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MEMO

To:	Natalie Kotyck, Alicia Kimberley
From:	Garry T. Hunter, M.A.Sc., P.Eng.
Date:	September 11, 2024
File:	21-407
Subject	**Strada Peer Review Meeting Impact Assessment – September 6, 2024 Comments**

This Peer Review Memo responds to Strada's consultants September 6, 2024 Peer Review Impact Assessment. This Response includes two parts:

A. Partial Overview of related Appendix ABCDE September 2024 Page by Page Peer Reviews not yet released.

B. Page by Page Response to Strada's September 6, 2024 Impact Assessment Slide Deck.

This Response has been prepared following 15 calendar months of Peer Review of 1,000's of pages of Strada evolving documents. The last tranche of Appendices ABCDE consisted of 671 pages. Supplementary Peer Review supporting site specific Figures are referenced in the Matrix. More recent Figures have been forwarded by a separate email. There is no duplication of the Peer Reviewer's Figures in the Strada document stack (see Matrix). The Peer Review Figures are evolving and will be updated or replaced as new information becomes available.

A. Partial Overview

A.1 Site Bedrock Formations

This Peer Review compliments the Strada Proposed Quarry 2023 / 2024 implementation of the MHBC / OGS (Frank Brunton) 2014 Revised Bedrock Formation Nomenclature as facilitated by the construction of seven, 60 m / 200 ft below original ground, deep cored and logged boreholes. Interpretation of these logs and formation elevation picks also formed the basis for the Model Layer Cakes.

The Spatial Analysis of Formation Tops and Thicknesses and the use of 2 m contours is sufficient and indicative of local bedrock irregularities and the overall accuracy of this Strada process. The pick elevations, although smoothed, are not significantly degraded by the model process and external data.

Although the logic is not apparent for the irregular distribution of the seven deep core holes within the extraction footprint and often not extended to the boundaries, these seven core holes are considered sufficient for the purpose.

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However, borehole logs constructed before 2023 do not recognize this revised bedrock nomenclature. Some logs interpreted by Strada hydrogeologists include even the Guelph / Eramosa Formations erroneously within the undifferentiated Amabel. The Mega Quarry hydrogeologists made this same bedrock interpretation error.

Strada's consultants have refused to provide the elevation picks for further audit and visualizations of Quarry phasing and to prepare bedrock formation quantity and excavated below water table volume estimates.

A.2 Groundwater Level Monitoring

The Strada site individual downhole point groundwater level monitoring program is now high quality following error trapping and implementation of geodetic elevation control during the period of this Peer Review. Single downhole monitor point water level accuracy is estimated in the 10 to 20 cm vertical range.

However, the Strada A/B Consultants show little ability to spatially analyze and interpolate between this single point downhole data.

A.2.1 No Legacy Manual Static Water Level Observations

No legacy manual static water level observations have been provided to facilitate reinforcement of equivalent Model Layer screen plots, i.e., filling in the 'monitoring gaps'.

This Peer Review does not agree that there is an exceptional network of data and monitoring for the purpose of a deep quarry application 60 to 70 m below ground and 50 to 60 m below the water table.

A.2.2 Non-Functional Monitor Wells

The Report should note that approximately one third of these monitor wells are non-functional – destroyed, pulled, not observed or dry. Many active wells are located within proposed quarry extraction areas and are not suitable as long term base line monitor wells.

A.2.3 Screen Classifications

The monitor screens in Table 1 are classified in accordance with legacy gravel pit compliance A, B and C criteria. These criteria do not recognize the considerable work and expense incurred by Strada in construction of deep boreholes to the base of the Gasport Formation, quality bedrock core classifications, precise geodetic elevation surveys, and in some cases, nested monitor well construction. Monitor screens need to be reclassified consistent with geological formation and Model Layers (see Matrix).

A.2.4 Upper Monitor Nests

The reader should be advised that most of the 22 groundwater monitor nests are screened in the Sand and Gravel, Overburden and Epikarst intervals for prior pit licencing purposes. Most of these upper monitor nests show very little vertical gradient.

Only about 7 or 8 monitors are screened across the very important (to the Quarry application) Goat Island Aquitard between the upper Model Layer 4 Guelph / Eramosa and the deeper Model Layer 6 Gasport Aquifers.

