MEMO

To:	Natalie Kotyck (NDACT)
From:	Garry T. Hunter, M.A.Sc., P.Eng.
Date:	January 10, 2025
File:	21-407
Subject	**Strada October 2024 Proposed Quarry Site Plans and Impact Assessment**

1.0 Strada Proposed Quarry

Strada with its proposed quarry is effectively taking over ground and surface water quantity and quality management in the local Pine River and Boyne River headwaters. This management must also include protection of local agriculture, residential lands and septic systems from increased water tables, water wells from excessive drawdowns, springs and streams from reduced dry weather flows as well as providing source water quality protection for private water wells, springs and stream flows within 2 km more or less from the Quarry perimeters.

Strada did not respond to my December 10, 2024 request for supplemental hydrogeological information. Completion of this Peer Review requires additional Strada responses to the discussions below.

1.1 Strada Report Disclaimers

This Peer Reviewer on behalf of NDACT does not accept the following Report Disclaimers and Copyright conditions as contained in the October 23, 2024 and prior Tatham / Earthfx Reports:

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1.2 October 2024 Document Review

This current Peer Review consists of the following October 2024 documents as provided by Strada:

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		Pages
•	Natural Environment Assessment	597
•	Level 1 and 2 Hydrogeological Assessment (*)	54
•	Appendix A and B: Data Compilation and Methodology	123
•	Appendix C: Conceptual Model Report	119
•	Appendix D: Model Development and Calibration Report	149
•	Appendix E: Impact Assessment Report	287
•	Appendix F: CVs	21
•	Site Plans	5
•	Site Plan Text	40
	TOTAL	**1,395**

With the exception of the Natural Environmental Assessment and proposed Site Plans, this is the 'fourth cycle' review of similar previously released document versions.

Despite this fourth release of documents, there continues to be similar technical and assessment contradictions within and between the various documents reviewed. Furthermore, these documents are excessive in length for public consumption, unnecessarily repetitive and inefficient for review tracking.

1.3 Matrix

This NDACT Peer Reviewer comments, since about June 2023, have been entered into a Project Matrix. A compendium of visual Figures has been prepared as a separate entity. The physical separation of the text and figures is problematic for communications.

Many of these comments remain 'parked' and unresolved despite Strada's Consultants unilateral 'closure' entries. Peer Review comments of September 25, October 1 and October 4 (3 items) 2024 have not been integrated into the Strada 4th Release reports.

1.4 Visuals

This NDACT Peer Review has prepared visual plots to assist interpretation and identification of errors in this data set. Very little work by Strada's Consultants has been duplicated to date.

2.0 Field Data Collection

2.1 NRSI

NRSI field base line surveys still need to be conducted at Horning's Mills Lake NAT-18 and for the NAT-14 upstream extension along the stream tributary from Melancthon 3rd Line to 4th Line OS. NDACT may have to make arrangements with owners for access.

2.2 Ground Water level Monitoring

Strada has previously refused to provide on-site groundwater level monitoring data after about March 2024 and have advised that new data will not be available to inform this Peer Review until the 2024 Annual Compliance Report is issued in early 2025. Appendix A/B is mainly 'data' display with little analysis or interpretation.

It is not clear how the current groundwater model is predicting Gasport Aquifer seasonal transient water levels without at least a full year of monitoring water level data. There is an appearance in Appendix A and B of monitoring for monitoring's sake rather than for informing the Site Plan development.

The groundwater monitoring program uses archaic prior gravel pit nomenclature and has not been stratified by Model Layer to facilitate data interpretation to inform the Site Plans.

To facilitate analysis, this NDACT Peer Review has stratified the groundwater monitor levels by screen corresponding to Model Layers 4 and 6 and prepared one meter water level (potential) contour gradient plots to inform the Site Plan development. This work has not duplicated to date any work presented by Strada Consultants despite its fundamental nature.

2.3 Water Quality Monitoring

Strada has not compiled the on-site water quality data in Appendix A/B to inform and support this pending quarry application. We now request the full 2024 MECP Compliance Annual Report water quantity and quality data set including for Monitor Well OW30C-D1.

Strada undertook water quality base line monitoring of the Gasport Aquifer during Sept 2024. However, no groundwater sample was collected and analyzed at OW30C-D1 in the general area of the proposed Southern Infiltration Pond. This data is required to independently assess the hydrogeological infiltration characteristics at the proposed southern infiltration pond.

This NDACT Peer Review has compiled the existing water quality data as provided up to September 2024 and prepared visualization plots. This has not duplicated any work performed by Strada Consultants. This water quality data is fundamental to Site Plan development and water management.

Strada's October 2024 Site Plans are unsupported by any water quality analysis. Agriculturally contaminated Upper Aquifer waters or pristine deep aquifer water is not recognized or considered in Site Plan development.

2.4 Dry Weather Stream Flow Monitoring

On August 15, 2024 Strada completed the Peer Review requested dry weather stream flow monitoring except for two stations on Mill Lane - one downstream of NAT-14 and the other downstream of NAT-15. There is significant base flow 'pick up' south of 15th Sideroad through the Mill Dam Reservoir to Mill Lane waterfall.

The Peer Review selected monitoring station at 177 Main Street is on the first topographic bench north of the River Road intersection. The 177 Main Street spring discharge is directly downgradient from the proposed Strada Quarry and will be directly influenced. There is a domestic well constructed in this spring. NDACT support may be required to facilitate resident cooperation.

These three stations together with the others already surveyed are required to independently partition stream flows above (Guelph) and below (Gasport) the Goat Island Aquitards and from flows originating from catchments in the vicinity of the Strada Site from those from the more remote Honeywood and Campbell Brook Catchments.

2.5 Additional Pump Tests - Underground Stream

Strada groundwater modellers are mainly relying on Pump Test data from remote Shelburne and Mega Quarry wells and from legacy insufficiently monitored pump tests on the Strada site.

Strada has no recent Gasport Aquifer Pump Tests on site to inform the Ground water modelling and Site Plan development. The Strada on site open hole pump test well (PW1) constructed to support a Permit To Take Water application only penetrated the top of the Gasport Aquifer. Except for nearby OW1 there were no other Gasport Aquifer Monitors available at the time. PW1 and OW1 were constructed in 2004.

Two standard 72-hour pump tests are proposed in newly constructed wells (say 10-inch diameter) – one in the vicinity of the 'underground stream' entering the site at the 4th line front of the Prince Pit opposite the former McTaggart farmhouse site and the other at the rear of the Melancthon Pit # 1 between Monitor Wells OW25C-D1 and OW16C-D1. These wells will further strengthen the on-site monitoring network and may likely be used for future pressure relief / injection purposes.

These new pump tests and the nearby continuous water level monitoring will allow evaluation of the local competency and integrity of the existing Goat Island Aquitard and the establishment of aquifer parameters and bounding limits for the modelers on-site

inferred zone of higher conductivity (underground stream) groundwater flow convergence zone.

3.0 NRSI Environmental Assessments

This Peer Review provides selected assessment extracts from the newly released (first) NRSI October 2024 Report. This report at 'face value' provides a clear, relatively objective assessment of wetland impacts which directly translate into contiguous agricultural field and rural residential lot impacts. The Strada Team apparently does not have the appropriate expertise to evaluate agricultural impacts of Quarry induced rising water levels (mounding).

