Water Management in Quarries

GravelFacts.ca

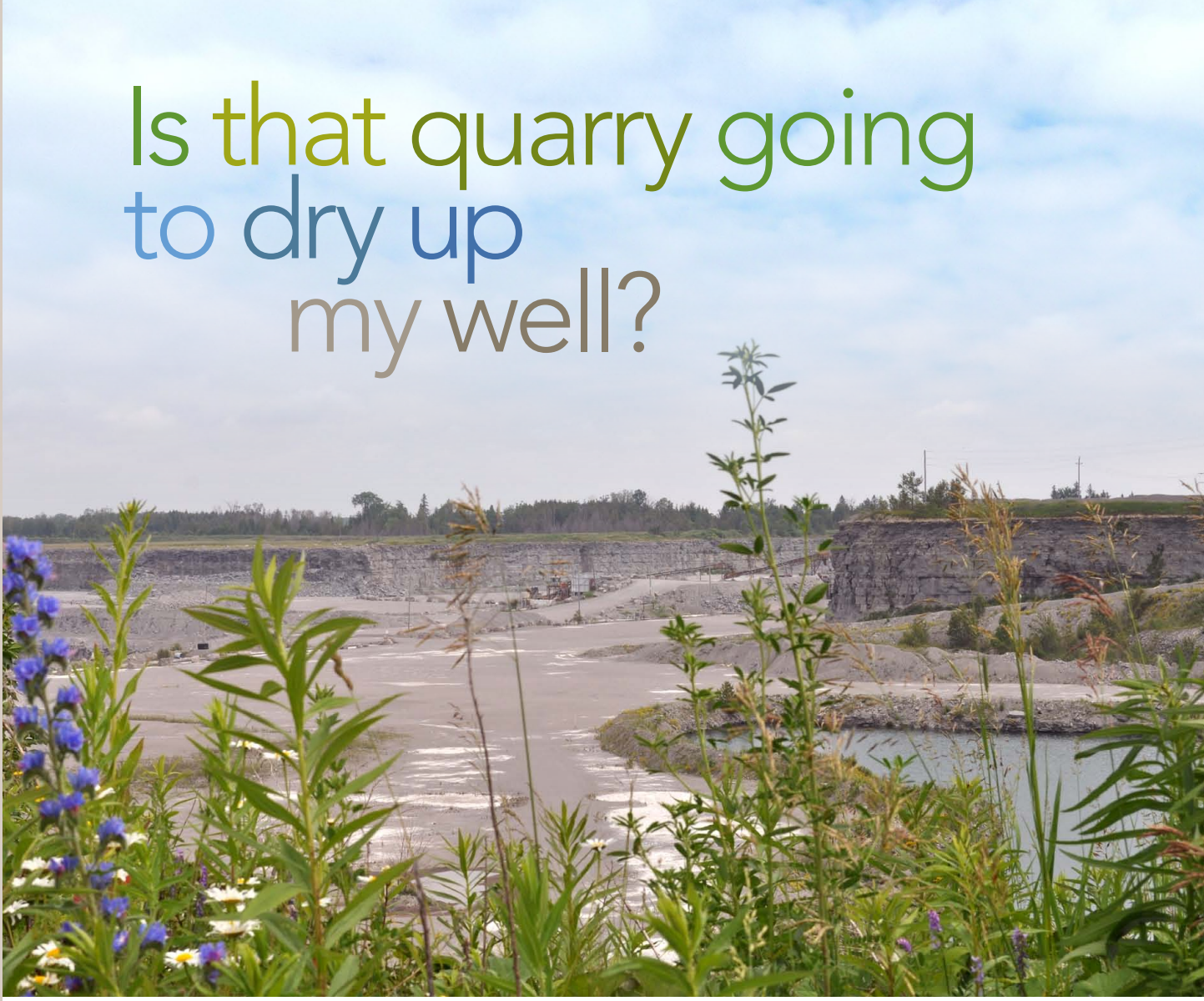
OSSGA

ONTARIO STONE, SAND & GRAVEL ASSOCIATION

Prepared by the
OSSGA Environment Committee

Water Management in Quarries

Is that quarry going to dry up my well?



