. What management strategies can be implemented to mitigate negative impacts on water resources?

Methods

To explore the impacts of aggregate extraction at the Teedon Pit and how well current policies protect the surrounding environment, this study used several different research methods:

- Literature Review & Interview: We reviewed a range of sources including peer-reviewed journal articles, government documents, researcher interviews, and industry reports. In addition, we had an interview with Mike Powell, a researcher at the University of Alberta currently looking into the Alliston aquifer. The goal was to understand how aggregate

extraction—especially the washing process—can affect groundwater quality and surrounding ecosystems, as well as the current environmental situation at hand and some of the research being done on it.

- Policy & Legal Regulation Review: We looked closely at Ontario's main laws that deal with aggregate operations, such as the *Aggregate Resources Act* and the *Clean Water Act*. This helped us evaluate how these policies manage risks to groundwater and whether they are effective in protecting the environment.
- Case Studies: We also researched similar aggregate extraction projects, like the proposed Melancthon Mega Quarry. Though these cases, along with the Teedon Pit case, we were able to see patterns in environmental impacts and find examples of how better management strategies have been applied elsewhere.

The Alliston Aquifer

The significance of the Alliston aquifer is difficult to define because of its unique nature. Although the statement of the water being of highest purity is a grand one that cannot be verified, it is worth exploring the reasons behind why some communities in the area claim it. In a meeting with Mike Powell, a researcher at the University of Alberta, he described the source as having no traces of organic pollutants, a rare finding for groundwater resources.

One of the research projects being done on this aquifer is a collaborative effort between three Canadian universities, the University of Alberta, University of Guelph, and the University of Ottawa. The focus of their research is to determine what subsurface processes are creating the conditions for the water's purity. Each university is using their specializations in hydrogeology, ultra trace elements, and isotopic determination to gain a better understanding of the aquifer.

Their hopes are to form a 3D model depicting the water's movement from recharge to discharge in order to apply filtration systems.

It is important to consider the need for aggregate extraction without diminishing the value of this aquifer. The concerns surrounding the Teedon pit beg the question of how land use changes are affecting the processes of this source. New approvals by the township have allowed the digging for aggregates below the water table which could have serious consequences for the Alliston aquifer. Mike Powell depicted a need for more time as the valuable information this source provides would be lost with the contamination and disappearance of this aquifer.

Overview of Aggregate Extraction Laws & Regulations in Ontario

The licencing and creation of aggregate pits is provincially managed by the Ministry of Natural Resources (MNR) which oversees the issuing of licences, permits, rules, inspections, complaints, enforcement, and rehabilitation of pits and quarries (Government of Ontario, 2014). This is something that can be obtained prior to public notification and consultation with landowners within 120 meters of a proposed site (Government of Ontario, 2014). Following this, a period lasting 60 days includes both time for any person/agency to submit comments/concerns to the applicant and ministry, and a mandatory information session within 10 of the notice and 10 days prior to the end of the 60-day period (Government of Ontario, 2014).

The exact laws governing the pits and quarries in Ontario fall under the *Aggregate Resources Act*, which the MNR uses to enforce current rules, regulations, and laws if necessary. The Teedon Pit would be subject to *Ontario Site Plan Standards, Resource Policies and Procedures, Technical Reports & Information Standard*s, and *Amendment Standards* (Government of Ontario, 2014). Site permits and licence are also subject to several other laws,

regulations, and standards such as the *Federal Fisheries Act* and Associated Guidelines, Zoning by-law(s), the *Ontario Water Resources Act, Clean Water Act, 2006, Conservation Authorities Act, Environmental Protection Act,* and the *Environmental Assessment Act* (Government of Ontario, 2014).

A proposed pit that is above the water table is not allowed within 1.5 meters above the maximum predicted water table, while excavation below the maximum predicted water table requires an application determining potential impacts on ground and surface water resources (Government of Ontario, 2020). This includes things such as well water, discharge areas, and springs. It also states that the permit holder/applicant must ensure the site is not classified as a Wellhead Protection Area for Quantity (protected and defined as an area surrounding a wellhead crucial for the long-term stability – both in quality and water level – of a drinking water source under the *Clean Water Act,* 2006) (Government of Ontario, 2020).