A.2.5 Degradation of Precision Downhole Water Level Data

This report takes real high quality (also see last page) monitoring data with water level vertical accuracy in the 10 to 20 cm range capable of one meter or better actual base line contouring and blends it into a degraded virtual base line model environment with errors in the more or less 5 m (16 ft) range with even higher residuals. This contrasts with the Bedrock Formation Spatial Analysis.

A.3 Groundwater Quality Monitor Sampling

There are no known issues with Strada downhole routine water quality analytical sampling as reported in past Compliance Reports.

However new simultaneous water quality sampling is required for Strada on-site Aquifers including the Gasport to further evaluate Model Layer 5 Aquitard structural integrity and to complete water quality impact assessment.

A.4 Compliance Reports

The Applicant's Hydrogeologist took offence at the Peer Review identification of water level spatial analysis errors in the Strada 2023 Compliance Report and impulsively decided the Peer Review was out of scope (see Matrix). However, elsewhere this same Hydrogeologist advised we should refer to the Compliance Report stack to find uncompiled real manual water level observation data.

A.5 Model Report

A.5.1 Site Plan Scenarios

This Model Report, subject to improved calibration as discussed in prior communications (see Matrix), does provide a realistic and useful virtual framework for Quantity Impact Assessment of the Strada Aggregate Site Plan proposal. Only one Site Plan Scenario has been analyzed. Modeling should lend itself to analyzing multiple scenarios, including the multi-disciplinary variation

proposed by this Peer Review. This Scenario may be more favourable to the NDACT community than the Strada version.

A.5.2 Model Layers

This Peer Review is in agreement with the Strada upland selection of Model Layers in the proposed Strada Quarry vicinity.

However, the preferential draping of Layer 1 down the escarpment slopes and resorting to 30 m shallow depth queries means the model may not recognize the Model Layer 5 Goat Island Aquitard. This Aquitard supports the upper level springs, streams, ponds, waterfalls and upper bedrock aquifer (Guelph Eramosa) water wells in the Horning's Mills Pine River Valley Headwaters.

The Horning's Mills Fish Hatcheries, Mill Street Dam and Mill Street Water Falls show this strong upper Aquitard influence on springs and stream flow.

Absence of this aquitard in the model may be why the Assessment virtual base line predicts zero dry weather flows at recent and former fish hatchery upper level aquifer sites (STR2 and STR10). The Model is opaque.

It may also explain why the modellers avoided providing direct stream flow validations and have refused to provide error statistics to this Peer Reviewer for the Strada site itself.

A.5.3 Model Process

There are no known issues with the model processing software other than accommodating the Model Layers on the escarpment slopes. The ability to model monthly transients is very useful as demonstrated for Scenario 1 Wetlands. However, within the Proposed Quarry Scenario 1 Assessment, the omission of a Monthly Water Balance for the proposed Extraction Phases and diversion of Pine River flows to the Boyne is unexplained.

This Peer Review concerns are practical and primarily related to the quality of the real data in and the virtual data out.

A.6 Model Calibration and Validation

A.6.1 Melancthon Old and New Survey

The modellers have relied on Legacy poorly researched surficial geology maps in preference to the more detailed field checked Dufferin County agricultural soil surveys. The modellers do not understand the fundamental hydrological differences between the Melancthon Old Survey and New Surveys known to most of the NDACT community and all local farmers and beyond.

As a very general statement the Old Survey (Honeywood Soils) have good internal drainage (recharge) with limited runoff and few wetlands. The New Survey has poor to imperfect internal drainage with many wetlands and significant runoff. Municipal Drains and Tile Drainage are required in the New Survey for wetland moderation and productive agriculture.

The modellers' preference for legacy Quaternary Geologists' surficial geology interpretation assumptions of uniform hydraulic conductivity and recharge rates across Melancthon Old and New Surveys are simply not credible.

A.6.2 Stream Flow

The modellers have not provided any stream flow virtual base line condition validation despite being aware of the availability of 15 year old Genivar (Mega Quarry) stream flow monitoring at a number of locations in and adjacent to the TPA.