The short answer is no. Water well users located near pits and quarries are often concerned that extraction operations will impact their water supply. These users need to know that their water supply is protected under existing legislation. Scientific research and decades of monitoring quarry operations have shown that the "extent of influence" a quarry has on the groundwater flow regime is quite limited. Aggregate producers handle water as part of their day-to-day operations but the majority of water handled during aggregate operations is re-circulated. Excess water is returned to the watershed. Very little water is actually consumed or lost.

Quarries commonly extend below the groundwater table in order to extract rock. These below water quarries pump small amounts of groundwater out of the quarry to maintain a dry quarry floor for their operations.

Water management programs are developed to ensure the responsible use of water at the site and comply with the many legal requirements governing its use.

REGULATIONS AND LEGISLATION

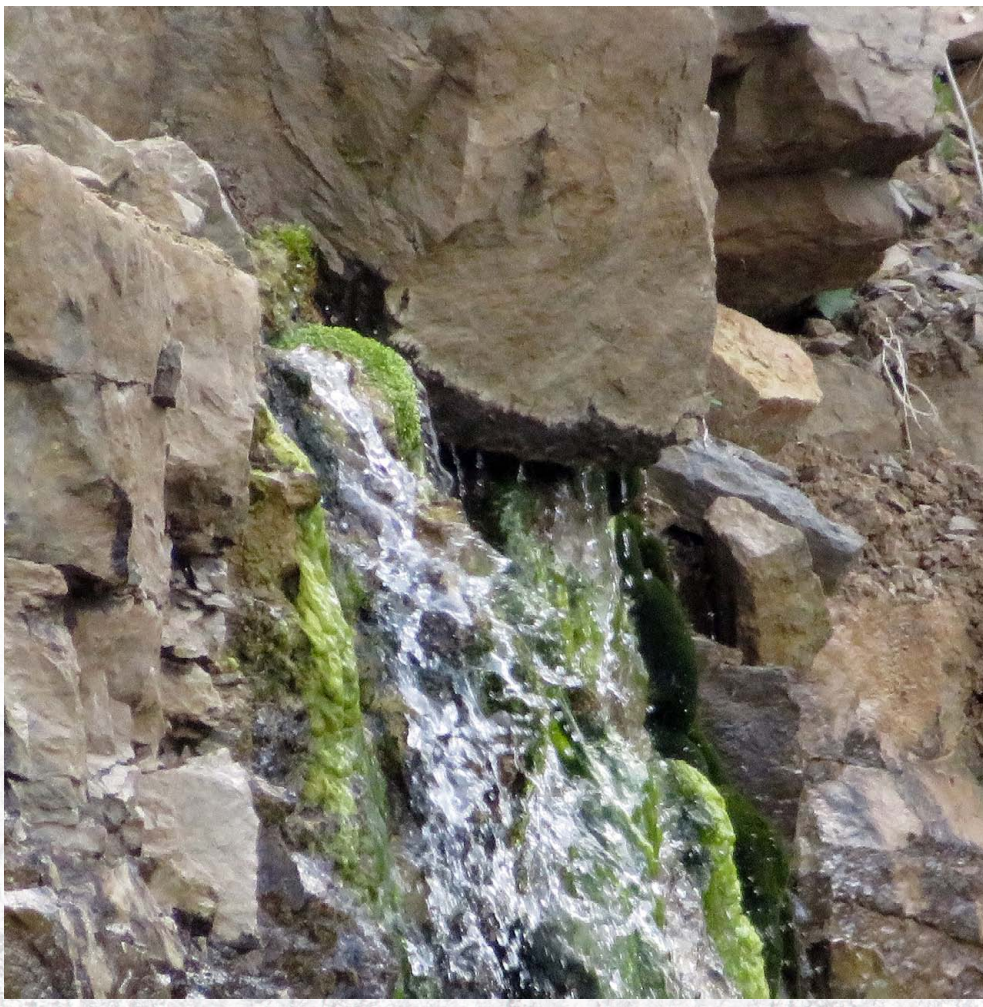
In order to use water at a quarry the aggregate operator must apply for a Permit to Take Water from the Ministry of the Environment and Climate Change (MOECC). This is a legal requirement regulated under Section 34 of the Ontario Water Resources Act (OWRA). To discharge naturally occurring water from the quarry, the aggregate operator must apply for an Environmental Compliance Approval under Section 53 of the OWRA. The Ministry of Natural Resources and Forestry, local municipalities, conservation authorities and Fisheries and Oceans Canada may also place requirements and restrictions on water handling and on the release of water from a quarry.

