

DRAFT **(for NDACT)**

January 10, 2025

Our File No.: 21-407

Mr. Carl Cosack
North Dufferin Agricultural
and Community Taskforce (NDACT)
Box 875
Shelburne, ON L9V 3M1

E-MAIL
cosack@zing-net.com
Natalie Kotyck <info@ndact.ca>

Re: Strada 4th Release Peer Review – Overview Summary January 10, 2025

Dear Mr. Cosack,

This letter provides a Peer Review Summary Overview of the Strada October 2024 pending Aggregate Quarry Application at this date. Modifications are anticipated as review with Strada continues.

1.0 Introduction

Strada Aggregates is proposing to establish a below the water table Dolostone Quarry within the existing 149 hectares (368 acres) licence footprint of a currently operating above the water table Gravel Pit complex. The existing Pit is located west of Dufferin County Rd 124 on the 4th Line just north of County Rd 17 on W½ of Lots 11, 12, 13 and 14 Con 3 Old Survey (OS) Melancthon.

The proposed Quarry Upper Lift 1 footprint is about 65 hectares (160 acres) and the Lower Lift 3 footprint is about 55 hectares (135 acres) more or less.

2.0 Project Description

2.1 Depth of Extraction and Lifts

The proposed depth of extraction is up to 70 m (230 ft) below original ground and the 4th Line corridor. The extraction depth below the water table is up to 55 m (180 ft). These depths exceed that of any other Niagara Escarpment Dolostone Quarry.

The proposed Dolostone Quarry is proposed to be operated in an upper overburden Lift (sand and gravel / glacial till) and three bedrock lifts – Lift 1 Guelph / Eramosa Formation, Lift 2 Goat Island (Ancaster / Niagara Falls) Formation and Lift 3 Gasport Formation. Lift 1 is lower quality softer rock, Lift 2 contains deleterious Chert (alkali aggregate reaction) and Lift 3 is the provincially prized high aggregate quality Gasport Bedrock Formation.

2.2 Extraction Quantities

The quantity of pit and quarry materials is roughly estimated at Overburden and Granular Resources 10,000,000 m³, the Guelph / Eramosa 11,000,000 m³, the Goat Island at 8,000,000 m³ and the high quality Gasport 10,000,000 m³. Mining and processing of this rock is expected to create about 2,000,000 m³ rock fines, silt (sediment) and dust. Rock fines may be marketable but silt and dust capture and disposal must be managed on site. The total bedrock aggregate resource is therefore about 27,000,000 m³ assuming lower quality rock may be marketed by Strada.

3.0 Water Management

3.1 Aquifers and Aquitards

The Overburden and the epikarst Top of Guelph Formation contain the water table aquifer, the Guelph Eramosa the upper bedrock aquifer and the Gasport the deep regional aquifer. In Strada's Groundwater Model vernacular, the sand and gravel is Model Layer 1, the top of bedrock epikarst is Model Layer 3, the Guelph Eramosa Model Layer 4 and the Gasport Model Layer 6. Significant aquitards occur within the glacial till overburden Model Layer 2, Goat Island Formation Model Layer 5 and the Cabot Head Shale Model Layer 7 under the Gasport. The top of Model Layer 7 is the proposed floor of the Quarry.

3.2 Proposed Quarry Water Quality and Quantity Management

There are no surface water outlets from the existing gravel pits. Drainage is internal with infiltration to deeper groundwater aquifers.

To reduce groundwater inflow into the proposed Quarry excavation, Strada relying on geological boreholes, interpretation of geological formation stratigraphy and groundwater modeling have proposed a system of low permeability hydraulic barriers / wedges constructed progressively against the newly excavated vertical bedrock Model Layer 4 and 6 Aquifer faces and perhaps Model Layer 5 aquitard faces.

These hydraulic barriers once in place will cut off and 'dam' the upgradient groundwater flows creating upgradient water level rises and mounding around the proposed quarry.

With the exception of an upgradient water flow capture and interceptor tile drain (invert 487 m asl) proposed within the quarry extraction limit setback bedrock epikarst top paralleling the 4th Line by the current October 2024 Site Plans, all other quarry contact drainage water will collect in the designated quarry floor sump.