However, the NRSI October 2024 Report is dependent on the September 2024 poorly calibrated groundwater model for Environmental Assessment and Impact conclusions. The NRSI Impact Assessment is also dependent on the Model Phase assumption scenarios selected by the Groundwater modellers. The NRSI report also does not address stream water quality.

The NRSI October 2024 Report apparently has not been updated from earlier model reports and is not consistent with the October 2024 Modelers Report. NRSI also did not consult the Mega Quarry Stantec (2011) Environmental Technical Report. This report contains overlapping Fisheries information for NAT-14 extended tributary not surveyed by NRSI.

Peer Review Comments are included below. The reader of this Section will need to refer to Strada's October 2024 Natural Environmental Assessment, Groundwater Modelling and the proposed October 2024 Site Plans for Map and Text reference. Directly quoted, occasionally lightly edited, text is shown below in *italics*. Emphasis is added by this Peer Review.

3.1 Overview – Altered Hydrogeological Regime

Creation and operation of the proposed below-water table quarry has the potential to alter the hydrogeological regime both within the subject lands and among the surrounding Study Area external lands if not appropriately mitigated. Changes in the shallow groundwater zone that provides hydrological inputs to surface natural features such as wetlands and watercourses could result in negative impacts to those natural features and their associated ecological functions. *Impacts could arise due to decreases or increases in the shallow groundwater elevation (i.e., the water table level), and in particular on factors such as the relative magnitude, duration, frequency, spatial extent and seasonal timing of those groundwater level changes (NRSI, pg 177).*

Negative effects may also occur where the groundwater flow paths have been altered, such that more or less groundwater is directed toward down-gradient natural features. *The degree of impact associated with these potential hydrogeological changes is also dependent on the relative sensitivity and significance of the ecological receptors, at the scales of both the vegetation communities as a whole to the individual constituent species. Habitat features and ecological functions associated with these community types and their resident species also have varying sensitivities to groundwater level change.* ***Examples of groundwater-sensitive habitat functions include amphibian breeding habitat, Brook Trout spawning habitat, and turtle overwintering habitat*** *(NRSI, pg 177 & 178).*

The L1 (Model Layer 1) groundwater levels are of most direct relevance to surface feature effects on the south and west sides of the subject lands, including within the subject lands and at NAT-19, due to its close association and direct connections in many parts of the Study Area. *The Gasport aquifer interacts with the surface near Horning's Mills and the edge of the escarpment (i.e., near NAT-14, NAT-15, NAT-16, and NAT-18). In these locations, the Gasport groundwater levels (L6 – Model Layer 6) are of most direct relevance to surface feature effects. Positive groundwater contour values represent increases in groundwater elevation relative to baseline (i.e.,* ***"groundwater mounding"****), while negative contour values represent decreases relative to (model) baseline (i.e., "groundwater drawdown") (NRSI, pg 179-180).*

With reference to the above locations within the Study Area, Map 10 overlays the Phase 4A predicted groundwater level changes for either the shallow groundwater zone L1 or L6 Gasport zone against the Study Area wetland and watercourse features. ***The modelling results generally show that groundwater mounding is anticipated to the south, southeast and northeast of the subject lands, while groundwater drawdown is anticipated to the east, west, and southwest of the subject lands. These groundwater change effects are generally caused by the following factors:***

Peer Review Comment

To further clarify, NAT-14 and NAT-15 wetlands are supported by The Goat Island aquitards and receive flows from the Guelph / Eramosa aquifers (Model Layer 4). There is a prominent waterfall over this aquitard immediately south of Mill Lane in Horning's Mills. The Guelph / Eramosa Aquifers have degraded anthropogenic water quality. NAT-18 and NAT-16 wetlands are supported by the Cabot Head aquitard and receive high quality, pristine groundwater discharge from the Gasport Formation (Model Layer 6).

3.2 Quarry Groundwater Mounding / Drawdowns

NRSI also advises on page 180:

- ***Construction of the buried tile drain along the west side of the pit/quarry boundary****, to mitigate groundwater mounding effects that would otherwise be caused by the low permeability till barrier (constructed) along the west side of the quarry,* ***will cause some groundwater level drawdown to the west of the subject lands.***

- ***Creation of the south, central and north infiltration facilities will cause locally higher groundwater levels due to water infiltration and recharge of the surrounding shallow groundwater zones.***

- ***Excavation of the quarry will create a "shadow" effect, whereby some prevailing groundwater flows will flow around the quarry due to the lower permeability till barrier, and groundwater levels will decrease immediately down-gradient (east) of the quarry, resulting in some drawdown effects and decrease in baseflow*** *(NRSI, pg 180).*

Despite this water management and mitigation strategy, some degree of groundwater drawdown is anticipated to the east and west of the subject lands*…..(NRSI, pg 181).*

3.3 Watercourses and Groundwater Divides

The watercourses that occur across the Study Area include a variety of ephemeral, intermittent, and permanent features. In general, the features that exist east of 4th Line and north of County Road 17, which include the lands to the north and east of the subject lands, are within the Pine River subwatershed. These include headwater tributaries to, and the mainstem of, the Pine River (NRSI, pg 14).

Features that exist south of County Road 17 and to the immediate west of the subject lands are within the Boyne River subwatershed and flow southeast and east as headwater tributaries to, and the mainstem of, the Boyne River (NRSI, pg 14).
Many of the tributaries exhibit some level of impairment as they flow across a landscape dominated by agricultural fields, which include online ponds. However, watercourse conditions improve to a more unimpaired condition as they enter the Niagara Escarpment area (NVCA 2018a, b) (NRSI, pg 14).

Peer Review Comments

This Peer Review generally agrees with the NRSI description of the Pine / Boyne River watersheds divide location. The Groundwater Model Reports present contradictory Pine / Boyne groundwater divides on many figures throughout Appendices C, D and E.

3.4 Brook Trout

Groundwater is integral for sustaining aquatic ecosystems by supplying baseflow (the lowest flows of late summer to winter) and maintaining water temperatures and other water quality requirements, including dissolved oxygen, that are conducive for fish (Hynes 1983, Blackport et al. 1995). Groundwater plays a vital role in the habitat of Brook Trout, a species highly dependent on clean, coldwater environments. Brook Trout are sensitive to changes in water temperature and quality, making groundwater a crucial factor in their survival, optimal growth and to carry out their various life history stages (e.g., spawning, incubation etc.). Groundwater discharge can help maintain stable stream temperatures, especially during hot and dry periods, providing essential refuges for Brook Trout populations. Additionally, groundwater inputs contribute to stream flow, ensuring sufficient oxygen levels and habitat connectivity for the fish (NRSI, pg 141).

The majority of the investigated watercourses were identified as coldwater or coolwater features, reflecting the importance of groundwater-surface water interactions on the landscape. Coolwater and coldwater fish species, including Brook Trout, occur widely across these features and were frequently encountered during surveys *(NRSI, pg 235).*

The permanent watercourses within the Study Area provide suitable year-round habitat for a relatively diverse fish community comprised primarily of cool- and coldwater species, including Brook Trout. *Fish community sampling completed in July 2022 identified 14 fish species throughout the 10 NAT complexes where sampling was completed (Map 2). Brook Trout (including both juveniles and adults) and Creek Chub (Semotilus atromaculatus) were found to be the most widespread species across the Study Area followed by Blacknose Dace (Rhinichthys atratulus),*

Brook Stickleback (Culaea inconstans), and Central Mudminnow (Umbra limi). Brook Stickleback and Brook Trout were also found to be the most abundant species captured (NRSI, pg 42).