How much water does a quarry really use?

A Permit to Take Water sets the maximum amount of water a permittee is allowed to take on a daily basis. This number can be very large. A common misconception is that the volume on the permit is the amount of water a quarry actually takes on a daily basis throughout the year. The truth is, the actual amount of water taken daily is very small compared with the amount allowed on the permit. However, from time-to-time, the quarry does need to pump larger volumes of water. This can happen when water accumulates from large rain storms or, more frequently, when snow melts in the spring. At these times, quarries typically pump out the water to ensure a dry quarry floor, and release the water back into the local watershed. These seasonal and weather variations are why the permits allow for large volumes of water. The actual amount of water that seeps into the quarry each day is small, and is really just being moved out of the quarry and back into the watershed.

Water management activities

Because very little water is actually consumed at a quarry, it is more accurate to say that water is handled or managed. This is done in three primary ways: dewatering the quarry, dust suppression and washing aggregates.



QUARRY DEWATERING

Typically, dewatering occurs in quarries but not necessarily in sand and gravel pits. Water in quarry excavations collects from precipitation or from groundwater seeping through fractures in quarry walls. Quarry operators pump this water out of the excavation to allow for extraction (blasting and recovering the bedrock) on a dry quarry floor. Groundwater seeping into the excavation from water-bearing breaks (fractures) in the bedrock lowers the water table to the depth of the fracture break, releasing the water into the quarry. This does affect groundwater flow patterns around the quarry, but only locally. Except for the fractures, the bedrock itself prevents the movement of water.

Before the quarry can begin operations, extensive studies are carried out to assess the local influence on groundwater flow systems. The area around the quarry affected by the proposed extraction is referred to as the drawdown cone or the cone of depression. These studies determine whether private wells will be affected by the proposed drawdown cone. If it is determined that a well may be affected, a mitigation strategy must be developed for approval by regulatory agencies before the quarry will be authorized for operation. In short, a quarry is not permitted to impact an existing water well.