Lower quality upper aquifer, agriculturally impacted water will be co-mingled with high quality pristine Gasport Aquifer water, quarry floor rainfall, quarry floor water contaminated by Ammonium Nitrate / Fuel Oil / Emulsion blasting residues, processing / haulage equipment oil and grease, hydrocarbons and turbidity. This 'storm' water is proposed to be collected in the quarry sump pond and pumped into infiltration infrastructure located on the current pit floor.

No quarry floor stormwater treatment is proposed except detention in a small quarry sump pond. The proposed infiltration infrastructure will recharge without treatment into the Horning's Mills rural and village community drinking water aquifers and brook trout streams.

3.3 Quarry Water Management (Run of the River)

Strada's October 2024 Site Plans, Groundwater Modeling and proposed Infiltration Infrastructure may be characterized as 'run of the river' Quarry Water Management. Groundwater inflow from the multiple aquifers is collected in a small quarry floor sump pond and pumped to the various infiltration infrastructure as required to keep the quarry floor dry. Maintaining groundwater flows to the Horning's Mills Community and the Pine River headwaters is based on operating Quarry requirements and not 'Job One'. There is no storage provided to facilitate winter and dry season infiltration operations.

Strada's proposed 'run of the river' Quarry operation mixes Upper Aquifer agriculturally contaminated groundwater, with pristine Gasport Aquifer groundwater, pit floor processing equipment hydrocarbons, blasting Ammonium Nitrate / Fuel Oil residuals and rock flour within the pit floor sump ponds. This pit floor storm water classified as sewage by MECP is proposed to be pumped directly without further treatment to Infiltration Infrastructure discharging to Horning's Mills community drinking water aquifers. This sump water may have elevated turbidity which will 'clog' infiltration media.

3.4 Underground Stream

An underground stream (modeler's inferred zone of increased hydraulic conductivity) or groundwater flow convergence zone has been identified to traverse the proposed quarry site from the former McTaggart farm topographic recharge depression (now Duivenvoorden proposed pit expansion site) through the southwest part of the Strada Prince Pit to the central east boundary of the Strada Melancthon Pit. This flow convergence zone extends easterly to Horning's Mills Lake and the Main Street / River Road Pine River headwater. This flow convergence zone is reflected in the principal Water Table, Guelph / Eramosa and Gasport Aquifers.

This feature will adversely impact extraction operations throughout the life of the Quarry. If Quarry dewatering is undertaken as proposed, infiltration quantity (and quality) compensation for 365 days/year will be required to replace the Quarry interrupted underground stream flow and protect the downgradient Horning's Mills Community and Pine River headwater streams.

3.5 Ambient Ground Water Quality and Proposed 4th Line Buried Interceptor Tile Drain

This Peer Review plotting of Strada Compliance Report Upper Aquifer Groundwater Quality based on averages for Years 2019 to 2022 illustrates Nitrates (as N) ranging from 3.26 to 8.16 mg/L on the four corners of the Prince (Doney Farm) Pit including at OW19-B (6.06 mg/L) a monitor well based on static water levels interpreted by this Peer Reviewer to be hydraulically connected to the deep Gasport Aquifer.

This connection is further illustrated by the Strada September 10, 2024 single event water quality sampling of nearby deep Gasport Aquifer Monitor Well OW 24C at 6.46 mg/L and OW27C at 4.1 mg/L. Additional deep aquifer sampling is required to address if there is downhole annular leakage at these monitor wells and confirm that the ambient Gasport Aquifer water is actually being sampled.

Elevated Upper Aquifer Nitrates (as N) contamination also occurs along the 4th Line and County Rd 17 boundaries of Shelburne Pit No 2.

At face value, the Strada October 2014 Site Plan proposal to construct an interceptor 'tile drain' with invert at 487 m asl more or less along the 4th Line within the quarry extraction limit setback and vertically within the shallow top of bedrock epikarst, will deliver Nitrate (as N) water elevated above the CCME (2012) 3 mg/L Criteria for Long-Term Protection of Aquatic life and approaching the Ontario Drinking Water Standard of 10 mg/L Nitrate (as N).

A 72-hour or longer pump test at this deep aquifer underground stream location should be undertaken to further evaluate if Nitrates (as N) reduce with aggressive pumping.