The majority of the Pine and Boyne River tributary system that drains the Study Area comprises cool- or coldwater watercourses that provide habitat for thermally sensitive species such as Brook Trout. These features are intrinsically connected to the shallow groundwater regime*, as has been demonstrated through observations of groundwater indicator vegetation species and seepages.* ***Accordingly, these features may be susceptible to alterations in the shallow groundwater regime*** *(NRSI, pg 138).*

The watercourses flowing to and from the NAT-3 complex were noted to have the most diverse and abundant fish community across the Study Area, comprised mainly of coolwater species. However, no Brook Trout were present at any of the locations sampled within the complex (NRSI, pg 69).

…the watercourses where Brook Trout were found supported a much less diverse and abundant fish community, often only containing Brook Trout *(NRSI, pg 142).*

3.5 NAT-18

NAT-18 are the wetlands surrounding Horning's Mills Lake (Wallyngton). NRSI (October 2024) reports the following conclusions:

> ***Modelling predicts that this reach, flowing from the NAT-18 pond, will experience the largest decrease in surface discharge and streamflow, particularly during Phase 4A. Under Phase 1 conditions, this reach may experience a relatively small decrease in surface discharge at various locations along its length, which would result in an overall decrease in streamflow*** *(NRSI, pg 222).*
>
> ***The decrease in the surface leakage and streamflow, as modeled for the watercourse reach outflowing from the NAT-18 pond, may result in an overall reduction in the amount of available fish habitat, and less coldwater input to the watercourse*** *(NRSI, pg 223).*
>
> ***The proposed quarry operation is expected to result in a temporary reduction in streamflow up to a maximum of roughly 40 – 50% during times of the year that may see water depths drop below the optimal depth for Brook Trout during the low flow period*** *(NRSI, pg 223).*

Peer Review Comments

These 'temporary' reductions in groundwater and stream flows in the order of 40 to 50% at Horning's Mills are not 'temporary' and may last for many years. These stream flow reductions will extend towards the Pine River Provincial Fishery Area. These groundwater and stream flow reductions are unlikely to be acceptable to the Horning's Mills community and to the approval agencies. Furthermore, Strada does not evaluate loss of base flows during the short time after Quarry closure or during an adverse quarry floor flooding contingency.

3.6 NAT-1

NAT-1 wetland is located directly west of the Strada Pits on Lots 11 and 12, Con 4. The east end of this wetland discharges via shallow groundwater flow under the 4th Line into the Strada (Bonnefield) Pit.

NRSI reports the following conclusions with respect to NAT-01 (pg 183 and 184):

> *NAT-01 is a large and complex system of natural features with a variety of wetland types. The south end is connected to several surface drainage features that flow south into and through NAT-04. Baseline groundwater elevations in NAT-01 are 1.3-3.5m below the ground surface (Appendix XII, Fig. 2.9) (NRSI, pg 183).*
>
> ***During Phase 1, the groundwater table will be lowered within NAT-01 between 0m and 0.5m, with the greatest change occurring at the eastern tip of the feature, closest to the subject lands. Slight groundwater mounding (<0.15m) will occur in the southeast portion of NAT-01 near County Road 17****, including the watercourses that drain this portion of NAT-01 (up to approximately 0.15m above baseline conditions) (Figure 3.6, Earthfx 2024a) (NRSI, pg 183).*
>
> ***During Phase 2C, the groundwater table will be lowered within NAT-01 between 0m (at the southeast corner and the southwest corner) to 1.0m (at the northeast tip, closest to the subject lands) (Figure 3.23, Earthfx 2024a) (NRSI, pg 183).***
>
> ***During Phase 4A, groundwater levels are expected to decrease across NAT-01.*** *Most of the NAT-01 complex will experience groundwater table reductions less than 0.5m; however, groundwater table elevations will decrease from 0.5m to 3.5m in the northeast corner of the complex.* ***The easternmost tip of NAT-01 will see the largest elevation decrease, where the complex is closest to the subject lands (Map 10)*** *(NRSI, pg 184).*
>
> ***Surface water is directed towards the shallow marsh pond, which does not have a surface outlet. Field surveys conducted by NRSI suggest that this feature may recharge the shallow groundwater system, rather than the deeper groundwater table (NRSI, pg 184).***

Peer Review Comments

This Peer Review agrees that the shallow marsh pond without a surface outlet at the eastern limit of NAT-01 recharges to the surficial sand and gravel aquifer overlying the glacial till west of the 4th Line (W½ Lot 12, Concession 4 OS) and opposite the former Strada Bonnefield Pit).

In the alternative to the above assessment, the proposed upper berms and hydraulic barrier walls (wedges) in the proposed Strada Quarry may interfere with groundwater flows from NAT-01 resulting in adverse wetland flooding with extensive tree kill and damage to internal residential sites, 'Lots of Record' and contiguous agricultural fields. The late fall water level in this NAT-01 recharge pond is about 498 m asl (LiDAR DTM CGVD 2013).

This groundwater flow from NAT-01 wetland provides 'make up' water for Strada's existing 'closed loop' aggregate pit washing operations.

3.7 NAT-02, NAT-03 and NAT-04

NAT-02, NAT-03 and NAT-04 Wetlands are located South of County Rd 17 in Con 2, 3 and 4 OS, Melancthon.

> ***NAT-03 will experience a minor amount of groundwater mounding during Phases 1 and 2C, between 0-0.25 m above baseline elevations, with southern half of the complex experiencing no, or imperceptible, mounding effects (Fig 3.6 and 3.23, Earthfx 2024a).***
>
> ***A minor increase in stream leakage to NAT-03 will occur, with the highest water depths (i.e., amount of groundwater seeping into NA-03 from the watercourses) occurring between May and November for both phases (Section 9.2 and 9.3, pp. 193 and 205, Earthfx 2024a).***

Peer Review Comments

Higher stream flows and increased water table elevations in the order of 0.25 m are not minor as predicted by the groundwater modellers (Oct 2024) within parts of the wetlands (pg 199 to 204) or more if the groundwater modellers have underestimated surface and groundwater flows to and from the central and southern infiltration facilities.

Increased water levels will adversely affect low-lying contiguous farm fields marginal to these wetlands and tile drainage outlets from farm fields as well as residences and 'Lots of Record' within or immediately adjacent to wetlands NAT-02, NAT-03 and NAT04. Strada has not recognized farm tile drainage outlets marginal or within these wetlands.

3.8 NAT-14

NAT-14 wetland as defined by NRSI is located along 15th Sideroad between Main Street Horning's Mills and 3rd Line.

> ***At NAT-14, groundwater seepage features occur as broad bands of saturated organic soil within the mixed and conifer-dominated swamp communities along the watercourse, both on the north and south side of Sideroad 15. Seepage was particularly evident on the south side of the road where water was emanating from a gentle slope and slowly trickling across the organic substrate to reach the watercourse*** *(NRSI, pg 80).*

Peer Review Comments

These groundwater seepage features extend into contiguous agricultural fields. Increased groundwater discharge induced by Strada infiltration facilities will extend these groundwater

seepage areas further upslope into farm fields reducing productive crop areas. NAT-14 wetlands are supported by the Goat Island Formation Aquitards.