Given this, a permit may still be granted in this case if the application includes mitigation measures as recommended by a required impact assessment (Government of Ontario, 2023). Under section 2.5 – Water Report of the *Aggregate Resources of Ontario: Technical Reports and Information Standards* it is stated that this assessment needs to include both the significance of potential effects and the viability of mitigation measures for ground and surface water features within the area of affect (including water wells and ground water aquifers among others) (Government of Ontario, 2023). The assessment, if conducted, would include a study and Water Report of the site hydrogeology, water table details (storage, discharge, drainage, etc.)., and technical support data at Level 2 (Government of Ontario, 2023). For remote areas, the Level 1 and 2 Water Report is required only if the proposed site is within 500 metres of a coldwater

stream, 1000 metres of well water, or 5 km of a sensitive receptor (Government of Ontario, 2023).

Section 2.2. – Natural Environment Report also states that a report evaluating and identifying any negative impacts must be submitted for sites that exist within 120 meters of significant wetlands, fish habitat, and significant areas of natural and scientific interest (Government of Ontario, 2023). While the *Ontario Water Resource Act* (1990) article 30 (1) states that the discharge of polluting material (any material that enters the water and may impair the quality of that water) is prohibited – article 30 (2) – and the Ministry must be notified when polluting material escapes or is discharged. The act also states that a Director can define an area as protected for public water supply, in which case it would be prohibited for any material to impair or diminish the quality of the public water supply. Though an annual compliance assessment report (with a copy provided to the relevant municipality) is required, under the *Aggregate Act* (1990), excavation can occur 30 meters from a body of water, including well water, article 0.13 (1).

Case Studies

The reality of the aggregate extraction concerns surrounding the Alistar aquifer can be seen in numerous case studies both in and outside of Canada. Green et al. (2005) in Minnesota (USA) focused on ground and surface water impacts from aggregate mining for eight sites. The results of this study found that five of the eight sites had negative water level impacts (Green et al., 2005). Most of these impacts resulted in a significant decline in aquifer water levels (resulting in altered groundwater hydrology) that were caused by quarry dewatering and rock removal, though others included a hydraulic gradient changes and groundwater spring diversion

(Green et al., 2005). This was in addition to other changes such as turbidity and possible temperature changes (Green et al., 2005).

A publication by the Ontario Stone, Sand & Gravel Association claims above-water pits and quarries usually have limited, if any, effects on groundwater and water levels (supported by Green et al., 2005), though this depends on the type of pit/quarry (OSSGA, 2010). A 1996 study on the Oak Ridges Moraine showed results that suggested some benefits to groundwater could be found as the pits capture rainfall and snowmelt effectively decreasing runoff and increasing infiltration and storage (Hunter & Beck as cited in OSSGA, 2010). Likewise, OSSGA (2010) states that below water pits work in a similar way, and promote groundwater recharge, though note that these benefits are offset by increased evaporation, minor water loss, and a temporary lowering of the water level (OSSGA, 2010). These effects were attributed to the removal of residual moisture, and solid sand and gravel particles from the site (OSSGA, 2010). Likewise, including localized temperature changes, other effects were said to have stabilized over time and were usually both minor and localized.

Though OSSGA (2010) also stated below water aggregate extraction may result in an altered groundwater flow pattern, so requires careful and detailed hydrogeological studies (especially when close to wetlands or shallow wells). Aggregate washing plants do consume large amounts of local surface and groundwater water sources (usually less than 10%), though are supposed to be closely regulated by the MNR and Ontario Water Resources Act. This is something that would undoubtedly affect the Alistar aquifer's water table. Likewise, dewatering in these below-water quarries typically results in groundwater effects on both flow patterns and water levels, so increased care is advised along with a higher level of studies on nearby sensitive areas (wetlands, wells, streams, etc.) and a groundwater monitoring program (OSSGA, 2010).