4.0 Groundwater Modeling

The Strada Ground Water Modeling at 5± m is poorly calibrated and / or validated for a number of reasons cited in this four cycle Peer Review. The most serious issue is the underestimate of by 2 to 3 times of dry weather and average flows in the Pine and Boyne River headwater tributary streams and by extension underestimate of quarry flows (fluxes) to be managed and infiltrated. A secondary issue is the inferred location of the zone of increased hydraulic conductivity which

distorts the location of model drawdowns from the proposed Quarry site to Horning's Mills community.

The Groundwater Modellers have refused to provide their input data for Peer Review audit. They have also refused to provide error statistic for on-site data monitoring

At face value, the October 2024 Groundwater Model estimates that for the October 2024 Site Plan proposal that groundwater and stream flow will be reduced up to 50% in some Quarry Operational Phases in the Pine River headwaters at Main Street and River Road.

Flows will also likely be reduced a similar amount in the spring discharge at 177 Main Street, Horning's Mills. A residential well (concrete tiles) is constructed in this spring. For unknown reasons, Strada omitted this Peer Review requested key spring discharge and stream flows on Mill Lane from its important August 15, 2024 dry weather streamflow survey.

Reduction of groundwater flow quantities in Horning's Mills community will also reduce dilution of village effluents including septics, road salts and water softener salts. Nitrates (as N), Sodium other parameter will be further elevated in existing Drinking Water Sources and stream discharges.

At the same time, the October 2024 Groundwater Model estimates, an increase in water tables and stream flow discharges within the Boyne River headwater streams and wetlands. These water table rises have adverse implication for wetland contiguous farm fields and agricultural tile drainage outlets. Rising water table implications are also adverse for existing residential lots and 'Lots of Record' contiguous with and located within these wetlands.

If Strada continues to pursue this Site Plan path, compensation may be required for damaged fields, residential lots and 'Lots of Record'.

5.0 Quarry Opening / Alternative

5.1 Proposed East Limit Phase 1 Quarry 1 Opening

Presumably because of minimal overburden depth and ready access to bedrock, the Strada October 2024 Site Plans propose to initiate Phase 1 extraction within this underground stream corridor on the east boundary of Melancthon Pit No. 1. Initiation of Lift 1, 2 and 3 extraction at this location guarantees that the maximum quantity of quarry dewatering and infiltration compensation will be required throughout the life of the Quarry into the Closure / Rehabilitation Phase.

Furthermore, the October 2024 Phase 1 A and I B are optimum critical site areas for location of infiltration compensation to maintain four season groundwater flows to Horning's Mills community throughout the life of the Quarry and beyond. Strada's Site Plan default Infiltration Ponds within Melancthon Pit No. 2 result in Quarry operational

flow diversions from the Pine River to the Boyne River headwater wetlands and streams with adverse rising water table impacts

5.2 Alternative Phase 1 Southwest Quarry Opening

This Peer Review strongly recommends that Strada initiates quarrying in the southwest corner of the proposed Quarry footprint. This initial location is anticipated to have much lower groundwater inflow and provide extended opportunity for Strada to implement an adaptive water management plan for implementation of four season infiltration (24/7/365) compensation along the east-central quarry corridor boundary.

Initiation of extraction in the south west area of the proposed Quarry is also an optimum area for Strada to obtain operational experience with the nuances of commercial quarrying on this site including issues of deeper excavation groundwater control and the lower quality of the upper bedrock.

This south west location is also more appropriate for unplanned Quarry abandonment with minimum resultant groundwater impacts than the Strada October 2024 Site Plan proposed initial Phase 1 extraction areas.

6.0 Long Term Monitoring

6.1 Long Term Site Water Level Monitoring Wells

Strada needs to rationalize its gravel pit origin groundwater monitoring infrastructure for purpose and efficiency. The existing infrastructure includes redundant no longer relevant monitors and monitors that will be destroyed under the proposed quarry operational footprint. Unexplained, a number of the recent 2023 / 2024 deep high quality Gasport multilevel monitors were installed at locations unprotected from future quarry operations. These monitors will have to be replaced after Site Plan approval for long-term continuous water level monitoring purposes.

Furthermore, Strada has refused to update its archaic gravel pit origin monitoring nomenclature to reflect the generally accepted Groundwater Model Layers based on the Geological Formations identified in the proposed quarry. The current Strada nomenclature of including fundamental Model Layer 4 and 6 monitors in the same 'C' bucket classification is simply confusing and inefficient for communications.

Hydrographs presented in reports also need to be grouped by Groundwater Model Layer for meaningful comparison.