3.9 NAT-19

Modelling for Phase 4A, prepared by Earthfx (2024a), shows that ***NAT-19 will experience groundwater mounding due to the influence of the adjacent infiltration galleries*** *(Map 10i; Appendix XII, Fig 3.40).* ***The predicted groundwater mounding, as shown on Map 10i, is expected to range from near 0.5 m to 1.5 m above baseline levels.*** *The increase in groundwater elevation will be highest in the western portion of the wetland, decreasing towards the east.* ***Surface leakage will occur, as a result, throughout the year, with the highest amounts expected during March and April when groundwater elevations are at their peak (NRSI, pg 209).***

Model simulation of the Rehabilitation Phase shows a projected decrease in the groundwater table elevation at NAT-19 between near 0 m and 1.0 m compared to baseline levels (Appendix XII, Fig 3.56) (NRSI, pg 209).

While an increase in groundwater elevation of up to 1.5 m has potential to increase the depth of water and the hydroperiod within the feature, the southern "arm" of NAT-19 directs surface water from the swamp, in a southward direction, toward NAT-02. This main outlet is regulated by a berm-culvert feature on an adjacent property between the feature and County Road 17.

Aerial imagery also suggests that a secondary route of overland drainage occurs from the southeastern portion of NAT-19, directing water south through a pasture and to the east by way of a low-lying area that contains intermittent channels that run parallel to County Road 17 on the north side of the road. *During site investigations of NAT-19, no plant species indicative of bog habitat were identified; this suggests that* ***under existing conditions, water entering the NAT-19 swamp ultimately exits the feature, unimpeded, and this inflow-outflow process will continue during and following quarry operation (NRSI, pg 209).***

Peer Review Comment

This Peer Reviewer also recognizes the NAT-19 southeast overflow and shallow groundwater outlet swale that parallels County Road 17 west of the 3rd Line OS. This wet swale (currently pastured by cattle) conveys wet weather flows easterly to the 3rd Line OS through E½ Lot 11, **Con 3 OS into existing dry swales conveyances through W½ Lot 11, Con 2 and into W½ Lot 10, Con 2 where excess runoff infiltrates during and after spring runoff into local recharge depressions at County Road 17.** These 'dry swale' fields are planted through in rows during potato rotations. Increased runoff from NAT-19 will adversely impact these field swales, delay or prevent planting due to surface and root zone flooding.

The Strada proposed Central and Southern Infiltration Facilities, shallow groundwater and surface outflows will adversely impact agricultural fields, tile

drainage outlets, residential lots and 'Lots of Record' contiguous and/or within Wetlands NAT-02, NAT-03 and NAT-04 south of County Road 17 and east of County Road 124.

The proposed October 2024 Strada Site Plans are in effect planning to utilize NAT-19 as a default shallow groundwater and/or direct surface outlet to dispose of 'excess' Quarry water into the Boyne River headwaters, resulting in depletion of the Horning's Mills Pine River headwater flows and rising water levels in and adjacent to the Boyne headwater wetlands.

3.10 NAT-20

Peer Review Comments

NRSI Map 3-10 shows the NRSI Natural Environmental Assessment of NAT-20 is based on SWD, SWD7 and MAM3 ELC units. However, this Peer Reviewer considers this wetland feature to be much more extensive containing poorly drained agricultural fields at Sideroad 280 and the 4th Line NS, permanently grassed swales north of Sideroad 15 OS at the mid-Township Con 4 OS and southerly grassed swales in the rear of the E½ Lot 15 OS into the McTaggart Farm major recharge basin (E½ Lot 14) west of the Strada Prince Pit.

The contiguous agricultural (and aggregate) lands to this more extensive NAT-20 are sensitive to water table increases.

3.11 Strada Created Wetland adjacent to NAT-19

As part of quarry site development, the area to contain the created wetland will first be raised in elevation through fill placement such that the created wetland will be at a similar elevation to the adjacent SWD4 swamp community*. Lower-permeability till sourced from the pit will be utilized to create tighter underlying soils that will function to hold surface water and facilitate pooling.* ***The overall grade of the wetland will be designed so that it passively drains into the adjacent SWD4 wetland, and ultimately into the broader adjacent NAT-19 wetland complex (NRSI, pg 175).***

A natural outlet will be created at the east end of the wetland to direct excess water into the SWD4 feature. The outlet is located at an existing topographic depression at the edge of the SWD4 feature which provides an established flow path to receive water from the created wetland. *Surface flow outputs to the SWD4 community will only occur when water levels within the downstream permanent pool of the created wetland exceed a specified weir elevation (NRSI, pg 175).*

The created wetland will be managed as part of the quarry's water management system during the operational phases *(NRSI, pg 176).*

The permanent pools of the wetland will be designed to maintain at least 0.5m of water depth. ***Water that is pumped to the wetland will be drawn from the clean water pond,***

where the water will have first undergone detention to settle out sediments and other particulates *(NRSI, pg 176).*

The wetland catchment grading has been designed to ensure that the desired water budget for the wetland is maintained. ***During the rehabilitation stage, the design of the created wetland will allow it to overflow, via its outlet to the NAT-19 wetland, at an elevation of 495 m asl.*** *Based on modelled simulations of the rehabilitation stage, and given the proposed surrounding catchment grading for surface runoff, it has been determined that a permanent pool of standing surface water can be achieved within the wetland (Earthfx 2024a) (NRSI, pg 176).*

Peer Review Comments

With regard to paragraph 1 above, the NAT-19 (SWD4) wetland is at about 492 m asl, similar to the existing impermeable pit floor under the proposed created wetland site. Raising through fill placement is not required.

No vertical datum is specified on the Site Plans.

The Strada south infiltration pond, 'Created Wetlands' and NAT-19 wetlands have inconsistent water level elevations quoted between the Model Report, the NRSI Report and the Site Plans. A Site Plan cross section is required through these facilities.

Why is pumping to the constructed wetland proposed? Strada has already extracted below the water table at this location.

This proposed constructed wetland appears to be frivolous in the overall context of Strada predicted rising water levels in the Boyne headwater wetlands.

4.0 Source Water Protection (Horning's Mills) and Pine River Headwaters

4.1 Water Quantity

Under quarrying operational and rehabilitation conditions, Strada will be assuming source water drinking quantity and quality responsibility for the community of Horning's Mills as well as local nearby downgradient rural residents. Strada will also be responsible for maintaining existing high quality groundwater dry weather flows in the nearby Pine River headwater streams and Brook Trout habitat. The following water level and water quality controls are proposed by this Peer Reviewer during proposed quarry operation and rehabilitation phases. These notes need to be added to future Site Plan versions.

Diversion of Pine River headwater stream flows to the Boyne River headwaters should not be permitted.