Wang et al. (2017) published a study revealing negative environmental effects from aggregate extraction on the Pepin Creek watershed in the Lower Fraser Valley of British Columbia, Canada. Despite the government regulations for mitigating and preventing negative environmental impacts, the study found there had been gradual soil decay, a change in surrounding vegetation cover, and a resulting change in the watershed's water balance (Wang et al., 2017). These changes were reported to have a likely negative effect on groundwater and/or surface water levels in addition to aquatic habitats (Wang et al., 2017). With a total estimated 25% of the watersheds surface area being affected and a 10% – 20% estimated loss of water storage, this more recent study serves as a documented case of the negative impact's aggregate extraction in Tiny, Ontario may have on Alistar's high quality waters and surrounding habitat.

Lastly, in another case the proposed Melancthon Mega Quarry project in Ontario sparked community opposition due to potential implications on local water systems (Patterson, 2011). This quarry, planned for operation in a sensitive part of Ontario's agricultural heartland, has sparked concerns about water depletion and contamination (Patterson, 2011). Public outrage prompted a rethinking of the project's environmental impact, with the Ontario government eventually admitting that a more extensive Environmental Assessment was required to assess the hazards involved with the extraction activities (Patterson, 2011). This event emphasizes the crucial need of comprehensive environmental assessments and transparent decision-making prior to beginning excavation to avoid harmful implications for both residents and the environment.

Discussion

The findings of this project suggest that aggregate extraction at the Teedon Pit could be putting the Alliston Aquifer at risk—an aquifer that supplies drinking water to many people in

Tiny Township and nearby communities. Even though there has not been any official confirmation that aggregate washing is contaminating the aquifer, the location of the pit and the amount of water being extracted raises serious concerns for both environmental and human health. Residents have raised serious worries about the impact of aggregate washing on the Alliston Aquifer, which provides drinking water to the neighborhood (Howard, 2021). The aquifer is noted for its high-water quality, and local stakeholders are concerned that inappropriate management of aggregate washing effluent would lead to contamination (Howard, 2021).

One of the biggest concerns is the potential for groundwater contamination (Shetty et al., 2023). Aggregate washing can introduce fine sediments and other materials into the surrounding environment, and if these reach the aquifer, they could reduce the quality of the water (Shetty et al., 2023). This is especially important in Tiny, where most people rely on private wells and lack access to municipal water systems (Shetty et al., 2023). Any change in water quality could directly affect their health and daily lives (Shetty et al., 2023). Additionally, changes in groundwater flow could also affect nearby ecosystems like wetlands or surface water bodies (Shetty et al., 2023). Numerous studies (Wang et al., 2017; Green et al., 2005; OSSGA, 2010) have shown that aggregate extraction can, even if only temporarily, negatively impact the hydrological cycles, ground and surface water table balances (particularly decreasing water levels), soil and vegetation cover, and aquatic habitats of watersheds in the area. This is in addition to other indirect impacts such as changes water temperature, water flow, and stream regime (Green et al., 2005). If the aquifer starts to degrade, we might see long-term effects on biodiversity and the overall health of local habitats (Shetty et al., 2023).

This project also highlights some of the weaknesses in the current regulations that govern aggregate extraction in Ontario. While the *Aggregate Resources Act* and the *Clean Water Act* are

supposed to manage these kinds of operations, there are a few concerns that should be addressed (Mueller & Gasteyer, 2021). The first concern is the lack of effective groundwater protection (Mueller & Gasteyer, 2021). Current policies and regulations are not strict enough when it comes to operating near vulnerable groundwater sources like the Alliston Aquifer. The second concern is the lack of transparency (Mueller & Gasteyer, 2021). Many community members feel as if they are not being informed properly or included when companies such as Dufferin apply for permit renewals, particularly since they are not required to be notified until after the permit has been granted (Mueller & Gasteyer, 2021; Government of Ontario, 2014). The last concern is the poor monitoring (Mueller & Gasteyer, 2021). Currently there is not enough long-term tracking of water quality near the pit, making it harder to detect issues before they get worse (Mueller & Gasteyer, 2021).