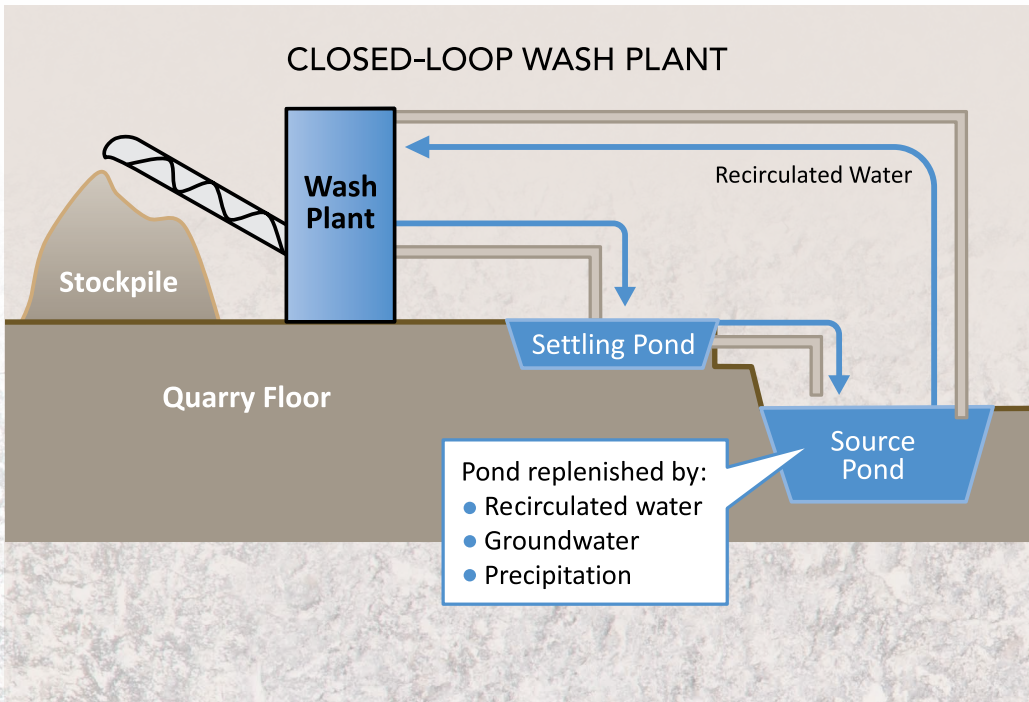
DUST SUPPRESSION: WATER TRUCK

Suppressing dust at a pit or quarry is the law. To minimize dust (a by-product of extracting and crushing rock) water is sprayed on internal haul roads, processing equipment, stockpiles and trucks exiting the site. Quarries have developed best management practices for water conservation that are designed to use only the amount of water that is needed to control dust.

AGGREGATE WASHING FACILITIES

Water may also be used to rinse fine sediments from the crushed rock (i.e., washing). Washing facilities use a closed-loop system design, where the rinse water is collected in a settling pond to be clarified and then recirculated back to the source pond to be re-used in the wash plant.

It is estimated that 92% to 98% of the water handled at an operation is returned to the local watershed. Only 2% to 8% of water used during the washing process is consumed (i.e. not returned to the watershed (Golder, 2006)). The industry responsibly reuses and recycles water extensively, and this means the quantity of water available in the watershed is not significantly impacted.



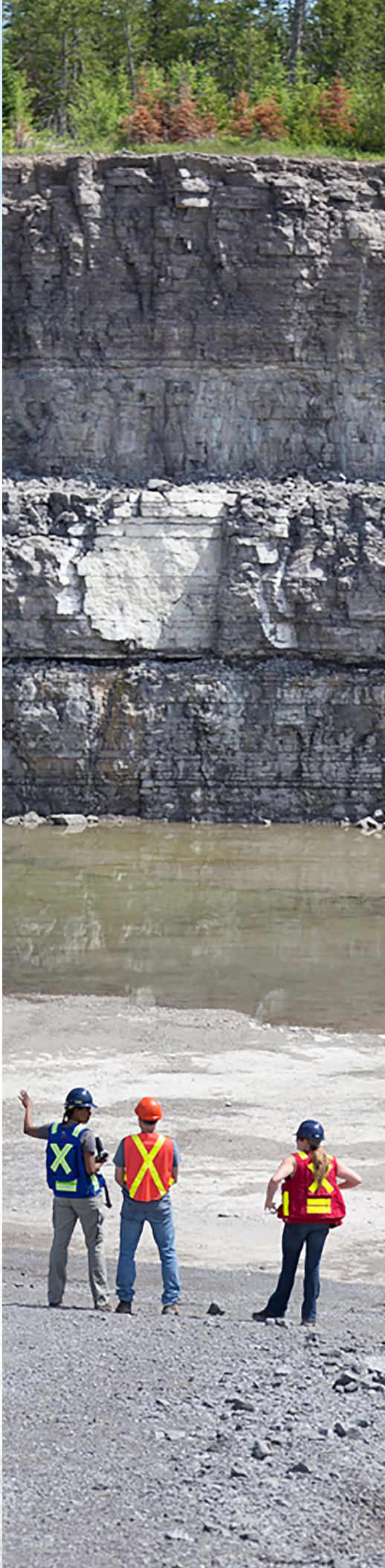
Water monitoring programs

Before a licence for a new quarry or gravel pit can be issued under the Aggregate Resources Act, extensive studies are required to determine the potential effects from the proposed aggregate operations on nearby wells, streams, wetlands or other sensitive environmental features. If concerns exist then mitigation measures are developed to eliminate those concerns to the satisfaction of regulatory agencies (Ministry of Natural Resources, 1997).