Finally, Strada needs to prepare visual plan view plots of monitor screens by Model Layer to evaluate the adequacy of the monitor network and identify the monitoring gaps. It is not sufficient to just look at a single consolidated plan view plot of all depth monitors and arbitrarily say, there are enough monitors by Model Layer.

6.2 Four Season Annual Monitoring Not Available

Only 3 months of continuous groundwater level potentials are provided for Strada's deep Gasport Aquifers groundwater monitor. Strada has advised 12 months of water level records will be provided in the 2024 Annual Compliance Report (not yet seen).

6.3 Eastern Site Sentry Perimeter Monitor Wells – Water Level Control

Minimum existing piezometric water levels (based on annual hydrographs) in the eastern perimeter multi-level Guelph / Eramosa and Gasport Aquifer monitoring wells will be maintained at OW9B, OW16C, OW25C or equivalent monitor installed for purpose. Maximum existing levels are not to be exceeded at OW28C and OW7C.

6.4 Sentry Wells 3rd Line OS

In view of the current Model Results of significantly (up to 50%) reduced groundwater flows to the Horning's Mills Community and Pine River Headwater streams, five dual level (Model Layer 4 and 6) Sentry Wells are proposed on the west side of the Third Line at each Township Lot boundary from County Road 17 north to Lot 14/15 boundary.

Existing hydrograph minimum water levels are to be maintained at all monitors as determined over a two period prior to initiation of extraction below the existing water table + 1.5 m. Increase in water levels above existing are not acceptable at County Road 17 and Lot 14/15 monitors due to predicted damage to agricultural fields.

Open Hole private pumping domestic and farm water wells are not suitable for sentry monitoring purposes.

6.5 Sentry Stream Flow Monitoring

Continuous stream flow monitoring is to be provided at the outlet structure at Horning's Mills Lake or at the Main Street River Road Pine River tributary, at 177 Main Street spring, at the two Mill Lane tributaries, at 3rd Line and 15th Sideroad, at the entrance to the River Road Mill Pond and at Honeywood Line (Mulmur 2nd Line WHS) or at the Prince of Wales

outlet of the Pine River Provincial Fisheries Area. Minimum flows for the life of the quarry operation and beyond to be based on August 15, 2024 dry weather flows or as established during a two year monitoring period prior to initiation of below the water table + 1.5 m extraction on the proposed Strada Quarry site.

6.6 Water Quantity Performance Criteria

The October 2024 Site Plans do not include performance criteria for maintenance of dry weather groundwater and streamflows to the Horning's Mills community.

6.7 Water Quality Performance Criteria

The October 2024 Site Plans do not include Drinking Water Quality and Aquatic Life Protection performance criteria for infiltrated and injected Quarry contact and non-contact agriculturally contaminated water.

6.8 Termination of Ongoing Quarry Extraction

Extraction activities but not infiltration compensation, aggregate processing and shipping are to be terminated if specified four seasonal hydrograph water levels are not continuously maintained throughout the life of the quarry operation and beyond at the Sentry monitoring wells and stream flow stations.

7.0 Other Site Plan Modifications

7.1 Quarry Floor Rupture / Pressure Relief Wells

Pressure relief (dewatering) wells are likely to be required to support extraction in the Quarry underground stream corridors and to prevent rupture of the Lift 2 Quarry Floor due to the high underlying water pressures in Model Layer 6, the regional Gasport Aquifer.

Construction of the deep Gasport Aquifer hydraulic barriers (wedges) may also require utilization of pressure relief wells. Resulting dewatering, if non-contact and if not agriculturally contaminated, may be piped to Gasport injection wells in the designated east boundary corridor infiltration adaptive management zone.

No Model Scenario for Lift 2 Quarry floor rupture and /or for a blast-fractured non-competent 2 m thin Niagara Falls Aquitard has been provided by Strada.

7.2 Aggregate Wash Water

Strada is currently employing a closed loop aggregate washing operation to support Pit operations. The 'make up water' is indirectly naturally sourced from the NAT-01 Wetland eastern outlet via underground flow and seepage into the Pit. The October 2024 Site Plans are silent if this function will continue at the same location without impacting the NAT-01 wetland.