Next Steps and Recommendations

To improve the situation, there are several steps that can and could be taken, both by the government and by concerned community groups (Silver et al., 2016). First, ongoing, long-term water testing (both groundwater and surface water) is essential (Silver et al., 2016). Getting current, accurate data with a long-term established baseline would help confirm whether the extraction is diminishing water quality. Soil and geological testing could also help figure out how easy it is for pollutants to travel from the pit into the aquifer (Silver et al., 2016). Given the effects found in the case studies included in this paper, it may also be worth including a study on the surrounding vegetation and habitat surround the Alister aquifer in addition to studies on the water table balances, storage, and water quality. Any future permit renewals should require more thorough environmental impact assessments, including potential long-term and cumulative

effects (Silver et al., 2016). These assessments should be reviewed by third-party experts, not just the company involved (Silver et al., 2016).

The *Aggregate Resources Act* could be improved by adding stronger safeguards, like increased minimum distance requirements from aquifers or stricter limits on how much water can be used (Environmental Registry of Ontario, 2019). There should also be more rules specifically focused on protecting drinking water in areas like Tiny, where residents rely on wells (Environmental Registry of Ontario, 2019). Residents, First Nations, and organizations like Aware Simcoe should have a bigger role in the monitoring and decision-making process (Environmental Registry of Ontario, 2019). A collaborative community-based water monitoring program could help keep track of water quality while also giving residents, surrounding Indigenous Peoples, and other stakeholders more information and control over what is going on in their community (Environmental Registry of Ontario, 2019). It may be beneficial for the results of this project, along with any past research and field data, to be collected into a comprehensive report and both reviewed and shared with stakeholders such as local councils, provincial ministries (like MECP and MNRF), environmental advocacy groups, and the residences and involved Indigenous Peoples among others (Environmental Registry of Ontario, 2019).

Public pressure and clear evidence can be powerful tools for driving policy reform (Freudenberg & Tsui, 2014). Other controversial extraction sites, like the Melancthon Mega Quarry, have shown how community opposition and solid scientific data can lead to better outcomes (Freudenberg & Tsui, 2014). Studying these examples more closely could give us useful ideas for advocacy and regulation here in Tiny (Freudenberg & Tsui, 2014). Lastly, Simcoe County should develop a regional land-use plan that prioritizes water protection when

deciding where and how aggregate extraction can happen (Freudenberg & Tsui, 2014). As climate change and development continue, protecting clean groundwater will only become more important (Freudenberg & Tsui, 2014).

Future Research & Conclusion

While this project provided a broad overview of the environmental and regulatory concerns around aggregate extraction in relation to the Teedon Pit, there are still several areas where further research is needed (Lea-Smith et al., 2025). Long-term studies are necessary to better understand how aggregate washing operations may be affecting the Alliston Aquifer, particularly during high extraction periods or seasonal shifts (Lea-Smith et al., 2025). Scientific testing over time would help determine whether subtle changes in water quality that current monitoring fails to detect is occurring (Lea-Smith et al., 2025).

There is also a need to compare the Teedon Pit with similar sites across Ontario to identify common patterns or regional differences in how aggregate operations interact with local ecosystems (Lea-Smith et al., 2025). These kinds of comparative studies could help policymakers develop more adaptive and locally sensitive regulations (Lea-Smith et al., 2025). Additionally, future research could explore how climate change and extreme weather events might interact with aggregate operations to amplify groundwater risks (Lea-Smith et al., 2025). For example, increased rainfall could potentially speed up the movement of contaminants into the aquifer (especially in regions with sandy soils) and effects from documented local water temperature changes may become exuberated (Lea-Smith et al., 2025; Wang et al., 2017).

Finally, it would be valuable to investigate public trust and perception regarding groundwater safety, especially in areas that rely on private wells (Lea-Smith et al., 2025).

Understanding how residents interpret scientific, and policy decisions could help create more transparent and inclusive water governance (Lea-Smith et al., 2025).

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