Groundwater and surface water monitoring programs are developed to predict potential effects and evaluate actual effects of operations on local water quantity and quality. Where granted by local water well users, this can include the monitoring of their private wells. Aggregate producers are mandated to implement comprehensive water monitoring programs, which are regulated and carried out under the direction of both the Ministry of Natural Resources and Forestry and the Ministry of the Environment and Climate Change, and are based on proven approaches and methodologies. This keeps aggregate producers accountable to the public and the government, and ensures water quantity and quality are protected in private wells and the surrounding environment.

Protecting the water supply

If there is a sudden adverse change in water quantity or quality in a domestic supply well that is attributed to an aggregate operation, the aggregate operator is legally required to provide a temporary supply of water equivalent in quantity and quality to the normal well takings, while the operator completes an assessment as to what caused the impact. If permanent interference is determined to have been caused by the quarry, the aggregate operator is required to restore the water supplies to the affected party. The need to restore water supplies happens occasionally in Ontario, but it is rare.



Cumulative impacts

A cumulative impact, which may result from multiple operations extracting in the same area at the same time, is defined as the additive effect of multiple quarry dewatering operations on groundwater, surface water and ecological features. In Ontario, the director of the Permit to Take Water program initiates cumulative impact assessments (CIAs) to ensure there are no adverse effects where multiple operations are extracting below the water table. In one of the largest CIA studies to date in Ontario, which was independently validated by the MOECC involving twelve quarries on the Carden Plain, the model showed the cumulative effects of the quarries on groundwater drawdown, drinking water wells, wetland function, low flows in creeks and rivers, flooding and erosion in creeks and rivers, and most water quality parameters were expected to be negligible over the study period (Golder, 2012). Ongoing monitoring programs help to ensure study results are accurate.

Climate change implications

While impacts to water resources are required to be minimized during the operation of quarries, the after use of these operations can contribute to creating resilient communities in the face of a changing climate. **Rehabilitated quarries provide opportunities for water storage and diverse wetland habitats,** which can address water quantity issues and minimize flooding in flood-prone areas. These are just two examples of the interim nature of extraction and accommodating subsequent land uses based on local needs. The Wainfleet Wetlands Conservation Area (1) and Kerncliff Park (2) in Burlington are examples of quarries that have been rehabilitated to biologically diverse wetland ecosystems, attracting wildlife for the enjoyment of the public long after aggregate extraction has ceased. Rehabilitated quarries can enhance the natural environment and create water assets that may offset the impacts of climate change.

OSSGA
ONTARIO STONE, SAND & GRAVEL ASSOCIATION

5720 Timberlea Blvd., Unit 103
Mississauga, ON L4W 4W2
905.507.0711
www.ossga.com
GravelFacts.ca

Essential materials for building a strong Ontario

Summary

The aggregate industry is sophisticated, accountable and deeply committed to environmental stewardship. Aggregate producers are primarily water handlers and not consumers. The actual amount of water consumed at an aggregate operation is relatively small. Well over 90% of the water handled is returned to the local watershed. The handling and use of water in an aggregate operation is regulated by multiple legislative requirements which require, among other things, the submission of detailed scientific studies prior to any approval being granted. Therefore private well users are fully protected under legislative authority. Once extraction at a quarry is completed, the site is rehabilitated creating water assets and enhancing the natural environment in ways that help mitigate the local impacts of climate change.

REFERENCES

Golder Associates Ltd. (2006). Water Consumption Study.

Golder Associates Ltd. (2012). Cumulative Impacts Assessment for Groundwater Takings in the Carden Plain Area.

Ministry of Natural Resources (1997). Aggregate Resources of Ontario Provincial Standards, Version 1.0.

Ministry of the Environment (2007). Guide to Permit to Take Water Application Form: Sections 34 and 98 Ontario Water Resources Act R.S.O. 1990 and Water Taking Regulation O. Reg. 387/04.

(1) https://npca.ca/conservation-areas/wainfleet-wetlands

(2) http://www.ontariotrails.on.ca/trails/view/kerncliff-park---ian-reid-side-trail

ACKNOWLEDGMENTS

OSSGA would like to thank David Ketcheson, Azimuth Environmental Consulting Inc., Kevin Warner, Cambium Inc., and Tecia White, Whitewater Hydrogeology Ltd. for their contribution to this factsheet. (2016)