4.1.1 East Strada Pit Boundary Monitor Wells

To ensure maintenance of existing groundwater and stream flows to the Horning's Mills community, Strada shall maintain the existing four seasons minimum water levels at the Melancthon Pit (Lot 13) east boundary as follows:

OW25A-B1 at 484.3 m asl (Guelph / Eramosa)

OW25C-D1 at 479.5 m asl (Gasport Aquifer)

OW16C-D1 at 477.8 m asl (Gasport Aquifer equivalent)

4.1.2 Third line Sentry Monitor Wells (Downgradient)

Five multi-level sentry monitors are proposed to be constructed by Strada along the Third Line OS Right-of-Way at each of County Road 17, Lot 11/12 boundary, Lot 12/13 boundary, Lot 13/14 boundary and Lot 14/15 boundary intersections subject to permission from the Township of Melancthon. Each dual level monitor well to be screened near the base of the respective Guelph/ Eramosa (Layer 4) and Gasport Aquifers (Layer 6).

Strada will ensure that minimum water levels in Third Line Sentry Wells during the life of the Quarry will not fall below the static water levels as observed for a two year monitoring period after construction at each well and that the water level in the Sentry Wells at County Rd 17 and Lot 14/15 Boundary will not rise above the maximum annual observed static water levels during a two year monitoring period after well construction. No maximum water level is proposed for Lot 11/ 12, Lot 12/ 13 and Lot 13/14 boundary sentry wells. This area may accommodate greater ground water flow, if necessary.

These 3rd Line Sentry Wells will be constructed after Site Plan approval with at least two years of continuous monitoring available before initiation of extraction below the existing Strada Pit water table plus 1.5 m.

4.2 Infiltration Water Quality

Despite repeated Peer Review requests since 2023, Strada has not provided any information on Hydrocarbon and Ammonium Nitrate / Fuel Oil / Emulsion (AN/FO) residual contamination which will be conveyed to the quarry floor sump water after incomplete combustion of blasting events.

Strada will also, in the proposed infiltration and well injection of quarry floor contact stormwater to local Drinking Water Aquifers, ensure that the water is pathogen-free, Turbidity does not exceed 5 NTU and Nitrate (as N) concentrations and do not exceed 3

mg/L consistent with the Long-Term Protection of Aquatic life (CCME 2012) and, by default, Drinking Water Aquifer users.

Strada will ensure that Petroleum Hydrocarbons do not exceed potable groundwater standards (MOE 2011) in infiltration / injection water.

F1 750 ug/ L
F2 150 ug/L
F3 500 ug/L
F4 500 ug/L

Oil and grease should be non-detectible.

Sampling will be monthly (four seasons) in each infiltration infrastructure facility for the full set of water quality parameters including calculated Total Dissolved Solids as specified elsewhere on the Site Plans.

4.3 Dry Weather Stream Flow Protection

Strada will maintain (four seasons) minimum dry weather stream flow quantity throughout quarry operations at the following flow monitoring stations:

SW4 60 L/s
SW5 150 L/s
SW6 40 L/s
SW13 25 L/s
SW17 35 L/s
SW24 210 L/s
SW25 No minimum flow constraint.

Continuous water level elevation and flow data loggers will be installed at each of the selected stream flow stations and monitored for a two year period prior to further pit extraction below the water table + 1.5 m. Minimum dry weather flow performance criteria may be further evaluated following this monitoring.

4.4 Operational Performance Controls – Termination of Extraction

Extraction will be terminated (but not processing, shipping and infiltration) when the above water quantity and quality exceedances occur until remedial measures are implemented and proven feasible.

5.0 Agricultural Crop Protection

1. Strada will ensure that after April 15 at the beginning of each year growing season and until after harvest at November 30, that water table levels will be a minimum 50 cm below existing

depressional field surfaces and below tile drain outlet inverts from existing cultivated lands adjacent to, contiguous with and / or connected to RDSI Wetlands NAT-01, 02, 03, 04, 14, 19 and 20. A key known farm tile drainage outlet to be monitored is located at the rear of E1/2 Lot 9 Con 2 OS (Noble Farm).

2. Strada will ensure that existing groundwater discharge zones within and adjacent to normally cultivated lands in Township Lot 15 east and west of the Third Line OS and south of Sideroad 15 will not be expanded due to incidental Quarry included mounding effects or as may be agreed with land owners.

3. Strada will ensure that necessary root zone drainage and recharge topographic swales within Lot 10 and 11 Con 2 and 3 OS Melancthon remain dry throughout the agricultural planting, growing and harvesting seasons.

4. To avoid wetland, contiguous field, residential lot and Lot of Record flooding, Strada shall ensure that the eastern groundwater outlet of NAT-01 located about 200 m west of the 4th Line on E½ Lot 12, Con 4 OS will not be barricaded from subsurface flow onto the Strada property.

5. To avoid flooding of upgradient farm fields and aggregate properties, Strada shall ensure that groundwater flows from E½ of Lot 14, Con 4 OS natural existing infiltration basin are not barricaded from entry into the Strada property.

6. Strada will compensate Farmers for land losses and crop damage due to Quarry induced rising water levels on a field (not depressional area) basis recognizing the row crop nature of local area specialty crops.

6.0 Multi-level Groundwater Monitors - Rationalization

Wells PW1, OW1, OW6, OW10, OW18, OW20, OW25, OW29 and OW30, as illustrated in Groundwater Model Appendix E, Fig 4,1 (pg 152) and Table 4.1 (pg 153 to 156 incl), are located in areas not protected from proposed Quarry Site Extraction, Operations, Stockpile and Infiltration Pond Areas. These wells are not suitable as Quarry long-term monitors (see also Site Plan Dwg 1 of 5).

This leaves only 18 existing monitor well sites, some with multi-level screens remaining. However, the existing vertical and horizontal distribution of these remaining monitor screens is not optimal by Model / Layer / Lifts and has not been visually disclosed by Strada for network evaluation.

Strada will rationalize its 2024 existing Site Plan groundwater monitors to provide a minimum of ten (10) multi-level monitors at protected locations, one at each approximate original Township (100 acre) Lot corner, more or less, plus at least one (1) additional monitor at the entrance (Prince Pit) and exit (Melancthon Pit No. 1) of the underground stream corridor at the Strada property (Modelers in inferred zone of higher conductivity).

Each of the 12 (minimum number) monitors to be screened within the existing Water Table Aquifer, at the base of the Guelph / Eramosa Aquifer and at the base of the Gasport Aquifer (minimum 36 screens). Monitors to be located on the perimeters of the site protected from quarry

activities and maintained (or replaced if damaged) throughout the life of the quarry and until full water level recovery after quarry closure.

The location of the rationalized long-term multilevel monitoring infrastructure including proposed salvaged and replacement wells to be described on the Site Plans. New long term quarry monitoring infrastructure to be constructed after Quarry Site Plan approval. Initiation of extraction below the water table plus 1.5 m to be delayed until after at least two years of continuous water level monitoring is completed.

Existing interior Pit and redundant monitors to be abandoned in accordance with MECP regulations after Quarry Site Plan approval and after at least two years of water level monitoring is available for the newly constructed Quarry monitoring network prior to any extraction below the water table plus 1.5 m.

7.0 Geotechnical

The Strada Level 1 and Level 2 Hydrogeological Assessment Groundwater Modelling, and Site Plans have not had sufficient regard for its own Geotechnical Report observations and conclusions (GEMTEC Oct 4, 2024). The Strada Consultants either do not understand or are ignoring the Strada Geotechnical Consultants conclusions with respect to the stability of the proposed Gasport hydraulic barrier walls / wedges, the potential hydraulic rupture of the Lift 2 Quarry Floor and the model proposed underlying 2 m thin Goat Island aquitard remnant. Geotechnical Report direct excerpts from pg 5 and pg 7 are provided as reminders below in *italics*.