This Peer Review has connected the dots in the Model Reports and determined that the current Impact Assessment Model Scenario 1 version predicts zero (0.0 L/s) dry weather flows at the Newell / Funston MECP permitted Commercial Aquaculture Centre (Fish Hatchery and Rearing Ponds). This is not credible. There can be little confidence that this Model Scenario 1 version is acceptable for Impact Assessment.

It appears that the Model may have omitted the underlying Goat Island Aquitard at this location with streambed elevation at about 484 m asl CGVD28. The model is opaque.

Genivar observed 40 L/s flows at this same location. Elsewhere in the Model Reports in the same Table repeated a number of times, **the modellers reported contradictory Mean Flows of 350 L/s. This mean flow is also not credible and an obvious error.**

Strada Hydrogeologists have not disclosed any aspect of its proposed dry weather stream base flow survey or if it even has been executed in accordance with this Peer Reviewers' recommendations of March 11, 2024 or otherwise.

A.6.3 Subsetting of Model - Increased Grid Cell Resolution

Subsetting of the Ground Model to the Honeywood Line (Mulmur 2nd Line WHS) or Genivar DP-SW10 Pine River Stations would permit increasing the model grid cell for local improved model accuracy and prediction of stream virtual baselines. This would require installation of a continuous stream monitor at this location.

A.6.4 MECP Water Well Database

The modellers' reported statistical errors of about 5 ± m is also consistent with the 5 m smoothed water level contouring from this MECP database. The modellers have not made the effort to edit the water well geographic locations and assign new ground elevations in this raw database. The modellers have instead relied on kriging and other statistical processing and have advised that not editing the standard MECP water well databases is an industry standard procedure.

The results of the Private Well Monitoring Network WELLness checks need to be included in the Model Calibration Report. Apparently only 51 of 144 participants (only one-third) have been provisionally linked to MECP well records by the modellers (Matrix Item 198). The applicant linkage is to the front of the Lot not to the actual well location. This is classic garbage in / garbage out.

This Peer Reviewer previously edited the Water Well Records to about 2010 as part of the Mega Quarry review (see Matrix). Post 2010 GPS located wells were recently added to this database. This work has been set aside until the TPA Wellness checks are completed.

The Applicant needs to edit, with the assistance of the TPA results, the MECP water well database to reduce the intrinsic error in the model input data and reduce the limiting nugget value. Inclusion of streamflow monitoring calibration will also enhance and improve the confidence of the model results.

The Spitz and Moreno (1996) comparison has no relevance when there are obvious calibration improvements which may be undertaken.

Strada needs to complete the execution of the fundamental TPA surveys to inform the water well edit process and improve the model calibration. This is not a Silo Task to be completed sometime in the future.

A.6.5 Hydrogeochemistry / Water Quality

The groundwater quality surveys available in the Strada Gravel Pit Compliance Report History and the Genivar stream water quality surveys offer opportunity for further integrated assessment model validation.

The Strada consultants are oblivious to this water quality assessment function fundamental to local Horning's Mills drinking water source protection.

A.6.6 Peer Review Spatial Analysis

This Peer Review has undertaken data mining, monitor screen classification by model layer and spatial analysis of the Strada undifferentiated precision groundwater level monitoring single point downhole data.

These Peer Review and earlier Mega Quarry productions, informed in part the modellers' incorporation of an inferred higher hydraulic conductivity / convergent flow zone between the Strada Duivenvoorden McTaggart farm depressional infiltration site and Horning's Mills Lake.

This Peer Review Process has also undertaken Model Layer 4/6 hydraulic head analysis across the Model Layer 5 Goat Island Aquitard to further evaluate the structural integrity of this formation (see Figures).

In contrast, the Report A/ B Hydrogeologists, unexplained, rely on the degraded model data for water level spatial analysis. Only the Strada 2023 Compliance Report provided site water level contour mapping. However, this mapping contradicted the MNRF approved Strada Site Plans water tables + 1.5 m extraction depth limits (see Matrix).

The Peer Reviewer's Data Mining and Spatial Analysis is another important form of Model validation. This spatial analysis will support alternative scenario infrastructure development of the proposed Site Plan.

A.7 Latest Version 5 Volume Appendices (671 pages)

Strada's modellers seem to be much more interested in extolling the virtues of its modelling process than in disclosing calibration / validation details.