7.3 Adaptive Management Infiltration Corridor

The proposed October 2024 Site Plan extraction footprint and Infiltration Infrastructure is inadequate for maintaining four seasons (24/7/365 days) groundwater flows to the Horning's Mills community and the Pine River headwater tributaries. This proposed Site Plan is over contributing excess water to the Boyne River headwaters with related adverse consequences of rising water levels.

In the alternative, this Peer Review proposes establishing an approximate 200 m wide adaptive management infiltration corridor along the east Quarry boundary and over the underground stream groundwater flow conveyance zone (modelers inferred zone of higher conductivity). This corridor may contain rotational infiltration pond cells with bases in the Upper Guelph bedrock epikarst. Rotating cells will provide opportunity for periodic maintenance and silt clean out.

In the alternative the proposed South Pond base would be established on the existing impermeable pit floor (not excavated to the epikarst to reduce infiltration). This Pond with upper water level at about 495 m asl (CGVD2013) and base at about 490 m asl has significant storage capacity for providing additional turbidity reduction of pumped quarry sump water. A gravity water pipeline may be provided to rotational infiltration cells with top water levels at say 492 m asl or lower in the east boundary adaptive management corridor.

7.4 Infiltration Operation 24 hours / 7 days / 365 days

This surplus storage capacity of the modified South Pond provides for the four season (24 hours/7 days/365 days) Infiltration Infrastructure operation as well as for contingency surge storage in the event of a quarry floor flooding emergency.

7.5 Rehabilitation Quarry Floor Flooding and Filling

The Guelph Eramosa Upper Aquifers have dry weather hydraulic heads at about 484 m asl along the proposed Quarry Melancthon Pit No. 1 Boundary and the Gasport Deep Aquifer at about 478 m asl. The Model predicted 487 m asl for final Quarry water level appears excessively high and is questioned. This elevation appears to be related to Strada leaving hydraulic barriers in place after extraction is completed.

The Level 1 and 2 Hydrogeological Report is conflicted on whether a portion of the Model Layer 6 (Gasport) hydraulic barrier will be removed on depletion of the Quarry.

No Model scenario has been provided for post quarry intermediate water level recovery (say two and ten years). Maximum flow reduction to the Horning's Mills community and Brook Trout habitat may occur during this period. No statement of time to fill the deep quarry excavation has been provided. This is required for planning purposes.

As an example, for a 30,000,000 m³ quarry, excavated volume with an average groundwater inflow of 40 L/s (3,500 m³/day). It may be roughly estimated that 8,600 days or about 23 years will be required to fill to the Site Plan specified 487 m asl level. This rough estimate requires a well calibrated model to refine.

The 487 m asl specified post quarry water level is considered to be too high. It may also be contradictory to Strada's proposal to open the proposed 4th Line interceptor drain with 487 m asl invert to flow freely into the closed quarry excavation on rehabilitation.

7.6 Private Well Replacement

Lift 1 / 2 / 3 Extraction along the 4th Line will require replacement of a private residential well at the severance lot cut out on the Duivenvoorden property and a private well to the south.

The critical Dairy Farm well about 100 rods from the eastern Quarry boundary on E½ Lot 12 Con 3 OS is likely to require diameter enlargement or pump lowering or other infrastructure improvement if uncontrolled drawdowns are propagated to this site as implied by Strada groundwater modelling. This well for the existing dairy operation has a four season 'pump off / pump on' operating range approaching 10 m and will be sensitive to even modest water level drawdowns.

7.7 Post Quarry Closure

The Strada October 2024 Site Plans propose to 'walk away' after Quarry Closure. Strada has not provided Groundwater Model Scenarios to demonstrate that Horning's Mills

community groundwater and streamflows will not be reduced by even greater than the 50% estimated during some Quarry operational phases.

8.0 Conclusion

This scientific based Peer Review cannot support a Quarry application based on the proposed October 2024 Site Plan and the flawed October 2024 Groundwater Model. This model estimates 50% reduction of groundwater and streamflow quantities with associated water quality degradation in the Horning's Mills Pine River Headwaters with adverse Quarry induced rising water levels due to non-optimal location of compensation infiltration infrastructure for reasons cited above and elsewhere in this fourth cycle Peer Review.

Therefore, Site Plan note edits have not been formalized at this time until the quarry footprint is finalized to accommodate an adaptive management plan and performance criteria.

Yours truly,

Garry T. Hunter, M.A.Sc., P.Eng.
President
Hunter and Associates

Enclosure: Supporting Graphics (not complete)