7.1 Hydraulic Barrier Berm Factor of Safety (FOS)

Based on the results of our analyses, the current berm configurations (i.e., 2H:1V slopes) are not meeting the target minimum FOS for global stability or sliding. *(pg 5)*

The FOS for the berms can be increased by:

- ***Decreasing the slope inclination from 2H:1V to 3H:1V;***
- ***Adding positive drainage to the berms (i.e., lower the groundwater level in the berms);*** *and/or,*
- *A combination of both. (pg 5)*

A preliminary global and sliding stability assessment was undertaken incorporating the additional stability measures outlined above, and it showed that ***these measures still fall short of the target minimum FOS where the berm is composed entirely of impermeable (i.e., clayey) material.*** *(pg 5)*

Therefore, it is recommended that, at the feasibility level, a composite berm construction using a 'core' of impermeable clay (or sufficiently impermeable material) with a well compacted cohesionless granular shell or outer material comprising of the majority of the berm backfill be utilized for the berm construction. ***Based on an initial limited global stability and sliding assessment, a composite berm structure could provide satisfactory FOS for both global and sliding stability at a 2H:1V slope.***

7.2 High Hydraulic Heads

It should be noted that potential high hydraulic heads are anticipated at the lowest berms, and consideration may need to be given to raising the berm height in order to extend the "clay core" across the bedrock units, while also increasing the berm thickness (and stability) at contact. This would be expected to limit groundwater "punching" through the berm where it is thinnest.

As noted above, the feasibility level sliding analysis did not consider partial failure i.e., "punching" or "piping" of the berms, and the overall stability of the berms, including these potential failure mechanisms, should be confirmed during the detailed design stage based on a site-specific geotechnical field investigation and prior to construction.

7.3 As Constructed Field Hydraulic Conductivity

A detailed geotechnical study including site specific boreholes and relevant geotechnical testing should be carried out during the detailed design phase and prior to construction and re-use of on-site materials for the berm construction. Should the fine grained material on-site not meet these requirements then ***additional testing may be conducted to demonstrate a design (i.e., laboratory testing) and / or an "as-constructed" field hydraulic conductivity of $1x10^{-9}$ m/s or less. Otherwise, importing of suitable low-permeable materials may be required.***

7.4 Construction Considerations – 2 m Thin Niagara Falls Unit

During the Phase 2 stage of excavation of the quarry, ***it has been noted that there will be a point where about 2 m of the Ancaster / Niagara Formation would be left overlying the permeable Gasport unit. The effects of groundwater uplift on the underside of the 2 m layer of the Ancaster / Niagara Falls unit should be considered during the detailed design phase. At the current feasibility level assessment, it is anticipated that potential excess pressures from the Gasport unit can be managed with through pressure relief wells and drainage galleries within the excavation.*** *(pg 7)*

At the final (Phase 4) stage of the excavation, it is not expected that significant uplift pressures would develop within the relatively thick layer of Cabot Head Shale (generally understood to be impermeable). However, if evidence of fractures and / or bulging due to uplift are noticed, then again, these pressures are anticipated to be manageable through the use of pressure and drainage galleries in the excavation. (pg 7)

Peer Review Comments

Strada's Site Plans have 'baked in' the hydraulic barrier berms 2:1 side slopes (Site Plan pg 3 of 5 and pg 5 of 5). The Site Plans do not consider the use of 3:1 side slopes, blast fracturing behind rock faces, the potential need to use higher berms across the 'aquitard' bedrock units and potential need for use of pressure relief wells to avoid rupture of the Lift 2 Quarry Floor (analogy Woods Quarry west of Kingston).

The 'Tavistock Tills' Model Layer has reported at 5 x 10^{-7} m/s Hydraulic Conductivity (Appendix D) and may not be suitable for hydraulic barrier berm construction.

The only known required 10^{-9} m/s hydraulic conductivity is the Cabot Head Shale at an Elevation on-site below 440 m asl more or less. However, this material should not be extracted for reasons cited above by the Geotechnical Consultants. Material will have to be imported from elsewhere.

Alternatively, as previously proposed by this Peer Review (see Matrix), Strada could employ underwater extraction for the relatively uniform Gasport bedrock as proposed for Hidden Quarry at Rockwood.

For Site Plan development purposes, it should be assumed in the Groundwater Model that the 2 m thick Ancaster / Niagara Formation will be compromised by progressive blast hole drilling and blasting and at some locations by natural 'windows' in the formation (see this Peer Review Gasport Groundwater Quality Analysis (Matrix Oct 4, 2024)). **Strada needs to model the quarry Lift 2 as though the proposed 2 m remnants of Niagara Falls Formation is fractured and no longer an aquitard under the excavated quarry floor.**

There is a high probability that pressure relief wells will be required upgradient of the Quarry excavation, especially in the underground stream area, to allow construction and stabilization of the proposed lower Gasport hydraulic barriers.

Strada's Geotechnical proposal for Pressure Relief (Dewatering) Wells to stabilize lower hydraulic barrier wall construction and operation may provide an all season stable source of clean Gasport Aquifer water for continuous 24/7/365 SCADA controlled discharge into the Horning's Mills Drinking Water Aquifers and Brook Trout streams. However, these pressure relief wells will generate additional water for disposal, which must be recognized by constructed infiltration infrastructure.

8.0 Groundwater Model Calibration

8.1 Model Calibration

The successive Strada Groundwater Model Calibration Reports for May 2024 (Table 5.4 pg 135, August 2024 (Table 4.4, pg D-107) and Oct 2024 (Table 4.4, pg D-109) reported identical Root Mean Square Errors of 5.19 m (17 ft). The Strada's groundwater modelers, despite this poor calibration result, have ignored successive NDACT Peer Review recommended calibration improvements for this model.

More importantly, this Root Mean Square Error is excessive. MNRF in recent comments to the CBM Caledon Quarry application advised that even a 1.7 m (5.6 ft) RMSE is not acceptable for modeling stream flows.

Similarly, there has been no revision of the Strada Model Parameter Values through May, August and October 2024 from the Shelburne WHPA of August 2022. The Melancthon Old Survey Model Domain north of Sideroad 15 is different than the Shelburne Model Domain.

The Strada groundwater modellers have refused to provide Model input data for Peer Review audit and specific error statistics for the Strada site. The modellers have not provided any horizontal and vertical error statistics for modelled groundwater drawdowns and mounding assessments.

This NDACT Peer Review has recommended model calibration improvements including, increase of 'Tavistock (Catfish) Till' hydraulic conductivities in the Melancthon Old Survey north of the Strada Pits, rigorous edits of MECP water well record locations (x,y and z), incorporation of ongoing WELLness Surveys, incorporation of Strada August 15, 2024 observed dry weather flows, incorporation of continuous flow data from the Mega Quarry work (Genivar, 2011) and / or increasing the model grid cells with recognition of flows at Surface Water monitoring station SW 25 and NVCA Site 1 above and below the Pine River Provincial Fishing Area.

The modelers also have not adjusted their inferred zone of increased hydraulic conductivity (underground stream) to the available Strada Site multi-level monitoring data and the Horning's Mills Lake / River Road geomorphic expression.