The 671-page 5 volume model-centric reports are opaque myopic obfuscations and are virtually incomprehensible in totality. They contain multi page word processor blocks of text and figures that repeat in duplicate, triplicate and more. Errors are frequent and even simple numerical errors are uncorrected from earlier Peer Review versions (see Matrix). There is little apparent 'finding' logic, especially for site specific real data scattered throughout the Appendices. **There is no glossary to explain the technical jargon.** This unwieldy duplicity propagates through the Peer Review Matrix creating additional clearance challenges.

This Peer Reviewer may be the only person who has actually read these 5 Appendices and their predecessor versions since June 2023 page by page, cover to cover.

Ruthless reorganization, editing or complete replacement is required to reduce the page count by 50% or more so these reports are fit for public consumption for those willing to invest the time. The Reports need to be Real Data-Centric first, Model-Centric virtual data second. We don't need to see multiple author versions of the same text and figures scattered throughout the Reports. Best the Figures are in separate Real Data and Virtual Data Volumes for improved readability. **These poorly written, process intensive reports disrespect both NDACT and Strada.**

A.8 Matrix Clearance

The Matrix, as it follows the illogical report organizations, is unwieldy, very repetitive and now a challenge. Strada consultants' response to Peer Reviewer comments are mainly abstract and unsupported by objective, independent, scientific and factual analysis.

The Matrix is out of control because of the Model-Centric Report organization, duplicity and triplicity of report sections. Furthermore, the Strada consultants simply use the Matrix as a Parking Lot for Peer Review Items without incorporation of even numerical error updates into later Report versions.

Peer Review comments were frequently misunderstood, almost never discussed and propagate through the Matrix with only impulsive, factually unsupported replies or unfulfilled promises. Therefore, few items have been 'closed'.

Most of the outstanding Peer Review Matrix comments have not been addressed. Promising sometime later delivery does not equal closure.

A.9 Additional Nested Groundwater Monitors

Four additional nested Groundwater Monitors extended to the Cabot Head Shales are proposed to improve the on-site 3D spatial definition of the modellers' inferred zone of enhanced hydraulic conductivity (Peer Review convergent groundwater flow zone).

This zone is likely to be karstic fracture related and narrower than inferred. The location is most poorly defined at the Fourth Line Prince Pit. Coring in these boreholes is likely not required.

This increased groundwater flow zone is likely to be problematic during Quarrying and require special mitigation treatment to be recognized by the Site Plans. The Scenario 1 poorly calibrated initial Assessment predicts 76.4 L/s or 6,600 m^3/day for Phase 2C extraction for this zone. This is much lower than the Genivar (2011) Mega Quarry prediction of 600,000 m^3/day quarry dewatering volume for a 3,000 acre site versus Strada at about 300 acres. Why is the Strada Extraction volume not proportional?

A.10 Additional Pump Tests

After installation of the four additional deep nested monitors an aggressive Pump Test is required in the PW1 area with an open hole well extended through the full thickness of the Gasport. The legacy PW1 Pump Test was conducted at only 300 m^3/day versus the poorly calibrated Model predicted maximum 6,600 m^3/day.

The purpose of this pump test is to further assist in the definition of the modelers' inferred zone of increased hydraulic conductivity on site, to evaluate the structural integrity of the Model Layer 5 Goat Island Aquitard, to further inform the model calibration and to inform Site Plan water management design and impact assessment.

Are the model assumptions correct?

A.11 Time to Fill

The Vertical Barrier Wall Model Scenario 1 does not include the time to fill the Quarry 'mined out' excavation. How can this extended fill period be accelerated?

B. Response to September 6 Slide Deck

B.1 Strada Impact Assessment Slide Deck / Review Meeting September 6, 2024

Pg 1

Better to have Aggregate Site Plans in this image.

Pg 2

Outstanding Requested Information (if time permits). This 'if time permits' reflects the omitted discussion of Matrix Items in previous virtual meetings. Always the emphasis by Strada Consultants has been on meeting unrealistic submission schedules, perhaps to please the client or conform to budgets. Strada continues to ignore the parked 'open' items in the Matrix.

Pg 3

Agreed.