Strada reported August 15, 2024 dry weather flows at 450 L/s at Station SW25 at the Second (Honeywood) Line WHS Mulmur upstream limit of the Pine River Provincial Fishing Area.

Unexplained, the groundwater modellers also have not had regard for Nottawasaga Valley Conservation Authority Pine River 2008 and 2013 Base Flow surveys. A continuous survey from mid-July to mid-October 2008 reported Peak flows at 1,400 L/s and base (dry weather) flows at about 600 L/s at Site 1. NVCA Site 1 is at First Line WHS Mulmur (Prince of Wales) at the downstream limit of the Pine River Provincial Fishing Area. NVCA Site 2 and 3 are further downstream in Mulmur.

Predicted significant reduction of Pine River headwater dry weather stream flows due to Quarry development will extend the measurable Quarry Impact zone further downstream from Horning's Mills towards the Pine River Provincial Fishing Area (see NRSI s3.5 above).

Accurately modeling dry weather headwater stream flows is very important in this sensitive Pine River headwater stream environment supporting Brook Trout Habitat and a formal Provincial Fishing Area. **Reduction of Horning's Mills groundwater flows will also adversely increase the concentration of village effluents (septics, water softener salts and road salts in groundwater) due to reduced groundwater flow dilution.**

8.2 Groundwater Model - Underestimated Stream Flows

Review of the Groundwater Model estimated stream flows (STR's in modelers vernacular) and comparison to available dry weather stream flows indicates that modeled virtual base flows are underestimated by 2 to 3 times compared to actual observed dry weather stream flows in the Pine and Boyne River headwaters.

Underestimating virtual stream flows likely means that modeled quarry flows and storage requirements are also being underestimated by more or less equivalent amounts. Therefore, the current proposed Site Plan infiltration facilities will be undersized and require additional functional site area.

For all of the above reasons due to poor single dimensional groundwater model calibration, the Strada Consultant Team's (Oct 2024) Environmental Impact Assessments, including those by NRSI for wetland impacts, are compromised and questioned.

8.3 Additional Model Runs

Assuming actual model calibration improvements, additional model runs are required to further assess alternative solutions and conditions. Assessment reports are not required, only drawdown and mounding Figures.

8.3.1 Model Runs

1. Prepare Model STRs for all Strada dry weather stream flow monitoring stations, the Genivar stream flow monitoring sites within the model domain, the 2008 and 2013 base flow monitoring sites from NVCA and at farmers field tile drainage outlets within NAT-02, NAT-03, NAT-04 and elsewhere.

2. A model run that assumes sudden hydraulic rupture of the Lift 2 Quarry Floor Aquitard during Lift Phases and the emergency pumped water volume discharge required if the operating Quarry floor is flooded. Where will this water be released?

3. A model run that includes 'underground stream' pressure relief wells upgradient of Lift 2 / 3 extraction areas (Peer Review July 2024 proposal concept) with additional clean water injection wells on the rear (east boundary) of Melancthon Pit # 1. Pressure relief wells to facilitate construction and stability of Gasport hydraulic barrier walls / wedges if constructed from on-site 10^{-7} m/s hydraulic conductivity glacial tills.

4. A model run for a revised quarry footprint that reserves a 200 m setback corridor from the eastern mid Township lot boundary (Township Lot 12, 13 and 14) for priority infiltration trench pond and injection well infrastructure. Construction of the South Clean Water Pond as a primary storage treatment

pond on the existing pit floor in accordance with an adaptive management plan.

5. A model run two years after Quarry closure under progressive water filling conditions to assess dry weather flow reduction within Pine River headwaters.
6. This model run may produce the highest Aquifer drawdowns in the Horning's Mills community east of the Quarry due to the proposed termination of infiltration on Quarry closure.
7. A model run ten years after quarry closure under water filling conditions to assess dry weather low reductions in the Pine River headwaters.

8.3.2 Groundwater Model Statements

8. Statement of water diversions quantities from the Pine River catchment to the Boyne Catchment by Quarry Phase.
9. Statement of water diversions quantities from the Grand River catchment to the Pine and /or Boyne catchments by Quarry Phase.
10. Statement as to the number of years required to fill the proposed Quarry to the anticipated (487 m asl?) rehabilitation design water level.
11. Statement as to how groundwater flows to Horning's Mills community and the Pine River headwaters will be maintained through the two decade, more or less, post quarry water filling rehabilitation period.

9.0 Site Plans (October 2024)

9.1 Site Plans Vertical Datum

The Site Plans provide no statement of vertical elevation geodetic datum employed.

9.2 Lifts and Benches

Lifts and bench terminology appear to be used interchangeably in the Oct 2024 Site Plans and various Reports, please clarify.

9.3 Corridor Infiltration / Injection Areas

Early extraction of Site Plan Phase 1 and 2 A immediately adjacent to the easy Quarry boundary is not appropriate considering the initial model prediction of adverse drawdowns and dry weather stream flow reduction of up to 40% in the Horning's Mills Pine River Headwaters (see NRSI s3.2 above).

The Site Plans need to protect a modeling error contingency quarry water management corridor about 200 m wide along the east limit of the Prince / Melancthon # 1 / Bonnefield Pits. This corridor may include infiltration trenches and ponds and deep injection wells recharging the Pine River headwater local Guelph Eramosa Upper Aquifer, and the deep Gasport Aquifers.

Infiltration facilities need to be priority located over the underground stream location at the Melancthon Pit No. 1 east quarry boundary and not just on the shoulders of this feature.

These eastern ponds / trenches may be arranged in alternative cells to allow periodic maintenance and clean out of sediment. Surplus injection wells will be provided for resting and as an alternative to local aquifer clogging. This surplus infiltration infrastructure provides contingency for modelling errors including underestimated flows.

Pumped water from the quarry floor sump will need to be discharged to a separate large settlement pond on the existing Pit Floor for treatment prior to infiltration to drinking Water Aquifers.

No infiltration ponds should be proposed on W½ Lot 11 Con 3 OS discharging directly or indirectly via surface or shallow groundwater to the Boyne River catchment south of County Road 17. Construction of a South Storage Pond on the existing impermeable pit floor may be required to accommodate wet season pump out of quarry floor flooding and / or for emergency Quarry Floor flooding events.

9.4 South Infiltration Pond

The south infiltration pond is located on or near the Pine River / Boyne River surface / groundwater divide (near zero flow). There are upward gradients between the Gasport and Guelph / Eramosa Aquifers at this location.

These upward groundwater gradients (no recharge) in Melancthon Pit #2 have allowed Strada to employ a closed loop pit aggregate washing system without supplementing with groundwater. Pond infiltration can only occur due to the proposed excavation of the pond floor to the underlying Guelph Formation Epikarst (Model Layer 3), increased hydraulic head and shallow seepage under or through the infiltration pond berms with overflow to NAT-19 outflow tributaries.

Mounding (3.6 m) under the proposed South Infiltration Pond will have adverse impacts on the Boyne tributary headwater wetlands and contiguous agricultural and rural residential sites.

9.5 Created Wetland

The proposed southern Infiltration Pond has a surface elevation of 494 m asl specified on the Site Plans but the created wetland is specified at 495 m asl (NRSI, 2024). In contradiction, Wetland NAT-19 has surface elevation at about 492 m asl (LiDAR CGVD2013). Design needs to be resolved.