Pg 4

This is not a new model scenario, simply a Band-Aid variation applied to the poorly calibrated initial Vertical Barrier Wall Model Scenario 1.

Where is the outlet to the drains installed behind the upper berms, into the quarry or pumped from the depression via a perimeter pipeline to the northeastern trench? Does this mean Duivenvoorden and farmers will have to continually rely on Strada to pump out the McTaggart farm field depression? This pipeline could be a component of the Peer Reviewers water management concept (Fig H.3). Pumped quarry water will not be the same quality as existing pumped ambient aquifer water.

It is a waste of time to run this amended Scenario 1 again until the current model calibration is improved and validated. Also, Scenario 1 is single dimensional, quantity focused and does not consider pumped Quarry effluent treatment and water quality source protection for the Village of Horning's Mills Village.

The Geotechnical Expert Report must be updated to further conceptualize the vertical barrier wall design, realistically evaluate the risks of failure of the barrier walls and potential for rupture of the Guelph / Eramosa quarry floor. It is relatively easy to model scenarios but can the mitigation features be economically built and reliably managed by Strada? Are vertical barrier walls or other mitigation construction, such as grout curtains, in the experience domain of the modellers?

The modellers seem to have a clear idea of what they are modelling but are either unwilling or incapable of graphically communicating their visualization of Quarry Phasing and Mitigation Features. This is not Site Plan dependent, the issue is what exactly are the Strada

modellers modelling? The model continues to be opaque. This is a requirement for Peer Review understanding and communicating with the NDACT community. This Peer Review is in the process of preparing visualizations in the absence of this information.

Nevertheless, this Scenario 1 has been a useful 'dry run'. It would be even more useful if a supplementary 'dry run' monthly water balance could be prepared now so there is an understanding of the monthly magnitude of water volume quantities proposed to be pumped, discharged and infiltrated.

This Peer Review notes that the maximum pumping rate from the quarry for Model Scenario 1 is 76.4 L/s for Phase 2C or about 6,600 m^3/day, more or less equivalent to about 4 or 5 Shelburne No. 7 Municipal Production Wells. What size do the infiltration ponds need to be to contain spring snowmelt, major storm and contingent unintended flooding quarry pump-outs? How much Pine River flow is being diverted to the Boyne River?

Pg 5

The Northeast Trench infiltration scenario is not within the natural flow convergence/ enhanced model hydraulic conductivity zone in the Melancthon Pit east boundary area but into a low Guelph / Eramosa bedrock hydraulic conductivity area. The majority of flow from the northeast trench will follow the epikarst zone and break out to the surface in an unnatural area and unless the Goat Island aquitard is discontinuous will not locally infiltrate to the underlying Gasport Aquifer.

One area of local groundwater discharge breakout will be to Lot 15 farm fields on either side of Third Line south of 15th Sideroad. These fields are about one km north east of the Strada proposed northeast infiltration area as well as to Marshall Brook and the Newell / Funston MECP Permitted Commercial Aquaculture area.

The Scenario 1 Assessment Model with predicted virtual baseline dry weather flow at zero (0.0 L/s) cannot credibly and confidently predict impacts in the Third Line / Sideroad 15 area. The Scenario 1 Model virtual base line needs to be properly calibrated and validated to real baseline to be credible in predicting change (impacts).

The September 6 amended proposed southern infiltration area is in area of upward gradients and little hydraulic head (real data) difference between Model Layers 4 and 6. This pond mound will in part infiltrate but mainly seep under, through and over the containment berms and follow Model Layer 1 off site to residences, farm fields and wetlands. Seeping over the berms will result in a rapid erosional breach with uncontrolled flooding of the pit operating floor behind the existing surrounding pit berms. Off-site properties will be flooded if the surrounding pit berms are discontinuous.

The logical, most efficient, natural location for infiltration of extracted upgradient clean drinking water (not pumped quarry effluent water) is at the location shown on Peer Review Fig H.3. Maintenance of extraction injection wells is not onerous compared to construction and maintenance of linear barrier walls under 50 m of hydraulic head. The Quarry will flood if these wells are not properly managed.

The Quarry will also generate about 5%, more or less, rock flour fines (dust). This dust will be deposited on nearby farm fields by blasting activities and accumulate on the Quarry floor and slopes. The quarry dust, including AN/FO, will be entrained in the pumped quarry effluent as turbidity and be deposited in infiltration trenches and ponds. These ponds will become clogged and require cleanout. Standby trenches and ponds will be required for maintenance.

Pg 6

See reply above and below. We did not have this slide deck in advance to consider.

Pg 8

Water Quality of Layer 6 Gasport Aquifer Monitors

The Slide Deck author is confused by the legacy Gravel Pit 'C' Series monitor designations and does not understand the data. Only the OW 24C to OW30C Monitors are screened in the deep Gasport Layer 6. The other specified (OW13C to OW23C) monitors are screened in Model Layer 4 or higher.

Water Quality Impact Assessment

The slide deck author does not seem to be familiar with this Peer Review's previous submissions and supplementary water quality Spatial Analysis Figures with references as parked in the Matrix. This Peer Review has now also graphed selected Genivar (2011) Stream Water Quality Data. No Strada consultant work has been duplicated in this process.

Recent Water Level Monitoring

This water level monitoring is required as part of the Peer Review particularly for extension of the nested monitor hydrographs for review of the Layer 4 and 6 head differentials and structural integrity across Layer 5. See the Peer Review hydraulic head spatial analysis.

This Peer Review will now have to wait for the 2024 Compliance Report to be prepared in early 2025.

Stream Flow Monitoring

This Peer Review has no knowledge of Strada's current stream flow monitoring program as compared to our March 11, 2024 proposed sites. These sites recognized the geomorphic expression of the Goat Island Aquitard on the Horning's Mills escarpment slopes.

This streamflow monitoring is required for improved model streamflow calibration / validation. Strada consultants have not cooperated and refused disclosure of base flow monitoring activity, if any.

Guelph Permeameter Testing

Guelph Permeameter testing is likely not very relevant to the scale of the high water table Infiltration Ponds being proposed in W ½ Lot 11 Con 3. It is more appropriate for septic tile fields and storm ponds well above the water table, but may be relevant in the Prince Pit northeast Infiltration trenches.

Legal Surveys

Not required until Site Plan drafts are available.

Pg 7 - Conclusions

Sept 13

This Peer Review has no confidence in the amended Scenario 1 Model Run as proposed due to negative calibration issues. This is a waste of time.

Sept 27

Considerable time will be required to review another 295 pages of Scenario 1 Impact Assessment documents and 1,000 pages of iterative versions of related documents with repetition and duplicity that have not considered resolution of open Matrix items.

The notion that 671 pages of Level 1 and 2 Appendix A through E will remain unchanged is frightening considering the significant unresolved number of Peer Review comments parked in the Matrix and articulated in the sequential Peer Reviews.

This proposed Schedule does not include sufficient time for Peer Review of the NRSI Report, Geotechnical Report, Real Stream Flow Baseline Monitoring Report, Water Quality Analytics, the TPA Private Well Monitoring, MECP WWIS Editing and further Recalibration and Validation of the Model to improve the confidence in Model Impact Assessment Predictions. There are also outstanding issues related to fly rock and quarry dust in farm fields and AN/FO additions to quarry effluent water. These are not 'Silo' Tasks to be postponed and conducted sometime later after Site Plan submission. Site Plan review of hydrogeological conditions is still required.

Furthermore, Strada has not offered any alternative Extraction Modelling Scenarios as would be reasonably expected with a well calibrated model.

Most of the Peer Review Matrix Comments have not been cleared. Many of Strada's responses are unsupported by factual analysis, impulsive and frivolous or simply unfulfilled promises. In person discussion of these items is required for resolution. Until very recently, Strada has simply been using the Matrix as a parking lot to be ignored.

The Strada consultants' inability to execute baseline surveys, inability to undertake site specific spatial analysis (GIS), error trap and identification of spatial anomalies and inability to write well organized, concise reports and calibrate / validate its models has made this Peer Review very difficult to execute efficiently, perhaps this is the intent.

Based on 15 months of Peer Review history, my estimate of realistic completion and Strada consultants' demonstrated slow execution rates is that a Peer Reviewed Submission will not be ready until about April 2025.

Strada's September 6 timetable implies Strada is relying simply on process and not scientific facts.