These water level elevations require checking for the intended design. No geodetic datum is specified. This Created Wetland appears to be, in effect, a surface relief outlet for the proposed South Infiltration Pond.

This Peer Review does not support the Creation of a constructed wetland during Quarry operation except in the below the water table Pit Floor. Furthermore, Strada is going to need the space to process wash water.

9.6 Aggregate Wash Water Processing

The Site Plans do not specify the source, treatment and disposal of sediment laden aggregate wash water.

This function will require space. Will a closed loop system continue to be utilized with clean make up water originating from NAT-01 wetland west of the 4th Line?

9.7 Phase 1 Quarry Extraction and Possible Premature Abandonment

Extraction should be initiated at the southwest corner of the proposed Quarry at the Geological Structure formation downgradient to permit natural Quarry Floor Drainage to a sump at this location.

This southwest corner of the Quarry has lower hydraulic conductivities and expected lower groundwater inflows into the quarry excavation. This is a better lower cost location for Strada to gain local quarry experience and implement an adaptive water management plan.

Furthermore, if quarrying the upper bedrock is determined to be not commercially feasible, the excavation may be abandoned and permitted to fill with water with minimal effect on the local groundwater systems.

9.8 Adaptive Management Plan

Infiltration facilities in the east corridor will have to be operated continuously 365 days per year in accordance with seasonal transients as determined by pre-bedrock extraction monitoring well annual hydrographs.

An adaptive management plan will be required as actual extraction experience may vary significantly to the modelled predicted conditions.

9.9 Site Plans / Model Vertical Working Faces and Bench Heights

The Occupational Health and Safety Act R.R.O. 1990, Regulation 854 Mines and Mining Plants states:

> *89.(1) Where metallic or non-metallic rock is being removed from a surface mine,*
>
> *(a) the vertical height of the working face shall be not more than twenty-five metres*
>
> *(b) ……..*
>
> *(2) Clause (1) does not apply if an engineer certifies in writing that no worker would be endangered if the vertical height of the working face is more than twenty-five metres…*

Both the proposed Site Plans and the Model scenarios show continuous vertical working faces up to 35 m in height without intervening benches (Site Plan Dwg 5 of 5).

The Site Plans need to reflect these 25 m vertical working face bench regulatory height constraint limits. Intermediate benches are required. Variances may be applied for at a later date.

Site Plans Drawing 2 of 5 should also include for convenience the typical top of bedrock elevation.

9.10 Additional Site Plan Cross Section D-D1

An additional east west cross section (s) is required through the proposed South Infiltration/ Storage Pond and Constructed Wetland

9.11 Rationale for Post Quarry Lake Level

Strada has provided no rationale for the Site Plan (Note 11.8) specified Post Quarry water level of 487.0 m asl. Why so high? A level of 482 to 483 m asl would seem to be more appropriate based on existing water levels and to reduce Quarry excavation water fill times.

9.12 Addition of an Inceptor Drain Profile

Provision of a drainage tile profile with construction phases, depths, invert elevations, gradients, pumping stations and discharge locations shown. The only invert elevation provided in the documents is 488 m asl.

This proposed Site Plan Interceptor Drain will intercept upper Aquifer groundwater flows with elevated agricultural 'nitrates' and inject these into the currently pristine Gasport Aquifers upgradient of Horning's Mills. This concept is not acceptable.

9.13 Volume of Hydraulic Barrier Berm Wedges

The volume of upper Hydraulic Barrier Berm Till wedges required should be estimated and compared with onsite suitable volumes of glacial till overburden available for construction.

The Geotechncial proposed composite construction of the lower hydraulic barrier berms are likely to require imported low permeability (10^{-9}) materials for 2:1 slope construction. These composite barrier berm wedges may have to extend higher than the top of the Gasport Formation to seal off aquitards within the upper Goat Island Formation as well as vertical face blast fracturing to 5 or 6 m.

9.14 Excess Fill

Import of Excess Fill should not be permitted except as may be required for construction of the 10^{-9} m/s Hydraulic Conductivity 'clay core' hydraulic barrier berm wedges.

9.15 Waste Overburden / Rock

This quarry site is likely to generate considerable waste overburden and rock which will require stockpiling on a temporary and / or permanent basis. There needs to be a space allocation and / or limit in the Site Plan notes. These stockpile areas cannot interfere with groundwater flow through the Quarry site.

9.16 Variations for Central and Operations Standards

Is it the intent of this Site Plan language to permit extraction of dolostone along the common licence boundary with #3512?

The height of benches shall not exceed 25 m with regard to remaining vertical faces.

9.17 Hydraulic Barrier Opening of Lifts 1 and 3

The Site Plan Note J.24 specifies that Quarry Lifts 1 and 3 shall be backfilled to reduce groundwater inflow except for a portion of Quarry Lift 3 in the final Phase 4 in the southwest area of the Quarry. However, it is not apparent how infiltration will occur to the Guelph and Gasport Aquifers east of the Quarry if Lift 2 and 3 Hydraulic Barriers are left in place after Quarry closure. The underground stream communication should be restored on Quarry closure, including in front of the Prince Pit at the 4th Line and at the rear of the Melancthon Pit No. 1.

9.18 Clear Water Pond

Site Plan para 'x' refers to a 'clear water pond'. Where is this clear water pond?

Site Plan para 't' specifies that no process water will be discharged from the Quarry directly prior to treatment and that there shall be no discharge of water offsite.

Para 't' also specifies there shall be no discharge of 'contact' water into the injection wells.

Para 'y' and 'z' specify that injection wells and infiltration infrastructure shall be decommissioned on quarry closure.

9.19 Source Protection

Para 'ab', although formal provincial Wellhead Protection Area policies do not apply, there continues to be a need to protect the Horning's Mills community drinking water supply aquifers from adverse quantity and quality influences resulting from Quarry activities.

9.20 Vulnerable Water Wells

The following wells are considered vulnerable under the October 2024 site Plan proposals (see pg 2 of 5, noise receptor locations):

R15	477084	3rd Line	(670 m)
R01	437146	4th Line	(160 m)
R02	437090	4th Line	(195 m)

Distance refers to straight line distance from Quarry Limit of Extraction to Receptor.

R15 is a Dairy Farm with higher water demands. Well improvements are required as a precautionary measure due to the high daily water volume requirements to sustain the dairy herd.

9.21 Blasting

Blasting should be undertaken at a regular time of day, say between 12:00 and 1:00 pm, so adjacent residents and farm field workers, who may be in close proximity to berm closures may be aware as a precaution.

Elevated cab eye levels on large tractors, application equipment and harvesters may be at or above the height of the berms specified on the Site Plans.

Wild fly rock may also be an issue. Most quarries do not have active farming to immediately adjacent boundaries. Agricultural equipment, although mobile, should be considered sensitive receptors.

10.0 Visualization

This Peer Review has produced a considerable number of graphic visualizations supporting the above proposed Site Plans important modifications. There has been no acknowledgement of these graphics by Strada except to advise that Strada Consultants will do their own graphics. However, equivalent graphics by Strada Consultants have not been seen.

11.0 Conclusions

Conclusions will be provided in a separate summary letter together with an Exhibit Book (in preparation).